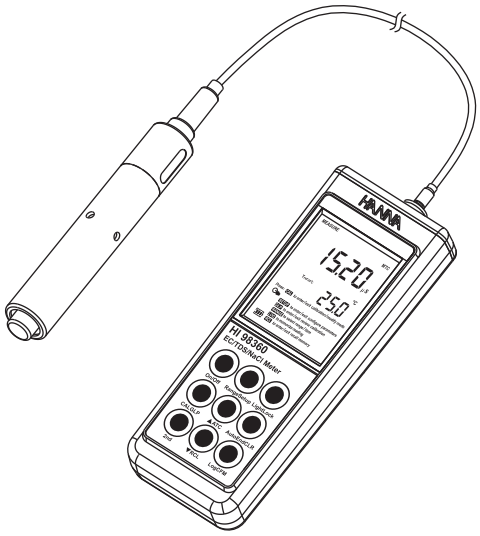
Instruction Manual

HI 9835 HI 98360

Auto Ranging EC/TDS/NaCl/ Temperature Meters



HANNA instruments®
www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Instruments product.

Please read this instruction manual carefully before using the instruments.

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

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com.

WARRANTY

HI 9835 and **HI 98360** are guaranteed for two years against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. Electrodes and probes are guaranteed for six months. This warranty is limited to repair or replacement free of charge.

Damage due to accidents, misuse, tampering or lack of prescribed maintenance is not covered.

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

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PRELIMINARY EXAMINATION

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

Each instrument is supplied with:

- **HI 76309** Conductivity probe with 1 m cable (**HI 9835**)
- **HI 76309/1.5** Conductivity probe with 1.5 m cable (**HI 98360**)
- 3 x 1.5V AAA Batteries
- Instruction Manual
- Rugged Carrying Case

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

GENERAL DESCRIPTION

HI 9835 and **HI 98360** are state-of-the-art, handheld conductivity meters, designed to provide laboratory results and accuracy under harsh industrial conditions.

These instruments are provided with a series of new diagnostic features and messages on the LCD which add an entirely new dimension to the measurement of EC, TDS and NaCl, by allowing the user to dramatically improve the reliability of the measurement.

The autoranging feature of the EC and TDS ranges automatically sets the meter to the scale with the highest possible resolution.

The Auto Endpoint feature automatically freezes the display when a stable reading is reached.

The measurements are automatically (ATC) or manually (MTC) compensated for temperature. The temperature coefficient value is user selectable. It is possible to disable the temperature compensation and measure the absolute (uncompensated) conductivity.

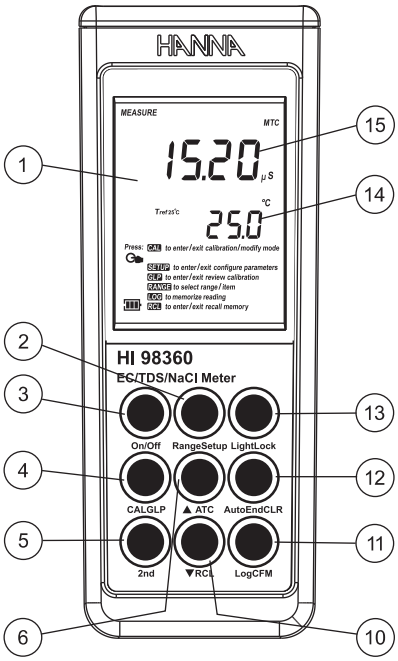
The **HI 98360** also has a logging feature (up to 500 records) and allows data transfer to computer through the USB port.

The Battery Error Preventing System (BEPS) detects when the batteries become too weak to ensure reliable measurements.

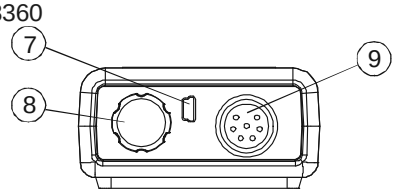
The backlight feature is automatically disabled when batteries are getting low and a clear indication is displayed to warn the user of this condition. However, the meter continues to measure correctly even when the low battery indication is displayed. The meter automatically switches itself off when the batteries are too weak to support proper function.

In addition, the meters allow the user to enter an ID code to uniquely identify the instrument.

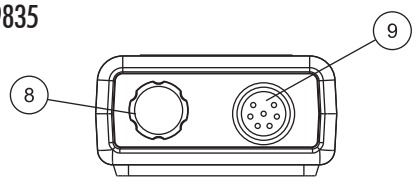
FUNCTIONAL DESCRIPTION



HI 98360



HI 9835



1) Liquid Crystal Display (LCD).
2) **Range** key, to select EC/TDS/NaCl range.
   Setup key, to enter/exit SETUP mode.
3) **On/Off** key, to turn the instrument ON and OFF.
4) **CAL** key, to enter/exit calibration mode.
   GLP key, to display Good Laboratory Practice information.
5) **2nd** key, to select second key function.

6) ▲ key, to manually increase temperature or other parameters.
   ATC key, to select temperature compensation mode.
7) USB connector (**HI 98360** only).
8) Battery compartment cap.
9) DIN connector for EC probe.
10) ▼ key, to manually decrease temperature or other parameters.
    RCL key, to enter/exit view logged data mode (**HI 98360** only).
11) **Log** key, to store measured data (**HI 98360** only).
    CFM key, to confirm different values.
12) **AutoEnd** key, to freeze first stable reading on the LCD.
    CLR key, to delete logged data (**HI 98360** only).
13) **Light** key, to toggle display backlighting.
    Lock to freeze/unfreeze the current displayed range.
14) Secondary LCD.
15) Primary LCD.

SPECIFICATIONS

RANGE	0.00 to 29.99 µS/cm 30.0 to 299.9 µS/cm 300 to 2999 µS/cm 3.00 to 29.99 mS/cm 30.0 to 200.0 mS/cm up to 500.0 mS/cm uncompensated(*) conductivity
	0.00 to 14.99 ppm 15.0 to 149.9 ppm 150 to 1499 ppm 1.50 to 14.99 g/l 15.0 to 100.0 g/l up to 400.0 g/l uncompensated(*) TDS (with 0.80 factor)
	0.0 to 400.0 % NaCl
	–20.0 to 120.0 °C
RESOLUTION	0.01 µS/cm 0.1 µS/cm 1 µS/cm 0.01 mS/cm 0.1 mS/cm
	0.01 ppm 0.1 ppm 1 ppm 0.01 g/l 0.1 g/l
	0.1% NaCl
	0.1°C
ACCURACY @ 20 °C / 68 °F	±1% of reading ±0.05 µS/cm or 1 digit, whichever greater
	±1% of reading ±0.03 ppm or 1 digit, whichever greater
	±1% of reading NaCl
	±0.2°C (excluding probe error)
EC Calibration	1 point with 6 buffers available: 84.0, 1413 µS/cm 5.00, 12.88, 80.0, 111.8 mS/cm

(*) Uncompensated conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.

NaCl Calibration	1 point with **HI 7037** buffer (optional)
Temperature Calibration	2 point, at 0 and 50°C (32 and 122°F)
Temperature Compensation	Manual or Automatic from –20.0 to 120.0ºC (-4.0 to 248.0°F) (can be disabled to measure absolute conductivity)
Temperature Coefficient	0.00 to 6.00 %/ºC (for EC and TDS only); default value is 1.90 %/ºC
Reference Temperature	20ºC or 25ºC
TDS Factor	0.40 to 0.80 (default value is 0.50)
Probe	**HI 76309** EC probe (included for **HI 9835**) **HI 76309/1.5** EC probe (included for **HI 98360**)
Log	on demand 500 records (**HI 98360** only)
Auto-off	After 5, 10, 20, 60 minutes (can be disabled)
PC Communication	Optoisolated USB (**HI 98360** only)
Battery Type & Life	3 x 1.5 AAA bratteries approx. 200 hours of contimuous use without backlight (50 hours with backlight)
Dimensions	185 x 72 x 36 mm (7.3 x 2.8 x 1.4")
Weight	300 g (10.6 oz)
Environment	0 – 50 ºC (32 – 122 ºF) max. RH 95%
Warranty	2 years

OPERATIONAL GUIDE

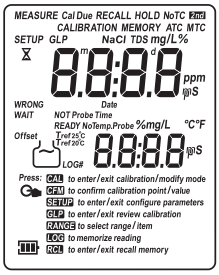
INITIAL PREPARATION

The instrument is supplied complete with batteries. In order to place the batteries inside the instrument follow the instructions from page 28.

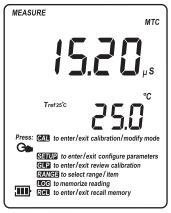
To prepare the instrument for use, connect the EC probe to the input socket on the top of the instrument.

Turn the instrument ON by pressing **On/Off**.

At start-up the display will show all the used segments for a few seconds (or while the button is held), followed by the percentage indication of the remaining battery life. During instrument startup the "⧖" and "**WAIT**" tags will blink.



The meter is now ready to operate.



Submerse the probe into the solution to be tested. The sleeve holes must be completely submersed. Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.

If needed, press the **Range** key repeatedly until the desired range (EC, TDS, NaCl) is selected on the LCD.

Allow for the reading to stabilize. The upper LCD displays the measure in the selected range while the temperature is displayed on the lower LCD.

The auto-off feature turns the instrument off after a set period (default 20 minutes) with no button pressed to save battery life. To set another period or to disable this feature, see SETUP menu on page 18.

The auto-off backlight feature turns the backlight off after a set period (default 1 min) with no buttons pressed. To set another period or to disable this feature, see SETUP menu on page 18.

Notes: • If the reading is out of range, the full scale value will be displayed blinking.
- If the reading is not stable, the instability indicator "⧖" will be on.
- Make sure the meter is calibrated before taking measurements.
- If measurements are taken successively in different samples, it is recommended to rinse the probe thoroughly with deionized water before immersion in the samples. If possible rinse with sample also.
- To maximize battery life, the meter is automatically switched off after a set period of non-use. To reactivate the instrument press the **On/Off** key. This feature can be disabled (see SETUP section for details).
- TDS reading is obtained multiplying the EC reading by the TDS factor, which has a default value of 0.50. It is possible to change the TDS factor in the 0.40 to 0.80 (see SETUP section). Always set the reference temperature to 25°C when measuring TDS.
- When the use of an alternate function is requested, press the **2nd** key.

BACKLIGHT FEATURE

The instrument is provided with a Backlight feature to enhance display readability in low light conditions. It can be easily toggled on and off through the keypad by pressing **Light**.

Note: The backlight automatically shuts off after a set time period to save battery life (see SETUP for details, page 18).

If battery percentage is less than 20% the backlight can not be ON.

AUTO-RANGING

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

By pressing **2nd** then **Lock**, the auto-ranging feature is disabled and the current range is frozen on the LCD. The "**MEASURE**" tag is displayed blinking.

To restore the auto-ranging option press **2nd** then **Lock** again.

Note: Auto-ranging is automatically restored if the **Range** or **2nd** then **Lock** keys are pressed, if the setup or calibration modes are entered and if the meter is turned off and back on again.

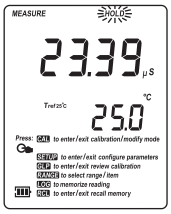
- If **2nd** then **Lock** was pressed to freeze the LCD range and the reading goes out of range, the full-scale value of the frozen range will be displayed blinking.

AutoEnd

To freeze the first stable reading on the LCD press **AutoEnd** while the instrument is in measurement mode.

The "**HOLD**" tag will be displayed blinking on the LCD until the reading is stabilized.

When the reading is stable, the "**HOLD**" tag stops blinking and the reading is frozen on the LCD.



Press **AutoEnd** again to return to normal measurement mode.

Note: • Pressing **Range** the instrument will skip to the displayed range, without leaving AutoEnd mode. The **Log** key also holds AutoEnd mode.

• Pressing **2nd** then **Setup**, **GLP** or **RCL**, the instrument leaves AutoEnd mode and performs the selected function.

TEMPERATURE COMPENSATION

The EC reading is affected by temperature and changes in ion concentration.

To measure only one variable, conductivity measurements are normally compensated to a fixed temperature. This reference temperature is configured in SETUP parameter rEF. See page 18.

Three options of temperature compensation are available:

Automatic (Atc): The probe has a built-in temperature sensor; the value of the temperature is used to automatically compensate the EC/TDS measurement to a reference temperature. This is the default option.

Manual (Mtc): The temperature value, shown on the lower LCD, can be manually set by the user with the up and down arrow keys to the solution temperature. The "**ºC**" or "**ºF**" symbol blinks when this option is active. The instrument compensates the conductivity measured at this temperature to the reference temperature.

No Compensation (NoTC): The temperature reading shown on the lower LCD is not taken into account. The reading displayed on the upper LCD is the absolute EC or TDS value without temperature compensation applied. The measurement changes due to temperature and ion concentration. The second "**ºC**" or "**ºF**" symbol blinks when this option is active.

To select the desired option press the **2nd** then **ATC** key. The option tag will blink for a few seconds then remain active on the LCD.

If temperature compensation is active, measurements are compensated using a default temperature coefficient of 1.90 %/°C to the 25°C reference temperature. This is a natural water tc value.

It is possible to view or select a different temperature coefficient (TC) in the 0.00 to 6.00 %/°C range by entering the setup mode and selecting the "**tc**" item (see SETUP section for details).

Notes: • The default compensation mode is Atc.
- If no temperature probe is detected, Atc mode can not be selected and the instrument displays "----" on the secondary LCD.
- If the temperature reading is out of the -20.0 – 120.0 ºC range and Atc option is selected, the "**ºC**" tag will blink and the closest interval limit will be displayed.
- By pressing the **ARROW** keys the displayed temperature value is changed. This value is used to compensate the EC/TDS reading.

Temperature compensation is performed by means of the following formula:

$$\text{Compensated conductivity} = \frac{\text{Measured conductivity}}{1 + TC_{25}(T - T_{ref})}$$

where T is the measured temperature and T_{ref} is the reference temperature (20 or 25°C).

Note that if a solution has a temperature coefficient TC with $T_{ref} = 25°C$, when changing the reference temperature to 20°C, the temperature coefficient must be manually adjusted by the user according to the following formula:

$$TC_{20} = \frac{TC_{25}}{1 - TC_{25}/20}$$

For example, $TC_{20} = 2.10\%/°C$ when $TC_{25} = 1.90\%/°C$.

Always set reference temperature to 25°C when measuring TDS.

TDS MEASUREMENTS

Press the **Range** key while in EC range. The instrument will switch to TDS measuring range. The TDS reading will be displayed on the primary LCD and the temperature reading on the secondary LCD.

- If the reading is out of range, the full-scale value (100.0 for **MTC/ATC** mode or 400.0 for uncompensated TDS) will be displayed blinking.

NaCl MEASUREMENTS

Percent sodium chloride on these meters refers to percentage of seawater salinity. 100% is equal to seawater. The scale goes from 0 - 400%.
Press the **Range** key while in EC range until NaCl is displayed on the LCD. The instrument will display the NaCl reading on the primary LCD and the temperature reading on the secondary LCD line.

- If the reading is out of range, the full-scale value (400.0%) will be displayed blinking.

EC/TDS CALIBRATION

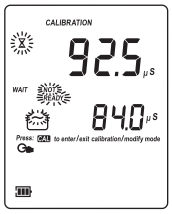
EC calibration on these meters is a single point procedure. Selectable calibration points are: 0.0 for offset and 84.0 μS/cm, 1413 μS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm for slope.

To enter EC calibration select the EC range and press the **CAL** key.

Note: **TDS reading is automatically derived from the EC reading and no specific calibration for TDS is needed. Pressing CAL while TDS range is selected has no effect.**

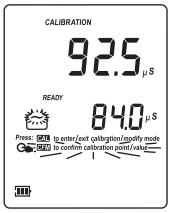
Rinse the probe with some of the calibration solution or deionized water. Submerse the probe into the solution. The sleeve holes must be completely submersed. Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.
For zero calibration, suspend the dry probe in air.
This calibration is performed in order to correct the reading arround 0.0 μS/cm.

Press **CAL** and the "**CALIBRATION**" tag is displayed and "**NOT READY**", "~" and "⧖" will blink. The primary LCD will display the EC reading. The secondary LCD will display the standard value.



Select the desired calibration value with the **ARROW** keys, if necessary.

When the reading is stable, "**READY**" tag is displayed and "**CFM**" along with "∼" tag starts blinking on the LCD, asking for confirmation.

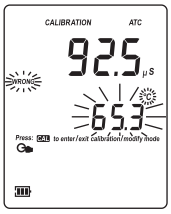


Press **CFM** (or **2nd** then **CFM**) to confirm calibration.

The instrument stores the calibration value and returns to measurement mode.

Notes:

- If the uncalibrated reading is too far from the expected value, the "**WRONG**" tag will blink. Calibration can not be confirmed. In this case check if the correct standard has been used or clean the probe by following the Probe Maintenance (see page 31).
- If the meter is in **MTC** or **ATC** mode and the standard temperature is out of the 0.0 - 60.0 °C interval, "**WRONG**" "**°C**" tags and the temperature will be displayed blinking.



- For best results choose an EC standard value close to the sample to be measured.
- In order to minimize any EMC interference, use plastic or glass beakers.
- It is possible to set the cell constant value directly in according with the specifications of the electrode indicated by the manufactures, without following the calibration procedure. To set the cell constant, enter SETUP mode and select "**CELL**" (see SETUP for details, page 18).

CONDUCTIVITY VERSUS TEMPERATURE CHART

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

The conductivity invariably increases with increasing temperature.

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

The following table lists the temperature dependence of HANNA EC calibration standards.

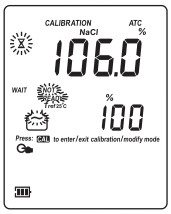
°C	°F	HI7030 HI8030 (µS/cm)	HI7031 HI8031 (µS/cm)	HI7033 HI8033 (µS/cm)	HI7034 HI8034 (µS/cm)	HI7035 HI8035 (µS/cm)	HI7039 HI8039 (µS/cm)
0	32	7150	776	64	48300	65400	2760
5	41	8220	896	65	53500	74100	3180
10	50	9330	1020	67	59600	83200	3615
15	59	10480	1147	68	65400	92500	4063
16	60.8	10720	1173	70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

NaCl CALIBRATION

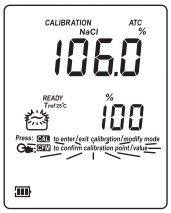
NaCl calibration is a one-point procedure at 100.0% NaCl. Use the **HI 7037L** calibration solution (sea water solution) as a 100% NaCl standard solution.

Rinse the probe with some of the calibration solution or deionized water. Submerse the probe into **HI 7037L** solution. The sleeve holes must be completely submersed. Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.

To enter NaCl calibration select the NaCl range and press **CAL**.



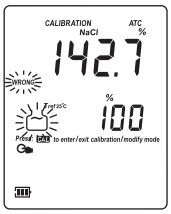
The "**CALIBRATION**" tag is displayed, "**NOT READY**", "〜" and "⧖" start blinking. The primary LCD will display the NaCl reading in percentage. The secondary LCD will display "**100**".



When the reading is stable, the "**READY**" tag will be displayed and the "**CFM**" tag starts blinking on the LCD, asking for confirmation.

Press **CFM** to confirm calibration.

The instrument stores the calibration value and returns to measurement mode.



<u>Notes</u>:

- If the reading is too far from the expected value, "**WRONG**" and "⌓" tags will blink. Calibration cannot be confirmed.
- If the temperature of the standard is out of the 0.0 – 60.0 °C temperature range, the "**WRONG**", "⌓" and "**°C**" tags and the temperature will be displayed blinking.
- If the meter range is changed to EC, and a new EC calibration is performed, the NaCl calibration is automatically cleared. Thus, a new NaCl calibration is required.

GOOD LABORATORY PRACTICE (GLP)

GLP is a set of functions that allows storage and retrieval of data regarding the calibration and status of the probe and meter.

All data regarding EC or NaCl calibration is stored for the user to review when necessary.

LAST EC CALIBRATION DATA

The last EC calibration data is stored automatically after a successful calibration. To view the EC calibration data, press **2nd** then **GLP** when the instrument is in EC measurement mode.

The instrument will display the date (mm.dd) and the time (hh:mm) of the last calibration.

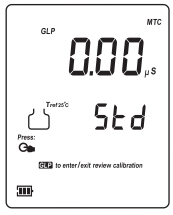
Press the **ARROW** keys to view the next calibration parameter.

Pressing the ▲ key:

- The EC calibration offset factor.

- The calibration cell constant.

- The calibration standard.



• The temperature coeficient.

• The instrument ID.

LAST NaCl CALIBRATION DATA

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

To view the NaCl calibration data, press **GLP** when the instrument is in NaCl measurement mode. The instrument will display:

• The date and time.

Press the **ARROW** key to view the next logged calibration parameters (pressing the ▲key).

• The cell constant (as for EC range).

• The salinity coefficient.

• The instrument ID (as for EC range).

Notes: • If **NoTC** is selected as temperature compensation mode during calibration, the temperature coefficient is not displayed in GLP.

• Press **GLP** at any moment and the instrument will return to measurement mode.

• If calibration has not been performed in NaCl range, the instrument displays "**no CAL**" message blinking.

SETUP

Setup mode allows viewing and modifying the following parameters:

- Cell constant (CELL)
- TDS factor (FAct)
- Temperature coefficient (tc)
- Reference temperature (rEF)
- Current Time (hour & minute)
- Current Date (month, day & year)
- Beep Status (bEEP)
- Instrument ID (InSId)
- Auto-off backlight timer (LIGH)
- Auto power off timer (AOFF)
- Temperature Unit

To enter SETUP mode, press **2nd** then **Setup** while the instrument is in measurement mode.

Select the desired setup parameter using the **ARROW** keys.

Press **CAL** if you want to change the item value. "**CFM**" tag and the selected item (e.g. hour, in setting up the correct time) will start blinking.

Press the **ARROW** keys to change the displayed value.

If there is another item to be set (e.g. minutes), press **Range**. The other item will start blinking.

Press the **ARROW** keys to change the displayed value.

Press **CFM** (or **2nd** then **CFM**) to confirm or **CAL** to escape without saving.

Press the **ARROW** keys to select the next/previous parameter.

Press **Setup** to exit SETUP menu at any time.

The following table (see page 19) lists the SETUP parameters, their valid values range and the factory settings (default). Use ▲ to move through parameters in this order.

SETUP PARAMETERS			
Abbreviation	**What it does**	**Valid Values**	**Default**
CELL	Cell constant for EC probe.	0.500 to 1.700/cm	1.000/cm
FAct TDS	Factor used to convert conductivity to a total dissolved solid value displayed in ppm. When FAct = 5; 100 uS/cm = 50 ppm. This is a good approximation for a neutral salt solution.	0.40 to 0.80	0.50
tc	tc is a temperature compensation factor that is used in Automatic and Manual temperature compensation. This factor is used with the temperature measurement to "correct" the measurement to a reference temperature. See page 11.	0.00 to 6.00%/°C	1.9%/°C
rEF	rEF is the temperature value used above. The temperature reference is regional specific.	20 to 25°C	25°C
Time	This value is used to reference calibrations and logging using a 24 hour clock. (hh:mm)	00:00 to 23:59	0:00
Date	This value is used to reference calibrations and logging. (mm.dd.yyyy)	01.01.2000 to 12.31.2099	01.01.2009
bEEP	Beep tone used to signal errors and confirming change.	On/Off	OFF
InSId	Instrument ID: Give this instrument a discreet #. When downloading logs this instrument will be identified.	0000 to 9999	0
LIGH	Backlight timer. If backlight is turned on display, permits it to be automatically turned off to save battery power.	Off, 1, 5 or 10 minutes	1 minute
AOFF	Auto off timer: Permits unit to turn off after preset time to save battery power.	Off, 5, 10, 20 or 60 minutes	20 minutes
	Temperature unit displayed.	°C or °F	°C

LOGGING (HI 98360 only)

This feature allows the user to log EC, TDS or NaCl measurements, together with corresponding temperature automatically. All logged data can be transferred to a PC through the USB port.

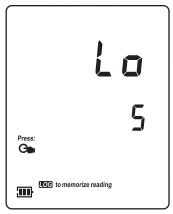
The maximum logging space is 500 record locations.

LOGGING THE CURRENT DATA

To store the current reading into memory, press **Log** while in measurement mode.

The instrument will display the current date (mm.dd) on the primary LCD, the record number on the secondary LCD and then the number of available tags remaining.

If there are less than 6 memory locations remaining, the "**Lo**" message will blink for a few seconds to alert the user, and then the available log number is displayed on the LCD.



If the LOG space is full, "**FULL LOG**" message will be displayed on the LCD for a few seconds and then "**FrEE 0**" message.

The instrument returns to normal measurement mode.

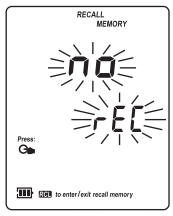
VIEW LOGGED DATA

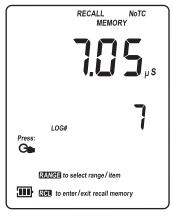
Press **2nd** then **RCL** to retrieve the information stored while in measurement mode for the specific range. "**RECALL MEMORY**" will be displayed on LCD.

If no records were logged, the instrument will display "**no rEC**" message blinking.

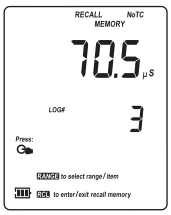
Otherwise, the instrument will display the logged data, in according with the selected range:

- If RCL mode was entered while the instrument was in EC range: the last **EC** memorized reading appears on the primary LCD and the record number on the secondary LCD.
- If RCL mode was entered while the instrument was in TDS range: the last **TDS** memorized reading appears on the primary LCD and the record number on the secondary LCD.





- If RCL mode was entered while the instrument was in NaCl range: the last **NaCl** memorized reading appears on the primary LCD and the record number on the secondary LCD.



Press **2nd** then **Setup** while in RECALL mode, when the record number is not displayed and the instrument will toggle between the record number on the secondary LCD and the current displayed information. Use the **ARROW** keys to select another record.

Press **Range** and the instrument will display the next logged parameter as shown in the table below:

Parameter	Primary LCD	Secondary LCD
EC	EC reading	Temperature
DATE/TIME	Month & day	Hour & minutes
Cell/Off	Cell value	Offset value

Press **2nd** then **CLR** or simply **CLR** to delete records.

The "**dEL**" message is displayed on the primary LCD, the record number on the secondary LCD and "**CFM**" tags will blink.

- Press the **ARROW** keys to change the record number.
- Press **CAL** or **Range** or **CLR** to escape from DEL screen and enter view record items mode.

Note: Pressing **2nd** then **Setup** the instrument toggles between record number and all records.

- Press **2nd** then **CFM** or **CFM** to confirm delete. The "**nuLL**" message will be displayed on the primary LCD for the selected record. While "**nuLL**" message is displayed the **2nd**, **CAL**, **Range** and **CLR** keys are inactive. Press the **ARROW** keys to select an undeleted record.
- If "**dEL ALL**" option was selected, all logged data are deleted and the instrument returns to measurement mode.

Press **2nd** then **RCL** at any time to return to measurement mode.

The "⧖" and "**WAIT**" tags blinks during memory reorganization.

TEMPERATURE CALIBRATION (for technical personnel only)

All the instruments are factory calibrated for temperature.

Hanna's temperature probes are interchangeable and no temperature calibration is needed when they are replaced.

If the temperature measurements are inaccurate, temperature recalibration should be performed.

For an accurate recalibration, contact your dealer or the nearest Hanna Customer Service Center, or follow the instructions below.

- Prepare a vessel containing ice and water and another one containing hot water (at approximately 50 °C or 122 °F). Place insulation material around the vessels to minimize temperature changes.
- Use a calibrated thermometer with a resolution of 0.1 °C as a reference thermometer. Connect the EC probe to the appropriate socket.
- With the instrument off, press and hold down the **Range** & ▼ keys, then power on the instrument. The "**CALIBRATION**" tag will appear and the secondary LCD will show "**0.0 °C**". The primary LCD will display the measured temperature or the "----" message, if the measured temperature is out of range.
- Submerse the temperature probe into the vessel with ice and water as close as possible to the reference thermometer. Allow a few seconds for the probe to stabilize.
- Use the **ARROW** keys to set the reading on the secondary LCD to that of ice and water, measured by the reference thermometer. When the reading is stable and close to the selected calibration point, "**CFM**" tag will blink.

- Press **CFM** to confirm. The secondary LCD will display "**50.0 °C**".

- Submerse the temperature probe into the second vessel as close as possible to the reference thermometer. Allow a few seconds for the probe to stabilize.
- Use the **ARROW** keys to set the reading on the secondary LCD to that of the hot water.
- When the reading is stable and close to the selected calibration point, "**CFM**" tag will blink.
- Press **CFM** to confirm. The instrument returns to measurement mode.

Note: If the reading is not close to the selected calibration point, "**WRONG**" tag will blink. Change the temperature probe and restart calibration.

PC INTERFACE (HI 98360 only)

Data transmission from the instrument to the PC can be done with the **HI 92000** Windows® compatible software (optional). **HI 92000** also offers graphing and an on-line help feature.
Data can be exported to the most popular spreadsheet programs for further analysis.
To connect your instrument to a PC, use a standard USB cable. Make sure that your instrument is switched off and plug one connector to the instrument's USB socket and the other to the USB port of your PC.

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

In order to avoid data errors the serial communication interface is not available if the battery percentage is less than 30%. The instrument will answer with an "Err9" message.

SENDING COMMANDS FROM PC

It is also possible to remotely control the instrument with any terminal program. Use a standard USB cable to connect the instrument to a PC, start the terminal program and set the communication options as follows: 8, N, 1, no flow control, baud rate 9600.

COMMAND TYPES

To send a command to the instrument follow the next scheme:

<command prefix> <command> <CR>

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

Note: Either small or capital letters can be used.

SIMPLE COMMANDS

RNG	Is equivalent to pressing **RANGE**
CAL	Is equivalent to pressing **CAL**
CFM	Is equivalent to pressing **CFM**
UPC	Is equivalent to pressing the **UP** arrow key
DWC	Is equivalent to pressing the **DOWN** arrow key
LOG	Is equivalent to pressing **LOG**
RCL	Is equivalent to pressing **RCL**
SET	Is equivalent to pressing **SETUP**
CLR	Is equivalent to pressing **CLR**
OFF	Is equivalent to pressing **OFF**
AED	Is equivalent to pressing **AutoEnd**

CHR xx Change the instrument range according with the parameter value (xx):

- xx=06 EC range
- xx=07 TDS range
- xx=08 NaCl range

The instrument will answer for these commands with:

<STX> <answer> <ETX>

where: <STX> is 02 ASCII code character (start of text)

<ETX> is 03 ASCII code character (end of text)

<answer>:

<ACK> is 06 ASCII code character (recognized command)

<NAK> is 21 ASCII code character (unrecognized command)

<CAN> is 24 ASCII code character (corrupted command)

COMMANDS REQUIRING AN ANSWER

The instrument will answer for these commands with:

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

where the checksum is the bytes sum of the answer string sent as 2 ASCII characters.

All the answer messages are with ASCII characters.

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

- EC and temperature reading on EC range.
- TDS, EC and temperature reading on TDS range.
- NaCl, EC and temperature reading on NaCl range.

The answer string contains:

- Meter mode (2 chars):
  - 06 - EC range
  - 07 - TDS range
  - 08 - NaCl range
- Meter status (2 chars of status byte): represents a 8 bit hexadecimal encoding.
  - 0x40 - TDS unit (0-ppm, 0-g/L)
  - 0x20 - EC unit (0-µS, 1-mS)
  - 0x10 - temperature probe is connected
  - 0x01 - new GLP data available
  - 0x02 - new SETUP parameter
  - 0x08 - AUTOHOLD is stable

- Reading status (1 char): R - in range, O - over range, U - under range.
- The reading (corresponding to the selected range) - 7 ASCII chars, including sign and decimal point.
- Temperature reading - 8 ASCII chars, with sign and two decimal points, always in °C.

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

GLP Requests the calibration data record.

The answer string contains:

- GLP status (1 char): represents a 4 bit hexadecimal encoding.
  - 0x04 - EC calibration available
  - 0x08 - NaCl calibration available
- EC calibration data (if available), which contains:
  - the number of calibrated satandard (1 char)
  - the offset factor, with sign and decimal point (7 chars)
  - the cell constant, with sign and decimal point (7 chars)
  - the calibration time, **yymmddhhmmss** (12 chars)
  - standards information
  - standard value, with sign and decimal point (7 chars).
  - standard unit (2 chars; 00-µS; 01-mS)
  - Reference Temperature with and decimal point (5 chars)
  - Temperature Compensation mode (2 chars)
    - 00 - no temperature compensation
    - 01 - automatic temperature compensation
    - 02 - manual temperature compensation
  - TC coeficient with sign and decimal point (5 chars)
- Na Cl Calibration data
  - the number of calibrated standards (1 char)
  - salinity coeficient, with sign and decimal point (7 chars)
  - Cell constant, with sign and decimal point (7 chars)

- the calibration time (12 chars)
- standard unit (always 00 - 2 chars)
- Reference Temperature with and decimal point (4 chars)
- Temperature Compensation mode (2 chars)
  - 00 - no temperature compensation
  - 01 - automatic temperature compensation
  - 02 - manual temperature compensation
- TC coeficient with sign and decimal point (5 chars)

PAR Requests the setup parameters setting.

The answer string contains:

- Instrument ID (4 chars)
- SETUP information (2 chars): 8 bit hexadecimal encoding.
  - 0x01 - beep ON (else OFF)
  - 0x04 - degrees Celsius (else degrees Fahrenheit)
- Auto-off/Light time (3 chars) (in minutes)
- Auto power off time (3 chars) (in minutes)
- Cell constant, with sign and decimal point (6 chars)
- TDS factor, with sign and decimal point (5 chars)
- TC coef, with sign and decimal point (5 chars)
- Reference Temperature, with sign and decimal point (5 chars)
- Temperature Compensation mode (1 char)

NSLx Requests the number of logged samples (4 chars).

The command parameter (1 char):

- E - request for EC range
- N - request for NaCl range
- T - request for TDS range

LODExxx Requests the xxxth EC record logged data.

LODNxxx Requests the xxxth NaCl record logged data.

LODTxxx Requests the xxxth TDS record logged data.

LODEALL Requests all EC Log on demand.

LODNALL Requests all NaCl Log on demand.

LODTALL Requests all TDS Log on demand.

The answer string for each record contains the number of records if ALL data is requested - 3 chars

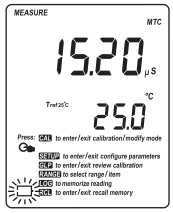
- The logged mode (2 chars):
  - 06 - EC range
  - 07 - TDS range
  - 08 - NaCl range
- Reading status (1 char): R, O, U
- Calculated reading, with sign and decimal point (7 chars)
- Temperature reading, with sign and two decimal points (8 chars)
- EC reading status (1 char): R, O, U - for TDS, NaCl range
- Unit of the reading - for TDS, NaCl range (1 char)
- The EC reading, with sign and decimal point - for TDS, NaCl range (7 chars)
- The logged time, **yymmddhhmmss** (12 chars)
- The calibration offset, with sign and decimal point (7 chars)
- The calibration slope, with sign and decimal point (7 chars) (Kcell for EC and TDS range and the slope for NaCl).
- Temperature probe presence (1 char)
- Temperature compensation coefficient (5 chars)
- Temperature reference value (5 chars)
- Temperature compensation mode (1 char)

Notes:
- "Err8" is sent if the instrument is not in measurement mode.
- "Err6" is sent if the requested range is not available.
- "Err4" is sent if the requested set parameter is not available.
- "Err3" is sent if the Log on demand is empty.
- "Err9" is sent if the battery power is less than 30%.
- Invalid commands will be ignored.

BATTERIES REPLACEMENT

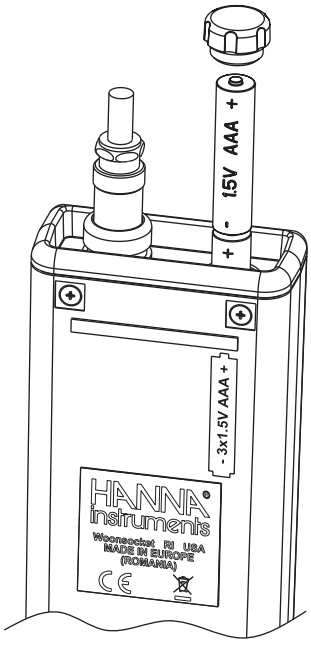
If the batteries become weak, the display will flash the battery symbol to advise the user that approx. 1 hour of working time is left.

It is recommended to change the batteries as soon as the battery indicator blinks (lower frequency).



To replace the batteries, follow the next steps:

- Turn the instrument OFF.
- Open the battery compartment cap (located on the top of the instrument).

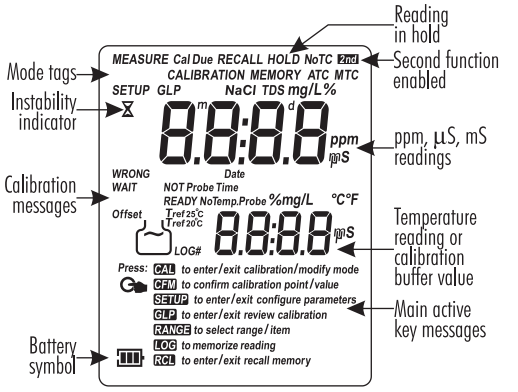


- Remove old batteries.
- Insert three new 1.5V AAA batteries in the battery compartment, following the instructions on the rear of the instrument.
- Reattach the battery compartment cap.

The instrument is provided with the BEPS (Battery Error Prevention System) feature, which automatically turns the instrument off when the batteries level is too low to ensure reliable readings. At start up the display will show "**0 bAtt**" message for a few seconds, then the instrument automatically turns off.

LCD MESSAGE GUIDE

TAGS & SYMBOLS



- **Mode tags** light up for indicating the corresponding active mode, and blink for warning the user.

  MEASURE on: Instrument in measurement mode.

  SETUP on: SETUP menu mode has been entered.

  CALIBRATION on: calibration mode has been entered.

  GLP on: GLP mode has been entered.

  RECALL MEMORY on: RECALL MEMORY mode has been entered.

- **Reading in HOLD**:

  HOLD on: reading frozen in AutoEnd mode.

  HOLD blinking: reading unstable in AutoEnd mode.

- Indication of **temperature compensation mode**:

  MTC for manual, **ATC** for automatic compensation.

- ⧖ **blinking (while in calibration)**: reading unstable.

- **Main active key messages** light up for indicating the corresponding active key.

  CAL on: CAL key available.

  CFM blinking: ask confirmation of calibration or set value.

  SETUP on: SETUP key available.

  GLP on: GLP key available.

  RANGE on: RANGE key available.

  LOG on: LOG key available.

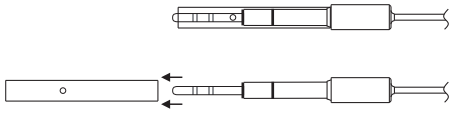
  RCL on: RLC key available.

- **Battery symbol blinking**: low battery condition. The batteries shoud be replaced soon.

PROBE MAINTENANCE

EC PROBE MAINTENANCE

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



TROUBLESHOOTING GUIDE

SYMPTOMS	PROBLEM	SOLUTION
Readings fluctuate up and down (noise).	EC probe sleeve not properly inserted; air bubbles inside sleeve.	Tap the probe to remove air bubbles.
The meter does not accept the standard solution for calibration.	Out of order EC probe.	Follow the maintenance procedure. If still no results replace the electrode.
The display shows EC, TDS or NaCl reading blinking.	Out of range in EC, TDS or NaCl scale.	Recalibrate the meter. Make sure the solution is in specified range. Make sure the **LOCK** key was not pressed.
The meter does not measure temperature.	Broken temperature probe.	Replace the EC probe.
The meter fails to calibrate or gives faulty readings.	Broken probe.	Replace the probe.
The meter fails to calibrate NaCl.	Incorrect NaCl calibration.	Recalibrate the meter in NaCl range. Set cell constant to 1.
At startup the meter displays all LCD tags permanently.	One of the keys is blocked.	Check the keyboard or contact the vendor.
"**Err xx**" error message is displayed and the meter turns off.	Internal error.	Power on the meter. If the error persists, contact the vendor.
The instrument does not start or stop when pressing **ON/OFF**.	Initialization error.	Press and hold down **ON/OFF** for about 15 seconds for a hardware reset. If the error persist, contact your dealer or any Hanna Service Center.
"**Cal Due**" "**Prod**" message at startup.	Instrument not factory calibrated.	Contact Hanna Technical Support for factory calibration.

ACCESSORIES

CONDUCTIVITY CALIBRATION SOLUTIONS

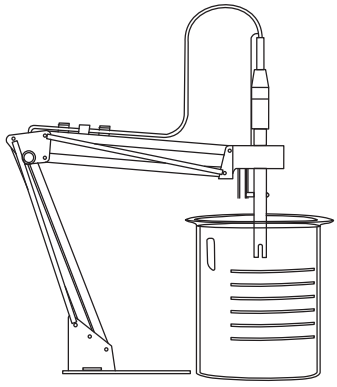
HI 70030P	12880 µS/cm solution, 20 mL sachet (25 pcs.)
HI 7030L	12880 µS/cm solution, 500 mL bottle
HI 7030M	12880 µS/cm solution, 230 mL bottle
HI 70031P	1413 µS/cm solution, 20 mL sachet (25 pcs.)
HI 7031L	1413 µS/cm solution, 500 mL bottle
HI 7031M	1413 µS/cm solution, 230 mL bottle
HI 70033P	84 µS/cm solution, 20 mL sachet (25 pcs.)
HI 7033L	84 µS/cm solution, 500 mL bottle
HI 7033M	84 µS/cm solution, 230 mL bottle
HI 7034L	80000 µS/cm solution, 500 mL bottle
HI 7034M	80000 µS/cm solution, 230 mL bottle
HI 7035L	111800 µS/cm solution, 500 mL bottle
HI 7035M	111800 µS/cm solution, 230 mL bottle
HI 70039P	5000 µS/cm solution, 20 mL sachet (25 pcs.)
HI 7039L	5000 µS/cm solution, 500 mL bottle
HI 7039M	5000 µS/cm solution, 230 mL bottle
HI 7037L	100% NaCl sea water standard solution, 500 mL bottle

PROBE CLEANING SOLUTIONS

HI 7061M	General Cleaning Solution, 230 mL bottle
HI 7061L	General Cleaning Solution, 500 bottle

OTHER ACCESSORIES

HI 76309	PVC Conductivity/TDS probe with 4-rings (stainless steel), temperature sensor and 1 m cable.
HI 76309/1.5	PVC Conductivity/TDS probe with 4-rings (stainless steel), temperature sensor and 1.5 m cable.
HI 710005	12VDC voltage adapter (US plug)
HI 710006	12VDC voltage adapter (European plug)
HI 710012	12VDC voltage adapter (UK plug)
HI 710013	12VDC voltage adapter (S. Africa plug)
HI 710014	12VDC voltage adapter (Australian plug)
HI 740028	1.5V AAA batteries (4 pcs)
HI 740036	100 mL plastic beaker (6 pcs)
HI 740034	Cap for 100 mL beakers (6 pcs)
HI 76405	Electrode holder



HI 92000 Windows® compatible software.

Windows® is registered Trademark of "Microsoft Co."

RECOMMENDATIONS FOR USERS

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

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

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

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

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

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

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