HI8043

Portable Dissolved Oxygen Meter

INSTRUCTION MANUAL

HANNA instruments

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 the necessary information for 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 or view our worldwide contact list at www.hannainst.com.

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INCLUDED

Remove the instrument and accessories from the packaging and verify damage has not occurred during shipping. Remove protective film from meter. Notify your nearest Hanna Customer Service Center if damage is observed.

Packaging for each HI8043 instrument includes:

- Spare membrane with O-Ring (2 pcs.)
- Calibration screwdriver
- 9V battery
- Instruction Manual
- Quality Certificate
- HI76401: Dissolved Oxygen probe
- HI7041S: electrolyte solution (30 mL)
- Protective cap

Note: Save all packing material until you are sure that the instrument works correctly. Any defective item must be returned in its original packing.

SAFETY MEASURES

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

Operation of this instrument may cause interference to other electronic equipment, requiring the operator to take steps to correct interference. Any variation introduced by the user to the supplied equipment may degrade the instrument's EMC performance.

To avoid damages or burns, do not put the instrument in microwave ovens. For your and the instrument's safety, do not use or store the instrument in hazardous environments.

HI8043 is a portable meter for Dissolved Oxygen measurements.

It is housed in a lightweight case, with an easy-to-read LCD.

Dissolved oxygen and temperature measurements can be performed in the field (wastewater treatment, fish-farming, water analysis, etc.) as well as in the laboratory without compromising accuracy.

Dissolved oxygen is indicated in mg/L (ppm) and the reading is compensated for the temperature effect (ATC).

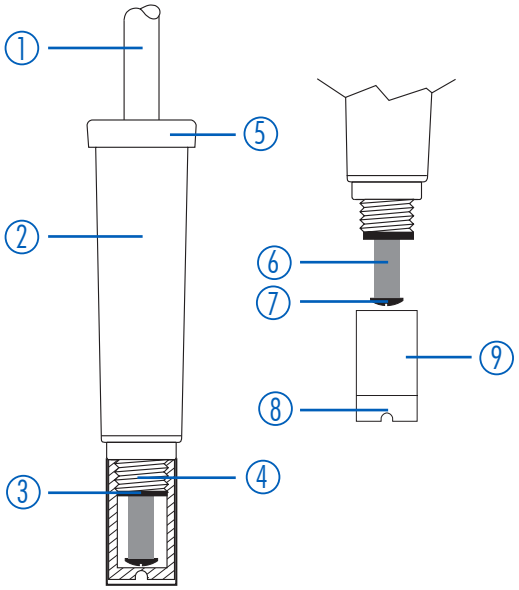
The dissolved oxygen probe is provided with a membrane for covering the polarographic sensors, and features a built-in thermistor for temperature measurements and compensation.

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

A voltage is applied across the sensor, and the oxygen that has passed through the membrane reacts causing the current to flow, hence determining a reading.

A convenient feature of the instrument is its standby mode which keeps the probe polarized and ready for instant measurements.

1. Liquid Crystal Display (LCD)
2. **stb** (to switch the meter on and polarize the probe. Use this standby position with out switching the meter off if you are going to take further measurements.)
3. **off** (to switch the meter off)
4. Rotary switch
5. **Zero** calibration trimmer
6. **Slope** calibration trimmer
7. **°C** calibration trimmer
8. **O_2** measurement
9. **°C** measurement
10. Probe connector



HI76401
Dissolved Oxygen Probe

1. Watertight Shielded Cable
2. Probe Body
3. O-Ring Seal
4. Protective Cap
5. DO Probe
6. Silver Chloride Anode
7. Platinum Cathode (sensor)
8. Oxygen Permeable Membrane
9. Membrane Cap

The main operating modes of HI8043 are calibration and measurement. Follow this general outline of steps to get you started.

1. Decide how the meter will be used and set up a clean area.
2. Connect the HI76401 probe to the meter.
3. Turn HI8043 on using the rotary switch.
4. Calibrate the probe.

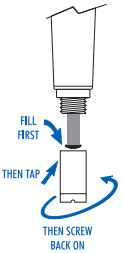
You are now ready for measurements.

All DO 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. This cap is only used for protecting the probe during shipment, and can be thrown away.

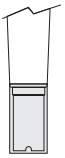
2. Wet the sensor by soaking the bottom (2.5 cm/1") of the probe in HI7041S electrolyte solution for 5 minutes.

3. Rinse the supplied membrane with some electrolyte while shaking it gently. Refill with clean electrolyte.



4. Gently tap the sides of the membrane with your finger tip to ensure that no air bubbles remain trapped inside. To avoid damaging the membrane, 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 the probe is not used, protect the membrane with the supplied cap.

	O_2	Temperature
Range	0.00 to 19.99 mg/L	0.0 to 50.0 °C ; (32.0 to 122.0 °F)
Resolution	0.01 mg/L	0.1 °C
Accuracy @ 25 °C / 77 °F	±1.5% F.S.	±0.5 °C
Calibration	Manual, two point (zero and slope)	
Temperature compensation	Automatic 0 to 30 °C (32 to 86 °F)	
Probe	HI76401 polarographic probe with 3 m (10') cable (included)	
Battery Type	9V alkaline (1 pcs.)	
Battery Life	Approximately 100 hours of continuous use	
Environment	0 to 50 °C (32 to 122 °F) Max 95% RH non-condensing	
Dimensions	180 x 83 x 40 mm (7.1 x 3.3 z 1.6")	
Weight	240 g (8.4 oz.)	

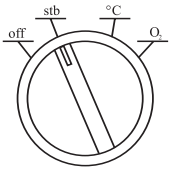
When the probe is under polarization it is continuously fed with a voltage of approximately 800 mV.

Probe polarization is essential for stable measurements to be taken with the same degree of accuracy.

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

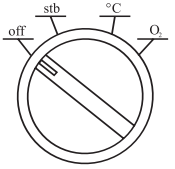
If measurements are taken with a non-polarized probe, the oxygen level detected by the meter is the sum of the oxygen dissolved in the tested sample and that of the electrolyte solution itself.



By leaving the instrument in the "stb" mode (i.e. keeping the probe in a continual state of polarization), the oxygen of the electrolyte solution is progressively "consumed", and the following measurements detect only the quantity of oxygen dissolved in the sample to be tested.

Therefore, in order to keep the probe continuously polarized it is necessary to switch the meter to the "stb" mode and wait for at least 30 minutes. This should be done with the probe covered with the protective cap and filled with some electrolyte solution.

Polarization is not maintained when the instrument is switched "off".



Calibration should be made:

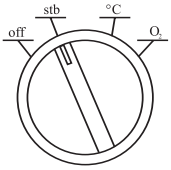
- after approximately 20 hours of use
- whenever the electrolyte or membrane is changed and after cleaning the electrode
- after use in aggressive solutions.

Accessories:

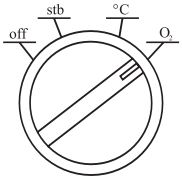
- 200 mL of HI7040 solution
- 1 bottle of HI7041S solution

Calibration at sea level:

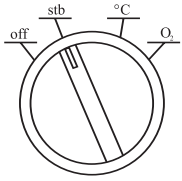
- Set the knob to the "stb" position and wait 30 minutes for a complete polarization of the probe.



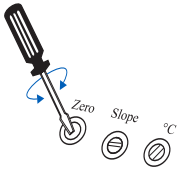
Zero Calibration



- Switch from "stb" to "O_2" position.
- Remove the membrane protective cap, immerse the probe in HI7040 zero oxygen solution and wait for approximately 5 minutes.

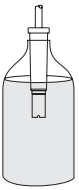


- The indications given by the instrument must fall to stabilization levels. If the probe has not been sufficiently polarized, the readout will continue to fluctuate. In this case, switch back to "stb" position, place the protective cap and wait for a few hours for complete polarization before proceeding.
- Using a small screwdriver, turn the "Zero" calibration trimmer until the display reads zero.



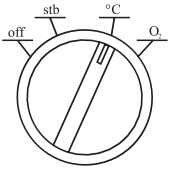
If you cannot get zero reading, the probe is probably defective. Check the membrane, electrode and electrolyte solution.

After the zero calibration has been completed, rinse the probe thoroughly with tap water.



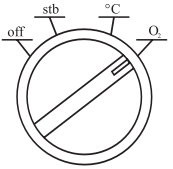
Slope Calibration

In order to perform a highly accurate calibration, take a B.O.D. bottle and fill with water to a depth of 1-2 cm (½ - ¾"). Seal the bottle with the probe inside.

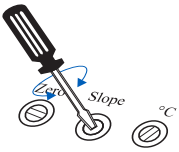


If this calibration is carried out with the bottle opened to air rather than according to the conditions described above, the margin of error is approximately 0.1 ppm.

- Switch the instrument to "°C", wait for reading to stabilize and note the temperature of the water.
- See Table on page 12 for the DO reading corresponding at the noted temperature.
- Switch to "O_2" position and adjust the "Slope" trimmer until the correct reading is displayed.



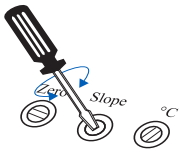
E.g. at 20.5°C the trimmer should be adjusted to read 9.08.

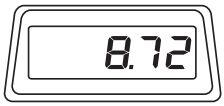


Altitude Compensation

If the calibration is not performed at sea level, a correction should be made for the altitude effect according to Table on page 13.

E.g. at 20.5°C and at an altitude of 300 m above sea level, the "Slope" trimmer should be adjusted to read 9.08 x 0.96 = 8.72.

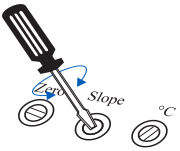


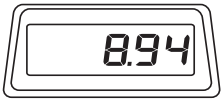


Salinity Compensation

An additional correction has to be performed if the sample presents significant salinity concentrations.

In such case, the reading has to be adjusted according to Table on page 14. E.g. at 20.5°C and if the sample has a salinity content of 3 g/L, the "Slope" trimmer should be adjusted to read 9.08 - (3 x 0.0478) = 8.94.





Dissolved Oxygen (ppm) in Fresh Water as a function of Temperature (°C)

°C	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	14.62	14.58	14.54	14.50	14.46	14.42	14.38	14.34	14.30	14.26
1	14.22	14.18	14.14	14.10	14.06	14.02	13.98	13.94	13.91	13.87
2	13.83	13.79	13.76	13.72	13.68	13.64	13.61	13.57	13.54	13.50
3	13.46	13.43	13.39	13.35	13.32	13.28	13.25	13.21	13.18	13.14
4	13.11	13.07	13.04	13.01	12.97	12.94	12.91	12.87	12.84	12.81
5	12.77	12.74	12.71	12.67	12.64	12.61	12.58	12.54	12.51	12.48
6	12.45	12.42	12.39	12.36	12.32	12.29	12.26	12.23	12.20	12.17
7	12.14	12.11	12.08	12.05	12.02	11.99	11.96	11.93	11.90	11.87
8	11.84	11.81	11.79	11.76	11.73	11.70	11.67	11.64	11.62	11.59
9	11.56	11.53	11.51	11.48	11.45	11.42	11.40	11.37	11.34	11.32
10	11.29	11.26	11.24	11.21	11.18	11.16	11.13	11.10	11.08	11.05
11	11.03	11.00	10.98	10.95	10.93	10.90	10.88	10.85	10.83	10.80
12	10.78	10.75	10.73	10.70	10.68	10.66	10.63	10.61	10.58	10.56
13	10.54	10.51	10.49	10.47	10.44	10.42	10.40	10.37	10.35	10.33
14	10.31	10.28	10.26	10.24	10.22	10.19	10.17	10.15	10.13	10.11
15	10.08	10.06	10.04	10.02	10.00	9.98	9.96	9.93	9.91	9.89
16	9.87	9.85	9.83	9.81	9.79	9.77	9.75	9.73	9.71	9.69
17	9.67	9.64	9.63	9.60	9.59	9.57	9.55	9.53	9.51	9.49
18	9.47	9.45	9.43	9.41	9.39	9.37	9.35	9.33	9.31	9.30
19	9.28	9.26	9.24	9.22	9.20	9.18	9.17	9.15	9.13	9.11
20	9.09	9.08	9.06	9.04	9.02	9.00	8.99	8.97	8.95	8.93
21	8.92	8.90	8.88	8.86	8.85	8.83	8.81	8.80	8.78	8.76
22	8.74	8.73	8.71	8.69	8.68	8.66	8.64	8.63	8.61	8.60
23	8.58	8.56	8.55	8.53	8.51	8.50	8.48	8.47	8.45	8.43
24	8.42	8.40	8.39	8.37	8.36	8.34	8.33	8.31	8.29	8.28
25	8.26	8.25	8.23	8.22	8.20	8.19	8.17	8.16	8.14	8.13
26	8.11	8.10	8.08	8.07	8.06	8.04	8.03	8.01	8.00	7.98
27	7.97	7.95	7.94	7.93	7.91	7.90	7.88	7.87	7.68	7.84
28	7.83	7.81	7.80	7.79	7.77	7.76	7.75	7.73	7.72	7.71
29	7.69	7.68	7.67	7.65	7.64	7.62	7.61	7.60	7.59	7.57
30	7.56	7.55	7.53	7.52	7.51	7.49	7.48	7.47	7.46	7.44
31	7.43	7.42	7.41	7.39	7.38	7.37	7.35	7.34	7.33	7.32
32	7.31	7.29	7.28	7.27	7.26	7.24	7.23	7.22	7.21	7.20
33	7.18	7.17	7.16	7.15	7.14	7.12	7.11	7.10	7.09	7.08
34	7.07	7.05	7.04	7.03	7.02	7.01	7.00	6.98	6.97	6.96
35	6.95	6.94	6.93	6.92	6.90	6.89	6.88	6.87	6.86	6.85
36	6.84	6.83	6.81	6.80	6.79	6.78	6.77	6.76	6.75	6.74
37	6.73	6.72	6.71	6.70	6.68	6.67	6.66	6.65	6.64	6.63
38	6.62	6.61	6.60	6.59	6.58	6.57	6.56	6.55	6.54	6.53
39	6.52	6.51	6.49	6.48	6.47	6.46	6.45	6.44	6.43	6.42
40	6.41	6.40	6.39	6.38	6.37	6.36	6.35	6.34	6.33	6.32
41	6.31	6.30	6.29	6.28	6.27	6.26	6.25	6.24	6.23	6.22
42	6.21	6.21	6.20	6.19	6.18	6.18	6.16	6.15	6.14	6.13
43	6.12	6.11	6.10	6.09	6.08	6.07	6.06	6.05	6.04	6.03
44	6.02	6.02	6.01	6.00	5.99	5.98	5.97	5.96	5.95	5.94
45	5.93	5.92	5.91	5.91	5.90	5.89	5.88	5.87	5.86	5.85
46	5.84	5.83	5.82	5.82	5.81	5.80	5.79	5.78	5.77	5.76
47	5.75	5.74	5.73	5.73	5.72	5.71	5.70	5.69	5.68	5.67
48	5.67	5.66	5.65	5.64	5.63	5.62	5.61	5.60	5.60	5.59
49	5.58	5.57	5.56	5.55	5.55	5.54	5.53	5.52	5.51	5.50
50	5.49									

Correction for measurements at different altitude

Altitude (Meters)	Atmospheric Pressure KPa	Correction Factor
Sea level	101.3	1.00
50	100.7	0.99
100	100.1	0.99
150	99.4	0.98
200	98.8	0.98
300	97.6	0.96
400	96.4	0.95
500	95.2	0.94
600	94.0	0.93
700	92.8	0.92
800	91.7	0.90
900	90.5	0.89
1000	89.4	0.88
1100	88.3	0.87
1200	87.2	0.86
1300	86.1	0.85
1400	85.0	0.84
1500	84.0	0.83
1600	82.9	0.82
1700	81.9	0.81
1800	80.9	0.80
1900	79.9	0.79

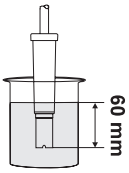
Correction for salinity effect

°C	Quantity to be subtracted per mg/L of NaCl	°C	Quantity to be subtracted per mg/L of NaCl
0	0.0892	26	0.0410
1	0.0861	27	0.0400
2	0.0830	28	0.0391
3	0.0802	29	0.0382
4	0.0779	30	0.0373
5	0.0749	31	0.0364
6	0.0724	32	0.0356
7	0.0701	33	0.0348
8	0.0678	34	0.0341
9	0.0657	35	0.0333
10	0.0637	36	0.0326
11	0.0618	37	0.0319
12	0.0599	38	0.0312
13	0.0582	39	0.0306
14	0.0565	40	0.0299
15	0.0549	41	0.0293
16	0.0533	42	0.0287
17	0.0519	43	0.0281
18	0.0505	44	0.0275
19	0.0491	45	0.0270
20	0.0478	46	0.0265
21	0.0466	47	0.0259
22	0.0454	48	0.0254
23	0.0442	49	0.0249
24	0.0431	50	0.0244
25	0.0421		

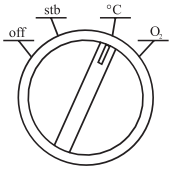
Temperature Calibration

The temperature scale should be calibrated at least every 3 months or whenever the readings are in doubt.

- Immerse the bottom 60 mm (2.4") of the probe in a beaker containing water.

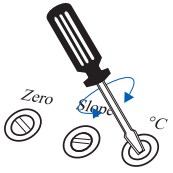


- Switch the knob to the "°C" position and agitate the water for at least 10 minutes to reach the thermal equilibrium between the probe and water.



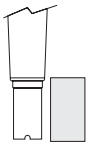
- Using a HI98501 or another thermometer with a resolution of 0.1°C, check the temperature of the water (e.g. 20.0°C).

- Adjust the "°C" trimmer until the display shows the noted temperature.

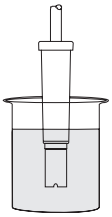


Note: It is important to ensure the thermal equilibrium between probe and water, because 1 degree of temperature difference entails an error of ±3% in dissolved oxygen measurement.

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.



For accurate dissolved oxygen measurements a water movement of at least 0.3 m/sec is required.

This movement will ensure that the oxygen depleted membrane surface is constantly replenished. A moving stream will provide adequate circulation.

To quickly check if the water speed is sufficient, wait for stable reading and then move the DO probe. If the reading remains stable, measurement conditions are correct. If the reading increases, the water movement is too low.

During field measurements, this condition may be met by manually agitating the probe. Accurate readings are not possible while the liquid is at rest.

During laboratory measurements, the use of a magnetic stirrer is recommended. In this way errors due to the diffusion of ambient oxygen in the solution are minimized.

Anyway, the time necessary for reaching the thermal equilibrium between probe and sample must be allowed (a few minutes for a temperature difference of several degrees).

The DO probe body is made of reinforced plastic for maximum durability. A thermistor temperature sensor provides temperature measurements and compensation. When not in use, it is always recommended to protect the probe against damage and dirt with the supplied cap.

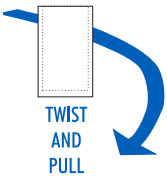


fig. 1

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

- Remove the protective cap by gently twisting and pulling it as shown in figure 1.
- Unscrew the membrane by turning it counterclockwise (see fig.2)
- Wet the sensor by soaking the bottom (2.5 cm / 1") of the probe in HI7041S electrolyte solution for 5 minutes.
- Rinse the new membrane supplied with the meter) with some electrolyte while shaking gently. Refill with clean electrolyte.

fig. 2

- Gently tap the sides of the membrane with your finger to ensure that no air bubbles remain trapped inside. Do no directly tap the bottom as this will damage the membrane.
- Make sure that the rubber O-Ring is seated properly inside the membrane cap.
- With the sensor facing down, screw the membrane cap clockwise. Some electrolyte will overflow.

The Platinum cathode (7 in the Probe diagram at page 7) 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 should be cleaned. Use a lint-free cardboard or cloth and 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. Afterwards, rinse the probe with deionized or distilled water and install a new membrane cap using fresh electrolyte. Recalibrate the instrument.

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

When the battery level is low, a battery symbol will be displayed to warn the user that the battery should be replaced soon.

Battery replacement must only take place in a safe area and using the battery type specified in this instruction manual.

Slide off the battery cover on the rear of the meter and replace the 9V battery with a new one.

Probe

HI76401	DO Probe with 3 m (10') cable
HI76407A/P	Spare membrane (5 pcs.)

Solutions

HI7040L	Zero oxygen solution
HI7041S	Refill electrolyte solution, 30 mL

Other Accessories

HI710009	Shockproof rubber boot, blue
HI710001	Soft carrying case
HI710010	Shockproof rubber boot, orange

Warranty

The HI8043 is 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 six months. This warranty is limited to repair or replacement free of charge.

Damage due to accidents, misuse, tampering or lack of prescribed maintenance is 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 problem. 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 (RGA) number from the Technical Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packed for complete protection.

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