INSTRUCTION MANUAL

HI3512

Two Channels

pH / ORP / ISE
EC / Resistivity / TDS / NaCl / Temperature
Bench Meter

Hanna Instruments Inc., 584 Park East Drive, Woonsocket, RI 02895 USA
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 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.
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 unit is supplied with:

- 12 Vdc power adapter
- Quick reference guide with instrument quality certificate

Available Models

HI3512-01 12 Vdc/115 Vac, USA plug

HI3512-02 12 Vdc/230 Vac, European plug

***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

The HI3512 is a professional bench meter with graphical LCD designed to support:

- pH/mV/ISE and temperature measurements (Channel 1)
- EC/TDS, NaCl/Resistivity and temperature measurements (Channel 2)

HI3512 is provided with a series of new diagnostic features for improved measurement reliability.

pH channel

- 7 standard pH buffers (pH 1.68, 4.01, 6.86, 7.01, 9.18, 10.01 and 12.45) for calibration
- pH calibration up to five calibration points (see instrument specifications)
- Custom calibration with up to two custom buffers
- Messages on the graphic LCD for an easy and accurate calibration
- Diagnostic features to alert the user when the electrode needs cleaning

EC channel

- 7 memorized standards (0.00 µS/cm, 84.0 µS/cm, 1.413 mS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm and 111.8 mS/cm) for calibration
- Up to two points EC calibration
- Messages on the graphic LCD for an easy and accurate calibration
- Diagnostic features to alert the user when the electrode needs cleaning
- Temperature compensation
- Temperature coefficient set
- Lock and user setup Fixed range selection

Other features

- Log on demand up to 400 samples
- Log interval with log on stability feature up to 600 records
- Auto Hold feature, to freeze first stable reading on the LCD
- GLP, last calibration data for pH, Rel mV, ISE, EC, or NaCl
- PC interface

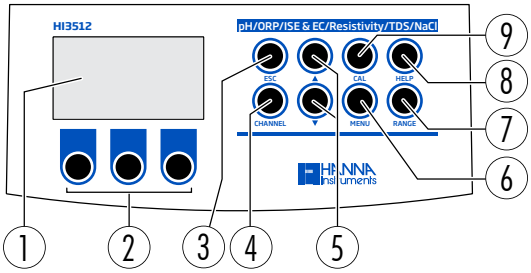
This instrument can also measure with ORP electrodes (pH channel input) given its capability to measure mV with a resolution up to 0.1 mV and with ISE electrodes on ppm scale (pH channel input).

The electrode type and unit selection and the ISE calibration in up to five calibration standards make this instrument useful for a large range of concentration solutions measurements.

Relative mV feature is also available.

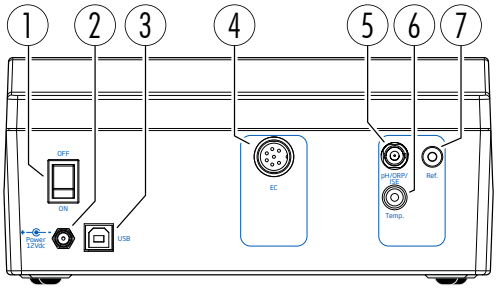
This instrument can also measure in Resistivity, TDS and Salinity on EC channel.

3. FUNCTIONAL DESCRIPTION



1. Liquid Crystal Display (LCD)
2. Virtual keys (perform action displayed above on the LCD)
3. **ESC** key, exit function
4. **CHANNEL** key, toggle pH (Ch.1) and EC (Ch. 2)
5. ▲/▼ forward/backward navigation & increase/decrease value
6. **MENU** key, log recall and GLP
7. **RANGE** key, switch between pH, mV and ISE range (Ch1); EC, Resistivity, TDS and Salinity range (Ch2)
8. **HELP** key, enter/exit contextual help
9. **CAL** key, enter calibration mode

Rear View



1. Power button
2. Input for power cable
3. Input for USB to PC connection
4. Channel 2 (Ch.2) EC probe with DIN
5. Channel 1 (Ch1) pH/ORP, ISE electrode with BNC
6. Channel 1 (Ch1) Temperature probe port
7. Channel 1 (Ch1) Reference electrode port

4. SPECIFICATIONS

pH	Range	–2.0 to 20.0 pH –2.00 to 20.00 pH –2.000 to 20.000 pH
	Resolution	0.1 pH 0.01 pH 0.001 pH
	Accuracy	±0.01 pH ±0.002 pH
ORP	Range	±2000.0 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
ISE	Range	1.00 E-7 to 9.99 E10 conc.
	Resolution	3 digits 0.01, 0.1, 1, 10 conc.
	Accuracy	±0.5% of reading (monovalent ions) ±1% of reading (divalent ions)
Temperature Channel 1	Range	–20.0 to 120.0 °C (4.0 to 248.0 °F)
	Resolution	0.1 °C / 0.1 °F
	Accuracy	±0.2 °C / ±0.4 °F (excluding probe error)
Rel mV offset range		±2000 mV
pH calibration		Up to 5 points 7 standard buffers (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) 2 custom buffers
Slope calibration		From 80 to 110%
pH temperature compensation		Manual Automatic
Electrode		Hanna® BNC connection pH/ORP/ISE electrodes For ordering codes go to www.hannainst.com/products/electrodes-probes
Temperature probe		RCA connection Recommended option: HI7662-TW
ISE calibration		Up to 5 points 6 standards (0.1, 1, 10, 100, 1000, 10000 ppm)

EC	Range	0 to 400 mS/cm (shows values up to 1000 mS/cm) Actual conductivity 1000 mS/cm 0.001 to 9.999 μS/cm 10.00 to 99.99 μS/cm 100.0 to 999.9 μS/cm 1.000 to 9.999 mS/cm 10.00 to 99.99 mS/cm 100.0 to 999.9 mS/cm 1000 mS/cm (autoranging)
	Resolution	0.001 μS/cm 0.01 μS/cm 0.1 μS/cm 0.001 mS/cm 0.01 mS/cm 0.1 mS/cm 1 mS/cm
	Accuracy	$\pm$1% of reading ($\pm$0.01 μS/cm or 1 digit whichever greater) excluding probe error
Resistivity	Range	1.0 to 99.9 ohms 100 to 999 ohms 1.00 to 9.99 Kohms 10.0 to 99.9 Kohms 100 to 999 Kohms 1.00 to 9.99 Mohms 10.0 to 100.0 Mohms (autoranging)
	Resolution	0.1 ohm 1 ohm 0.01 Kohms 0.1 Kohms 1 Kohms 0.01 Mohms 0.1 Mohms
	Accuracy	$\pm$1% of reading ($\pm$10 ohms or 1 digit whichever greater) excluding probe error

TDS	Range	0.000 to 9.999 ppm 10.00 to 99.99 ppm 100.0 to 999.9 ppm 1.000 to 9.999 g/L 10.00 to 99.99 g/L 100.0 to 400.0 g/L (autoranging)
	Resolution	0.001 ppm, 0.01 ppm, 0.1 ppm 0.001 g/L, 0.01 g/L, 0.1 g/L
	Accuracy	±1% of reading (±0.05 ppm or 1 digit whichever greater) excluding probe error
Salinity	Range	% NaCl: 0.0 to 400.0 %
	Resolution	0.1 %
	Accuracy	±1% of reading excluding probe error
Temperature Channel 2	Range	−20.0 to 120.0 °C (4.0 to 248.0 °F)
	Resolution	0.1 °C / 0.1 °F
	Accuracy	±0.2 °C (excluding probe error)
EC calibration		Up to 2 points 7 standards (0.00 µS/cm, 84.0 µS/cm, 1.413 mS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm)
Cell constant setup		0.010 to 10.000
NaCl Calibration		Max. 1 point only (with HI7073 standard)
EC probe		DIN connection Recommended option: HI76310
Temperature source		Automatic Manual
EC temperature compensation		NoTC, MTC, ATC
Reference temperature		15, 20, 25 °C
Temperature coeficient		0.00 to 10.00 %/°C
TDS factor		0.40 to 1.00
Log on demand		400 samples
Lot logging		5, 10, 30 sec 1, 2, 5, 10, 15, 30, 60, 120, 180 min, AutoEnd (max 600 samples)
Power supply		12 Vdc Power Adaptor
PC interface		opto-isolated USB
Dimensions		235 x 207 x 110 mm (9.2 x 8.14 x 4.33")
Weight (meter only)		1.8 Kg (4.1 lb)
Environment		0 to 50 °C (32 to 122 °F); max. RH 55% non-condensing

5. OPERATIONAL GUIDE

5.1. POWER CONNECTION

Plug the 12 Vdc adapter into the power supply socket.

***Note**: have a fuse protected main line.*

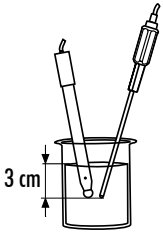
5.2. ELECTRODE AND PROBE CONNECTIONS

For pH, ORP or ISE measurements connect a combination pH/ORP/ISE electrode to the BNC connector located on the rear panel of the instrument.
For half cell electrodes with a separate reference connect the electrode's BNC to the BNC connector and the electrode's reference to the corresponding reference input socket.
For temperature measurements and automatic temperature compensation on pH/ORP/ISE channel, connect the temperature probe to the appropriate socket.
For EC, TDS, NaCl or Resistivity measurements connect the EC probe to the DIN connector located on the rear panel of the instrument. As the channels are fully isolated and a temperature probe is connected on pH channel you can view independent temperature readings on each channel.

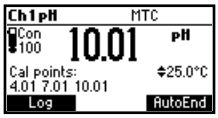
5.3. INSTRUMENT START UP

- Turn the instrument ON by pressing **ON/OFF** switch located on the rear panel of the instrument.
- At start-up the display will show the Hanna® logo for a few seconds followed by the "Loading Log" message, then enters the measurement mode.

5.4. pH MEASUREMENTS



To take a pH measurement remove the electrode protective cap and submerse the electrode and the temperature probe 3 cm (1¼") into the sample to be tested.
If necessary, press **CHANNEL** to select pH channel or/and press **RANGE** until the display changes to the pH mode.
Enter SETUP menu to select the pH resolution.
Allow for the electrode to adjust and reading to stabilize (hourglass symbol turns off).



pH screen displays:

- pH reading with the selected resolution.
- Temperature reading in the selected unit (°C or °F).

- Temperature compensation mode (MTC - manual, ATC - automatic). While in MTC mode the ▲▼ indicate that the temperature can be manually changed using **ARROW** keys.
- Electrode condition during the calibration day.
- The buffers used in last pH calibration (if feature is enabled in SETUP).
- Available function keys.

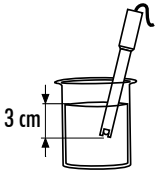
Ensure the instrument is calibrated (see pH CALIBRATION section for details).
Keep the electrode moist and rinse thoroughly with the sample before use.
The pH reading is directly affected by temperature. If the sample temperature is different from the temperature at which the pH electrode was kept, allow a few minutes to reach thermal equilibrium.
To use the instrument's Automatic Temperature Compensation feature, submerse the temperature probe into the sample as close to the electrode as possible and wait for a few seconds.

For manual temperature compensated measurements (MTC), disconnect the temperature probe.

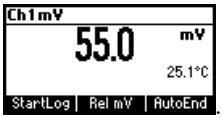
The display will show the last measured temperature reading, or the last set temperature, with the "MTC" indication.
The "MTC" indication and the ▲▼ symbol light up on the LCD to indicate that the instrument is in MTC mode and the **ARROW** keys can be used to enter the desired temperature value.

***Note**: When in MTC mode the user can press and hold an ARROW key, and the instrument will start incrementing/decrementing the temperature value. The instrument keeps measuring and the display is updated periodically.*

5.5. ORP MEASUREMENTS



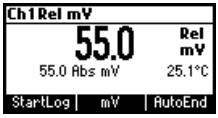
- Connect an ORP electrode (see ACCESSORIES section) to the instrument. Turn the instrument ON.
- Press **RANGE** to enter mV mode.
- Submerse the ORP electrode 3 cm (1¼") into the sample to be tested and wait a few seconds for the reading to stabilize.
  Measurements are displayed with 0.1 mV resolution.



The "ATC" (or "MTC") message is not displayed because mV readings are not temperature compensated.
Keep electrode surface clean and smooth to ensure accuracy. Pretreatment solutions are available to condition the electrode and improve its response time (see ACCESSORIES section).

5.6. RELATIVE mV MEASUREMENTS

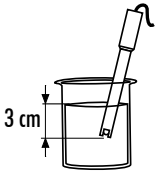
Use **Rel mV** key from mV measurement mode.
The relative mV reading is displayed along with the Absolute mV value and the current temperature readings.



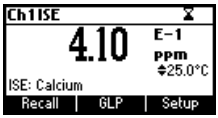
The relative mV reading is equal to the difference between the absolute mV input value and relative mV offset established in the relative mV calibration.

***Note**: If using the pH or ISE electrode while in mV mode, the instrument will measure the mV generated by the electrode.*

5.7. ISE MEASUREMENTS



- Connect an ISE electrode (and reference if necessary) to the corresponding BNC input.
- Turn the instrument ON.
- Submerse the ISE electrode tip 3 cm (1¼") into the sample to be tested and wait for the reading to stabilize.
  The ISE reading is displayed along with the current temperature reading.



The "ATC"(or "MTC") message is not displayed because ppm readings are not temperature compensated.
To take accurate ISE measurements, ensure correct ISE electrode type and ISE unit are configured in SETUP menu and the instrument is calibrated (see ISE CALIBRATION for details).

Notes:
- *When the reading is out of range, the display will flash the closest full-scale value.*
- *The instrument will display "----" on the first LCD line if inot calibrated. Perform at least a single-point calibration in order to take ISE measurements.*
- *ISE electrode SETUP menu reconfiguration needs to be followed by calibration.*

5.8. TEMPERATURE MEASUREMENTS

pH Channel

Connect the HI7662-TW temperature probe to the appropriate socket.
Immerse the temperature probe into the sample and allow the reading on the secondary LCD to stabilize.

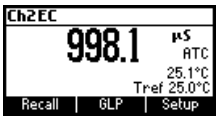
***Note**: The temperature can be displayed in Celsius degrees (°C) or in Fahrenheit degrees (°F) (see SETUP for details).*

EC / TDS / NaCl / Resistivity Channel

Immerse the conductivity probe (with built-in temperature sensor) into the solution to be tested. The sleeve holes must be completely submerged.

Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.
Press **CHANNEL** to select EC channel or/and press **RANGE** to select range (EC, Resistivity, TDS, Salt). If needed, select the "Automatic" or "No TC" compensation mode to perform temperature measurements (see SETUP for details).
Allow for the reading to stabilize. The main LCD line displays the measurement in the selected range, while the temperature is displayed on the lower LCD line.

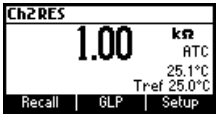
EC Range



The conductivity range is from 0 to 400 mS/cm .
The actual conductivity range (not compensated) is up to 1000 mS/cm. The instrument displays conductivity readings up to 1000 mS/cm.

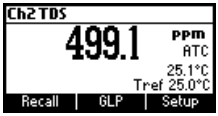
***Note**: The ▲▼ symbol in front of the temperature reading means that the temperature can be entered by the user ("Manual" option selected in SETUP).*

Resistivity Range



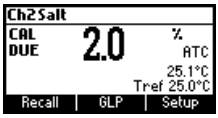
The reciprocal of the conductivity of a material is the resistivity.

TDS Range



A conductivity measured value can be corrected to a total disolved solids value using the TDS factor (value entered in SETUP).

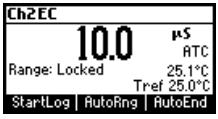
Salinity



The salinity is derived from the conductivity of a sample.
The percent of salinity in a sample is depending of the sample and on the salinity coefficient.

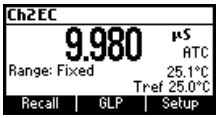
6. AUTO-RANGING EC CHANNEL

The EC, Resistivity and TDS scales are auto-ranging. The meter automatically sets the scale with the highest possible resolution.
Press **Lock** to disable auto-ranging. Current range is frozen on the LCD.



The "Range: Locked" message is displayed. To restore the auto-ranging option press **AutoRng** key again.

The auto-ranging mode is also disabled by selecting a "fixed range" in the SETUP menu. While in fixed range mode the instrument will display the readings with the fixed resolution. Maximum 6 digits can be displayed.



The top of the fixed range is displayed blinking when the reading exceeds this value.
To disable fixed range mode enter SETUP and select auto-ranging mode.

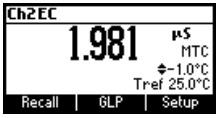
***Note**: Auto-ranging is automatically restored if the range is changed, if the meter is turned off and back on again or if the calibration mode is entered.*

7. TEMPERATURE COMPENSATION EC CHANNEL

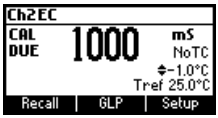
The conductivity of a solution with a specific electrolyte concentration changes with temperature. The relationship of the change in conductivity as a function of temperature is described by a solution's temperature coefficient. This coefficient varies with each solution and is user selectable (see SETUP section).
Two selectable temperature sources are available: direct readings (built-in sensor) or manual entries.

Linear temperature compensation options:
Automatic: temperature readings taken with EC probe built-in sensor.

Manual: temperature entered manually by the user.



No Temperature Compensation (No TC): Displayed temperature is not taken into account. The meter displays the actual conductivity.



To select the desired option enter SETUP menu (see SETUP section).
If the temperature is out of the -20 °C - 120 °C range the instrument will not do temperature compensation.

8. CONDUCTIVITY VERSUS TEMPERATURE CHART

The conductivity of an aqueous solution is the measure of its ability to carry an electrical current by means of ionic motion.

The conductivity increases with increasing temperature.

It is affected by the type and number of ions in the solution and by the viscosity of the solution itself. Both parameters are temperature dependent. The dependency of conductivity on temperature is expressed as a relative change per Celsius degree at a particular temperature, commonly as percent per °C.

The following table lists the temperature dependence of the Hanna Instruments® calibration buffers.

°C	°F	HI7030 HI8030 (µS/cm)	HI7031 HI8031 (µS/cm)	HI7033 HI8033 (µS/cm)	HI7034 HI8034 (µS/cm)	HI7035 HI8035 (µS/cm)	HI7039 HI8039 (µS/cm)
0	32	7150	776	64	48300	65400	2760
5	41	8220	896	65	53500	74100	3180
10	50	9330	1020	67	59600	83200	3615
15	59	10480	1147	68	65400	92500	4063
16	60.8	10720	1173	70	67200	94400	4155
17	62.6	10950	1199	71	68500	96300	4245
18	64.4	11190	1225	73	69800	98200	4337
19	66.2	11430	1251	74	71300	100200	4429
20	68	11670	1278	76	72400	102100	4523
21	69.8	11910	1305	78	74000	104000	4617
22	71.6	12150	1332	79	75200	105900	4711
23	73.4	12390	1359	81	76500	107900	4805
24	75.2	12640	1386	82	78300	109800	4902
25	77	12880	1413	84	80000	111800	5000
26	78.8	13130	1440	86	81300	113800	5096
27	80.6	13370	1467	87	83000	115700	5190
28	82.4	13620	1494	89	84900	117700	5286
29	84.2	13870	1521	90	86300	119700	5383
30	86	14120	1548	92	88200	121800	5479
31	87.8	14370	1575	94	90000	123900	5575

Backlight Feature

The instrument is provided with a backlight feature. The backlight levels can be selected in the SETUP menu.

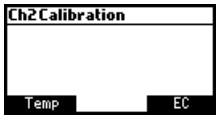
9. USER CALIBRATION

To enter *User Calibration* screen press **CAL** key while in pH/Rel mV/ISE range (pH channel) or EC/Salinity range (EC channel).

From EC range

Press the corresponding functional key to enter:

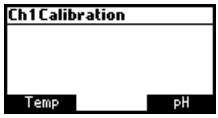
- EC user calibration
- Ch2 temperature user calibration



From pH range

Press the corresponding functional key to enter:

- pH user calibration
- Ch1 temperature user calibration



***Note**: For REL mV, ISE, or Salinity range, press CAL, with range selected, to enter calibration mode.*

10. pH CALIBRATION

It is recommended to calibrate the instrument frequently, especially if high accuracy is required.
The pH range should be recalibrated:

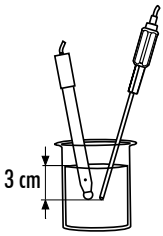
- Whenever the pH electrode is replaced.
- At least once a week.
- After testing aggressive chemicals.
- When calibration alarm time out is expired - "CAL DUE" displayed blinking (feature enabled in SETUP).
- When "Out of cal. range" displayed during pH measurement, indicating the measurement range is not covered by current calibration (feature enabled in SETUP).

10.1. PROCEDURE

The HI3512 supports use of 7 standard buffers (1.68, 4.01, 6.86, 7.01, 9.18, 10.01 and 12.45 pH) and up to 2 custom buffers.
Standard pH buffers are temperature compensated during calibration whereas custom buffers are not.
When a custom buffer is selected during calibration, the **Custom** key is displayed on the LCD.
Press **Custom** key to alter the value to the actual pH value at the temperature of measurement.
Use **ARROW** keys to change the value within a ±1.00 pH window and then press **Accept**.
Press **ESC** to leave custom buffers value unchanged. Press **Confirm**.
For accurate pH measurements a two-point calibration is required.
The instrument automatically skips the buffers within ±0.2 pH window, around one of the calibrated buffers.

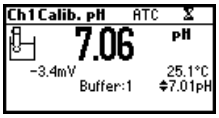
- Pour small quantities of selected buffer solutions into clean beakers. Use two beakers for each buffer solution. One for rinsing the electrode and one for calibration.
- Remove the protective cap, open the fill hole and rinse the electrode with some of the buffer solution to be used for the first calibration point.

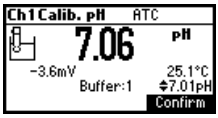
10.2. FIVE-POINT CALIBRATION



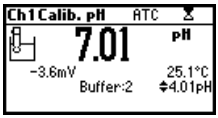
- Immerse the pH electrode and the temperature probe approximately 3 cm (1¼") into a buffer solution and stir gently.

  ***Note**: The temperature probe should be close to the pH electrode.*
- Enter pH calibration. The instrument will display the measured pH, the first expected buffer and the temperature reading.
- Use the **ARROW** keys to configure a different buffer value.
- The "⧖" tag displayed blinking until the reading is stable.
- When the reading is stable and close to the selected buffer, **Confirm** is displayed.



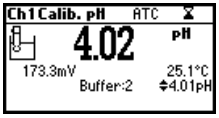


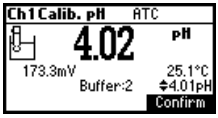
- Press **Confirm** to confirm first point.
- The calibrated value and the second expected buffer value is displayed.



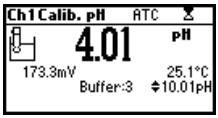
- Immerse the pH electrode and the temperature probe approximately 3 cm (1¾") into the second buffer solution and stir gently.

  ***Note**: The temperature probe should be close to the pH electrode.*
- Use the **ARROW** keys to configure a different buffer value.
- The "⧖" tag is displayed blinking until the reading is stable.
- When the reading is stable and close to the selected buffer, the **Confirm** is displayed.





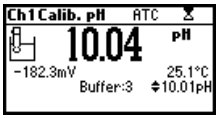
- Press **Confirm** to confirm calibration.
- The calibrated value and the third expected buffer value are displayed.

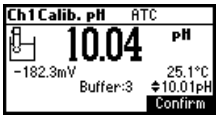


- Immerse the pH electrode and the temperature probe approximately 3 cm (1¾") into a third buffer solution and stir gently.

  ***Note**: The temperature probe should be close to the pH electrode.*

- Use the **ARROW** keys to configure a different buffer value.
- The "⧖" tag is displayed blinking until the reading is stable.
- When the reading is stable and close to the selected buffer, the **Confirm** is displayed.





- Press **Confirm** to confirm calibration.

Repeat this procedure with two additional pH buffers to cover the entire sample pH range.

10.3. FOUR, THREE OR TWO-POINT CALIBRATION

- Proceed as described in "FIVE-POINT CALIBRATION" section.
- Press **ESC** after the appropriate accepted calibration point.
  The instrument returns to calibration screen.

10.4. SINGLE-POINT CALIBRATION

Options: Replace and **Offset**

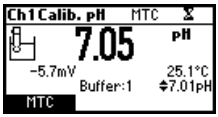
Option is configured in SETUP, parameter First Point Mode.

If "Replace" is selected a new calibration point is added to the existing data, and the slope is calculated. The slopes between current buffer and nearest lower and higher buffers are reevaluated.

If the "Offset" is selected, an electrode offset correction is performed to all buffer data keeping the existing slopes unchanged.

- Proceed as described in "FIVE-POINT CALIBRATION" section.
- Press **ESC** after the first calibration point is confirmed. The instrument memorizes the single-point calibration data and returns to calibration screen.

Notes: • *Press MTC key to toggle pH buffer selection and the temperature reading during calibration while (temperature probe is disconnected, MTC mode).*

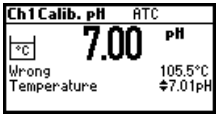


- *The displayed arrow is moving to the temperature value. Use ARROW keys to configure temperature value.*

10.5. ERROR SCREENS

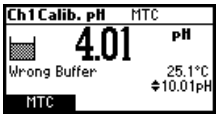
Wrong Temperature: calibration cannot be confirmed

If the temperature is less than 0 °C (greater than 100 °C) during calibration, calibration cannot be confirmed.



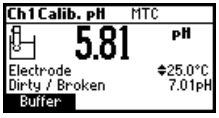
Wrong Buffer: calibration cannot be confirmed

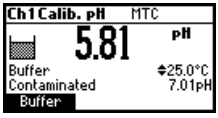
The pH reading is not close to the selected buffer. Select another buffer or change the buffer.



Electrode Dirty/Broken alternatively with **Buffer Contaminated**: calibration cannot be confirmed

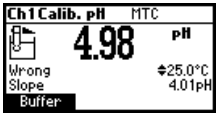
The offset of the electrode is out of accepted range. Check the electrode. Clean the electrode following the Cleaning Procedure (see ELECTRODE CONDITIONING & MAINTENANCE section). Check the quality of the buffer. If necessary, change the buffer.



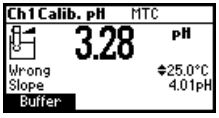


Wrong Slope: calibration cannot be confirmed

Slope is less than the lowest accepted value (80% of default slope).

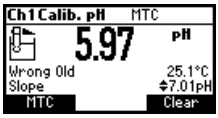


Slope is more than the highest accepted value (110 % of default slope).



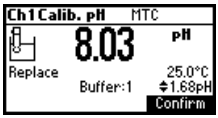
Wrong Old Slope

An inconsistency between new and previous (old) calibration is detected. Clear old calibration parameters and initiate calibration from the current point. The instrument will keep all confirmed values during current calibration.



***Note**: For single-point calibration the electrode condition is not displayed in the measurement screen.*

Each time a buffer is confirmed, the new calibration parameters replace the older calibration parameters of the corresponding buffer.
If an additional single buffer calibration is added subsequently, the new buffer point will be added to the stored calibration.
If the existing stored calibration is full (five calibration points), after confirming the calibration point, the instrument will ask which buffer will be replaced by current buffer. On the Buffer line will be displayed the proposed buffer.

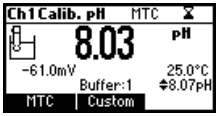


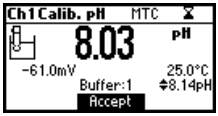
Use **ARROW** keys to select another buffer for replacement.
Press **Confirm** to confirm the buffer to be replaced.
Press **ESC** to exit. In this case, the buffer will not be entered.

***Note**: The replaced buffer is not removed from calibration list and can be selected for the next calibration points.*

10.6. WORKING WITH CUSTOM BUFFERS

Custom buffer configured in SETUP can be selected for calibration (use **ARROW** keys).
Custom key is displayed. Press **Custom** to adjust the buffer value at the current temperature.
Use the **ARROW** keys to change the buffer value.
Press **Accept** to accept new value or **ESC** to exit.



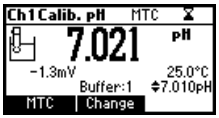


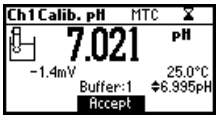
***Note**: Custom buffer value can be adjusted within a ±1.00 pH window, around the set value.*

10.7. WORKING WITH MILI PH BUFFERS

Hanna® millesimal pH buffers are ±0.002 pH buffers formulated to correspond to nominal pH values (1.000, 2.000, 3.000, 4.010, 5.000, 6.000, 7.010, 8.000, 9.000, 10.010, 11.000, 12.000, 13.000 and 9 that fall between). These buffers require the user to use the closest standard buffer and adjust it, or to use custom buffers. With these buffers it is possible to closely bracket the measurement range of interest and ensure an accurate measurement.
The resolution of the meter must be set to 0.001 pH (see SETUP section). Eight buffers are stored for calibration.
If calibration with millesimal buffers is required, the calibration buffer can be modified within a ±0.020 pH range.
Press **Change** to enter buffer adjust mode.
Use **ARROW** keys to change the buffer value.

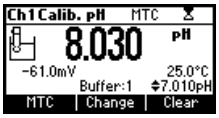
Press **Accept** to accept new value or **ESC** to exit adjusting mode.

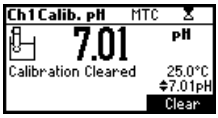




10.8. CLEAR CALIBRATION

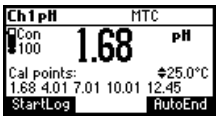
Press **Clear** key to clear previous calibrations.
The instrument displays "Calibration Cleared".





10.9. ELECTRODE CONDITION

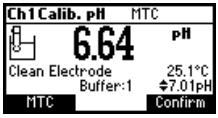
Electrode condition icon and a numeric value (unless feature is disabled) indicate electrode status after calibration. The condition remains active until the end of the calibration day.



***Note**: The electrode condition is evaluated only if current calibration includes at least two standard buffers.*

10.10. CLEAN ELECTRODE WARNING

Each time pH calibration is performed the instrument compares the new calibration with the one previously stored. When there is a significant difference, the "Clean Electrode" warning notifies the user that the pH electrode needs to be cleaned (see ELECTRODE CONDITIONING & MAINTENANCE section for details).



Calibrate after cleaning.

***Note**: If calibration is cleared, comparison is done against default values.*

11. pH BUFFER TEMPERATURE DEPENDENCE

Temperature has an effect on pH buffers. During calibration the instrument will automatically calibrate to the pH value corresponding to the measured or set temperature.

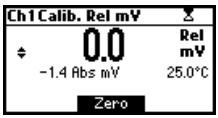
Temp		pH Buffers						
°C	°F	**1.68**	**4.01**	**6.86**	**7.01**	**9.18**	**10.01**	**12.45**
0	**32**	1.67	4.01	6.98	7.13	9.46	10.32	13.38
5	**41**	1.67	4.00	6.95	7.10	9.39	10.24	13.18
10	**50**	1.67	4.00	6.92	7.07	9.33	10.18	12.99
15	**59**	1.67	4.00	6.90	7.05	9.27	10.12	12.80
20	**68**	1.68	4.00	6.88	7.03	9.22	10.06	12.62
25	**77**	1.68	4.01	6.86	7.01	9.18	10.01	12.45
30	**86**	1.68	4.02	6.85	7.00	9.14	9.96	12.29
35	**95**	1.69	4.03	6.84	6.99	9.11	9.92	12.13
40	**104**	1.69	4.04	6.84	6.98	9.07	9.88	11.98
45	**113**	1.70	4.05	6.83	6.98	9.04	9.85	11.83
50	**122**	1.71	4.06	6.83	6.98	9.01	9.82	11.70
55	**131**	1.72	4.08	6.84	6.98	8.99	9.79	11.57
60	**140**	1.72	4.09	6.84	6.98	8.97	9.77	11.44
65	**149**	1.73	4.11	6.84	6.99	8.95	9.76	11.32
70	**158**	1.74	4.12	6.85	6.99	8.93	9.75	11.21
75	**167**	1.76	4.14	6.86	7.00	8.91	9.74	11.10
80	**176**	1.77	4.16	6.87	7.01	8.89	9.74	11.00
85	**185**	1.78	4.17	6.87	7.02	8.87	9.74	10.91
90	**194**	1.79	4.19	6.88	7.03	8.85	9.75	10.82
95	**203**	1.81	4.20	6.89	7.04	8.83	9.76	10.73

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

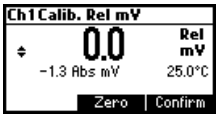
12. RELATIVE mV CALIBRATION

The relative mV value calibration is used to perform a single point calibration with an ORP standard or remove the contribution of the reference electrode to display mV equivalent to a SHE.

- Press **CAL** when the instrument is in Relative mV mode. The relative mV value and the temperature values are displayed.
- Use the **ARROW** keys to configure the relative mV value.



- Use **Zero** key for Rel mV reading to be zero (Relative mV offset equals the mV reading).
- When the reading is stable in mV range and the Relative mV offset is inside the offset window (±2000 mV), **Confirm** is displayed.



- Use **Confirm** to confirm relative mV calibration. The instrument returns to measurement mode.
- If the absolute mV reading is out of range or the Relative mV offset is outside offset window, "Wrong relative offset" is displayed.

Change the input value or the Relative mV value to complete the calibration process.

***Note**: If a Rel mV offset calibration exists, CLR function key is displayed. Press CLR for Rel mV offset to be 0.0 mV.*

13. ISE CALIBRATION

It is recommended to calibrate the instrument frequently, especially if high accuracy is required.
Additionally, the ISE range should be recalibrated:

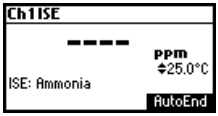
- Whenever the ISE probe or ion charge is changed.
- At least once a day.
- After testing aggressive chemicals.
- When calibration alarm time out is expired – "CAL DUE" is displayed blinking.

Follow instructions for the individual electrode.
The electrode must be kept immersed a few seconds to stabilize.
On-screen messages guide users through calibration.

13.1. PROCEDURE

Select the ISE probe in SETUP or select the Ion Charge slope (see SETUP for details).

***Note**: If the ISE probe has not been previously calibrated (one point), "----" is displayed.*

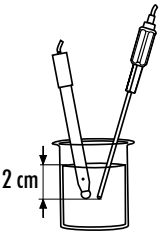


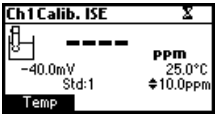
Pour small quantities of the buffer solutions into clean beakers. If possible, use plastic beakers to minimize any EMC interferences.
For accurate calibration and to minimize cross-contamination, use two beakers for each standard solution. One for rinsing the electrode and one for calibration.
The HI3512 permits a 5 point calibration in 6 standard solutions (0.1, 1, 10, 100, 1000, 10000). It is advised to bracket expected ion concentration with your standards.
For fluoride electrode the 2 ppm standard is also available.
For accurate ISE measurements a minimum of two-point calibration is required.
Remove the ISE electrode protective cap.

13.2. FIVE-POINT CALIBRATION

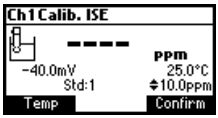
Use part of this procedure for 2, 3 or 4 point calibration. Press **ESC**.

- Immerse the ISE electrode approximately 2 cm (¾") into the less concentrated standard solution and stir gently.
- Press **CAL**. The first LCD line displays the ion concentration in the selected unit ("----" if not calibrated) and first standard value.

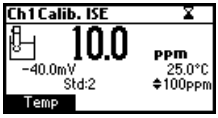




- Use the **ARROW** keys to select a different standard value.
- The "⧖" tag is displayed blinking until the reading is stable.
- When the reading is stable and close to the selected standard, **Confirm** key is displayed.



- Press **Confirm** to confirm calibration.
- The calibrated value and the second expected standard value are displayed.



- After the first calibration point is confirmed, immerse the ISE electrode approximately 2 cm (¾") into the second calibration solution.
- Use the **ARROW** keys to select a different standard value.
- The "⧖" tag is displayed blinkiong until the reading is stable.
- When the reading is stable and close to the selected standard, **Confirm** key is displayed.
- Press **Confirm** to confirm calibration.
- The calibrated value and the third expected standard value are displayed.
- After the second calibration point is confirmed, immerse the ISE electrode approximately 2 cm (¾") into the third calibration solution.
- Use the **ARROW** keys to select a different standard value.
- The "⧖" tag is displayed blinking until the reading is stable.
- When the reading is stable and close to the selected standard, the **Confirm** key is displayed.
- Press **Confirm** to confirm calibration.
- The calibrated value and the fourth expected standard value are displayed.
- After the third calibration point is confirmed, immerse the ISE electrode approximately 2 cm (¾") into the fourth calibration solution.
- Use the **ARROW** keys to select a different standard value.
- The "⧖" tag is displayed blinking until the reading is stable.
- When the reading is stable and close to the selected standard, the **Confirm** key is displayed.
- Press **Confirm** to confirm calibration.
- The calibrated value and the fifth expected standard value are displayed.
- After the fourth calibration point is confirmed, immerse the ISE electrode approximately 2 cm (¾") into the fifth calibration solution.
- Use the **ARROW** keys to select a different standard value.
- The "⧖" tag is displayed blinking until the reading is stable.
- When the reading is stable and close to the selected standard, the **Confirm** key is displayed.

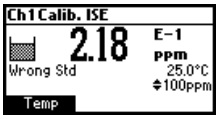
- Press **Confirm** to confirm calibration. The instrument stores the calibration value and returns to normal measurement mode.

***Note**: The instrument will automatically skip the standard solutions used during calibration.*

13.3. ERROR SCREENS

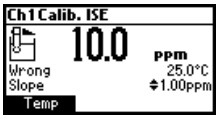
Wrong Standard: calibration cannot be confirmed

Verify that the correct standard is selected.
The message appears if mV input is out of ±2000 mV range.

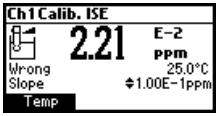


Wrong Slope: calibration cannot be confirmed

This message is displayed if slope is out of the accepted range.
Slope under accepted value (30 % default slope). Verify that the correct standard is selected.



Slope over accepted value (130 % default slope).



Wrong Old Slope: an inconsistency between present and previous (old) calibration is detected.

Clear old calibration parameters and continue calibration from the current point. The instrument will keep all confirmed values during current calibration.
The instrument displays "----"on the first LCD line if is not calibrated or if all calibrations are cleared.
Selecting "Clear" during the first calibration point, returns the instrument to measurement mode.

Notes: • *Press **Temp** key to select temperature value to be changed if the temperature probe is not connected*
- *ISE range is not temperature compensated*
- *Standards and samples should be at the same temperature*

14. EC CALIBRATION

It is recommended to calibrate the instrument frequently, especially if high accuracy is required.
Additionally, the EC range should be calibrated:

- Whenever the EC electrode is replaced.
- At least once a week.
- After testing aggressive chemicals.
- When "CAL DUE" is displayed blinking (feature enabled in SETUP).
- When "Out of cal. range" is displayed during EC measurement (the measurement range is not covered by current calibration, feature enabled in SETUP).

***Note**: TDS and Resistivity readings are derived from the EC reading and do not require calibration.*

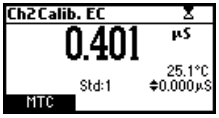
14.1. PROCEDURE

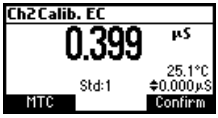
HI3512 instrument supports 7 standards (0.00 µS/cm, 84.0 µS/cm, 1.413 mS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm and 111.8 mS/cm).
For accurate EC measurements, it is recommended to perform an offset calibration and slope calibration in the nearest value standard solution of the samples readings (two-point calibration).
The instrument will automatically recognize the standards and skip the standard used during calibration.

- Pour small quantities of selected standard solutions into clean beakers. For accurate calibration use two beakers for each standard solution, the first one for rinsing the electrode and the second one for calibration.
- Remove the protective cap and rinse the electrode with some of the standard solution to be used for the first calibration point.

14.2. TWO-POINT CALIBRATION

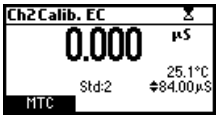
- Perform the first point calibration as offset calibration.
- Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.
- For offset (zero) calibration, leave the dry probe in the air.
- Press **CAL** from EC range to enter calibration mode.
- Leave the probe in the air and press **EC**. The instrument displays the measured EC, first expected standard and the temperature reading.
- Use the **ARROW** keys to select a different standard value.
- The "⧖" tag is displayed blinking until the reading is stable.
- When the reading is stable and close to the selected buffer, **Confirm** key is displayed.



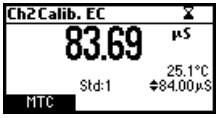


- Press **Confirm** to confirm first point.

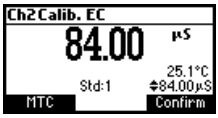
- The calibrated value and the second expected standard value are displayed.



- After the first calibration point is confirmed, immerse the EC electrode into the second standard solution and stir gently. Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve. The instrument automatically detects the standard after few seconds the reading is stable.



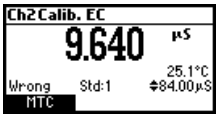
- Use the **ARROW** keys to select a different standard value.
- The "⧖" tag is displayed blinking until the reading is stable.
- When the reading is stable and close to the selected standard, the **Confirm** key is displayed.



- Press **Confirm** to confirm calibration.

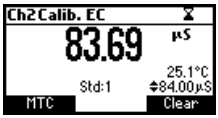
14.3. ERROR SCREENS

Wrong Standard: calibration cannot be confirmed
The EC reading is not close to the selected standard or the temperature is out of the 0 - 60 °C window.
Select another standard using the **ARROW** keys or change the temperature value.



14.4. CLEAR CALIBRATION

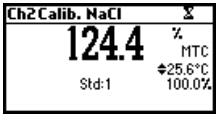
Press **Clear** key to clear old calibrations.
The instrument returns to measurement mode.



14.5. NaCl CALIBRATION

NaCl calibration is a one-point procedure in 100.0% NaCl solution.
Use the HI7037L calibration solution (sea water solution) as a 100% NaCl standard solution.

- Select the Salinity % range and press **CAL**.
- The measured % NaCl, the temperature and the 100% NaCl standard are displayed.

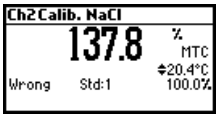


- Rinse the probe with some of the calibration solution or deionized water.
- Immerse the probe into HI7037L solution.
  Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.
- The "⧖" tag is displayed blinking until the reading is stable.
- When the reading is stable, the **Confirm** key is displayed.
  Press **Confirm** to confirm calibration.

- The instrument returns to measurement mode.

Notes: • *If the uncalibrated reading is too far from the expected value, calibration is not recognized. "Wrong" message is displayed.*

• *The meter uses 1.90 %/°C temperature compensation factor during calibration. If the "Temperature Coef" in the Setup menu has been set to a different value, when exiting calibration mode, the displayed value might be different from the nominal standard value.*



15. GOOD LABORATORY PRACTICE (GLP)

GLP is a set of functions that allows storage and retrieval of data regarding electrode's status and maintenance. All data regarding pH, Rel mV, ISE, EC or Salinity calibration is stored for the user to review.

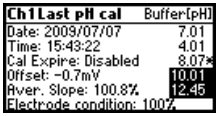
Expired Calibration

The "expired calibration" status is triggered when the instrument detects a calibration time out. The "CAL DUE" warning is displayed blinking to warn the user that the instrument should be recalibrated.
The calibration time out can be set from 1 to 7 days or disabled (see SETUP for details).
For example, if a 4 days time out is configured, the instrument issues the alarm 4 days after the last calibration. If the expiration value changes (e.g. 5 days), the alarm is recalculated and issued 5 days after the last calibration.

Notes: • *When the instrument is not calibrated or calibration is cleared (default values loaded) there is no "expired calibration", and the display always shows the "CAL DUE" warning blinking.*
• *When an abnormal condition in the RTC (Real Time Clock) is detected, the instrument forces the "expired calibration" status.*

Last pH Calibration Data

The last pH calibration data is stored automatically after a successful calibration.
To view the pH calibration data, press **GLP** key when the instrument is in the pH measurement mode. If key is not displayed press **MENU** key.

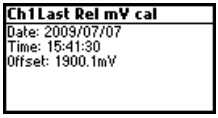


The instrument displays: calibration buffer, offset, slope, electrode condition.

Notes: • *Buffers (standards) displayed in video inverse mode are from previous calibrations (pH and ISE range only).*
• *The pH custom buffers are marked with an "*" .*

Last Relative mV Calibration Data

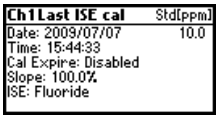
Last Relative mV calibration data is stored automatically after a successful calibration.
To view the Relative mV calibration data, press **GLP** key while in Relative mV measurement mode.
The instrument displays: calibration date, time, and offset.



Last ISE Calibration Data

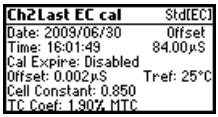
Last ISE calibration data is stored automatically after a successful calibration.
To view the ISE calibration data, press **GLP** key while in ISE measurement mode. If key is not displayed, press **MENU** key.

The instrument displays: calibration date, time, slope, calibration status, and electrode type.



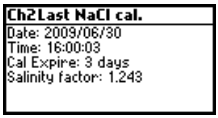
Last EC Calibration Data

The last pH calibration data is stored automatically after a successful calibration.
To view the EC calibration data, press **GLP** when the instrument is in the EC measurement mode.
The instrument displays: calibration standards, offset, time and date, cell constant.



Last NaCl % Calibration Data

Last NaCl calibration data is stored automatically after a successful calibration.
To view the NaCl calibration data, press **GLP** key while in NaCl measurement mode.
The instrument displays: calibration date, time and salinity factor.



Notes: • *Press ESC and the instrument returns to measurement mode.*
• *If no calibration, the instrument displays "No user calibration" .*

16. SETUP

Setup mode allows viewing and modifying the measurement parameters. These are general SETUP parameters for all the ranges and range specific parameters.

The following table lists the general SETUP parameters, their valid range and the factory default settings.

New	Description	Valid value	Default
Backlight	Backlight level	0 to 8	4
Contrast	Contrast level	0 to 20	10
Date/Time		01.08.2009 to 12.31.2099 00:00 to 23:59	current date/time
Time Format		AM/PM or 24 hours	24 hours
Date Format		DD/MM/YYYY MM/DD/YYYY YYYY/MM/DD YYYY-MM-DD Mon DD, YYYY DD-Mon-YYYY YYYY-Mon-DD	YYYY/MM/DD
Language	Message display language	Up to four languages	English
Temperature unit		°C or °F	°C
AutoEnd Stability	Select AutoEnd Stability Criteria	Fast, Medium, Accurate	Medium
Log interval	Select log interval	Manual, AutoEnd, 5, 10, 30 s 1, 2, 5, 10, 15, 30, 60, (Log on demand) 120, 180 min.	Manual
Beep ON	Beeper Status	Enabled or Disabled	Disabled
Instrument ID	Instrument identification	0000 to 9999	0000
Baud Rate	Serial Communication	600, 1200, 2400, 4800 9600, 19200, 38400	9600
Meter information	Displays general information		

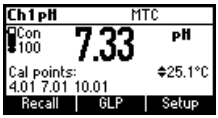
The following table lists the specific pH/ORP/ISE range parameters.

Item	Description	Valid value	Default
Calibration Timeout (pH/ISE)	Number of days after Calibration warning is displayed	Disable, 1 to 7 days	Disable
First point mode (pH)	Management of 1 point calibration	Replace or offset	Replace
Custom buffer (pH)	Custom buffer setting	Max. 2 buffers	No
pH Resolution	Set pH resolution display	0.1, 0.01 0.001	0.01
View calibr. points (pH)	Display calibration points	Enable or disabled	Enable
Display out of calibr. range warning		Enable or disable	Enable
ISE probe	Type of ISE probe	Custom or Standard (17)	Fluoride
ISE unit		ppt, g/L, ppm, mg/L, ppb, µg/L mg/mL, M, mol/L, mmol/L, % W/V, user	ppm
Ion Charge	±1, ±2, none		+1

The following table lists the specific EC/TDS/NaCl/Resistivity range parameters:

Item	Description	Valid value	Default
Calibration Timeout (EC/Salinity)	Number of days after Calibration warning is displayed	Disable, 1 to 7 days	Disable
Out cal range check (EC range only)	Display warning if the reading is too far from the calibration points	Enable/Disable	Disable
Temperature compensation mode		No TC, MTC, ATC	ATC
Range select	Fix one specific range	Automatic, Fix one resolution of EC, resistivity or TDS range	Automatic
Cell constant	Manual set of the cell constant	0.010 to 10.000	1.000
Temperature coefficient	Set the coefficient for linear temperature compensation	0.00 to 10.00 %/°C	1.90 %/°C
Temperature Ref	Reference temperature	15 °C, 20 °C, 25 °C	25 °C
Temperature unit		°C or °F	°C
TDS factor		0.40 to 1.00	0.50

To enter SETUP menu, press **SETUP** key while in measuring mode.

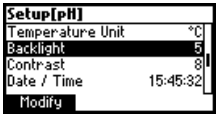


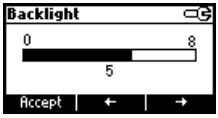
If SETUP is not displayed press **MENU** key.

16.1. GENERAL PARAMETER SCREENS

Backlight

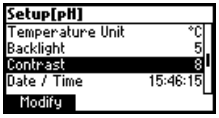
Select *Backlight item.*
Press **Modify**.
Use ←/→ keys to change the intensity then press **Accept** to confirm.
Press **ESC** to leave without changing.

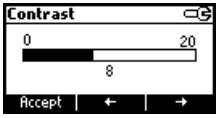




Contrast

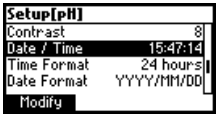
Select *Contrast* item.
Press **Modify**.
Use ←/→ keys to change contrast then press **Accept** to confirm.
Press **ESC** to leave without changing.





Date/Time

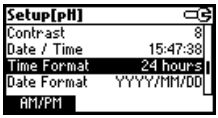
Select *Date/Time* item.
Press **Modify**.
Use ←/→ keys to select item.
Use **ARROW** keys to change selected values.
Press **Accept** to confirm, or **ESC** to leave without changing.



Time Format

Select *Time Format* item.

Press function key to change the option.



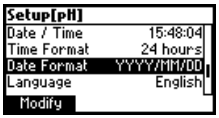
Date Format

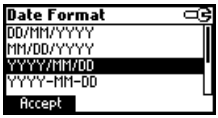
Select *Date Format* item.

Press **Modify**.

Use **ARROW** keys to select date format then press **Accept**.

Press **ESC** to leave without changing.





Language

Select *Language* item.

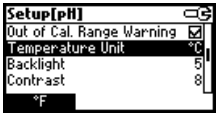
Use the desired function key to change the option. Wait until new language is loaded. If language load fails the instrument will try to reload current language.

If any language can't be loaded, the instrument will work in safe mode. In this mode all messages are displayed in English and HELP is not available.

Temperature Unit

Select *Temperature Unit* item.

Press the displayed function key in order to change the temperature unit.



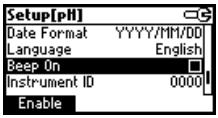
Beep On

Selectn *Beep On* item.

Press the displayed function key to enable/disable beep.

When enabled, a short acoustic signal is heard every time a key is pressed or when calibration can be confirmed.

A long acoustic signal indicates that the pressed key is not active or a wrong condition is detected while in calibration.



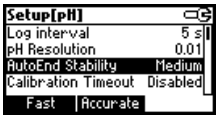
AutoEnd Stability

Select *AutoEnd Stability* item.

Press one of the displayed function keys to select the AutoEnd stability criteria.

Three options are available: Fast, Medium, Accurate.

For the pH range the stability criteria are different for different pH resolution selected (Medium in 0.01 pH range is different than Medium in 0.001 range).



Log Interval

Select *Log interval* item.

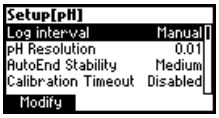
Press **Modify** in order to change the option.

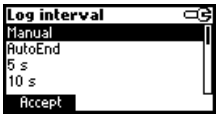
Use the arrow keys to select an option.

If the selected option is Manual the Log on demand is selected.

If AutoEnd is selected the reading will be memorized only when is stable.

If a specific interval is selected, the reading is memorized at the start of the specific interval.





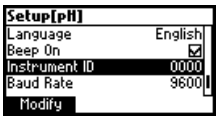
Instrument ID

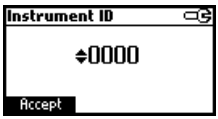
Select *Instrument ID* item.

Press **Modify**.

Use **ARROW** keys to change the instrument ID.

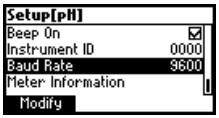
Press **Accept** to confirm or **ESC** to exit without saving.

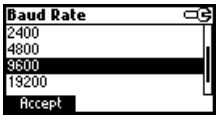




Baud Rate

Select *Baud Rate* item.
Press **Modify**.
Use **ARROW** keys to select the desired communication baud.
Press **Accept** to confirm or **ESC** to exit.

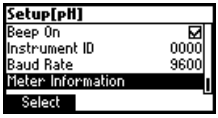


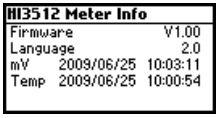


Meter Information

Select *Meter Information* item.
Press **Select**.
Following meter information is displayed:

- firmware version
- language version
- mV/EC and temperature factory calibration time/date

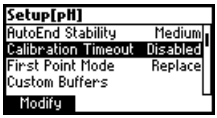


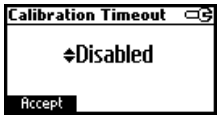


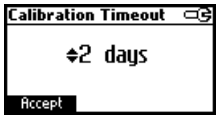
16.2. pH CHANNEL RANGE SPECIFIC PARAMETERS

Calibration Timeout

Select *Calibration Timeout* item.
Press **Modify**.
Use **ARROW** keys to set desired value.
Press **Accept** to confirm or **ESC** to return without saving.







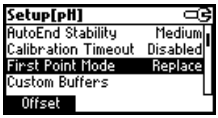
***Note**: If enabled "CAL DUE" warning will be displayed, the set number of days calibration is past due.*

First Point Mode

Select *First Point Mode* item.

Press the displayed function key to change the option.

First point mode refers to the behavior of the instrument regarding "One point calibration".

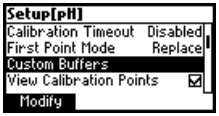


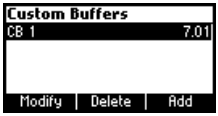
If **Offset** is set, after one point calibration the instrument evaluates the offset and keeps the slopes unchanged.

Custom Buffers

Select *Custom Buffers* item.

Press **Modify**.

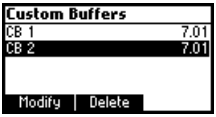


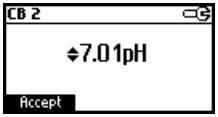


Press **Delete** to delete focused buffer.

Press **Add** to add a new buffer to the list (maximum 2).

Press **Modify** to set custom buffer value.





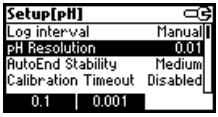
Use **ARROW** keys to change the value.

Press **Accept** to confirm custom buffer value or **ESC** to exit without saving.

pH Resolution

Select *pH Resolution* item.

Press the displayed function key to change option.

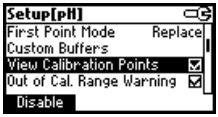


View Calibration Points

Select *View Calibration Points* item.

Press the displayed function key to change option.

If option is enabled the calibration buffers corresponding to the last calibration are displayed in the pH measurement screen.



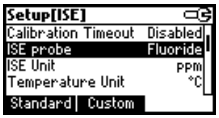
Out of Calibration Range Warning

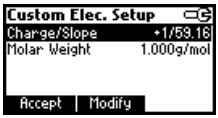
Select *Out of Cal. Range Warning* item.
Press the displayed function key to change option.
If enabled, the "Out of cal. range" message is displayed if the pH reading is not within the calibration range.

ISE Probe

Select *ISE probe* item.
Press **Custom** to set the parameters for a custom probe.
Press **Standard** to select one probe from the standard probes list.

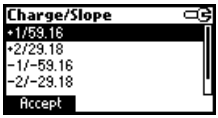
If **Custom** is pressed:



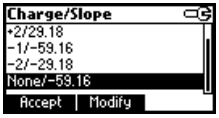


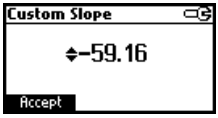
Use **ARROW** keys to focus on the parameter to be changed ("Charge/Slope" or "Molar Weight").

Focus on *Charge/Slope* item.



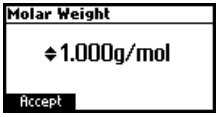
Use **ARROW** keys to select the desired combination.
If "None/-59.16" is selected the slope of the probe can be changed by pressing **Modify** key.
Press **Modify**.





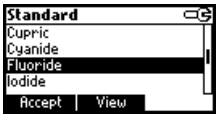
Use **ARROW** keys to change the slope.
Press **Accept** to confirm or **ESC** to exit.

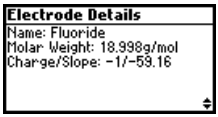
Focus on *Molar Weight*.
Press **Modify** in order to change molar weight.



Use **ARROW** keys to change the value.
Press **Accept** to confirm or **ESC** to exit.

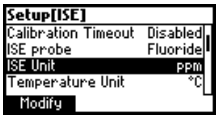
If **Standard** was pressed.
Use **ARROW** keys to focus on the desired electrode.
Press **Accept** to confirm setting or **ESC** to exit.
Press **View** to see probe parameters.

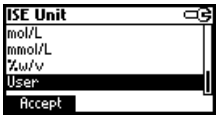




ISE Unit

Select *ISE Unit* item.
Press **Modify**.
Use **ARROW** key to select unit.
Press **Accept** to confirm selection or **ESC** to exit.



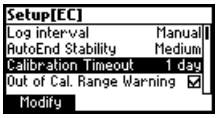


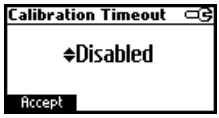
Notes: • *If the unit is changed or "User" is selected a warning message will be displayed to alert that the ISE range must be calibrated.*
• *If a new probe was selected or custom probe parameter are changed, the ISE range must be calibrated.*

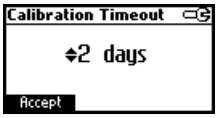
16.3. EC CHANNEL RANGE SPECIFIC PARAMETERS

Calibration Timeout

Select *Calibration Timeout* item.
Press **Modify**.
Use **ARROW** keys to set desired value.
Press **Accept** to confirm or **ESC** to return without saving.





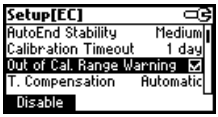


Note: *If enabled "CAL DUE" warning will be displayed, the set number of days after calibration is over passed.*

Out of Calibration Range Warning

Select *Out of Cal. Range Warning* item.

Press the corresponding functional key in order to enable/disable this feature. If enabled, a warning message is displayed when the EC reading is too far from the EC calibration points.



Temperature Compensation

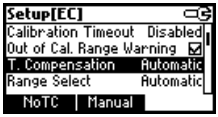
Select *T. Compensation* item.

Press one of the selected functional keys to change the option.

Select **No TC** to display actual conductivity (no temperature compensation).

Select **MTC** to automatically compensate conductivity using the set temperature coefficient with the temperature manually selected by the user.

Select **ATC** to automatically compensate conductivity using the set temperature coefficient with the temperature read from the sensor inside the EC probe.



Range Select

Select *Range Select* item.

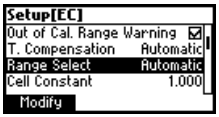
Press **Modify** to select ranging mode.

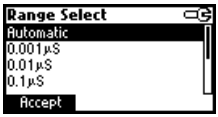
Use the **ARROW** keys to change selection.

Press **Accept** to confirm or **ESC** to exit without saving. If "Automatic" is selected the instrument changes the range automatically according with the input.

If one of the range is selected all the readings are displayed on the corresponding range.

The readings are displayed with maximum 6 digits. If the reading exceeds the maximum number of digits for the fixed range, the maximum value is displayed blinking.

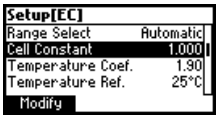


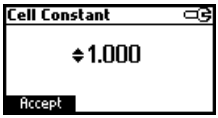


***Note**: The Range Select parameter can be set only in EC, resistivity, and TDS range.*

Cell Constant

Select *Cell Constant* item.
Press **Modify** to change the cell constant value.
Use **ARROW** keys to change the cell constant value.
Press **Accept** to confirm or **ESC** to exit without changing.

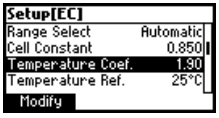


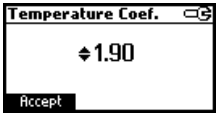


***Note**: If the cell constant value is modified, the EC slope calibration is deleted and the NaCl calibration is deleted. If performed, the EC offset calibration remains active.*

Temperature Coefficient

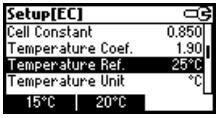
Select *Temperature Coef.* item.
Press **Modify** in order to set the temperature coefficient.
Use the **ARROW** keys to change the value.
Press **Accept** to confirm or **ESC** to exit without changing.





Temperature Reference

Select *Temperature Ref.* item.
Press the corresponding functional key to select the desired reference temperature.



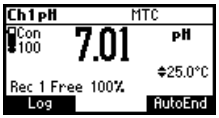
17. LOGGING

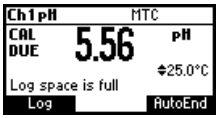
This feature allows the user to log pH, Rel mV, ISE, EC, TDS, NaCl or Resistivity measurements. All logged data can be transferred to a PC through the USB port.
The logging space includes 400 records of Log on demand and 600 records of Log interval (lot logging). The log interval is organized in lots. A maximum of 100 lots are accepted. One lot can occupy all the memory space available.

17.1. LOGGING THE CURRENT DATA

To store the current reading into memory, press **Log** while in measurement mode.
The instrument will display for few seconds the record number and the amount of the free log space.

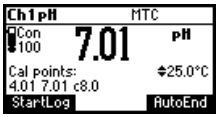
If the LOG space is full, the "Log space is full" message will be displayed for few seconds when **Log** key is pressed. Enter View Logged Data Mode and delete records in order to free log space.



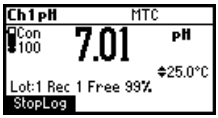


17.2. LOT LOGGING

Select the desired interval in SETUP as a timed interval or AutoEnd waits for a stable value before logging.



Press the **StartLog** function key in order to start Log interval.

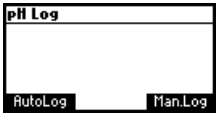


Press the **StopLog** function key in order to stop logging and close current lot.

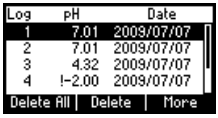
Notes:
- *At Power Off the current lot is automatically closed.*
- *If the 600 records space or 100 lots are reached, the "AutoLog space is full" message will be displayed.*
- *Enter View Log Data mode and delete lots in order to free space.*

17.3. VIEW LOGGED DATA

Press the **Recall** function key to retrieve the information stored while in measurement mode for the specific range. If the **Recall** function key is not displayed press **MENU** key.
The Recall selection screen is displayed.



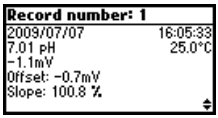
Press the corresponding function key to view the records.
If **Man.Log** is pressed, the list of records is displayed.



If no data were logged, the instrument will display "No Records" message.

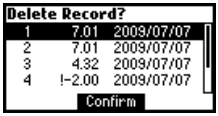
Use **ARROW** keys to scroll between the records from the list.
Press **Delete All** to enter *Delete All* screen.
Press **Delete** to enter *Delete records* screen.
Press **More** to view more information of the focused record.

If **More** is pressed.

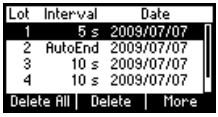


Use **ARROW** keys to scroll between complete log information.

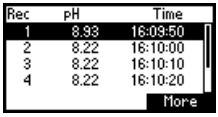
If **Delete** is pressed.



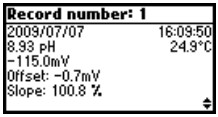
Use **ARROW** key to focus the record to be deleted and then press **Confirm**.
Press **ESC** to exit.
If **Delete All** is pressed the instrument asks for confirmation.
Press **Confirm** to confirm or **ESC** to exit without deleting.
If **AutoLog** is pressed, the lot information of the specific range are displayed.



Use the **ARROW** keys to scroll the lots.
Press the **Delete All** function key to enter the *Delete All lots* screen.
Press the **Delete** function key to enter the *Delete lot* screen.
Press the **More** function key to view the records information of the focused lot.



If **More** is pressed.



18. mV CALIBRATION (FOR TECHNICAL PERSONNEL ONLY)

All the instruments are factory calibrated for mV, EC and temperature.
Hanna Instruments® temperature probes are interchangeable and no temperature calibration is needed when they are replaced.
If the temperature or ORP measurements are inaccurate, calibration should be performed.
For an accurate recalibration, contact tech@hannainst.com, or follow the instructions below.

mV Calibration

- With the instrument off press and hold down the **CHANNEL** and ▼ keys and then power on the instrument. The meter enters mV calibration mode.

A two point calibration can be performed at 0 mV and 1800 mV.

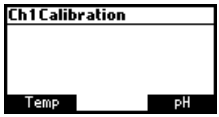
- Attach to the BNC connector a mV simulator with an accuracy of ±0.1 mV.
- Enter the calibration screen. Press **mV** function key.
- Set 0.0 mV on the simulator.
- When the reading is stable and close to the selected calibration point, **Confirm** key is displayed.
- Press **Confirm** to confirm. The second calibration point of "1800 mV" is displayed.
- Set 1800.0 mV on the simulator.
- When the reading is stable and close to the selected calibration point, **Confirm** key is displayed.
- Press **Confirm** to confirm. The instrument will restart and the calibration will be memorized.

Notes: • *If the reading is not close to the selected calibration point, "Wrong" tag will blink. Verify calibration condition or contact your vendor if you cannot calibrate.*

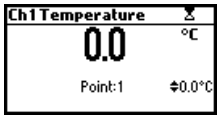
• *Press ESC in any moment of the calibration process. The instrument will restart and no calibration will be memorized.*

19. TEMPERATURE CALIBRATION (FOR TECHNICAL PERSONNEL ONLY)

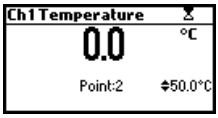
- Press **CAL** key on the pH range or on the EC range. The calibration screen is displayed. Press **Temp** key to enter the temperature calibration mode. The temperature calibration is performed for the current channel only. The calibration routine is the same for both channels, so Ch1 calibration is prompted next.



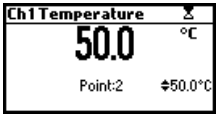
- Prepare a vessel containing ice and water and another one containing hot water (at approximately 50 °C or 122 °F). Place insulation material around the vessels to minimize temperature changes.
- Use a calibrated thermometer with a resolution of 0.1 °C as a reference thermometer. Connect the temperature probe or the EC probe to the appropriate socket.



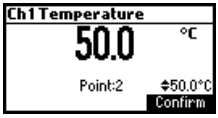
- Immerse the temperature probe or the EC probe including temperature sensor into the vessel with ice and water as close as possible to the reference thermometer. Allow a few seconds for the probe to stabilize.
- Use the **ARROW** keys to set the calibration point value to that of ice and water mixture, measured by the reference thermometer. When the reading is stable and close to the selected calibration point, the **Confirm** function key is displayed.
- Press **Confirm** to confirm.
- The second expected calibrated point is displayed.



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



- Use the **ARROW** keys to set the calibration point value to that of the hot water.
- When the reading is stable and close to the selected calibration point, **Confirm** function key is displayed.



- Press **Confirm** to confirm. The instrument returns to the calibration screen.

***Note**: Use ARROW keys to change calibration point if necessary (±10.0 °C) around the point.*

If the reading is not close to the selected calibration point, "Wrong" message will blink. Change the temperature probe and restart calibration.

20. PC INTERFACE

Data transmission from the instrument to the PC can be done with the HI92000 Windows® compatible software (optional). HI92000 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 an USB cable connector. Make sure that your instrument is switched off and plug one connector to the instrument USB socket and the other to the serial or USB port of your PC.

***Note**: If you are not using Hanna Instruments® HI92000 software, please see the following instructions.*

Sending Commands from PC

It is also possible to remotely control the instrument with any terminal program. Use an USB 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 follow the next scheme:

<command prefix> <command> <CR>

where: <command prefix> is the 16 ASCII character
<command> is the command code.

***Note**: Either small or capital letters can be used.*

Simple Commands

KF1 Is equivalent to pressing **function key 1**
KF2 Is equivalent to pressing **function key 2**
KF3 Is equivalent to pressing **function key 3**
RNG Is equivalent to pressing **RANGE** key
CAL Is equivalent to pressing **CAL** key
UPC Is equivalent to pressing the **UP** arrow key
DWC Is equivalent to pressing the **DOWN** arrow key
MNU Is equivalent to pressing **MENU** key
ESC Is equivalent to pressing **ESC** key
CHRxx Change the instrument range according with the parameter value (xx):

- xx=10 pH range/0.001 resolution on channel 1
- xx=11 pH range/0.01 resolution on channel 1
- xx=12 pH range/0.1 resolution on channel 1
- xx=13 mV range on channel 1
- xx=14 Relative mV range on channel 1
- xx=15 ISE range on channel 1
- xx=20 EC range on channel 2
- xx=21 Resistivity range on channel 2
- xx=22 TDS range on channel 2
- xx=23 Salinity range on channel 2

The instrument will answer for these commands with:

<STX> <answer> <ETX>

where: <STX> is 02 ASCII code character (start of text)
<ETX> is 03 ASCII code character (end of text)
<answer>:
<ACK> is 06 ASCII code character (recognized command)
<NAK> is 21 ASCII code character (unrecognized command)
<CAN> is 24 ASCII code character (corrupted command)

Commands Requiring an Answer

The instrument will answer for these commands with:

<STX> <answer> <checksum> <ETX>

where the checksum is the bytes sum of the answer string sent as 2 ASCII characters.
All the answer messages are with ASCII characters.

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

- pH, mV reading and temperature on pH range.
- mV and temperature reading on mV range
- Rel mV, absolute mV and temperature reading on Rel mV range.
- concentration, mV and temperature reading on ppm range.
- EC and temperature reading on the EC range
- Resistivity, EC and temperature reading on the Resistivity range
- TDS, EC and temperature reading on the Resistivity range
- Salinity, EC and temperature reading on the Resistivity range

The answer string contains:

- Meter mode (2 chars):
  - 10 pH range/0.001 resolution on channel 1
  - 11 pH range/0.01 resolution on channel 1
  - 12 pH range/0.1 resolution on channel 1
  - 13 mV range on channel 1
  - 14 Relative mV range on channel 1
  - 15 ISE range on channel 1
  - 20 EC range on channel 2
  - 21 Resistivity range on channel 2
  - 22 TDS range on channel 2
  - 23 Salinity range on channel 2
- Meter status (2 chars of status byte): represents a 8 bit hexadecimal encoding.
  - 0x10 - temperature probe is connected
  - 0x01 - new GLP data available
  - 0x02 - new SETUP parameter

- 0x04 - out of calibration range
- 0x08 - the meter is in autoend point mode

- Reading status (2 chars): R - in range, O - over range, U - under range. First character corresponds to the primary reading. Second character corresponds to the second reading (if second reading exists).
- The unit of the reading (2 chars) (for ISE, EC, Resistivity, TDS, Salinity ranges only)
  - for ISE range it represent the index of the unit selected from setup (0-ppt, 11-User)
  - for EC range: 0 - microsiemens, 1 - milisiemens
  - for TDS range: 0 - ppm, 1 - g/L
  - for Salinity range the unit represents always %
- Primary reading (corresponding to the selected range) - 12 ASCII chars, including sign and decimal point and exponent.
- The unit of the second reading (1 char) (it is sent only for Resistivity, TDS and Salinity ranges only). It represents the unit of the EC reading (0 - microsiemens, 1 - milisiemens)
- Secondary reading (only when primary reading is not mV or EC) - 8 ASCII chars, including sign and decimal point.
- Temperature reading - 7 ASCII chars, with sign and decimal point, always in °C.

MDR Requests the instrument model name and firmware code (16 ASCII chars).

GLPx Requests the calibration data record.

- x=1 calibration data from channel 1
- x=2 calibration data from channel 2

The answer string contains:

- GLP status (1 char): represents a 4 bit hexadecimal encoding.
  - 0x01 - pH calibration available (Ch1) or EC calibration available (Ch2)
  - 0x02 - Rel mV calibration available (Ch1) or Salinity calibration available (Ch2)
  - 0x04 - ISE calibration available

Channel 1 GLP

- pH calibration data (if available), which contains:
  - the number of calibrated buffers (1 char)
  - the offset, with sign and decimal point (7 chars)
  - the average of slopes, with sign and decimal point (7 chars)
  - the calibration time, **yymmddhhmmss** (12 chars)
  - buffers information (for each buffer)
    - type (1 char): 0 - standard, 1 - custom
    - status (1 char): N (new) - calibrated in last calibration; O (old) - from an old calibration.
    - warnings during calibration (2 chars): 00 - no warning, 04 - Clean Electrode warning
    - buffer value, with sign and decimal point and exponent (12 chars)
    - the calibration time of the buffer, **yymmddhhmmss** (12 chars).
  - electrode condition, with sign (3 chars). The "-01" code means not calculated

- ISE calibration data (if available) which contains:
  - the number of calibrated standards (1 char)
  - the ISE unit (2 chars)
  - the calibration slope, with sign and decimal point (7 chars)
  - the calibration time of the standard, **yymmddhhmmss** (12 chars)
  - standards information (for each standard)
    - type (1 char): 0 - always standard solution
    - status (1 char): N (new) - calibrated in last calibration; 0 (old) - from an old calibration
    - warnings during calibration (2 chars): 00 - no warning
    - standard value, with sign and decimal point and exponent (12 chars)
    - calibration time, **yymmddhhmmss** (12 chars)
- Rel mV calibration data (if available), which contains:
  - the calibration offset, with sign (7 chars)
  - the calibration time, **yymmddhhmmss** (12 chars)

Channel 2 GLP

- EC calibration data (if available), which contains:
  - the number of calibrated standards (1 char)
  - the offset, with sign and decimal point (7 chars)
  - the cell constant, with sign and decimal point (7 chars)
  - the calibration time, **yymmddhhmmss** (12 chars)
  - standards information (for each buffer)
    - the unit of the standard (0 - microsiemens, 1 - milisiemens)
    - the standard value, with sign, decimal point and exponont (11 chars)
    - the calibration time of the standard, **yymmddhhmmss** (12 chars)
  - the temperature reference value (2 chars)
  - the temperature compensation mode (2 chars: 00 - NoTC, 01 - MTC, 02 - ATC)
  - the temperature compensation coefficient, with sign and decimal point (6 chars)
- Salinity calibration data (if available), which contains:
  - the number of calibrated standards (1 char always 1)
  - the salinity factor, with sign and decimal point (7 chars)
  - calibration time, **yymmddhhmmss** (12 chars)

PARx Requests the setup parameters setting.

- x=1 setup parameters for channel 1
- x=2 setup parameters for channel 2

The answer string contains:

- Lot log interval index (2 ASII chars - it represents the index from the setup list for the log interval)
- Backlight Value (1 ASCII char)
- Contrast Value (2 ASCII char)
- Instrument ID (4 chars)

Channel 1 data

- Calibration Alarm time out for pH (2 chars)
- Calibration Alarm timeout for ISE (2 chars)
- SETUP information (2 chars): 8 bit hexadecimal encoding.
  - 0x01 - beep ON (else OFF)
  - 0x02 - degrees Celsius (else degrees Fahrenheit)
  - 0x04 - Offset calibration (else Point calibration)
- The number of pH custom buffers (1 char)
- The custom buffer values, with sign and decimal point, for each defined custom buffer (7 chars)
- The ID of the ISE electrode (2 chars) (standard or custom)
- The molar weight of the selected ION, with sign and decimal point (9 ASCII characters)
- The electrode slope (6 ASCII chars)
- The ion charge (2 chars)
- The ISE unit (2 chars)
- The short name of the selected language (3 chars)

Channel 2 data

- Calibration alarm timeout for the EC (2 chars)
- Calibration alarm timeout for the Salinity (2 chars)
- Setup information (2 chars): 8 bit hexadecimal encoding
  - 0x01 - beep ON (else OFF)
  - 0x02 - degrees Celsius (else Fahrenheit)
  - 0x04 and 0x08 - this 2 bits represent the temperature compensation mode (10 - ATC, 01 - MTC, 00 - NoTC)
- The cell constant, with sign and decimal point (7 chars)
- The temperature compensation coefficient, with sign and decimal point (6 chars)
- The temperature reference value (2 chars)
- The TDS factor, with sign and decimal point (5 chars)
- The short name of the selected language (3 chars)

NSLxy Requests the number of logged samples (4 chars).
The command parameter (2 chars):

- x=1 request for channel 1
- x=2 request for channel 2
- y=P request for pH range
- y=M request for mV and Rel mV ranges
- y=I request for ISE range
- y=E request for EC range
- y=R request for Resistivity range
- y=T request for TDS ranges
- y=N request for NaCl range

LLSxy Requests the number of lots (information about lots) on the specified channel and range (x - channelnumber; y - range first letter)

- x=1 request for channel 1
- x=2 request for channel 2
- y=P request for pH range
- y=M request for mV and Rel mV ranges
- y=I request for ISE range
- y=E request for EC range
- y=R request for Resistivity range
- y=T request for TDS ranges
- y=N request for NaCl range

The answer string contains:

- number of lots (3 chars)

For each lot:

- the lot number (3 chars)
- the number of records in lot (3 chars)
- the log interval (5 chars): the value is in seconds; for AutoEnd log the value sent is 11000
- the log starting time, **yymmddhhmmss** (12 chars)

GLDxyqqq Requests all records of the qqqth lot from the specified channel and range (x - channel number; y - range first letter). The command parameter (5 chars):

- x=1 request for channel 1
- x=2 request for channel 2
- y=P request for pH range
- y=M request for mV and Rel mV ranges
- y=I request for ISE range
- y=E request for EC range
- y=R request for Resistivity range
- y=T request for TDS ranges
- y=N request for NaCl range
- qqq=the qqqth lot of the requested range

The answer string contains:

- Log header data:
  - The log type (2 chars)
  - The lot number (3 chars)
  - The number of records in lot (3 chars)
  - The log the log interval (5 chars): the value is in seconds; for AutoEnd log the value sent is 11000
  - The offset, with sign and decimal point (7 chars) (not available for ISE log)
  - The slope for Channel 1 and the cell constant for Cannel 2, with sign and decimal point (7 chars) (not available for Rel mV log)

For Channel 2 only

- The TDS factor (for the TDS log only) or the salinity factor (for the Salinity log only), with sign and decimal point (6 chars)
- The temperature reference value (2 chars)
- The temperature compensation mode (2 chars)
- The temperature compensation coefficient, with sign and decimal point (6 chars)

For both Channels

- The log starting time, **yymmddhhmmss** (12 chars)
- For each record:
- The number of the record (3 chars)
- The reading status (1 char): R, O, U
- The unit of the reading (2 chars): it is sent only for ISE, EC, Resistivity, TDS, Salinity log only
- The calculated reading, with sign, decimal point and exponent (12 chars)
- The temperature reading, with sign and decimal point (7 chars)
- The second reading status (1 char): R, O, U; not available for EC log
- The second unit of the reading (2 chars); it is sent only for Resistivity, TDS and Salinity log only
- The second reading, with sign and decimal point (8 chars); not available for EC log
- The logging time (6 chars): it is sent only for AutoEnd log
- The temperature probe persence (1 char)

LODxPyyy Requests the yyyth pH record logged data when x=1
LODxMyyy Requests the yyyth mV/Rel mV record logged data when x=1
LODxIyyy Requests the yyyth ISE record logged data when x=1
LODxEyyy Requests the yyyth EC record logged data when x=2
LODxRyyy Requests the yyyth Resistivity record logged data when x=2
LODxTyyy Requests the yyyth TDS record logged data when x=2
LODxNyyy Requests the yyyth Salinity record logged data when x=2
LODxPALL Requests all pH Log on demand when x=1
LODxMALL Requests all mV/Rel mV Log on demand when x=1
LODxIALL Requests all ISE Log on demand when x=1
LODxEALL Requests all EC Log on demand when x=2
LODxRALL Requests all Resistivity Log on demand when x=2
LODxTALL Requests all TDS Log on demand when x=2
LODxNALL Requests all Salinity Log on demand when x=2

The answer string contains:

- The number of records (3 chars): this is sent only is "ALL" data is requested
- The log type (2 chars)
- The number of the record (3 chars)
- The reading status (1 char): R, O, U
- The unit of the reading (2 chars): it is sent only for ISE, EC, Resistivity, TDS, Salinity log

- The calculated reading, with sign, decimal point and exponent (12 chars)
- The temperature reading, with sign and decimal point (7 chars)
- The reading status (1 char): R, O, U; not available for EC log
- The second unit of the second reading (2 chars); it is sent only for Resistivity, TDS and Salinity log
- The second reading, with sign and decimal point (8 chars); not available for EC log
- The logged time, **yymmddhhmmss** (12 chars)
- The offset, with sign and decimal point (7 chars) (not available for ISE log)
- The slope for Channel 1 and the cell constant for Channel 2, with sign and decimal point (7 chars) (not available for Rel mV log)
- The temperature probe presence (1 char)

For channel 2 only

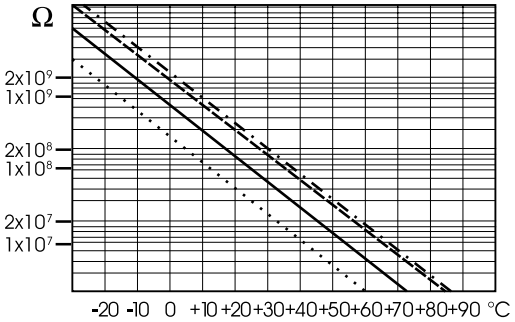
- The TDS factor (for the TDS log only) or the salinity factor (for the salinity log only), with sign and decimal point (6 chars)
- The temperature reference value (2 chars)
- The temperature compensation mode (2 chars)
- The temperature compensation coefficient, with sign and decimal point (6 chars)

Notes:

- *"Err3" is sent if the Log on demand is empty.*
- *"Err4" is sent if the requested parameter is not available.*
- *"Err6" is sent if the requested range is not available.*
- *"Err8" is sent if the instrument is not in measurement mode.*
- *Invalid commands will be ignored.*

21. 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 (77 °F).



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 (194 °F)	Less than 4 months
120 °C (248 °F)	Less than 1 month

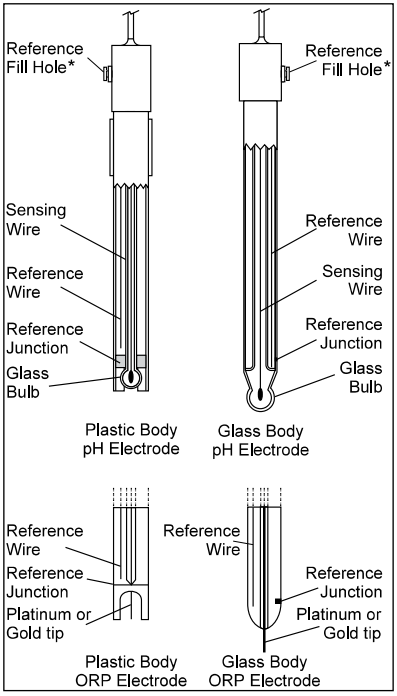
Alkaline Error

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 Instruments'® glass formulations have the indicated characteristics.

Sodium Ion Correction for the Glass at 20-25 °C (68-77 °F)

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

22. ELECTRODE CONDITIONING & MAINTENANCE



* Not present in gel electrodes.

Preparation Procedure

- Remove the sensor protective cap. Do not be alarmed if any salt deposits are present. This is normal with pH / ORP probes and they will disappear when rinsed with water.
- Shake down the probe to eliminate any air bubbles inside the glass bulb.
- If the bulb and/or junction are dry, soak the electrode in HI70300 Storage solution for at least 30 minutes. To ensure a quick response, the glass bulb and the junction should be kept moist and not allowed to dry.

***Note**: Never use distilled or deionized water to store electrode.*

For refillable electrodes:

If the filling solution (electrolyte) is more than 2½ cm (1") below the fill hole, add HI7082 or HI8082 3.5M KCl Electrolyte Solution for double junction or HI7071 or HI8071 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 has run down and the electrode should be replaced.

Measurement

Rinse the pH electrode tip with distilled or deionized water. Immerse the tip 3 cm (1¾") 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.

See that the sleeve holes of the ORP probe are completely submersed.

Storage Procedure

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

Replace the solution in the protective cap with a few drops of HI70300 or HI80300 Storage Solution or, in its absence, Filling Solution (HI7071 or HI8071 for single junction and HI7082 or HI8082 for double junction electrodes). Follow the Preparation Procedure 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 (HI7071 or HI8071 for single junction or HI7082 or HI8082 for double junction electrodes). Allow the electrode to stand upright for 1 hour. Follow the Storage Procedure above.

pH Cleaning Procedure

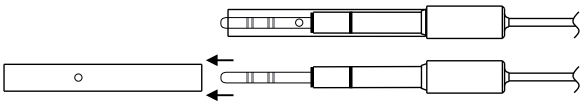
- General Soak in Hanna® HI7061 or HI8061 General Cleaning Solution for approximately ½ hour.
- Protein Soak in Hanna HI7073 or HI8073 Protein Cleaning Solution for 15 minutes.
- Inorganic Soak in Hanna HI7074 Inorganic Cleaning Solution for 15 minutes.
- Oil/grease Rinse with Hanna HI7077 or HI8077 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 HI70300 or HI80300 Storage Solution for at least 1 hour before calibrating.*

23. EC PROBE MAINTENANCE

Rinse the probe with clean water after measurements. If more cleaning is required, remove the probe sleeve and clean the probe with a cloth or a nonabrasive detergent. Make sure to reinsert the sleeve onto the probe properly and in the right direction. After cleaning the probe, recalibrate the instrument.

The platinum rings are sustained with glass. Take great care while handling the probe.



24. TROUBLESHOOTING GUIDE

Symptoms	Problem	Solution
Slow response/excessive drift.	Dirty pH electrode.	Soak the electrode tip in HI7061 cleaning solution for 30 minutes then rinse and condition (see ELECTRODE CONDITIONING & MAINTENANCE section). Refill with fill solution.
Reading fluctuates up and down (noise).	Clogged/dirty junction. Low electrolyte level (refillable electrodes only). EC probe not properly connected.	Clean the electrode (see above). Refill with fresh electrolyte (refillable electrodes only). Insert the probe.
Display shows blinking full scale value.	Reading out of range.	Check that sample is within measurable range; Check electrolyte level and general electrode status. Recalibrate the meter; Check the range is not fixed or locked.
mV scale out of range.	Dry membrane or dry junction.	Soak electrode in HI70300 storage solution for at least 30 minutes.
Display shows ▲▼ symbol in front of temperature reading.	Out of order or missing temperature probe.	Replace temperature probe or check the connection.
Display shows "Clean electrode" blinking.	Difference between new and previous calibration has been detected.	Clean electrode, condition and recalibrate. If the problem remains, check the buffer solutions.
Meter does not work with temperature probe.	Broken temperature probe.	Replace temperature probe.
Meter fails to calibrate or gives faulty readings.	Broken electrode.	Replace electrode.
At startup the meter displays Hanna® Logo tags permanently.	One of the keys is blocked.	Contact your dealer at any Hanna Instruments® Service Center.
Error messages are displayed during pH calibration procedure.	Wrong or contaminated buffer, electrode dirty or broken.	Check that buffer solution is correct and fresh, and the meter is set for the correct buffer.
"Errxx" message at start up.	Internal error.	Contact tech@hannainst.com.

25. ACCESSORIES

25.1. pH CALIBRATION SOLUTIONS

HI50004-01	pH 4.01 Buffer Solution, 20 mL sachet, 10 pcs.
HI50004-02	pH 4.01 Buffer Solution, 20 mL sachet, 25 pcs.
HI50007-01	pH 7.01 Buffer Solution, 20 mL sachet, 10 pcs.
HI50007-02	pH 7.01 Buffer Solution, 20 mL sachet, 25 pcs.
HI50010-01	pH 10.01 Buffer Solution, 20 mL sachet, 10 pcs.
HI50010-02	pH 10.01 Buffer Solution, 20 mL sachet, 25 pcs.
HI5016	pH 1.68 Buffer Solution, 500 mL bottle
HI5004	pH 4.01 Buffer Solution, 500 mL bottle
HI5068	pH 6.86 Buffer Solution, 500 mL bottle
HI5007	pH 7.01 Buffer Solution, 500 mL bottle
HI5091	pH 9.18 Buffer Solution, 500 mL bottle
HI5010	pH 10.01 Buffer Solution, 500 mL bottle
HI5124	pH 12.45 Buffer Solution, 500 mL bottle
HI8004L	pH 4.01 Buffer Solution in FDA approved bottle, 500 mL
HI8006L	pH 6.86 Buffer Solution in FDA approved bottle, 500 mL
HI8007L	pH 7.01 Buffer Solution in FDA approved bottle, 500 mL
HI8009L	pH 9.18 Buffer Solution in FDA approved bottle, 500 mL
HI8010L	pH 10.01 Buffer Solution in FDA approved bottle, 500 mL

25.2. ELECTRODE STORAGE SOLUTION

HI70300L	Storage Solution, 500 mL bottle
HI80300L	Storage Solution in FDA approved bottle, 500 mL

25.3. ELECTRODE CLEANING SOLUTIONS

HI70000P	Electrode Rinse Solution, 20 mL sachet, 25 pcs.
HI7061L	General Purpose Solution, 500 mL bottle
HI7073L	Protein Cleaning Solution, 500 mL bottle
HI7074L	Inorganic Cleaning Solution, 500 mL bottle
HI7077L	Oil & Fat Cleaning Solution, 500 mL bottle
HI8061L	General Purpose Cleaning Solution in FDA approved bottle, 500 mL
HI8073L	Protein Cleaning Solution in FDA approved bottle, 500 mL
HI8077L	Oil & Fat Cleaning Solution in FDA approved bottle, 500 mL

25.4. ELECTRODE REFILL ELECTROLYTE SOLUTIONS

HI7071	3.5M KCl + AgCl Electrolyte for single junction electrodes, 4x30 mL
HI7072	1M KNO3 Electrolyte, 4x30 mL
HI7082	3.5M KCl Electrolyte for double junction electrodes, 4x30 mL
HI8071	3.5M KCl + AgCl Electrolyte in FDA approved bottle, 4x30 mL, for single junction electrodes
HI8082	3.5M KCl Electrolyte in FDA approved bottle, 4x30 mL, for double junction electrodes
HI8093	1M KCl + AgCl Electrolyte in FDA approved bottle, 4x30 mL

25.5. ORP PRETREATMENT SOLUTIONS

HI7091L	Reducing Pretreatment Solution, 500 mL bottle + 14 g (set)
HI7092L	Oxidizing Pretreatment Solution, 500 mL bottle

25.6. ORP SOLUTIONS

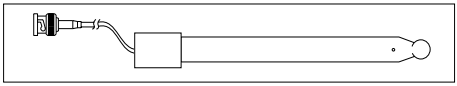
HI7021L	Test Solution 240 mV, 500 mL bottle
HI7022L	Test Solution 470 mV, 500 mL bottle

25.7. EC CALIBRATION SOLUTIONS

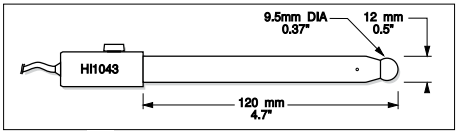
HI70031C	1413 µS/cm, 20 ml sachet, 25 pcs.
HI70039C	5000 µS/cm, 20 ml sachet, 25 pcs.
HI70030C	12880 µS/cm, 20 ml sachet, 25 pcs.
HI6033	84 µS/cm, 500 ml, bottle
HI6031	1413 µS/cm, 500 ml, bottle
HI7039L	5000 µS/cm, 500 ml, bottle
HI7030L	12880 µS/cm, 500 ml, bottle
HI7034L	80000 µS/cm, 500 ml, bottle
HI7035L	111800 µS/cm, 500 ml, bottle
HI7037L	100% NaCl, 500 ml, bottle

25.8. pH ELECTRODES

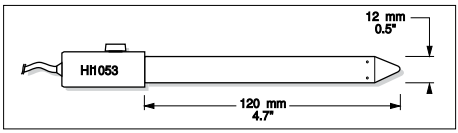
All electrodes part numbers ending in B are supplied with a BNC connector and 1 m (3.3') cable, as shown below:



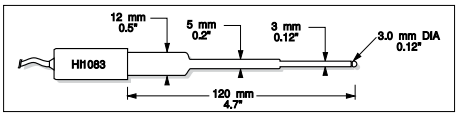
HI1043B Glass-body, double junction, refillable, combination pH electrode. Use: strong acid/alkali.



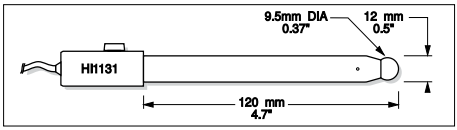
HI1053B Glass-body, triple ceramic, conic shape, refillable, combination pH electrode. Use: emulsions.



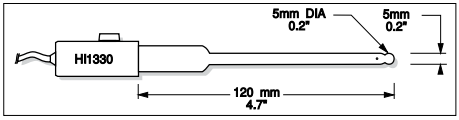
HI1083B Glass-body, micro, Viscolene, non-refillable, combination pH electrode.
Use: biotechnology, micro titration.



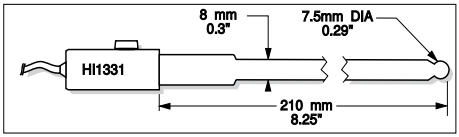
HI1131B Glass-body, double junction, refillable, combination pH electrode. Use: general purpose.



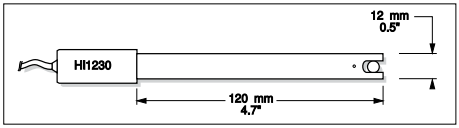
HI1330B Glass-body, semimicro, single junction, refillable, combination pH electrode.
Use: laboratory, vials.



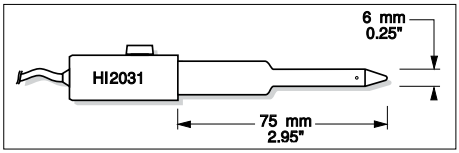
HI1331B Glass-body, semimicro, single junction, refillable, combination pH electrode. Use: flasks.



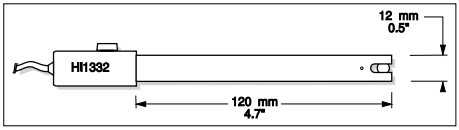
HI1230B Plastic-body (PEI), double junction, gel-filled, combination pH electrode. Use: general, field.



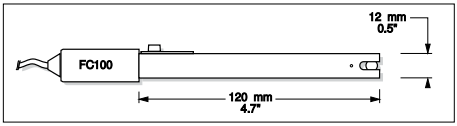
HI2031B Glass-body, semimicro, conic, refillable, combination pH electrode. Use: semisolid products.



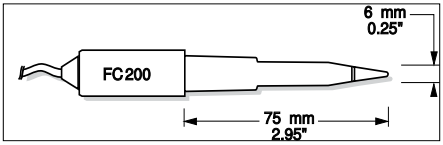
HI1332B Plastic-body (PEI), double junction, refillable, combination pH electrode. Use: general purpose.



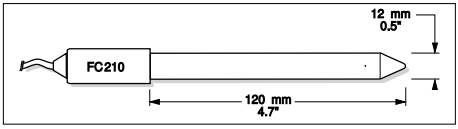
FC100B Plastic-body (PVDF), double junction, refillable, combination pH electrode.
Use: general purpose for food industry.



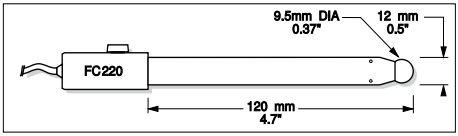
FC200B Plastic-body (PVDF), open junction, conic, Viscolene, non-refillable, combination pH electrode.
Use: meat & cheese.



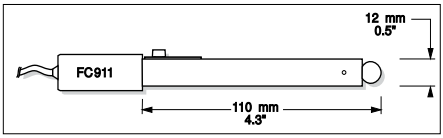
FC210B Glass-body, double junction, conic, Viscolene, non-refillable, combination pH electrode.
Use: milk, yogurt.



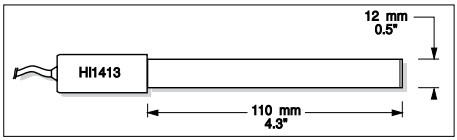
FC220B Glass-body, triple-ceramic, single junction, refillable, combination pH electrode. Use: food processing.



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

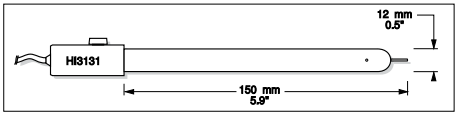


HI1413B Glass-body, single junction, flat tip, Viscolene, non-refillable, combination pH electrode. Use: surface measurement.

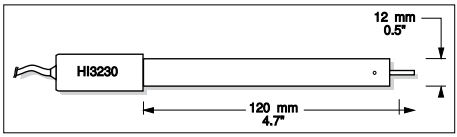


25.9. ORP ELECTRODES

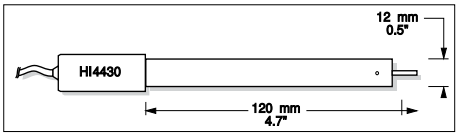
HI3131B Glass-body, refillable, combination platinum ORP electrode. Use: titration.



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



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

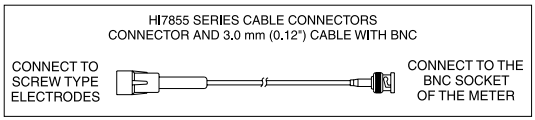


Consult the Hanna Instruments® General Catalog for a complete and wide selection of electrodes.

25.10. EXTENSION CABLE FOR SCREW-TYPE ELECTRODES (Screw to BNC Adapter)

HI7855/1 Extension cable 1 m (3.3') long

HI7855/3 Extension cable 3 m (9.9') long



25.11. OTHER ACCESSORIES

HI740155P	Capillary pipette for electrode refilling, 20 pcs.
HI76404W	Electrode holder
HI7662-TW	Stainless steel Temperature probe with 1 m (3.3') screened cable
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

CERTIFICATION

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

RoHS compliant

Disposal of Electrical & 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 and battery 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

The HI3512 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 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 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 meter 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 meter, make sure it is properly packed for complete protection.