

Instruction Manual

HI 9143 • HI 9145

Portable D.O. Meters
in Water-Resistant Casing



Dear Customer,

Thank you for choosing a HANNA product.

Please read this instruction manual carefully before using the instrument.

This manual will provide you with the necessary information for a correct use of the instrument.

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

These instruments are in compliance with the CE directives.

TABLE OF CONTENTS

Preliminary Examination	3
General Description	3
Functional Description - Probe	4
Functional Description - Meter	5
Specifications	6
Probe Preparation	7
Calibration	8
Taking Measurements	10
Altitude Compensation	12
Salinity Compensation	13
Probe & Membrane Maintenance	14
Battery Replacement	16
Accessories	17
Warranty	18
CE Declaration of Conformity	19

PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it to make sure that no damage has occurred during shipping. If there is any damage, immediately notify your dealer.

Each meter is supplied complete with:

- **HI 76407/4** DO probe with 4 m (13') cable
- 2 spare membranes with O-rings
- Protective cap
- **HI 7041S** electrolyte solution (30 mL)
- Batteries (4 x 1.5V AA)
- Instruction manual
- Rugged carrying case

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

GENERAL DESCRIPTION

HI 9143 and **HI 9145** are water-resistant dissolved oxygen meters designed for harsh outdoor applications, especially waste water treatment and fish farming.

Simple on-site calibration requires no chemical solutions. Just expose the probe to air and press the CAL button. In a few minutes, the meter is calibrated and ready to use.

The new and improved **HI 9143** and **HI 9145** measure and display O₂ from 0 to 300%, 0 to 45 mg/L and temperature from 0 to 50 °C.

In addition to the features of **HI 9145**, **HI 9143** also supplies the user with compensation of salinity and altitude factors.

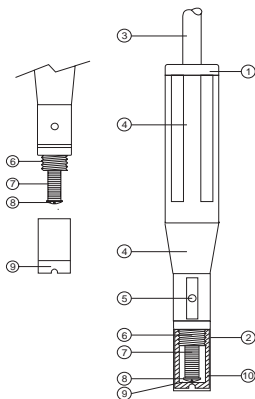
Both meters compensate for the temperature effect.

The dissolved oxygen probe is provided with a membrane covering the polarographic sensor elements, and a built-in thermistor for temperature measurement and compensation.

The thin permeable membrane isolates the sensor elements from the testing solution, but allows oxygen to enter.

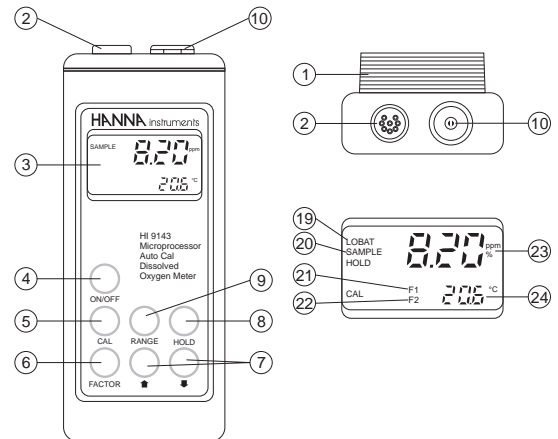
When a voltage is applied across the sensor, oxygen that passes through the membrane causes a current to flow from which the oxygen concentration is determined.

FUNCTIONAL DESCRIPTION - PROBE



1. D.O. probe
2. Protective cap
3. Watertight shielded cable
4. Polypropylene body
5. Temperature sensor
6. O-Ring seal
7. AgCl (silver chloride) anode
8. Platinum cathode
9. Oxygen permeable membrane
10. Membrane cap

FUNCTIONAL DESCRIPTION - METER



- 1) Battery compartment
- 2) Probe connector
- 3) Liquid Crystal Display (LCD)
- 4) ON/OFF key
- 5) CAL key, to enter/exit calibration mode
- 6) FACTOR* key, to select altitude (F1) and salinity (F2)
- 7) UP* and DOWN* arrow keys, to set F1 and F2 values
- 8) HOLD key, to freeze reading on display
- 9) RANGE key, to select oxygen measurement range (ppm or % of saturation)
- 10) Socket for 12 Vdc power adapter
- 19) "LOW BAT", low battery indicator
- 20) "SAMPLE", measuring mode indicator
- 21) "F1", altitude factor* indicator
- 22) "F2", salinity factor* indicator
- 23) "%", or "ppm", oxygen measure unit
- 24) Secondary display

(*) HI 9143 only

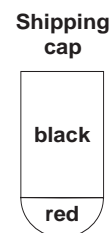
SPECIFICATIONS

	HI 9143	HI 9145
Range	0.00 to 45.00 mg/L O ₂ 0.0 to 300.0% O ₂ 0.0 to 50.0°C	
Resolution	0.01 mg/L / 0.1% O ₂ 0.1°C	
Accuracy (@20°C/68°F)	±1.5% FS (O ₂) ±0.5°C	
Typical EMC Deviation	±0.3 mg/L / ±3.5% O ₂ ±0.5 °C	
Calibration	Automatic, in air, at 100%	
Temperature Compensation	Automatic, 0 to 50°C (32 to 122°F)	
Altitude Compensation	0 to 1900 m (resolution 100 m)	---
Salinity Compensation	0 to 40 g/L (resolution 1 g/L)	---
Probe	HI 76407/4 polarographic with 4 m (13') cable (included)	
Environment	0 to 50°C (32 to 122°F); RH max 100%	
Power Supply	4 x 1.5V AA batteries; approx. 200 hours of continuous use; auto-off after 4 hours of inactivity; or input for 12 Vdc adapter	
Dimensions	196 x 80 x 60 mm (7.7 x 3.1 x 2.4")	
Weight	500 g (1.1 lb.)	

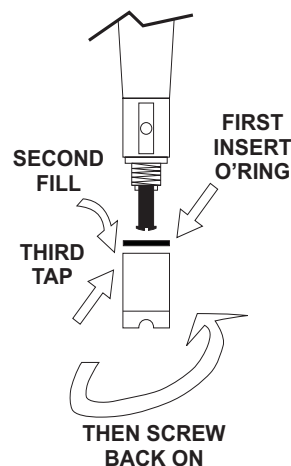
PROBE PREPARATION

All HANNA D.O. probes are shipped dry. To hydrate the probe and prepare it for use, connect it to the meter and proceed as follows.

1. Remove the red & black plastic cap used for shipping purposes only.
2. Wet the sensor by soaking the bottom (2.5 cm/1") of the probe in **HI 7041S** electrolyte solution for 5 minutes.

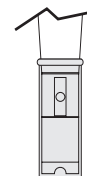


3. Rinse the supplied membrane (**HI76407A**) with some electrolyte while shaking it gently. Refill with fresh electrolyte.
4. Gently tap the sides of the membrane with your finger to ensure that no air bubbles remain trapped. To avoid any damage, do not tap the membrane directly on the bottom.



5. Make sure that the rubber O-ring sits properly inside the membrane cap.
6. With the sensor facing down, screw the cap clockwise. Some electrolyte will overflow.

When not in use, protect the membrane with the supplied cap.



CALIBRATION

PROBE POLARIZATION

The probe is under polarization with a fixed voltage of approximately 800 mV. Probe polarization is essential for stable measurements with the same recurring degree of accuracy.

With the probe properly polarized, oxygen is continually "consumed" by passing through the sensitive diaphragm and dissolving in the electrolyte solution contained inside the probe.

If this operation is interrupted, the electrolyte solution continues to be enriched with oxygen until it reaches an equilibrium with the surrounding solution. Measurements taken with a non-polarized probe give an oxygen level that indicates that of the test solution as well as any oxygen present in the electrolyte solution. This reading is obviously incorrect.

The HANNA **HI 9143** and **HI 9145** oxygen meter automatically polarize the probe each time they are switched on.

Calibration is simple and is recommended every time the meter is switched on.

- Make sure the probe is ready for measurement (see page 7), i.e. the membrane is filled with electrolyte, probe is connected to the meter and properly polarized.

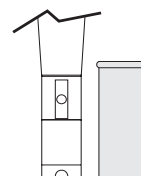
- Switch the meter on.
- "COND" appears on the display to inform the user that the probe is in auto-conditioning (automatic polarization) mode.



- Once "COND" disappears, the probe is polarized and the instrument can be calibrated.

- For an accurate calibration, it is recommended to wait an additional 5-10 minutes to ensure optimum conditioning of the probe.

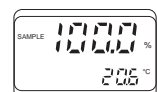
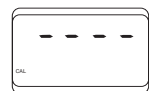
- Remove the protective cap.



- Press CAL. The display shows "----" together with the "CAL" symbol to indicate that the instrument is in calibration mode.



- The instrument will automatically standardize itself to the actual saturation value. After approx. 1 minute it will display "100%" with "SAMPLE" to indicate that the calibration is complete.



- **HI 9143 only:** press FACTOR and ensure that F1 and F2 are set to the appropriate altitude and salinity values.

Notes: • The instrument must be calibrated whenever the probe, membrane or electrolyte is changed.

- To exit the calibration mode at any time, press CAL.



- The display may be switched from readings in % saturation to ppm (mg/L) by simply pressing the RANGE key. Recalibration is not needed.



TAKING MEASUREMENTS

Make sure the meter has been calibrated and the protective cap has been removed. Immerse the tip of the probe in the sample to be tested ensuring that the temperature sensor is also immersed.



To display values in % saturation, press RANGE.



For accurate dissolved oxygen measurements, a water movement of at least 30 cm (12")/sec is required. This is to ensure that oxygen depleted on the membrane surface is constantly replenished. A moving stream will provide adequate circulation.

During field measurements, this condition may be obtained by manually stirring the probe. Accurate readings are not possible while the liquid is stationary.

During laboratory measurements, the use of a magnetic stirrer to ensure a certain agitation of the fluid is recommended. This way, any errors due to the presence of air bubbles on the membrane surface are minimized.

For accurate measurements, allow sufficient time for the thermal equilibrium to be reached between the probe and the measured sample (a few minutes if the temperature difference is several degrees).

mg/L READINGS

The mg/L mode give the dissolved oxygen concentration directly in ppm.

If the sample contains significant salinity or if the measurement is taken at a higher altitude than sea level, the readout values must be corrected, by taking into account the lower degree of oxygen solubility in such conditions. Compensation for altitude and sality effects is possible with the **HI 9143** model.

Altitude and/or salinity values should be set before calibrating and taking measurements. The meter will automatically compensate for these factors (see "Altitude Compensation" and "Salinity Compensation" sections).

% O₂ SATURATION READINGS

The % O₂ reading provides the rate of oxygen saturation with reference to 100% at sea level.



TEMPERATURE READINGS

The secondary display will show the sample temperature in Celsius degrees.

Allow the probe to reach thermal equilibrium with the sample before taking any measurement. The greater the difference between the ambient temperature and the temperature of the sample, the longer it will take the probe to acclimatized itself to the sample.

ALTITUDE COMPENSATION

HI 9143

Press FACTOR and “F1” will be displayed.



Use the UP and DOWN keys to set the altitude from 0 to 1900 m, in steps of 100 m.



HI 9145

With **HI 9145**, all the DO readings refer to the sea level. Altitude affects the DO concentration by decreasing its value.

The following table reports the maximum oxygen solubility at various temperatures and altitudes.

The table provides an idea of the error that can be introduced at different altitudes and the quantity to be subtracted to correct the reading.

°C	Altitude above Sea Level (in meters)							°F
	0 m	300 m	600 m	900 m	1200 m	1500 m	1800 m	
0	14.6	14.1	13.6	13.2	12.7	12.3	11.8	32.0
2	13.8	13.3	12.9	12.4	12.0	11.6	11.2	35.6
4	13.1	12.7	12.2	11.9	11.4	11.0	10.6	39.2
6	12.4	12.0	11.6	11.2	10.8	10.4	10.1	42.8
8	11.8	11.4	11.0	10.6	10.3	9.9	9.6	46.4
10	11.3	10.9	10.5	10.2	9.8	9.5	9.2	50.0
12	10.8	10.4	10.1	9.7	9.4	9.1	8.8	53.6
14	10.3	9.9	9.6	9.3	9.0	8.7	8.3	57.2
16	9.9	9.7	9.2	8.9	8.6	8.3	8.0	60.8
18	9.5	9.2	8.7	8.6	8.3	8.0	7.7	64.4
20	9.1	8.8	8.5	8.2	7.9	7.7	7.4	68.0
22	8.7	8.4	8.1	7.8	7.7	7.3	7.1	71.6
24	8.4	8.1	7.8	7.5	7.3	7.1	6.8	75.2
26	8.1	7.8	7.5	7.3	7.0	6.8	6.6	78.8
28	7.8	7.5	7.3	7.0	6.8	6.6	6.3	82.4
30	7.5	7.2	7.0	6.8	6.5	6.3	6.1	86.0
32	7.3	7.1	6.8	6.6	6.4	6.1	5.9	89.6
34	7.1	6.9	6.6	6.4	6.2	6.0	5.8	93.2
36	6.8	6.6	6.3	6.1	5.9	5.7	5.5	96.8
38	6.6	6.4	6.2	5.9	5.7	5.6	5.4	100.4
40	6.4	6.2	6.0	5.8	5.6	5.4	5.2	104.4

SALINITY COMPENSATION

HI 9143

Press FACTOR twice and “F2” will be displayed.



Press the UP and DOWN keys to set the salinity between 0 and 40 g/L. Press FACTOR again to display the temperature.



HI 9145

All DO readings refer to 0 g/L of salinity. Salinity affects the DO concentration by decreasing its value.

The table below shows the maximum solubility of oxygen at various temperatures and salinity levels. By using the table, the quantity to be subtracted to correct the reading can be calculated.

°C	Salinity (g/L) at Sea Level					°F
	0 g/L	10 g/L	20 g/L	30 g/L	35 g/L	
10	11.3	10.6	9.9	9.3	9.0	50.0
12	10.8	10.1	9.5	8.9	8.6	53.6
14	10.3	9.7	9.1	8.6	8.3	57.2
16	9.9	9.3	8.7	8.2	8.0	60.8
18	9.5	8.9	8.4	7.9	7.6	64.4
20	9.1	8.5	8.0	7.6	7.4	68.0
22	8.7	8.2	7.8	7.3	7.1	71.6
24	8.4	7.9	7.5	7.1	6.9	75.2
26	8.1	7.6	7.2	6.8	6.6	78.8
28	7.8	7.4	7.0	6.6	6.4	82.4

PROBE & MEMBRANE MAINTENANCE

The oxygen probe body is made of reinforced polypropylene for maximum durability.

A built-in thermistor sensor measures the temperature of the sample. It is recommended to keep the protective cap on the probe when the it is not in use.

To replace the membrane or refill it with electrolyte, proceed as follows:

- Remove the protective cap by gently twisting and pulling it off the probe (fig.1).
- Unscrew the membrane by turning it counterclockwise (fig.2)
- Wet the sensor by soaking the bottom (2.5 cm / 1") of the probe in **HI7041S** electrolyte solution for 5 minutes.
- Rinse a new membrane (**HI 76407A**) with some electrolyte while shaking it gently. Refill with fresh electrolyte.
- Gently tap the sides of the membrane with your finger to ensure that no air bubbles remain trapped. Do not directly tap the bottom as this may damage the membrane.
- Make sure that the rubber O-ring is seated properly inside the membrane cap.

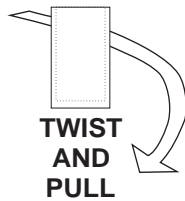


fig. 1

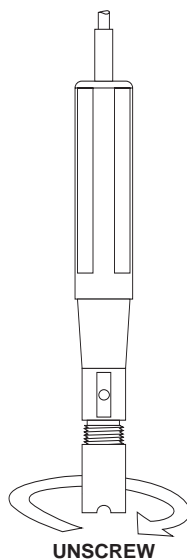


fig. 2

- With the sensor facing down, screw the membrane cap clockwise. Some electrolyte will overflow.

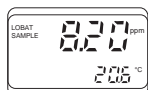
The platinum cathode sensor should always be bright and untarnished. If it is tarnished or stained, which could be due to contact with certain gases or extended use with a loose or damaged membrane, the cathode sensor should be cleaned.

Use a clean, lint-free cardboard or cloth. Rub the cathode very gently side to side 4-5 times. This will be enough to polish and remove any stains without damaging the platinum tip. Then, rinse the probe with deionized or distilled water. Install a new membrane and fill it with fresh electrolyte following the instructions above. Recalibrate the instrument.

Important: For accurate and stable measurements, it is important that the surface of the membrane is in perfect condition. This permeable membrane isolates the sensor elements from the environment but allows oxygen to enter. If any dirt is deposited on the membrane, rinse it carefully with distilled or deionized water. If any imperfection is observed, or any damage is evident (such as wrinkles, tears or holes), the membrane should be replaced. Make sure that the O-Ring is properly seated in the membrane cap.

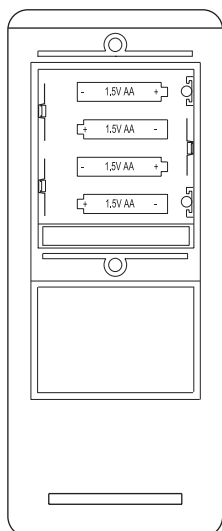
BATTERY REPLACEMENT

When the batteries become weak, the "LOBAT" indication appears on the LCD to warn the operator that the display will be shut-off after about 4 hours of use to prevent erroneous readings due to low voltage.



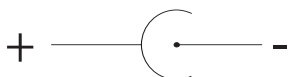
Battery replacement must only take place in a safe area using 1.5V AA alkaline batteries.

In order to replace the batteries, simply remove the two screws on the rear cover of the instrument and replace all four batteries with new ones, while paying attention to the correct polarity.

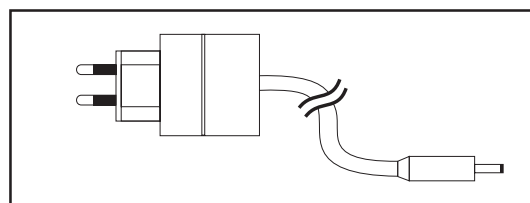


A 12 Vdc power source can also be used to power the unit. Simply unscrew the protective cap on the top of the instrument and plug the power adapter into the socket.

Note: The instrument uses the following configuration.



Use the HANNA adapters (such as **HI 710005** or **HI 710006**) with proper polarity configuration.



HI 9143 and **HI 9145** can also run on other adapters. In this case, check the correct polarity of the adapter before connecting it to the meter.

ACCESSORIES

- HI 76407/4** DO probe with 4 m (13') cable
- HI 76407/10** DO probe with 10 m (33') cable
- HI 76407/20** DO probe with 20 m (66') cable
- HI 7041S** Refilling electrolyte solution, 30 mL
- HI 76407A/P** Spare DO membrane (5 pcs)
- HI 710005** 115 Vac/12 Vdc adapter, US plug
- HI 710006** 230 Vac/12 Vdc adapter, European plug
- HI 710012** 240 Vac/12 Vdc adapter, UK plug
- HI 710013** 230 Vac/12 Vdc adapter, South African plug
- HI 710014** 230 Vac/12 Vdc adapter, Australian plug

WARRANTY

All Hanna **meters** are warranted for **two years** against defects in workmanship and materials when used for their intended purpose and maintained according to the instructions.

Probes are warranted for six months.

This warranty is limited to repair or replacement free of charge.

Damages due to accidents, 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 charge for repair or replacement.

If the instrument is to be returned to Hanna Instruments, please obtain a Return Goods Authorization from the Customer Service Department and then send it with shipment cost prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

All rights are reserved. Reproduction in whole or in part is prohibited without the written consent of the copyright owner.

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

CE DECLARATION OF CONFORMITY


CE <i>DECLARATION OF CONFORMITY</i>
We Hanna Instruments Italia Srl via E. Fermi, 10 35030 Sarmeola di Rubano - PD ITALY
herewith certify that the waterproof dissolved oxygen meters
HI 9143 HI 9145
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
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: <u>30-10-1998</u>
 P. Cesa - Technical Director On behalf of Hanna Instruments 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 this instrument in residential area could cause unacceptable interference to radio and TV equipment, requiring the operator to take all necessary steps to correct interferences.

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 voltage at the measurement surface exceeds 24 Vac or 60 Vdc.

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

SALES & TECHNICAL SERVICE

Australia:

Tel. (03) 9769.0666 • Fax (03) 9769.0699

China:

Tel. (10) 88570068 • Fax (10) 88570060

Egypt:

Tel. & Fax (02) 2758.683

Germany:

Tel. (07851) 9129-0 • Fax (07851) 9129-99

Greece:

Tel. (210) 823.5192 • Fax (210) 884.0210

Indonesia:

Tel. (21) 4584.2941 • Fax (21) 4584.2942

Japan:

Tel. (03) 3258.9565 • Fax (03) 3258.9567

Korea:

Tel. (02) 2278.5147 • Fax (02) 2264.1729

Malaysia:

Tel. (603) 5638.9940 • Fax (603) 5638.9829

Singapore:

Tel. 6296.7118 • Fax 6291.6906

South Africa:

Tel. (011) 615.6076 • Fax (011) 615.8582

Taiwan:

Tel. 886.2.2739.3014 • Fax 886.2.2739.2983

Thailand:

Tel. 66.2619.0708 • Fax 66.2619.0061

United Kingdom:

Tel. (01525) 850.855 • Fax (01525) 853.668

USA:

Tel. (401) 765.7500 • Fax (401) 765.7575

MANDOWPR3 09/05

For e-mail contacts and complete list of Sales and Technical offices, please see www.hannainst.com