Instruction Manual
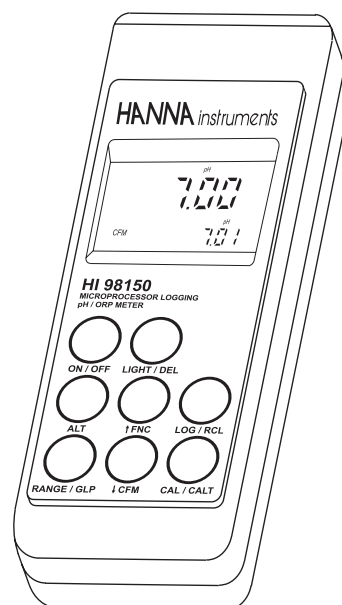
HI 98140 • HI 98150

Portable Waterproof pH / ORP Meters with Smart Electrodes & Log-On-Demand

HANNA instruments

HI 98150
MICROPROCESSOR LOGGING
pH / ORP METER

ON / OFF   LIGHT / DEL

ALT   ↑ FNC   LOG / RCL

RANGE / GLP   ↓ CFM   CAL / CALT

HANNA®
instruments
w w w . h a n n a i n s t . c o m

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.

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

These instruments are in compliance with the $C \epsilon$ directives.

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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:

- **HI 1618D** amplified pH electrode with built-in temperature sensor, plastic body and DIN connector
- pH 4.01 & pH 7.01 buffer solution (20 mL sachet each)
- Electrode cleaning solution
- Batteries (4 x 1.5V AA alkaline) and 12 Vdc adapter
- Instruction manual and 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

HI 98140 and **HI 98150** are two of the most innovative portable pH meters ever offered.

These instruments feature IP 67 waterproof protection, GLP (Good Laboratory Practice) capabilities and use the HANNA instruments' intelligent electrodes.

These pH electrodes incorporate a chip which memorizes the calibration data performed with a specific instrument. When the "intelligent" electrode is attached to the meter again, it is automatically recognized. This technology allows the operator to optimize time and efficiency with unsurpassed safety. It avoids erroneous measurements taken in the event the pH electrode is substituted after calibration. This series of electrodes also incorporates a temperature sensor, eliminating the need for an additional temperature probe.

HI 98140 and **HI 98150** feature all the most advanced features of laboratory pH meters. Moreover they are provided with a dual level LCD which facilitates operation in dimly lit locations.

By pressing a button, these meters can store up to 500 measurements complete with date and hour. Stored data can be displayed later or downloaded to a computer through an RS232 serial port and the **HI 92000** Windows® compatibile software.

These instruments also feature a controlled access to calibration and GLP settings through a password protection method.

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

The backlight feature is automatically disabled when the 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.

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

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

FUNCTIONAL DESCRIPTION
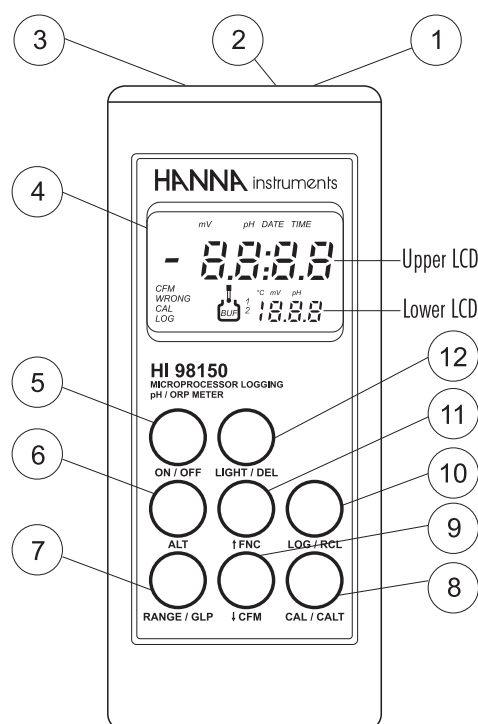
1) Power adapter plug
2) RS232 connector
3) DIN connector for smart electrodes
4) Liquid Crystal Display (LCD)
5) **ON/OFF** key, to turn the meter ON and OFF
6) **ALT** key, to activate alternate key function
7) **RANGE / GLP** key, to select measurement range, to display time and date, and to view 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)

Range	-4.00 to 19.99 pH / -20 to 120.0°C **HI 98150** only: ±600.0 mV; ±2000 mV
Resolution	0.01 pH 0.1°C (-10 to 120°C) / 1°C (below -10°C) **HI 98150** only: 0.1 mV (±400 mV) / 0.2 mV (±400 to ±600 mV) / 1 mV (outside)
Accuracy (@20°C/68°F)	±0.01 pH ±0.4 °C from 0 to 70°C / ±1°C outside **HI 98150** only: ±0.2 mV (±400 mV) / ±0.4 mV (±400 to ±600 mV) / ±2 mV (outside)
Typical EMC Deviation	±0.02 pH / ±0.4°C **HI 98150** only: ±1 mV (±600 mV) / ±2 mV (outside)
pH Calibration	Automatic, 1 or 2 point with 5 memorized buffers (pH 4.01, 6.86, 7.01, 9.18 and 10.01)
mV Calibration (**HI98150** only)	Automatic, 2 point at 0 and 350 mV or 3 point at 0, 350 and 1900 mV
Temperature Compensation	Automatic, -20 to 120°C (-4 to 248°F)
pH Electrode	**HI 1618D** smart electrode with built-in temperature sensor, DIN connector and 1 m (3.3') cable (included)
ORP Electrode	Smart ORP electrode with DIN connector (**HI98150** only; see accessories)
Input Impedance	10^{12} Ohm
PC Connection	Through RS232 serial port, using **HI 920011** connection cable & **HI 92000** software
Power Supply	4 x 1.5V AA batteries / approx. 300 hours of use (with backlight off) or 12 Vdc input
Casing	IP 67
Environment	0 to 50°C (32 to 122°F); RH max 100%
Dimensions	196 x 80 x 60 mm (7.7 x 3.1 x 2.4")
Weight	500 g (1.1 lb.)

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 supplied 12 Vdc adapter to the power adapter plug.

To prepare the instrument for use, connect the pH or ORP (**HI 98150** 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 it from the sample before turning the meter off.

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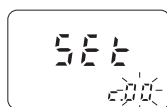
SETUP MODE

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

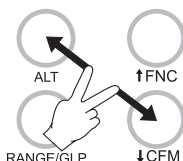- To enter this mode press the ALT and FNC keys when the meter is in measurement mode.

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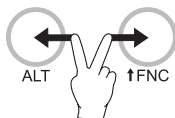
- The setup code "00" will blink on the lower LCD and "Set" will be displayed on the upper one.

5EŁ
ᴄ.00

- Select the code of the desired parameter using the ☐ or ☐ key.

↑FNC   ↓CFM

- Press ALT and CFM to confirm the code.

ALT   ↑FNC
RANGE/GLP   ↓CFM

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).

TIME
10:25
ᴄ.01

- Enter the new value using the arrow keys.

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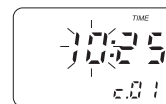
- If there is another part of the parameter to be set (e.g. minutes for the time), press RANGE to gain access and then enter the new value using the arrow keys.

RANGE/GLP

TIME
10:25
ᴄ.01

- 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]	YYYY	1998
10 Calibration alarm time-out	01 ÷ 99 days , OFF	OFF
20 Auto-Off/Power down time-out	ON, OFF	ON
21 Firmware version		
22 Battery level test		
99 Password[2]	0000 ÷ 9999	0000

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.

Connect the pH electrode with the built-in tempera-
ture 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 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).
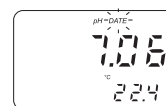
To take pH measurements, simply submerge the bottom 4 cm (1½") of the electrode in the solution to be tested and stir gently. Allow for the reading to stabilize.
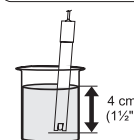
The temperature is displayed in the lower LCD.

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** only)

  The mV scale is autoranging, when the reading is outside ±600mV 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: If measurements are taken successively in different samples, it is recommended to rinse the electrode thoroughly with deion-ized 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 ONLY)

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

The temperature sensor is integrated in the pH electrode.

Immerse the pH electrode 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:
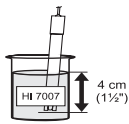
(4.01)   (6.86 / 7.01)   (9.18 / 10.01)

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.

2. Press CAL when the meter displays pH measurement.

3. Enter the password (if different from "0000") with the arrow keys.

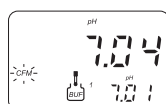4. Press ALT and CFM to confirm the password or CAL to exit.
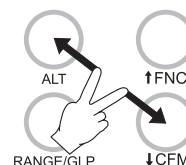
5. If password is correct, the meter displays "7.01pH" on the lower LCD with the "BUF 1" and "CAL" indication. The upper LCD shows the uncalibrated pH reading.
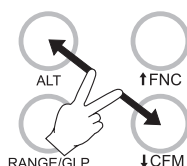
Note: The buffer pH value, and thus the value displayed on the lower LCD, varies with temperature. For example, at 20°C it shows 4.00 -7.03 -10.06, at 25°C it shows 4.01-7.01-10.01.

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.
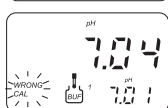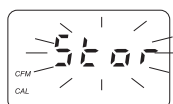
10. If only a single point calibration is required, press CAL to exit the calibration mode and maintain the previous slope calibration. The instrument then checks the electrode parameters and advises user of abnormalities by "old probe" and "dead probe" indications.
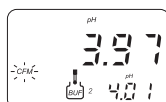
11. Press ▢ or ▢ to select the second buffer value. The meter will display the "BUF 2" indication.

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.

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

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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 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.
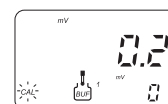
2. Press CAL when LCD is displaying mV.

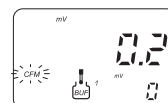3. Enter the password (if different from "0000") with the arrow keys.

4. Press ALT and CFM to confirm the password or CAL to exit.

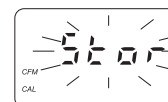5. If password is correct, the meter will display "0 mV" on the lower LCD with the "BUF 1" and "CAL" indication. The upper LCD displays the mV reading.

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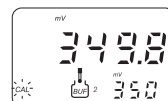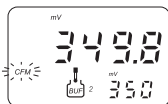
7. Press ALT and CFM to confirm the first value.

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.
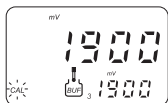
10. Set the simulator to +350 mV.

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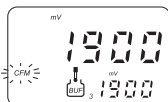
17. Calibration is now complete, the instrument returns to normal operational mode.

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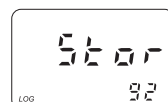
By pressing the LOG key a complete set of information is memorized: date, time, pH and mV (**HI98150** only) readings, temperature reading and also a message on the meter status.

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.
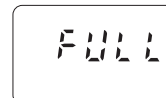
TO VIEW LOGGED DATA

To retrieve the memorized information press ALT and RCL.
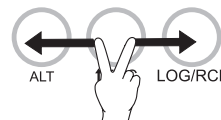
The meter displays the date (upper LCD) and the number (lower LCD) of the last logged sample. The "ZERO" indication will be displayed if no samples are stored in memory.
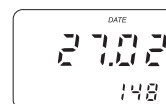
• Select the desired sample number with the arrow keys. Pressing the ▯ key while the last sample is displayed causes the meter to go to the first sample.

• 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

DATE

`1999`
`148`

- time

TIME

`16:28`
`148`
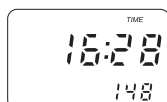
- pH reading
"----" means reading out of range or
no probe was connected.
"OrP" means that an ORP electrode
was connected.

pH

`8.49`
`148`

- mV reading
(**HI98150** only)
"----" means reading out of range.

mV

`88.1`
`148`

- temperature reading
"----" means reading out of range.

`25.0`
°C
`148`

- GLP message

`old P` `robE`
`148`
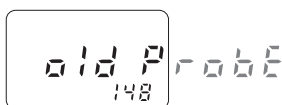
- If RANGE is pressed when the GLP message is displayed, the LCD
will revert to the date of the viewed sample.

- 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
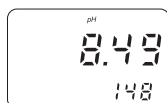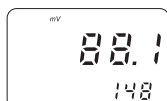pressing ALT and RCL.

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 confirma-
tion.

ON/OFF LIGHT/DEL

ALT ↑FNC

- Press the ALT and CFM to confirm deletion.

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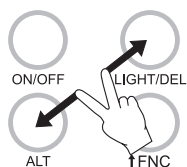
Note: Press ALT and DEL. to escape without data deletion.
When viewing through the logged data, the "NUL" message will be
displayed when selecting a deleted sample.

To delete all data in memory:

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

CFM

`dEL`
`ALL`

- Press ALT and CFM to confirm deletion.

ALT ↑FNC

RANGE/GLP ↓CFM
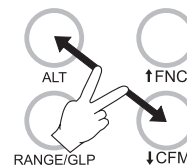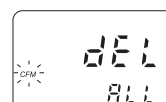
Note: Press ALT and DEL to escape without data deletion.

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.

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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

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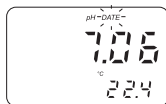
Alarm time-out is also signaled when viewing logged data through the "Cal date" message.

GLP AND RS232

All the GLP data can be retrieved (if the electrode is connected) 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.
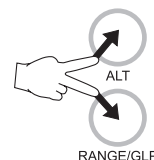
• The LCD will then display the last pH calibration date.
• Press RANGE to scan remaining data, in the following order:
    last calibration time
    electrode offset value in mV ("OFF" appears in the lower LCD)
    electrode slope in mV/pH ("SLP" appears in the lower LCD)
    first point calibration 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 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.

LIGHT/DEL

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.
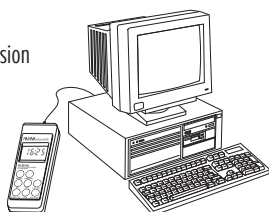
SPECIFICATIONS:

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 (**HI98150** only;1=calibrated,0=not calibr.)
mV calibration date (ddmmyy; **HI98150** only)
mV calibration time (hhmm; **HI98150** only)
mV buffer 1 (**HI98150** only)
mV buffer 2 (**HI98150** only)
mV buffer 3 (**HI98150** only)
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; **HI98150** only)
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 safe area and using four 1.5 V AA alkaline 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 12 Vdc power adapter can also be used to power the unit (see accessories).

SCREW POTS
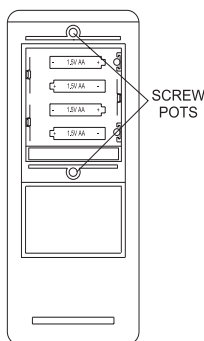
**Note:** The instrument uses the following configuration.

It is recommendable to purchase the Hanna voltage adapters that use the proper polarity configuration (**HI 710005** or **HI 710006**). However, **HI 98140** and **HI 98150** 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.
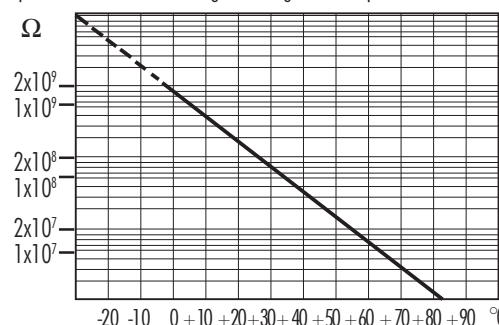
Since the resistance of the pH electrode is in the range of 200 Mohm, the current across the membrane is in the pico Ampere range. Large currents can disturb the calibration of the electrode for many hours.

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
	13.50	0.29
	14.00	0.40

ELECTRODE CONDITIONING AND MAINTENANCE

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

With the meter OFF, detach the electrode from the meter and immerse it 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 **HI 70300** storage solution for at least one hour.

For refillable electrodes

If the filling solution (electrolyte) is less than 1 cm (½") below the fill hole, add **HI 7082** (3.5M KCl electrolyte solution) for double junction or **HI 7071** (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 /1½") 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 **HI 70300** storage solution or, in its absence, filling solution (**HI 7071** for single junction or **HI 7082** 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 (**HI 7071** for single junction or **HI 7082** for double junction electrodes). Allow the electrode to stand upright for 1 hour. Follow the Storage Procedure above.

CLEANING PROCEDURE

- *General:* soak in HANNA **HI 7061** general cleaning solution for approximately 1 hour.

Removal of films, dirt or deposits on the membrane/junction:
- *Protein:* soak in HANNA **HI 7073** protein cleaning solution for 15 minutes
- *Inorganic:* soak in Hanna **HI 7074** inorganic cleaning solution for 15 minutes
- *Oil/grease:* rinse with Hanna **HI 7077** Oil & 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 **HI 70300** storage solution for at least 1 hour before taking measurements.

TROUBLESHOOTING

Evaluate performance of your electrode 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 (for refillable electrodes only): refill with fresh **HI 7071** for single junction electrodes or **HI 7082** for double junction electrodes.

- **Dry Membrane/Junction**: soak in **HI 70300** storage solution for at least 1 hour
- **Drifting**: soak the electrode tip in warm **HI 7082** solution for one hour, then flush tip with distilled water. Refill with fresh **HI 7071** for single junction electrodes and **HI 7082** 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 **HI 7061** solution 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 solution, 20 mL sachet, 25 pcs
HI 70007P   pH 7.01 buffer solution, 20 mL sachet, 25 pcs
HI 70010P   pH 10.01 buffer solution, 20 mL sachet, 25 pcs
HI 7004L   pH 4.01 buffer solution, 500 mL bottle
HI 7006L   pH 6.86 buffer solution, 500 mL bottle
HI 7007L   pH 7.01 buffer solution, 500 mL bottle
HI 7009L   pH 9.18 buffer solution, 500 mL bottle
HI 7010L   pH 10.01 buffer solution, 500 mL bottle

ELECTRODE MAINTENANCE SOLUTION
HI 70300L   Storage solution, 500 mL bottle
HI 70000P   Electrode rinsing solution, 20 mL sachet, 25 pcs
HI 7061L   General cleaning solution, 500 mL bottle
HI 7073L   Protein cleaning solution, 500 mL bottle
HI 7074L   Inorganic cleaning solution, 500 mL bottle
HI 7077L   Oil & Fat cleaning solution, 500 mL bottle
HI 7071   3.5M KCl+AgCl electrolyte solution, 4 x 50 mL bottle
HI 7072   1M KNO_3 electrolyte solution, 4 x 50 mL bottle
HI 7082   3.5M KCl electrolyte solution, 4 x 50 mL bottle

ORP PRETREATMENT SOLUTIONS
HI 7091L   Reducing pretreatment solution, 500 mL bottle
HI 7092L   Oxidizing pretreatment solution, 500 mL bottle

SMART ELECTRODES
HI 1615D   Smart pH electrode, glass body, single junction, refillable, with built-in temperature sensor, DIN connector and 1 m (3.3') cable
HI 1616D   Smart pH electrode, glass body, single junction, gel-filled, with built-in temperature sensor, DIN connector and 1 m (3.3') cable
HI 1617D   Smart pH electrode, glass body, single junction, triple ceramic, refillable, with built-in temperature sensor, DIN connector and 1 m (3.3') cable
HI 1618D   Smart pH electrode, plastic body, single junction, gel-filled, with built-in temperature sensor, DIN connector and 1 m (3.3') cable
HI 3619D   Smart ORP/Pt electrode, glass body, single junction, with DIN connector and 1 m (3.3') cable
HI 3620D   Smart ORP/Pt electrode, glass body, single junction, gel-filled, with DIN connector and 1 m (3.3') cable
FC 201D   Smart pH electrode, single junction, with built-in temperature sensor, DIN and 1 m (3.3') cable
FC 212D   Smart pH electrode, double junction, with built-in temperature sensor, DIN and 1 m (3.3') cable
FC 231D   Smart pH electrode, single junction, with penetration blade (20 mm / 0.79"), built-in temperature sensor, DIN connector and 1 m (3.3') cable
FC 241D   Smart pH electrode, single junction, with penetration blade (35 mm / 1.38"), built-in temperature sensor, DIN connector and 1 m (3.3') cable

OTHER ACCESSORIES
HI 710005   Voltage adapter, 115 Vac / 12 Vdc
HI 710006   Voltage adapter, 230 Vac / 12 Vdc
HI 76405   Electrode holder
HI 8427   pH and mV simulator
HI 931001   pH and mV simulator with LCD display
HI 92000   Windiws® compatible software
HI 920011   Serial cable for PC connection (5 to 9-pin)

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 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.

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

CE DECLARATION OF CONFORMITY

HANNA
instruments

$C\epsilon$

DECLARATION OF CONFORMITY

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

have been tested and found to be in compliance with EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC according to the following applicable normatives:

EN 50082-1: Electromagnetic Compatibility - Generic Immunity Standard
IEC 801-2 Electrostatic Discharge
IEC 801-3 RF Radiated
IEC 801-4 Fast Transient

EN 50081-1: Electromagnetic Compatibility - Generic Emission Standard
EN 55022 Radiated, Class B

EN61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use

Date of Issue: 3-6-1999

P. Cesa - Technical Director
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 24 Vac or 60 Vdc.

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

SALES AND TECHNICAL SERVICE CONTACTS

Australia:
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