



Cat. No. 54500-18

*sension*<sup>TM</sup>7

**Laboratory  
Conductivity Meter**

# HACH Company Trademarks

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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>sensio</i> n™
BariVer®	ICE-PIC™	Simply Accurate <sup>SM</sup>
BODTrak™	IncuTrol®	SINGLET™
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Gelex®		

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# 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 Power Connections***

 ***Section 2.3 Conductivity Probe Connection***

 ***Section 2.4 Printer and Computer Connections***

 ***Section 6.1 Connecting to Printers/Computers***



# SPECIFICATIONS

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Specifications subject to change without notice.

## Measurement Range:

Conductivity Range	0–19.99 $\mu\text{S}$ ; 20–199.9 $\mu\text{S}/\text{cm}$ ; 200–1999 $\mu\text{S}/\text{cm}$ ; 2–19.99 $\text{mS}/\text{cm}$ ; 20–199.9 $\text{mS}/\text{cm}$
TDS	0–50,000 $\text{mg}/\text{L}$ as NaCl
Salinity	0–42 ppt ( $\%$ )
Temperature	-10 to 105 $^{\circ}\text{C}$

## Resolution:

Conductivity:	
0.00–19.99 $\mu\text{S}/\text{cm}$	0.01 $\mu\text{S}/\text{cm}$
20.0–199.9 $\mu\text{S}/\text{cm}$	0.1 $\mu\text{S}/\text{cm}$
200–1999 $\mu\text{S}/\text{cm}$	1 $\mu\text{S}/\text{cm}$
2.00–19.99 $\text{mS}/\text{cm}$	0.01 $\text{mS}/\text{cm}$
20.0–199.9 $\text{mS}/\text{cm}$	0.1 $\text{mS}/\text{cm}$

TDS:	
0.00–199.9 $\text{mg}/\text{L}$	0.1 $\text{mg}/\text{L}$
200–1999 $\text{mg}/\text{L}$	1 $\text{mg}/\text{L}$
2.00–19.99 $\text{g}/\text{L}$	0.01 $\text{g}/\text{L}$
20.0–50 $\text{g}/\text{L}$	0.1 $\text{g}/\text{L}$

Salinity	0.1 ppt
Temperature	$\pm 0.1$ $^{\circ}\text{C}$

## Accuracy:

Conductivity	$\pm 0.5\%$ of range
TDS	$\pm 0.5\%$ of full scale
Salinity	$\pm 0.1$ ppt (-2 to 35 $^{\circ}\text{C}$ )
Temperature	$\pm 0.3$ $^{\circ}\text{C}$ from 0–70 $^{\circ}\text{C}$ $\pm 1.0$ $^{\circ}\text{C}$ >70–110 $^{\circ}\text{C}$

**Conversion Factor for TDS:** automatic or user adjustable

## Temperature Compensation:

**Manual** (user selected coefficient,  $\%$  per  $^{\circ}\text{C}$ ) or  
**Automatic** (non-linear based on NaCl solutions)

**Display:** Custom LCD

## SPECIFICATIONS, continued

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**Inputs:** 5 pin (with temperature); line power

**Outputs:** One-way RS232

**Power Requirements:** 6–12 V dc; 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:** < $\pm 1$  picoamp at 25  $^\circ\text{C}$ ;  $\pm 4$  picoamp over full range

**Environmental Requirements:** 0 to 50  $^\circ\text{C}$  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.





# 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**

*Das Arbeiten mit chemischen Proben, Standards und Reagenzien ist mit Gefahren verbunden. Es wird dem Benutzer dieser Produkte empfohlen, sich vor der Arbeit mit sicheren Verfahrensweisen und dem richtigen Gebrauch der Chemikalien vertraut zu machen und alle entsprechenden Material Sicherheitsdatenblätter aufmerksam zu lesen.*

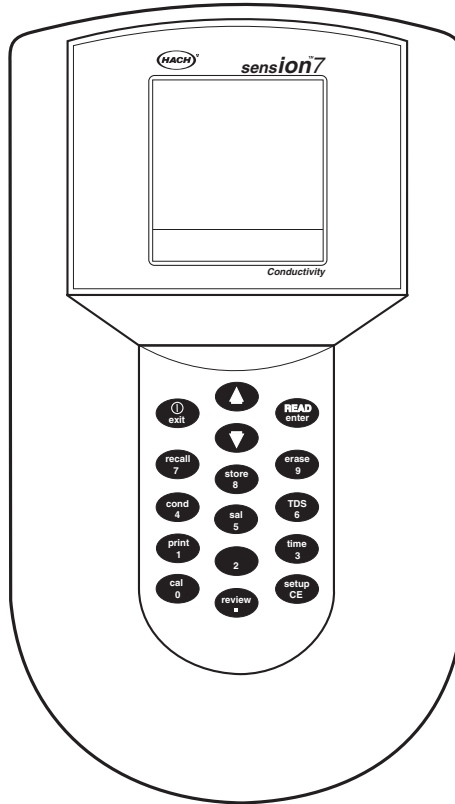
## **PERIGO**

*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.*



The *sensio*<sup>TM</sup>7 Conductivity Meter (*Figure 1*) features a custom digital LCD display that simultaneously displays temperature and measurement results. This meter is splashproof and features datalogging and RS232 communication for printing results to a computer or printer.

**Figure 1** *sensio*7 Conductivity Meter



The meter can be used for a wide variety of applications in the laboratory. Stream samples, saline waters, acids, bases, and other aqueous samples can be easily analyzed for conductivity with the available conductivity probes.

The meter microprocessor automates complicated and time-consuming calibration and measurement procedures for many applications. The direct calibration technique allows calibration by entering actual calibration standard values, eliminating repeated adjustments of cell constants. Conductivity standards, TDS standards, and accessories are available.

## SECTION 1, continued

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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

- Instrument Manual
- Conductivity probe ( $K = 0.5 \pm 10\%$ )
- Conductivity standard (1000  $\mu\text{S}/\text{cm}$ )

## SECTION 1, continued

### 1.2 Keypad Description

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

Figure 2 *sensION7* Meter Keypad

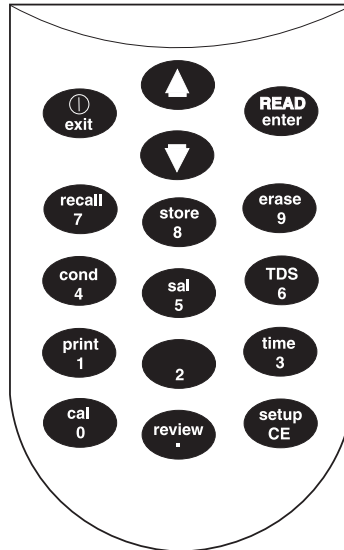


Table 1 Keys and Description

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 illuminated.</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, Erase, or Recall mode</li><li>• Aborts a calibration</li><li>• Exits a calibration review</li></ul>
Arrow Keys	<p>Scroll between options in Setup mode.</p> <p>Scroll through data points in Store and Recall modes.</p> <p>Scroll between the option to print or erase one data point and all data points.</p>

## SECTION 1, continued

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

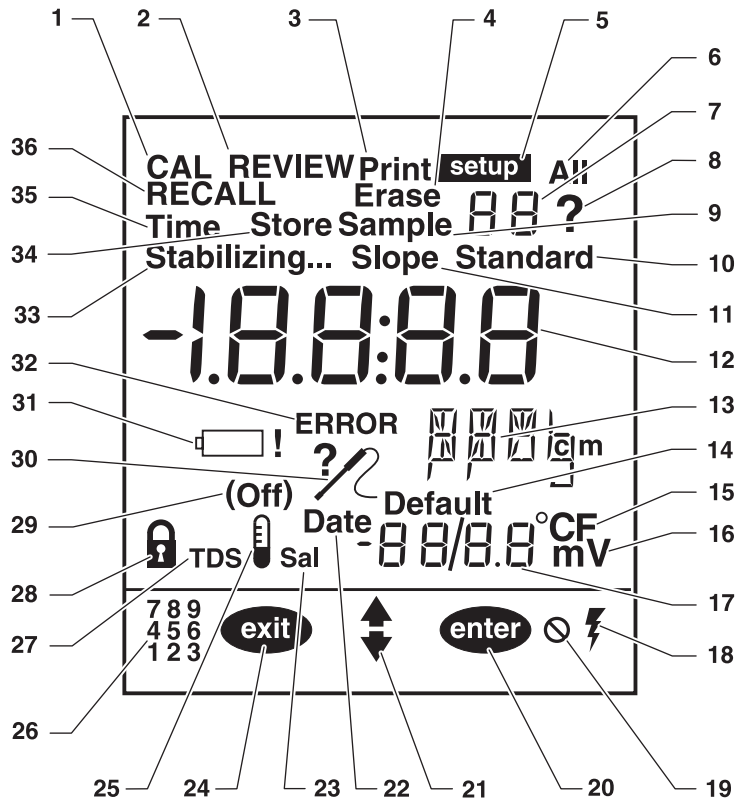
<b>Key</b>	<b>Description</b>
<b>READ/enter Key</b>	Accepts numerical input. Acts as a "YES" answer when the question mark is flashing. Allows user to edit a setup when the setup number is flashing. Accepts the current setup option when that option is flashing. Initiates a new measurement when the meter has stabilized in the Display Lock Enabled mode.
<b>Recall Key</b>	Recalls stored sample data (from Reading mode only).
<b>Store Key</b>	Stores the current (displayed) measurement (from Reading mode only).
<b>Erase Key</b>	Erases recalled data points.
<b>Cond</b>	Displays sample conductivity in Read or Recall mode.
<b>Sal</b>	Displays sample salinity in Read or Recall mode.
<b>TDS</b>	Displays estimated Total Dissolved Solids in Read or Recall mode.
<b>Print Key</b>	Sends current or recalled data to a printer or a computer via the RS232 port.
<b>Time Key</b>	In Reading mode, allows user to view the current time and date. In Recall Data and Calibration Review modes, it toggles between the time and date of the stored measurement.
<b>Cal Key</b>	Enters Calibration mode (from Reading mode only).
<b>Review Key</b>	Enters Calibration Review mode (from Reading mode only).
<b>Setup/CE Key</b>	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, sample temperature, error codes, and meter reading stability. The lower screen displays the active keys.

Figure 3 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 3 Display Elements



## SECTION 1, continued

**Table 2 Main Display Elements**

Item No.	Description
1	Indicates that the meter is in Calibration mode. If the ? is flashing, calibration is necessary.
2	Indicates that the meter is in Calibration Review mode.
3	Indicates data is being sent to a printer/computer.
4	Indicates that recalled data that is currently displayed is being erased.
5	Indicates that the meter is in Setup mode.
6	Indicates that all data points are being printed or erased.
7	Numerical field that displays Setup, Sample, and Standard numbers when those words are displayed to the left of the number. If <b>Standard</b> is displayed, the meter is measuring a calibration standard.
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 that the meter is displaying recalled data.
10	Indicates that the meter is displaying or measuring a calibration standard.
11	NA
12	Numerical field that displays the measured value of standards and samples.
13	Indicates measurement units.
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	NA
17	Numerical field that displays temperature value.
18	NA
19	Indicates that an inactive key has been pressed and that function is not allowed.
20	Indicates that the <b>ENTER</b> key is active.
21	Indicates that the arrow keys are active.
22	In Setup mode, it indicates that the date is being set.
23	Indicates that the displayed value is salinity.
24	Indicates the <b>EXIT</b> key is active.
25	When seen with the (OFF) icon, the temperature compensation is not being used.
26	Indicates that the numeric part of the keys is active.
27	Indicates displayed value is TDS.
28	Display Lock icon. Displayed with item 29.
29	Indicates whether Display Lock or Temperature Compensation setting is <b>On</b> or <b>Off</b> .
30	Faulty probe connection or incorrect probe attached. Usually displayed with an error code.
31	NA



## SECTION 1, continued

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

<b>Item No.</b>	<b>Description</b>
32	Indicates a meter function problem.
33	Flashing word indicates the signal from the sample is not yet stable. When it quits flashing, the reading is stable and may be recorded.
34	Used with ? icon. Asks if the user wants to store the displayed sample data or the calibration that has been just completed.
35	Used with large display to indicate that the time is being set.
36	Indicates that the meter is in recall mode and that 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 when measurement stability is reached during reading mode (three beeps)
- Any time measurement stability is reached during calibration mode, regardless of the Display Lock setting



## 2.1 Instrument Description

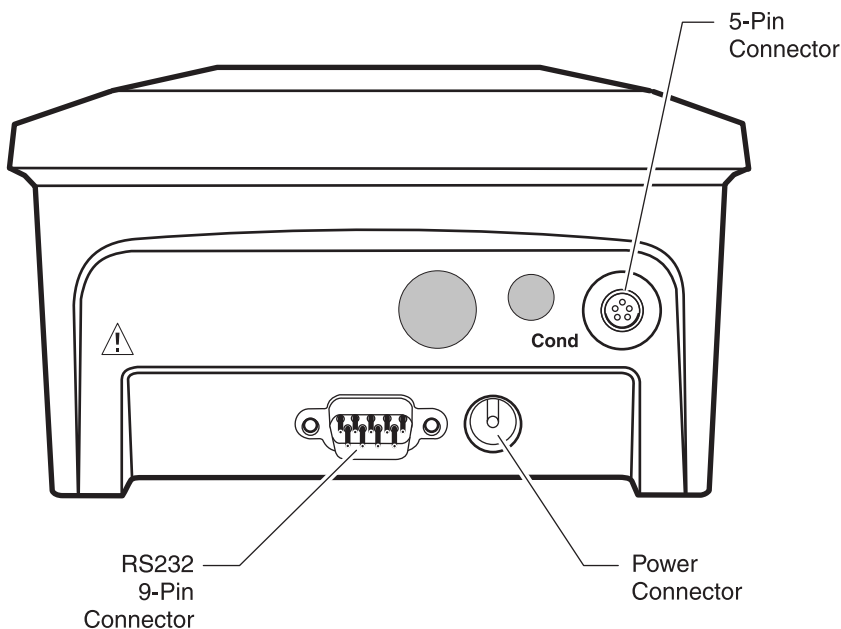
This *sensio*<sup>TM</sup>7 Laboratory Conductivity meter is designed for laboratory use and operates on 115/230 V ac power.

The meter measures from 0  $\mu$ S to 199.9 mS/cm, 0 to 50.0 g/L TDS, 0 to 42 g/L salinity, and the sample temperature. Displayed values are temperature corrected using the measured sample temperature. To display conductivity, TDS, and salinity values, press the **COND**, **TDS**, and **SAL** keys, respectively.

## 2.2 Power Connections

A 115 or 230 V ac 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.

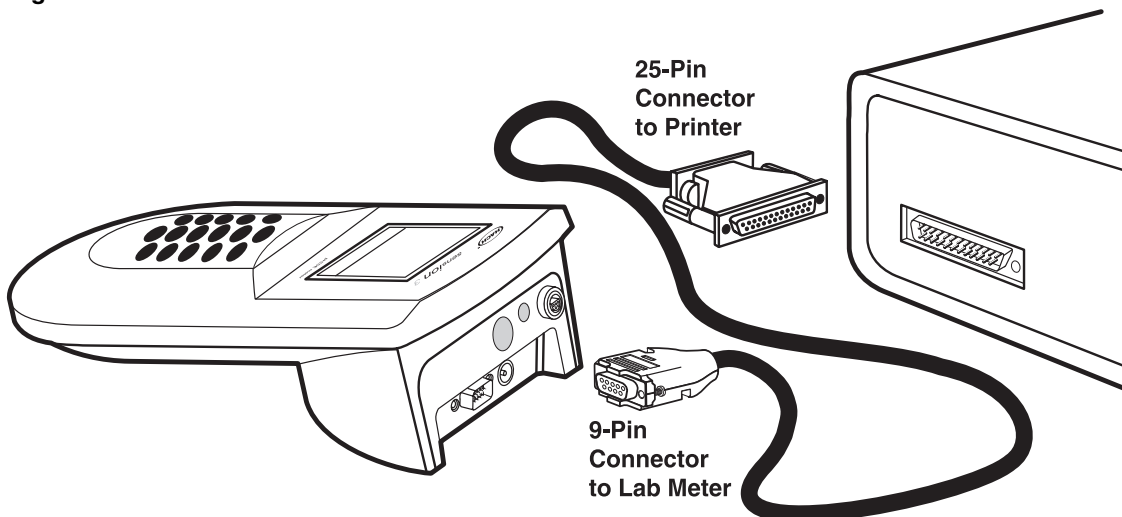
Figure 4



### 2.3 Conductivity Probe Connection

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

Figure 5 *sensION7* Probe Connection



### 2.4 Printer and Computer Connections

The meter can send data to a computer or printer via the 9-pin serial port. **The printer cable and computer cable are different.** The printer cable (Cat. No. 49503-00) is a 9-pin to 25-pin cable and the computer cable (Cat. No. 48129-00) 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. Press the **PRINT** key to send the currently displayed data to the computer. The data may be either a current measurement or recalled data.

### 3.1 Setup Menu

The *sensio*<sup>TM7</sup> Laboratory Conductivity meter setup menu allows the analyst to choose options for display lock, temperature units, time, date, temperature correction factor, TDS calculation factor, and reference temperature.

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 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 *sensio*7 Setup Options**

Setup Number	Description
1	Display lock (On or Off)
2	Temperature units (°C or °F)
3	Temperature Correction (conductivity only) (On or Off)
4	Temperature Correction Factor
5	TDS Correction Factor
6	Reference Temperature Selection (20 or 25 °C)
7	Time of day (24 hour clock)
8	Date (mm/dd)
9	Year (four digits)
10	Timed print function

#### 3.1.1 Turning Display Lock Off and On

Setup 1 is the Display Lock option. This feature stops measurement reading fluctuation on the display once a stable reading is reached. The default setting is On.

When this feature is not used, the measurement value may continue to fluctuate and **Stabilizing...** will be displayed.

1. From the reading mode, press **SETUP**.
2. The **Setup** icon and the number **1** (flashing) will be displayed. Change the Display Lock status by pressing **ENTER**; this

## SECTION 3, continued

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toggles the setting between off and on. When the setting is disabled, the Display Lock icon and **Off** are displayed. When this feature is enabled, the Display Lock icon is displayed without **Off**

3. When the desired option is selected, press **EXIT** to return to the reading mode or an arrow key to scroll to other setups.

### 3.1.2 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 once so the Setup number is **2**.
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 or an arrow key to scroll to other setups.

### 3.1.3 Turning Temperature Correction Off and On

Because the activity of ions in solutions varies with temperature, conductivity measurements are typically corrected for the sample temperature. To obtain conductivity measurements that are not temperature corrected (i.e., using the soil cup), turn this option off. For typical measurements, ignoring the effects of temperature can result in significant error. Salinity and TDS always require temperature compensation. The probe supplied with the meter measures temperature with a thermistor for automatic temperature compensation.

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 **3**.
3. Change the temperature correction status by pressing **ENTER**; this toggles the setting between off and on. When the setting is disabled, the thermometer icon and **Off** are displayed. When this feature is enabled, the thermometer icon is displayed without the **Off** icon.

## SECTION 3, continued

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**Note:** When the thermometer and Off icons appear in the Read mode, the instrument is not correcting the measured conductivity for temperature.

4. Press **EXIT** to return to the reading mode or an arrow key to scroll to other setups.

**Note:** Salinity and TDS measurements always use temperature-compensated conductivity readings even if this feature has been turned off.

### 3.1.4 Entering a Temperature Correction Value

This feature allows selection of a linear or non-linear temperature correction function. The non-linear coefficient has been determined from measurements using aqueous NaCl solutions. If the linear function is chosen, the measured conductivity values are automatically temperature-corrected based on the entered temperature coefficient and the selected reference temperature. The linear temperature correction value for the meter has a default value of 2% per 1 °C.

Conductivity of samples which contain other salts or ions may change at a different rate with temperature. This rate depends on the solution temperature, the ion concentration, and the reference temperature selected, and should be determined experimentally. Once determined, enter the temperature correction value using this setup option.

The Temperature Correction option must be on for the meter to use a temperature correction value (see *Section 3.1.3*).

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 temperature correction value by pressing **ENTER**.

**Note:** If the linear function is currently active, the temperature correction coefficient will appear in the display (i.e., 2.000%). If the non-linear function is active, then NaCl will appear in the display.

4. The ? icon and the flashing NaCl will appear. If the linear function is active, go to *step 5*. If the linear function is not active, press the up arrow key.

## SECTION 3, continued

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5. The main display will show the current value. The numeric keypad will become active.
6. Enter the desired value using the keypad. Once a number key is pressed, the next digit place holder will flash. Continue to enter the desired numbers. Press **ENTER** to accept the value. If an number entry error occurs, start over by pressing the **CE** key.

**Note:** *If the compensation factor is set to 0.00%, the conductivity readings will not be corrected for temperature.*

7. Press **EXIT** to return to the reading mode or an arrow key to scroll to other setups.

Table 4 shows some typical temperature coefficients.

**Table 4 Percentage Change of Conductivity per Degree C**

Solution	Percent/°C
Ultrapure Water	4.55
Salt (NaCl)	2.125
NaOH	1.72
Dilute Ammonia	1.8810
10% HCl	1.325
5% Sulfuric Acid	0.9698
Sugar Syrup	5.64

### 3.1.5 Entering a TDS Correction Factor

This setup lets the user choose a linear or non-linear conversion from conductivity to TDS. TDS measurements use conductivity readings that are temperature-compensated. When the linear conversion is chosen, the meter uses the reference temperature (see *Section 3.1.6*) and the temperature-correction option chosen in *Section 3.1.4* to determine temperature-corrected conductivity. The non-linear (NaCl) conversion uses the non-linear temperature correction function and a reference temperature of 25 °C to convert temperature-compensated conductivity readings to TDS readings.

1. From the reading mode, press **SETUP**.



## SECTION 3, continued

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2. The **Setup** icon and the number **1** (flashing) will be displayed. Press the up arrow until the Setup number is **5**.
3. If the linear TDS conversion is active, the conversion coefficient will appear in the display (e.g., **0.500**). If the non-linear TDS conversion is active, then **NaCl** will appear.
4. To change the conversion type, press **ENTER**. A **?** will appear next to the **5**.
5. Press an arrow key to toggle between linear and non-linear conversion. To choose a non-linear conversion, scroll until a flashing **NaCl** appears, then press **ENTER**.

***Note:** In Reading Mode, the TDS icon indicates the meter is using the default non-linear conversion.*

6. To select a linear conversion, scroll until the conversion factor appears. Use the numeric keypad to set the value of the factor, then press **ENTER**. If an number entry error occurs, start over by pressing the **CE** key.
7. Press **EXIT** to return to the reading mode or an arrow key to scroll to other setups.

### 3.1.6 Selecting a Reference Temperature

When measuring solutions that are not at the reference temperature, the meter automatically adjusts the reading to the conductivity value that would have been measured if the sample had been at the reference temperature. The reference temperature choices are 20 or 25 °C.

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 reference temperature unit by pressing **ENTER**; this key toggles the temperature units between 20 °C and 25 °C. The default is 25 °C.
4. When the desired option is selected, press **EXIT** to return to the reading mode or an arrow key to scroll to other setups.

## SECTION 3, continued

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### 3.1.7 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 **7**.
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 left-most digit(s) is not necessary, use zero for the value (i.e., 08:00 for 8 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 the **CE** key.
6. Press **EXIT** to return to the reading mode or an arrow key to scroll to other setups.

### 3.1.8 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 **8**.
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 the left-most digit is not necessary, use zero for the value (i.e., 02/06 is February 6).

## SECTION 3, continued

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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 an number entry error occurs, start over by pressing the **CE** key.
6. Press **EXIT** to return to the reading mode or an arrow key to scroll to other setups.

### 3.1.9 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 **9**.
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 an number entry error occurs, start over by pressing the **CE** key.
5. Press **EXIT** to return to the reading mode or an arrow key to scroll to other setups.

### 3.1.10 Automatic Data Transfer

This setup feature activates the meter's automatic data transfer (Print) function. The automatic data transfer function automatically sends data through the RS232C depending upon the time interval selected. Time intervals are selected from the following options: 10 seconds, 30 seconds, 1 minute, 5 minutes, 20 minutes, 1 hour, 2 hours, or 6 hours.

Accessing the calibration mode or the setup mode halts automatic data transfer. Also, if the meter has been set to the Lock mode using setup 1, the meter will not send data. When the meter is in Lock mode and the **READ** key is pressed, automatic data transfer will occur at selected time intervals only until the meter stabilizes and the value in the display is locked.

## SECTION 3, continued

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To change the automatic data transfer setup:

1. Press the **SETUP** key.
2. Press the up arrow nine times. A **10** will begin flashing in the upper right hand corner of the display. The current automatic data transfer entry will be displayed.
3. Press the **EXIT** key to leave the value unchanged. To change the value, press the **ENTER** key. The flashing question mark will appear in the upper right corner of the display next to the 10. Use the arrow keys to view the time intervals for automatic data transfer.
4. Press the **ENTER** key and then the **EXIT** key when the desired automatic data transfer time interval appears in the display. The meter will return to the Reading mode.

Each time data transfer occurs, the Print icon will momentarily appear at the top of the display.

To turn off automatic data transfer:

1. Access setup 10 as described above.
2. Press the **ENTER** key.
3. When the question mark is flashing next to the 10, press the down arrow until **(off)** appears in the display.
4. Press the **ENTER** key.
5. Press the **EXIT** key. The meter will return to the Reading mode and automatic data transfer will no longer occur.

### 3.2 Calibrating the Meter

The meter must be calibrated before use. There are two ways to calibrate the meter:

- Using NaCl standards with known electrolytic conductivity. The meter is factory-set for use with a NaCl standard having conductivity of 1000  $\mu\text{S}/\text{cm}$  at 25 °C or a NaCl standard having conductivity of 18 mS/cm at 25 °C. In addition, conductivity of other standards may be entered via the keypad. The meter will use the non-linear temperature coefficient to correct the measurement during calibration.

If using standards that are not sodium chloride-based (i.e., the 53 mS/cm standard), calibrate as closely to 25 °C as possible for best accuracy.

- Entering/adjusting the cell constant of the conductivity probe.

Each method is described in the following sections.

#### 3.2.1 Calibrating with a Known Standard

1. Place the probe in a conductivity standard that is in the expected range of the samples. (Choose from the four meter ranges.) Agitate the probe to dislodge bubbles in the cell. Avoid resting the probe on the bottom or sides of the container.
2. Press **CAL**. Functional keys will appear in the lower left of the display. **CAL**, **?**, and **1.000 1/cm** will appear in the upper display. If the meter has been calibrated, the last calibration value will appear. The numeric keypad will become active.
3. Press the arrow keys to scroll to the factory calibration options (1000  $\mu\text{S}/\text{cm}$  or 18 mS/cm). To calibrate using one of these standards, press **ENTER**.
4. If using a standard with a different value, use the number keys to enter the standard conductivity at 25 °C, then press **ENTER**. The meter will automatically correct the calibration measurement to 25 °C using the NaCl-based, non-linear temperature coefficient.

## SECTION 3, continued

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If the standard has a value at 25 °C in the  $\mu\text{S}/\text{cm}$  range, enter the value when 1000  $\mu\text{S}/\text{cm}$  is displayed. If the standard has a value at 25 °C in the  $\text{mS}/\text{cm}$  range, enter the value when 18  $\text{mS}/\text{cm}$  is displayed. It is not necessary that all four places have a number entered in them. If a number entry error occurs, start over by pressing the **CE** key.

5. When the reading is stable, the calibration is automatically stored and the instrument returns to reading mode.

### 3.2.2 Calibrating by Adjusting the Cell Constant

The Conductivity probe may have slightly different cell constants depending on the nature, temperature, and range of the solution used for calibration.

1. Follow *Section 3.2.1* to calibrate the meter. Be sure the meter is in the conductivity measurement mode.
2. After the calibration is complete, press **REVIEW**. The cell constant for the probe will be displayed. Record this value.
3. Press the up arrow to display the standard concentration value. Record this value. Press **EXIT**.
4. As the conductivity of the sample measurements change, the cell constant can be updated without calibrating with a standard. First, press **CAL**.
5. Functional keys will appear in the lower left part of the display. **CAL** and **?** will appear in the upper display. The main display will show the last value used for calibration.
6. Press the down arrow until the current cell constant is displayed (in  $1/\text{cm}$ ).
7. Use the numeric keypad to enter the cell constant from the previous calibration. If the range of the samples has changed, use a cell constant from a previous calibration in that range. If a number entry error occurs, clear the entry by pressing **CE**.
8. Press **ENTER**. When the calibration is complete, the meter will return to measurement mode.

### 3.3 Reviewing Calibrations

1. From the reading mode, press the **REVIEW** key.
2. The meter will display the current cell constant in 1/cm. Press the up arrow key once.
3. The display will show the value of the standard used for calibration. Press the up arrow once.
4. The display will show the time of the most recent calibration. Press the up arrow once.
5. The display will show the date of the most recent calibration.
6. To exit Cal Review mode, press **EXIT**. To review the standard information again, press the down arrow.

### 3.4 Measuring Total Dissolved Solids

To determine TDS with the *sensio*7 meter, press the **TDS** key on the keypad. The instrument will display the TDS value for the currently displayed conductivity measurement.

The standard method to determine TDS (Total Dissolved Solids) is to evaporate the sample to dryness at 180 °C, then weigh the residue. Another way to estimate TDS is by calculating the concentration of sodium chloride that would have the same conductivity as the sample at the same temperature. The *sensio*7 meter reports a sample's TDS value in mg/L of sodium chloride by comparing the sample conductivity and temperature to data stored in the meter's memory. Data were obtained from empirical procedures using sodium chloride solutions.

### 3.5 Measuring Salinity

To determine salinity with the *sensio*7 meter, press the **SAL** key on the keypad. The instrument will display the salinity value for the sample being measured.

Salinity, a measure of the mass of dissolved salts in a given mass of solution, is used to describe seawater, natural, and industrial waters. Salinity is a relative scale based on a KCl solution. A salinity value of 35 is equivalent to a KCl solution containing 32.4356 g KCl in 1 kg of solution at 15 °C. Salinity is measured

## SECTION 3, continued

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in ‰ (ppt—parts per thousand). The meter calculates the salinity based on the Extended Practical Salinity Scale of 1978, as referenced in 17<sup>th</sup> edition of *Standard Methods*, 25200 B. The applicable range is 0 to 42‰ and –2 to 35 °C.

### 3.6 Measuring Conductivity

Determining conductivity with the *senion7* meter is easy; just press the **COND** key on the keypad. The instrument will display the conductivity value for the sample being measured.

For conductivity, place the probe into the sample and make sure the slot on the end of the probe is totally immersed. Agitate the sample with the probe for 5–10 seconds to remove bubbles that may be trapped in the slot.

Table 5 shows the conductivity ranges of common solutions.

**Table 5 Conductivity Range of Common Aqueous Solutions**

Sample Type	Conductivity Range
High Pressure Boiler Water	<0.1 µS/cm to 0.2 µS/cm
Demineralized Water	1 µS/cm to 80 µS/cm
Drinking Water	100 µS/cm to 1 mS/cm
Wastewater	85 µS/cm to 9 mS/cm
Surface Water	100 µS/cm to 10 mS/cm
Industrial Process Water	8 mS/cm to 130 mS/cm
Concentrated Acids and Dyes	85 mS/cm to >1000 mS/cm

#### 3.6.1 Measuring Low Levels of Conductivity

When the non-temperature corrected conductivity is less than 1 µS/cm, the meter automatically uses the temperature correction coefficients for pure water for the reference temperature selected (derived from *ASTM method D 1125-91*, page 253, 1993).

For increased accuracy, Hach recommends using the Low Ionic Strength Chamber to prevent gases in the atmosphere from changing the conductivity level.

1. Make sure the meter is using the non-linear NaCl temperature correction (see *Section 3.1.4* on page 23).



## SECTION 3, continued

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2. Zero the dry probe by pressing **READ** and **CAL** at the same time. The probe must be dry to obtain a correct value.
3. Calibrate using the 180  $\mu\text{S}/\text{cm}$  standard (see *Section 3.2.1* on page 29).
4. Thoroughly rinse the electrode with the sample.
5. Start the sample flow into the LIS chamber. Insert the conductivity probe into the LIS chamber.
6. Wait for a stable conductivity value, then store or record the result.

**Note:** *If the non temperature-corrected conductivity of the sample increases above 1  $\mu\text{S}/\text{cm}$ , the meter will use the temperature correction coefficients for NaCl. This may cause a noticeable jump in the displayed conductivity reading.*

### 3.7 Operational Notes

When measuring very low conductivity levels ( $< 2 \mu\text{S}$ ), protect the sample from gasses such as ammonia or carbon dioxide. These gasses cause rapid changes in the conductivity when they dissolve into water. To avoid this problem, measure conductivity using the Low Ionic Strength Chamber.

Pretreat water that is likely to contain high amounts of hydroxides (boiler water) with Gallic Acid Solution. Untreated samples may result in falsely high values. To pretreat the sample:

1. Add four drops of Phenolphthalein Indicator Solution to the sample.
2. Stirring constantly, add Gallic Acid Solution until the pink/red color disappears. The solution will become colorless if a small amount of hydroxides is present, or it may turn brownish-yellow if large amounts of hydroxides are present. Adding too much Gallic Acid can increase the conductivity, so add the minimum amount to achieve the color change.

### 3.8 Common Conversion Factors

The *sensio7* meter converts conductivity readings to TDS and salinity values at the touch of a key. *Table 6* lists more conversion factors that may be useful.

**Table 6 Conversions**

To Convert From	To	Use This Equation
mS/cm	μS/cm	mS/cm x 1000
μS/cm	mS/cm	μS/cm x 0.001
μS/cm	μmhos/cm	μS/cm x 1
mS/cm	mmhos/cm	mS/cm x 1
g/L TDS	mg/L TDS	g/L TDS x 1000
mg/LTDS	g/L TDS	mg/L TDS x 0.001
mg/L TDS	gpg TDS	mg/L TDS x 0.05842
g/L TDS	gpg TDS	g/L TDS x 58.42
μS/cm	ohms•cm	1,000,000 ÷ μS/cm
mS/cm	ohms•cm	1,000 ÷ mS/cm

### 3.9 Theory of Operation

Conductivity is the ability of a material to conduct current. Positive and negative ions in a solution will move to the oppositely charged electrode when an electric charge is applied to the solution, thus conducting current. In addition to the current applied, ion movement is affected by the solvent properties (temperature, viscosity) and the physical properties of the ion (size, charge, concentration...). As temperature increases, ions move faster and conduct more current. As viscosity increases, the ions move slower and conduct less current.

For our purposes, conductivity is measured by placing a cell (probe) in an electrolytic solution. A cell consists of two electrodes of a specific size, spaced at a specific distance apart. The conductivity of a liquid is the ratio of current to voltage between the electrodes. The conductivity value changes if the electrodes are spaced closer or further from each other. To have useful analyses, the distance between the two electrodes must be considered in the conductivity calculation.

In theory, a conductivity measuring cell consists of two 1-cm square electrode surfaces spaced 1 cm apart. The cell constant (K)

## SECTION 3, continued

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is determined by the cell length (L) and cross-sectional area (A) ( $K = L \div A$ ). The theoretical cell just described has a cell constant of  $K = 1.0 \text{ cm}^{-1}$ . Cells with larger/smaller electrodes or electrodes spaced at a different distance are characterized by a different cell constant.

Often, the physical characteristics of a cell are designed differently due to sample volume or space. Cells with cell constants of  $1.0 \text{ cm}^{-1}$  or greater normally have small, widely spaced electrodes. Cells with constants of  $K = 0.1 \text{ cm}^{-1}$  or less normally have large, closely spaced electrodes.

Electrolytic conductivity is not the same as specific conductivity. Electrolytic conductivity is a property of the solution being measured; specific conductivity includes the property of the measuring cell, partially defined by its physical design. By defining the physical parameters of the cell, a standard measure is created. This standard measure (specific conductivity) is reciprocal of the resistance (1/ohm), measured between the opposing faces of 1 cm cube of liquid at a specific temperature. The S.I. unit for conductivity is Siemens (S) (1 Siemen = 1 mho). Other units are:  $1/\text{ohm} = 1 \text{ mho} = 1000 \text{ mS} = 1,000,000 \text{ }\mu\text{S}$ .

Since the cell's physical configuration significantly affects the conductivity measurement, it must be multiplied by the conductance to obtain the actual conductivity reading. For example, if the conductance reading is  $350 \text{ }\mu\text{S}$  using a cell with  $K = 0.1 \text{ 1/cm}$ , the conductivity value is  $350 \times 0.1 = 35.0 \text{ }\mu\text{S/cm}$ .

Simply stated, the cell constant is defined as the ratio of the distance between the electrodes (d) to the electrode area (A). However, this neglects the existence of a fringe-field effect, which affects the electrode area by the amount AR. Therefore:

$$K = d/(A + AR)$$

Normally it is not possible to measure the fringe-field effect and the amount of AR to calculate the cell constant. For most uses, the actual cell constant (K) of a specific cell is determined by comparing the measurement of a standard solution of known specific conductivity (e.g., 0.01 M KCl) to the measured conductance.

## SECTION 3, continued

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The conductivity of a solution at a specific electrolyte concentration will change if the temperature changes. For accuracy, measured values should be adjusted for the solution temperature. The temperature-compensated conductivity of a solution is the conductivity that the solution exhibits at the reference temperature. This temperature is either 25 °C or 20 °C. A measurement made at reference temperature does not need compensation.

The *sensION7* meter automatically compensates for temperature during conductivity measurements, using the sample temperature. Temperature compensation is different for different types of samples. Some examples are shown in *Table 4* on page 24. The closer the sample is to the reference temperature, the smaller the error will be if the meter temperature coefficient is not correct.

### 4.1 Storing Measurements

The *sension*<sup>TM</sup>7 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 conductivity (or TDS/salinity) value, the following information is stored and can be downloaded (or printed) for each sample:

- storage location
- software version
- date
- time
- sample temperature
- model and serial number
- conductivity, TDS, or salinity value

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 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 next stored sample data. There are three options at this point:
  - Press **ERASE** 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

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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* for more information.
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 Cleaning the Probe**

Rinse the probe thoroughly with deionized water between measurements. This will minimize the buildup of interfering substances on the probe element.

If the sample contains oils, grease, or fats, the probe may become coated. If this occurs, clean the probe with a strong detergent solution or dip it in a 1:1 hydrochloric acid solution. Rinse thoroughly with deionized water.

For long term storage, rinse the probe with deionized water and store dry.

**5.2 Meter Maintenance**

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



## 6.1 Connecting to Printers/Computers

### 6.1.1 Connecting with the RS232 Cable

The standard 9-pin RS232 connector on the *sensio*<sup>TM</sup>7 Meter connects with a 9-pin D-sub connector. A suitable cable is listed under *REPLACEMENT PARTS* on page 53.

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.

### 6.1.2 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 7* 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 the 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 7 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

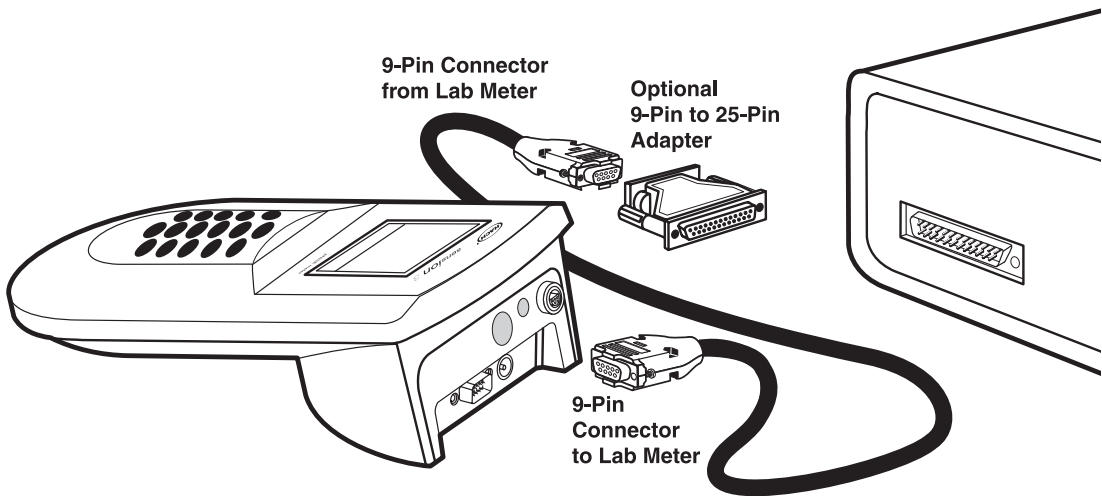
## SECTION 6, continued

Connect the RS232 cable to the *sensio*<sup>TM</sup>7 Meter by lining up the holes in the cable connector with the pins of the serial port. Gently and firmly push the cable into the meter (see *Figure 6*). 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 6** RS232 Cable Connector



### 6.1.3 Connecting to a Personal Computer

Connect the meter to a personal computer (PC) with the computer interface cable (Cat. No. 48129-00) listed under *REPLACEMENT PARTS* on page 53. 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 6, continued

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Table 8 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.

**Table 8 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 meter by lining up the holes in the cable connector with the pins of the serial port. Gently and firmly push the cable into the meter (see *Figure 6*). 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 *sens<sup>ion</sup>* 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:

- IBM® PC/AT or compatible with a 386SX processor (16 MHz or better)

## SECTION 6, continued

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- 4 megabytes of RAM
- Hard disk drive with 2 megabytes or more of free space
- 3½ 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 and DOS 3.3 or later

## 6.2 Sending Data to Printers/Computers

### 6.2.1 Sending Currently Displayed Data

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.

*Note: It is possible to print data before the reading stabilizes. Unstable values are noted with an asterisk on the printout.*

### 6.2.2 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 Recalling Stored Data* on page 38 for more information.
2. When the desired sample data is displayed, press **PRINT**.
3. **Print Sample #** and a flashing ? will be displayed. Press **ENTER**.
4. The word **PRINT** will be briefly displayed, then the meter will return to Recall mode.

## SECTION 6, continued

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### 6.2.3 Sending All Stored Data

1. To transfer all data, it must be recalled first. Press the **RECALL** key while in the Reading mode. See *Section 4.2 Recalling Stored Data* on page 38 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 Recall mode without printing.
  - Press the down arrow to return to the prompt for printing single data points.
  - Press **ENTER** to print all data (data that is displayed 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.

#### 6.2.3.1 Printed Data Format

Printed data will have the following format:

	TDS, Salinity or Conductivity Reading*	Units	Sample Temperature	Alternate Units	Reference Temperature/ Temperature compensation	Date	Time	Serial Number	Software Version
1	400	uS/cm	13.5 °C	0.450/cm	Tref:25 Tc:0.0%	10/03/99	08:30	SI512344577	PX.X
2	557	mg/L	13.5 °C	TDS:NaCl		10/04/99	09:11	SI512344577	PX.X
3	0.6	‰	13.5 °C	881 uS/cm		10/10/99	12:44	SI512344577	PX.X
4	1284	uS/cm	25.0 °C	0.450/cm	Tref:20 Tc:2.00%	10/12/99	23:10	SI512344577	PX.X
5	642	mg/L	25.0 °C	TDS:0.500	Tref:20 Tc:2.00%	10/13/99	13:45	SI512344577	PX.X
6	1412	uS/cm	25.0 °C	0.450/cm	Tref:25 Tc:NaCl	10/13/99	14:23	SI512344577	PX.X

\* Value depends on the mode used to measure the sample. For example, the TDS value will appear in this column if the meter was in TDS mode during the stored measurement.

Tref:= reference temperature in °C; Tc:= temperature compensation in effect;  
TDS:= TDS calculation scheme in effect; 0.450/cm is the cell constant;  
881 µS/cm is the non-temperature corrected conductivity for stored salinity





## 7.1 Introduction

Correcting problem conditions with the *sension*<sup>TM</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 55. **Do not** attempt to service the meter as there are no field serviceable parts. Opening the meter case will void the warranty.

## 7.2 Error Codes

Error codes indicate a functional problem with the meter and/or the electrode. Error code numbers will appear in the temperature field along with other icons. *Table 9* describes the possible error codes and some possible solutions to eliminate the cause.

**Table 9 Error Codes**

Error Code	Error Name & Display Icons	Description
E1	Storage failure	Call Hach Service.
E2	Cell constant is out of range.	Incorrect standard value was entered or an electrode malfunctioned. Prepare fresh buffers/standards and repeat calibration.
E3	Probe error	The value read will not work in the calibration algorithm. Repeat calibration with a new standard. Check electrode.
E6	Conductivity is out of range.	Sample conductivity is too high.
E7	Temperature is out of range. <b>ERROR</b> will be displayed.	Sample temperature is too low for salinity measurement (less than -2 °C).
E8	Temperature is out of range. <b>ERROR</b> will be displayed.	Sample temperature is too high for salinity measurement (greater than 35 °C).
E9	Corrupt data	Recalled data had a bad checksum. Call Hach Service.

## SECTION 7, continued

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### 7.3 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, 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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## REAGENTS

Description	Unit	Cat. No.
Gallic Acid Solution.....	50 mL SCDB .....	14423-26
Phenolphthalein Indicator Solution.....	15 mL SCDB .....	162-36
Potassium Chloride, ACS.....	454 g.....	764-01
Sodium Chloride Standard Solution, 1000 mg/L (1990 ±20 µS/cm, 995 ±5 TDS) .....	100 mL.....	2105-42
Sodium Chloride Standard Solution, 85.47 mg/L (180 ±10 µS/cm, 90 ±5 TDS) .....	100 mL.....	23075-42
Sodium Chloride Standard Solution, 491 mg/L (1000 ±10 µS/cm, 500 ±5 TDS) .....	100 mL.....	14400-42
Sodium Chloride Standard Solution, 10246 mg/L (18000 ±50 µS/cm, 9000 ±25 TDS) .....	100 mL.....	23074-42
Potassium Chloride Standard Solution, (53000 µS/cm, 35 ppt salinity).....	500 mL.....	27143-49

## APPARATUS

Beaker, poly, 50 mL .....	each.....	1080-41
Bottle, wash, 125 mL .....	each.....	620-14
Computer Interface Cable, 9-pin to 9-pin .....	each.....	48129-00
Low Ionic Strength Chamber .....	each.....	51899-00
Power Supply for meter, 115 V.....	each.....	51898-00
Power Supply for meter, 230 V.....	each.....	46080-00
Probe, Conductivity, cell constant = .45 wire, 1 m cable.....	each.....	51975-00
Probe, Conductivity, cell constant = .45 wire, 3 m cable.....	each.....	51975-03
Printer, Citizen PN60I, 115 V, North American plug.....	each.....	26687-00
Printer, Power Cord, European style for Citizen PN60I printer.....	each.....	46836-00
Printer Interface Cable, 9-pin to 25-pin .....	each.....	49503-00
Software, HachLink™, 3½ in.Disk.....	each.....	49665-00

# 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)**.

## **International Customers**

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:

### **In Canada, Latin America, Africa, Asia, Pacific Rim:**

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.



# 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>TM</sup>7 Conductivity 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 & CSA Certified or

230 Vac Supply, CE Marked per 73/23/EEC, VDE Listed

## EMI Immunity:

Instrument Tested with the 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 Field Immunity (Criteria A, @ 1 V/m)

IEC 1000-4-4:1995 (EN 61000-4-5:1995) 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 Disturbances Induced by RF Fields (Criteria A, @ 3 V/m)

IEC 1000-4-11:1994 (EN 61000-4-11:1994) Voltage Dip/Short Interruptions (Criteria B)

### Additional immunity Standard/s include:

ENV 50204:1996 Radiated Electro-Magnetic Field from Digital Telephones (Criteria A, @ 3 V/m)

## CERTIFICATION, continued

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### Emissions:

Instrument Tested with the 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 Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01), certified compliance by Hach Company.

#### **Standards include:**

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

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

#### **Additional Emissions Standard/s include:**

**EN 55011 (CISPR 11)**, Class “B” emission limits

#### **CANADIAN INTERFERENCE-CAUSING EQUIPMENT REGULATION, IECS-003: Class “A” emission limits.**

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01), 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 emission “A” limits.**

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01), 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 *sensio7* Conductivity Meter to verify that the meter is or is not the source of the interference.
2. Move the *sensio7* Conductivity Meter and its power supply away from the device receiving the interference.
3. Reposition the receiving antenna for the device receiving the interference.
4. Try combinations of the above.



**HACH COMPANY**  
WORLD HEADQUARTERS  
P.O. Box 389  
Loveland, Colorado 80539-0389  
Telephone: (970) 669-3050  
FAX: (970) 669-2932

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**FOR TECHNICAL ASSISTANCE, PRICE INFORMATION AND ORDERING:**

In the U.S.A. - **Call toll-free 800-227-4224**

Outside the U.S.A. - **Contact the HACH office or distributor serving you.**

On the Worldwide Web - **[www.hach.com](http://www.hach.com)**; E-mail - **[techhelp@hach.com](mailto:techhelp@hach.com)**

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