INSTRUCTION MANUAL

HI2209

Bench pH Meter

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www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Instruments® product.

Please read this instruction manual carefully before using this instrument as it provides the necessary information for correct use of this instrument and a precise idea of its versatility.

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com.
Visit www.hannainst.com for more information about Hanna Instruments and our products.

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1. PRELIMINARY EXAMINATION

Remove the instrument and accessories from the packaging and examine it carefully. For further assistance, please contact your local Hanna Instruments® office or email us at tech@hannainst.com.
Each meter is supplied with:

- HI1332B plastic-body combination double-junction refillable pH electrode with BNC connector and 1 m (3.3') cable
- 12 Vdc adapter
- Electrode quality certificate and quick reference guide
- Instrument quality certificate with quick reference guide

***Note**: Save all packing material until you are sure that the instrument works correctly. Any damaged or defective item must be returned in its original packing material with the supplied accessories.*

2. GENERAL DESCRIPTION

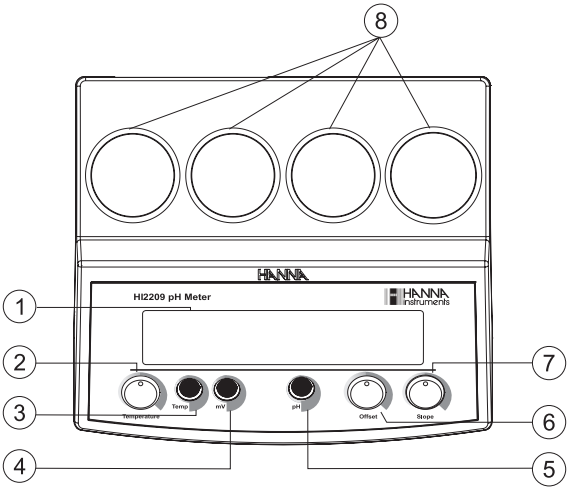
HI2209 bench pH meter is designed for simplicity of use.
It features a large easy-to-read liquid crystal display (LCD) and user friendly keyboard.
The pH calibration is made simple through the easy-to-operate front panel knobs for offset and slope adjustment.
A front knob is provided for easy manual set for temperature compensation of the pH reading.
HI2209 can also measure ORP (Oxidation Reduction Potential) in the mV range.
The range selection (pH, mV or °C for temperature compensation) is made simple through the front membrane keyboard.

3. SPECIFICATIONS

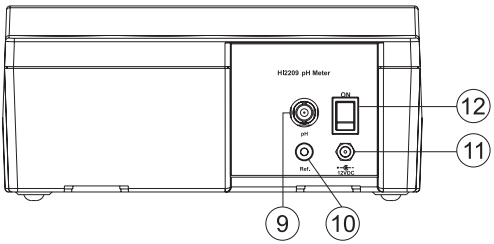
Range	0.00 to 14.00 pH ±1999 mV
Resolution	0.01 pH 1 mV
Accuracy @ 25 °C	±0.01 pH ±1 mV
pH calibration	Manual, 2 point, through knobs
Temperature compensation	Manual from 0 to 100 °C (32 to 212 °F)
pH electrode (included)	HI1332B plastic body, double junction, refillable, with BNC and 1 m (3.3') cable
Power supply	12 Vdc adapter (included)
Environment	0 to 50 °C (32 to 122 °F); max. 95% RH non-condensing
Dimensions	235×222×109 mm (9.2×8.7×4.3")
Weight	1.3 Kg (2.9 lbs)

4. FUNCTIONAL DESCRIPTION

Front Panel



Rear Panel



1. Liquid Crystal Display (LCD)
2. Temperature setting knob
3. °C range selection key
4. mV range selection key
5. pH range selection key
6. pH offset adjustment knob
7. pH slope adjustment knob
8. Sample holders
9. BNC electrode connector
10. Reference electrode socket
11. Power adapter socket
12. ON/OFF switch

5. OPERATIONAL GUIDE

Power Connection

Plug the supplied 12 Vdc adapter into the power supply socket (#12, Functional Description section).

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

Electrode Connection

For combination **pH** or **ORP** electrodes (with internal reference) connect the electrode's BNC to the socket provided (#10, Functional Description section).

For an electrode with a separate reference, connect the measuring electrode's BNC to the BNC socket (#10, Functional Description section) and the reference electrode's jack to the socket provided (#11, Functional Description section).

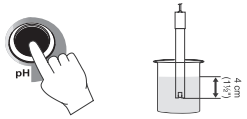
***Note**: To prevent damage to the electrode, remove the pH electrode from the solution before turning the meter off. If the meter is OFF, detach the electrode from the meter before immersing the electrode in the storage solution.*

Taking pH Measurements

Make sure that the instrument has been calibrated for pH before taking pH measurements.

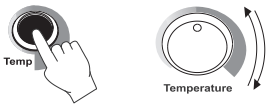
- Put the beakers (bottles 50 or 100 mL) with the solutions under test on the sample holders.
- Switch the instrument on by pressing the **ON/OFF** switch.

- Press the **pH** key to display the pH measurement.
- Immerse the electrode tip (4 cm / 1½") into the sample and shake briefly.



- Take the temperature of the solution with a **ChecktempC** or a glass thermometer (e.g. 25 °C).

- Press and hold the **Temp** key to display temperature setting on the LCD and adjust the **Temperature** knob to display the temperature of the sample.



- Release **Temp** key. The meter returns to pH range.

- The display shows the pH value of the test solution compensated for temperature.

If measurements are taken in different samples successively, it is recommended that the electrode be rinsed thoroughly for better conditioning and to eliminate cross-contamination of the sample.
For the rinsing process, it is recommended to use a liberal amount of the next solution to be measured.

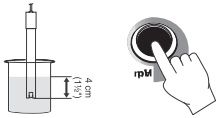
Taking ORP Measurements

HI2209 has the capability to take ORP measurements, using an ORP electrode. Hanna Instruments® offers a variety of ORP electrodes for this purpose (see Accessories). Contact your local Hanna Instruments office for more information.

- Connect the ORP electrode to the meter and submerge the tip (4 cm / 1½") into the sample to be tested.

***Note**: ORP measurements are taken without temperature compensation.*

- Press the **mV** key to enter the mV mode. Allow a few minutes for the reading to stabilize.



- The display will indicate the mV value (positive or negative).

After Measurements

- Press the **ON/OFF** switch to switch the instrument off.

6. pH CALIBRATION

Important

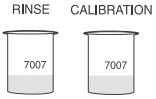
The instrument's pH range should be re-calibrated:

- When the meter is new.
- Whenever the pH electrode is replaced.
- At least once a month.
- After use in aggressive chemicals.
- After cleaning procedure and changing the reference electrolyte.
- For greatest accuracy.

Preparation

Pour small quantities (up to 4 cm / 1½" level) of pH7.01 (HI7007) and pH4.01 (HI7004) or pH10.01 (HI7010) solution into clean beakers (50 or 100 mL bottles). If possible use plastic beakers to minimize any EMC interferences.

If you are measuring in the acid range, use pH4.01 as second buffer; if you are measuring in the alkaline range, use pH10.01 as second buffer.



For accurate calibration, use two beakers for each buffer solution; the first for rinsing the electrode, the second for calibration. In this way, contamination of the buffer is minimized.

***Note**: The electrode should be submerged approximately 4 cm (1½") into the solution.*
If you need to calibrate to NBS standards, use pH6.86 (HI7006) and pH9.18 (HI7009) instead of pH7.01 and 10.01 respectively.

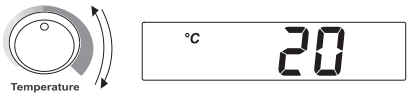
Use a **ChecktempC** or a glass thermometer as reference.
Put the beakers with the calibrations solutions on the beaker holders on the top of the instrument.

Procedure

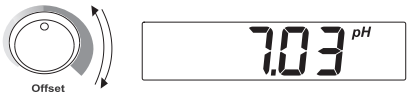
- Switch the instrument on by pressing the **ON/OFF** switch.

- Rinse and immerse the pH electrode into pH7.01 buffer and shake briefly. Wait for the reading to stabilize.
- Note the temperature of the buffer solution using a **ChecktempC** or a glass thermometer (e.g. 20 °C).
- Press and hold the **Temp** key to select temperature setting.

- Adjust the **Temperature** knob until the LCD shows the noted temperature.
- Release the **Temp** key. The instruments returns to pH range.



- Wait a couple of minutes and adjust the **Offset** knob until display shows the pH value at the noted temperature (see the pH versus temperature chart).



- Rinse and immerse the pH electrode in pH4.01 / pH10.01 buffer and shake briefly.

- Wait a couple of minutes and adjust the **Slope** knob until display shows the pH value at the noted temperature (see the pH versus temperature chart).

- The pH calibration is now complete.

7. pH BUFFER TEMPERATURE DEPENDENCE

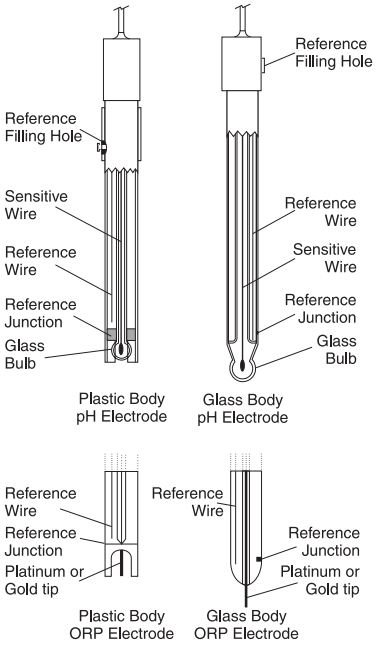
Temperature has an effect on pH. The calibration buffer solutions are affected by temperature changes to a lesser degree than normal solutions.
For manual temperature calibration please refer to the following chart.

Temp		pH Buffers				
°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	7.05	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	9.11	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	4.08	6.84	6.98	8.99	9.79
60	140	4.09	6.84	6.98	8.97	9.77
65	149	4.11	6.84	6.99	8.95	9.76
70	158	4.12	6.85	6.99	8.93	9.75
75	167	4.14	6.86	7.00	8.91	9.74
80	176	4.16	6.87	7.01	8.89	9.74
85	185	4.17	6.87	7.02	8.87	9.74
90	194	4.19	6.88	7.03	8.85	9.75
95	203	4.20	6.89	7.04	8.83	9.76

For instance, if the buffer temperature is 25 °C, the display should show pH4.01, 7.01 or 10.01 at pH4, 7 or 10 buffers, respectively.
At 20 °C, the display should show pH4.00, 7.03 or 10.06. The meter reading at 50 °C will then be 4.06, 6.98 or 9.82.

8. ELECTRODE CONDITIONING AND MAINTENANCE

***Note**: To prevent damage to the electrode, remove the pH electrode from the solution before turning the meter off. If the meter is OFF, detach the electrode from the meter before immersing the electrode in the storage solution.*



Preparation Procedure

Remove the protective cap.

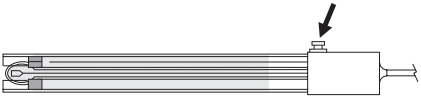
Do not be alarmed if salt deposits are present. This is normal with electrodes and they will disappear when rinsed with water.

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 HI70300 storage solution for at least one hour.

For refillable electrodes:

If the fill solution (electrolyte) is more than 2½ cm (1") below the fill hole, add HI7082 3.5M KCl electrolyte solution for double junction or HI7071 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 protective cap with a few drops of HI70300 storage solution or, in its absence, electrolyte solution (HI7071 for single junction, or HI7082 for double junction electrodes). Follow the Preparation Procedure above before taking measurements.

Never store the electrode in distilled or deionized water.

Periodic Maintenance

Inspect electrode and 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.

For refillable electrodes:

Refill the reference chamber with fresh electrolyte (HI7071 for single junction or HI7082 for double junction electrodes). Allow the electrode to stand upright for 1 hour.

Follow the Storage Procedure above.

Cleaning Procedure

General Soak in HI7061 general cleaning solution for approximately 30 minutes.

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

- *Protein* Soak in HI7073 protein cleaning solution for 15 min.
- *Inorganic* Soak in HI7074 inorganic cleaning solution for 15 minutes.
- *Oil/grease* Rinse with HI7077 Oil & 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 HI70300 storage solution for at least 1 hour before taking measurements.*

Troubleshooting

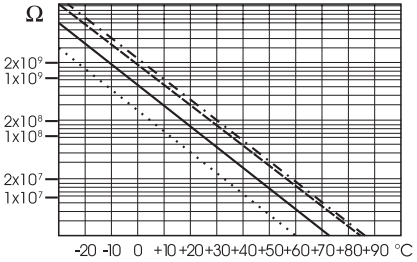
Evaluate your electrode performance based on the following.

- **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 HI7071 for single junction or HI7082 for double junction electrodes.
- **Dry Membrane/Junction:** soak in HI70300 storage solution for at least 1 hour.
- **Drifting:** soak the electrode tip in warm (approx. 50-60 °C) Hanna Instruments® HI7082 solution for one hour and rinse the tip with distilled water. Refill with fresh HI7071 for single junction electrodes and HI7082 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 HI7061 solution for 30 minutes, rinse thoroughly in distilled water and then follow the Cleaning Procedure above.

9. TEMPERATURE CORRELATION FOR pH SENSITIVE GLASS

The resistance of glass electrodes partially depends on the temperature. The lower the temperature, the higher the resistance. It takes longer time 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 range of 200 Mohm, 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 to a stable pH reading.

The pH electrode's life also depends on the temperature. If constantly used at high temperatures, the electrode life is drastically reduced.

Typical Electrode Life

Ambient Temperature	**1- 3 years**
90 °C	**Less than 4 months**
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 Instruments® glass formulations have the indicated characteristics.

Alkaline Error

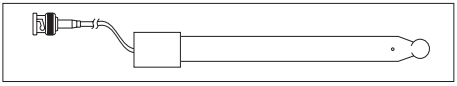
Sodium Ion Correction for the Glass at 20-25 °C		
0.1 Mol L^{-1} Na^+	13.00	0.10
	13.50	0.14
	14.00	0.20
1.0 Mol L^{-1} Na^+	12.50	0.10
	13.00	0.18
	13.50	0.29
	14.00	0.40

10. ACCESSORIES

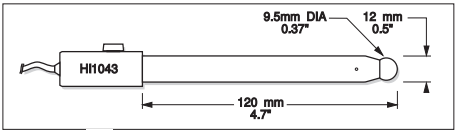
pH Calibration Solutions	
HI70004P	pH4.01 buffer solution, 20 mL sachet, 25 pcs.
HI70007P	pH7.01 buffer solution, 20 mL sachet, 25 pcs.
HI70010P	pH10.01 buffer solution, 20 mL sachet, 25 pcs.
HI7004L	pH4.01 buffer solution, 500 mL
HI7006L	pH6.86 buffer solution, 500 mL
HI7007L	pH7.01 buffer solution, 500 mL
HI7009L	pH9.18 buffer solution, 500 mL
HI7010L	pH10.01 buffer solution, 500 mL
HI8004L	pH4.01 buffer solution in FDA bottle, 500 mL
HI8006L	pH6.86 buffer solution in FDA bottle, 500 mL
HI8007L	pH7.01 buffer solution in FDA bottle, 500 mL
HI8009L	pH9.18 buffer solution in FDA bottle, 500 mL
HI8010L	pH10.01 buffer solution in FDA bottle, 500 mL
Electrode Storage Solutions	
HI70300L	Storage solution, 500 mL
HI80300L	Storage solution in FDA bottle, 500 mL
Electrode Cleaning Solutions	
HI70000P	Electrode rinsing solution, 20 mL sachet, 25 pcs.
HI7061L	General cleaning solution, 500 mL
HI7073L	Protein cleaning solution, 500 mL
HI7074L	Inorganic cleaning solution, 500 mL
HI7077L	Oil & fat cleaning solution, 500 mL
HI8061L	General cleaning solution in FDA bottle, 500 mL
HI8073L	Protein cleaning solution in FDA bottle, 500 mL
HI8077L	Oil & fat cleaning solution in FDA bottle, 500 mL
Electrolyte Solutions	
HI7071	3.5M KCl + AgCl electrolyte solution, 4×30 mL, for single junction electrodes
HI7072	1M KNO_3 electrolyte solution, 4×30 mL
HI7082	3.5M KCl electrolyte solution, 4×30 mL, for double junction electrodes
HI8071	3.5M KCl + AgCl electrolyte solution in FDA bottle, 4×30 mL, for single junction electrodes
HI8072	1M KNO_3 electrolyte solution in FDA bottle, 4×30 mL
HI8082	3.5M KCl electrolyte solution in FDA bottle, 4×30 mL, for double junction electrodes
ORP Pretreatment Solutions	
HI7091L	Reducing pretreatment solution, 500 mL + 14 g
HI7092L	Oxidizing pretreatment solution, 500 mL

pH Electrodes

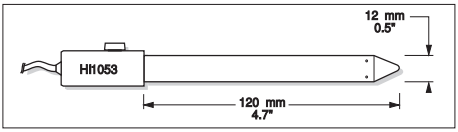
All electrodes part numbers ending in B are supplied with BNC connectors and 1 m (3.3') cable, as shown below:



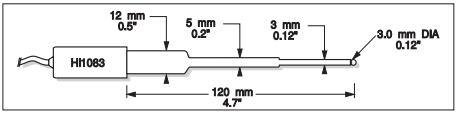
HI1043B Glass-body, double junction, refillable, combination pH electrode. Use: strong acid/alkali.



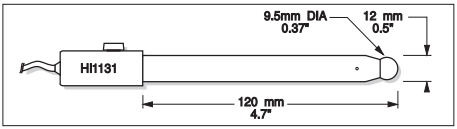
HI1053B Glass-body, triple ceramic, conic shape, refillable, combination pH electrode. Use: emulsions.



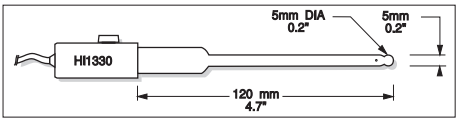
HI1083B Glass-body, micro, Viscolene, non-refillable, combination pH electrode. Use: biotechnology, micro titration.



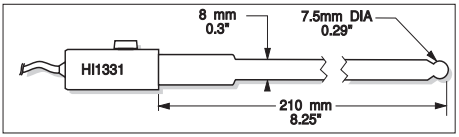
HI1131B Glass-body, double junction, refillable, combination pH electrode. Use: general purpose.



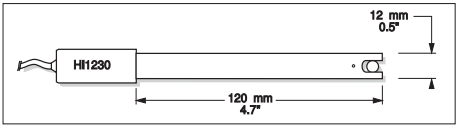
HI1330B Glass-body, semimicro, single junction, refillable, combination pH electrode. Use: laboratory, vials.



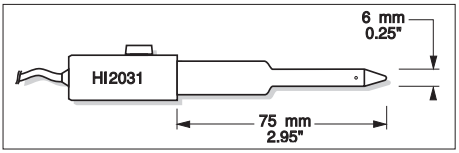
HI1331B Glass-body, semimicro, single junction, refillable, combination pH electrode. Use: flasks.



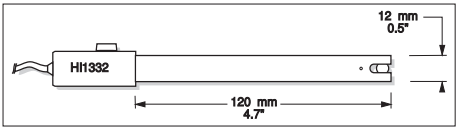
HI1230B Plastic-body (Ultem®), double junction, gel-filled, combination pH electrode. Use: general, field.



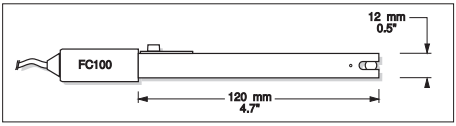
HI2031B Glass-body, semimicro, conic, refillable, combination pH electrode. Use: semisolid products.



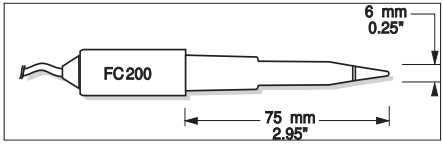
HI1332B Plastic-body (Ultem®), double junction, refillable, combination pH electrode. Use: general purpose.



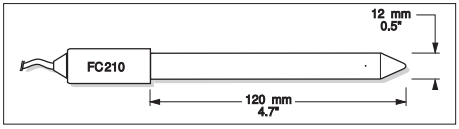
FC100B Plastic-body (PVDF), double junction, refillable, combination pH electrode. Use: general purpose for food industry.



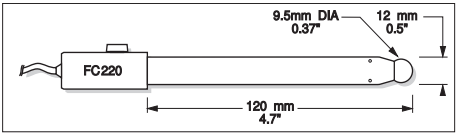
FC200B Plastic-body (PVDF), open junction, conic, Viscolene, non-refillable, combination pH electrode. Use: meat & cheese.



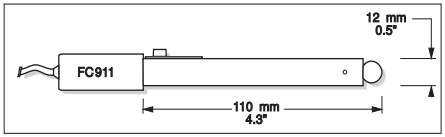
FC210B Glass-body, double junction, conic, Viscolene, non-refillable, combination pH electrode. Use: milk, yogurt.



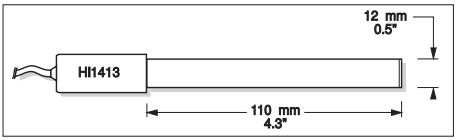
FC220B Glass-body, triple-ceramic, single junction, refillable, combination pH electrode. Use: food processing.



FC911B Plastic-body (PVDF), double junction, refillable with built-in amplifier, combination pH electrode. Use: very high humidity.

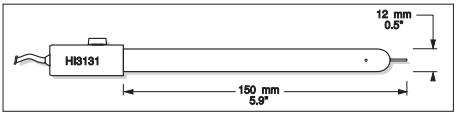


HI1413B Glass-body, single junction, flat tip, Viscolene, non-refillable, combination pH electrode. Use: surface measurement.

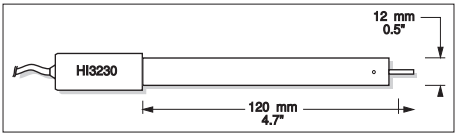


ORP Electrodes

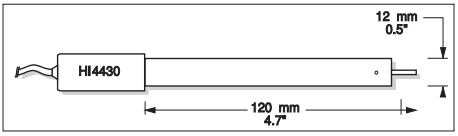
HI3131B Glass-body, refillable, combination platinum ORP electrode. Use: titration.



HI3230B Plastic-body (PES), gel-filled, combination platinum ORP electrode. Use: general purpose.

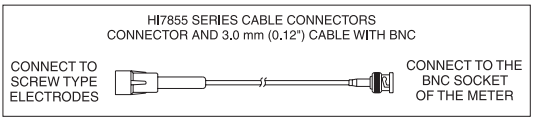


HI4430B Plastic-body (PES), gel-filled, combination gold ORP electrode. Use: general purpose.



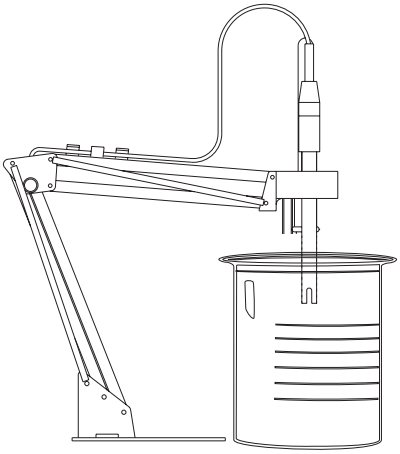
Extension Cables for Screw-Type Electrodes (Screw To BNC Adapter)

HI7855/1	Extension cable 1m (3.3') long
HI7855/3	Extension cable 3m (9.9') long
HI7855/5	Extension cable 5m (16.5') long
HI7855/10	Extension cable 10m (33') long
HI7855/15	Extension cable 15m (49.5') long



Other Accessories

HI710005	Voltage adapter from 115 Vac to 12 Vdc
HI710006	Voltage adapter from 230 Vac to 12 Vdc
HI98501	Pocket-size thermometer (range -50.0 to 150.0 °C)
HI76405	Electrode holder
HI8427	pH and ORP electrode simulator with 1 m (3.3') coaxial cable ending in female BNC connectors
HI931001	pH and ORP electrode simulator with LCD and 1 m (3.3') coaxial cable ending in female BNC connectors



11. ELECTRODE APPLICATION REFERENCE GUIDE

Application	Electrodes
1. Aquarium	HI1332B, HI1911B
2. Bath-water	HI1910B, HI1130B
3. Beer	HI1131B
4. Bread	HI2031B, FC200B
5. Cheese	FC200B
6. Dairy products	FC911B, FC100B
7. Dirty water	HI1910B, HI1912B
8. Emulsions	HI1053B
9. Environment	HI1230B
10. Flasks	HI1331B
11. Food industry general use	FC911B, FC100B
12. Fruit	FC200B, FC220B
13. Fruit juices, organic	FC210B
14. Galvanizing waste solution	HI1130B, HI1912B
15. Heavy-duty applications	HI1135B
16. High purity water	HI1053B
17. Horticulture	HI1053B, FC200B
18. In-line applications	HI1134B,HI1135B, HI2114B, HI2910B
19. Laboratory general use	HI1131B, HI1230B, HI1332B, HI1330B
20. Leather	HI1413B
21. Lemon juice	FC100B
22. Meat	FC200B, HI2031B
23. Micro plate sampling of less than 100 mL	HI1083B
24. Milk and Yogurt	FC210B
25. Paints	HI1053B
26. Paper	HI1413B
27. Photographic chemicals	HI1230B
28. Quality control	HI1332B
29. Sausages	FC200B, HI2031B
30. Semisolid products	HI2031B
31. Skin	HI1413B
32. Soil samples	HI1230B
33. Solvents	HI1043B
34. Strong acid	HI1043B
35. Submersion application	HI1130B
36. Surface measurements	HI1413B
37. Swimming pool	HI1130B, HI2114B, HI2910B

Application	Electrodes
38. Titrations with constant temperature range	HI1131B
39. Titrations with wide temperature range	HI1131B
40. Very high humidity	FC911B, HI1912B, HI1911B
41. Vials and test tube	HI1330B
42. Wine processing	FC220B

CERTIFICATION

All Hanna® instruments conform to the **CE European Directives** and **UK Standards**.

Disposal of Electrical and Electronic Equipment. The product should not be treated as household waste. Instead, hand it over to the appropriate collection point for the recycling of electrical and electronic equipment, which will conserve natural resources.
Ensuring proper product disposal prevents potential negative consequences for the environment and human health. For more information, contact your city, your local household waste disposal service, or the place of purchase.

RECOMMENDATIONS FOR USERS

Before using this product, make sure it is entirely suitable for your specific application and for the environment in which it is used. Any variation introduced by the user to the supplied equipment may degrade the meter's performance. For your and the meter's safety do not use or store the meter in hazardous environments.

WARRANTY

HI2209 is warranted for two years against defects in workmanship and materials when used for its intended purpose and maintained according to instructions. Electrodes and probes are warranted for six months. This warranty is limited to repair or replacement free of charge. Damage due to accidents, misuse, tampering, or lack of prescribed maintenance is not covered.
If service is required, contact your local Hanna Instruments® office. If under warranty, report the model number, date of purchase, serial number (engraved on the bottom of the meter), 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 (RGA) number from the Technical Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packed for complete protection.