



*sensio*TM**n3**
Laboratory pH Meter
Instruction Manual

TRADEMARKS OF HACH COMPANY

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ACS-Plus™	Hach.com™	ProNetic™
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APA 6000™	HexaVer®	Ratio™
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BariVer®	HydraVer®	RoVer®
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BoroTrace™	LeadTrak®	StablCal™
BODTrak™	m-ColiBlue 24®	StannaVer®
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Formula 2533™	PhosVer®	Voluette®
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CERTIFICATION

Hach Company certifies this instrument was tested thoroughly, inspected and found to meet its published specifications when it was shipped from the factory.

The *sensio*TM3 Laboratory pH Meter has been tested and is certified as indicated to the following instrumentation standards:

Product Safety:

External Power Supplies Only:

115 VAC Supply: UL Listed and CSA certified or

230 VAC Supply: CE marked per 73/23/EEC, VDE listed

EMI Immunity:

Instrument tested with external 230V, 50 Hz power supply.

Per **89/336/EEC EMC: EN 61326:1998** (Electrical Equipment for measurement, control, and laboratory use— EMC requirements) Supporting test records by Hach Company, certified compliance by Hach Company.

Standards include:

IEC 1000-4-2: 1995 (EN 61000-4-2:1995) Electro-Static Discharge Immunity (Criteria B)

IEC 1000-4-3: 1995 (EN 61000-4-3:1996) Radiated RF Electro-Magnetic Fields (Criteria B)

IEC 1000-4-4: 1995 (EN 61000-4-4:1995) Electrical Fast Transients/Burst (Criteria B)

IEC 1000-4-5: 1995 (EN 61000-4-5:1995) Surge (Criteria B)

IEC 1000-4-6: 1996 (EN 61000-4-6:1996) Conducted Disturbance Induced by RF Fields (Criteria A)

IEC 1000-4-11: 1994 (EN 61000-4-6:1994) Voltage Dips, Interruptions and Variations (Criteria B)

ENV 50204:1996 Radiated Electro-Magnetic Field from Digital Telephones (Criteria B)

CERTIFICATION, continued

Emissions:

Instrument tested with external 230V, 50 Hz power supply.

Per **89/336/EEC EMC: EN 61326:1998** (Electrical Equipment for measurement, control, and laboratory use— EMC requirements). Class B emission limits. Supporting test records by Criterion Technology O.A.T.S. (NVLAP #0369), certified compliance by Hach Company.

Standards include:

EN 61000-3-2 Harmonic Disturbances Caused by Electrical Equipment

EN 61000-3-3 Voltage Fluctuations (Flicker) Disturbances Caused by Electrical Equipment

Additional Standards include:

EN 55011 (CISPR 11) Emissions, Class B Limits

Additional Emissions Standard/s include:

CANADIAN INTERFERENCE-CAUSING EQUIPMENT REGULATION, IECS-003: Class A emission limits. Supporting test records by Criterion Technology O.A.T.S. (NVLAP #0369), certified compliance by Hach Company.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

FCC PART 15, Class “A” Limits:

Supporting test records by Criterion Technology O.A.T.S. (NVLAP #0369), certified compliance by Hach Company.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CERTIFICATION, continued

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. The following techniques of reducing the interference problems are applied easily.

1. Disconnect the external power supply from *sensioN3* Laboratory pH meter to verify that the meter is not the source of interference.
2. Move the meter away from the device receiving the interference.
3. Reposition the receiving antenna for the device receiving the interference.
4. Try combinations of the above.

SPECIFICATIONS

Specification subject to change without notice.

pH mode

Range	-2.00 to 19.99
Resolution (selectable)	0.001/0.01/0.1
Slope (meter allowable)	48–65 mV/decade

Millivolt mode

Range	-2000 to 2000 mV
Resolution	0.1 mV
Accuracy (meter only)	±0.2 or ±0.05% of the reading, whichever is greater

Temperature mode

Range	-10.0 to 110 °C (can also display °F)
Resolution	0.1 °C
Accuracy	±1.0 °C

Display: Custom LCD

Inputs: 1 BNC; 5-pin Hach pH/temperature or Hach temperature probe; 1 pin-tip

Outputs: One-way RS232

Power Requirements: 6–12 Vdc; use either Hach-supplied 115 or 230V, 50/60 Hz external power supply or a customer-provided supply with 50 mA output, 5.5-mm power plug with a 2.5 mm center post opening.

Installation Category: II

Instrument Drift: <40 $\mu\text{V}/^\circ\text{C}$

Input Bias Current: <±1 picoamp at 25 °C; ±4 picoamp over full range

Environmental Requirements: 0 to 50 °C at 85% non-condensing relative humidity

Dimensions: 15 x 25.4 x 8.37 cm (10.15 x 6 x 3.5 in.)

Enclosure: Water resistant (IP32), chemical resistant, dust proof.

SAFETY PRECAUTIONS

Please read this entire manual before unpacking, setting up, or operating this instrument. Pay particular attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that which is specified in this manual.

Use of Hazard Information

If multiple hazards exist, this manual will use the signal word (Danger, Caution, Note) corresponding to the greatest hazard.

DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION


Indicates a potentially hazardous situation that may result in minor or moderate injury.


NOTE


Information that requires special emphasis.


Precautionary Labels


Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

 This symbol, if noted on the instrument, references the instruction manual for operational and/or safety information.

 ***Section 2.2 on page 19***

 ***Section 2.3 on page 20***

 ***Section 2.4 on page 20***

 ***Section 5.1 on page 37***



OPERATION

DANGER

Handling chemical samples, standards, and reagents can be dangerous. Review the necessary Material Safety Data Sheets and become familiar with all safety procedures before handling any chemicals.

DANGER

La manipulation des échantillons chimiques, étalons et réactifs peut être dangereuse. Lire les Fiches de Données de Sécurité des Produits (FDSP) et se familiariser avec toutes les procédures de sécurité avant de manipuler tous les produits chimiques.

PELIGRO

La manipulación de muestras químicas, estándares y reactivos puede ser peligrosa. Revise las fichas de seguridad de materiales y familiarícese con los procedimientos de seguridad antes de manipular productos químicos.

GEFAHR

Da das Arbeiten mit chemischen Proben, Standards und Reagenzien mit Gefahren verbunden ist, empfiehlt die Hach Company dem Benutzer dieser Produkte dringend, sich vor der Arbeit mit sicheren Verfahrensweisen und dem richtigen Gebrauch der Chemikalien vertraut zu machen und alle entsprechenden Materialsicherheitsdatenblätter aufmerksam zu lesen.

PERIGO

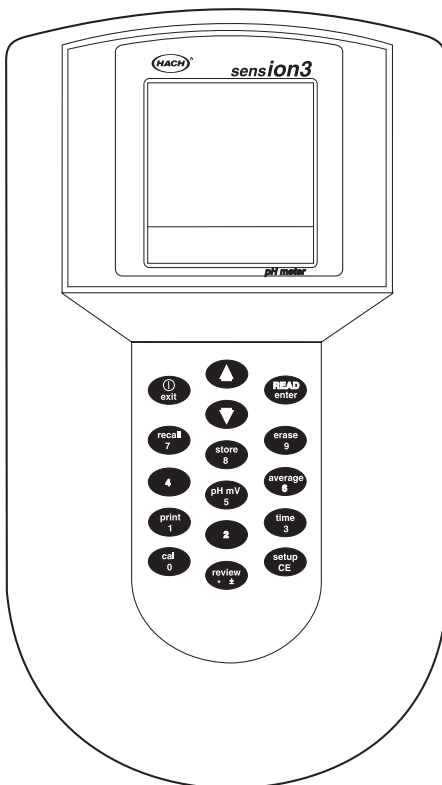
A manipulação de amostras, padrões e reagentes químicos pode ser perigosa. Reveja a folha dos dados de segurança do material e familiarize-se com todos os procedimentos de segurança antes de manipular quaisquer produtos químicos.

Hach provides pH and ISE meters for applications from pH measurements to accurate Ion Selective Electrode work. This manual describes the operation and use of the Hach *sensionTM3* Laboratory pH/mV/Temperature Meter (see *Figure 1*).

This meter features a custom digital LCD display which simultaneously displays temperature and measurement results. This meter has all the features of a pH meter plus a millivolt mode, water resistant design, ergonomic design, and automatic buffer recognition. Additional features include datalogging and RS232 communication for printing results to a computer or printer.

The meter is designed to be maintenance-free. If the meter gets dirty, wipe the surface with a damp cloth. Use a cotton-tipped applicator to clean or dry the connectors if they get wet.

Figure 1 Hach *sension3* Meter



1.1 Unpacking the Instrument

Remove the instrument and accessories from the shipping container and inspect each item for any damage that may have occurred during shipping. Verify that all items listed on the packing slip are included. If any items are missing or damaged, contact Hach Customer Service, Loveland, Colorado for instructions. Hach's toll free phone number for customers within the United States is 800-227-4224. For customers outside the United States, contact the Hach office or distributor serving you.

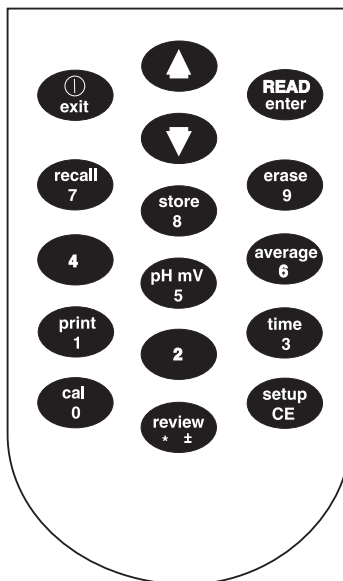
1.1.1 Standard Accessories

- AC to DC adapter
- Instrument Manual
- May contain electrode and related accessories (covered in the electrode manual)

1.2 Keypad Description

Figure 2 illustrates the meter's keypad. The description and function of each key is given in *Table 1*.

Figure 2 *sension3* pH Meter Keypad



SECTION 1, continued

Table 1 Keys and Description

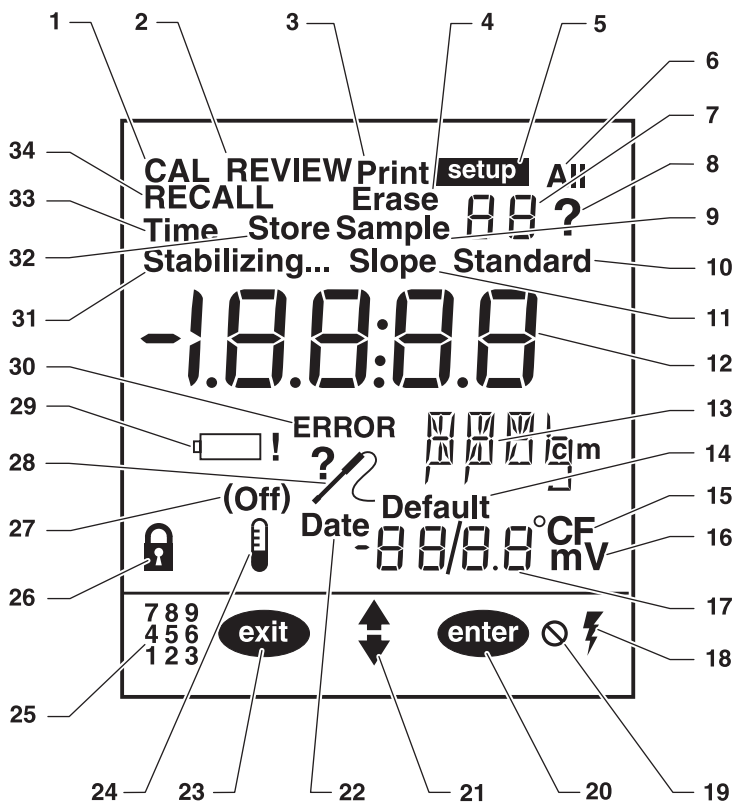
Key	Description
Exit/Power On-Off	<p>Turns the instrument on; turns it off from a Reading mode.</p> <p>Acts as a NO or Cancel key when the question mark icon is flashing.</p> <p>Exits setup function or aborts a setup change.</p> <p>Performs the following and returns to the most recent Reading mode:</p> <ul style="list-style-type: none"> • Exits the Store or Recall mode • Aborts a calibration • Exits a calibration review
Arrow Keys	<p>Scrolls between options in Setup mode.</p> <p>Scrolls through data points in Store and Recall modes.</p> <p>Scrolls between the option to print or erase one data point and all data points.</p> <p>Changes the default temperature when a temperature probe is not in use.</p>
READ/ENTER Key	<p>Acts as a "YES" answer when the question mark is flashing.</p> <p>Allows user to edit a setup when the setup number is flashing.</p> <p>Accepts a change to the current Setup option.</p> <p>Initiates a new measurement when the meter has stabilized in the Display Lock Enabled mode.</p>
Recall Key	Recalls stored sample data (from Reading mode only).
Store Key	Stores the current (displayed) measurement (from Reading mode only).
Erase Key	Erases recalled data points.
pH/mV Key	Toggles between pH value and mV value in Reading, Calibration, and Cal Review modes.
Print Key	Sends current or recalled data to a printer or a computer via the RS232 port.
Average Key	Calculates the average of all the stored pH readings. Any stored ISE readings are ignored.
Time Key	In Reading mode, allows user to view the current time and date. In Recall Data mode, it toggles between the time and date of the stored measurement.
Cal Key	Enters Calibration mode (from Reading mode only)
Review Key	Enters Calibration Review mode (from Reading mode only)
Setup/CE Key	Enters Setup mode (from Reading mode only) or clears a numeric entry when the keypad icon is displayed.

1.3 Display Fields and Icons

The display has two screens. The upper screen displays measurements or standard values, the operation mode in use, slope, sample/default temperature, pH or mV units, error codes, and indicates if the meter reading is stable. The lower screen displays the keys that are active.

Figure 3 shows the icons and fields displayed by the meter and Table 2 describes each element. Some icons on the display are not used by the laboratory pH *sensION3* meter, but will be displayed if the power key is held down for several seconds.

Figure 3 sensION 3 Display Elements



SECTION 1, continued

Table 2 Main Display Elements

Item No.	Description
1	Indicates meter is in Calibration mode. If the ? is flashing, it indicates calibration is necessary.
2	Indicates meter is in Calibration Review mode.
3	Indicates data is being sent to a printer/computer.
4	Indicates recalled data that is currently displayed is being erased.
5	Indicates meter is in Setup mode.
6	Indicates all data points are being printed or erased.
7	Numerical field that displays Setup, Sample.pH average, and Standard numbers when those words are displayed with the number. If Standard and 1 are displayed, the meter is measuring Standard 1.
8	Flashing ? and CAL indicate calibration is necessary. Also a prompt to press the ENTER or EXIT key.
9	Indicates the meter is measuring a sample (sample number is displayed to the right).
10	Indicates the meter is measuring a standard (standard number is displayed above).
11	Indicates the displayed number is the electrode slope.
12	Numerical field that displays the slope and pH or mV values of standards and samples.
13	Indicates measurement units (pH or mV).
14	When Default is displayed, the meter is using the default temperature value to calculate the temperature correction for the pH value.
15	Temperature units (choice of °C or °F).
16	Indicates value displayed in small numerical field (item 17) is in millivolts.
17	Numerical field that displays temperature value, or pH offset in Calibration Review.
18	Indicates meter is using AC power.
19	Indicates an inactive key has been pressed and that function is not allowed.
20	Indicates ENTER key is active.
21	Indicates arrow keys are active.
22	In Setup mode, it indicates the date is being set.
23	Indicates EXIT key is active.
24	NA
25	Indicates numeric part of the key is active.
26	Display Lock icon. Displayed with item 27.
27	Indicates whether Display Lock is On or Off.
28	Faulty probe connection or incorrect probe attached. Usually displayed with an error code. May also indicate a low slope.
29	NA (low battery icon)
30	Indicates a meter function problem.

SECTION 1, continued

Table 2 Main Display Elements (Continued)

Item No.	Description
31	Stabilizing... indicates signal from sample is not yet stable. When it disappears, the reading is stable and may be recorded or stored.
32	Used with ? icon. Asking if user wants to store the displayed sample data or the calibration that has been just completed.
33	Used with large display to indicate the time is being set.
34	Indicates meter is in recall mode and the data displayed is stored data.

1.4 Audible Signals

The meter will beep under certain conditions:

- when a non-functional key press is made (one beep).
- when display lock is enabled and measurement stability is reached in calibration and reading mode (three beeps).
- any time measurement stability is reached during calibration mode, regardless of the Display Lock setting.
- when an inappropriate standard value is entered during calibration.
- to signal an error condition.

If the number entry and a press of the **ENTER** key causes two beeps, the meter will automatically return to the beginning of number entry.

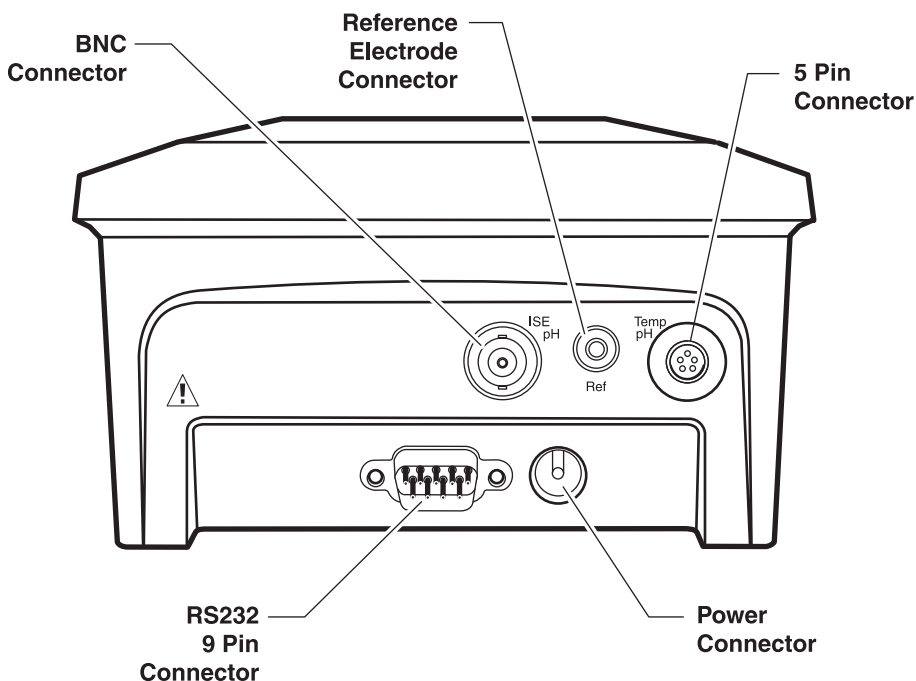
2.1 Instrument Description

This *sensio*TM 3 benchtop pH/mV meter is designed for laboratory use and operates on 115 or 230 VAC power. The meter measures from -2.0 to 19.99 pH units and the sample temperature. Displayed pH values are temperature corrected using the measured sample temperature or a default temperature setting. The meter also measures and displays mV. To toggle between pH and mV readings, press the **pH/mV** key.

2.2 Power Connection

A 115 or 230 VAC pin adapter connects the meter to line power. Plug the pin end of the adapter into the pin connector in the meter (see *Figure 4*). Then plug the adapter into the outlet.

Figure 4 *sensio*3 Power and Probe Connections



2.3 Probe Connections

2.3.1 Connecting pH Probes

Attach electrodes with 5-pin connectors to the sensor input by lining the pins up with the holes in the meter port (see *Figure 4*). Push toward the instrument.

For probes with BNC connectors, slide the connector into the input. Push towards the instrument and turn clockwise to lock into position.

Electrodes may be attached to both the 5-pin and BNC connectors at the same time as long as they are **not** in contact with the same solution. To select either of the connectors for measurement, go to the **Setup 1** menu and select one.

When using half-cells, connect reference electrodes with pin tip connectors by pushing the connector straight into the center reference input.

Note: If using a combination electrode with a BNC or 5-pin connector, the reference pin-tip jack is not used.

2.3.2 Connecting the Temperature Probe

Each electrode with the 5-pin connector has the temperature sensing unit included in the electrode probe. If using an electrode with BNC connector, connect a Hach temperature probe to the 5-pin connector. Alternatively, measure the temperature manually and enter the value as the default temperature on the meter.

2.4 Printer and Computer Connections

The meter can send data to a computer or printer via the 9-pin serial port (see *Figure 4*). **The printer cable and computer cable are different.** The printer cable is a 9-pin to 25-pin cable and the computer cable is a 9-pin to 9-pin cable. Be sure to use the correct cable.

The meter can print to serial printers without an adapter. For parallel printers, a converter and cable adapter are required. The Citizen PN60 printer (Cat. No. 26687-00) requires a special Citizen adapter. Pressing the **PRINT** key will send the currently

SECTION 2, continued

displayed data to the printer. The data may be either a current measurement or stored data.

To send data to a computer, connect the 9-pin serial port on the meter to a 9-pin serial port of the computer. Pressing the **PRINT** key will send the currently displayed data to the computer. The data may be either a current measurement or stored data.

2.5 Turning the Meter On

After plugging the correct power adapter into the wall, turn the instrument on using the **I/O/EXIT** key (located on the upper left side of the keypad). Press the key once to power the instrument up. The display will show the software version number, then default to the Reading mode.

2.6 Temperature Measurement

The meter displays temperature in the range of -10.0 to +110 °C simultaneously with sample results. If a temperature probe is properly connected, actual temperature measurements are displayed in the temperature field.

The meter receives temperature data from one of three sources:

- The temperature probe in the sample
- The factory default setting (20 °C)
- A user-entered default setting

The meter requires a temperature to calculate temperature-corrected readings. When a temperature probe is not used to supply the temperature for temperature compensation, the temperature must be set manually or the displayed default temperature will be used.

If a temperature probe is connected properly, the meter will not allow the temperature to be manually set, and the sample temperature will be displayed.

If a default setting is used, **Default** will be displayed with the default temperature.

SECTION 2, continued

To manually set the temperature

When temperature probe is not in use, put the instrument in Reading or Calibration mode and enter the default temperature by using the arrow keys to change the default temperature value on the display to the desired temperature. The value adjusts in 0.1 °C (0.1 to 0.2 °F) increments. Hold the arrow key down to rapidly scroll the temperature value. The factory default is 20 °C.

Note: Acceptable temperatures range from -10 to 110 °C.

To change the units of temperature measurement, see *Section 3.1.3* on page 24.

2.7 Millivolt Measurements

The meter can be used to measure absolute millivolts (mV). To display a current millivolt reading, press the **pH/mV** key. The mV value is displayed with **mV** in the units field. Press the key again to return to pH measurement units.

Absolute millivolts are displayed with 0.1 mV resolution in the range of -2000 to +2000. The millivolt mode is useful when measuring oxidation-reduction potential, performing potentiometric titrations, or preparing calibration curves. Detailed instructions for any Hach electrode are given in the electrode instruction manual. Titration instructions are included in the Hach ORP Electrode Instruction Manual, or in standard analytical chemistry texts.

3.1 Setup Menu

The *sensION*[™]3 Portable pH meter has a setup menu which allows the analyst to choose options for connector choice, display lock, temperature units, display resolution, automatic buffer recognition, time, and date.

To access the Setup menu, press the **SETUP** key. The arrow icons will be displayed, indicating that additional options are available within the menu. Press the up or down arrow key to scroll to the desired option, then press **ENTER**.

When using the Setup menu, the screen will display a number in the upper right numerical field, indicating which option is being changed. *Table 3* describes these options.

Table 3 *sensION*3 Setup Options

Setup Number	Setup Description
1	Use BNC or 5-pin connector
2	Display lock (On or Off)
3	Temperature units (°C or °F)
4	Measurement resolution(0.0, 0.00, or 0.000)
5	Buffer auto recognition (6.86 or 7.00)
6	Time of day (24 hour clock)
7	Date (mm/dd)
8	Year (4 digits)

3.1.1 Choosing the Probe Connector

This setup ensures the potential from the appropriate electrode is detected by the meter. Connect only one electrode to the meter.

1. From the reading mode, press **SETUP**.
2. The **Setup** icon and the number **1** (flashing) will be displayed. Change the connector choice by pressing **ENTER**; this toggles the selection between **BNC** and **5 pin**.
3. When the desired option is selected, press **EXIT** to return to the reading mode.

SECTION 3, continued

3.1.2 Turning Display Lock Off and On

Setup 2 is the Display Lock option. This feature stops measurement reading fluctuation on the display once a stable reading is reached. The default setting is Off.

When this feature is not used, the measurement value may continue to fluctuate.

1. From the reading mode, press **SETUP**.
2. The **Setup** icon and the number **1** (flashing) will be displayed. Press the up arrow once so the Setup number is **2**.
3. Change the Display Lock status by pressing **ENTER**; this toggles the Display Lock between off and on. When the Display Lock is disabled, the Display Lock icon and **Off** are displayed. When this feature is enabled, the Display Lock icon is displayed and three beeps occur when the stabilization criteria are met.
4. When the desired option is selected, press **EXIT** to return to the reading mode.

3.1.3 Selecting Temperature Units

1. From the reading mode, press **SETUP**.
2. The **Setup** icon and the number **1** (flashing) will be displayed. Press the up arrow twice so the Setup number is **3**.
3. Change the temperature unit by pressing **ENTER**; this key toggles the temperature units between °C and °F. The default is °C.
4. When the desired option is selected, press **EXIT** to return to the reading mode.

SECTION 3, continued

3.1.4 Selecting Measurement Resolution

The meter can display measurement values to tenths (0.0), hundredths (0.00) or thousandths (0.000). The default is hundredths.

1. From the reading mode, press **SETUP**.
2. The **Setup** icon and the number **1** (flashing) will be displayed. Press the up arrow until the Setup number is **4**.
3. Change the resolution by pressing **ENTER**; this toggles the between the three resolution options.
4. When the desired option is selected, press **EXIT** to return to the reading mode.

3.1.5 Selecting Auto Buffer Recognition

The *sensio***n3** pH Meter is designed to auto-recognize and calibrate on 4.01, 6.86 or 7.00, and 10.01 pH buffers.

The only selection option for pH buffer auto recognition is choosing 6.86 or 7.00. The default is pH 7.00. To change this option:

1. From the reading mode, press **SETUP**.
2. The **Setup** icon and the number **1** (flashing) will be displayed. Press the up arrow until the Setup number is **5**.
3. Change the buffer value by pressing **ENTER**; this toggles the between the choices 6.86 and 7.00.
4. When the desired option is selected, press **EXIT** to return to the reading mode.

SECTION 3, continued

3.1.6 Setting the Time

1. From the reading mode, press **SETUP**.
2. The **Setup** icon and the number **1** (flashing) will be displayed. Press the up arrow until the Setup number is **6**.
3. Change the time by pressing **ENTER**. The main display will change to **__:__**, with the left place holder flashing. The numerical keypad will become active.
4. Press the desired number key for the left most digit. The meter uses a 24-hour military clock (12 a.m. = 00:00; 1 p.m. = 13:00). All four digit places must have a number. If the left-most digit(s) is not necessary, use zero for the value (i.e., 08:15 for 8:15 a.m. or 00:30 for 12:30 a.m.).
5. Once a number key is pressed, the next digit place holder will flash. Continue to enter the desired numbers until all four places have a value. Press **ENTER**. If a number entry error occurs, start over by pressing **SETUP/CE**.
6. When the desired option is selected, press **EXIT** to return to the reading mode.

3.1.7 Setting the Month and Day

1. From the reading mode, press **SETUP**.
2. The **Setup** icon and the number **1** (flashing) will be displayed. Press the up arrow until the Setup number is **7**. The display will show **Date** and a date near the bottom of the display.
3. Change the date by pressing **ENTER**. The numeric display will change to **__/__**, with the left place holder flashing. The date format has two places for the month on the left side of the slash and two places for the day of the month on the right side of the slash.
4. The numerical keypad will become active. Press the desired number key for the left most digit. All four digit places must have a number. If the left-most digit is not necessary, use zero for the value (i.e., 02/06 is February 6).

SECTION 3, continued

5. Once a number key is pressed, the next digit place holder will flash. Continue to enter the desired numbers until all four places have a value. Press **ENTER**. If a number entry error occurs, start over by pressing **SETUP/CE**.
6. When the desired option is selected, press **EXIT** to return to the reading mode.

3.1.8 Setting the Year

1. From the reading mode, press **SETUP**.
2. The **Setup** icon and the number **1** (flashing) will be displayed. Press the up arrow until the Setup number is **8**. The display will show **Date** and a year in the main display.
3. Change the year by pressing **ENTER**. The main display will change to **__ __ __**, with the left place holder flashing. The numerical keypad will become active.
4. Press the desired number key for the left most digit. Once a number key is pressed, the next digit place holder will flash. Continue to enter the desired numbers until all four places have a value. Press **ENTER** to accept the value. If a number entry error occurs, start over by pressing **SETUP/CE**.
5. When the desired option is selected, press **EXIT** to return to the reading mode.

3.2 Calibrating the Meter

The *sensio***n3** pH Meter is designed to auto-recognize and calibrate on 4.01, 6.86 or 7.00, and 10.01 pH buffers. Calibrating with buffers that have pH values other than these requires a modified procedure.

Hach recommends a daily two-point calibration using buffers that bracket the sample pH. This will verify the electrode is working properly and allow the slope value to be stored.

SECTION 3, continued

3.2.1 Performing a Calibration Using pH 4, 6.86, 7, and 10 Buffers

1. If using a probe without a temperature sensor, see *Section 2.3.2* on page 20 and 2.6 on page 21 for information about obtaining and using a default temperature.

2. Prepare two or three of the auto-recognizable pH buffers according to the electrode instruction manual.

Note: Use a 6.86 or 7.0 pH buffer for the mid-range buffer. To view or change the setting for the mid-range buffer see *Section 3.1.5*.

Note: The pH values for the buffers are given for 25 °C. If the sample temperature is not 25 °C, the pH values displayed for the buffers will reflect the correct pH value for the sample temperature.

3. Press the **I/O/EXIT** key to turn the instrument on. If necessary, press the **pH/mV** key to get into the pH reading mode (**pH** will be displayed).

4. From the pH reading mode, press **CAL**. **CAL** and **?** will appear in the upper display area, along with **Standard** and **1**.

5. Place the pH electrode in one of the buffers. **Do not** use a stir bar or swirl or stir during pH measurements.

6. Press **READ/ENTER**. The temperature and pH values will be updated until a stable reading is reached.

Note: If the meter is measuring in pH mode, it automatically moves to the next calibration step when stabilization is reached (indicated by three beeps). If measuring in mV mode, the three beeps will still sound when the stabilization occurs, but you must press **ENTER** to accept the reading. This lets the operator control the acceptance point of the buffer.

7. When the reading has been accepted, the standard number will change to 2.

8. Remove the probe from the first buffer and rinse. Place the probe in the second buffer.

9. Press **READ/ENTER**. The temperature and pH values will be updated until a stable reading is reached.

SECTION 3, continued

10. When the reading has been accepted, the standard number will change to **3**.
11. Repeat *steps 8 and 9* for the third buffer or press **EXIT** if using two buffers. In either case, the slope value and the **Store** and **?** icons will appear. Verify the slope value is within the ranges specified in the electrode manual.
12. To save the calibration and return to the reading mode, press **ENTER**. To exit the calibration without saving it and return to the reading mode, press **EXIT**.

3.2.2 Calibrating With Other Buffers

1. If using a probe without a temperature sensor, see *Sections 2.3.2 on page 20 and 2.6 on page 21* for information about obtaining and using a default temperature.
2. Prepare two or three pH buffers according to the electrode instruction manual.
3. Press the **I/O/EXIT** key to turn the instrument on. If necessary, press the **PH/mV** key to get into the pH reading mode (**pH** will be displayed).
4. From the reading mode, press **CAL**. Functional keys will appear in the lower left part of the display. **CAL** and **?** will appear in the upper display area, along with **Standard** and **1**. The numeric keypad will become active.
5. Place the pH electrode in the first buffer. **Do not** use a stir bar or swirl or stir during pH measurements.
6. Enter the pH value of the buffer using the number keys and press **ENTER**. A flashing underscore (**_**) indicates where the next number will be placed. It is not necessary that all four places have a number entered in them. Press **CE** to clear and re-enter a value if a number entry error occurs.
7. The temperature and pH (or mV) value will be updated until a stable reading is reached.

SECTION 3, continued

8. When the reading has stabilized, the standard number will change to **2**. If measuring in the mV mode, press **ENTER** to continue.
9. Rinse the electrode and place it in the next buffer.
10. Enter the pH value of the buffer using the number keys as described above. Press **ENTER**.
11. Repeat steps 8–10 for the third buffer or press **EXIT** if using two buffers. In either case, the slope value and the **Store** and **?** icons will appear. Verify the slope value is within the ranges specified in the electrode manual.
12. To save the calibration and return to the reading mode, press **ENTER**. To exit the calibration without saving it and return to the reading mode, press **EXIT**.

3.2.3 One-Point Calibration

The one-point calibration is used to adjust the slope offset and cannot be done unless a prior two or three point calibration has been done.

1. Press **CAL**. **Cal, 1, ?, and Standard** will be displayed.
2. Place the electrode in an auto-recognizable pH buffer. or any other buffer and manually enter the pH value.
3. Press **READ/ENTER**. The temperature and pH values will be continuously updated until a stable reading is reached.
4. When the reading has stabilized, the standard number will change to **2**.
5. Press **EXIT**. The adjusted offset value, the slope, and the **Store** and **?** icons will appear. Verify the offset value (isopotential point) is within the range specified in the electrode manual.
6. To save the adjusted calibration and return to the reading mode, press **ENTER**. To exit the calibration without saving it and return to the reading mode, press **EXIT**.

3.3 Reviewing Calibrations

pH calibrations result in a linear calibration curve, so only one slope value is displayed in Cal Review mode. To view calibration data, make sure the meter is in Reading mode, then press **REVIEW**. The display will show the calibration time. Press the up arrow key to scroll through the slope and pH values of the buffer standards. The mV values for the standards can be viewed by pressing the **pH/mV** key. This toggles between pH and mV values.

3.4 Measuring Samples

After successful calibration, the meter is ready to measure samples. See instructions in the electrode manual for more information and specific steps.

1. Place the electrode in the sample. Press **READ/ENTER**. **Stabilizing...** will be displayed, along with the sample temperature and the pH or mV reading. These values may fluctuate until the system is stable.
2. If the Display Lock is enabled, **Stabilizing...** will disappear and the display will “lock in” the pH or mV and sample temperature when a stable reading is reached. If the Display Lock is off, **Stabilizing...** will still disappear, but the display will show the current reading and temperature and the values may fluctuate.
3. Record or store the pH and mV value. See *SECTION 4* on page 33 for more information on storing and recalling data.
4. Remove the electrode from the sample, rinse with deionized water and place the electrode in the next sample. Repeat steps 1–3 for each sample.
5. When measurements are complete, press the **I/O/EXIT** key to turn the meter off. Rinse the electrode with deionized water and blot dry. Replace the protective cap on the electrode. See the electrode manual for specific storage instructions.

4.1 Storing pH Measurements

The *sensION3*TM meter can store up to 99 measurement readings. Data must be stored to recall it later for review, downloading, or printing. Although the meter display will only show the temperature, data location and pH/mV value, the following information is stored (and can be downloaded or printed) for each sample:

- storage location
- software version
- date
- time
- mV reading
- sample temperature
- pH value
- instrument model and serial number

The new data is saved in the next available memory location, numbered from 1 to 99. If no memory locations higher than the current one are available, the meter will “wrap around” and choose the next available location. The user also has the option of choosing the storage location.

To store data:

1. Press **STORE**. The display will prompt **Store Sample #?** (# is the next available location). The question mark will be flashing.
2. Press **ENTER** to store the measurement reading in that location number. To store the data in another location, use the arrow keys to scroll to another location or enter a location using the number keys. Press **ENTER**.

Note: *If all memory locations are full, the meter will prompt to overwrite a data point by displaying **Erase Sample ##?** Press **ENTER** to replace the data in that location with the current data. Press **EXIT** to return to the previous screen without replacing the data.*

3. The meter will store the reading and return to Reading mode.

4.2 Recalling Stored Data

1. To recall stored data, press the **RECALL** key while in the Reading mode. The screen will display the most recently saved or recalled measurement data.
2. Use the arrow keys to scroll to the desired storage location. Press **RECALL** again to allow number entry of a storage location. The question mark will flash. Enter the number of the desired storage location. Press **ENTER** to accept the storage location or **EXIT** to escape.
3. When recalling is complete, press **EXIT** to return to the Reading mode.

4.3 Erasing Data

4.3.1 Erasing Single Data Points

1. To erase data, it must be recalled first. Press the **RECALL** key while in the Reading mode. See *Section 4.2* for more information.
2. When the desired data point is displayed, press **ERASE**.
3. The meter will display **Erase Sample #** and a flashing **?**. Press **ENTER** to erase the data. The data will disappear.
4. The meter will recall the most recently stored or recalled sample data. There are three options at this point:
 - Press **ERASE**, then **ENTER**, to erase the displayed data.
 - Press **EXIT** to exit Recall mode.
 - Press an arrow key to scroll to other data points.
5. Repeat steps 2–3 for each data point that needs to be deleted.

SECTION 4, continued

4.3.2 Erasing All Data Points

1. To erase data, it must be recalled first. Press the **RECALL** key while in the Reading mode. See *Section 4.2* for more information.
2. When the data point is displayed, press **ERASE**.
3. Press the up arrow. The instrument will show **Erase** and **All** with the ? (flashing). At this point the options are:
 - Press **EXIT** to return to Recall mode without erasing.
 - Press the down arrow to return to the single point erase prompt.
 - Press **ENTER** to erase all data and return to the Reading mode.
4. After all the data is erased, the meter will return to the Reading mode.

5.1 Connecting To Printers/Computers

5.1.1 Connecting With The RS232 Cable

The standard 9-pin RS232 connector on the meter connects with a 9-pin D-sub connector. A suitable cable is listed under *Optional Apparatus* in Replacement Parts.

The RS232 interface output is an 8-bit data word plus one stop bit and no parity with a baud rate of 1200. It can communicate with a serial printer or a serial port on a computer.

5.1.2 Connecting To A Printer

Connecting a serial printer to the meter requires a 9-pin to 25-pin RS232 cable. The cable provides a direct link between the instrument and the 25-pin connector used for the serial port on most serial printers. *Table 4* shows the proper pin connections for 25-pin printer cables. Using cables that do not match the pin information in the table may cause undesirable operation.

Parallel printers require a serial-to-parallel adapter. This allows use of printers that are normally used for IBM-compatible applications.

The Citizen PN60 printer requires a special cable to fit into the printer. This cable is shipped with the printer when ordered from Hach Company.

Table 4 Standard 9-pin to 25-pin Printer Cable

9-pin D Connector Socket		Serial Printer 25-pin D Connector, plug	
Pin	Signal Name	Pin	Signal Name
2	RXD	no connection	
3	TXD	3	RXD
4	DTR	no connection	
5	GND	7	GND
6	DSR	20	DTR
7	RTS	no connection	
8	CTS	20	DTR

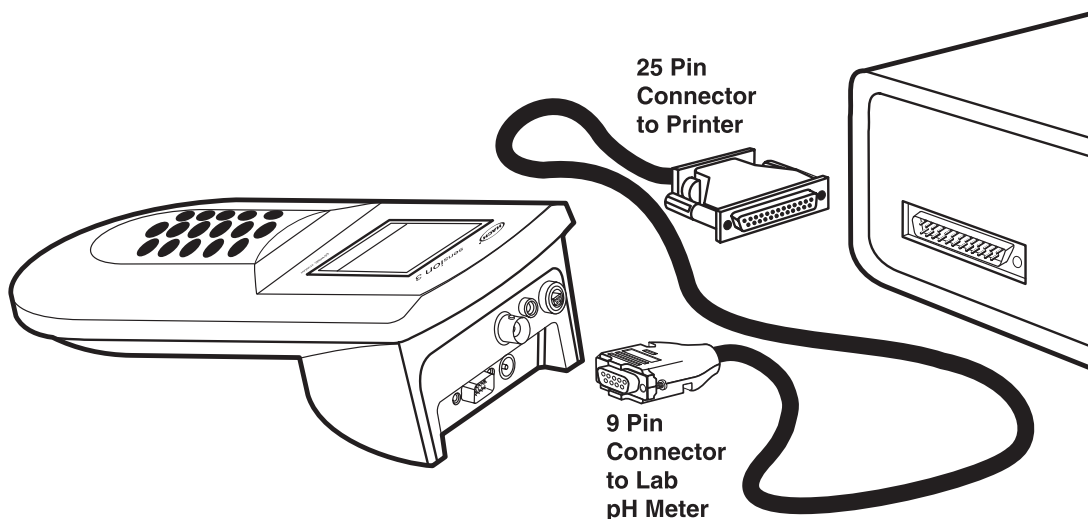
SECTION 5, continued

Connect the RS232 cable to the meter by lining up the holes in the cable connector with the pins of the meter serial port. Gently and firmly push the cable into the meter. Then secure the connection by screwing in the screws on either side of the cable port (see *Figure 5*). Connect the cable to the printer in the same manner. Once the communication link is established, press **PRINT** to send data to the computer.

Note: For optimum performance and ESD protection, use a five-conductor shielded cable. Use a metal shell for the printer or computer terminal connector, and connect the shield of the cable to the metal shell and the sleeve (signal ground) of the RS232 plug.

Follow the printer manufacturer's instructions to configure the printer for compatibility with the meter.

Figure 5 RS232 Cable Connector



5.1.3 Connecting to a Personal Computer

Connect the meter to a personal computer (PC) with the computer interface cable (Cat. No. 48129-00) listed under *Optional Accessories* on page 47. The cable provides a direct link between the meter and the 9-pin D connector used for the serial port on most personal computers. If your computer has a 25-pin D connector, use a 9-pin to 25-pin adapter (available at most computer supply stores).

SECTION 5, continued

Table 5 Standard 9-pin to 9-pin Computer Cable

9-pin D Connector Socket		Computer 9-pin D Connector, plug	
Pin	Signal Name	Pin	Signal Name
2	RXD	3	TXD
3	TXD	2	RXD
4	DTR	no connection	---
5	GND	5	GND
6	DSR	no connection	---
7	RTS	8	CTS
8	CTS	7	RTS

Table 5 shows the proper pin connections for 9-pin computer cables. Using cables that do not match the pin information in the table may cause undesirable operation.

Connect the RS232 cable to the meter by lining up the holes in the cable connector with the pins of the meter serial port. Gently and firmly push the cable into the meter. Then secure the connection by screwing in the screws on either side of the cable port (see *Figure 5*). Connect the cable to the computer in the same manner.

To transfer data, the communication parameters (baud rate, data bits and parity) of the meter and the computer must match. Once the communication link is established, press **PRINT** to send data to the computer.

Use a communications software, such as HachLink™ (Cat. No. 49665-00) to collect data from the instrument. HachLink is a Windows-based application that allows a personal computer to capture data from several Hach instruments, including the *sensio*™ electrochemical meters. The captured data can be stored as a text file in a spread-sheet compatible format or a free-format text. Data captured in the spreadsheet format is easily transferred into most spreadsheet programs (i.e., Excel®, Microsoft® Works, Lotus® 123) for graphing and reporting.

To install and run HachLink™ Data Capture, the computer and software must meet the following minimum requirements:

SECTION 5, continued

- IBM PC/AT or compatible with a 386SX processor (16 MHz or better)
- 4 megabytes of RAM
- Hard disk drive with 2 megabytes or more of free space
- 3-1/2 inch, 1.44 megabyte floppy disk drive
- VGA graphics with 640 x 480 or higher resolution, 16 or more colors
- Mouse or other pointing device
- A 9-pin serial port (or 25-pin serial port with 9-pin adapter)
- Windows 3.1 or later
- DOS 3.3 or later

5.2 Sending Data to Printers/Computers

5.2.1 Sending Currently Displayed Data

To print or transfer a current reading:

1. Wait until the display is stable. Press **PRINT**.
2. The word **PRINT** will be briefly displayed, then the meter will return to Reading mode.
3. The print out for data that is printed without being stored will not have a storage location number.

5.2.2 Sending Recalled Data Points

1. To transfer data, it must be recalled first. Press the **RECALL** key while in the Reading mode. See *Section 4.2* on page 34 for more information.
2. When the desired sample data is displayed, press **PRINT**.
3. The word **PRINT** will be briefly displayed, then the meter will return to Reading mode.

SECTION 5, continued

5.2.3 Sending All Stored Data And The Average pH Value

1. To transfer all data, it must be recalled first. Press the **RECALL** key while in the Reading mode. See *Section 4.2* on page 34 for more information.
2. When a data point is displayed, press **PRINT**. The display will show **Print Sample # ?**.
3. Press the up arrow. The instrument will show **Print, Sample** and **All** with the flashing **?**. At this point the options are:
 - Press **EXIT** to return to Reading mode without printing.
 - Press the down arrow to return to the prompt for printing single data points.
 - Press **ENTER** to print all data and the average pH of the stored data (data that is printed but not stored will not be included). The word **PRINT** will be displayed until all the data has been printed. Then the meter will return to the most recently stored sample data. Press **EXIT** to return to Reading mode or an arrow key to scroll to another data point.

5.2.3.1 Printed Data Format

Printed data will have the following format:

Storage Location	Reading	Temperature	mV Reading	Date	Time	Meter Model	Serial Number	Software Version
# 1	7.53 pH	22.7 C	-30.0 mV	10/03/98	08:30	senslon3	12344577	PX.X
# 2	6.13 pH	13.6 C	50.0 mV	10/04/98	09:11	senslon3	12344577	PX.X.
# 3	7.01 pH	20.1 C	-0.0 mV	10/10/98	12:44	senslon3	12344577	PX.X
		*Average: 6.54	pH					

* This line will not be included unless **Print All** is chosen. This calculation is included for some reporting regulations, but is not just an average of the pH readings. The calculation for the pH average is:

$$\text{pH}_{\text{AVG}} = -\log_{10} \left(\frac{\sum_{i=1}^n (10^{-\text{pH}_i})}{n} \right)$$

6.1 Introduction

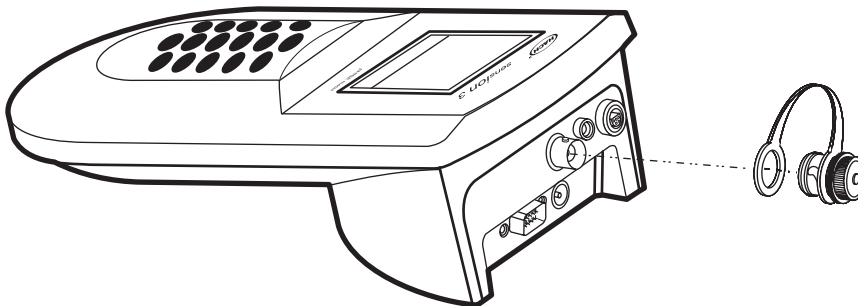
Correcting problem conditions with the *sension*[™] electrochemical meters is limited to responding to the error message displayed. Other problems must be handled by a Hach technician at a service center. Refer to Repair Service. **Do not** attempt to service the meter as there are no field-serviceable parts. Opening the meter case will void the warranty.

6.2 Shorting Test

This test detects the meter offset

1. Turn the meter on. Connect the shorting cap to the BNC connector (see *Figure 6*). Select the BNC connector from **Setup 1**.
2. Change the output to display in mV (press the **pH/mV** key to toggle between mV and pH). The display should show **0.1 mV**. If it does not, contact Hach Service.

Figure 6 Attaching Shorting Caps to the BNC Connector



SECTION 6, continued

6.3 Error Codes

Error codes indicate a functional problem with the meter and/or the electrode. Error codes numbers will appear in the temperature field along with other icons. *Table 6* describes the possible error codes and some possible solutions to eliminate the cause.

Table 6 Error Codes

Error Code	Error Name & Display Icons	Description
E2	Cal slope error. ERROR and SLOPE will be displayed.	Calibration is too high or low. Ensure correct pH buffers are used. Be sure a pH probe is connected to the meter. Disconnect any probe connected to the BNC connector.
E3	Cal Std Error. ERROR, ENTER, CAL and Standard will be displayed.	The value read will not work in the calibration algorithm. Repeat calibration with new buffers or standards.
E9	Corrupt data	Recalled data had a bad checksum. Call Hach Service.

6.4 Meter Service Request Questionnaire

1. What is the complete lot code of the meter and electrode?
2. On what date was the meter purchased?
3. How long has the meter been in use?
4. What types of samples are being tested?
5. What is the temperature of the samples being tested?
6. How often is the meter being used?
7. How is the meter being stored between uses?
8. If the meter has been in use for a while, what maintenance has been performed?
9. Describe the suspected problem or failure of the meter.
10. Please have your meter, electrode, buffers/standards, and this completed questionnaire near the phone before calling technical support.



GENERAL INFORMATION

At Hach Company, customer service is an important part of every product we make.

With that in mind, we have compiled the following information for your convenience.

REPLACEMENT PARTS

REQUIRED REAGENTS

Description	Quantity Required		Cat. No.
	Per Test	Unit	
Buffer Powder Pillows:			
pH 4.01, color-coded red.....	1.....	15/pkg.....	22269-95
pH 7.00, color-coded yellow	1.....	15/pkg.....	22270-95
pH 10.01, color-coded blue	1.....	15/pkg.....	22271-95
Buffer Solutions:			
pH 4.00, color-coded red.....	30 mL ...	500 mL.....	22834-49
pH 7.00, color-coded yellow	30 mL ...	500 mL.....	22835-49
pH 10.01, color-coded blue	30 mL ...	500 mL.....	22836-49
pH Electrode Storage Powder Pillows	1.....	20/pkg.....	26573-44
pH Electrode Storage Solution.....	50 mL ...	475 mL.....	50301-49

REQUIRED APPARATUS

Beaker, poly, 50 mL	1.....	each.....	1080-41
Combination pH Electrode, 5-pin	1.....	each.....	51910-00
<i>sension</i> TM 3 Benchtop pH Meter, 115 V, No. American plug .	1.....	each.....	51750-10
<i>sension</i> TM 3 Benchtop pH Meter, 230 V, European plug	1.....	each.....	51750-11
Shorting Cap, BNC	1.....	each.....	51875-00
Temperature Probe, 5-pin.....	1.....	each.....	51980-00

OPTIONAL APPARATUS

Comb. Flat pH Electrode, BNC.....		each.....	51915-00
Demineralizer Bottle, 177 mL.....		each.....	14299-00
Electrode Stand		each.....	45300-00
Electrode Stand with Electromagnetic Stirrer, 115 Vac		each.....	45300-01
Electrode Stand with Electromagnetic Stirrer, 230 Vac		each.....	45300-02
Low Ionic Strength Chamber		each.....	51899-00
<i>sension</i> TM 1 Portable pH Meter		each.....	51700-10
<i>sension</i> TM 2 Portable pH/ISE Meter		each.....	51725-10
<i>sension</i> TM 4 Benchtop pH/ISE Meter, 115 V, No. American Style Plug.		each.....	51775-10
<i>sension</i> TM 4 Benchtop pH/ISE Meter, 230 V, European Style Plug		each.....	51775-11
Printer, Citizen PN60I, 115 V, North American Style Plug		each.....	26687-00
Power Cord, for Citizen PN60I, Continental European Style Plug		each.....	46836-00
Stir Bar		each.....	45315-00
Thermometer, mercury, -20 to 110 °C		each.....	20959-11

HOW TO ORDER

By Telephone:

6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH
(800-227-4224)

By FAX:

(970) 669-2932

By Mail:

Hach Company
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A.

Ordering information by E-mail:

orders@hach.com

Information Required

- Hach account number (if available)
- Your name and phone number
- Purchase order number
- Brief description or model number
- Billing address
- Shipping address
- Catalog number
- Quantity

Technical and Customer Service (U.S.A. only)

Hach Technical and Customer Service Department personnel are eager to answer questions about our products and their use. Specialists in analytical methods, they are happy to put their talents to work for you. Call **1-800-227-4224** or E-mail **techhelp@hach.com**.

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Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send E-mail to **intl@hach.com** or contact:

In Europe, the Middle East, or Mediterranean Africa:

Hach Europe, S.A./N.V.; Namur, Belgium
Telephone: (32)(81) 44.71.71; FAX: (32)(81) 44.13.00

**In Canada, Latin America, the Caribbean,
the Far East, the Indian Subcontinent, Africa
(except Mediterranean Africa), or the Pacific Basin:**

Hach Company World Headquarters; Loveland, Colorado, U.S.A.
Telephone: (970) 669-3050; FAX: (970) 669-2932

REPAIR SERVICE

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the Hach Service Center serving your location.

In the United States:

Hach Company
100 Dayton Ave.
Ames, Iowa 50010
(800) 227-4224 (U.S.A. only)
Telephone: (515) 232-2533
FAX: (515) 232-1276

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Hach Sales & Service Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba
R3H 0X4
(800) 665-7635 (Canada only)
Telephone: (204) 632-5598
FAX: (204) 694-5134
E-mail: canada@hach.com

In Europe, the Middle East, or in Mediterranean Africa:

Hach Europe, S.A./N.V.
Chaussée de Namur, 1
B-5150 Floriffoux (Namur), Belgium
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FAX: (32)(81) 44.13.00

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Africa (except Mediterranean Africa) or Pacific Basin:**

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WARRANTY

Hach warrants most products against defective materials or workmanship for at least one year from the date of shipment; longer warranties may apply to some items.

HACH WARRANTS TO THE ORIGINAL BUYER THAT HACH PRODUCTS WILL CONFORM TO ANY EXPRESS WRITTEN WARRANTY GIVEN BY HACH TO THE BUYER. EXCEPT AS EXPRESSLY SET FORTH IN THE PRECEDING SENTENCE, HACH MAKES NO WARRANTY OF ANY KIND WHATSOEVER WITH RESPECT TO ANY PRODUCTS. HACH EXPRESSLY DISCLAIMS ANY WARRANTIES IMPLIED BY LAW, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF REMEDIES: Hach shall, at its option, replace or repair nonconforming products or refund all amounts paid by the buyer. **THIS IS THE EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.**

LIMITATION OF DAMAGES: IN NO EVENT SHALL HACH BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND FOR BREACH OF ANY WARRANTY, NEGLIGENCE, ON THE BASIS OF STRICT LIABILITY, OR OTHERWISE.

This warranty applies only to Hach products purchased and delivered in the United States.

Catalog descriptions, pictures and specifications, although accurate to the best of our knowledge, are not a guarantee or warranty.

For a complete description of Hach Company's warranty policy, request a copy of our Terms and Conditions of Sale for U.S. Sales from our Customer Service Department.

Hach warrants the meter against defective materials or workmanship for three years from the date of shipment. The Docking Station has a one-year warranty from the date of shipment.



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