



*sension<sup>TM</sup>2*

# **Portable pH/ISE Meter**

## **Instruction Manual**

# TRADEMARKS OF HACH COMPANY

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AccuGrow®	H <sub>2</sub> O University™	Pond In Pillow™
AccuVac®	H <sub>2</sub> OU™	PourRite®
AccuVer™	Hach Logo®	PrepTab™
AccuVial™	Hach One®	ProNetic™
Add-A-Test™	Hach Oval®	Pump Colorimeter™
AgriTrak™	Hach.com™	QuanTab®
AluVer®	HachLink™	Rapid Liquid™
AmVer™	Hawkeye The Hach Guy™	RapidSilver™
APA 6000™	HexaVer®	Ratio™
AquaChek™	HgEx™	RoVer®
AquaTrend®	HydraVer®	<i>sension</i> ™
BariVer®	ICE-PIC™	Simply Accurate <sup>SM</sup>
BODTrak™	IncuTrol®	SINGLET™
BoroTrace™	Just Add Water™	SofChek™
BoroVer®	LeadTrak®	SoilSYS™
C. Moore Green™	M-ColiBlue24®	SP 510™
CA 610™	ManVer®	SpecV™
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ColorQuik®	NetSketcher™	SteriChek™
CoolTrak®	NitraVer®	StillVer®
CuVer®	NitriVer®	SulfaVer®
CyaniVer®	NTrak®	Surface Scatter®
Digesdahl®	OASIS™	TanniVer®
DithiVer®	On Site Analysis. Results You Can Trust <sup>SM</sup>	TenSette®
Dr. F. Fluent™	OptiQuant™	Test 'N Tube™
Dr. H. Tueau™	OriFlow™	TestYES! <sup>SM</sup>
DR/Check™	OxyVer™	TitraStir®
EC 310™	PathoScreen™	TitraVer®
FerroMo®	PbEx®	ToxTrak™
FerroVer®	PermaChem®	UniVer®
FerroZine®	PhosVer®	VIScreen™
FilterTrak™ 660	Pocket Colorimeter™	Voluette®
Formula 2533™	Pocket Pal™	WasteAway™
Formula 2589™	Pocket Turbidimeter™	ZincoVer®
Gelex®		

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# CERTIFICATION

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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*<sup>™</sup>2 portable pH/ISE Meter has been tested and is certified as indicated to the following instrumentation standards:

## Product Safety:

Battery Eliminator 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 Docking Station and 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

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## Emissions:

Instrument tested with Docking Station and external 230 V, 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 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

**CANADIAN INTERFERENCE-CAUSING EQUIPMENT REGULATION, IECS-003:** Class A emission limits. Supporting test records by Criterion Technology O.A.T.S., 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., 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

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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 the Docking Station and/or remove one of the batteries from the *sensio<sup>n2</sup>* Portable pH/ISE meter to verify that the meter is or 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.





# SAFETY PRECAUTIONS

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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 2.2.3 on page 25***



# SPECIFICATIONS

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Specification subject to change without notice.

## **pH mode**

Range	-2.00 to 19.99
Resolution	0.001/0.01/0.1 (selectable)
Slope range	58 ±3 mV/decade

## **ISE mode**

Range	0.000 to 19900
Resolution	0.1/0.01/0.001 (selectable)

## **Millivolt mode**

Range	-2000 to 2000 mV
Resolution	0.1 mV
Accuracy	±0.2 mV or ±0.05% of 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:** 1BNC; 5-pin Hach pH/temperature or Hach temperature probe; 1 pin-tip

**Output:** One-way RS232

## **Power Requirements:**

**Meter**— 4 AA alkaline batteries or via Docking Station

**Docking Station**— 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 (for 120 and 230 V external power supply)

**Input Impedance:** > 10<sup>12</sup> ohms

**Instrument Drift:** < 40 µV/°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:** 21.2 x 8.7 x 4.2 cm (8.35 x 3.43 x 1.65 in.)

**Enclosure:** Meter is water resistant (designed to meet IP67), chemical resistant, dust proof. Instrument will float. Docking Station is water resistant to IP40.





# 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 *sension*<sup>™2</sup> Portable pH/ISE/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 simple pH/mV/ISE meter plus an IP67 water-proof design, electrode holder, ergonomic design, and automatic buffer recognition when in the pH mode. Additional features include floatability, a display backlight, datalogging, and RS232 communication for printing results to a computer or printer.

The electrode holder in the back of the instrument allows the user to store the electrode and meter in one convenient package when not in use. The electrode holder is designed so the user can slip a vinyl electrode cover over the electrode tip, creating a humid environment that allows the electrode membrane to remain hydrated when not in use (*Figure 2*).

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.

## 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

- Batteries— 4 alkaline AA (not rechargeable)
- Instrument Manual
- May include electrode and related accessories (covered in the electrode manual).

## SECTION 1, continued

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Figure 1 Hach *sension2* Meter

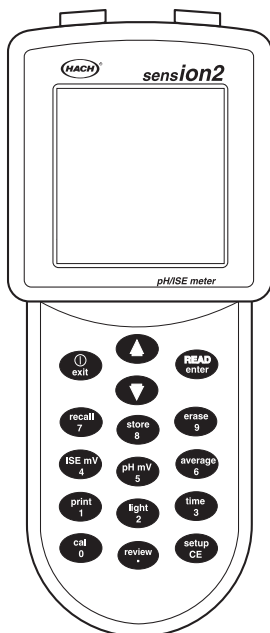
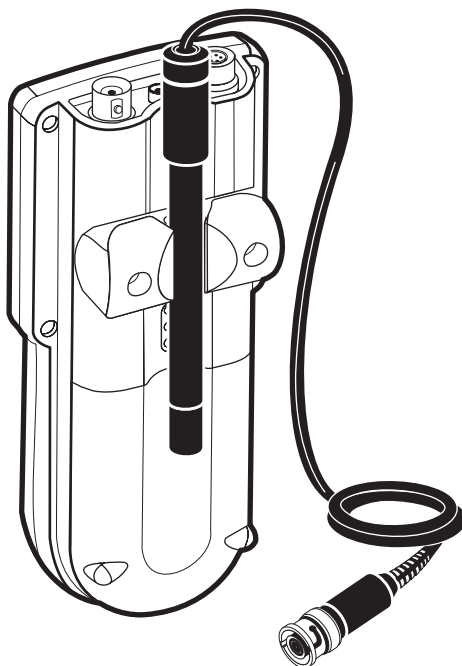


Figure 2 Electrode Holder





## SECTION 1, continued

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### 1.2 Keypad Description

Figure 3 illustrates the meter's keypad. The description and function of each key are given in Table 1.

Figure 3 *sensION2* Meter Keypad

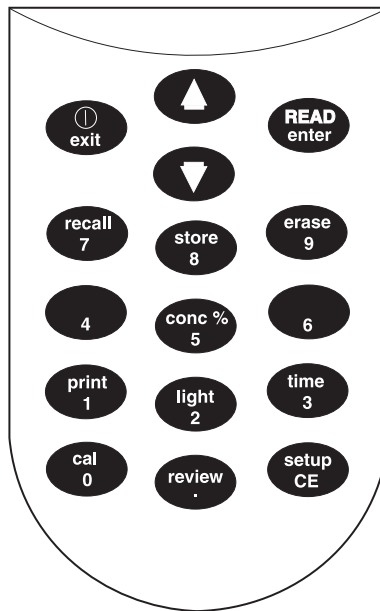


Table 1 Keys and Description

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>In Setup mode, backs up one step toward the Reading mode.</p> <p>Performs the following and returns to the most recent Reading mode:</p> <ul style="list-style-type: none"><li>• Exits the Store or Recall mode</li><li>• Aborts a calibration</li><li>• Exits a calibration review</li></ul>

## SECTION 1, continued

**Table 1 Keys and Description (Continued)**

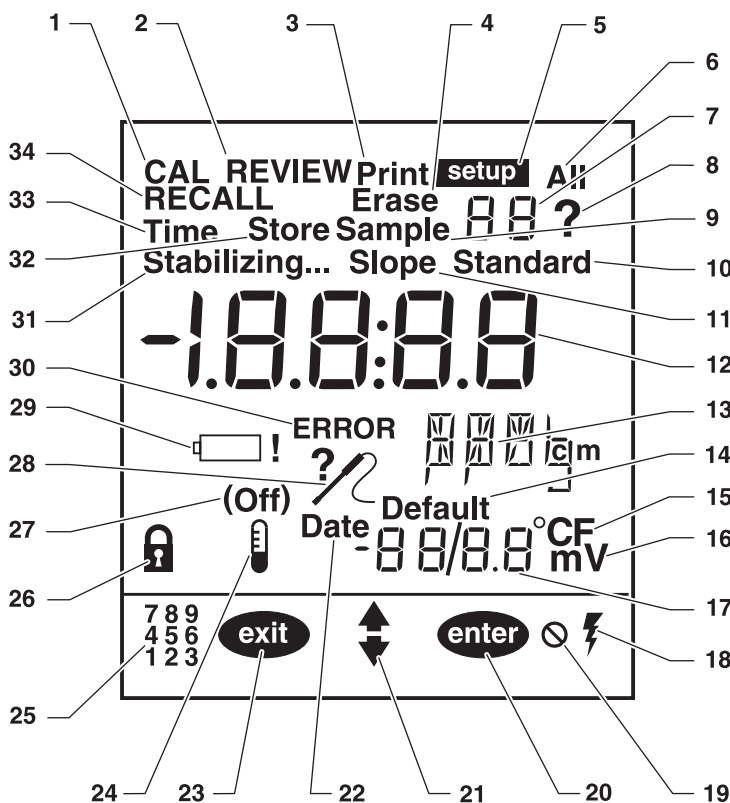
<b>Key</b>	<b>Description</b>
Arrow Keys	Scrolls between options in Setup mode. Scrolls through data points in Store and Recall modes. Scrolls between the option to print or erase one data point and all data points. Changes the default temperature when a temperature probe is not in use (for temperature compensation for pH measurement).
READ/ENTER Key	Accepts numerical input. Acts as a “YES” answer when the question mark is flashing. Allows user to edit a setup when the setup number is flashing. Accepts changes to the current Setup option. Initiates a new measurement when the meter has stabilized in the Display Lock Enabled mode.
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.
ISE/mV Key	Toggles between ISE concentration value and mV in Reading, Calibration, and Cal Review modes.
pH/mV Key	Toggles between pH value and mV value in Reading, Calibration, and Cal Review modes.
Average Key	Calculates the average of all the stored pH readings. Any stored ISE readings are ignored.
Print Key	Sends current or recalled data to a printer or a computer via the RS232 port.
Light key	Turns on the backlight for the display when pressed.
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, slope, sample/default temperature, pH, mV or concentration units, error codes, and indicates if the meter reading is stable. The lower screen displays the keys that are active.

Figure 4 shows the icons and screens displayed by the meter and Table 2 describes each element. All icons on the display will be displayed if the power key is held down for several seconds.

Figure 4 Display Elements



## SECTION 1, continued

**Table 2 Main Display Elements**

Item No.	Description
1	Indicates meter is in Calibration mode. If the ? is flashing, 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, and Standard numbers when those words are displayed with the number. If <b>Standard</b> and <b>1</b> are displayed, the meter is measuring Standard 1.
8	Flashing ? and <b>CAL</b> indicate calibration is necessary. Also a prompt to press the <b>ENTER</b> or <b>EXIT</b> key.
9	Indicates the meter is measuring/reviewing a sample (sample # is displayed to the right).
10	Indicates the meter is measuring/reviewing a standard (standard # is displayed above).
11	Indicates the displayed number is the electrode slope.
12	Numerical field that displays the slope and pH, mV or concentration values of standards and samples.
13	Indicates measurement units (pH, mV, mg/L, µg/L, ppm, ppb, M).
14	When <b>Default</b> 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.
18	Indicates meter is using AC power (only displayed when in the docking station).
19	Indicates an inactive key has been pressed and that function is not allowed.
20	Indicates <b>ENTER</b> key is active.
21	Indicates arrow keys are active.
22	Indicates the date is being set or viewed.
23	Indicates <b>EXIT</b> key is active.
24	NA
25	Indicates numeric part of the keys is active.
26	Display Lock icon. Indicates readings will be locked after stability criteria are met.
27	In Setup mode, indicates whether Display Lock setting is <b>On</b> or <b>Off</b> .
28	Faulty probe connection or incorrect probe attached. May also indicate the calibration is questionable. Usually displayed with an error code.
29	Low battery icon. Change batteries as soon as possible.

## SECTION 1, continued

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**Table 2 Main Display Elements (Continued)**

Item No.	Description
30	Indicates a meter function problem. This is displayed with a number.
31	When on or flashing, <b>Stabilizing...</b> indicates signal from sample is not yet stable. When it disappears, the reading is stable and may be recorded.
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 or viewed.
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 on and measurement stability is reached in reading mode (three beeps).
- any time measurement stability is reached during calibration mode, regardless of the Display Lock setting.
- 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 *sens<sup>ion</sup>*<sup>™</sup>2 portable pH/ISE/mV meter is designed for field or laboratory use and operates on four alkaline batteries or 115/230 VAC power. A Docking Station supplies line voltage to the meter in the laboratory. It will not recharge batteries.

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. To display mV and pH values, press the **pH/mV** key to toggle between the units.

In the ISE mode, the meter measures from 0 to 19900 with the highest resolution as thousandths (0.001). To display mV and the user-selected ISE concentration units, press the **ISE/mV** key to toggle between the units.

## 2.2 Power Connections

The Docking Station provides AC power to the meter and also acts as the connection for sending data to a printer or computer. The Docking Station will operate with the batteries inserted or removed. It will not recharge the batteries.

### 2.2.1 Using the Docking Station

The optional *sens<sup>ion</sup>* Docking Station (*Figure 5*) is the AC adapter for the meter when it is used in the laboratory. It also allows the meter to send data to a printer or computer.

1. Plug the AC/DC connector into the Docking Station.
2. Plug the external power supply into a wall outlet.
3. Place the meter in the Docking Station so the three metal connector pins on the bottom of the meter align with the three metal connectors protruding up from the Docking Station.

When the meter is using AC power, the AC power icon will be displayed in the lower right corner of the display. The indicator light on the docking station only lights when data is being transferred and does **not** indicate that power is on.

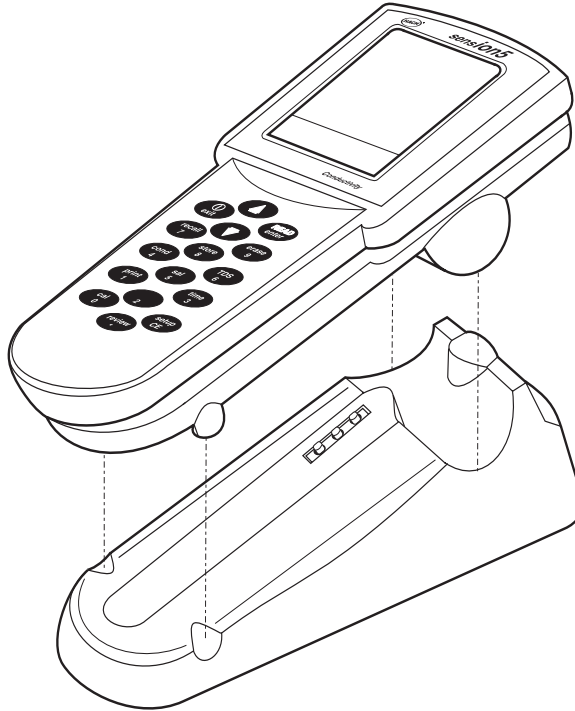
**The Docking Station will not recharge rechargeable batteries.** Use a separate alkaline battery charger.

## SECTION 2, continued

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Automatic shutoff is not functional while the meter is in the Docking Station.

Figure 5      Docking Station



### 2.2.2 Docking Station Connections

The Docking Station has a power connector, a serial port, and a green indicator light on the back (see *Figure 6*). To connect the Docking Station to AC power, plug the pin connector from the wall power unit into the power jack.

The standard 9-pin RS232 serial port connector on the Docking Station is used for sending data to a printer or computer. Adapters, such as a 9-pin to 25-pin connector, may be required. See *5.1 Connecting To Printers/Computers* for more information.

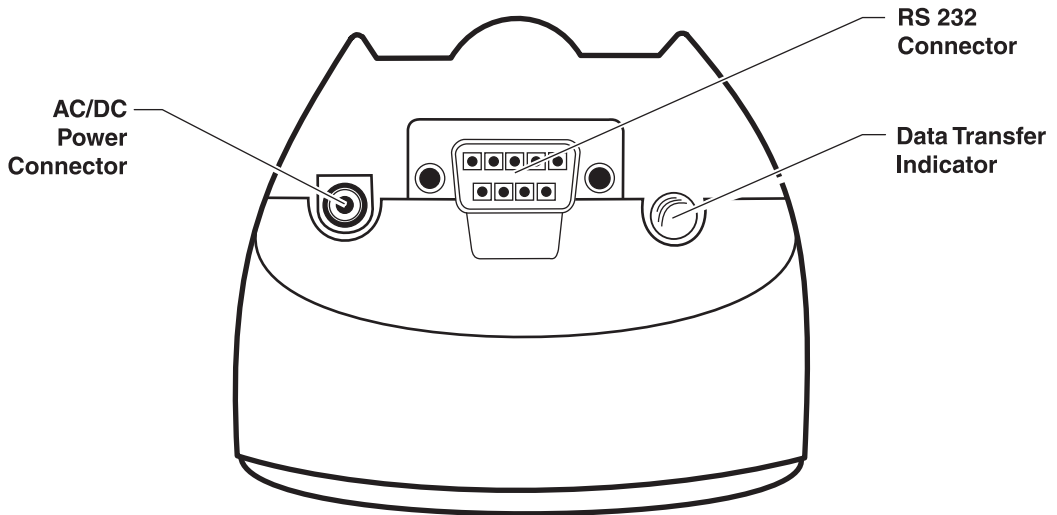
The green light on the Docking Station is lit when a connection is made to a printer or computer. It flickers when data is being transferred to a printer or computer via the serial port. It does **not** indicate the power is on.



## SECTION 2, continued

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Figure 6 Docking Station Connections



### 2.2.3 Battery Installation

#### **DANGE**

*Use only alkaline batteries in this product. Other types of batteries can cause safety hazards.*

#### **PRUDENCE**

*Utiliser seulement des piles alcalines dans cet appareil. Les autres types de piles peuvent créer des risques pour la sécurité.*

#### **ATENCIÓN**

*Utilice solamente baterias alcalinas en este producto. El uso de otros tipos de baterias puede causar riesgos de seguridad.*

#### **VORSICHT**

*Verwenden Sie in diesem Produkt nur Alkali-Batterien. Die Verwendung anderer Batterien gefährdet die Betriebssicherheit.*

#### **ATENÇÃO**

*Use somente baterias alcalinas neste produto. Outros tipos de baterias podem resultar em risco a segurança.*

## SECTION 2, continued

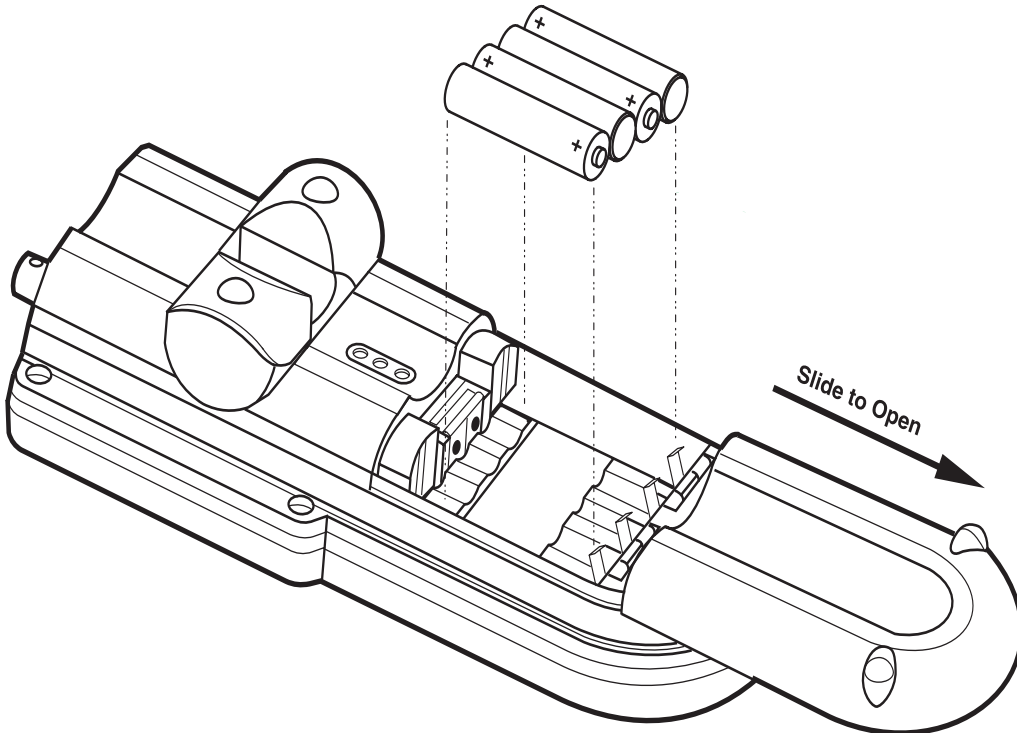
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The *sensio2* meter requires four **alkaline** AA batteries for portable operation. **Other types of batteries should not be used in the meter.** The battery compartment access panel is on the bottom of the instrument. To access the battery compartment, turn the instrument over and position the connectors away from you. Hold the instrument between your hands and use your thumbs to slide the panel towards you. See *Figure 7*.

When battery replacement is necessary, replace all four batteries. The position of the batteries in the instrument is important. Icons of the correct orientation are molded into the bottom of the compartment.

With the connectors pointing away from you, insert a battery in the left-most position so the positive end faces you. Insert the other three batteries so the positive and negative ends alternate (i.e., +, -, +, -). Insertion is easiest if the battery is pushed against the spring connector first, then put into place.

**Figure 7**      **Battery Installation**



### 2.3 ISE and pH Probe Connections

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

#### 2.3.1 ISE Probe Connections

##### Five-pin Connectors

Attach electrodes with 5-pin connectors to the meter input by lining the pins up with the holes in the meter port (see *Figure 8*). Push the plug into the instrument.

##### BNC Connectors

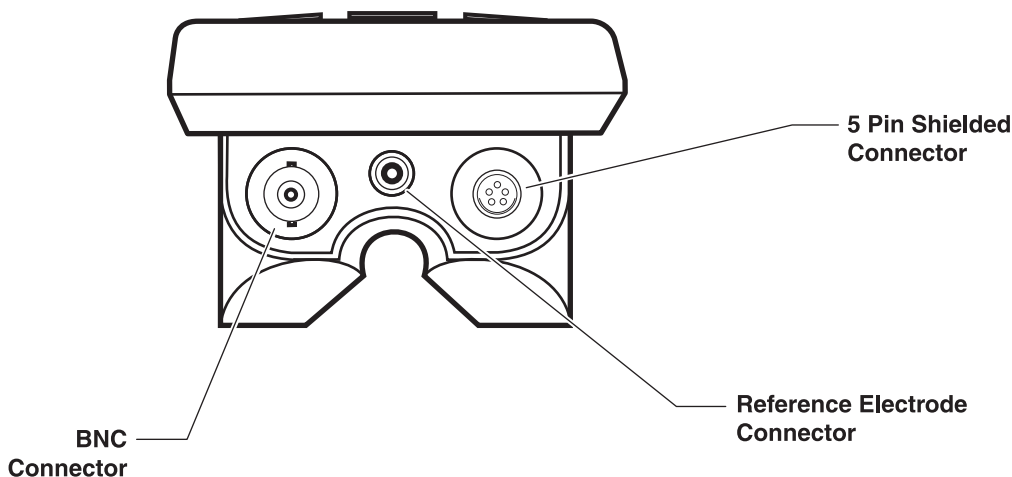
For probes with BNC connectors, slide the connector into the input. Push towards the instrument and turn the metal sleeve clockwise to lock into position.

##### Pin-type Connectors

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.

Figure 8 *sensION2* Connections



## SECTION 2, continued

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### 2.3.2 Temperature Probe Connection (for pH measurement)

Hach pH electrodes with the 5-pin connector have the temperature sensing unit included in the electrode probe and require only the 5-pin connector. If using a pH electrode with BNC connector, connect the Hach Temperature Probe (Cat. No. 51980-00) to the 5-pin connector on the meter (see *Figure 8*). The user can also measure the temperature manually and enter the value as the default temperature on the meter (see *Section 2.6*)

### 2.4 Printer and Computer Connections

The meter can send data to a computer or printer via the 9-pin serial port on the Docking Station (see Section 3.2). **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 (supplied with the printer). Pressing the **PRINT** key will send the currently displayed data to the printer. The data may be either a current measurement or recalled 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 using a 9-pin to 9-pin cable. Pressing the **PRINT** key will send the currently displayed data to the computer. The data may be either a current measurement or recalled data.

### 2.5 Turning the Meter On

After installing batteries or 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 move 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/mV field.

## SECTION 2, continued

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The meter requires a temperature to calculate temperature-corrected pH readings. The meter uses temperature data from one of three sources:

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

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

### **To manually set the temperature**

When a temperature probe is not used to supply the temperature for pH temperature compensation, the temperature must be set manually or the factory default temperature (20 °C) will be used. In either case, **Default** will be displayed above the temperature.

To change the default temperature, first put the meter in Reading or Calibration mode. Press the arrow keys to increase or decrease the displayed default temperature value to the desired temperature. The value adjusts in 0.1 °C (0.1 to 0.2 °F) increments. Hold the arrow key down to scroll rapidly. The acceptable temperature range is -10 to 110 °C.

To change the units of temperature measurement, see *Section 3.1.3* on page 32.

## **2.7 Millivolt Measurements**

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

Absolute millivolts are displayed with 0.1 mV resolution in the range of -2000.0 to +2000.0. 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.

### 2.8 Automatic Shut-off Function

The meter is equipped with an automatic shut-off feature to prolong battery life. The meter will automatically shut off after 15 minutes after the last key press unless the meter is in Calibration mode. If it is Calibration mode, automatic shutoff will occur after four hours from the last key press.

Press the **I/O/EXIT** key after automatic shut-off to restore power to the instrument.

### 3.1 Setup Menu

The *sensio***n2** Portable pH/ISE meter setup menu allows the analyst to choose options for connectors, display lock, temperature units, time, date, automatic buffer recognition, and display resolution.

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**. After scrolling to the desired option, press **ENTER** to view/edit the option.

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** *sensio***n2** Setup Options

Setup Number	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	Automatic buffer recognition (pH 7.00 or 6.86)
6	Time of day (24 hour clock)
7	Date (mm/dd)
8	Year (four digits)

#### 3.1.1 Choosing the Probe Connector

This setup ensures the potential from the appropriate electrode is detected by the meter. Two electrodes may be attached to the meter as long as they are not in the same solution. The meter processes only the signal from the chosen connector.

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**.

## SECTION 3, continued

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3. When the desired option is selected, press **EXIT** to return to the reading mode.

### 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 without **Off**. When this feature is enabled, the Display Lock icon is displayed 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

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### 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 between the three resolution options.
4. When the desired option is selected, press **EXIT** to return to the reading mode.

### 3.1.5 Selecting pH Auto Buffer Recognition

The *sensio*<sup>2</sup> pH/ISE 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.

When the desired option is selected, press **EXIT** to return to the reading mode.

### 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**.

## SECTION 3, continued

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3. Change the time by pressing **ENTER**. The main display will change to `__:__`, with the left place holder flashing. The numeric 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 number is only one digit, use a zero for the left-most 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**.
6. If a number entry error occurs, start over by pressing **SETUP/CE**.

### 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.
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 numeric keypad will become active. Press the desired number key for the left-most digit. All four digit places must have a number. If number is only one digit, use a zero for the left-most value (i.e., 02/06 is February 6).
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**.
6. If an number entry error occurs, start over by pressing **SETUP/CE**.

## SECTION 3, continued

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### 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**.
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.
5. If an number entry error occurs, start over by pressing **SETUP/CE**.

### 3.2 pH Calibration

The *sensio***n2** pH/ISE Meter is designed to auto-recognize and calibrate on 4.01, 6.86 or 7.00, and 10.00 pH buffers. Calibrating with buffers that have pH values other than these requires a modified procedure (see *Section 3.2.2*).

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.

#### 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 28 and *2.6* on page 28 for information about setting and using a default temperature.
2. Prepare 4.01 and 7.00 (or 6.86) or 7.00 (or 6.86) and 10.01 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.

## SECTION 3, continued

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3. Press **I/O/EXIT** 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.
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 stabilized or been accepted, the standard number will change to **2**.
8. Remove the probe from the first buffer and rinse with deionized water. 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.
10. When the reading has stabilized or been accepted, the standard number will change to **3**.
11. Repeat *steps 8 and 9* for the third buffer or press **EXIT**. 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**.

## SECTION 3, continued

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### 3.2.1.1 Stirring During Measurement

Stirring during measurement may cause problems in conventional electrodes with frit-type reference junctions. Stirring can cause reference-junction potential shifts in this type of electrode.

Hach's Platinum Series pH electrodes, with their patented reference junction technology, have eliminated reference-junction potential shift errors. Initial stirring can speed response times, and is essential during titration when using a pH electrode to measure an end point.

However, in low ionic strength, basic solutions with limited buffer-capacity, stirring can cause more rapid absorption of atmospheric CO<sub>2</sub>. This absorption lowers the pH of the solution. If stirring is necessary in these situations, the Hach Platinum Series pH electrodes are recommended due to their extremely low reference junction potential shift during stirring.

### 3.2.2 Calibrating With Other pH Buffers

1. If using a probe without a temperature sensor, see *Sections 2.3.2 on page 28 and 2.6 on page 28* for information about obtaining and using a default temperature.
2. Prepare two or three pH buffers according to the electrode instruction manual.
3. 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 a buffer (starting with the lowest pH makes it easy to keep track).
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.

## SECTION 3, continued

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7. The temperature and pH values (or mV) will be updated until a stable reading is reached.
8. When the reading has stabilized, the standard number will change to **2**. If measuring in the mV mode, press **ENTER** to accept the reading and 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. When the reading has stabilized, the standard number will change to **3**. If measuring in the mV mode, press **ENTER** to accept the reading and continue.
12. If desired, repeat *steps 10* and *11* for a third buffer or press **EXIT**. If not, go to the next step.
13. The slope value and the **Store** and **?** icons will appear. Verify the slope value is within the ranges specified in the electrode manual.
14. 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**. After the calibration is stored, the meter is immediately ready to begin measuring samples. See the next section for pH sample measurements.

## SECTION 3, continued

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### 3.2.3 One-Point pH Calibration

The one-point calibration is used to adjust the mV offset and cannot be done unless a prior two or three point calibration is being used for measurements.

1. Press **CAL**. **Cal, 1, ?,** and **Standard** will be displayed.
2. Place the electrode in a pH calibration standard.
3. Press **READ/ENTER**. The temperature and pH values will be 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, and the **Store** and **?** icons will appear. Verify the slope value 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 ISE Calibration

Calculation for ISE values does not require temperature compensation, so a temperature probe is not necessary for ISE testing. However, a temperature probe will still function properly and display the correct sample temperature.

1. Prepare standards according to the electrode instruction manual or the instructions for the standard. Use two to five standards for calibration. Pour 25 mL of each standard into a 50-mL beaker.
2. Turn the instrument on. If necessary, press the **ISE/mV** key to get into the ISE reading mode (the last concentration units entered will be displayed).
3. Press **CAL**. Functional keys will appear in the lower left part of the display. **CAL, ?,** and flashing units will appear.
4. To change the units, use the arrow keys to scroll to the desired choice (g/L, mg/L, µg/L, ppm, ppb, M).

## SECTION 3, continued

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5. Add ionic strength adjustor to 25 mL of the least concentrated standard.
6. Press **ENTER**. **CAL**, **?**, **Standard**, and **1** will appear in the upper display. If the meter has been calibrated, the last value for standard 1 will appear. The numeric keypad will become active.
7. Place the ISE electrode in the standard with the lowest value. While measuring, gently swirl the electrode or use a stir bar.
8. To enter or change the standard's concentration value, use the number keys. 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 **ENTER** to accept the value or **CE** to change the value.

To retain the standard concentration value, just press **ENTER**.

**Note:** *Once a new value is entered, the meter will assume the calibration values have changed and will no longer display values for other standards from the previous calibration.*

9. The temperature and concentration values will be updated until a stable reading is reached. mV values may be observed during calibration by pressing the **ISE/mV** key.

**Note:** *If the meter is measuring in ISE 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.*

10. When the reading has stabilized, the standard number will change to **2**. The previous value for standard 2 will be displayed if a new value for Standard 1 has not been entered.
11. Add ISA to 25 mL of the standard with the next highest value.
12. Rinse the electrode and place it in the standard with the next highest concentration. Gently swirl the electrode during the measurement or use a stir bar.



## SECTION 3, continued

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13. Enter or change the standard's concentration value using the number keys as described above. Press **ENTER**.

To retain the standard concentration value, just press **ENTER**.

14. When the reading has stabilized, the standard number will change to 3. Repeat steps 10–12 for each standard. The meter will accept up to five calibration points.
15. After the last standard is measured, press **EXIT**. The **Store** and **?** icons will appear.
16. 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**.
17. After the calibration is stored, the meter is immediately ready to begin measuring samples. See *Section 3.6* on page 44.

### 3.4 Reviewing Calibrations

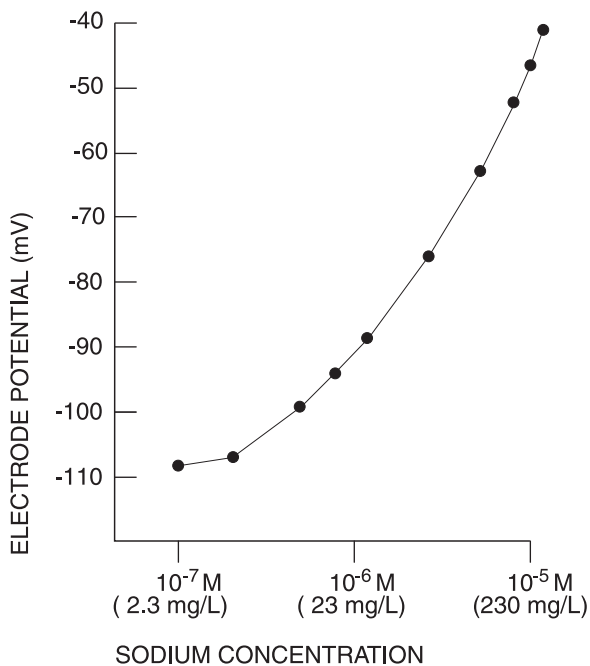
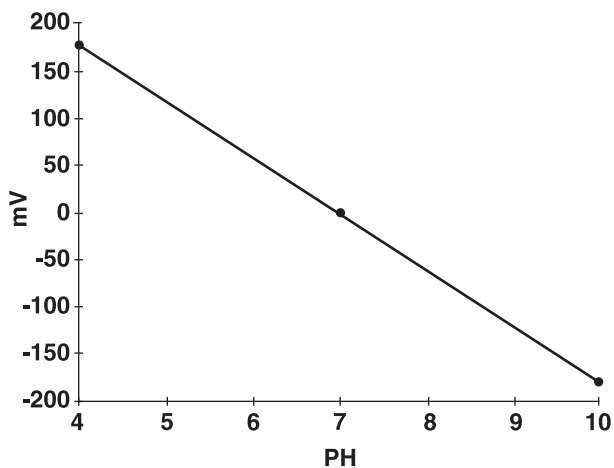
pH calibrations result in a linear calibration curve, so only one slope value is displayed in Cal Review mode. ISE calibration result in a linear, piecewise calibration for each pair of standards (see *Figure 9*). Therefore, the meter will display a slope for each “calibration” between each pair of standards. The first slope displayed is for Standards 1 and 2. The second slope displayed is for standards 2 and 3, and so forth. Use the arrow keys to scroll to these values.

The mV values for the standards can be viewed by pressing the **ISE/mV** or **pH/mV** key. This toggles between concentration and mV values.

## SECTION 3, continued

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Figure 9      pH and ISE Calibration Curves



## SECTION 3, continued

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1. From the pH or ISE reading mode, press the **REVIEW** key. To review the pH calibration, be sure the meter is in pH mode. To review the ISE calibration, be sure the meter is in ISE reading mode.
2. The meter will display the time the calibration was stored. Press the up arrow key once.
3. The display will show the standard number, standard concentration and temperature (view mV values by pressing **pH/mV** or **ISE/mV**). Press the up arrow once.
4. The meter will continue to scroll through the standard information with each press of the up arrow key. When all the standards have been displayed, press the up arrow key again.
5. For ISE calibrations, the meter will display the slope value of the curve between standards 1 and 2. Press the up arrow once. For pH calibrations, The meter will display the slope and offset of the calibration curve. Skip to *step 8* if reviewing a pH calibration.
6. The meter will display the slope value for the curve between standards 2 and 3.
7. Each press of the up arrow will display the remaining slope values until all the slope values have been displayed.
8. To exit Cal Review mode, press **EXIT**. To review any standard or slope information again, press the down arrow.

### 3.5 Measuring Sample pH

See instructions in the electrode manual for more information and specific steps for using the electrode.

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. When the reading is stable, **Stabilizing...** will disappear. If the Display Lock is enabled, the display will “lock in” on the pH or mV and sample temperature. If the Display Lock is off, the display will show the current reading and temperature, but the values may fluctuate.

## SECTION 3, continued

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3. Record or store the pH or mV value. See *SECTION 4* on page 45 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 and put the electrode in the electrode holder. See the electrode manual for specific storage instructions.

### 3.6 Measuring Samples Using ISEs

This is a general guide for ISE measurements. Most measurements require reagent addition. See instructions in the electrode manual for more information and specific steps.

1. After calibration, rinse the electrode. If necessary, add ISA to 25 mL of sample.
2. When the reading is stable **Stabilizing...** will disappear. If the Display Lock is enabled, the display will show the concentration or mV and sample temperature when a stable reading is reached. If the Display Lock is off, the display will show the current reading and temperature, but the values may fluctuate.
3. Record or store the concentration or mV value. See *SECTION 4* on page 45 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 prepared 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 and put the electrode in the electrode holder. To store the electrode for more than seven days, see the electrode manual for specific instructions.

### 4.1 Storing Measurements

The *sensio<sup>n</sup>2* 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/ISE 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 or ISE 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 storage location). The question mark will be flashing.
2. Press **ENTER** to store the measurement reading in that location. 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 one of the data points 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. To display the mV value of the reading, press the **pH/mV** or **ISE/mV** key.
4. To review the time of the calibration, press **TIME** once. To review the date of the calibration, press **TIME** twice. Press **EXIT** to return the reading value.
5. 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*.
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 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 2–4* for each data point that needs to be deleted.

## SECTION 4, continued

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### 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*.
2. When a data point is displayed, press **ERASE**.
3. Press the up arrow. The meter will display **Erase All** and a 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 Docking station 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 Docking Station requires a 9-pin to 25-pin RS232 cable. See *Figure 10*. 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. The meter does not need AC power to transfer data to a printer.

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

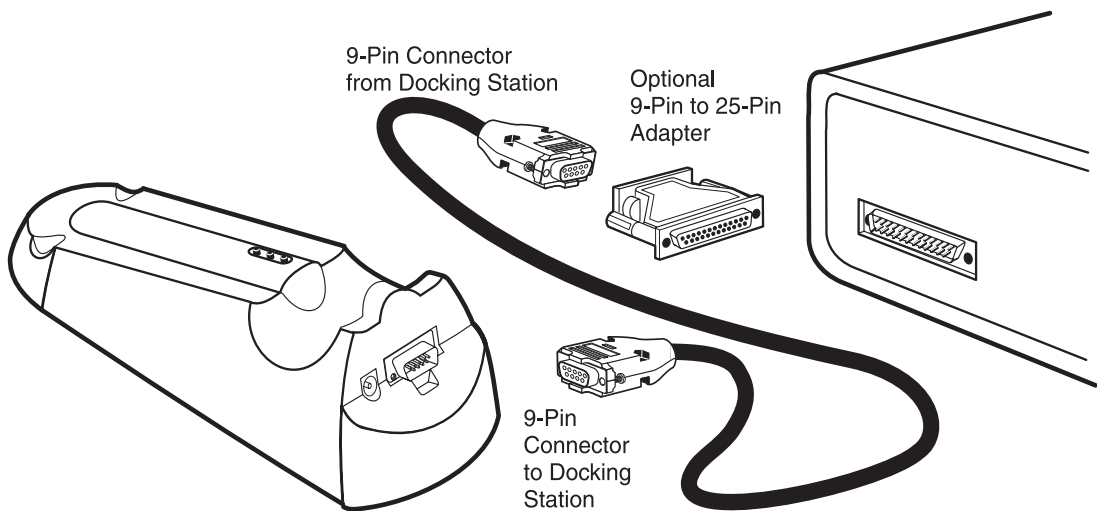
## SECTION 5, continued

Connect the RS232 cable to the Docking Station by lining up the holes in the cable connector with the pins of the serial port. Gently and firmly push the cable into the Docking Station. Then secure the connection by screwing in the screws on either side of the cable connector. 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 10 RS232 Cable Connector



### 5.1.3 Connecting to a Personal Computer

Connect the Docking Station to a personal computer (PC) with the computer interface cable (Cat. No. 48129-00). 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

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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. The meter does not need AC power to transfer data to a computer.

**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

Connect the RS232 cable to the Docking Station by lining up the holes in the cable connector with the pins of the serial port. Gently and firmly push the cable into the Docking Station. Then secure the connection by screwing in the screws on either side of the cable connector. 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 *sension* electrochemical meters. The captured data can be stored in a text file as 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

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- 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 recalled data, it must be recalled first. Press the **RECALL** key while in the Reading mode. See *Section 4.2* on page 46 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

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### 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 46 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	senslon2	12344577	PX.X
# 2	6.13 pH	13.6 C	50.0 mV	10/04/98	09:11	senslon2	12344577	PX.X.
# 3	7.01 pH	20.1 C	-0.0 mV	10/10/98	12:44	senslon2	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

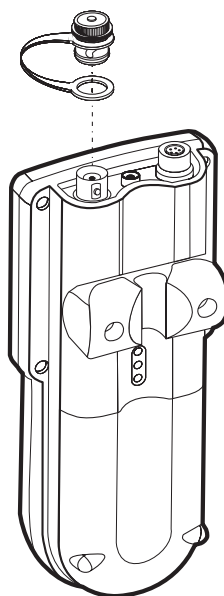
Correcting problem conditions with the *sens<sup>ion</sup>* electrochemical meters is limited to responding to the error message displayed. Other problems must be handled by a Hach technician at a service center. Refer to *REPAIR SERVICE* on page 62. **Do not** attempt to service the meter as there are 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 11*). Select the BNC connector from **Setup 1**.
2. Change the output to display in mV (press **pH/mV** or **ISE/mV** to toggle between mV and concentration values). After the meter has stabilized, simultaneously press **CAL** and **ENTER**. The display should show **0.0 mV**. If it does not, contact Hach Service.

Figure 11 Attaching The Shorting Cap To The BNC



## SECTION 6, continued

### 6.3 Error Codes And Errors

Errors and error codes indicate a functional problem with the meter and/or the electrode (see *Table 6*).

**Table 6 Error Codes and Errors**

<b>Error Code</b>	<b>Error Name &amp; Display Icons</b>	<b>Description</b>
E1	Configuration error	Means mV measurement accuracy is not within specifications, but the meter is still functional unless using an ORP electrode. Call Hach Service.
E2	Cal slope error. <b>ERROR</b> and <b>SLOPE</b> will be displayed.	Calibration slope 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. <b>ERROR, ENTER, CAL</b> and <b>Standard</b> will be displayed.	The value read will not work in the calibration algorithm. May be caused by reading a standard twice or an unrecognized buffer. Repeat calibration with new buffers or standards.
E9	Corrupt data	Recalled data had a bad checksum. Call Hach Service.
Error, Enter, Cal, and Slope icons are lit	For pH— latest standard reading is out of range. For ISE— latest standard reading indicates a non-monotonic calibration.	Repeat calibration, making sure the correct standards are used. Repeat calibration, making sure to read the correct standard and/or enter the correct value for the standard.

### 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

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## REPLACEMENT REAGENTS

Description	Quantity Required		Cat. No.
	Per Test	Unit	
<b>Buffer Powder Pillows:</b>			
pH 4.01, color-coded red.....	1.....	50/pkg.....	22269-66
pH 7.00, color-coded yellow.....	1.....	50/pkg.....	22270-66
pH 6.86 (NIST).....	1.....	15/pkg.....	14098-95
pH 10.0, color-coded blue.....	1.....	50/pkg.....	22271-66
<b>Buffer Solutions:</b>			
pH 4.00, color-coded red, NIST.....	20 mL....	500 mL.....	22834-49
pH 7.00, color-coded yellow, NIST.....	20 mL....	500 mL.....	22835-49
pH 10.0, color-coded blue, NIST.....	20 mL....	500 mL.....	22836-49
pH Electrode Storage Powder Pillows.....		20/pkg.....	26573-64
pH Electrode Storage Solution.....		475 mL.....	50301-49

Standards and reagents for ISE testing are listed in the specific electrode manuals.

## APPARATUS

Beaker, poly, 50 mL.....	1.....	each.....	1080-41
<i>sensio</i> <sup>™</sup> 2 Portable pH/ISE Meter.....	1.....	each.....	51725-10
<i>sensio</i> <sup>™</sup> Docking Station, 120 V, North American Plug.....	1.....	each.....	51875-01
OR			
<i>sensio</i> <sup>™</sup> Docking Station, 230 V, European Style Plug.....	1.....	each.....	51875-02
Shorting Cap, BNC.....	1.....	each.....	51895-00
Temperature Probe, 5-pin.....	1.....	each.....	51980-00

## OPTIONAL APPARATUS

Ammonia Combination Electrode, BNC.....		each.....	50250-00
Calcium Half-cell.....		each.....	50240-00
Chloride Combination Electrode, BNC.....		each.....	50225-00
Computer Interface Cable, 9-pin to 9-pin D-sub.....		each.....	48129-00
Cyanide/Iodide Electrode.....		each.....	50260-00
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
Fluoride Combination Electrode.....		each.....	50265-00
Fluoride Half-cell.....		each.....	44500-71
HachLink <sup>™</sup> Data Capture software.....		each.....	49665-00
Nitrate Combination Electrode, BNC.....		each.....	51920-00
ORP Combination Electrode, BNC.....		each.....	50230-00

## REPLACEMENT PARTS, continued

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### OPTIONAL APPARATUS (continued)

Description	Unit	Cat. No.
pH Flat Combination Electrode, 5-pin connector.....	each	51915-00
pH Combination Electrode, w/temp., 5-pin connector .....	each	51910-00
pH Gel-filled Electrode, w/temp., 5-pin connector .....	each	51935-00
Potassium Half-cell.....	each	50245-00
Printer Cartridges, black .....	2/pkg	26690-00
Printer Port Cable, 9-pin to 25-pin.....	each	26689-00
Printer, Citizen PN60, 115 V, North American Style Plug .....	each	26687-00
Power Cord, for Citizen PN60, Continental European Style Plug .....	each	46836-00
Reference Electrode, single junction .....	each	50220-00
Reference Electrode, double junction .....	each	50225-00
<i>sensio</i> <sup>TM</sup> <b>1</b> Portable pH Meter.....	each	51700-10
<i>sensio</i> <sup>TM</sup> <b>3</b> Benchtop pH Meter, 120 V, No. American style plug .....	each	51750-10
<i>sensio</i> <sup>TM</sup> <b>3</b> Benchtop pH Meter, 230 V, European style plug .....	each	51750-11
<i>sensio</i> <sup>TM</sup> <b>4</b> Benchtop pH/ISE Meter, 120 V, No. American Style Plug .	each	51775-10
<i>sensio</i> <sup>TM</sup> <b>4</b> Benchtop pH/ISE Meter, 230 V, European Style Plug .....	each	51775-11
Sodium Combination Electrode, BNC.....	each	51925-00
Stir Bar, $\frac{7}{16} \times \frac{3}{16}$ in. ....	each	45315-00
Thermometer, mercury, -20 to 110 °C .....	each	20959-11

# HOW TO ORDER

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## **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, CO 80539-0389  
U.S.A.

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**Ordering information by E-mail:** [orders@hach.com](mailto: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](mailto: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](mailto:intl@hach.com) or contact:

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Telephone: (970) 669-3050; FAX: (970) 669-2932

### **In Europe, the Middle East, or Mediterranean Africa:**

**HACH** Company, c/o

Dr. Bruno Lange GmbH

Willstätterstr. 11

D-40549 Düsseldorf

Germany

Telephone: +49/[0]211.52.88.0

Fax: +49/[0]211.52.88.231

# REPAIR SERVICE

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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 Avenue  
Ames, Iowa 50010  
(800) 227-4224 (U.S.A. only)  
Telephone: (515) 232-2533  
FAX: (515) 232-1276

**In Canada:**

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](mailto:canada@hach.com)

**In Latin America, the Caribbean, the Far East, the Indian Subcontinent, Africa, Europe, or the Middle East:**

Hach Company World Headquarters  
P.O. Box 389  
Loveland, Colorado, 80539-0389  
U.S.A.  
Telephone: (970) 669-3050  
FAX: (970) 669-2932  
E-mail: [intl@hach.com](mailto:intl@hach.com)

# WARRANTY

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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 BINDING 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 specification, 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 *sension*<sup>TM</sup> meters against defective materials or workmanship for three years from the date of shipment.



**HACH COMPANY**  
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