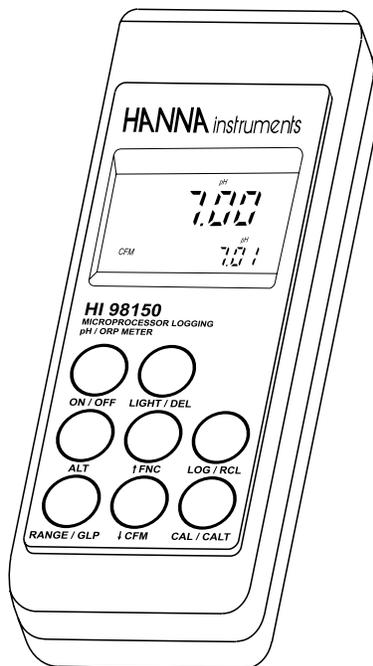


Instruction Manual

HI 98140 - HI 98150 HI 99144 Portable Waterproof Microprocessor Logging GLP pH / ORP Meters



 **HANNA**
instruments
<http://www.hannainst.com>


These Instruments are in
Compliance with the CE Directives

Dear Customer,

Thank you for choosing a Hanna Instruments Product.

Please read this instruction manual carefully before using the instrument.

This manual will provide you with all the necessary information for the correct use of the instrument, as well as a precise idea of its versatility in a wide range of applications.

These instruments are in compliance with **CE** directives EN 50081-1 and EN 50082-1.

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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.

Each meter is supplied complete with:

- Amplified pH electrode with built-in temperature sensor and EEPROM and DIN connector (HI 98140 and HI 98150 only)
- HI1230B Combination pH Electrode with BNC (HI 99144 only)
- HI7669/2W Temperature Probe (HI 99144 only)
- HI70004 pH 4.01 sachet (1 pc)
- HI70007 pH 7.01 sachet (1 pc)
- Instruction Manual
- AA size Alkaline Batteries (4 pcs)
- Rugged Carrying Case.

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

GENERAL DESCRIPTION

HI98150 and HI99144 are portable logging microprocessor-based pH/ORP/temperature meters.

HI98140 is a portable logging microprocessor-based pH/temperature meter.

HI98140 and HI98150 are supplied with an exclusive HANNA (smart) amplified pH/temperature electrode with DIN connector. The electrode has an internal memory for storing calibration data.

All pH measurements are automatically compensated for temperature (ATC). The instrument housing is made of rugged, lightweight material, making it truly portable.

Five memorized buffers (4.01, 6.86, 7.01, 9.18 and 10.01pH) and wrong buffer recognition technology make calibration simple and error free. One or two-point calibration is possible.

The meters are also equipped with a stability indicator and backlight feature for comfortable reading even in excessively dark environments.

A user friendly interface provides clear messages regarding errors, functions and more.

The GLP features provide a guarantee of data consistency.

Measurements can be performed with lab-grade precision in the field as well as in the laboratory.

An alarm time-out is available to alert the user if too much time has elapsed since the last pH calibration and that re-calibration may be required.

The meter provides a controlled access to calibration and GLP settings through a password protection method.

The Battery Error Preventing System (BEPS) recognizes batteries levels as they become weaker.

To prolong battery life, the backlight feature is automatically disabled when the batteries are getting low; a clear indication is displayed on LCD 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.

For long term field and lab applications, these meters can be connected to a 12VDC adapter.

The meters can store measurements in memory at the request of the user for retrieval at a later time.

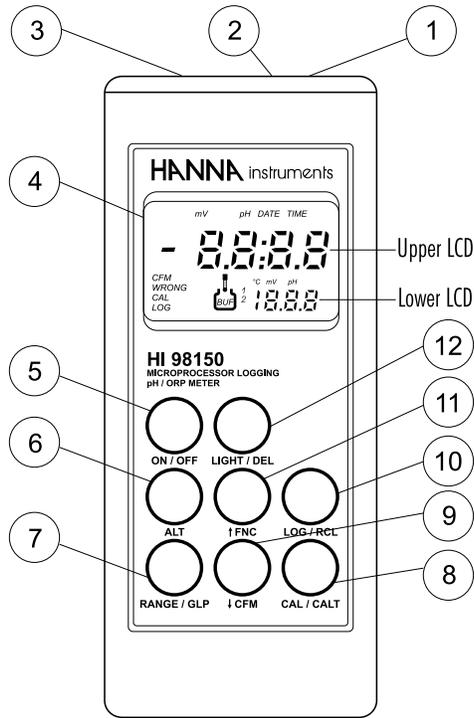
HI98140, HI98150 and HI99144 also allow transfer of data to computer through the RS232 port.

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

Made of tough, lightweight ABS material, the water-resistant rugged casing is built to last.

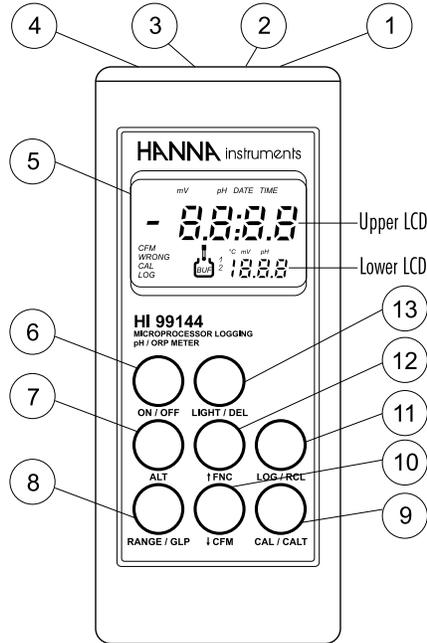
The meters are in compliance with **IP67** standards: dust-tight, protected against the effects of temporary immersion in water and designed to provide laboratory results and accuracy under harsh industrial conditions.

**FUNCTIONAL DESCRIPTION
HI 98140 AND HI 98150**



- 1) Power adapter plug
- 2) RS232 connector
- 3) Electrode Connector
- 4) Liquid Crystal Display (LCD)
- 5) ON/OFF key, to turn the meter on and off
- 6) ALT key, to alternate key function
- 7) RANGE / GLP key, to select measurement ranges, to display time and date, and to view calibration data (with ALT)
- 8) CAL / CALT key, to enter calibration mode
- 9) ↓CFM key, to move down or confirm values (with ALT)
- 10) LOG / RCL key, to store or recall (with ALT) measurements
- 11) ↑FNC key, to move up or enter setup mode (with ALT)
- 12) LIGHT / DEL key, to turn the LCD backlight on and off and to delete stored data (with ALT)

FUNCTIONAL DESCRIPTION HI 99144



- 1) Power adapter plug
- 2) RS232 connector
- 3) Temperature Probe Connector
- 4) Electrode BNC Connector
- 5) Liquid Crystal Display (LCD)
- 6) ON/OFF key, to turn the meter on and off
- 7) ALT key, to alternate key function
- 8) RANGE / GLP key, to select measurement ranges, to display time and date, and to view calibration data (with ALT)
- 9) CAL / CALT key, to enter calibration mode
- 10) ↓CFM key, to move down, to manually decrease temperature, and to confirm values (with ALT)
- 11) LOG / RCL key, to store or recall (with ALT) measurements
- 12) ↑FNC key, to move up, to manually increase temperature, and to enter setup mode (with ALT)
- 13) LIGHT / DEL key, to turn the LCD backlight on and off and to delete stored data (with ALT)

SPECIFICATIONS

Range	pH	-4.00 to 19.99 pH
	mV	± 600.0 mV (not for HI98140) ± 2000 mV autoranging (not for HI98140)
	Temp.	-20 to 120 °C
Resolution	pH	0.01 pH
	mV	0.1 mV between ± 400mV (not for HI98140) 0.2 mV from +400 to +600mV (not for HI98140) 0.2 mV from -400 to -600mV (not for HI98140) 1 mV outside (not for HI98140)
	Temp.	0.1 °C from -10 to 120 °C / 1°C below -10°C
Accuracy (@20°C/68°F)	pH	± 0.01 pH
	mV	± 0.2mV between ± 400mV (not for HI98140) ± 0.4mV from +400 to +600mV (not for HI98140) ± 0.4mV from -400 to -600mV (not for HI98140) ± 2mV outside (not for HI98140)
	Temp.	± 0.4 °C from 0 to 70°C / ± 1°C outside
Typical EMC Deviation	pH	± 0.02 pH
	mV	± 1mV between ± 600mV (not for HI98140) ± 2 mV outside (not for HI98140)
	Temp.	± 0.4°C
pH Calibration		Automatic 1 or 2 points with 5 memorized buffers (4.01, 6.86, 7.01, 9.18 and 10.01 pH)
mV Calibration (not for HI98140)		Automatic 2 points at 0, 350 mV or 3 points at 0, 350 and 1900 mV
Temperature Compensation		Automatic from -20 to 120°C
pH Electrode		Amplified, with built-in EEPROM and DIN connector (HI98140 and HI98150 only; see accessories) HI1230B (HI99144 only)
ORP Electrode (not for HI98140)		Amplified ORP electrode with DIN connector (HI98150 only; see accessories) ORP electrode with BNC connector (HI99144 only)
Input Impedance		10 ¹² Ohm
Temperature Probe		HI 7669/2W (HI99144 only)
Power supply		4x1.5V AA alkaline type/300 hours typical life (with 2700mA/h batteries, without backlight). 12 VDC adapter (HI710005 or HI710006)
Casing		IP 67
Environment		0 to 50°C / 100% RH
Dimensions		196 x 80 x 60 mm (7.7 x 3.1 x 2.4")
Weight		500 g (18 oz)

INITIAL PREPARATION

Each meter is supplied complete with batteries. Remove the back cover, unwrap the batteries and install them while paying attention to the polarity. Alternatively, connect the HI 710005 or HI 710006 voltage adapter to the power adapter plug.

To prepare the instrument for use, connect the pH or ORP (HI98150 and HI99144 only) electrode to the connector located on the top of the instrument.

To switch the meter on, press the ON/OFF key.

The batteries charge status or "LINE" message (if external power adapter is connected) will be displayed on the LCD for a few seconds.



The meter is now ready to operate.

To maximize battery life, the meter is automatically switched off after 5 minutes of non-use (this feature is enabled by default and can be disabled through setup code 20). To reactivate the instrument press the ON/OFF key.

Before proceeding with pH measurements follow the calibration procedure.

Note: When the use of an alternate function (DEL, FNC, CFM, GLP, RCL and CALT) is requested, press and hold the ALT key first and then the second listed key.

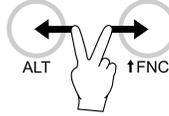
Note: to prevent damage to the electrode, remove the pH electrode from the sample before turning the meter off.

If the meter is OFF, detach the electrode from the meter before immersing the electrode in the storage solution.

SETUP MODE

Setup can be used to view data regarding instrument status (e.g. battery charge) or to change the meter parameters (e.g. time).

- To enter this mode press the ALT and FNC keys when the meter is in measurement mode.



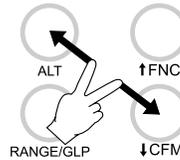
- The setup code "00" will blink on the lower LCD and "Set" will be displayed on the upper one.



- Select the code of the desired parameter using the ↑ or ↓ key.



- Press ALT and CFM to confirm the code.



Note: If ALT and FNC are pressed before code confirmation, the meter will default to measurement mode.

- If the selected parameter is password protected, the lower LCD will display "PAS" and the password must be entered to proceed. Otherwise, the current parameter value will be displayed.

PASSWORD PROTECTION

Setting of time, date and calibration alarm time-out are password protected and the user will be asked to enter the password to change these parameters. After code confirmation the upper LCD will display "0000".

- If password is set to 0000 (factory setting), just press ALT and CFM to confirm.
- If password is set to a value different from 0000, enter the password with the up and down arrow keys and then press ALT and CFM to confirm.
- If password is incorrect the meter displays the "WRONG" indication and asks for the password again.
- If password is correct, the meter provides access to the parameter.

PARAMETER SETTINGS

- Once the parameter code (and password if needed) has been entered, the current value of the selected parameter on the upper LCD and the parameter code on the lower LCD will be displayed. The parameter or a part of it will blink (e.g. only the hour blinks if time has been selected).
- Enter the new value using the arrow keys.



- If there is another part of the parameter to be set (e.g. minutes for the time), press RANGE to gain access and then enter the new value using the arrow keys.



- Press ALT and CFM to confirm the value.
- If the entered value is not acceptable, the "WRONG" indication will be displayed for a few seconds and then the meter will ask for a correct value.
- If the confirmed value is accepted, the meter will pass to the next parameter (asking for the password if it is protected).

Note: If ALT and FNC are pressed before parameter value confirmation, the meter will not update the parameter and after escaping will ask for a new setup code.

The following table lists the setup codes along with the description of the specific setup items, their valid values and the factory settings (default):

Code	Valid values	Default
00 Instrument ID code	0000 ÷ 9999	0000
01 Current time ¹	hh:mm	00:00
02 Current date ¹	dd:mm	01:01
03 Current year ¹	YYY	1998
10 Calibration alarm time-out	01 ÷ 99 days , OFF	07
20 Auto-Off/Power down time-out	ON, OFF	ON
21 Firmware version		
22 Battery level test		
99 Password ²	0000 ÷ 9999	0000

- ¹ The meter automatically checks for entered time/date accuracy as follows:
0≤hh≤23; 0≤mm≤59; 01≤dd≤28/29/30/31; 1≤MM≤12; 1998≤YYYY≤2097.
- ² To change the password, the correct code must be entered first. If the password has been forgotten, the password protected features are no longer accessible; in this case contact your nearest Hanna Service Center.

Some of the setup parameters are explained below.

Code 00 - Setting the identification (ID) code

When using several identical meters it may be useful to uniquely identify them by assigning an ID code to each meter.

- Select code 00.
- Enter a 4-digit value using the arrow keys.
- Press ALT and CFM to confirm the value.

Code 20 - Auto-off

The auto-off timeout is fixed at 5 minutes.

- Select code 20 to enable/disable this feature.

Code 22 - Battery level test

- Select code 22.
- If the meter is connected to an external power adapter, the LCD will display "LINE" otherwise it will display "bAtt" on the upper display, and the remaining percentage of battery charge (100% means fully charged battery and 0% corresponds to the minimum battery voltage that allows the meter to operate).



Note: the battery level test is also performed any time the meter is turned on.

TAKING pH MEASUREMENTS

For HI98140 and HI98150 only, connect the pH electrode with the built-in temperature sensor to the meter and press ON/OFF to power on the instrument. The meter automatically checks that the stored calibration data correspond to the connected electrode. The pH range will be automatically set.



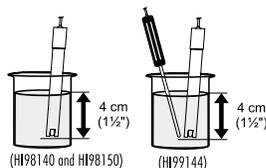
If the pH electrode is not connected the LCD will display the "no probe" message and then dashed lines in place of the readings.

For HI99144 only, connect the pH electrode to the BNC connector and the temperature probe to the RCA connector and press ON/OFF.

For greatest accuracy, it is recommended to set the Calibration alarm time-out to the value appropriate to your specific use and calibrate the meter as soon as the "DATE" warning symbol blinks on LCD (see GLP section).



To take pH measurements, simply submerge the bottom 4 cm (1½") of the electrode in the solution to be tested and stir gently. For HI99144 only, immerse the temperature probe close to the pH electrode.



Allow for the reading to stabilize. The temperature is displayed in the lower LCD.

The pH reading is automatically temperature compensated (ATC).

If the meter displays "----" it means that the reading is out of range.

A blinking reading means that the electrode is "dead".

By continuously pressing the RANGE key the following information will be displayed on the upper LCD:



- mV reading (HI98150 and HI99144 only)

The mV scale is autoranging, when the reading is outside $\pm 600\text{mV}$ the decimal point automatically disappears.



- Time
- Day - Month
- Year

Pressing RANGE again, the meter returns to pH reading.

Note: When date or time is displayed, it is possible to change them pressing ALT and FNC with no need to enter setup mode.

Note: for HI99144 only, the temperature reading blinks if the temperature probe is not inserted. Use the up and down arrow keys to manually set the temperature of the solution.

Note: If measurements are taken successively in different samples, it is recommended to rinse the electrode thoroughly with deionized water or, if not available, tap water first and then with some of the next sample to condition the electrode before immersing it in the sample.

TAKING ORP MEASUREMENTS (HI98150 AND HI99144 ONLY)

Connect the ORP electrode to the meter and press the ON/OFF key.

For HI98150 only, the meter automatically sets the mV range.

If the ORP electrode is not connected the LCD will display the "no probe" message and then dashed lines in place of the readings.

To take ORP measurements, simply submerge the bottom 4 cm (1½") of the ORP electrode in the solution to be tested, stir gently and allow for the reading to stabilize.

Note: The ORP electrodes are not provided with the temperature sensor.

By continuously pressing the RANGE key the following information will be displayed on the upper LCD:

- Time
- Day - Month
- Year

Pressing RANGE again, the meter returns to mV reading.

Note: If measurements are taken successively in different samples, it is recommended to rinse the electrode thoroughly with deionized water or if not available tap water first and then with some of the next sample to condition the electrode before immersing it in the sample to be tested.

TAKING TEMPERATURE MEASUREMENTS

For HI98140 and HI98150 only, the temperature sensor is integrated in the pH electrode. For HI99144 only, connect the temperature probe to the RCA connector provided.

Immerse the pH electrode or temperature probe in the solution (allow a few minutes for the temperature to stabilize) and press the ON/OFF key. The temperature is displayed in the lower LCD.

Note: If temperature measurement is out of range the LCD will display " - - -".

pH CALIBRATION PROCEDURE

For greatest accuracy, it is recommended that the instrument is calibrated frequently. For a faster procedure, it is possible to calibrate at 1 point, but it is always a good practice to calibrate at 2 points.

A two-point calibration can use any combination of the three sets:

(4.01) (6.86 / 7.01) (9.18 / 10.01)

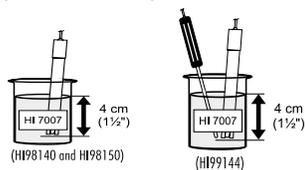
Only one value from each set can be selected. For example if pH 7.01 is used as first point, it will not be possible to select pH 6.86 as the second point.

In the case of a two-point calibration (in the acidic range) from 0 to 7 pH, use pH buffer 7.01 (or 6.86) as the first solution and pH buffer 4.01 as the second solution. If testing in the alkaline range from 7 to 14 pH, use pH buffer 10.01 (or 9.18) as the second solution.

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

pH CALIBRATION

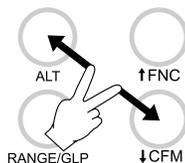
1. Rinse the electrode with a portion of the first calibration buffer or clean water. Dip the bottom 4 cm (1½") of the electrode into a beaker containing the solution. For HI99144 only, immerse the temperature probe close to the pH electrode.



2. Press CAL when the meter displays pH measurement.



3. Enter the password (if different from "0000") with the arrow keys.
4. Press ALT and CFM to confirm the password or CAL to exit.



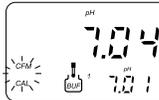
5. If password is correct, the meter displays "7.01pH" on the lower LCD with the "BUF 1" and "CAL" indication. The upper LCD shows the uncalibrated pH reading.



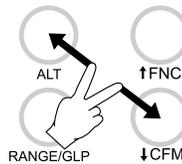
Note: The buffer pH value, and thus the value displayed on the lower LCD, varies with temperature. For example, at 20°C it shows 4.00-7.03-10.06, at 25°C it shows 4.01-7.01-10.01.

6. Select the first buffer solution value with ↑ and ↓ if necessary.

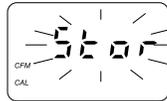
7. When the "CFM" symbol blinks, the reading is stable and calibration can be confirmed.



8. Press ALT and CFM to confirm the first buffer.



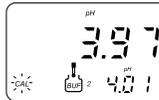
9. If everything is satisfactory the LCD will display "Stor" and then the second buffer value expected will be displayed (two-point calibration). If a wrong solution or electrode has been used or if the buffer is polluted, "WRONG" will be displayed to alert the user.



10. If only a single point calibration is required, press CAL to leave the calibration mode and maintain the previous slope calibration. The instrument then checks the electrode parameters and advises user of abnormalities by "old probe" and "dead probe" indications.

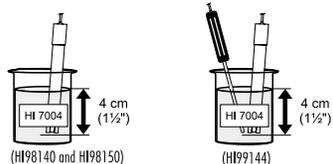


11. Press ↑ or ↓ to select the second buffer value. The meter will display the "BUF 2" indication.

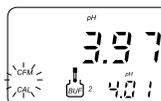


12. Rinse the electrode with some of the second buffer solution or clean water.

13. Dip the bottom 4 cm (1½") of the pH electrode in a beaker containing the second buffer. For HI99144 only, immerse the temperature probe close to the pH electrode.



14. When the "CFM" symbol blinks, press ALT and CFM to confirm the second calibration point.



15. The LCD will display "Stor". The instrument checks the electrode parameters and advises the user of abnormalities by "old probe" and "dead probe" indications (in these cases, repeat the calibration with fresh buffers). If everything is satisfactory the meter is calibrated and it returns to normal operational mode.

CALIBRATION ERROR MESSAGES

If the "old probe", "dead probe" or "WRONG" messages are displayed during calibration, check your electrode by following the conditioning and maintenance procedures and repeat calibration. The pH electrode might have to be replaced if calibration cannot be successfully performed.

note: see "GLP" paragraph for more details about "old probe" and "dead probe" messages.

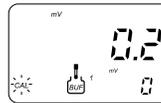
mV CALIBRATION PROCEDURE (HI98150 AND HI99144 ONLY)

A two or three-point calibration can be performed. The first two calibration points are always 0 and +350 mV; the third point is optional at +1900 mV.

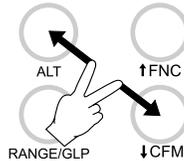
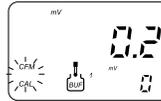
1. Connect a mV simulator (HI8427 or HI931001 with the proper connecting cable) to the meter and set it to 0 mV.
2. Press CAL when LCD is displaying mV.



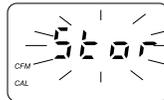
3. Enter the password (if different from "0000") with the arrow keys.
4. Press ALT and CFM to confirm the password or CAL to exit.
5. If password is correct, the meter will display "0 mV" on the lower LCD with the "BUF 1" and "CAL" indication. The upper LCD displays the mV reading.



6. When the "CFM" symbol blinks, the reading is stable and calibration can be confirmed.
7. Press ALT and CFM to confirm the first value.

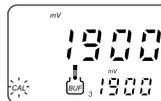


8. The LCD will display "Stor" for a few seconds.
9. The meter will then display "350 mV" on the lower LCD with the "BUF 2" indication.
10. Set the simulator to +350 mV.
11. When the "CFM" symbol blinks, the reading is stable. Press ALT and CFM to confirm the second value.
12. The LCD will display "Stor" for a few seconds.



13. If only a two-point calibration is required, press CAL to leave the calibration mode. Proceed with the next step for three-point calibration.

14. The meter will display "1900 mV" on the lower LCD with the "BUF 3" indication.



15. Set the simulator to 1900 mV.

16. When the "CFM" symbol blinks, the reading is stable. Press ALT and CFM to confirm the third value.



17. Calibration is now complete, the instrument returns to normal operational mode.

Note: "WRONG" message notifies the user if the selected value is wrong.

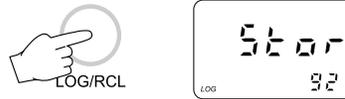
TEMPERATURE CALIBRATION PROCEDURE (for technical personnel only)

A two point calibration at 0.0, 50.0°C has to be performed in order to store the new calibration data in memory.

1. Immerse the pH electrode with the built-in temperature sensor (HI98140 and HI98150 only) or the temperature probe (HI99144 only) in the 0°C temperature bath.
2. Press ALT and CALT to enter temperature calibration mode.
3. Enter the password.
4. The meter will display "0.0 °C" on the lower LCD with the "BUF 1" and "CAL" indication.
5. When the reading is stable the "CFM" symbol starts to blink.
6. Press ALT and CFM to confirm. LCD will then display 50.0°C on the lower LCD with the "BUF 2" indication.
7. Immerse the pH electrode with the built-in temperature sensor (HI98140 and HI98150 only) or the temperature probe (HI99144 only) in the 50°C temperature bath.
8. When the reading is stable the "CFM" symbol starts to blink.
9. Press ALT and CFM to confirm and return to normal operational mode.

LOGGING FUNCTION

To store the current reading in memory press the LOG key while in measurement mode. The LCD will display "Stor" along with the "LOG" indication and the sample number for a few seconds.



By pressing the LOG key a complete set of information is memorized: date, time, pH and mV (HI98150 and HI99144 only) readings, temperature reading and also a message on the meter status.

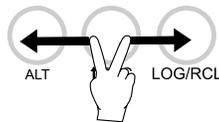
Up to 500 samples can be stored into memory.

When the memory is full and the LOG key is pressed, the sample will not be stored and the LCD will display "FULL". In this case it is necessary to delete all the memory to proceed.



TO VIEW LOGGED DATA

To retrieve the memorized information press ALT and RCL.



The meter displays the date (upper LCD) and the number (lower LCD) of the last logged sample. The "ZERO" indication will be displayed if no samples are stored in memory.



- Select the desired sample number with the arrow keys. Pressing the \uparrow key while the last sample is displayed causes the meter to go to the first sample.



- Press RANGE to view remaining data of the selected sample. After the date information, the remaining data will be displayed in the following order:



- year	
- time	
- pH reading "----" means reading out of range or no probe was connected. "OrP" means that an ORP electrode was connected.	
- mV reading (HI98150 and HI99144 only) "----" means reading out of range.	
- temperature reading "----" means reading out of range.	
- GLP message	

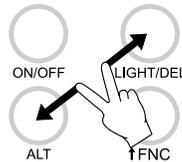
- If RANGE is pressed when the GLP message is displayed, the LCD will revert to the date of the viewed sample.
- It is always possible to skip to another sample using the up and down arrow keys. For example, if the pH reading of a sample is displayed, pressing the up arrow key will cause the meter to display the pH reading of the next sample.
- At any time it is possible to return to normal operational mode by pressing ALT and RCL.

TO DELETE LOGGED DATA

It is possible to delete a single sample or all the memory at one time.

To delete a single sample:

- Enter the viewing logged data mode and select the desired sample number.
- Press ALT and DEL. The "CFM" indication will start blinking asking for confirmation.



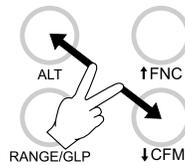
- Press the ALT and CFM to confirm deletion.

Note: Press ALT and DEL. to escape without data deletion.

When viewing through the logged data, the "NUL" message will be displayed when selecting a deleted sample.

To delete all data in memory:

- Press ALT and DEL while in normal operational mode. The "del All" message will scroll on the LCD and the "CFM" indication will start blinking asking for confirmation.
- Press ALT and CFM to confirm deletion.



Note: Press ALT and DEL to escape without data deletion.

Note: If no samples are stored in memory and a deletion is attempted, the meter will show the message "Zero" and then returns to normal operational mode.

GOOD LABORATORY PRACTICE (GLP)

GLP is a set of functions that allows the storage or retrieval (when necessary) of data regarding the maintenance and status of the electrode. HI98140 and HI98150 use electrodes with a built-in EEPROM in which calibration data are read at start-up and stored after calibration. The meter can automatically analyze the data and advise the user if a problem is found with a clear message.

PROBE LIFE VERIFICATION

At the end of calibration, the meter checks if offset is between -30 and +30 mV and the slope between 53.5 and 62 mV/pH. If the values are not within these parameters, the message "old probe" scrolls across the LCD. The electrode is still working, but it will be necessary to perform a cleaning procedure (see electrode cleaning and maintenance paragraph) or replace it.

If the offset is outside the -60 and +60 mV range or the slope is outside the 40 to 70 mV/pH interval, the "dead probe" message will scroll across the LCD; the readings will blink on the upper LCD to warn the user that they are not reliable.

ELECTRODE IDENTIFICATION (HI98140 and HI98150 only)

At start-up the meter checks if the electrode is inserted. If not the message "no probe" scrolls across the LCD and a dashed line "----" will be displayed in place of the reading.

If the meter detects a "dead probe" the readings will blink.

The meter checks the electrode only at start up. If an electrode replacement is needed, turn the meter off before disconnecting the electrode. Then replace the electrode and turn the meter on again.

CALIBRATION ALARM TIME-OUT

The calibration alarm time-out is available only for pH calibration.

It is possible to set (through setup code 10) the number of days before the next required calibration procedure. User can set a value from 01 to 99 days. The default value is 07. Set the parameter to "OFF" to disable this feature.

When turned on, the meter checks if the time-out time has expired. If the time has run out, the message "Cal date" scrolls across the LCD. The "DATE" symbol will blink as a reminder.



Alarm time-out is also signaled when viewing logged data through the "Cal date" message.

GLP AND RS232

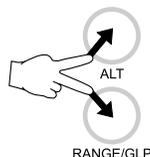
All the GLP data can be retrieved (if the electrode is connected for HI98140 and HI98150 only) from a PC through the RS232 communication feature. The calibration data are transferred to the PC along with measurement data (see "Data transfer to PC" paragraph).

LAST CALIBRATION DATA

Last calibration data are stored automatically after a successful calibration and they can be displayed by pressing the GLP key.

to view pH calibration data

- Press ALT and GLP when the meter displays pH reading.



- The LCD will then display the last pH calibration date.
- Press RANGE to scan remaining data, in the following order:
 - last calibration time
 - electrode offset value in mV ("OFF" appears in the lower LCD)
 - electrode slope in mV/pH ("SLP" appears in the lower LCD)
 - first point calibration buffer
 - second point calibration buffer (only if a 2-point calibration has been performed).

If calibration was performed with an old or dead probe, the message "Old probe" or "Dead probe" will scroll on LCD.

- The meter will then return to normal operational mode. Press ALT and GLP to escape before viewing all the data.

to view mV calibration data (HI98150 and HI99144 only)

- Press ALT and GLP when the meter displays mV reading.
- The LCD will then display the last mV calibration date.
- Press RANGE to scan remaining data, in the following order:
 - last calibration time
 - first calibration point
 - second calibration point
 - third calibration point (only if a 3-point calibration has been performed).
- The meter will then return to normal operational mode. Press ALT and GLP to escape before viewing all the data.

LCD BACKLIGHT

The LCD can be illuminated to allow the user to see the readings even in dark environments.

It can be enabled/disabled through the LIGHT key and it is automatically disabled when batteries are in low battery condition.



Two levels (low and high) of backlighting can be selected. Repeatedly pressing the LIGHT key causes the lighting to cycle from off to low then to high intensity.

Note: It is not possible to enable backlight in low battery condition; the "Batt" indication will be displayed when trying to do so.

When the backlight is enabled and an external power supply is connected to the instrument, the backlight is always on.

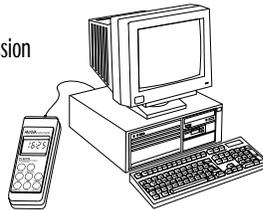
DATA TRANSFER TO PC

Press RANGE to set the meter to time or date mode and connect the meter to a PC through the RS232C output (the connector is located on the top of the meter). Use HI920011 (5 to 9-pin) connection cable.

To stop communication, press RANGE to display pH or mV reading.

SPECIFICATIONS:

Isolated 8-bit data transmission
Baud Rate: 2400
Start bit: 1
Stop bit: 1
Parity bit: none



SENDING COMMANDS FROM PC

With any terminal programs it is possible to remotely control your pH meter. Connect the meter to the PC through the HI920011 cable, start the terminal program and set the communication options as follows: 8, N, 1, no flow control.

To send a command to the pH meter the scheme is:

`<command> <CR>`

The computer sends the command expressed as a 3-character sequence and a CR character.

Note: All the terminal programs that support the ANSI escape sequence, represent the CR character with the string '^ M'.

The commands available are as follows:

MOD - to request the firmware code of the meter.

GLP - to request the last calibration data.

The meter answers with the following order:

pH calibration status (0=not calibrated , 1=calibrated)

pH calibration date (ddmmyy)

pH calibration time (hhmm)

pH electrode offset

pH electrode slope

pH buffer 1

pH buffer 2

mV calibration status(not for HI98140;1=calibrated,0=not calibr.)

mV calibration date (ddmmyy; not for HI98140)

mV calibration time (hhmm; not for HI98140)

mV buffer 1 (not for HI98140)

mV buffer 2 (not for HI98140)

mV buffer 3 (not for HI98140)

If an item is not available (e.g. buf 3 in case of a two points mV calibration) the character "N" will be received.

PAR - to request the setup parameters setting.

The meter answers with a 6-character string for each parameter.

LTB - to request the number of logged samples.

LOD - to request the logged data.

The meter answers with the following order:

status byte

date (ddmmyy)

time (hhmm)

pH reading (binary)

mV reading (binary; not for HI98140)

temperature reading (binary)

At the end of the logged data the checksum (2 complement) is sent.

Note: The meter will send <CAN> if a corrupted or unknown command is received.

These commands may be sent with either capital or small letters. Invalid commands will be ignored. The characters sent by the pH meter are always capital letters.

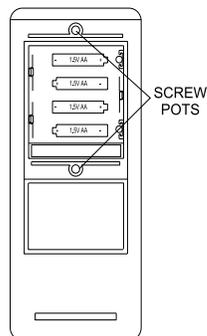
BATTERY REPLACEMENT

When the batteries are inserted and no power adapter is connected, the meter can recognize different batteries charge levels.

1. Fully charged batteries - The backlight can be enabled.
2. Weakening batteries - The backlight is automatically disabled and it is not possible to enable it until new batteries are inserted or an external power adapter is connected. The "Batt" indication appears when trying to enable backlight.
3. Weak batteries - "Bat" indication is displayed on lower LCD alternating the temperature reading. Backlight is disabled and meter can work for about 10 hours.
4. Dead batteries - LCD shuts off. The instrument stops working to avoid erroneous readings.

Battery replacement must only take place in a non hazardous area using 1.5V alkaline AA type batteries.

In order to replace run down batteries, simply remove the two screws on the rear cover of the instrument and replace the four 1.5V AA batteries with new ones, paying attention to the correct polarity. A 12VDC power adapter can also be used to power the unit (see accessories).



Note: The instrument uses the following configuration.

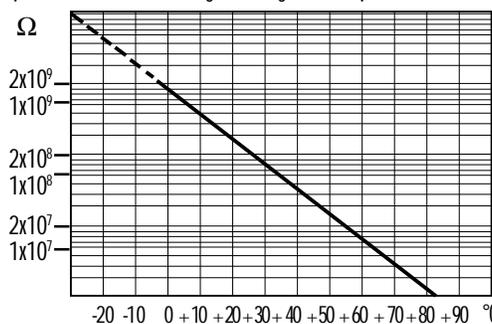


It is recommendable to purchase the Hanna HI710005 and HI710006 voltage adapters that use the proper polarity configuration.

However, HI 98140, HI 98150 and HI 99144 can be used with other adapters. In this case, remember to check the correct polarity of your adapter before connecting it to the meter.

TEMPERATURE-RESISTANCE CORRELATION FOR HANNA pH SENSITIVE GLASS

The resistance of glass electrodes partially depends on the temperature. The lower the temperature, the higher the resistance. It takes longer time for the reading to stabilize if the resistance is higher. In addition, the response time will suffer to a greater degree at temperatures below 10°C.



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

For these reasons high humidity environments, short circuits and static discharges are detrimental to a stable pH reading.

The pH electrode's life also depends on the temperature. If constantly used at high temperatures, the electrode life is drastically reduced.

Typical Electrode Life

Ambient Temperature	1- 3 years
90 °C	Less than 4 months
120°C	Less than 1 month

High concentrations of sodium ions interfere with readings in alkaline solutions; the pH at which the interference starts to be significant depends upon the composition of the glass. This interference is the alkaline error and causes the pH to be underestimated. Hanna's glass formulations have the indicated characteristics.

Alkaline Error

Sodium Ion Correction for the Glass at 20-25°C		
Concentration	pH	Error
0.1 Mol L ⁻¹ Na ⁺	13.00	0.10
	13.50	0.14
	14.00	0.20
1.0 Mol L ⁻¹ Na ⁺	12.50	0.10
	13.00	0.18
	14.00	0.40

ELECTRODE CONDITIONING AND MAINTENANCE

Note: to prevent damage to the electrode, remove the pH electrode from the sample before turning the meter off.

If the meter is OFF, detach the electrode from the meter before immersing the electrode in the storage solution.

PREPARATION

Remove the protective cap.

DO NOT BE ALARMED IF SALT DEPOSITS ARE PRESENT.

This is normal with electrodes and they will disappear when rinsed with water.

During transport tiny bubbles of air may form inside the glass bulb. The electrode cannot function properly under these conditions. These bubbles can be removed by "shaking down" the electrode as you would do with a glass thermometer.

If the bulb and/or junction are dry, soak the electrode in HI70300 or HI80300 Storage Solution for at least one hour.

For refillable electrodes:

If the fill solution (electrolyte) is less than 1 cm (1/2") below the fill hole, add HI7082 or HI8082 3,5M KCl Electrolyte Solution for double junction or HI7071 or HI8071 3,5M KCl + AgCl Electrolyte Solution for single junction electrodes.

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

For Amphel electrodes:

If the electrode does not respond to pH changes, the battery is run down and the electrode should be replaced.

MEASUREMENT

Rinse the electrode tip with distilled water.

Immerse the tip (4 cm /1 1/2") in the sample and stir gently for approx. 30 seconds.

For a faster response and to avoid cross contamination of the samples, rinse the electrode tip with a few drops of the solution to be tested, before taking measurements.

STORAGE

To minimize clogging and ensure a quick response time, the glass bulb and the junction should be kept moist and not allowed to dry out.

Replace solution in the protective cap with a few drops of HI70300 or

HI80300 Storage Solution or, in its absence, Filling Solution (HI7071 or HI8071 for single junction or HI7082 or HI8082 for double junction electrodes). Follow the Preparation Procedure above before taking measurements.

Note: NEVER STORE THE ELECTRODE IN DISTILLED WATER OR DRY.

PERIODIC MAINTENANCE

Inspect the electrode and the cable. The cable used for connection to the meter must be intact and there must be no points of broken insulation on the cable or cracks on the electrode stem or bulb. Connectors must be perfectly clean and dry.

If any scratches or cracks are present, replace the electrode.

Rinse off any salt deposits with water.

For refillable electrodes:

Refill it with fresh electrolyte (HI7071 or HI8071 for single junction or HI7082 or HI8082 for double junction electrodes). Allow the electrode to stand upright for 1 hour.

Follow the Storage Procedure above.

CLEANING PROCEDURE

General Soak in Hanna HI7061 or HI8061 General Cleaning Solution for approximately 1 hour.

Removal of films, dirt or deposits on the membrane/junction:

- *Protein* Soak in Hanna HI7073 or HI8073 Protein Cleaning Solution for 15 minutes.

- *Inorganic* Soak in Hanna HI7074 or HI8074 Inorganic Cleaning Solution for 15 minutes.

- *Oil/grease* Rinse with Hanna HI7077 or HI8077 Oil and Fat Cleaning Solution.

IMPORTANT: After performing any of the cleaning procedures rinse the electrode thoroughly with distilled water, drain and refill the reference chamber with fresh electrolyte, (not necessary for GEL filled electrodes) and soak the electrode in HI70300 or HI80300 Storage Solution for at least 1 hour before taking measurements.

TROUBLESHOOTING

Evaluate your electrode performance based on the following possibilities.

- Noise (Readings fluctuate up and down) could be due to:
 - Clogged/Dirty Junction: Refer to the Cleaning Procedure above.
 - Loss of shielding due to low electrolyte level (in refillable

electrodes only): refill with fresh HI7071 or HI8071 for single junction or HI7082 or HI8082 for double junction electrodes.

- Dry Membrane/Junction: Soak in Storage Solution HI70300 or HI80300 for at least 1 hour.
- Drifting: Soak the electrode tip in warm Hanna Solution HI7082 or HI8082 for one hour then flush tip with distilled water. Refill with fresh HI7071 or HI8071 for single junction electrodes and HI7082 or HI8082 for double junction electrodes.
- Low Slope: Refer to the cleaning procedure above.
- No Slope: Check the electrode for cracks in glass stem or bulb and replace the electrode.
- Slow Response/Excessive Drift: Soak the tip in Hanna Solution HI7061 or HI8061 for 30 minutes, rinse thoroughly in distilled water and then follow the Cleaning Procedure above.

ACCESSORIES

pH CALIBRATION SOLUTIONS

HI 70004P	pH 4.01 Buffer Sachets, 20mL, 25 pcs
HI 70007P	pH 7.01 Buffer Sachets, 20mL, 25 pcs
HI 70010P	pH 10.01 Buffer Sachets, 20mL, 25 pcs
HI 7004L	pH 4.01 Buffer Solution, 460 mL
HI 7006L	pH 6.86 Buffer Solution, 460 mL
HI 7007L	pH 7.01 Buffer Solution, 460 mL
HI 7009L	pH 9.18 Buffer Solution, 460 mL
HI 7010L	pH 10.01 Buffer Sol., 460 mL
HI 8004L	pH 4.01 Buffer Solution, 460 mL FDA approved bottle
HI 8006L	pH 6.86 Buffer Solution, 460 mL FDA approved bottle
HI 8007L	pH 7.01 Buffer Solution, 460 mL FDA approved bottle
HI 8009L	pH 9.18 Buffer Solution, 460 mL FDA approved bottle
HI 8010L	pH 10.01 Buffer Solution, 460 mL FDA approved bottle

ELECTRODE STORAGE SOLUTION

HI 70300L	Storage Solution, 460 mL
HI 80300L	Storage Solution, 460 mL FDA approved bottle

ELECTRODE CLEANING SOLUTIONS

HI 70000P	Electrode Cleaning Sachets, 20 mL, 25 pcs
HI 7061L	General Cleaning Sol., 460 mL
HI 7073L	Protein Cleaning Sol., 460mL
HI 7074L	Inorganic Cleaning Sol., 460mL
HI 7077L	Oil & Fat Cleaning Sol., 460 mL
HI 8061L	General Cleaning Solution, 460 mL FDA approved bottle
HI 8073L	Protein Cleaning Solution, 230 mL FDA approved bottle
HI 8077L	Oil & Fat Cleaning Solution, 460mL FDA approved bottle

REFILL ELECTROLYTE SOLUTIONS

HI 7072	1M KNO ₃ Electrolyte, 4x50 mL
HI 7082	3.5M KCl Electrolyte, 4x50 mL, for double junction electrodes
HI 8072	1M KNO ₃ Electrolyte, 4x50 mL FDA approved bottle
HI 8082	3.5M KCl Electrolyte, 4x50 mL FDA approved bottle, for double junction electrodes

ORP PRETREATMENT SOLUTIONS

HI 7091L	Reducing Pretreatment Solution, 460 mL
HI 7092L	Oxidizing Pretreatment Solution, 460 mL

SMART ELECTRODES (HI98140 and HI98150 only)

HI1615D	combination pH electrode, glass-body, single junction, refillable with built-in temperature NTC sensor and EEPROM for GLP data storing.
HI1616D	combination pH electrode, glass-body, single junction, gel-filled with built-in temperature NTC sensor and EEPROM for GLP data storing.
HI1617D	combination pH electrode, glass-body, single junction, triple ceramic, refillable with built-in temperature NTC sensor and EEPROM for GLP data storing.
HI1618D	combination pH electrode, single junction, gel-filled with built-in temperature NTC sensor and EEPROM for GLP data storing.
HI3619D	combination ORP / Pt electrode, glass-body, single junction.
HI3620D	combination ORP / Pt electrode, single junction, gel-filled.
FC231D	combination pH electrode with knife (penetration 20mm/0.79"), single junction, with built-in temperature NTC sensor and EEPROM for GLP data storing.
FC241D	combination pH electrode with knife (penetration 35mm/1.38"), single junction, with built-in temperature NTC sensor and EEPROM for GLP data storing.

pH ELECTRODES (HI99144 only)

All following electrodes are supplied with a BNC connector and 1 m (3.3') cable.

HI 1043B	Glass-body, double junction, refillable, combination pH electrode. Use: strong acid/alkali.
HI 1053B	Glass-body, triple ceramic, conic shape, refillable, combination pH electrode. Use: emulsions.
HI 1083B	Glass-body, micro, Viscolene, non-refillable, combination pH electrode. Use: biotechnology, micro titration.
HI 1131B	Glass-body, single junction, refillable, combination pH electrode. Use: general purpose.
HI 1330B	Glass-body, semimicro, single junction, refillable, combination pH electrode. Use: laboratory, vials.
HI 1331B	Glass-body, semimicro, single junction, refillable, combination pH electrode. Use: flasks.
HI 1230B	Plastic-body, double junction, gel-filled, combination pH electrode. Use: general, field.

HI 2031B	Glass-body, semimicro, conic, refillable, combination pH electrode. Use: semisolid products.
HI 1332B	Plastic-body, double junction, refillable, combination pH electrode. Use: general purpose.
FC 100B	Plastic-body, double junction, refillable, combination pH electrode. Use: general purpose for food industry.
FC 200B	Plastic-body, open junction, conic, Viscolene, non-refillable, combination pH electrode. Use: meat & cheese.
FC 210B	Glass-body, double junction, conic, Viscolene, non-refillable, combination pH electrode. Use: milk, yogurt.
FC 220B	Glass-body, triple-ceramic, single junction, refillable, combination pH electrode. Use: food processing.
FC 911B	Plastic-body, double junction, refillable with built-in amplifier, combination pH electrode. Use: very high humidity.
HI 1413B	Glass-body, single junction, flat tip, Viscolene, non-refillable, combination pH electrode. Use: surface measurement.

ORP ELECTRODES (HI99144 only)

All following electrodes are supplied with a BNC connector and 1 m (3.3') cable.

HI 3131B	Glass-body, refillable, combination platinum ORP electrode. Use: titration.
HI 3230B	Plastic-body, gel-filled, combination platinum ORP electrode. Use: general purpose.
HI 4430B	Plastic-body, gel-filled, combination gold ORP electrode. Use: general purpose.

OTHER ACCESSORIES

HI710005	Voltage adapter from 115 VAC to 12 VDC
HI710006	Voltage adapter from 230 VAC to 12 VDC
HI 710031	Rugged carrying case
HI 740027	1.5V AA batteries (4 pcs)
HI 76405	Electrode holder
HI 8427	pH and mV simulator
HI 931001	pH and mV simulator with LCD display
HI 920011	5 to 9-pin cable for connection to PC
HI 7669/2W	Temperature probe with 1m(3.3') cable (HI99144 only)

WARRANTY

All Hanna Instruments meters are warranted for two years against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. The electrodes and the probes are warranted for a period of six months. This warranty is limited to repair or replacement free of charge.

Damages due to accident, misuse, tampering or lack of prescribed maintenance are not covered.

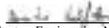
If service is required, contact the dealer from whom you purchased the instrument. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the instrument is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

To validate your warranty, fill out and return the enclosed warranty card within 14 days from the date of purchase.

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Hanna Instruments reserves the right to modify the design, construction and appearance of its products without advance notice.

CE DECLARATION OF CONFORMITY


CE <i>DECLARATION OF CONFORMITY</i>
We Hanna Instruments Italia Srl via E.Fermi, 10 35030 Sarmeola di Rubano - PD ITALY
herewith certify that the pH meters: HI 98140 HI 98150 HI 99144
have been tested and found to be in compliance with the following regulations: IEC 801-2 Electrostatic Discharge IEC 801-3 RF Radiated IEC 801-4 Fast Transient EN 55022 Radiated, Class B EN 61010-1 User Safety Requirement
Date of Issue: <u>3-6-1999</u>
 D. Volpato - Engineering Manager On behalf of Hanna Instruments S.r.l.

Recommendations for Users

Before using this product, make sure that it is entirely suitable for the environment in which it is used.

Operation of this instrument in residential area could cause unacceptable interferences to radio and TV equipments, requiring the operator to take all necessary steps to correct interferences.

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

During calibration of instruments, ESD wrist straps should be worn to avoid possible damage to the electrode by electrostatic discharge.

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

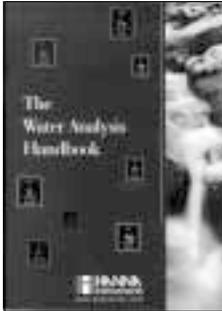
To avoid electrical shock, do not use these instruments when voltages at the measurement surface exceed 24VAC or 60 VDC.

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

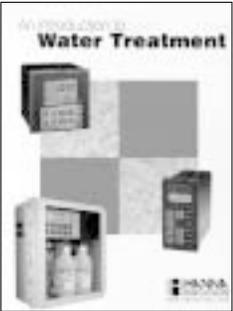
HANNA LITERATURE



LAB RECORDING



WATER ANALYSIS HANDBOOK



WATER TREATMENT



GENERAL CATALOG

PRINTED IN PORTUGAL

MAN98150R2
6/99

These and many others catalogs, handbooks and leaflets are available from Hanna. To receive your free copy, contact your dealer or the nearest Hanna Customer Service Center.



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