Instruction  Manual

# HI 98160

## Portable Waterproof Microprocessor Logging  GLP pH / ORP Meter

**HANNA**

7.29

22.5

**HI 98160**
*Microprocessor Logging pH/ORP Meter*

ON / OFF   LIGHT DEL

ALT   ▲ FNC   LOG RCL

RANGE GLP   ▼ CFM   CAL AutoEnd

MAN98160R1   09/04

**HANNA**
instruments

www.hannainst.com
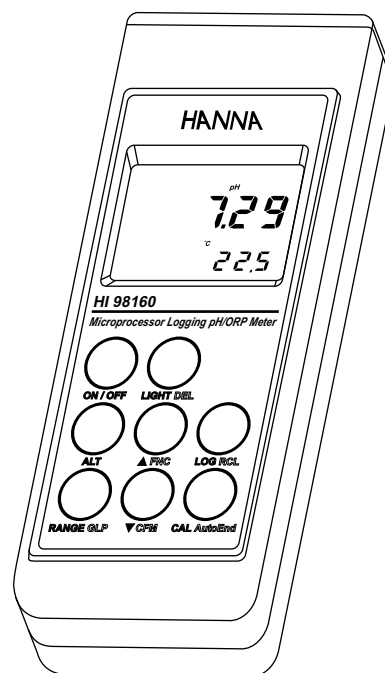
Dear Customer,

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

This instrument is in compliance with the $C\mathcal{E}$ directives.

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## 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.

**Electrodes and 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.

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

### 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.

| HI 2031B | Glass-body, semimicro, conic tip, refillable |
|---|---|
| FC 100B | Plastic-body (Kynar®), double junction, refillable, for food industry. |
| FC 200B | Plastic-body (Kynar®), single junction, conic, Viscolene, non-refillable, for meat & cheese. |
| FC 210B | Glass-body, double junction, conic, Viscolene, non-refillable, for milk & yogurt. |
| FC 220B | Glass-body, triple ceramic, single junction, refillable, for food processing. |
| FC 911B | Plastic-body (Kynar®), double junction, refillable with built-in amplifier |
| HI 1413B | Glass-body, single junction, flat tip, Viscolene for surface measurement. |

## ORP ELECTRODES (with BNC connector & 1 m cable)

| HI 3131B | Glass-body, refillable, Pt sensor |
|---|---|
| HI 3230B | Plastic-body (Ultem®), gel-filled, Pt sensor |
| HI 4430B | Plastic-body (Ultem®), gel-filled, Gold sensor |

## OTHER ACCESSORIES

| HI 710031 | Rugged carrying case |
|---|---|
| HI 740027 | 1.5V AA size alkaline batteries (4 pcs) |
| HI 76405 | Electrode holder |
| HI 7662 | Temperature probe with 1 m (3.3') cable |
| HI 8427 | pH and mV simulator |
| HI 931001 | pH and mV simulator with display |
| HI 920011 | 5 to 9-pin cable for connection to PC |

Ultem® is registered Trademark of "General Electrics Co."

Kynar® is registered Trademark of "Pennwalt Corp."

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:

- **HI1230B/C** pH electrode, double junction, plastic body, BNC connector with protective sleeve, 1 m (3.3') cable
- **HI7662** temperature probe with 1 m (3.3') cable
- **HI70004** pH 4.01 buffer solution, 20 ml sachet (1 pc)
- **HI70007** pH 7.01 buffer solution, 20 ml sachet (1 pc)
- Instruction manual
- 1.5V 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

**HI98160** is a portable logging microprocessor-based pH/ORP/temperature meter.

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

Eight memorized buffers (1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01 and 12.45 pH) and wrong buffer recognition technology make pH calibration simple and error free. One or two-point procedure can be performed.

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

An 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 level and automatically switches the meter off when batteries are too weak to support proper function.

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 can store measurements in memory upon user request for retrieval at a later time.

HI98160 also allows transfer of data to computer through the RS232 interface.

In addition, the meter allows the user to enter an ID code to uniquely identify the instrument.

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

The meter is 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.

## pH CALIBRATION SOLUTIONS

| | |
|---|---|
| HI 70004P | pH 4.01 Buffer Sachets, 20 ml sachet, 25 pcs |
| HI 70007P | pH 7.01 Buffer Sachets, 20 ml sachet, 25 pcs |
| HI 70010P | pH 10.01 Buffer Sachets, 20 ml sachet, 25 pcs |
| HI 7001M | pH 1.68 Buffer Solution, 230 ml |
| HI 7004L | pH 4.01 Buffer Solution, 500 ml |
| HI 7006L | pH 6.86 Buffer Solution, 500 ml |
| HI 7007L | pH 7.01 Buffer Solution, 500 ml |
| HI 7009L | pH 9.18 Buffer Solution, 500 ml |
| HI 7010L | pH 10.01 Buffer Solution, 500 ml |

## ELECTRODE STORAGE & CLEANING SOLUTIONS

| | |
|---|---|
| HI 70000P | Electrode Cleaning Sachets, 20 ml sachet, 25 pcs |
| HI 70300L | Storage Solution, 460 ml |
| HI 7061L | General Cleaning Solution, 460 ml |
| HI 7073L | Protein Cleaning Solution, 460 ml |
| HI 7074L | Inorganic Cleaning Solution, 460 ml |
| HI 7077L | Oil & Fat Cleaning Solution, 460 ml |

## REFILL ELECTROLYTE SOLUTIONS

| | |
|---|---|
| HI 7071 | 3.5M KCl + AgCl Electrolyte, 4x50 ml |
| HI 7072 | 1M $KNO_3$ Electrolyte, 4x50 ml |
| HI 7082 | 3.5M KCl Electrolyte, 4x50 ml, for double junction electrodes |

## ORP PRETREATMENT SOLUTIONS

| | |
|---|---|
| HI 7091L | Reducing Pretreatment Solution, 460 ml |
| HI 7092L | Oxidizing Pretreatment Solution, 460 ml |

## pH ELECTRODES (with BNC connector & 1 m cable)

| | |
|---|---|
| HI 1230B/C | Plastic-body (Ultem®), double junction, gel-filled, BNC protective sleeve |
| HI 1230B | Plastic-body (Ultem®), double junction, gel-filled |
| HI 1043B | Glass-body, double junction, refillable, combination |
| HI 1053B | Glass-body, triple ceramic, conic shape, refillable, |
| HI 1083B | Glass-body, micro, Viscolene |
| HI 1131B | Glass-body, single junction, refillable |
| HI 1330B | Glass-body, semimicro, single junction, refillable |
| HI 1331B | Glass-body, semimicro, single junction, refillable |
| HI 1332B | Plastic-body (Ultem®), double junction, refillable |

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For refillable electrodes:
Refill it with fresh electrolyte (**HI7071** for single junction or **HI7082** for double junction). Allow the electrode to stand upright for 1 hour.
Follow the Storage Procedure above.

CLEANING PROCEDURE

General    Soak in Hanna **HI7061 General Cleaning Solution** for approximately 1 hour.
Removal of films, dirt or deposits on the membrane/junction:
- *Protein*        Soak in Hanna **HI7073 Protein Cleaning Solution** for 15 minutes.
- *Inorganic*      Soak in Hanna **HI7074 Inorganic Cleaning Solution** for 15 minutes.
- *Oil/grease*     Rinse with Hanna **HI7077 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 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** for single junction or **HI7082** for double junction electrodes.
- **Dry Membrane/Junction:** Soak in **Storage Solution HI70300** for at least 1 hour.
- **Drifting:** Soak the electrode tip in warm Hanna Solution **HI7082** for one hour then flush tip with distilled water. Refill with fresh **HI7071** for single junction electrodes and **HI7082** 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** for 30 minutes, rinse thoroughly in distilled water and then follow the Cleaning Procedure above.
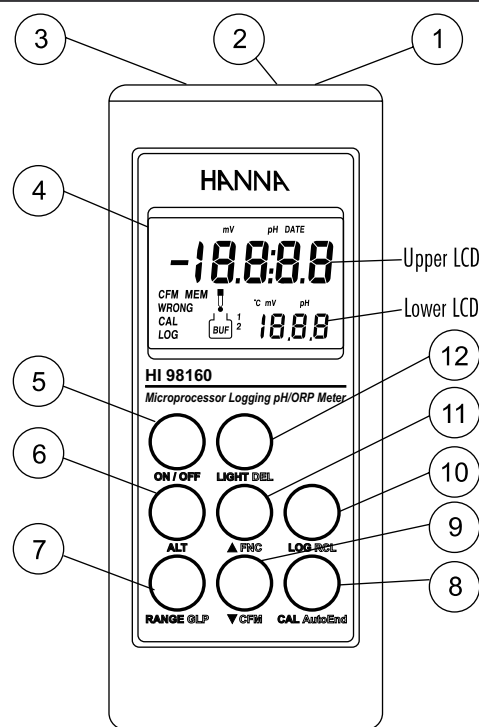
1) Socket for temperature probe
2) RS232 connector
3) BNC connector for pH electrode
4) Liquid Crystal Display (LCD)
5) **ON/OFF** key, to turn the meter on and off
6) **ALT** key, to alternate key function
7) **RANGE / GLP** key, to select measurement ranges, to display time and date, and to view calibration data (with ALT)
8) **CAL / AutoEnd** key, to enter pH calibration mode or (with **ALT**) to enter Auto Endpoint mode
9) **▼ / CFM** key, to move down or confirm values (with ALT)
10) **LOG / RCL** key, to store or recall measurements (with ALT)
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)

# SPECIFICATIONS

| Range | pH | − 4.00 to 19.99 pH |
|---|---|---|
| | mV | ±600.0 mV |
| | | ±2000 mV autoranging |
| | Temp. | − 20 to 120 °C |
| Resolution | pH | 0.01 pH |
| | mV | 0.1 mV within ±400mV |
| | | 0.2 mV from +400 to +600mV |
| | | 0.2 mV from -400 to -600mV |
| | | 1 mV outside |
| | Temp. | 0.1°C from -10 to 120 °C / 1°C below -10°C |
| Accuracy | pH | ±0.01 pH |
| (@20°C/68°F) | mV | ±0.2mV within ±400mV |
| | | ±0.4mV from +400 to +600mV |
| | | ±0.4mV from -400 to -600mV |
| | | ±2mV outside |
| | Temp. | ±0.2°C from 0 to 70°C / ±1°C outside |
| Typical EMC | pH | ±0.02 pH |
| Deviation | mV | ±1mV within ±600mV |
| | | ±2 mV outside |
| | Temp. | ±0.4°C |
| pH Calibration | | Automatic, at 1 or 2 points with 8 memorized buffers (1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45 pH) |
| mV Calibration | | Automatic, 2 points at 0 and 350 mV, or 3 points at 0, 350 and 1900 mV |
| Temperature Compensation | | Automatic or Manual between -20 and 120°C or |
| pH Electrode | | HI 1230B/C, double junction, BNC connector with protective sleeve (included) |
| Temperature probe | | HI 7662 (included) |
| Input Impedance | | $10^{12}$ Ohm |
| Power supply | | 4x1.5V AA size alkaline batteries; approx. 400 hours (without backlight) |
| 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.) |

## 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** Storage Solution for at least one hour.

### *For refillable electrodes:*

If the fill solution (electrolyte) is less than 1 cm (½") below the fill hole, add **HI7082 3,5M KCl Electrolyte Solution** for double junction or **HI7071 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 **HI70300** or **HI80300 Storage Solution** or, in its absence, **Filling Solution** (**HI7071** for single junction or **HI7082** for double junction electrodes). Follow the Preparation Procedure above before taking measurements.

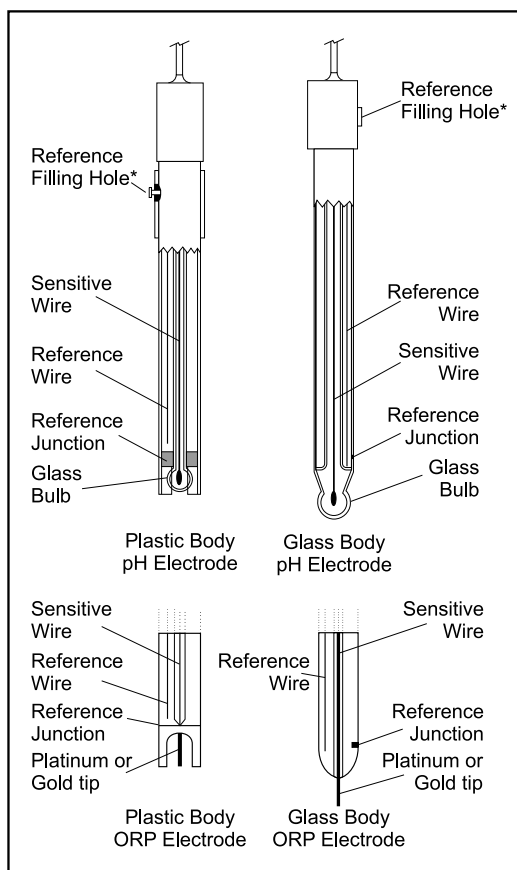**Note:** NEVER STORE THE ELECTRODE IN DISTILLED WATER OR DRY.

## 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.

## ELECTRODE CONDITIONING AND MAINTENANCE



Plastic Body pH Electrode

Glass Body pH Electrode

Plastic Body ORP Electrode

Glass Body ORP Electrode

* Only for refillable electrodes, must be open when taking measurements.

**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.

## 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.

To prepare the instrument for use, connect the pH (or ORP) electrode and the temperature probe to the connectors located on the top of the instrument.

In order to achieve the maximum protection against vapors and humidity, the BNC connector of the supplied pH electrode **HI1230B/C** is shielded behind a waterproof sheath.

Slide the protective sheath down; connect the **HI1230B/C** pH electrode to the instrument and then slide the protective sheath back. Since the protective sheath is rubberized and to ensure maximum waterproof protection, make sure the connector is completely covered.
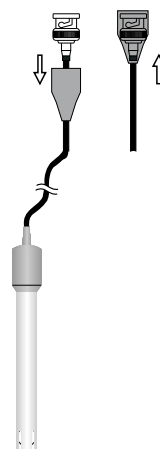
To switch the meter on, press the ON/OFF key. The batteries charge status will be displayed on the LCD for a few seconds.

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 "AOF"). To reactivate the instrument press the ON/OFF key.

Before proceeding with pH measurements follow the pH calibration procedure.

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

**Note:** To prevent damages to the electrode, remove it from the sample before turning the meter off.
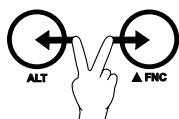
If the meter is off, detach the electrode from the meter before immersing it in the storage solution.

Setup 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.
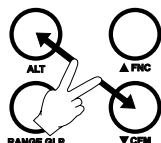
- The setup code "tC" will blink on the lower LCD and "SEt" will be displayed on the upper one.

- Select the code of the desired parameter using the arrow keys.

- Press the ALT and CFM keys to confirm the code.

**Note:** If the ALT and FNC keys are pressed before code confirmation, the meter will return 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 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 the ALT and CFM keys 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 the ALT and CFM keys 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 all parameters.

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.
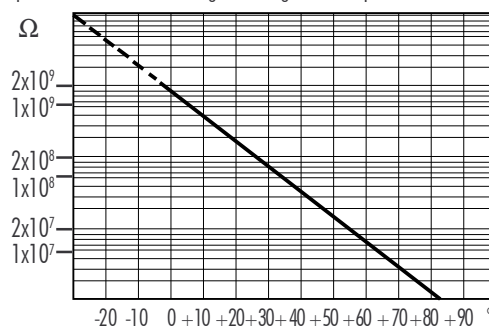


Since the resistance of the pH electrode is in the range of 200 Mohm, the current across the membrane is in the pico-Ampere range. Large currents can disturb the calibration of the electrode for many hours.

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 |

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

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. The "Batt" indication appears when trying to enable backlight. The meter can work for about 10 hours.
3. **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 re- place the four 1.5V AA batteries with new ones, paying attention to the cor- rect polarity.



SCREW POTS
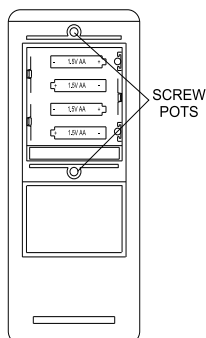
## PARAMETER SETTINGS

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



- Enter the desired value using the arrow keys.



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



- Press the ALT and CFM keys to confirm the value.
- If the entered value is not accepted, "WRONG" 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 the ALT and FNC keys 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 setup items table lists the items code, their valid values and the factory settings (defaults):

| Item | Description | Valid values | Default |
|------|-------------|--------------|---------|
| tC | Temperature compensation | Atc, ntc | Atc |
| ELC | Electrode condition | On, OFF | On |
| dUE | Calibration alarm time-out | OFF, 1 to 15 days | OFF |
| AOF | Auto-Off | On, OFF | On |
| HOU | Current time[1] | hh:mm | 00:00 |
| dAt | Current date[1] | dd.mm | 01.01 |
| YEA | Current year[1] | YYYY | 1998 |
| Id | Instrument ID code | 0000 to 9999 | 0000 |
| uEr | Firmware version | | |
| CHr | Battery level test | | |
| PAS | Password[2] | 0000 to 9999 | 0000 |

Some of the setup parameters are explained below.

## Item tC - Temperature Compensation

The temperature used for pH compensation can be:

- automatic reading from the probe (ATC).

- user defined (MTC)

Follow, the next steps to select the temperature source:

• Select item "tC".

• Select option: "Atc" or "ntc".

• Press ALT and CFM to confirm.

Note: If the "ntc" option has been selected, in pH measurement mode the "°C" tag blinks and the temperature value can be modified with the arrow keys.

## Item ELC - Electrode Condition

Electrode condition provides information about the electrode's performance. 100 means a good electrode, a low value means a bad electrode. When this value is below 10, the "bAd" message is displayed.

• Select item ELC.

• Select option: "On" or "OFF".

• Press ALT and CFM to confirm.

The electrode condition will be displayed while in pH or mV measurement mode, alternatively with the temperature.

Note: The electrode condition value is displayed only if a two-point procedure has been performed for pH calibration and the ELC option is "On".

## Item AOF - Auto-off

The auto-off time-out is fixed at 5 minutes.

• Select item AOF to enable / disable this feature.

## Item Id - 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 item Id.

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## 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 available commands 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
    electrode condition
    mV calibration status (0=not calibrated)
    mV calibration date (ddmmyy)
    mV calibration time (hhmm)
    mV buffer 1
    mV buffer 2
    mV buffer 3
    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)
    temperature reading (binary)

- Press the RANGE key to scan remaining data, in the following order:
    last calibration time
    first calibration point
    second calibration point
    third calibration point
- The meter will then return to normal operating mode. Press the ALT and GLP keys 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.

## DATA TRANSFER TO PC

Before starting the serial communication, please put the meter in measurement mode (pH or mV mode). Connect the meter to a PC through the RS232 output (the connector is located on the top of the meter). Use **HI920011** (5 to 9-pin) connection cable.

*SPECIFICATIONS:*

Isolated 8-bit data transmission
Baud Rate:      2400
Start bit:        1
Stop bit:         1
Parity bit:      none
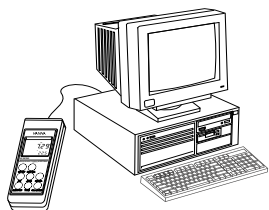
- Enter a 4-digit value using the arrow keys.
- Press the ALT and CFM keys to confirm the value.

Item CHr - Battery level test
- Select item CHr.
- The LCD will display "bAtt" 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).
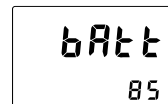
Note: The battery level test is also performed each time the meter is turned on.
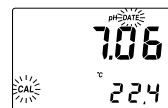
## TAKING pH MEASUREMENTS

Connect pH electrode and temperature probe to the meter and press the ON/OFF key to power on the instrument.

If necessary, press the RANGE key until the display enters the pH mode.

For greatest accuracy, it is recommended to set the calibration alarm time-out to the appropriate value for the specific use and calibrate the meter as soon as the "CAL" and "DATE" symbols blink on LCD (see GLP section).

To take pH measurements, remove the electrode protective cap and simply submerge the bottom 4 cm (1½") of the electrode and the temperature probe in the solution to be tested. Allow for the reading to stabilize.
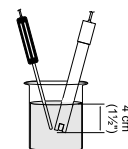
Note: To better use the meter ATC capability, it is recommended to position the temperature probe as close as possible to the pH electrode.

The temperature is displayed on the lower LCD.

The pH reading is temperature compensated.

If the meter displays "----" the reading is out of range, while a blinking reading means that the electrode is "dead".

By pressing the RANGE key the meter will switch between pH and mV reading. The mV scale is autoranging: when the reading is outside ±600mV the decimal point automatically disappears.

**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

Connect the ORP electrode to the meter and press the ON/OFF key. To enter the mV mode, press RANGE until the display changes to mV. 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:** 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

Immerse the 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 " - - -".

**Note:** If manual temperature compensation is selected (see Setup "tC"), the lower display will show the manual temperature used to pH compensation.

**Note:** If no temperature probe is connected, the instrument automatically switches to "Manual temperature compensation" working mode.

from 01 to 15 days or disable this function by selecting OFF. The default setting is OFF.

When turned on, the meter checks if the time-out time has expired. If the time has run out, the message "CAL duE" scrolls across the LCD. The "CAL" and "DATE" symbols will blink as a reminder.
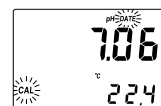
Alarm time-out is also signaled when viewing logged data through the "Cal" and "Due" message.

### 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" section).

### 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 the ALT and GLP keys when the meter displays pH reading.
- The LCD will then display the electrode condition if available. If electrode condition is not available or by pressing the RANGE key, the meter will display the last pH calibration date.
- Press RANGE key 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).
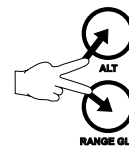
    If calibration was performed with an old or dead probe, the message "Old probe" or "Dead probe" will scroll on LCD.
- The meter will then return to normal operating mode. Press the ALT and GLP keys to escape before viewing all the data.

#### To view mV calibration data

- Press the ALT and GLP keys when the meter displays mV reading.
- The LCD will then display the last mV calibration date.

**Note:** Press the ALT and DEL keys 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 the ALT and DEL keys while in normal operating mode. The "del All" message will appear on the LCD and the "CFM" indication will start blinking asking for confirmation.



- Press the ALT and CFM keys to confirm deletion.
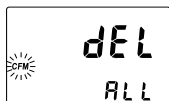
**Note:** Press the ALT and DEL keys to escape without data deletion.

**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 operating 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.

### 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 boundaries, 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 section) 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; readings will blink on the upper LCD to warn the user that they are not reliable.

### CALIBRATION ALARM TIME-OUT

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

It is possible to set (through setup code "dUE") the number of days before the next required calibration procedure. User can set a value

## AUTO ENDPOINT MODE

The Auto Endpoint feature allows the user to freeze the display when a stable reading is reached.

To enter the Auto Endpoint mode, press the ALT and AutoEnd keys. The MEM symbol will blink on the LCD until measurements become stable, then readings (pH/mV and temperature) are frozen on the display.

By pressing the RANGE key it is possible to switch between pH and mV measurements.

While in Auto Endpoint mode, frozen readings can be logged by pressing the LOG key (See "Logging function" section).

To exit from Auto Endpoint mode, press again the CAL and AutoEnd keys. The meter will return to continuous measurement mode.

**Note:** By entering the setup mode, by log consulting or by pressing the ALT and GLP keys, the meter will automatically exit from the Auto Endpoint mode.

## pH CALIBRATION PROCEDURE

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

A two-point calibration can use any combination from the following sets of pH buffers:

| 1.68 | 4.01 | (6.86 or 7.01) | (9.18 or 10.01) | 12.45 |

or

| 3.00 | | (6.86 or 7.01) | (9.18 or 10.01) | 12.45 |

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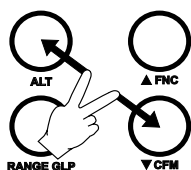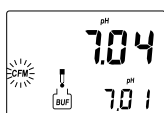
## pH CALIBRATION

1. Rinse pH electrode and temperature probe with a portion of the first calibration buffer or clean water. Dip the bottom 4 cm (1½") of both probes into a beaker containing the solution, while pay attention that the temperature probe is as close as possible to the pH electrode.

2. Press CAL when the meter displays pH measurement.


CAL AutoEnd

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

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


ALT    ▲ FNC
RANGE GLP    ▼ CFM
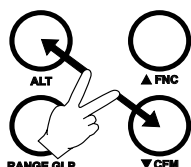
5. If password is correct, the meter displays "7.01pH" on the lower LCD with the "BUF 1" and "CAL" indication. The upper LCD shows the pH reading.

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 the ▲ and ▼ keys if necessary.

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


CFM   7.04 pH
BUF   7.01 pH

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


ALT    ▲ FNC
RANGE GLP    ▼ CFM

9. If everything is satisfactory the LCD will display "Stor" and then the second buffer value expected (two-point calibration).
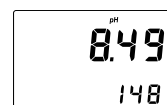

Stor
CFM
CAL

---

- year


DATE
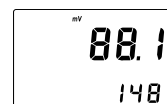1999
148

- time


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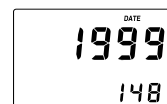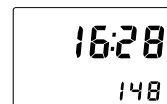
- pH reading
"----" means reading out of range or no probe was connected.
"OrP" means that an ORP electrode was connected.


pH
8.49
148

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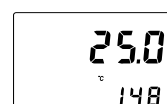"----" means reading out of range.


mV
88.1
148

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


25.0
°C
148

- GLP message


old ProbE
148

- If the RANGE key 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 ▲ key will cause the meter to display the pH reading of the next sample.

- At any time it is possible to return to normal operating mode by pressing the ALT and RCL keys.

## 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 the ALT and DEL keys. The "dEL" and "CFM" indications will start blinking asking for confirmation.

- Press the ALT and CFM keys to confirm.


ON / OFF    LIGHT DEL
ALT    ▲ FNC
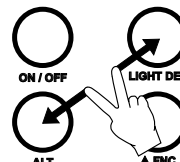
## LOGGING FUNCTION

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.

Stor
LOG    92

By pressing the LOG key a complete set of information is memorized: date, time, pH and mV readings, temperature reading and also a message on the meter status.
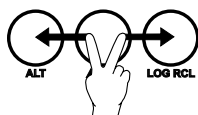
Up to 500 samples can be stored into memory.

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.

FULL
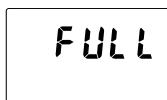
### TO VIEW LOGGED DATA

To retrieve the memorized information press the ALT and RCL keys.

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.
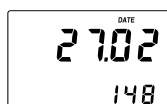
DATE
27.02
148

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

---

If a wrong solution or electrode has been used or if the buffer is polluted, "WRONG" symbol will blink to alert the user.

pH
7.04
WRONG
CAL    BUF    pH
7.01
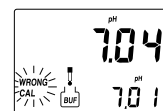
10. If a single point calibration is required, press CAL to exit the calibration mode and maintain the previous slope calibration. The instrument then checks the electrode parameters and advises user of abnormalities by "old probe" and "dead probe" indications.

11. Press the ▲ or ▼ keys 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 the ALT and CFM keys to confirm the second calibration point.

pH
3.97
CFM
BUF 2    pH
4.01

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.
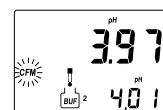
### CALIBRATION ERROR MESSAGES

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" section for more details about "old probe" and "dead probe" messages.

## ELECTRODE CONDITION

The evaluation of the electrode performance is made by using a reference scale from 10 to 100%. If the electrode condition is below 10%, the warning "bAd" electrode will be displayed.

The electrode performance is evaluated at calibration time. The new evaluation for the electrode is made only if a new calibration is performed. For an accurate electrode evaluation, a daily calibration is necessary.

If only one point calibration was made, the meter will not display the electrode condition.

Also if the electrode condition option (ELC) is disabled (OFF) from the setup menu, the electrode performance will not be evaluated.
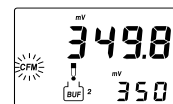
## mV CALIBRATION PROCEDURE

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. Turn off the meter.
2. Connect a mV simulator (**HI8427** or **HI931001** with the proper connecting cable) to the meter and set it to 0 mV.
3. Turn on the meter with the LOG and ▼ keys pressed.
4. Enter the password (if different from "0000") with the arrow keys.
5. Press the ALT and CFM keys to confirm the password or the CAL key to exit.
6. 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.
7. When the "CFM" symbol blinks, the reading is stable and calibration can be confirmed.
8. Press the ALT and CFM keys to confirm the first value.
9. The LCD will display "Stor" for a few seconds.
10. The meter will then display "350 mV" on the lower LCD with the "BUF 2" indication.
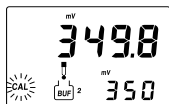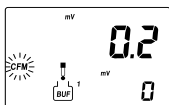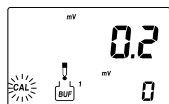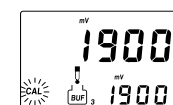
11. Set the simulator to $+350$ mV.
12. When the "CFM" symbol blinks, the reading is stable. Press the ALT and CFM keys to confirm the second value.
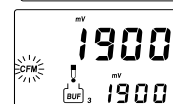13. The LCD will display "Stor" for a few seconds.
14. If only a two-point calibration is required, press the CAL key to leave the calibration mode. Proceed with the next step for three-point calibration.
15. The meter will display "1900 mV" on the lower LCD with the "BUF 3" indication.
16. Set the simulator to 1900 mV.
17. When the "CFM" symbol blinks, the reading is stable. Press the ALT and CFM keys to confirm the third value.
18. Calibration is now complete, the instrument returns to normal operating 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. Turn off the meter.
2. Turn on the meter with the LOG and CAL keys pressed to enter temperature calibration mode.
3. Immerse the temperature probe in the 0°C temperature bath.
4. Enter the password.
5. The meter will display "0.0 °C" on the lower LCD with the "BUF 1" and "CAL" indication.
6. When the reading is stable the "CFM" symbol starts to blink.
7. Press the ALT and CFM keys to confirm. LCD will then display 50.0°C on the lower LCD with the "BUF 2" indication.
8. Immerse the temperature probe in the 50°C temperature bath.
9. When the reading is stable the "CFM" symbol starts to blink.
10. Press the ALT and CFM keys to confirm and return to normal operating mode.