Instruction Manual

HI 3512

Two Channels
pH/ORP/ISE,
EC/TDS/NaCl/Resistivity,
Temperature
Bench Meter
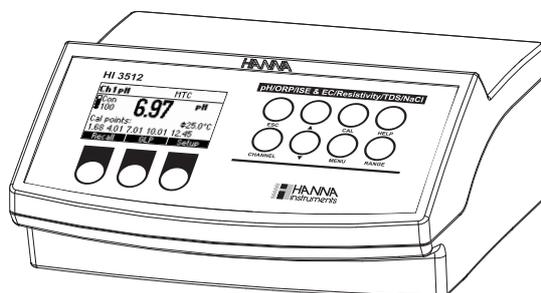
HANNA®
instruments

www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Instruments product.

Please read this instruction manual carefully before using this instrument.

This manual will provide you with the necessary information for correct use of this instrument, as well as a precise idea of their versatility.

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com or view our worldwide contact list at www.hannainst.com.

WARRANTY

The **HI 3512** is guaranteed for two years against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. Electrodes and probes are guaranteed for six months. This warranty is limited to repair or replacement free of charge. Damage due to accidents, misuse, tampering or lack of prescribed maintenance is not covered.

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

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PRELIMINARY EXAMINATION

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

Each instrument is supplied with:

- **HI 1131B** Glass body combination double-junction pH electrode
- **HI 76310** Four Ring Conductivity Probe with built-in temperature
- **HI 7662-T** stainless steel Temperature Probe with 1 m (3.3') Cable
- **HI 70004** pH 4.01 Buffer Solution (20 mL sachet)
- **HI 70007** pH 7.01 Buffer Solution (20 mL sachet)
- **HI 700661** Cleaning solution (2x20 mL each)
- **HI 7071S** Electrolyte Solution
- **HI 76404N** Electrode Holder
- 12 Vdc Power Adaptor
- Instruction Manual

HI 3512 is supplied with 12 Vdc/230 Vac power adapter
HI 3512-01 is supplied with 12 Vdc/115 Vac power adapter

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

GENERAL DESCRIPTION

The **HI 3512** instrument is state-of-the-art, professional bench meter with graphical LCD, designed to provide laboratory results and accuracy. Two input channels are available.

- Channel 1: pH/mV/ISE and temperature
- Channel 2: EC/TDS, NaCl/Resistivity and temperature

HI 3512 is provided with a series of new diagnostic features which add an entirely new dimension to the measurement of pH and EC, by allowing the user to dramatically improve the reliability of the measurement:

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.
- User selectable "**Out of cal. range**" warning.
- User selectable "**Calibration Timeout**" to remind when a new calibration is necessary.

- Extended temperature range on pH channel from −20 to 120 ºC (−4 to 248 ºF), using **HI 7662-T** interchangeable temperature probes.

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.
- EC calibration up to two calibration points.
- Messages on the graphic LCD for an easy and accurate calibration.
- Diagnostic features to alert the user when the electrode needs cleaning.
- User selectable "**Out of cal. range**" warning.
- User selectable "**Calibration Timeout**" to remind when a new calibration is necessary.
- Extended temperature range on EC channel from −20 to 120 ºC (−4 to 248 ºF), using temperature sensor inside EC probe.
- Temperature compensation selection
- Temperature reference selection 15 °C, 20 °C or 25 °C.
- Temperature coefficient set
- Lock and user setup Fixed range selection

Other features include:
- 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 feature, to view last calibration data for pH, Rel mV, ISE, EC or NaCl.
- PC interface

This instrument can also measure with ORP electrodes (pH channel input), thanks to their 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 capability and the ISE calibration in up to five calibration standard solutions make this instrument very 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.

FUNCTIONAL DESCRIPTION

Front view
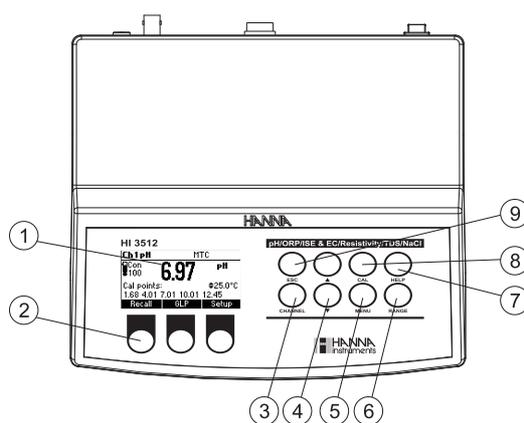
1) Liquid Crystal Display (LCD)

2) Function keys

3) **CHANNEL** keys to toggle between channels (Ch1 - pH, Ch2 - EC)

4) ▲/▼ keys to manually increase/decrease the parameters or to scroll between the parameter list

5) **MENU** key, to change the function key at the bottom of the display

6) **RANGE** key, to switch between pH, mV and ISE range (Ch1); EC, Resitivity, TDS and Salinity range (Ch2)

7) **HELP** key to enter/exit contextual help

8) **CAL** key, to enter calibration mode

9) **ESC** to escape the current mode, exit calibration, setup, help, etc.

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Rear view
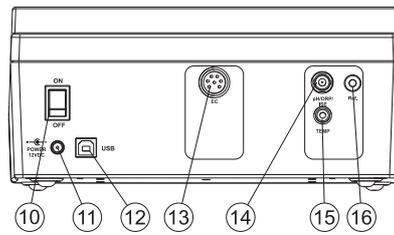
10) **ON/OFF** switch.

11) Power adaptor socket.

12) **USB** connector.

13) **DIN** connector for EC probe.

14) **BNC** electrode connector for pH/ORP, ISE electrode.

15) Temperature socket for pH/ORP, ISE channel.

16) Reference electrode connector for pH/ORP, ISE channel.

SPECIFICATIONS

Range	−2.0 to 20.0 pH −2.00 to 20.00 pH −2.000 to 20.000 pH
	±2000.0 mV
	1.00 E-7 to 9.99 E10 conc.
	−20.0 to 120.0 °C (4.0 to 248.0 °F) Channel 1
Resolution	0.1 pH 0.01 pH 0.001 pH
	0.1 mV
	3 digits 0.01, 0.1, 1, 10 conc.
	0.1 °C (0.1 °F)
Accuracy @ 20 °C / 68°F	±0.01 pH ±0.002 pH
	±0.2 mV
	±0.5% of reading (monovalent ions) ±1% of reading (divalent ions)
	±0.2 °C (±0.4 °F) (excluding probe error)
Rel mV offset range	±2000 mV
pH Calibration	Up to five-point calibration, 7 standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45), and 2 custom buffers
Slope Calibration	From 80 to 110%
pH Temperature Compensation	Manual or Automatic from −20.0 to 120.0 °C (−4.0 to 248.0 °F)
pH Electrode	**HI 1131B** (included)
Temperature probe	**HI 7662-T** (included)
ISE Calibration	Up to five-point calibration points. 6 standard solutions available (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	$\pm$1% of reading ($\pm$0.05 ppm or 1 digit whichever greater) excluding probe error

	Range	% NaCl: 0.0 to 400.0 %
Salinity	Resolution	0.1 %
	Accuracy	±1% of reading excluding probe error
	Range	-20.0 to 120.0 °C
Temperature Channel 2	Resolution	0.1 °C
	Accuracy	±0.2 °C (excluding probe error)
EC Calibration	Automatic up to 2 points with 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, 111.8 mS/cm)	
Cell constant setup	0.010 to 10.000	
NaCl Calibration	Max. 1 point only (with **HI 7073** standard);	
EC probe	**HI 76310**	
Temperature source	Automatic from sensor inside the probe; Manual entry	
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)	
Input impedance	10^{12} ohms	
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 - 50 °C (32 - 122 °F) max. RH 55% non-condensing	

POWER CONNECTION

Plug the 12 Vdc adapter into the power supply socket.

<u>Note</u>: This instrument use non volatile memory to retain the pH, mV, Ion, EC, NaCl calibrations and all other settings, when unplugged.

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.

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.

pH MEASUREMENTS

To take a pH measurement remove the electrode protective cap and simply 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.
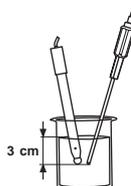
Allow for the electrode to adjust and reading to stabilize (hourglass symbol turns off).

On the pH screen are displayed:

- pH reading with the selected resolution.
- Temperature reading in the selected unit (ºC or ºF).
- 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.

In order to take more accurate pH measurements, make sure that the instrument is calibrated (see page 19 for details).

It is recommended that the electrode is always kept wet and rinsed thoroughly with the sample to be measured before use.

The pH reading is directly affected by temperature. For accurate pH measurements, temperature must be taken into consideration. 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.

<u>**If manual temperature compensation (MTC) is desired, the temperature probe must be disconnected from the instrument**</u>.

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.

<u>Note</u>: 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.

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ORP MEASUREMENTS

To perform ORP measurements, connect an ORP electrode (see ACCESSORIES section) to the instrument and turn it ON.

If necessary, enter the mV mode by pressing **RANGE** until the display changes to mV.

Submerse the ORP electrode 3 cm (1¼") into the sample to be tested and wait a few seconds for the reading to stabilize.


```
Ch1 mV
          55.0        mV
                     25.1°C
StartLog |  Rel mV  | AutoEnd
```

Measurements are displayed with 0.1 mV resolution.

The **"ATC"** (or **"MTC"**) message is turned off because mV readings are not temperature compensated.

For accurate ORP measurements, the surface of the electrode must be clean and smooth. Pretreatment solutions are available to condition the electrode and improve its response time (see ACCESSORIES section, page 77).

RELATIVE mV MEASUREMENTS

To enter Relative mV mode, press **Rel mV** function key while in mV measurement mode. The relative mV reading will be displayed along with the Absolute mV value and the current temperature readings.

```
Ch1 Rel mV
          55.0        Rel
                       mV
      55.0 Abs mV    25.1°C
StartLog |   mV   | AutoEnd
```

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.

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

ISE MEASUREMENTS

To perform ion concentration measurements, connect an ISE electrode (and the corresponding reference if necessary) to the corresponding BNC input and turn it 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 will be displayed along with the current temperature reading.
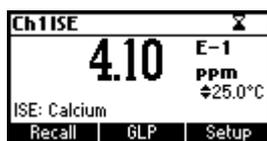
The "**ATC**"(or "**MTC**") message is turned off because ppm readings are not temperature compensated.

In order to take accurate ISE measurements, make sure that the appropriate ISE electrode type and ISE unit were set in SETUP menu and the instrument was calibrated (see ISE CALIBRATION for details, page 29).

<u>Notes</u>: • When the reading is out of range, the display will flash the closest full-scale value.

• The instrument will display "----" on the primary LCD if it is not calibrated. Perform at least a single-point calibration in order to take ISE measurements.

• Changing the selection in the SETUP menu for the ISE electrode or the ISE parameter will require calibration.

TEMPERATURE MEASUREMENTS

pH channel

Connect the **HI 7662-T** temperature probe to the appropriate socket. Immerse the temperature probe into the sample and allow the reading on the secondary LCD to stabilize.

<u>Note</u>: The temperature can be displayed in Celsius degrees (ºC) or in Fahrenheit degrees (ºF) (see SETUP for details, page 40).

EC/TDS/NaCl/Resistivity channel

Immerse the conductivity probe (which includes also the 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.

If needed, press **CHANNEL** to select EC channel or/and press **RANGE** repeatedly until the desired range (EC, Resistivity, TDS, Salt) is selected on the LCD. If needed, select the "Automatic" or "No TC" compensation mode to perform temperature measurements (see SETUP for details, page 40).

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 (the uncompensated conductivity) is up to 1000 mS/cm. The instrument will display conductivity readings up to 1000 mS/cm.

```
Ch2 EC
        998.1     μS
                  ATC
                  25.1°C
              Tref 25.0°C
 Recall  |  GLP  |  Setup
```

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.

```
Ch2 RES
        1.00      kΩ
                  ATC
                  25.1°C
              Tref 25.0°C
 Recall  |  GLP  |  Setup
```

TDS range

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

```
Ch2 TDS
        499.1     ppm
                  ATC
                  25.1°C
              Tref 25.0°C
 Recall  |  GLP  |  Setup
```
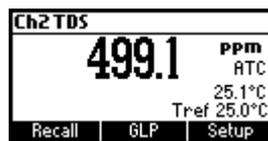
Salinity

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.

```
Ch2 Salt
 CAL            %
 DUE    2.0     ATC
                25.1°C
            Tref 25.0°C
 Recall  |  GLP  |  Setup
```

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AUTO-RANGING EC CHANNEL

The EC, Resistivity and TDS scales are auto-ranging. The meter automatically sets the scale with the highest possible resolution.

By pressing **Lock**, the auto-ranging feature is disabled and the current range is frozen on the LCD.

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

<u>Note</u>: 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.

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 mode).

Two selectable temperature sources are available: reading directly from the sensor inside the probe or manual entry.

Three options of linear temperature compensation are available:

Automatic: temperature readings from the sensor inside the EC probe.

```
┌─────────────────────────┐
│ Ch2EC                   │
│           μS            │
│    1.909  ATC           │
│           0.0°C         │
│           Tref 25.0°C   │
│ Recall  |  GLP  | Setup │
└─────────────────────────┘
```
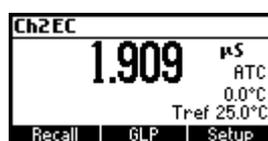
Manual: temperature entered manually by the user.

```
┌─────────────────────────┐
│ Ch2EC                   │
│           μS            │
│    1.981  MTC           │
│           ‡-1.0°C       │
│           Tref 25.0°C   │
│ Recall  |  GLP  | Setup │
└─────────────────────────┘
```

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

```
┌─────────────────────────┐
│ Ch2EC                   │
│ CAL       mS            │
│ DUE 1000  NoTC          │
│           ‡-1.0°C       │
│           Tref 25.0°C   │
│ Recall  |  GLP  | Setup │
└─────────────────────────┘
```
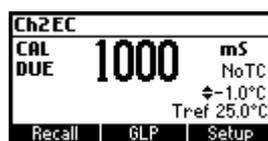
To select the desired option enter SETUP menu (see page 40).
If the temperature is out of the -20 °C - 120 °C range the instrument will not do temperature compensation.

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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 invariably 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 $^{\circ}C$.

The following table lists the temperature dependence of the HANNA 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.

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
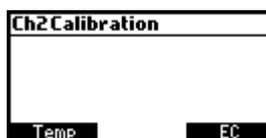
Press the corresponding functional key to enter:

• EC user calibration.

• Ch2 temperature user calibration.

From pH range
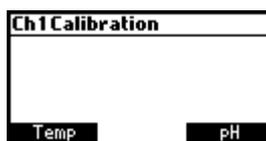
Press the corresponding functional key to enter:

• pH user calibration.

• Ch1 temperature user calibration.

<u>Note</u>: For REL mV, ISE or Salinity range, pressing **CAL** on the selected range will cause the meter to enter directly in calibration mode.

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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"** blinks (if feature is enabled in SETUP).

• If **"Out of cal. range"** message appears on the LCD during pH measurement (the measurement range is not covered by current calibration, if this feature is enabled in SETUP).

PROCEDURE

The **HI 3512** offers a choice 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. The standard pH buffers are temperature compensated during calibration. The custom, user entered buffers are not temperature compensated during calibration.

When a custom buffer is selected during calibration, the **Custom** function key is displayed on the LCD. Press **Custom** key in order 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, it is recommended to perform a multipoint calibration. At least a two-point calibration is required.

The instrument will automatically skip the buffers within ± 0.2 pH window, around one of the calibrated buffers.

• Pour small quantities of selected buffer solutions into clean beakers. For accurate calibration use two beakers for each buffer solution, the first one for rinsing the electrode and the second 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.

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FIVE-POINT CALIBRATION

- Immerse the pH electrode and the temperature probe approximately 3 cm (1¼") into a buffer solution of your choice (pH 1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45 or a custom buffer) and stir the buffer gently. The temperature probe should be close to the pH electrode.
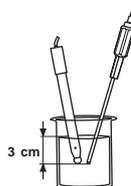
- Enter pH calibration. The instrument will display the measured pH, the LCD first expected buffer and the temperature reading.
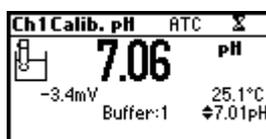

```
Ch1 Calib. pH    ATC    ⛌
       7.06          pH
  -3.4mV           25.1°C
       Buffer:1   ⬍7.01pH
```

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

- The "⛌" tag will blink on the LCD until the reading is stable.

- When the reading is stable and close to the selected buffer, **Confirm** function key is displayed.


```
Ch1 Calib. pH    ATC
       7.06          pH
  -3.6mV           25.1°C
       Buffer:1   ⬍7.01pH
                  Confirm
```
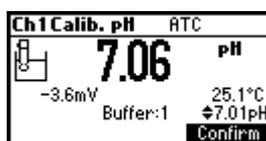
- Press **Confirm** to confirm first point.

- The calibrated value and the second expected buffer value is then displayed on the LCD.
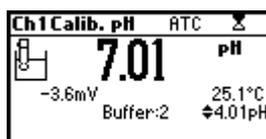

```
Ch1 Calib. pH    ATC    ⛌
       7.01          pH
  -3.6mV           25.1°C
       Buffer:2   ⬍4.01pH
```

- After the first calibration point is confirmed, immerse the pH electrode and the temperature probe approximately 3 cm (1¾") into the second buffer solution and stir gently. The temperature probe should be close to the pH electrode.

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

- The "⛌" tag will blink on the LCD until the reading is stable.

20
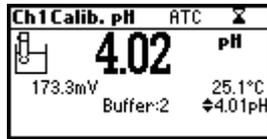
- When the reading is stable and close to the selected buffer, the **Confirm** function key is displayed.
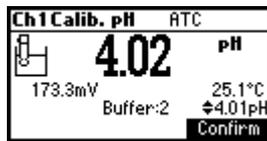
- Press **Confirm** to confirm calibration.
- The calibrated value and the third expected buffer value will be displayed.

- After the second calibration point is confirmed, immerse the pH electrode and the temperature probe approximately 3 cm (1¾") into a third buffer solution and stir gently. The temperature probe should be close to the pH electrode.
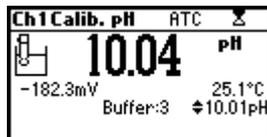
- If necessary, press the **ARROW** keys to select a different buffer value.
- The "⌛" tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, the **Confirm** function key is displayed.
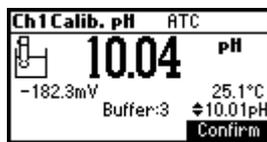
- Press **Confirm** to confirm calibration.

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

FOUR, THREE or TWO-POINT CALIBRATION

- Proceed as described in "FIVE-POINT CALIBRATION" section.

- Press **ESC** after the appropriate accepted calibration point. The instruments will return to calibration screen and will memorize the calibration data.

SINGLE-POINT CALIBRATION

There are two selectable options for a single-point calibration: **Replace** and **Offset**.

This option is configured in SETUP mode under the parameter First Point Mode. In both cases the meter will alter the present calibration data in the instrument. If **"Replace"** is selected a new calibration point will be added to the existing data, and the slope is calculated. The slopes between current buffer and nearest lower and higher buffers will be reevaluated.

If the **"Offset"** option 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 was confirmed. The instruments will memorize the single-point calibration data and will return to calibration screen.

Notes: • Press **MTC** key to toggle between pH buffer selection and the temperature reading during calibration while temperature probe is disconnected (**MTC** mode).
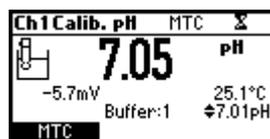
- The displayed arrow is moving to the temperature value. Use **ARROW** keys in order to change the temperature.

ERROR SCREENS

Wrong temperature
The calibration cannot be confirmed.

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

Wrong buffer

The calibration cannot be confirmed.

The pH reading is not close to the selected buffer. Select another buffer using the **ARROW** keys or change the buffer.

```
┌─────────────────────────┐
│ Ch1 Calib. pH    MTC     │
│  ▭      4.01      pH     │
│ Wrong Buffer      25.1°C │
│                 ⬍10.01pH │
│ ▐ MTC ▌                  │
└─────────────────────────┘
```

"**Electrode Dirty/Broken**" alternatively with "**Buffer Contaminated**".

The calibration cannot be confirmed.

```
┌──────────────────────────┐ ┌──────────────────────────┐
│ Ch1 Calib. pH    MTC      │ │ Ch1 Calib. pH    MTC      │
│  🔲     5.81      pH      │ │  ▭      5.81      pH      │
│ Electrode       ⬍25.0°C   │ │ Buffer          ⬍25.0°C   │
│ Dirty / Broken   7.01pH   │ │ Contaminated     7.01pH   │
│ ▐ Buffer ▌                │ │ ▐ Buffer ▌                │
└──────────────────────────┘ └──────────────────────────┘
```
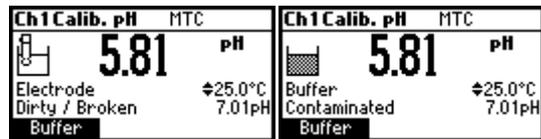
The offset of the electrode is not in the accepted range. Check if the electrode is broken or clean it following the CLEANING PROCEDURE (see page 74). Check the quality of the buffer. If necessary, change the buffer.

Wrong slope

The calibration cannot be confirmed.

```
┌─────────────────────────┐
│ Ch1 Calib. pH    MTC     │
│  🔲     4.98      pH     │
│ Wrong           ⬍25.0°C  │
│ Slope            4.01pH  │
│ ▐ Buffer ▌               │
└─────────────────────────┘
```
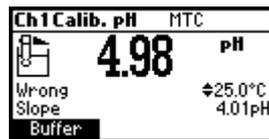
The evaluated slope is less than the lowest accepted value (80% of default slope).

```
┌─────────────────────────┐
│ Ch1 Calib. pH    MTC     │
│  🔲     3.28      pH     │
│ Wrong           ⬍25.0°C  │
│ Slope            4.01pH  │
│ ▐ Buffer ▌               │
└─────────────────────────┘
```

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

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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.

```
Ch1 Calib. pH    MTC
         5.97      pH

Wrong Old              25.1°C
Slope                 ⇕7.01pH
       MTC          Clear
```

<u>Note:</u> 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 at a latter time, 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.

```
Ch1 Calib. pH    MTC
         8.03      pH

Replace                25.0°C
        Buffer:1     ⇕1.68pH
                   Confirm
```
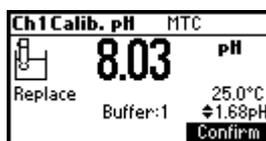
Press **ARROW** keys to select another buffer to be replaced.
Press **Confirm** to confirm the buffer that will be replaced.
Press **ESC** to exit mode. In this case, the buffer will not be entered.

<u>Note:</u> The replaced buffer is not removed from calibration list and it can be selected for the next calibration points.

WORKING WITH CUSTOM BUFFERS

If at least one custom buffer was set in SETUP menu, it can be selected for calibration by pressing the **ARROW** keys. The **Custom** function key will be displayed.

```
Ch1 Calib. pH    MTC   ⏳
         8.03      pH

-61.0mV                25.0°C
        Buffer:1     ⇕8.07pH
     MTC  |  Custom
```
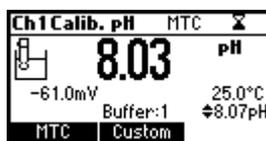
Press **Custom** if you want to adjust the buffer to its value at the current temperature.

Use the **ARROW** keys to change the buffer value.
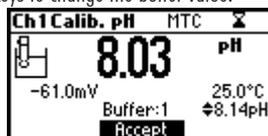
Press **Accept** to accept new value or **ESC** to exit mode.

<u>Note</u>: Custom buffer value can be adjusted within a ±1.00 pH window, around the set value.

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 insure an accurate measurement.

The resolution of the meter must be set to 0.001 pH (see SETUP on page 40). Eight buffers are stored in instrument for calibration.

If calibration is invoked using millesimal buffers, the calibration buffer can be modified within a ±0.020 pH range in accordance with the label on the calibration buffer.
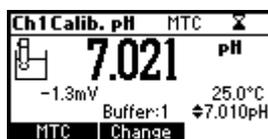
Press **Change** to enter buffer adjust mode.
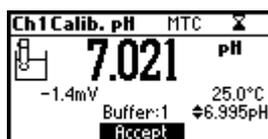
Use **ARROW** keys to change the buffer value.

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

CLEAR CALIBRATION
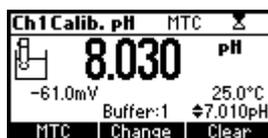
Press **Clear** function key when displayed to clear previous calibrations.

The instrument will display "**Calibration Cleared**" and the instrument returns to measuring mode.

ELECTRODE CONDITION

The display is provided with an icon, and a numeric value (unless the feature is disabled) which gives an indication of the electrode status after calibration.

The indication remains active until the end of the calibration day.
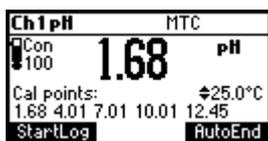
<u>Note</u>: The electrode condition is evaluated only if current calibration includes at least two standard buffers.

CLEAN ELECTRODE WARNING

Each time pH calibration is performed, the instrument internally compares the new calibration with the one previously stored.

When this comparison indicates a significant difference, the "**Clean Electrode**" warning message is displayed to advise the user that the pH electrode may need to be cleaned (see ELECTRODE CONDITIONING & MAINTENANCE section for details, page 72).
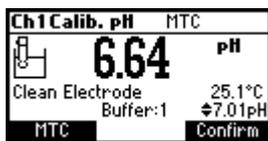
After cleaning, perform a new calibration.

<u>Note</u>: If the calibration data are cleared, the comparison is done with the default values.

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

RELATIVE mV CALIBRATION

The relative mV value calibration may be 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 measurement mode. The relative mV value and the temperature values are displayed.
- Use the **ARROW** keys if you want to change the displayed relative mV value.

- Press **Zero** function key if you want 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 ($\pm$2000 mV), the **Confirm** function key is displayed.

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

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

<u>Note</u>: If a **Rel mV** offset calibration exists, **CLR** function key is displayed. Press **CLR** if you want **Rel mV** offset to be 0.0 mV.

28

ISE CALIBRATION

It is recommended to calibrate the instrument frequently, especially if high accuracy is required.

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"** warning blinks (if feature is enabled).

Follow instructions for the individual electrode.

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

PROCEDURE

Select the proper ISE probe in SETUP menu or select the proper Ion Charge slope (see SETUP for details, page 40).

<u>Note</u>: If the ISE probe has not been previously calibrated (at least one point), the "----" will be displayed.
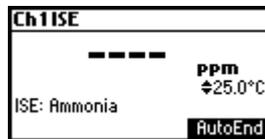
Pour small quantities of the buffer solutions into clean beakers. If possible, use plastic beakers to minimize any EMC interferences.

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 **HI 3512** 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 it is recommended to perform a multipoint calibration. At least a two-point calibration is required.

Remove the protective cap from the ISE electrode.

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.
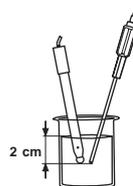
- Press **CAL**. The primary LCD will displays the ion concentration in the selected unit or "----" if not calibrated and first standard value.
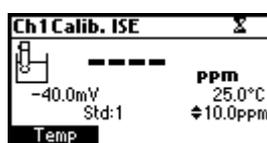
```
Ch1 Calib. ISE          ⌛
🔲      ----
              ppm
-40.0mV          25.0°C
    Std:1       ‡10.0ppm
 Temp
```

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

- The "⌛" tag will blink on the LCD until the reading is stable.

- When the reading is stable and close to the selected standard, the **Confirm** function key is displayed.

```
Ch1 Calib. ISE
🔲      ----
              ppm
-40.0mV          25.0°C
    Std:1       ‡10.0ppm
 Temp             Confirm
```

- Press **Confirm** to confirm calibration.

- The calibrated value and the second expected standard value will be displayed.

```
Ch1 Calib. ISE          ⌛
🔲    10.0
              ppm
-40.0mV          25.0°C
    Std:2       ‡100ppm
 Temp
```
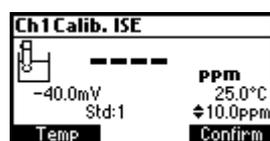
- After the first calibration point is confirmed, immerse the ISE electrode approximately 2 cm (¾") into the second calibration solution.

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

- The "⌛" tag will blink on the LCD until the reading is stable.

- When the reading is stable and close to the selected standard, the **Confirm** function key is displayed.

- Press **Confirm** to confirm calibration.

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- The calibrated value and the third expected standard value will be displayed.

- After the second calibration point is confirmed, immerse the ISE electrode approximately 2 cm ($\frac{3}{4}$") into the third calibration solution.

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

- The "⊠" tag will blink on the LCD until the reading is stable.

- When the reading is stable and close to the selected standard, the **Confirm** function key is displayed.

- Press **Confirm** to confirm calibration.

- The calibrated value and the fourth expected standard value will be displayed.

- After the third calibration point is confirmed, immerse the ISE electrode approximately 2 cm ($\frac{3}{4}$") into the fourth calibration solution.

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

- The "⊠" tag will blink on the LCD until the reading is stable.

- When the reading is stable and close to the selected standard, the **Confirm** function key is displayed.

- Press **Confirm** to confirm calibration.

- The calibrated value and the fifth expected standard value will be displayed.

- After the fourth calibration point is confirmed, immerse the ISE electrode approximately 2 cm ($\frac{3}{4}$") into the fifth calibration solution.

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

- The "⊠" tag will blink on the LCD until the reading is stable.

- When the reading is stable and close to the selected standard, the **Confirm** function key is displayed.

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

<u>Note</u>: The instrument will automatically skip the standard solutions used during calibration.

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ERROR SCREENS

Wrong standard

The 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

The 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).
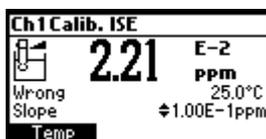
Wrong old slope

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 will display "----"on the primary LCD if is not calibrated or after all calibrations are cleared.

If "**Clear**" is pressed during the first calibration point, the instrument returns to measurement mode.

Notes: • Press **Temp** function key to select temperature value to be changed if the temperature probe is not connected;

• ISE range is not temperature compensated on this meter;

• Standards and samples should be at the same temperature.

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EC CALIBRATION

It is recommended to calibrate the instrument frequently, especially if high accuracy is required.

The EC range should be recalibrated:

• Whenever the EC electrode is replaced.

• At least once a week.

• After testing aggressive chemicals.

• When calibration alarm time out is expired - **"CAL DUE"** blinks (if feature is enabled in SETUP).

• If **"Out of cal. range"** message appears on the LCD during EC measurement (the measurement range is not covered by current calibration, if feature is enabled in SETUP).

<u>Note</u>: TDS and Resistivity readings are automatically derived from the EC reading and no specific calibration is needed.

PROCEDURE

HI 3512 instrument offers a choice of 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 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.

TWO-POINT CALIBRATION

• It is better to 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, just 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 will display the measured EC on the LCD, first expected standard and the temperature reading.

```
Ch2 Calib. EC          ⌛
      0.401      µS
                   25.1°C
        Std:1    ‡0.000µS
MTC
```

- If necessary, press the **ARROW** keys to select a different standard value.
- The "⌛" tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, **Confirm** functional key is displayed.

```
Ch2 Calib. EC
      0.399      µS
                   25.1°C
        Std:1    ‡0.000µS
MTC               Confirm
```

- Press **Confirm** to confirm first point.
- The calibrated value and the second expected standard value is then displayed on the LCD.

```
Ch2 Calib. EC          ⌛
      0.000      µS
                   25.1°C
        Std:2    ‡84.00µS
MTC
```

- 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 will automatically detect the standard after few seconds the reading is stable.

```
Ch2 Calib. EC          ⌛
      83.69      µS
                   25.1°C
        Std:1    ‡84.00µS
MTC
```

- If necessary, press the **ARROW** keys to select a different standard value.
- The "⌛" tag will blink on the LCD until the reading is stable.

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- When the reading is stable and close to the selected standard, the **Confirm** functional key is displayed.

- Press **Confirm** to confirm calibration.

ERROR SCREENS

Wrong standard

The 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.

CLEAR CALIBRATION

Press **Clear** functional key when displayed to clear old calibrations.

All old calibrations, are cleared and the instrument returns to measurement mode.

NaCl CALIBRATION

NaCl calibration is a one-point procedure in 100.0% NaCl solution. Use the **HI 7037L** calibration solution (sea water solution) as a 100% NaCl standard solution.

- To enter NaCl calibration select the Salinity % range and press **CAL**.
- The measured % NaCl, the temperature and the 100% NaCl standard are displayed.

35
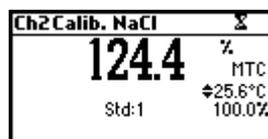
- Rinse the probe with some of the calibration solution or deionized water. Immerse the probe into **HI 7037L** solution. Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.

- The "Σ" tag will blink on the LCD until the reading is stable.

- When the reading is stable, the **Confirm** functional key is displayed. Press **Confirm** to confirm calibration.

- The instrument returns to measurement mode.

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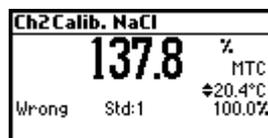
- If the uncalibrated reading is too far from the expected value, calibration is not recognized. The "**Wrong**" message will be displayed.

- 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.

GOOD LABORATORY PRACTICE (GLP)

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

All data regarding pH, Rel mV, ISE, EC or Salinity calibration is stored for the user to review when necessary.

EXPIRED CALIBRATION

The instrument is provided with a real time clock (RTC), in order to monitor the time elapsed since the last pH calibration.

The real time clock is reset every time the instrument is calibrated and the "expired calibration" status is triggered when the instrument detects a calibration time out. The "**CAL DUE**" warning will start blinking to warn the user that the instrument should be recalibrated.

The calibration time out can be set (see SETUP for details, page 40) from 1 to 7 days or can be disabled.

For example, if a 4 days time out has been selected, the instrument will issue the alarm exactly 4 days after the last calibration.

However, if at any moment the expiration value is changed (e.g. to 5 days), then the alarm will be immediately recalculated and appear 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** function key when the instrument is in the pH measurement mode. If **GLP** function key is not displayed press **MENU** key.


```
Ch1 Last pH cal      Buffer[pH]
Date: 2009/07/07           7.01
Time: 15:43:22             4.01
Cal Expire: Disabled       8.07*
Offset: -0.7mV            10.01
Aver. Slope: 100.8%       12.45
Electrode condition: 100%
```

The instrument will display a lot of data including 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 "*" on the right side of the buffer value.

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 will display the Relative mV GLP information: calibration date, time and offset.

```
Ch1Last Rel mV cal
Date: 2009/07/07
Time: 15:41:30
Offset: 1900.1mV
```

LAST ISE CALIBRATION DATA

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

To view the ISE calibration data, press **GLP** function key while in ISE measurement mode. If **GLP** function key is not displayed press **MENU** key.

The instrument will display the ISE calibration information: calibration date, time, slope, calibration status and electrode type.

```
Ch1Last ISE cal      Std[ppm]
Date: 2009/07/07          10.0
Time: 15:44:33
Cal Expire: Disabled
Slope: 100.0%
ISE: Fluoride
```

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 will display a lot of data including calibration standards, offset, time and date, cell constant, etc.

```
┌────────────────────────────┐
│ Ch2Last EC cal      Std[EC] │
├────────────────────────────┤
│ Date: 2009/06/30     Offset │
│ Time: 16:01:49     84.00µS  │
│ Cal Expire: Disabled        │
│ Offset: 0.002µS    Tref: 25°C│
│ Cell Constant: 0.850        │
│ TC Coef: 1.90% MTC          │
└────────────────────────────┘
```

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 will display the NaCl information: calibration date, time and salinity factor.

```
┌────────────────────────────┐
│ Ch2Last NaCl cal.          │
├────────────────────────────┤
│ Date: 2009/06/30           │
│ Time: 16:00:03             │
│ Cal Expire: 3 days         │
│ Salinity factor: 1.243     │
│                            │
│                            │
└────────────────────────────┘
```

<u>Notes</u>: • Press **ESC** at any moment and the instrument will return to measurement mode.

• If calibration has not been performed, the instrument displays **"No user calibration"** message.

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	current
		00:00 to 23:59	date/time
Time Format		AM/PM or 24 hours	24 hours
Date Format		DD/MM/YYYY	YYYY/MM/DD
		MM/DD/YYYY	
		YYYY/MM/DD	
		YYYY-MM-DD	
		Mon DD, YYYY	
		DD-Mon-YYYY	
		YYYY-Mon-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, 120, 180 min.	Manual (Log on demand)
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
Calibribration 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
Calibribration 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 coeficient	Set the coeficient 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** function key while in measuring mode.

```
┌─────────────────────────────┐
│Ch1pH          MTC           │
│▌Con                    pH   │
│▌100    7.33                 │
│                             │
│Cal points:          ↕25.1°C │
│4.01 7.01 10.01              │
│  Recall  │  GLP  │  Setup   │
└─────────────────────────────┘
```
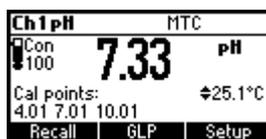
If SETUP is not displayed press **MENU** key.

GENERAL PARAMETER SCREENS

Backlight

Focus on the *Backlight* item.

```
┌─────────────────────────────┐
│Setup[pH]                    │
│Temperature Unit          °C │
│Backlight                  5 │
│Contrast                   8 │
│Date / Time        15:45:32  │
│  Modify                     │
└─────────────────────────────┘
```

Press **Modify**.

```
┌─────────────────────────────┐
│Backlight              ▭↻     │
│0                         8  │
│  ████████████▏              │
│           5                 │
│  Accept  │   ←   │   →      │
└─────────────────────────────┘
```
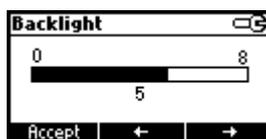
Use ←/→ keys to change the intensity then press **Accept** to confirm.

Press **ESC** to leave without changing.

Contrast

Focus on the *Contrast* item.

```
┌─────────────────────────────┐
│Setup[pH]                    │
│Temperature Unit          °C │
│Backlight                  5 │
│Contrast                   8 │
│Date / Time        15:46:15  │
│  Modify                     │
└─────────────────────────────┘
```
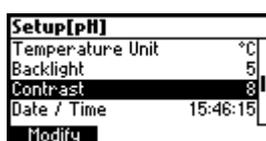
Press **Modify**.

Use ←/→ keys to change contrast then press **Accept** to confirm.

```
┌─────────────────────────────┐
│Contrast               ▭↻     │
│0                        20  │
│  █████▏                     │
│        8                    │
│  Accept  │   ←   │   →      │
└─────────────────────────────┘
```

Press **ESC** to leave without changing.

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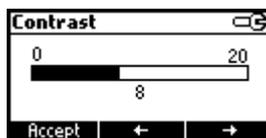
Date/Time

Focus on the *Date/Time* item.

```
┌─────────────────────────┐
│ Setup[pH]               │
│ Contrast              8 │
│ Date / Time    15:47:14 │
│ Time Format   24 hours▐ │
│ Date Format YYYY/MM/DD▐ │
│ ▀▀Modify▀▀              │
└─────────────────────────┘
```

Press **Modify**.

```
┌─────────────────────────┐
│ Date / Time          ⊂⊖ │
│        YYYY/MM/DD        │
│   ♦  2009/06/30         │
│   ♦   16:02:49          │
│ ▀Accept▀│  ←  │   →      │
└─────────────────────────┘
```
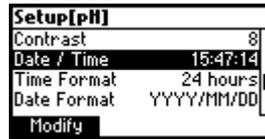
Use ←/→ keys to select item.

Use **ARROW** keys to change focused values.

Press **Accept** to confirm new setting, or **ESC** to leave without changing.

Time Format

Focus on the *Time Format* item.

```
┌─────────────────────────┐
│ Setup[pH]            ⊂⊖ │
│ Contrast              8 │
│ Date / Time    15:47:38 │
│ Time Format   24 hours▐ │
│ Date Format YYYY/MM/DD▐ │
│ ▀▀AM/PM▀▀               │
└─────────────────────────┘
```
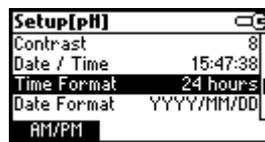
Press function key to change the option.

Date Format

Focus on the *Date Format* item.

```
┌─────────────────────────┐
│ Setup[pH]               │
│ Date / Time    15:48:04 │
│ Time Format   24 hours▐ │
│ Date Format YYYY/MM/DD▐ │
│ Language        English▐│
│ ▀▀Modify▀▀              │
└─────────────────────────┘
```

Press **Modify**.

```
┌─────────────────────────┐
│ Date Format          ⊂⊖ │
│ DD/MM/YYYY              │
│ MM/DD/YYYY              │
│ YYYY/MM/DD              │
│ YYYY-MM-DD              │
│ ▀▀Accept▀▀              │
└─────────────────────────┘
```

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

Press **ESC** to leave without changing.

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Language

Focus on the *Language* item.

```
┌─────────────────────────┐
│ Setup[pH]           ⊂⊝  │
│ Time Format    24 hours │
│ Date Format  YYYY/MM/DD │
│ Language        English │
│ Beep On              ☑  │
│                         │
│  Italiano │ Portug │ Español │
└─────────────────────────┘
```
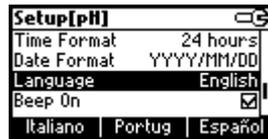
Use the desired function key to change the option. Wait until new language is loaded. If language load fails the instrument will try to reload current language.

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

Focus on the *Temperature Unit* item.

```
┌─────────────────────────┐
│ Setup[pH]           ⊂⊝  │
│ Out of Cal. Range Warning ☑ │
│ Temperature Unit     °C │
│ Backlight             5 │
│ Contrast              8 │
│    °F                   │
└─────────────────────────┘
```
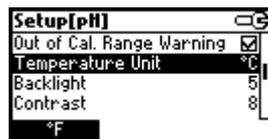
Press the displayed function key in order to change the temperature unit.

Beep On

Focus on *Beep On* item.

```
┌─────────────────────────┐
│ Setup[pH]           ⊂⊝  │
│ Date Format  YYYY/MM/DD │
│ Language        English │
│ Beep On              ☐  │
│ Instrument ID      0000 │
│   Enable                │
└─────────────────────────┘
```

Press the displayed function key to enable/disable beep.

When enabled, beep sounds as a short beep every time a key is pressed or when the calibration can be confirmed.

A long beep alert means that the pressed key is not active or a wrong condition is detected while in calibration.

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AutoEnd stability

Focus on *AutoEnd Stability* item.

```
┌─────────────────────────┐
│ Setup[pH]          ⊂⊙  │
│ Log interval        5 s │
│ pH Resolution      0.01 │
│ AutoEnd Stability Medium│
│ Calibration Timeout Disabled│
│   Fast  │Accurate      │
└─────────────────────────┘
```
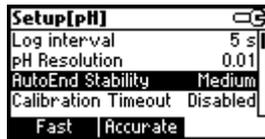
Press one of the displayed function keys to select the AutoEnd stability criteria.

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

Focus on *Log interval* item.

```
┌─────────────────────────┐
│ Setup[pH]               │
│ Log interval      Manual│
│ pH Resolution      0.01 │
│ AutoEnd Stability Medium│
│ Calibration Timeout Disabled│
│   Modify                │
└─────────────────────────┘
```

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

```
┌─────────────────────────┐
│ Log interval       ⊂⊙  │
│ Manual                  │
│ AutoEnd                 │
│ 5 s                     │
│ 10 s                    │
│   Accept                │
└─────────────────────────┘
```
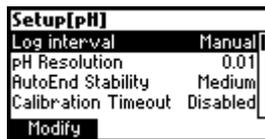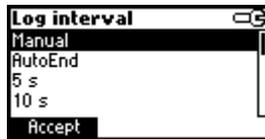
Use the arrow keys in order to select an option.

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.

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Instrument ID

Focus on the *Instrument ID* item.

```
Setup[pH]
Language           English
Beep On               ☑
Instrument ID       0000
Baud Rate          9600
   Modify
```

Press **Modify**.

```
Instrument ID      ⊐⊖
        ⇕0000

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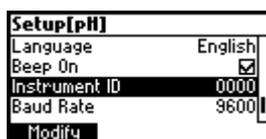
Use **ARROW** keys to change the instrument ID.

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

Baud Rate

Focus on the *Baud Rate* item.

```
Setup[pH]
Beep On               ☑
Instrument ID       0000
Baud Rate          9600
Meter Information
   Modify
```

Press **Modify**.

```
Baud Rate          ⊐⊖
2400
4800
9600
19200
   Accept
```

Use **ARROW** keys to select the desired communication baud.

Press **Accept** to confirm or **ESC** to exit.

Meter information

Focus on the *Meter Information* item.

```
Setup[pH]
Beep On               ☑
Instrument ID       0000
Baud Rate          9600
Meter Information
   Select
```

Press **Select**.

The meter informations are displayed:

-firmware version

-language version

-mV/EC and temperature factory calibration time/date

```
HI3512 Meter Info
Firmware            V1.00
Language             2.0
mV    2009/06/25 10:03:11
Temp  2009/06/25 10:00:54
```

pH CHANNEL RANGE SPECIFIC PARAMETERS SCREENS

Calibration Timeout

Focus on the *Calibration Timeout* item.

```
Setup[pH]
AutoEnd Stability     Medium
Calibration Timeout   Disabled
First Point Mode      Replace
Custom Buffers
    Modify
```

Press **Modify**.

```
Calibration Timeout  ⊂⊖        Calibration Timeout  ⊂⊖

     ⬍Disabled                      ⬍2  days

 Accept                         Accept
```

Use **ARROW** keys to set desired value.

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

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

First point mode

Focus on the *First Point Mode* item.

```
Setup[pH]                      ⊂⊖
AutoEnd Stability     Medium
Calibration Timeout   Disabled
First Point Mode      Replace
Custom Buffers
    Offset
```

Press the displayed function key in order to change the option.

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

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

Custom Buffers

Focus on the *Custom Buffers* item.

```
Setup[pH]
Calibration Timeout   Disabled
First Point Mode      Replace
Custom Buffers
View Calibration Points    ☑
    Modify
```

Press **Modify**.

```
Custom Buffers
CB 1                    7.01

    Modify | Delete | Add
```
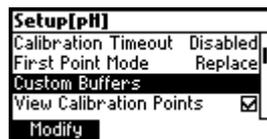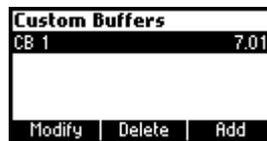
Press **Delete** to delete focused buffer.

```
Custom Buffers
CB 1                    7.01
CB 2                    7.01

    Modify | Delete
```
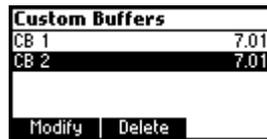
Press **Add** to add a new buffer to the list (max 2).
Press **Modify** to set custom buffer value.

```
CB 2                      ⊂⊃
        ⬍7.01pH
  Accept
```

Use **ARROW** keys to change the value.
Press **Accept** to confirm custom buffer value or **ESC** to exit without saving.

pH Resolution

Focus on the *pH Resolution* item.

```
Setup[pH]                 ⊂⊃
Log interval          Manual
pH Resolution            0.01
AutoEnd Stability     Medium
Calibration Timeout   Disabled
    0.1  |  0.001
```

Press the displayed function key to change option.

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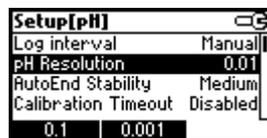
View Calibration Points

Focus on the *View Calibration Points* item.

```
┌─────────────────────────────┐
│ Setup[pH]              ⊂⊃    │
│ First Point Mode    Replace  │
│ Custom Buffers               │
│ View Calibration Points  ☑  │
│ Out of Cal. Range Warning ☑ │
│  Disable                     │
└─────────────────────────────┘
```
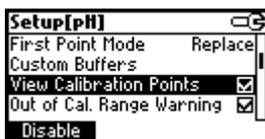
Press the displayed function key to change option.

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

Out of Calibration Range Warning

Focus on the *Out of Cal. Range Warning* item.

```
┌─────────────────────────────┐
│ Setup[pH]              ⊂⊃    │
│ Custom Buffers               │
│ View Calibration Points  ☑  │
│ Out of Cal. Range Warning ☑ │
│ Temperature Unit        °C   │
│  Disable                     │
└─────────────────────────────┘
```
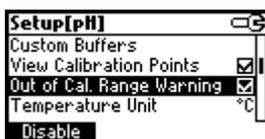
Press the displayed function key in order to change option.

If enabled, the **"Out of cal. range"** message will be displayed if the pH reading is not within the calibration range.

ISE probe

Focus on the *ISE probe* item.

```
┌─────────────────────────────┐
│ Setup[ISE]             ⊂⊃    │
│ Calibration Timeout Disabled │
│ ISE probe          Fluoride  │
│ ISE Unit               ppm   │
│ Temperature Unit        °C   │
│  Standard │ Custom           │
└─────────────────────────────┘
```

Press **Custom** in order to set the parameters for a custom probe.

Press **Standard** in order to select one probe from the standard probes list.

If **Custom** is pressed:

```
┌─────────────────────────────┐
│ Custom Elec. Setup     ⊂⊃    │
│ Charge/Slope      +1/59.16   │
│ Molar Weight     1.000g/mol  │
│                              │
│   Accept  │ Modify           │
└─────────────────────────────┘
```
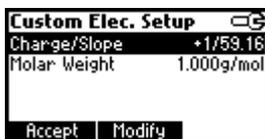
Use **ARROW** keys to focus on the parameter to be changed (**"Charge/Slope"** or **"Molar Weight"**).

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Focus on *Charge/Slope* item.

Charge/Slope
+1/59.16
+2/29.18
-1/-59.16
-2/-29.18
Accept

Use **ARROW** keys in order to select the desired combination.

If "**None/-59.16**" is selected the slope of the probe can be changed by pressing **Modify** key.

Charge/Slope
+2/29.18
-1/-59.16
-2/-29.18
None/-59.16
Accept | Modify

Press **Modify**.

Custom Slope
⇕-59.16
Accept

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

Press **Accept** to confirm or **ESC** to exit.

Focus on *Molar Weight*.

Custom Elec. Setup
Charge/Slope   +1/59.16
Molar Weight   1.000g/mol
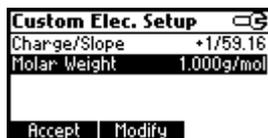
Accept | Modify

Press **Modify** in order to change molar weight.

Molar Weight
⇕1.000g/mol
Accept
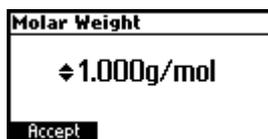
Use **ARROW** keys to change the value. Press **Accept** to confirm or **ESC** to exit.

If **Standard** was pressed.
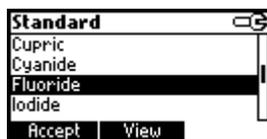
Use **ARROW** keys to focus on the desired electrode.

Press **Accept** to confirm setting or **ESC** to exit.

Press **View** to see probe parameters.
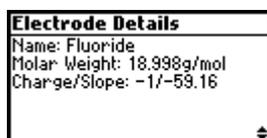
ISE unit

Focus on the *ISE Unit* item.
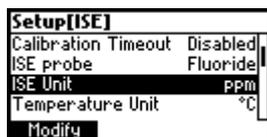
Press **Modify**.
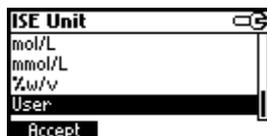
Use **ARROW** key to select unit.

Press **Accept** to confirm selection or **ESC** to exit.

<u>Notes</u>: • 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.

EC CHANNEL RANGE SPECIFIC PARAMETERS

Calibration Timeout
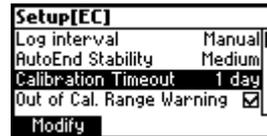
Focus on the *Calibration Timeout* item.

```
Setup[EC]
Log interval          Manual
AutoEnd Stability     Medium
Calibration Timeout    1 day
Out of Cal. Range Warning ☑
   Modify
```

Press **Modify**.

```
Calibration Timeout  ⊂⊖   Calibration Timeout  ⊂⊖


    ⬍Disabled               ⬍2 days


 Accept                    Accept
```

Use **ARROW** keys to set desired value.

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

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

Out of Calibration Range Warning

Focus on *Out of Cal. Range Warning* item.

```
Setup[EC]              ⊂⊖
AutoEnd Stability     Medium
Calibration Timeout    1 day
Out of Cal. Range Warning ☑
T. Compensation      Automatic
   Disable
```

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

Focus on *T. Compensation* item.

```
Setup[EC]              ⊂⊖
Calibration Timeout  Disabled
Out of Cal. Range Warning ☑
T. Compensation      Automatic
Range Select         Automatic
   NoTC  |  Manual
```

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

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

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

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

Range Select

Focus on the *Range Select* item.

```
Setup[EC]
Out of Cal. Range Warning  ☑
T. Compensation      Automatic
Range Select         Automatic
Cell Constant           1.000
    Modify
```
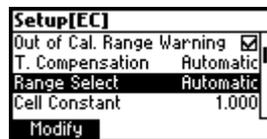
Press **Modify** to select ranging mode.

```
Range Select          ⊂G
Automatic
0.001μS
0.01μS
0.1μS
    Accept
```

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 will be displayed with maximum 6 digits. If the reading exceeds the maximum number of digits for the fixed range, the maximum value is displayed blinking.

<u>Note</u>: The Range Select parameter can be set only in EC, resistivity and TDS range.

Cell constant

Focus on the *Cell Constant* item.

```
Setup[EC]
Range Select         Automatic
Cell Constant           1.000
Temperature Coef.        1.90
Temperature Ref.         25°C
    Modify
```
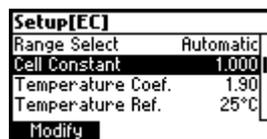
Press **Modify** to change the cell constant value.

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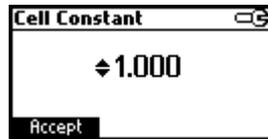
Use **ARROW** keys to change the cell constant value.

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

<u>Note</u>: 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

Focus on the *Temperature Coef.* item.
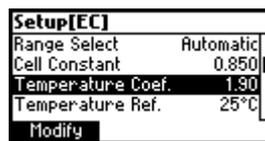
Press **Modify** in order to set the temperature coefficient.

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

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

Temperature Reference

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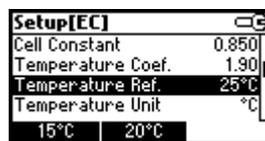
Press the corresponding functional key to select the desired reference temperature.

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.

LOGGING THE CURRENT DATA

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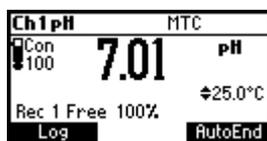
The instrument will display for few seconds the record number and the amount of the free log space.

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.
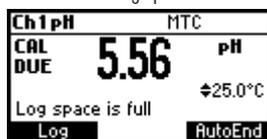
LOT LOGGING

Select the desired interval in SETUP as a timed interval or AutoEnd waits for a stable value before logging.
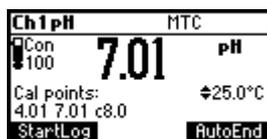
Press the **StartLog** function key in order to start Log interval.

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

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• 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.

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.

```
┌─────────────────────────┐
│ pH Log                  │
│                         │
│                         │
│                         │
│                         │
│ AutoLog        Man.Log  │
└─────────────────────────┘
```

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

```
┌──────────────────────────┐
│ Log    pH      Date      │
│  1    7.01  2009/07/07   │
│  2    7.01  2009/07/07   │
│  3    4.32  2009/07/07   │
│  4  !-2.00  2009/07/07   │
│ Delete All | Delete | More│
└──────────────────────────┘
```

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.

```
┌──────────────────────────┐
│ Record number: 1         │
│ 2009/07/07      16:05:33 │
│ 7.01 pH          25.0°C  │
│ -1.1mV                   │
│ Offset: -0.7mV           │
│ Slope: 100.8 %         ↕ │
└──────────────────────────┘
```

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

If **Delete** is pressed.

```
Delete Record?
1     7.01   2009/07/07
2     7.01   2009/07/07
3     4.32   2009/07/07
4    !-2.00  2009/07/07
          Confirm
```

Use **ARROW** key to focus the record to be deleted and then press **Confirm**.

Press **ESC** to exit.

If **Delete All** is pressed the instrumet 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.

```
Lot  Interval      Date
1        5 s   2009/07/07
2     AutoEnd  2009/07/07
3       10 s   2009/07/07
4       10 s   2009/07/07
Delete All |  Delete  |  More
```

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.

```
Rec    pH        Time
1     8.93    16:09:50
2     8.22    16:10:00
3     8.22    16:10:10
4     8.22    16:10:20
                 More
```

If **More** is pressed.

```
Record number: 1
2009/07/07         16:09:50
8.93 pH             24.9°C
-115.0mV
Offset: -0.7mV
Slope: 100.8 %              ↕
```

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mV CALIBRATION
(for technical personnel only)

All the instruments are factory calibrated for mV, EC and temperature. Hanna's 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 your dealer or the nearest Hanna Customer Service Center, 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 will enter 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, the **Confirm** function key is displayed.

- Press **Confirm** to confirm. The second calibration point of "**1800 mV**" will be displayed.

- Set 1800.0 mV on the simulator.

- When the reading is stable and close to the selected calibration point, the **Confirm** function key is displayed.

- Press **Confirm** to confirm. The instrument will restart and the calibration will be memorized.

<u>Notes</u>: • 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 calibartion will be memorized.

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** function 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 presented next.

```
Ch1 Calibration



Temp                    pH
```
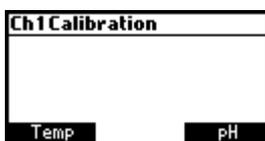
- Prepare a vessel containing ice and water and another one containing hot water (at approximately 50 °C or 122 °F). Place insulation material around the vessels to minimize temperature changes.

- 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.

```
Ch1 Temperature      ⌛
      0.0            °C
   Point:1       ⇕0.0°C
```

- 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.

```
Ch1 Temperature      ⌛
      0.0            °C
   Point:2      ⇕50.0°C
```
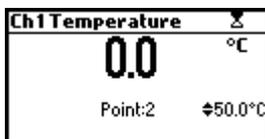
- Immerse the temperature probe into the second vessel as close as possible to the reference thermometer. Allow a few seconds for the probe to stabilize.

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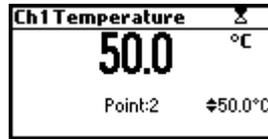
- Use the **ARROW** keys to set the calibration point value to that of the hot water.
- When the reading is stable and close to the selected calibration point, **Confirm** function key is displayed.

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

<u>Note</u>: Use **ARROW** keys to change calibration point if necessary (± 10.0 ºC) 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.

PC INTERFACE

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

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

To connect your instrument to a PC, use 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.

<u>Note</u>: If you are not using Hanna Instruments **HI 92000** software, please see the following instructions.

SENDING COMMANDS FROM PC

It is also possible to remotely control the instrument with any terminal program. Use 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.

<u>Note</u>: 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, **yymmdd hhmmss** (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, **yymmdd hhmmss** (12 chars)
  - standards information (for each standard)
    - type (1 char): 0 - always standard solution
    - status (1 char): N (new) - calibrated in last calibration; O (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 exponent (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

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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

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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)

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- 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)

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- 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 yyy[th] pH record logged data when x=1

LODxMyyy   Requests the yyy[th] mV/Rel mV record logged data when x=1

LODxIyyy   Requests the yyy[th] ISE record logged data when x=1

LODxEyyy   Requests the yyy[th] EC record logged data when x=2

LODxRyyy   Requests the yyy[th] Resistivity record logged data when x=2

LODxTyyy   Requests the yyy[th] TDS record logged data when x=2

LODxNyyy   Requests the yyy[th] 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.

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).
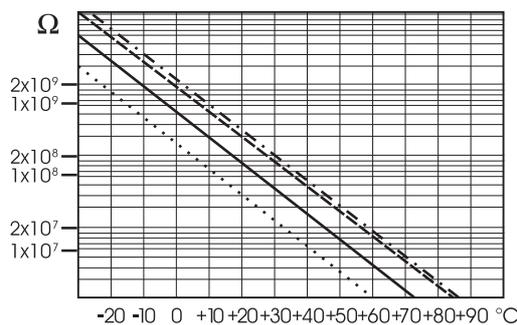
Since the resistance of the pH electrode is in the range of $50 - 200$ Mohm, the current across the membrane is in the pico Ampere range. Large currents can disturb the calibration of the electrode for many hours.

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's 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
	12.50	0.10
	13.00	0.18
1.0 Mol L^{-1} Na$^+$	13.50	0.29
	14.00	0.40

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ELECTRODE CONDITIONING & MAINTENANCE

Reference Fill Hole*
Sensing Wire
Reference Wire
Reference Junction
Glass Bulb
Plastic Body pH Electrode

Reference Fill Hole*
Reference Wire
Sensing Wire
Reference Junction
Glass Bulb
Glass Body pH Electrode

Reference Wire
Reference Junction
Platinum or Gold tip
Plastic Body ORP Electrode

Reference Wire
Reference Junction
Platinum or Gold tip
Glass Body ORP Electrode
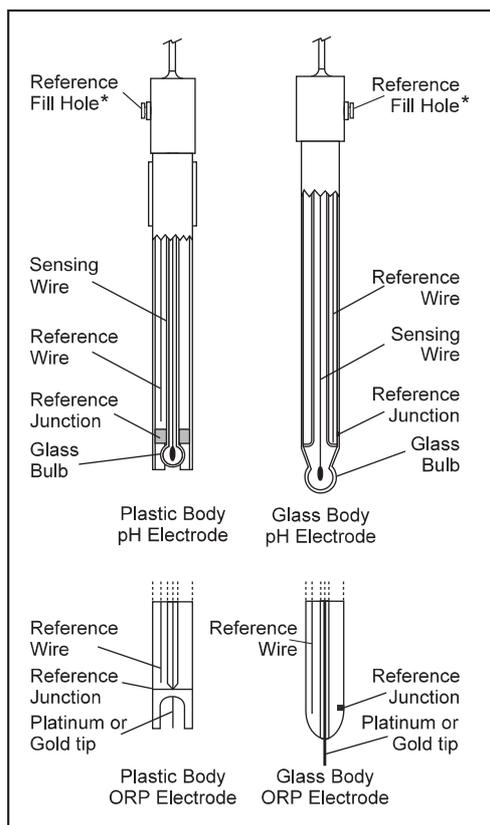
* Not present in gel electrodes.

PREPARATION PROCEDURE

Remove the electrode protective cap.
DO NOT BE ALARMED IF ANY SALT DEPOSITS ARE PRESENT. This is normal with electrodes and they will disappear when rinsed with water. During transport tiny bubbles of air may have formed inside the glass bulb. The electrode cannot function properly under these conditions. These bubbles can be removed by "shaking down" the electrode as you would do with a glass thermometer.
If the bulb and/or junction are dry, soak the electrode in **HI 70300** Storage Solution for at least one hour. Open the fill hole if refillable.

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For refillable electrodes:

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

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

For AmpHel® electrodes:

If the electrode does not respond to pH changes, the battery 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 completly 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 **HI 70300** or **HI 80300** Storage Solution or, in its absence, Filling Solution (**HI 7071** or **HI 8071** for single junction and **HI 7082** or **HI 8082** for double junction electrodes). Follow the Preparation Procedure on page 72 before taking measurements.

<u>Note</u>: 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.

pH Probe Maintenance

For refillable electrodes:

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

Follow the Storage Procedure above.

pH CLEANING PROCEDURE

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

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

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.
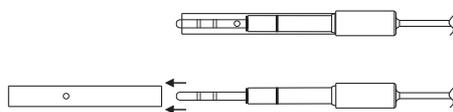
TROUBLESHOOTING GUIDE

SYMPTOMS	PROBLEM	SOLUTION
Slow response/excessive drift.	Dirty pH electrode.	Soak the electrode tip in **HI 7061** cleaning solution for 30 minutes. 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 **HI 70300** 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 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 your dealer or any Hanna Service Center.

ACCESSORIES

pH CALIBRATION SOLUTIONS

HI 50004-01	pH 4.01 Buffer Solution, 20 mL sachet, 10 pcs
HI 50004-02	pH 4.01 Buffer Solution, 20 mL sachet, 25 pcs
HI 50007-01	pH 7.01 Buffer Solution, 20 mL sachet, 10 pcs
HI 50007-02	pH 7.01 Buffer Solution, 20 mL sachet, 25 pcs
HI 50010-01	pH 10.01 Buffer Solution, 20 mL sachet, 10 pcs
HI 50010-02	pH 10.01 Buffer Solution, 20 mL sachet, 25 pcs
HI 5016	pH 1.68 Buffer Solution, 500 mL bottle
HI 5004	pH 4.01 Buffer Solution, 500 mL bottle
HI 5068	pH 6.86 Buffer Solution, 500 mL bottle
HI 5007	pH 7.01 Buffer Solution, 500 mL bottle
HI 5091	pH 9.18 Buffer Solution, 500 mL bottle
HI 5010	pH 10.01 Buffer Solution, 500 mL bottle
HI 5124	pH 12.45 Buffer Solution, 500 mL bottle
HI 8004L	pH 4.01 Buffer Solution in FDA approved bottle, 500 mL
HI 8006L	pH 6.86 Buffer Solution in FDA approved bottle, 500 mL
HI 8007L	pH 7.01 Buffer Solution in FDA approved bottle, 500 mL
HI 8009L	pH 9.18 Buffer Solution in FDA approved bottle, 500 mL
HI 8010L	pH 10.01 Buffer Solution in FDA approved bottle, 500 mL

ELECTRODE STORAGE SOLUTION

HI 70300L	Storage Solution, 500 mL bottle
HI 80300L	Storage Solution in FDA approved bottle, 500 mL

ELECTRODE CLEANING SOLUTIONS

HI 70000P	Electrode Rinse Solution, 20 mL sachet, 25 pcs
HI 7061L	General Purpose Solution, 500 mL bottle
HI 7073L	Protein Cleaning Solution, 500 mL bottle
HI 7074L	Inorganic Cleaning Solution, 500 mL bottle
HI 7077L	Oil & Fat Cleaning Solution, 500 mL bottle
HI 8061L	General Purpose Solution in FDA approved bottle, 500 mL
HI 8073L	Protein Cleaning Solution in FDA approved bottle, 500 mL
HI 8077L	Oil & Fat Cleaning Solution in FDA approved bottle, 500 mL

ELECTRODE REFILL ELECTROLYTE SOLUTIONS

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

HI 8082	3.5M KCl Electrolyte in FDA approved bottle, 4x30 mL, for double junction electrodes
HI 8093	1M KCl+AgCl Electrolyte in FDA approved bottle, 4x30 mL

ORP PRETREATMENT SOLUTIONS

HI 7091L	Reducing Pretreatment Solution, 500 mL bottle
HI 7092L	Oxidizing Pretreatment Solution, 500 mL bottle

ORP SOLUTIONS

HI 7020L	Test Solution 200-275 mV, 500 mL bottle
HI 7021L	Test Solution 240 mV, 500 mL bottle
HI 7022L	Test Solution 470 mV, 500 mL bottle

pH ELECTRODES

All electrodes part numbers ending in B are supplied with a BNC connector and 1 m (3.3') cable, as shown below:
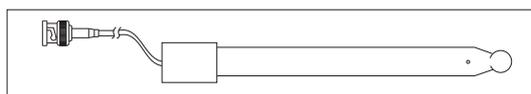
HI 1043B

Glass-body, double junction, refillable, combination **pH** electrode.
Use: strong acid/alkali.
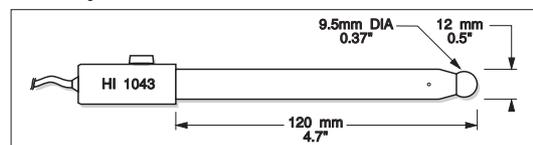
HI 1053B

Glass-body, triple ceramic, conic shape, refillable, combination **pH** electrode.
Use: emulsions.
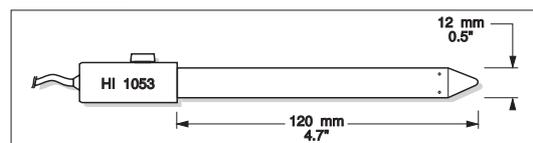
HI 1083B

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

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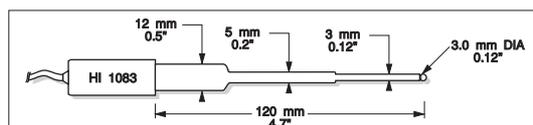
HI 1131B

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

```
                                    9.5mm DIA    12 mm
                                      0.37"       0.5"
   ┌──────────────────────────────────────────────┐
   │  HI 1131                                    ·  │
   └──────────────────────────────────────────────┘
              ├──────── 120 mm ────────┤
                        4.7"
```
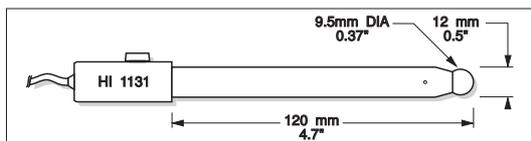
HI 1330B

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

```
                                    5mm DIA      5mm
                                      0.2"       0.2"
   ┌──────────────────────────────────────────────┐
   │  HI 1330                                       │
   └──────────────────────────────────────────────┘
              ├──────── 120 mm ────────┤
                        4.7"
```
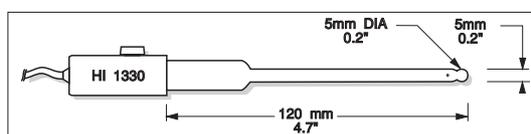
HI 1331B

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

```
                    8 mm              7.5mm DIA
                    0.3"                0.29"
   ┌──────────────────────────────────────────────┐
   │  HI 1331                                       │
   └──────────────────────────────────────────────┘
              ├──────── 210 mm ────────┤
                        8.25"
```
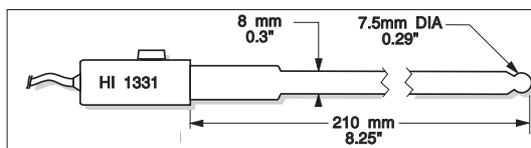
HI 1230B

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

```
                                              12 mm
                                               0.5"
   ┌──────────────────────────────────────────────┐
   │  HI 1230                                       │
   └──────────────────────────────────────────────┘
              ├──────── 120 mm ────────┤
                        4.7"
```
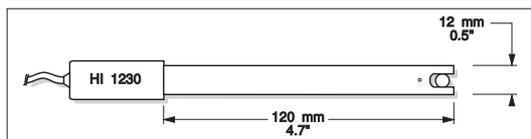
HI 2031B

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

```
                                            6 mm
                                            0.25"
   ┌──────────────────────────────────────────────┐
   │  HI 2031                                       │
   └──────────────────────────────────────────────┘
              ├──── 75 mm ────┤
                   2.95"
```

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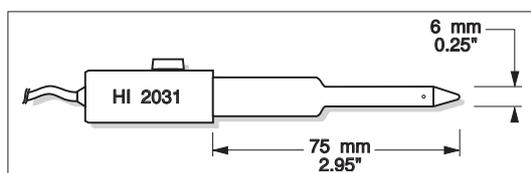
HI 1332B

Plastic-body (**PES**), double junction, refillable, combination **pH** electrode. Use: general purpose.
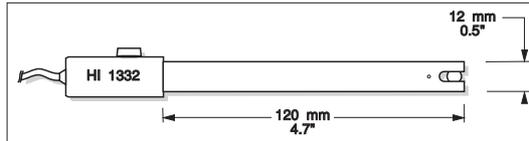
FC 100B

Plastic-body (**PVDF**), double junction, refillable, combination **pH** electrode. Use: general purpose for food industry.
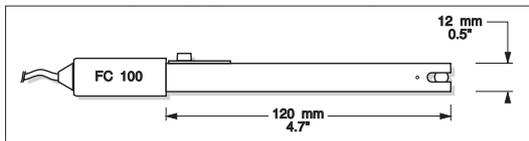
FC 200B

Plastic-body (**PVDF**), open junction, conic, Viscolene, non-refillable, combination **pH** electrode. Use: meat & cheese.
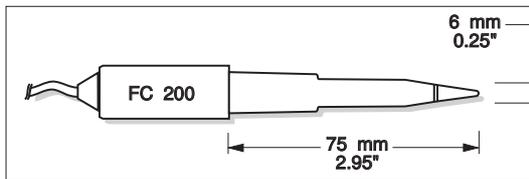
FC 210B

Glass-body, double junction, conic, Viscolene, non-refillable, combination **pH** electrode. Use: milk, yogurt.
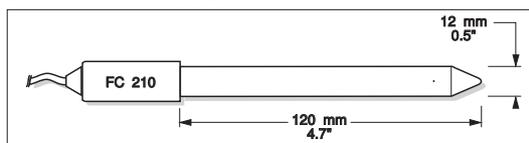
FC 220B

Glass-body, triple-ceramic, single junction, refillable, combination **pH** electrode. Use: food processing.
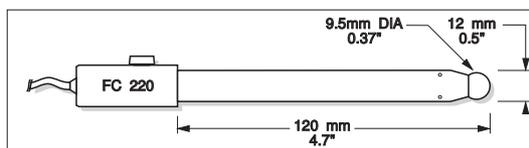
FC 911B

Plastic-body (**PVDF**), double junction, refillable with built-in amplifier, combination **pH** electrode. Use: very high humidity.
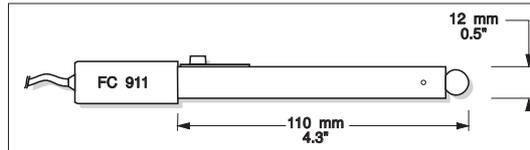
HI 1413B

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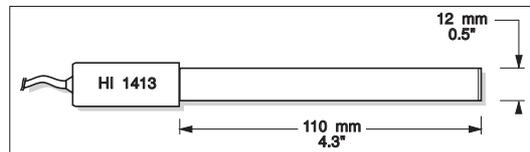
ORP ELECTRODES

HI 3131B

Glass-body, refillable, combination platinum **ORP** electrode.

Use: titration.
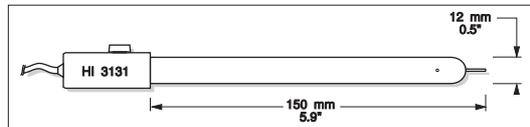
HI 3230B

Plastic-body (**PES**), gel-filled, combination platinum **ORP** electrode.
Use: general purpose.
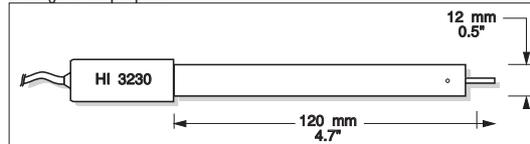
HI 4430B

Plastic-body (**PES**), gel-filled, combination gold **ORP** electrode.
Use: general purpose.
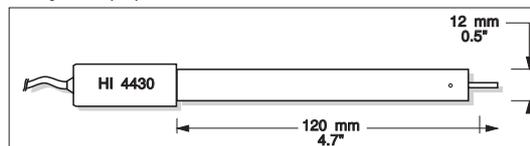
Consult the Hanna General Catalog for a complete and wide selection of electrodes.

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

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

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

HI 7855 SERIES CABLE CONNECTORS
CONNECTOR AND 3.0 mm (0.12") CABLE WITH BNC

CONNECT TO SCREW TYPE ELECTRODES

CONNECT TO THE BNC SOCKET OF THE METER
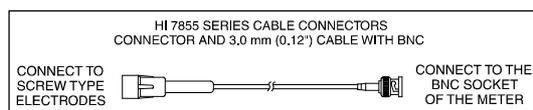
OTHER ACCESSORIES

HI 740157   Plastic electrode refilling pipet (20 pcs)

HI 76404N   Electrode holder

HI 7662-T   Stainless steel Temperature probe with 1 m (3.3') screened cable

HI 8427   pH and ORP electrode simulator with 1 m (3.3') coaxial cable ending in female BNC connectors

HI 931001   pH and ORP electrode simulator with LCD and 1 m (3.3') coaxial cable ending in female BNC connectors

HI 76404N   Electrode Holder

EC CALIBRATION SOLUTIONS

HI 70033C   84 μS/cm, 20 ml sachet, 25 pcs.

HI 70031C   1413 μS/cm, 20 ml sachet, 25 pcs.

HI 70039C   5000 μS/cm, 20 ml sachet, 25 pcs.

HI 70030C   12880 μS/cm, 20 ml sachet, 25 pcs.

HI 6033   84 μS/cm, 500 ml, bottle

HI 6031   1413 μS/cm, 500 ml, bottle

HI 7039L   5000 μS/cm, 500 ml, bottle

HI 7030L   12880 μS/cm, 500 ml, bottle

HI 7034L   80000 μS/cm, 500 ml, bottle

HI 7035L   11800 μS/cm, 500 ml, bottle

HI 7037L   100% NaCl, 500 ml, bottle

RECOMMENDATIONS FOR USERS

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

Operation of these instruments in residential areas could cause unacceptable interferences to radio and TV equipment, requiring the operator to follow all necessary steps to correct interferences.

The glass bulb at the end of the pH electrode is sensitive to electrostatic discharges. Avoid touching this glass bulb at all times.

During operation, ESD wrist straps should be worn to avoid possible damage to the electrode by electrostatic discharges.

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

To avoid electrical shock, do not use these instruments when voltages at the measurement surface exceed 24 VAC or 60 VDC.

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

HANNA®
instruments

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