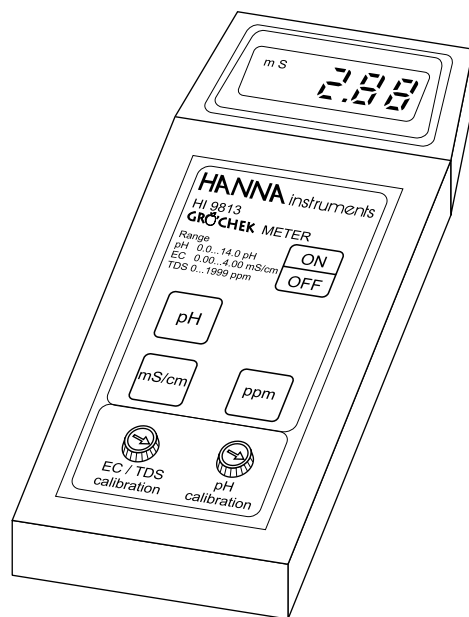


Instruction Manual

HI 9812 - HI 9813 Portable pH/EC/TDS Meters



Dear Customer,
 Thank you for choosing a Hanna product.
 Please read this instruction manual carefully before using the meter.
 This manual will provide you with the necessary information for a
 correct use of the instrument, as well as a precise idea of its versatility.
 If you need additional technical information, do not hesitate to e-mail
 us at tech@hannainst.com.
 These instruments are in compliance with **CE** directives
 EN 50081-1 and EN 50082-1.

TABLE OF CONTENTS

PRELIMINARY EXAMINATION 3
 GENERAL DESCRIPTION 3
 FUNCTIONAL DESCRIPTION HI 9812 4
 SPECIFICATIONS HI 9812 5
 FUNCTIONAL DESCRIPTION HI 9813 6
 SPECIFICATIONS HI 9813 7
 OPERATIONAL GUIDE 8
 pH CALIBRATION 10
 EC/TDS CALIBRATION 11
 pH VALUES AT VARIOUS TEMPERATURES 12
 TEMPERATURE COMPENSATION 13
 EC/TDS COVERSION FACTOR 13
 ELECTRODE CONDITIONING AND MAINTENANCE 14
 ACCESSORIES 16
 BATTERY REPLACEMENT 18
 WARRANTY 18
 CE DECLARATION OF CONFORMITY 19



PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it carefully to make sure that no damage has occurred during shipment. If noticeable damage is found, notify your Dealer.

Each meter is supplied with:

- HI 1285 combination, amplified, double-junction, gel pH electrode with incorporated EC/TDS probe and built-in temperature sensor and 1m (3.3') cable
- HI70004 pH 4.01 sachet (1 pc)
- HI70007 pH 7.01 sachet (1 pc)
- Instruction Manual
- 9 V battery.

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

GENERAL DESCRIPTION

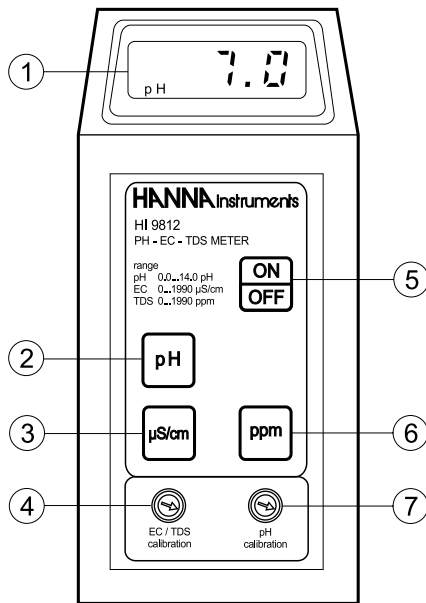
HI 9812 and HI 9813 are the most complete and versatile portable pH/EC/TDS meters ever manufactured. Designed with utmost precision and simplicity, these meters provide 3 kinds of measurements. The pH, EC and TDS ranges are easily selected using a membrane keyboard on the front panel.

The conductivity of a solution depends on the temperature and for this reason measurements are carried out with reference to a standard temperature of 25°C. If the solution measured has a different temperature than 25°C, compensation must be performed.

HI 9812 and HI9813 automatically compensate for temperature changes with a built-in temperature sensor and circuitry. The temperature coefficient is fixed at 2%.

- HI 9812 is a pH/EC/TDS meter designed for simplicity of use in taking pH, $\mu\text{S}/\text{cm}$ and ppm measurements. Suited for aquariums, fish-farming, seawater applications.
- HI 9813 is a pH/EC/TDS meter designed for simplicity of use in taking pH, mS/cm and ppm measurements. Suited for hydroponics, greenhousing, farming and ground water applications.

FUNCTIONAL DESCRIPTION HI 9812

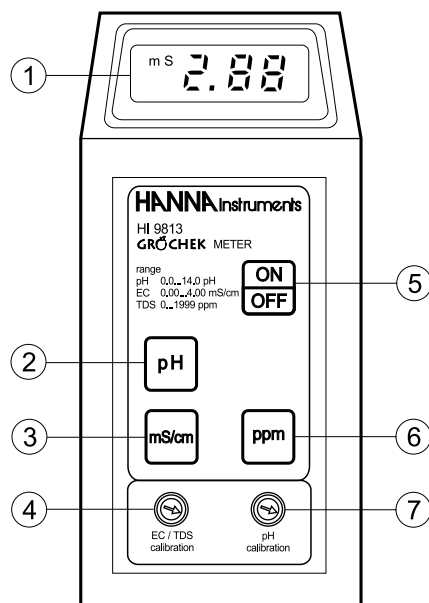


- 1) LCD display
- 2) pH range selection key
- 3) μ S/cm (EC) range selection key
- 4) EC/TDS calibration knob
- 5) ON/OFF key
- 6) ppm (TDS) selection key
- 7) pH offset calibration knob.

SPECIFICATIONS HI 9812

		HI 9812
Range	pH	0.0 to 14.0
	ppm	0 to 1990
	μS/cm	0 to 1990
Resolution	pH	0.1
	ppm	10
	μS/cm	10
Accuracy (@20°C/68°F)	pH	±0.2
	ppm	±2% f.s.
	μS/cm	±2% f.s.
Conversion Factor		1μS/cm = 0.5 ppm
Typical EMC Deviation	pH	±0.1
	ppm	±2% f.s.
	μS/cm	±2% f.s.
pH Calibration		Manual 1 point through offset trimmer
Offset Calibration		±1.5 pH
EC/TDS Calibration		Manual 1 point through slope trimmer
EC/TDS Temperature Compensation		Automatic from 0 to 50°C (32 to 122°F) with a β of 2% per degree °C
Electrode		HI 1285 combination pH/EC/TDS electrode with temperature sensor and 1 m (3.3') cable (included)
Battery Type		9 Volt 150 hours of continuous use
Environment		0 to 50°C (32 to 122°F); max 95% RH non-condensing
Dimensions		185 x 82 x 45 mm (7.3 x 3.2 x 1.8")
Weight		520 g (1.1 lb.)

FUNCTIONAL DESCRIPTION HI 9813



- 1) LCD display
- 2) pH range selection key
- 3) mS/cm (EC) range selection key
- 4) EC/TDS calibration knob
- 5) ON/OFF key
- 6) ppm (TDS) selection key
- 7) pH offset calibration knob.

SPECIFICATIONS HI 9813

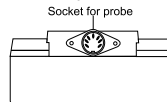
		HI 9813
Range	pH	0.0 to 14.0
	ppm	0 to 1999
	mS/cm	0.00 to 4.00
Resolution	pH	0.1
	ppm	1
	mS/cm	0.01
Accuracy (@20°C/68°F)	pH	±0.2
	ppm	±2% f.s.
	mS/cm	±2% f.s.
Conversion Factor		1µS/cm = 0.56-0.72 ppm
Typical EMC Deviation	pH	±0.1
	ppm	±2% f.s.
	mS/cm	±2% f.s.
pH Calibration		Manual 1 point through offset trimmer
Offset Calibration		±1.5 pH
EC/TDS Calibration		Manual 1 point through slope trimmer
EC/TDS Temperature Compensation		Automatic from 0 to 50°C (32 to 122°F) with a β of 2% per degree °C
Electrode		HI 1285 combination pH/EC/TDS electrode with temperature sensor and 1 m (3.3') cable (included)
Battery Type		9 Volt 150 hours of continuous use
Environment		0 to 50°C (32 to 122°F); max 95% RH non-condensing
Dimensions		185 x 82 x 45 mm (7.3 x 3.2 x 1.8")
Weight		520 g (1.1 lb.)

OPERATIONAL GUIDE

INITIAL PREPARATION

Each meter is supplied complete with a 9V battery. Slide off the battery compartment cover on the back of the meter (see page 18), install the battery while paying attention to its polarity.

Connect the probe to the DIN socket on the top of the meter by aligning the pins with the socket and pushing in the plug.



Always remove the electrode protective cap before taking any measurements.

Make sure the meter has been calibrated before taking any measurements (see pages 10 and 11 for calibration procedures).

Turn the meter on by pressing the ON/OFF key.



TAKING PH MEASUREMENTS

If the electrode has been left dry, soak the tip in a pH 7 or pH 4 buffer solution for a few minutes to reactivate it.

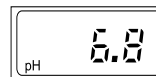
- To take a pH measurement simply submerge the tip (4cm/1½") of the combination pH/EC/TDS electrode into the sample to be tested.



- Select the pH mode .



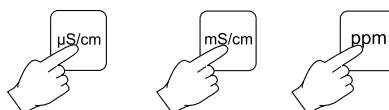
- Shake the electrode briefly while submerged and allow a couple of minutes for the electrode to adjust and stabilize. The display will show the pH value.



- If measurements are taken in different samples successively, it is recommended to rinse (clean) the electrode thoroughly to eliminate cross-contamination. After cleaning, it is recommended to rinse the electrode with some of the sample to be measured.

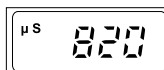
TAKING EC/TDS MEASUREMENTS

- Immerse the tip of the electrode (4cm/1½") into the sample to be tested. If possible, use plastic beakers or containers to minimize any EMC interference.
- Tap the electrode lightly on the bottom of the beaker to remove any air bubbles which may be trapped inside the tip.
- Select the appropriate measurement range (EC or TDS).

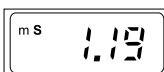


- Wait for 1-2 minutes for the temperature sensor to attain thermal equilibrium. The display will then show the measurement automatically temperature compensated for temperature with the appropriate indication among the following:

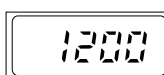
μS symbol indicates the meter is in μS/cm, EC mode (HI 9812 only)



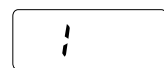
mS symbol indicates the meter is in mS/cm, EC mode (HI 9813 only)



- No symbol indicates the meter is in TDS mode.



Note: If the display shows only a "1" on the far left hand side, the meter is out of range.



AFTER MEASUREMENTS

After measurements have been completed, the instrument should be switched off and the probe cleaned and covered with the protective cap.

pH CALIBRATION

For greatest accuracy, frequent calibration of the instrument is recommended. The instrument should be recalibrated for pH:

- Whenever the electrode is replaced.
- At least once a month.
- After testing aggressive chemicals.
- Where extreme accuracy is required.

PREPARATION

Pour small quantities of pH 7.01 (HI 7007 or HI 8007) or pH 4.01 (HI 7004 or HI 8004) or pH 10.01 (HI 7010 or HI 8010) solution into a clean beaker.

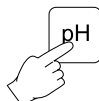


To obtain accurate readings, use pH 7.01 (HI 7007 or HI 8007) if you are going to measure neutral or close to neutral samples, pH 4.01 (HI 7004 or HI 8004) if you are going to measure acidic samples or pH 10.01 (HI 7010 or HI 8010) for alkaline measurements.

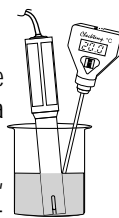
If you need to calibrate HI 9812 and HI 9813 to NBS standards, use pH 6.86 (HI 7006 or HI 8006) instead of pH 7.01 and pH 9.18 (HI 7009 or HI 8009) instead of pH 10.01.

PROCEDURE

- Switch the meter on after connecting the electrode and press pH to display pH measurement.



- Remove the protective cap from the electrode, rinse and immerse it in the buffer and stir gently. Wait a couple of minutes for the reading to stabilize.
- If the buffer solution is not at ambient temperature, take its temperature with a ChecktempC (or an accurate thermometer), e.g. 10.0°C.



Note: the electrode should be submerged approximately 4 cm (1½") into the solution. The ChecktempC should be located close to the electrode.

- Adjust the pH calibration knob until the LCD shows the pH value at the above temperature (see the pH versus temperature chart on page 12).



- The pH calibration is now complete.



EC/TDS CALIBRATION

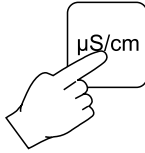
Accessories needed:

- Use HI 7031 or HI 8031, 1,413 $\mu\text{S}/\text{cm}$ (= 1.413 mS/cm) EC solution for HI 9812 and HI 9813 or HI 7032, 1382 ppm TDS solution for HI 9812 or HI 70442, 1500 ppm TDS solutions for HI 9813.

Note: the conversion between EC and TDS is made by a built-in circuit, hence it is requested to calibrate the meter only in EC or TDS range. The other range is thus automatically calibrated.

PROCEDURE

- Pour approximately 4 cm (1½") of a conductivity calibration solution (e.g. HI 7031/HI 8031) into a beaker. If possible, use plastic beakers to minimize any EMC interference. 
- Immerse the combined electrode in the solution. 
- Wait for a couple of minutes for thermal equilibrium to be reached.
- Tap the combined electrode on the bottom, then shake it lightly while rotating to make sure no air bubbles remain trapped inside the probe.
- Select the appropriate range, e.g. $\mu\text{S}/\text{cm}$ for HI 9812 or the mS/cm key for the HI9813.



- Turn the EC/TDS calibration knob until the display shows the EC or TDS reading at 25°C.



pH VALUES AT VARIOUS TEMPERATURES

For temperature compensation during calibration, please refer to the following chart.

TEMP		pHVALUES				
°C	°F	4.01	6.86	7.01	9.18	10.01
0	32	4.01	6.98	7.13	9.46	10.32
5	41	4.00	6.95	7.10	9.39	10.24
10	50	4.00	6.92	7.07	9.33	10.18
15	59	4.00	6.90	7.04	9.27	10.12
20	68	4.00	6.88	7.03	9.22	10.06
25	77	4.01	6.86	7.01	9.18	10.01
30	86	4.02	6.85	7.00	9.14	9.96
35	95	4.03	6.84	6.99	9.10	9.92
40	104	4.04	6.84	6.98	9.07	9.88
45	113	4.05	6.83	6.98	9.04	9.85
50	122	4.06	6.83	6.98	9.01	9.82
55	131	4.07	6.84	6.98	8.99	9.79
60	140	4.09	6.84	6.98	8.97	9.77
65	149	4.11	6.85	6.99	8.95	9.76
70	158	4.12	6.85	6.99	8.93	9.75

For instance, if the buffer temperature is 25°C, the display should show pH 4.0 or 7.0 or 10.0.

If the buffer temperature is 10°C, the display should show pH 4.0 or 7.0 or 10.1.

If the buffer temperature is 50°C, the display should show pH 4.0 or 6.9 or 9.8.

TEMPERATURE COMPENSATION

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

The conductivity invariably increases with increasing temperature.

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

For common ionic solution, this value is about 2%/°C. Acids, alkalis and concentrated salt solutions have somewhat lower value, typically 1.5%/°C.

Since a small difference in temperature causes a large change in conductivity, it is necessary to compensate for conductivity readings at high and low temperature. The readings are usually normalized at 25°C.

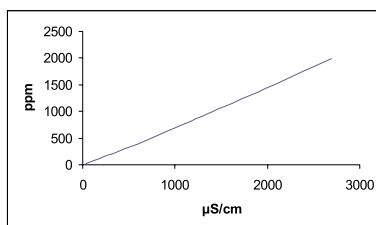
HI 9812 and HI9813 automatically compensate for temperature differences with a built-in temperature sensor circuitry. With this compensation, the display shows the readings at 25°C (77°F).

EC/TDS CONVERSION FACTOR

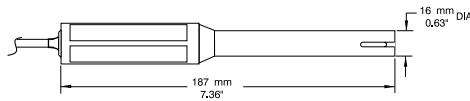
The TDS value in aqueous solutions is directly proportional to conductivity. The ratio between the two parameters depends on the solution.

HI 9812 has a fixed conversion factor set to 0.5 (corresponding to a solution of CaCO₃). This means that 1 μS/cm is equal to 0.5 ppm (mg/L) of TDS.

HI 9813 has a variable conversion factor from 0.56 to 0.72 according to TDS442 curve (see fig. below). TDS442 standard curve represents the best approximation for the TDS measurement in the field of hydroponics, farming and ground water, where many ingredients in fertilizer mixtures and ground water are present.



ELECTRODE CONDITIONING AND MAINTENANCE



HI 1285 is a combined pH/EC/TDS electrode with built-in temperature sensor for EC/TDS automatic temperature compensation. The probe screened cable is 1 m (3.3') long.

PREPARATION

Remove the protective cap.

DO NOT BE ALARMED IF ANY SALT DEPOSITS ARE PRESENT.

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

During transport tiny bubbles of air may have formed inside the glass bulb. The pH 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.

TEST MEASUREMENT

Rinse the electrode tip with tap water.

Immerse the tip (bottom 4 cm / 1½") in the sample and stir gently for approx. 30 seconds. Light tapping of the electrode on the bottom of the beaker is sometimes necessary to eliminate air bubble trapped in the electrode tip that could affect the EC/TDS reading.

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

STORAGE

When not in use, replace the protective cap.

PERIODIC MAINTENANCE

Inspect the electrode and the cable. The cable used for the 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.

CLEANING PROCEDURE

General Soak in Hanna HI 7061 General Cleaning Solution for approximately ½ 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 and Fat Cleaning Solution.

IMPORTANT: After performing any of the cleaning procedures rinse the electrode thoroughly with tap water and soak the electrode in HI 70300 Storage Solution for at least 1 hour before taking a measurement.

TROUBLESHOOTING

Evaluate your electrode performance on pH measurements based on the following.

- Noise (Readings fluctuate up and down) could be due to:
 - Clogged/Dirty Junction: Refer to the Cleaning Procedure above.
- Dry Membrane/Junction: Soak in Storage Solution HI 70300 for at least 1 hour.
- Drifting: Soak the electrode tip in warm Hanna Solution HI 7082 for one hour and rinse tip with distilled water (refill with fresh HI 7071 for single junction electrodes and HI 7082 for double junction electrodes if necessary).
- Low Slope: Refer to the cleaning procedure above.
- No Slope:
 - Check the electrode for cracks in glass stem or bulb (replace the electrode if cracks are found).
 - Make sure cable and connections are not damaged nor lying in a pool of water or solution.
- Slow Response/Excessive Drift: Soak the tip in Hanna Solution HI 7061 for 30 minutes, rinse thoroughly in distilled water and then follow the Cleaning Procedure above.

Note: for field applications, it is always recommended to keep a spare electrode handy. When anomalies are not resolved with simple maintenance, change the electrode (and recalibrate the meter) to see if the problem is alleviated.

ACCESSORIES

pH CALIBRATION SOLUTIONS

HI 70004P	pH 4.01 Buffer Sachets, 25 x 20 mL
HI 7004M	pH 4.01 Buffer Solution, 230 mL
HI 7004L	pH 4.01 Buffer Solution, 460 mL
HI 7006M	pH 6.86 Buffer Solution, 230 mL
HI 7006L	pH 6.86 Buffer Solution, 460 mL
HI 70007P	pH 7.01 Buffer Sachets, 25 x 20 mL
HI 7007M	pH 7.01 Buffer Solution, 230 mL
HI 7007L	pH 7.01 Buffer Solution, 460 mL
HI 7009M	pH 9.18 Buffer Solution, 230 mL
HI 7009L	pH 9.18 Buffer Solution, 460 mL
HI 70010P	pH 10.01 Buffer Sachets, 25 x 20 mL
HI 7010M	pH 10.01 Buffer Solution, 230 mL
HI 7010L	pH 10.01 Buffer Solution, 460 mL

pH CALIBRATION SOLUTIONS IN FDA APPROVED BOTTLE

HI 8004L	pH 4.01 Buffer Solution, 460 mL
HI 8006L	pH 6.86 Buffer Solution, 460 mL
HI 8007L	pH 7.01 Buffer Solution, 460 mL
HI 8009L	pH 9.18 Buffer Solution, 460 mL
HI 8010L	pH 10.01 Buffer Solution, 460 mL

CONDUCTIVITY & TDS BUFFER SOLUTIONS

HI 7031L	1413 $\mu\text{S/cm}$ ($\mu\text{mho/cm}$), 460mL
HI 7031M	1413 $\mu\text{S/cm}$ ($\mu\text{mho/cm}$), 230mL
HI 7033L	84 $\mu\text{S/cm}$ ($\mu\text{mho/cm}$), 460 mL
HI 7033M	84 $\mu\text{S/cm}$ ($\mu\text{mho/cm}$), 230 mL
HI 7032L	1382 ppm (mg/L), 460 mL
HI 7032M	1382 ppm (mg/L), , 230 mL

CONDUCTIVITY BUFFER SOLUTIONS IN FDA APPROVED BOTTLES

HI 8031L	1413 $\mu\text{S/cm}$ ($\mu\text{mho/cm}$), 460 mL
HI 8033L	84 $\mu\text{S/cm}$ ($\mu\text{mho/cm}$), 460 mL

ELECTRODE STORAGE SOLUTIONS

HI 70300M	Storage Solution, 230 mL
-----------	--------------------------

HI 70300L Storage Solution, 460 mL

ELECTRODE STORAGE SOLUTIONS IN FDA APPROVED BOTTLE

HI 80300M Storage Solution, 230 mL

HI 80300L Storage Solution, 460 mL

ELECTRODE CLEANING SOLUTIONS

HI 70000P Electrode Rinsing Sachets, 25 x 20 mL

HI 7061M General Cleaning Solution, 230 mL

HI 7061L General Cleaning Solution, 460 mL

HI 7073M Protein Cleaning Solution, 230 mL

HI 7073L Protein Cleaning Solution, 460 mL

HI 7074M Inorganic Cleaning Solution, 230 mL

HI 7074L Inorganic Cleaning Solution, 460 mL

HI 7077M Oil & Fat Cleaning Solution, 230 mL

HI 7077L Oil & Fat Cleaning Solution, 460 mL

ELECTRODE CLEANING SOLUTIONS IN FDA APPROVED BOTTLE

HI 8061M General Cleaning Solution, 230 mL

HI 8061L General Cleaning Solution, 460 mL

HI 8073M Protein Cleaning Solution, 230 mL

HI 8073L Protein Cleaning Solution, 230 mL

HI 8077M Oil & Fat Cleaning Solution, 230 mL

HI 8077L Oil & Fat Cleaning Solution, 460 mL

OTHER ACCESSORIES

CHECKTEMPC Electronic thermometer (range: -50.0 to 150.0°C)

HI 710001 Soft carrying case

HI 710009 Shockproof, blue rubberboot

HI 710010 Shockproof, orange rubberboot

HI 710031 Rugged carrying case

MAN9812R1 Instructions manual

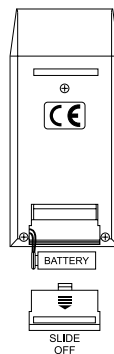
BATTERY REPLACEMENT

All meters are powered by a 9V battery that is located on the rear of the instrument.

When the battery becomes weak reaching a certain threshold, the instrument automatically switches off.

Replacement must only take place in a nonhazardous area using an alkaline 9V battery.

To access the battery, remove the battery cover by applying pressure in the direction indicated. Replace the old battery with a new one while paying attention to its polarity.



WARRANTY

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

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

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

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

All rights are reserved. Reproduction in whole or in part is prohibited without the written consent of the copyright owner, Hanna Instruments Inc., 584 Park East Drive, Woonsocket, Rhode Island, 02895, USA.

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

CE DECLARATION OF CONFORMITY

								
 DECLARATION OF CONFORMITY								
We Hanna Instruments Italia Srl via E.Fermi, 10 35030 Sarmeola di Rubano - PD ITALY								
herewith certify that the pH/EC/TDS meters: HI 9812 HI 9813								
have been tested and found to be in compliance with the following regulations:								
<table><tr><td>IEC 801-2</td><td>Electrostatic Discharge</td></tr><tr><td>IEC 801-3</td><td>RF Radiated</td></tr><tr><td>EN 55022</td><td>Radiated, Class B</td></tr><tr><td>EN 61010-1</td><td>User Safety Requirement</td></tr></table>	IEC 801-2	Electrostatic Discharge	IEC 801-3	RF Radiated	EN 55022	Radiated, Class B	EN 61010-1	User Safety Requirement
IEC 801-2	Electrostatic Discharge							
IEC 801-3	RF Radiated							
EN 55022	Radiated, Class B							
EN 61010-1	User Safety Requirement							
Date of Issue: <u>23-10-1997</u>	 D.Volpato - Engineering Manager On behalf of Hanna Instruments Italia S.r.l.							

Recommendations for Users

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

Operation of these instruments in residential areas could cause unacceptable interferences to radio and TV equipment.

The metal band at the end of the electrode is sensitive to electrostatic discharges. Avoid touching this metal band all the times.

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

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

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

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

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

HANNA LITERATURE



LAB RECORDING



WATER ANALYSIS HANDBOOK



ENVIROCORE



GENERAL CATALOG

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

PRINTED IN PORTUGAL

MAN9812R1
12/98



<http://www.hannainst.com>