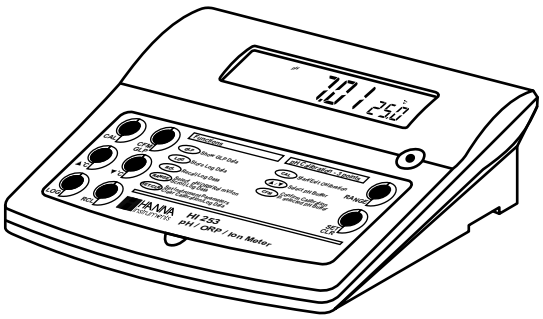
Instruction Manual

HI 253

Microprocessor-Based pH/mV/Ion/°C Bench Meter



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 use of the instrument, as well as a precise idea of its versatility.

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com or turn to the back cover for our worldwide contact list.

This instrument is in compliance with CE directives.

WARRANTY

HI 253 is guaranteed for two years against defects in workmanship and materials when used for its intended purpose and maintained according to instructions. Electrodes and probes are guaranteed 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 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 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 Technical Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packed for complete protection.

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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 damage, notify your Dealer or the nearest Hanna Customer Service Center.

Each instrument is supplied with:

- **HI 1131B** Glass-body Combination pH Electrode with 1 m (3.3') Cable
- **HI 7669/2W** Temperature Probe
- **HI 76404** Electrode Holder
- **pH 4.01 & 7.01** Buffer Solutions (20 mL each)
- **HI 7071S** Electrolyte Solution
- 12VDC Power Adapter
- Instruction Manual

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

GENERAL DESCRIPTION

The HANNA **HI 253** is a logging microprocessor-based pH, mV, Ion and temperature bench meter. Relative mV feature is also provided.

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

One, two or three-point calibration is possible, using five memorized buffers (4.01, 6.86, 7.01, 9.18 and 10.01 pH).

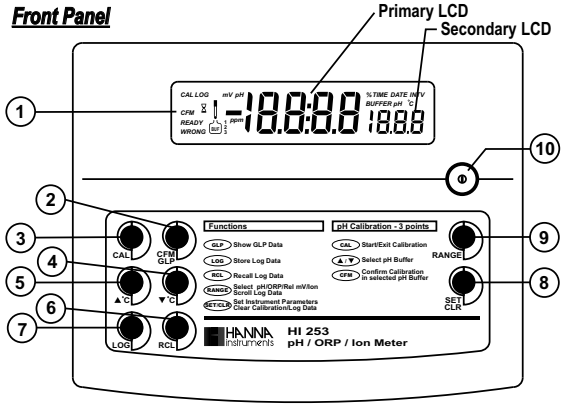
The **GLP** feature provides a guarantee of data consistency.

An alarm time-out is available to alert the user that too much time elapsed since the last pH calibration.

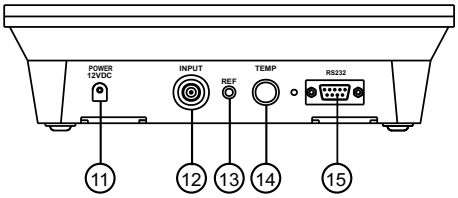
The instrument can store data in memory at the user's request for later retrieval.

FUNCTIONAL DESCRIPTION

Front Panel



Rear Panel



1) Liquid Crystal Display (LCD).
2) **CFM/GLP** key, to confirm different values or to display Good Laboratory Practice information.
3) **CAL** key, to enter and exit/escape calibration mode.
4) ▼/ºC key, to manually decrease temperature value or other parameters.
5) ▲/ºC key, to manually increase temperature value or other parameters.
6) **RCL** key, to enter/exit recall mode.
7) **LOG** key, to store measured data.
8) **SET/CLR** key, to enter/exit setup mode, clear pH calibration or delete logged data.
9) **RANGE** key, to select measurement range or to switch focused data.
10) **ON/OFF** switch.
11) Power supply socket.
12) BNC electrode connector.
13) Electrode reference socket.
14) Temperature probe socket.
15) RS232 serial communication connector.

HI 253 SPECIFICATIONS	
RANGE	–2.0 to 16.0 pH –2.00 to 16.00 pH –2.000 to 16.000 pH
	±699.9 mV ±2000 mV
	0.001 to 19999 ppm
	–9.9 to 120.0 °C
RESOLUTION	0.1 pH 0.01 pH 0.001 pH
	0.1 mV (±699.9 mV) 1 mV (±2000 mV)
	0.001 (0.001 to 9.999) ppm 0.01 (10 to 99.99) ppm 0.1 (100 to 999.9) ppm 1 (1000 to 19999) ppm
	0.1 °C
ACCURACY @ 20 °C/68 °F	±0.1 pH ±0.01 pH ±0.002 pH
	±0.2 mV (±699.9 mV) ±1 mV (±2000 mV)
	±0.5% f.s.
	±0.4 °C (excluding probe error)
Rel mV offset range	±2000 mV
Computer interface	opto-isolated RS232
pH Calibration	1, 2 or 3 point calibration, 5 buffers available (4.01, 6.86, 7.01, 9.18, 10.01)

HI 253 SPECIFICATIONS (cont.)	
Ion Calibration	Up to two-point calibration, 5 buffers available (0.1, 1, 10, 100, 1000)
Temperature compensation	Manual or Automatic from: –9.9 to 120.0 °C
pH Electrode	HI 1131B
Temperature probe	HI 7669/2W
Input impedance	10^{12} ohm
Power supply	12 VDC adapter
Dimensions	240x182x74 mm (9.4x7.1x2.9")
Weight	1.1 Kg (2.5 lb); kit with holder 2.5 Kg (5.5 lb)
Environment	0 – 50 °C (32 – 122 °F) max RH 95% non condensing
Warranty	2 years

OPERATIONAL GUIDE

POWER CONNECTION

Plug the 12 VDC adapter into the power supply socket.

Note: This instrument uses non volatile memory to retain the pH, mV, temperature calibrations and all other settings, even when unplugged.

Note: Make sure a fuse protects the main line.

ELECTRODE AND PROBE CONNECTIONS

For pH or ORP measurements connect an electrode with internal reference to the BNC connector on the back of the instrument.

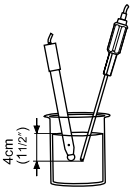
For electrodes with a separate reference connect the electrode's BNC to the BNC connector and the reference electrode plug to the reference socket.

For temperature measurements and automatic temperature compensation connect the temperature probe to the appropriate socket.

INSTRUMENT START-UP

- Turn the instrument on by pressing the **ON/OFF** switch.
- All LCD tags are displayed and a beep is sounded while the instrument performs a self test.

pH MEASUREMENTS



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

- Submerge the electrode tip and the temperature probe approximately 4 cm (1½") into the sample to be tested and stir gently. Allow time for the electrode to stabilize.
- The pH is displayed on the primary LCD and the temperature on the secondary LCD.

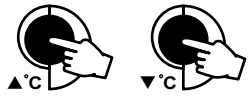
- If the reading is out of range, the closest full-scale value will be displayed blinking on the primary LCD.

If measurements are taken successively in different samples, it is recommended to rinse the electrode thoroughly with deionized water or tap water and then with some of the next sample to prevent cross-contamination.

The pH reading is affected by temperature. In order to measure the pH accurately, the temperature effect must be compensated for. To use the Automatic Temperature Compensation feature, connect and submerge the **HI 7669/2W** temperature probe into the sample as close as possible to the electrode and wait for a few seconds.

If the temperature of the sample is known, simple manual compensation can be performed by disconnecting the temperature probe.

The display will then show the default temperature of 25 °C or the last temperature reading with the "°C" tag blinking. The temperature can now be adjusted with the **ARROW** keys (from –9.9 °C to 120.0 °C).

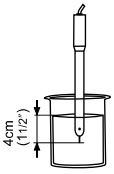


mV/ORP MEASUREMENTS

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

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

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



- Press **RANGE** to enter mV range.
- Submerge the tip of the ORP electrode 4 cm (1½") into the sample to be tested and allow a few seconds for the reading to stabilize.
- The instrument displays the mV reading on the primary LCD and the temperature on the secondary LCD.

- If the reading is out of range, the closest full-scale value will be displayed blinking on the primary LCD.

RELATIVE mV MEASUREMENTS

- Press **RANGE** until "rEL" message will be displayed on the secondary LCD line for about one second and "mV" tag will blink. After one second the temperature will be displayed on the secondary LCD.

The reading displayed by the instrument is equal to the difference between the current mV input value and relative mV offset established in the relative mV calibration.

ION MEASUREMENTS

- Press **RANGE** to enter ppm measurement mode.
- Submerge the tip of the ISE electrode 4 cm (1½") into the sample to be tested and allow a few seconds for the reading to stabilize.
- The instrument displays the ppm reading on the primary LCD and the temperature on the secondary LCD line.

TEMPERATURE MEASUREMENTS

Connect the **HI 7669/2W** temperature probe to the appropriate socket and turn the instrument on.

Immerse the temperature probe into the sample and allow the reading on the secondary LCD to stabilize.

pH CALIBRATION

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

The instrument should be recalibrated :

- Whenever the pH electrode is replaced.
- At least once a week.
- After testing aggressive chemicals.
- If "CAL" "INTV" tags are blinking during measurement.

Every time you calibrate the instrument use fresh buffers and perform an electrode Cleaning Procedure (see page 34).

PREPARATION

Pour small quantities of the buffer solutions into clean beakers. If possible, use plastic or glass beakers to minimize any EMC interferences.

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

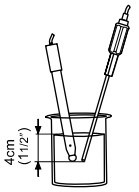
If you are measuring in the acidic range, use pH 7.01 or 6.86 as first buffer and pH 4.01 as second buffer. If you are measuring in the alkaline range, use pH 7.01 or 6.86 as first buffer and pH 10.01 or 9.18 as second buffer.

PROCEDURE

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

It is recommended to perform a two or three-point calibration. However, the instrument also allows one-point calibration, as described on page 12.

THREE-POINT CALIBRATION



- Immerse the pH electrode and the temperature probe 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. The temperature probe should be close to the pH electrode.
- Press **CAL**. The "CAL" and "BUF 1" tags will appear and the "7.01" buffer will be displayed on the secondary LCD.

- If necessary, press the **ARROW** keys to select a different buffer value.

- The "⧖" tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, the "READY" tag will be displayed and the "CFM" tag will blink.
- Press **CFM** to confirm calibration.
- The calibrated value will be displayed on the primary LCD and the second expected buffer value on the secondary LCD.

Note: The instrument will automatically skip the buffer used for the first point. It also skips 6.86 if 7.01 buffer was used and viceversa. Likewise, it will skip 9.18 if 10.01 buffer was used and viceversa.

- After the first calibration point is confirmed, immerse the pH electrode and the temperature probe approximately 4 cm (1½") into the second buffer solution and stir gently. The temperature probe should be close to the pH electrode.
- If necessary, press the **ARROW** keys to select a different buffer value.
- The "⧖" tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, the "READY" tag will be displayed and the "CFM" tag will blink.
- Press **CFM** to confirm calibration.
- The calibrated value will be displayed on the primary LCD and the third expected buffer value on the secondary LCD.

Note: The instrument will automatically skip the buffers used for the first and second calibration points.

- After the second calibration point is confirmed, immerse the pH electrode and the temperature probe approximately 4 cm (1½") into the third buffer solution and stir gently. The temperature probe should be close to the pH electrode.
- If necessary, press the **ARROW** keys to select a different buffer value.
- The "⧖" tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, the "READY" tag will be displayed and the "CFM" tag will blink.
- Press **CFM** to confirm calibration.
- The instrument stores the calibration values and returns to normal measurement mode.

Note:
- If the value measured by the instrument is not close to the selected buffer, "WRONG" "" and "WRONG" " " tags will blink alternately. In this case, check if the correct buffer has been used or regenerate the electrode by following the Cleaning Procedure (see page 34). If necessary, change the buffer or the electrode.
- If "WRONG", "Buffer pH" tags and "Old" tag on the secondary LCD are displayed blinking, an inconsistency between new and previous (old) calibration is detected. Clear calibration parameters by pressing **SET/CLR** and proceed with calibration from the current calibration point (the instrument will keep all confirmed values during current calibration).
- The "WRONG" tag and temperature value are displayed blinking if temperature reading is out of the defined temperature range of the buffer. Calibration cannot be confirmed in this situation.

- Press **RANGE** to display the temperature reading on the LCD during calibration.

TWO-POINT CALIBRATION

- Proceed as described in "Three-point calibration" section.
- Press **CAL** after the second calibration point was confirmed.

The instrument will return to measurement mode and will memorize the two-point calibration data.

ONE-POINT CALIBRATION

- Proceed as described in "Three-point calibration" section.
- Press **CAL** after the first calibration point was confirmed.

The instrument will return to measurement mode and will memorize the one-point calibration data.

Note: Calibration parameters are evaluated taking in consideration the new values for the confirmed buffers in current calibration and the old values, if existing, for the other buffers. To clear old calibration values, press **SET/CLR** before exiting calibration.

ION CALIBRATION

For greatest accuracy, it is recommended to calibrate the instrument frequently.

Due to electrode conditioning time, the electrode must be kept immersed a few seconds to stabilize. The user will be guided step by step during calibration with easy to follow tags on the display. This will make the calibration a simple and error-free procedure.

PREPARATION

In SETUP menu, select the proper ion charge.

Note: If "undF" option is selected in SETUP menu, calibration must be performed in two points, otherwise "----" message will be displayed on the LCD if exiting calibration after confirming the first used buffer.

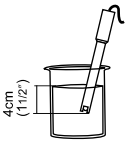
Pour small quantities of the buffer solutions into clean beakers. If possible, use plastic beakers to minimize any EMC interferences.

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

PROCEDURE

One or two-point calibration is available, using five memorized buffers: 0.1, 1, 10, 100, 1000 ppm.

Select Ion measurement range by pressing **RANGE**. Remove the protective cap from the ISE electrode.



TWO-POINT CALIBRATION

- Immerse the ISE electrode approximately 4 cm (1½") into the selected solution and stir gently.
- Press **CAL**. The primary LCD will display the ppm value using the current offset and slope. The "CAL" and "BUF 1" tags will appear and 0.1 ppm buffer will be displayed on the secondary LCD.

- If necessary, press the **ARROW** keys to select a different buffer value.
- The "⧖" tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, the "READY" tag will be displayed and the "CFM" tag will blink.

- Press **CFM** to confirm calibration.
- The calibrated value will be displayed on the primary LCD and the second expected buffer value on the secondary LCD.

Note: The instrument will automatically skip the buffer used for the first point.

- After the first calibration point is confirmed, immerse the ISE electrode approximately 4 cm (1½") into the second calibration solution.
- If necessary, press the **ARROW** keys to select a different buffer value.
- The "⧖" tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, the "READY" tag will be displayed and the "CFM" tag will blink.
- Press **CFM** to confirm calibration.
- The instrument stores the calibration value and returns to normal measurement mode.

Note:

- If the mV value is out of the mV range (±2000), "WRONG" "BUF" and "WRONG" "!" tags will blink alternately. In this case, check if the correct buffer has been used or refresh the electrode by following the Cleaning Procedure (see page 34). If necessary, change the buffer or the electrode.
- If the new slope is out of the slope window, "WRONG" "BUF" and "WRONG" "!" tags will blink alternately. In this case, check if the correct buffer has been used or refresh the electrode by following the Cleaning Procedure. If necessary, change the buffer or the electrode.

  Slope window is between ±20 mV and ±105 mV if ion charge is not specified (undF option in SETUP menu) or between 50% and 120% of default slope for the corresponding ion charge.

  Default slope value (mV/decade):

  –59.16 (monovalent anion) - ion charge is –1
  59.16 (monovalent cation) - ion charge is 1
  –29.58 (divalent anion) - ion charge is –2
  29.58 (divalent cation) - ion charge is 2
  100 - ion charge is "undF"
- Press **SET/CLR** during calibration if you want to clear calibration values and set to default. The instrument will display "CLR" message and will return to measurement mode.

- Press **RANGE** to display the temperature reading on the LCD during calibration.

ONE-POINT CALIBRATION

- Press **CAL** after first calibration point was confirmed. The instrument memorizes the one-point calibration parameters and returns to measurement mode.

GOOD LABORATORY PRACTICE (GLP)

GLP is a set of functions that allows storage and retrieval of data regarding the maintenance and status of the electrode.

All data regarding last pH calibration (one, two or three-point) and Ion calibration is stored for the user to review when necessary. This data includes the following: calibration time stamp, offset (mV), average of pH slope (%) or Ion slope (mV), calibration buffers and the time until a new calibration is required (only for pH calibration).

CALIBRATION ALARM TIME-OUT

For pH calibration, **HI 253** allows the user to set the number of days before the next required calibration. This value can be set from 1 to 7 days. The default setting is OFF (disabled).

The instrument checks if the time-out time has expired. If the time elapsed, the "CAL" "INTV" tags will blink as a reminder.

Note: If the instrument was not calibrated, the "CAL" "INTV" tags will be displayed even if the feature is disabled in SETUP menu.

LAST pH CALIBRATION DATA

Last pH calibration data is stored automatically after a successful calibration.

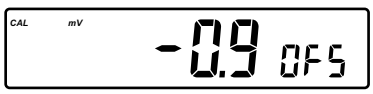
To view the pH calibration data, press **GLP** while in normal measurement mode.

The instrument will display the time (hh:mm) of the last calibration.

Press the **ARROW** keys to view the next logged calibration parameter (pressing the ▲ºC key):

- The date (yyyy.mm.dd).

- The pH calibration offset.



- The pH calibration slope (the GLP slope is the average of the calibration slopes; the percentage is referred to the ideal value of 59.16 mV/pH).

- The pH calibration buffers in calibrating order.
  The first pH calibration buffer:

  The second pH calibration buffer:

  The third pH calibration buffer:

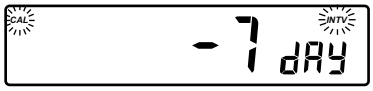
Note:
- The "OLd" message displayed beside the pH value means that this buffer was not used during last calibration. Press and hold down **SET/CLR** if you want to see calibration date (or time if old calibration was made in the same day with current calibration).
- If "no bUF" message appears on the LCD, the instruments inform you that calibration was performed in less than three points.

- pH resolution during calibration.

- Calibration Alarm Time-Out status:
  if disabled.

or the number of days until the calibration alarm will be displayed.

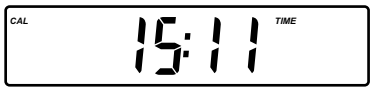
or if expired (7 days ago).



- The instrument ID.

LAST ION CALIBRATION DATA

Last Ion calibration data is stored automatically after a successful calibration.
To view Ion calibration data, press **GLP** when the instrument is in Ion measurement mode.
The instrument will display the time (hh:mm) of the last calibration.



Press the **ARROW** keys to view the next logged calibration parameter (pressing the ▲°C key):

- The date (yyyy.mm.dd).

- The first Ion calibration buffer.

- The first mV value.

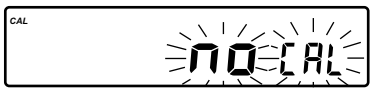
- The second Ion calibration buffer.

- The second mV value.

- The Ion calibration slope (mV/decade).

- The instrument ID.

Note:
- If a one-point calibration is performed after a two-point calibration, the instrument will keep the old slope.
- If "no bUF" message appears on the LCD, the instrument informs you that calibration was performed in only one point.
- Press **GLP** at any moment and the instrument will return to measurement mode.
- If calibration has not been performed, the instrument displays "no CAL" message blinking.



LOGGING FUNCTION

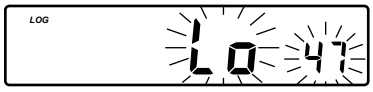
Up to 50 LOG samples can be stored into memory.

LOGGING THE CURRENT DATA

To store the current reading into memory press **LOG** while the instrument is in measurement mode.

The instrument will display the current date (mm.dd) on the primary LCD, the record number on the secondary LCD and "LOG" tag will blink for a few seconds (see example below: record No. 5 dated September 14):

If there are less than 6 memory locations remaining, the record number and "Lo" message will blink to alert the user.

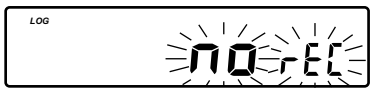


If the log space is full, "FULL LOC" message will be displayed and no more data will be saved.

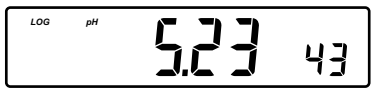
When **LOG** is pressed, a complete set of information is stored: date, time, pH or ppm, mV, temperature and calibration data.

VIEW LOGGED DATA

Press **RCL** to retrive the information stored while in measurement mode.
If no data were logged, the instrument displays:



Otherwise, the instrument will display the **pH**, **relative mV** or **ppm** value on the primary LCD and the last stored record number on the secondary LCD, along with "LOG" tag.



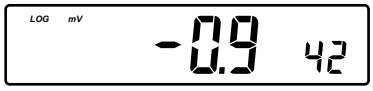
or

or

Pressing the **ARROW** keys, the instrument will display the same parameter but for a different record:

Press **RANGE** and the instrument will display the next logged parameter as follows:

- The **mV** value on the primary LCD and the record number on the secondary LCD.



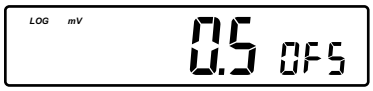
- The **temperature** value on the primary LCD and the record number on the secondary LCD.

Note: When the pH, mV or temperature is displayed, if **SET/CLR** is pressed and hold down, the secondary LCD will display the record date.

- The **time** on the primary LCD, along with "TIME" tag.

- The **date** on the primary LCD, along with "DATE" tag.

- The calibration **offset** on the primary LCD and "OFS" message on the secondary LCD.



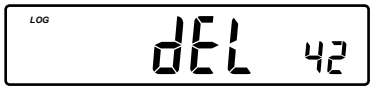
Note: If in Ion RECALL mode, the instrument will display "----" message on the primary LCD.

- The calibration **slope** (for pH or ppm range) on the primary LCD and "SLP" message on the secondary LCD.

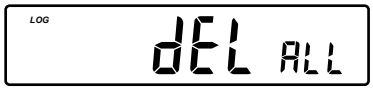
or

Note:
- If in Relative mV RECALL mode, the instrument will display "----" message on the primary LCD.
- When the time, date, year, offset or slope is displayed, if **SET/CLR** is pressed and hold down, the secondary LCD will display the record number.

- The "dEL" message on the primary LCD and the selected record on the secondary LCD, along with "LOG" tag.



Note:
- If one of the **ARROW** keys is pressed while "dEL" and record number is displayed, the next/previous record number is selected.
- If **LOG** is pressed, the secondary LCD will display "ALL" message.



- Pressing **LOG** again, the secondary LCD will display the record number.
- Press **SET/CLR** to delete the selected or all records.
- If "del ALL" option was selected, all records are deleted and the instrument returns to measurement mode.

Note: After **LOG** is pressed while in measurement mode or a selected record is deleted, the instrument will display the amount of free log space for about one second (e.g. 25 records free).

Press **RCL** to leave RECALL mode at any time.

SETUP

Setup mode allows viewing and modifying the following parameters:

- Current Time
- Current Date
- pH Resolution
- Ion Charge
- Beep Status
- Baud Rate (serial communication)
- Command prefix (serial communication)
- Calibration Alarm Time-Out
- Instrument ID

To enter SETUP mode press **SET** while the instrument is in measurement mode.

Select a parameter with the **ARROW** keys.

Press **CAL** if you want to change a parameter value. The selected parameter will start blinking.

Press **RANGE** to toggle between displayed parameters.

Press the **ARROW** keys to increase or decrease the displayed value.

Press **CFM** to save the modified value or **CAL** to escape.

Press the **ARROW** keys to select the next/previous parameter.

CURRENT TIME SET

Press **CAL** when the current time is displayed. The hour will start blinking.

Press the **ARROW** keys to change the hour.

Press **RANGE**. The minutes will start blinking.

Press the **ARROW** keys to change the minutes.

Press **CFM** to save the modified value.

Press **CAL** to escape without saving.

CURRENT DATE SET

Press **CAL** when the current date is displayed. The year will start blinking.

Press the **ARROW** keys to change the year.

Press **RANGE**. The month will start blinking.

Press the **ARROW** keys to change the month.

Press **RANGE**. The day will start blinking.

Press the **ARROW** keys to change the day.

Press **CFM** to save the modified value.

Press **CAL** to escape without saving.

pH RESOLUTION SET

Press **CAL** when the pH range is displayed. The pH range (0.1, 0.01 or 0.001) will start blinking.

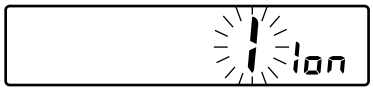
Press the **ARROW** keys to change the pH range.

Press **CFM** to save the modified pH range.

Press **CAL** to escape without saving.

ION CHARGE

Press **CAL** when the ion charge is displayed. The ion charge (undF, –2, –1, 1 or 2) will start blinking.



Press the **ARROW** keys to change the ion charge.

Note: To select the right ion charge, different ion types and their charge are presented in the table below.

ION CHARGE	ION types
–2 (divalent anions)	S, CO_3
–1 (monovalent anions)	F, Cl, Br, I, CN, SCN, ClO_4, NO_3
1 (monovalent cations)	Na, K, Ag, NH_4
2 (divalent cations)	Mg, Ca, Ba, Cd, Cu, Pb
undF	undefined ion

Press **CFM** to save the modified ion charge.

Press **CAL** to escape without saving.

BEEP STATUS SET

Press **CAL** when the beep status is displayed. Beep status (On or OFF) will start blinking.

Press the **ARROW** keys to change the beep status (On or OFF).

Press **CFM** to save the modified beep status.

Press **CAL** to escape without saving.

BAUD RATE SET

Press **CAL** when the baud rate is displayed. The baud rate (600, 1200, 2400, 4800 or 9600) will start blinking.

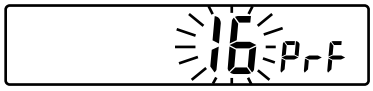
Press the **ARROW** keys to change the baud rate value.

Press **CFM** to save the modified baud rate value.

Press **CAL** to escape without saving.

SERIAL COMMUNICATION COMMAND PREFIX SET

Press **CAL** when the command prefix is displayed. The command prefix (0 to 47) will start blinking.



Press the **ARROW** keys to change the command prefix.
Press **CFM** to save the modified command prefix value.
Press **CAL** to escape without saving.

Note:
- See the PC interface section on page 29 for a complete explanation.
- The command prefix must be 16 if **HI 92000** PC software is used.

CALIBRATION ALARM TIME-OUT SET

Press **CAL** when the calibration time-out is displayed. Calibration time-out (OFF or 1 to 7 days) will start blinking.

Press the **ARROW** keys to change the calibration time-out value.
Press **CFM** to save the modified calibration time-out value.
Press **CAL** to escape without saving.

INSTRUMENT ID PARAMETER SET

Press **CAL** when the instrument ID is displayed. The instrument ID (0000 to 9999) will start blinking.

Press the **ARROW** keys to change the instrument ID value.
Press **CFM** to save the modified instrument ID value.
Press **CAL** to escape without saving.

Note: The instrument ID is downloaded to a PC as part of a logged data, set to identify its origin.

TEMPERATURE CALIBRATION (for technical personnel only)

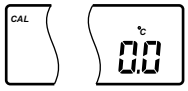
All the instruments are factory calibrated for temperature.

Hanna's temperature probes are interchangeable and no temperature calibration is needed when they are replaced.

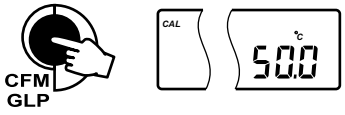
If the temperature measurements are inaccurate, temperature recalibration should be performed.

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

- Prepare a vessel containing ice and water and another one containing hot water (at a temperature of around 50 °C). Place insulation material around the vessels to minimize temperature changes.
- Use a calibrated thermometer with a resolution of 0.1 °C as a reference thermometer.
- With the instrument off, press and hold down the **CAL**&**LOG** keys, then power on the instrument. The "CAL" tag will appear and the secondary LCD will show 0.0 °C.



- Immerse the temperature probe in the vessel with ice and water as near as possible to the reference thermometer. Allow a few seconds for the probe to stabilize.
- Use the **ARROW** keys to set the reading on the secondary LCD to that of ice and water, measured by the reference thermometer . When the reading is stable and close to the selected calibration point, "READY" tag will appear and "CFM" tag will blink.
- Press **CFM** to confirm. The secondary LCD will show 50.0 °C.



- Immerse the temperature probe in the second vessel as near as possible to the reference thermometer. Allow a few seconds for the probe to stabilize.

- Use the **ARROW** keys to set the reading on the secondary LCD to that of the hot water.

- When the reading is stable and close to the selected calibration point, "READY" tag will appear and "CFM" tag will blink.
- Press **CFM** to confirm. The instrument returns to measurement mode.

Note: If the reading is not close to the selected calibration point, "WRONG" tag will blink. Change the temperature probe and restart calibration.

mV CALIBRATION (for technical personnel only)

All the instruments are factory calibrated for mV.

Hanna's ORP electrodes are interchangeable and no mV calibration is needed when they are replaced.

If the mV measurements are inaccurate, mV recalibration should be performed.

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

A two or three-point calibration can be performed at 0.0 mV, 600.0 mV and 1800.0 mV.

- Attach to the BNC connector a mV simulator with an accuracy of ±0.1 mV.
- With the instrument off, press and hold down the **CFM**&**RCL** keys, then power on the instrument. The "CAL" tag will appear and the secondary LCD will show 0.0 mV.
- Set 0.0 mV on the simulator.
  When the reading is stable and close to the selected calibration point, "READY" tag will appear and "CFM" tag will blink.
- Press **CFM** to confirm. The secondary LCD will display 600 mV.
- Set 600.0 mV on the simulator.
  When the reading is stable and close to the selected calibration point, "READY" tag will appear and "CFM" tag will blink.
- Press **CFM** to confirm. The secondary LCD will display 1800 mV.
- Set 1800.0 mV on the simulator.
  When the reading is stable and close to the selected calibration point, "READY" tag will appear and "CFM" tag will blink.
- Press **CFM** to confirm. The instrument returns to measurement mode.

Note: • If the reading is not close to the selected calibration point, "WRONG" tag will blink. Verify calibration condition or contact your vendor if you can not calibrate.

• Press **CAL** in any moment of the calibration process. The instrument will return to measurement mode. If calibration process is stopped after 600 mV is confirmed, the 600 mV range is calibrated and calibration parameters are memorized.

RELATIVE mV CALIBRATION

- Press **CAL** when the instrument is in RELATIVE mV measurement mode. The "mV" and "⧖" tags will blink. Absolute mV is displayed on the primary LCD and "AbS" message is displayed on the secondary LCD.
- When the absolute reading is stable and in measurement range, the instrument asks for confirmation.
- If the reading is out of range, "WRONG" tag will be displayed.
- Press **CFM** to confirm the absolute value. The instrument will display 0.0 mV on the primary LCD and "rEL" message on the secondary LCD. In this moment the relative mV offset is equal to absolute mV reading.
- Use the **ARROW** keys if you want to change the displayed relative mV value.
- Press **CFM** to confirm the relative mV value. The relative mV offset is displayed on the primary LCD and "OFF" message on the secondary LCD for a few seconds. The instrument returns to measurement mode.

Note: The relative mV value can be changed only inside the relative mV offset window (± 2000 mV).

PC INTERFACE

Data transmission from the instrument to the PC can be done with the **HI 92000** Windows® compatible software (optional). **HI 92000** also offers graphing and on-line help feature.

Data can be exported to the most popular spreadsheet programs for further analysis.

To connect your instrument to a PC, use the optional Hanna **HI 920010** cable connector. Make sure that your instrument is switched off and plug one connector to the instrument RS232C socket and the other into the serial port of your PC.

Note:
- Other cables than **HI 920010** may use a different configuration. In this case communication between instrument and PC may not be possible.
- If you are not using Hanna Instruments **HI 92000** software, please see the following instructions.

SENDING COMMANDS FROM PC

It is also possible to remotely control the instrument with any terminal program. Use **HI 920010** cable to connect the instrument to a 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 instrument the scheme is:

<command prefix> <command> <CR>

where: <command prefix> is a selectable ASCII character between 0 and 47.

<command> is the command code (3 characters).

Note: Either small or capital letters can be used.

SIMPLE COMMANDS

RNG	Is equivalent to pressing **RANGE**
CAL	Is equivalent to pressing **CAL**
CFM	Is equivalent to pressing **CFM/GLP**
UPC	Is equivalent to pressing the **UP** arrow key
DWC	Is equivalent to pressing the **DOWN** arrow key
SET	Is equivalent to pressing **SET/CLR**
LOG	Is equivalent to pressing **LOG**

CHR n Change the instrument range according with the parameter value (n):

- n=0 pH range/0.001 resolution
- n=1 pH range/0.01 resolution
- n=2 pH range/0.1 resolution
- n=3 mV range
- n=4 Relative mV range
- n=5 Ion range

COMMANDS REQUIRING AN ANSWER

pH? Causes the instrument to send the pH reading. If the range is set to mV, "Err6" is received.

MV? Causes the instrument to send the mV reading. If the range is set to pH, "Err6" is received.

MR? Causes the instrument to send the relative mV reading. If the range is set to pH or mV, "Err6" is received.

TM? Causes the instrument to send the temperature reading.

pM? Causes the instrument to send the Ion reading. "Err6" is received if the instrument is not in Ion range.

RAS Causes the instrument to send a complete set of readings in according with the current range:

- pH, mV and temperature reading on pH range.
- mV and temperature reading on mV range.
- Rel mV, absolute mV and temperature reading on Rel mV range.
- ppm, mV and temperature reading on Ion range.

MDR Requests the instrument model name and firmware code.

PAR Requests the setup parameters setting (instrument ID, calibration alarm time-out, pH range, beep status).

NSL Requests the number of logged samples.

GLP Requests the calibration data record.

LOD xxx Requests the xxx^{th} record logged data ("Err3" is sent when "xxx" is an invalid record number).

LOD ALL Requests all logged data.

Note:

- "Err8" is sent if instrument is not in measurement mode.
- "Err7" is sent if mV are asked during pH calibration mode.
- "NAK" (21) character is sent when the instrument receives an unknown or a corrupted command.

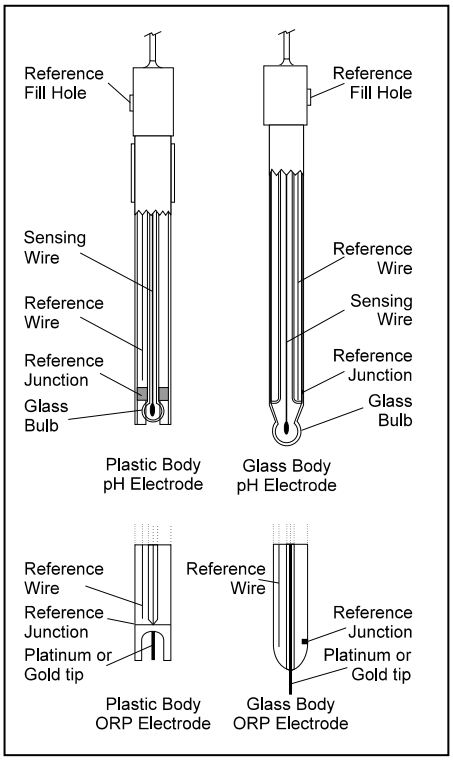
pH VALUES AT DIFFERENT TEMPERATURES

The 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 instrument 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	9.98
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

During calibration the instrument will display the pH buffer value at 25 °C.

ELECTRODE CONDITIONING & MAINTENANCE



PREPARATION PROCEDURE

Remove the protective cap of the pH electrode.

DO NOT BE ALARMED IF SALT DEPOSITS ARE PRESENT. This is normal with electrodes. 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 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 PROCEDURE

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 and **HI 7082** or **HI 8082** for double junction electrodes). Follow the Preparation Procedure on page 32 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 instrument 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 and **HI 7082** or **HI 8082** for double junction electrodes). Allow the electrode to stand upright for 1 hour.

Follow the Storage Procedure above.

CLEANING PROCEDURE

• General	Soak in Hanna **HI 7061** or **HI 8061** General Cleaning Solution for approximately ½ hour.
• Protein	Soak in Hanna **HI 7073** or **HI 8073** Protein Cleaning Solution for 15 minutes.
• Inorganic	Soak in Hanna **HI 7074** Inorganic Cleaning Solution for 15 minutes.
• Oil/grease	Rinse with Hanna **HI 7077** or **HI 8077** Oil and Fat Cleaning Solution.

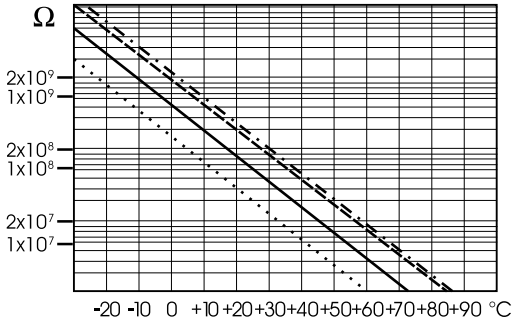
IMPORTANT: After performing any of the cleaning procedures, rinse the electrode thoroughly with distilled water, refill the reference chamber with fresh electrolyte (not necessary for gel-filled electrodes) and soak the electrode in **HI 70300** or **HI 80300** Storage Solution for at least 1 hour before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

TROUBLESHOOTING GUIDE

SYMPTOMS	PROBLEM	SOLUTION
Slow reponse/excessive drift.	Dirty pH electrode.	Soak the electrode tip in HI 7061 or HI 8061 solution for 30 minutes and then clean the electrode.
Readings fluctuate up and down (noise).	Clogged/dirty junction. Low electrolyte level (refillable electrodes only).	Clean the electrode. Refill with fresh solution (for refillable electrodes only).
Out of range in the mV scale.	Dry membrane/junction.	Soak in HI 70300 or HI 80300 storage solution.
The meter does not accept the buffer solution for calibration.	Out of order pH electrode.	Follow the cleaning procedure. If still no results, replace the electrode.
If the display shows: "pH" and " -2.00" or "16.00" blinking.	Out of range in the pH scale.	a) Recalibrate the meter. b) Make sure the pH sample is in the specified range. c) Check the electrolyte level and the general state of the electrode.
If the display shows: "mV" and "-2000" or "+2000" blinking	Out of range in the mV scale.	Electrode not connected.
The meter does not work with the temperature probe.	Broken temperature probe.	Replace the temperature probe.
The meter fails to calibrate or gives faulty readings.	Broken pH electrode.	Replace the electrode.
At startup the meter displays all LCD tags permanently.	One of the keys is blocked.	Check the keyboard or contact the vendor.
"Err xx" error message displayed.	Internal error.	Power off the meter and then power it on. If the error persists, contact the vendor.

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 more 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 25 °C.



Since the resistance of the pH electrode is in the range of 50 – 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

Alkaline Error

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 called alkaline error and causes the pH to be underestimated. Hanna's glass formulations have the indicated characteristics.

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

ACCESSORIES

pH BUFFER SOLUTIONS

HI 70004P pH 4.01 Buffer Sachets, 20 mL, 25 pcs
HI 70007P pH 7.01 Buffer Sachets, 20 mL, 25 pcs
HI 70010P pH 10.01 Buffer Sachets, 20 mL, 25 pcs
HI 7001L pH 1.68 Buffer Solution, 500 mL
HI 7004L pH 4.01 Buffer Solution, 500 mL
HI 7006L pH 6.86 Buffer Solution, 500 mL
HI 7007L pH 7.01 Buffer Solution, 500 mL
HI 7009L pH 9.18 Buffer Solution, 500 mL
HI 7010L pH 10.01 Buffer Solution, 500 mL
HI 7001L pH 1.68 Buffer Solution in FDA approved bottle, 500 mL
HI 8004L pH 4.01 Buffer Solution in FDA approved bottle, 500 mL
HI 8006L pH 6.86 Buffer Solution in FDA approved bottle, 500 mL
HI 8007L pH 7.01 Buffer Solution in FDA approved bottle, 500 mL
HI 8009L pH 9.18 Buffer Solution in FDA approved bottle, 500 mL
HI 8010L pH 10.01 Buffer Solution in FDA approved bottle, 500 mL

ELECTRODE STORAGE SOLUTIONS

HI 70300L Storage Solution, 460 mL
HI 80300L Storage Solution in FDA approved bottle, 460 mL

ELECTRODE CLEANING SOLUTIONS

HI 70000P Electrode Rinse Sachets, 20 mL, 25 pcs
HI 7061L General Cleaning Solution, 460 mL
HI 7073L Protein Cleaning Solution, 460 mL
HI 7074L Inorganic Cleaning Solution, 460 mL
HI 7077L Oil & Fat Cleaning Solution, 460 mL
HI 8061L General Cleaning Solution in FDA approved bottle, 460 mL
HI 8073L Protein Cleaning Solution in FDA approved bottle, 460 mL
HI 8077L Oil & Fat Cleaning Solution in FDA approved bottle, 460 mL

ELECTRODE REFILL ELECTROLYTE SOLUTIONS

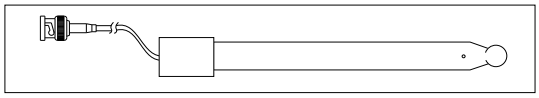
HI 7071 3.5M KCl + AgCl Electrolyte, 4x30 mL, for single junction electrodes
HI 7072 1M KNO_3 Electrolyte, 4x30 mL
HI 7082 3.5M KCl Electrolyte, 4x30 mL, for double junction electrodes
HI 8071 3.5M KCl + AgCl Electrolyte in FDA approved bottle, 4x30 mL, for single junction electrodes
HI 8072 1M KNO_3 Electrolyte in FDA approved bottle, 4x30 mL
HI 8082 3.5M KCl Electrolyte in FDA approved bottle, 4x30 mL, for double junction electrodes.

ORP PRETREATMENT SOLUTIONS

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

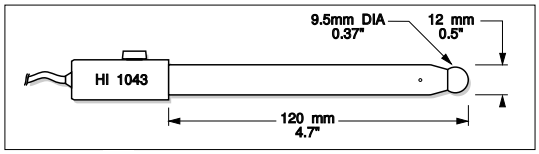
pH ELECTRODES

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



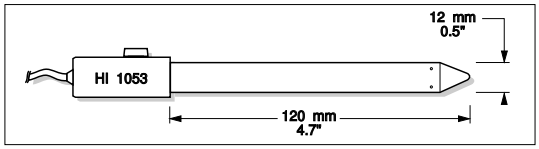
HI 1043B

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



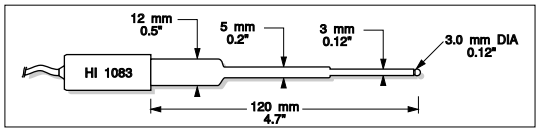
HI 1053B

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



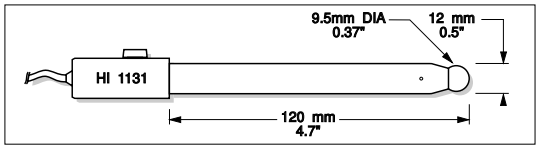
HI 1083B

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



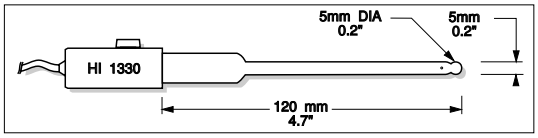
HI 1131B

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



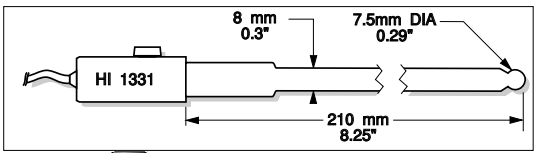
HI 1330B

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



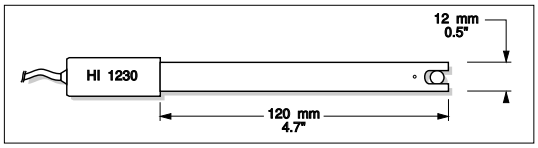
HI 1331B

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



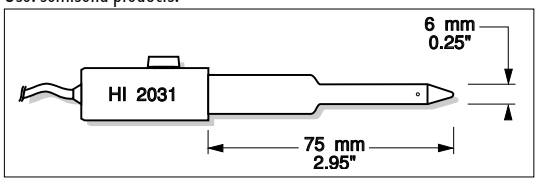
HI 1230B

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



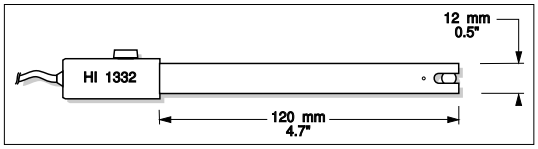
HI 2031B

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



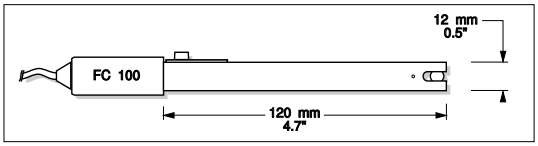
HI 1332B

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



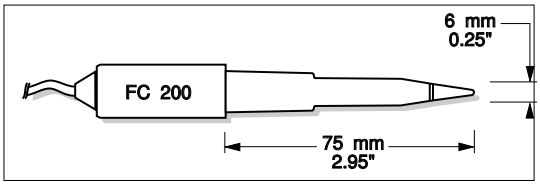
FC 100B

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



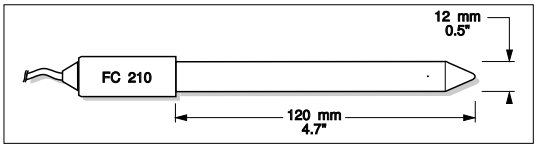
FC 200B

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



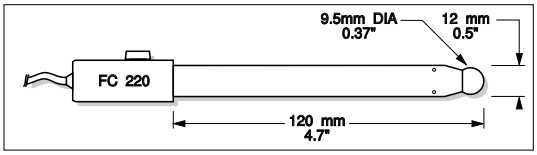
FC 210B

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



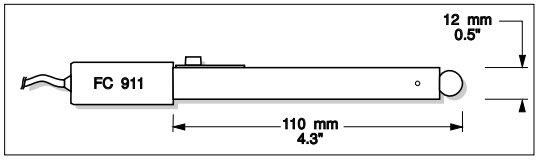
FC 220B

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



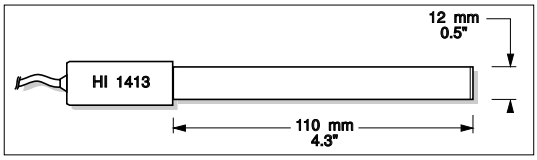
FC 911B

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



HI 1413B

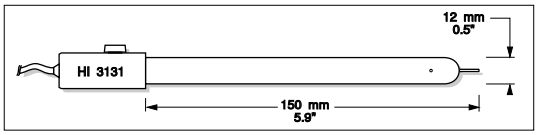
Glass-body, single junction, flat tip, Viscolene, non-refillable, combination **pH** electrode. Use: surface measurement.



ORP ELECTRODES

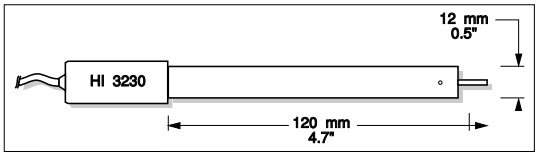
HI 3131B

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



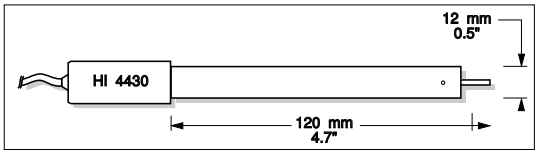
HI 3230B

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.

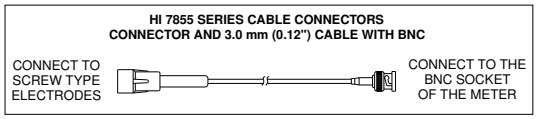


Consult the Hanna General Catalog for more electrodes with screw-type or BNC connectors.

Ultem® is registered Trademark of "General Electric Co."
Kynar® is registered Trademark of "Pennwalt Corp."

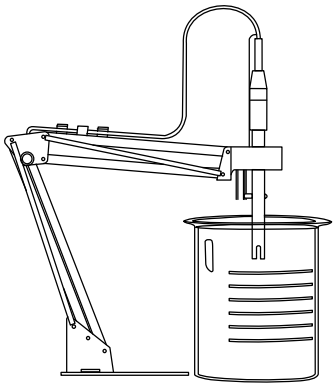
EXTENSION CABLE FOR SCREW-TYPE ELECTRODES (SCREW TO BNC ADAPTER)

HI 7855/1 Extension cable 1 m (3.3') long
HI 7855/3 Extension cable 3 m (9.9') long



OTHER ACCESSORIES

HI 710005 Voltage adapter from 115 VAC to 12 VDC (USA plug)
HI 710006 Voltage adapter from 230 VAC to 12 VDC (European plug)
HI 710012 Voltage adapter from 240 VAC to 12 VDC (UK plug)
HI 710013 Voltage adapter from 230 VAC to 12 VDC (South Africa plug)
HI 710014 Voltage adapter from 230 VAC to 12 VDC (Australia plug)
HI 76405 Electrode holder



HI 8427 pH and ORP electrode simulator with 1 m (3.3') coaxial cable ending in female BNC connectors
HI 931001 pH and ORP electrode simulator with LCD and 1 m (3.3') coaxial cable ending in female BNC connectors
HI 7669/2W Temperature probe with 1 m (3.3') cable
HI 92000 Windows® compatible software
HI 920010 9 to 9-pin RS232 cable

RECOMMENDATIONS FOR USERS

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

Operation of this instrument in residential areas could cause unacceptable interferences to radio and TV equipment, requiring the operator to follow 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 24 VAC or 60 VDC.

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

SALES AND TECHNICAL SERVICE CONTACTS

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