Milwaukee **USER MANUAL**

PORTABLE
DISSOLVED OXYGEN METER
MODEL: MW600

Smart DO Meter



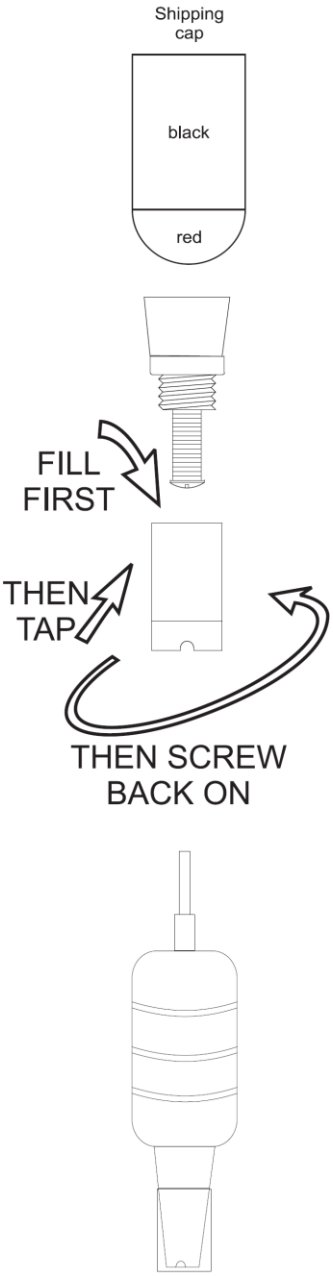
PROBE PREPARATION:

The meter is supplied with a 9V battery. Slide off the battery compartment cover on the back of the meter. Install the battery into the battery clip connector while observing polarity.

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

1. Remove the red and black plastic cap. This cap is used for shipping purposes only and can be thrown away.
2. Wet the sensor by soaking the bottom 2½ cm of the probe in electrolyte (**MA9071**) for 5 minutes.
3. Rinse the membrane (supplied with the meter) with electrolyte while shaking it gently. Refill with clean electrolyte.
4. Gently tap the sides of the membrane with a pencil or a rod to disengage air bubbles. To avoid damaging the membrane, do not tap the membrane directly on the bottom.
5. Install O-Ring properly inside the membrane cap.
6. With the sensor facing down, screw the cap clockwise. Some electrolyte will overflow.
7. Examine membrane to verify air is not trapped between the membrane and electrode tip.

When probe is not in use and during polarization, place the protective cap supplied over the electrode tip.



PROBE POLARIZATION:

- A dissolved oxygen probe must be polarized to function properly.
- To polarize the probe, the fully assambled probe must be connected to the meter and the meter must be on.
- During polarization (and during measurement), approximately 800 mV is applied to the cathode and anode inside the membrane and a chemical reaction occurs. During the polarization period excess oxygen in the electrolyte is consumed. During this phase, probe movement that “moves” the electrolyte will yield jumpy measurements. When a probe is totally polarized moving the probe will not effect the measurement.
- When the meter is turned off, the probe will revert to it’s prepolarized state. Before using again, the probe will have to be repolarized.

CALIBRATION PROCEDURE:

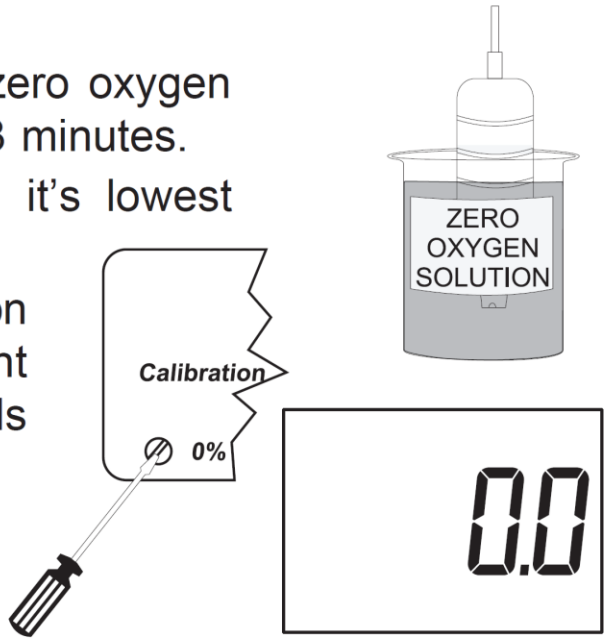
The calibration is very simple and fast.

- Make sure the probe is ready for measurements (see Probe Preparation), i.e. the membrane is filled with electrolyte and the probe is connected to the meter.
- Switch the meter on by pressing the ON/OFF key.
- For an accurate calibration, it is recommended to wait at least 15 minutes to ensure polarization of the probe.
- Remove the protective cap from the D.O. probe.



Zero Calibration:

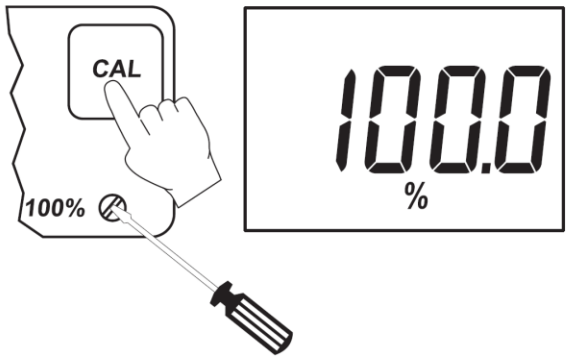
- Dip the probe into **MA9070** zero oxygen solution and stir gently for 2-3 minutes.
- Wait for the probe to reach it's lowest stable reading.
- Adjust the zero D.O. calibration trimmer (located on the front panel) until the display reads "0.0".



Slope Calibration:

It is suggested to perform the slope calibration in water saturated air.

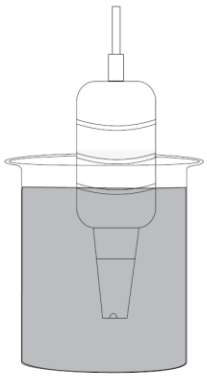
- Rinse the probe with a large amount of clean water to remove any residual zero oxygen solution.
- Dry the probe tip and allow a few minutes for the D.O. probe to stabilize while suspending over a container of water in the air.
- Press and hold the CAL key.
- Adjust the slope trimmer on the front panel of the meter to read "100%" on the LCD (while still holding the CAL button).
- Release the CAL key and the LCD will display a value in ppm of oxygen.



The **zero calibration** of the **MW600** is very stable, therefore this procedure needs only to be performed **whenever the probe is replaced**. However, if most of the measurements are closer to zero, **more frequent zero calibration is advised**.

Slope calibration can be easily performed on a **weekly** basis.

TAKING MEASUREMENTS:



Verify the probe is polarized and the probe and meter have been calibrated. Remove the protective cap from probe. Immerse the tip of the probe in the sample to be tested.

For accurate dissolved oxygen measurements a minimum water movement of 0.3 m/sec is required. This is to 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 the reading to stabilize and then move the D.O. probe. If the reading is still stable, the measurement conditions are right, while if the reading increases, the water movement is not adequate.

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 to ensure a certain velocity in the fluid is recommended. In this way, errors due to the diffusion of the oxygen present in the air into the solution are reduced to a minimum.

Always wait for thermal equilibrium to occur between the probe and the sample before recording a measurement (a few minutes for temperature difference of several degrees).

ALTITUDE & SALINITY COMPENSATION:

If the sample contains salts or if you are performing the measurements at a higher altitude, the displayed reading must be corrected to account for the lower degree of oxygen solubility.

ALTITUDE COMPENSATION:

The displayed measurements are referenced to sea level pressures. At higher elevations, oxygen solubility decreases (thus at higher elevations actual oxygen concentrations are really lower than the displayed value).
The table below illustrates the changes in the solubility of oxygen in air saturated fresh water as a result of changes in elevation. The table can also be used to correct the displayed measurement. If the meter was calibrated at an elevation above sea level, you multiply your reading by the ratio of:
(ppm at the elevation) / (the ppm at sea level)
For example: You are at 600 m above sea level and the meter displays 3.2 ppm. The temperature is 14 °C.
To correct your measurement multiply the displayed measurement by the ratio of (ppm reading at 600 m) / (ppm reading at 0 m) = 3.2 ppm X (9.6 ppm/10.3 ppm) = 2.98 ppm (or 3.0 ppm altitude corrected).

°C	Altitude, Meters above Sea Level							°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	104.0

SALINITY COMPENSATION:

The table below illustrates the change in the solubility of oxygen in air saturated water as a result of chloride concentration or salinity.
The table can also be used to correct the displayed measurement. If you are making measurements in salt water and know the chloride concentration (or salinity), you can multiply your reading by the ratio of (ppm at the chloride concentration) / (the ppm at 0 g/L chloride) at the temperature of measurement to compensate for the salt effect.

Oxygen Solubility dependance on Chloride and Salinity												Pressure 760 Torr = Sea level
Chloride	0 g/L	2 g/L	4 g/L	6 g/L	8 g/L	10 g/L	12 g/L	14 g/L	16 g/L	18 g/L	20 g/L	Chloride
Salinity	0 g/L	3.6 g/L	7.3 g/L	10.9 g/L	14.5 g/L	18.1 g/L	21.7 g/L	25.3 g/L	28.9 g/L	32.5 g/L	36.1 g/L	Salinity
°C												°F
0	14.6	14.2	13.9	13.6	13.3	12.9	12.6	12.3	11.9	11.6	11.3	32.0
2	13.8	13.5	13.2	12.9	12.6	12.3	12.0	11.6	11.3	11.0	10.7	35.6
4	13.1	12.8	12.5	12.2	11.9	11.6	11.4	11.1	10.8	10.5	10.2	39.2
6	12.4	12.2	11.9	11.6	11.3	11.1	10.8	10.5	10.3	10.0	9.7	42.8
8	11.8	11.6	11.3	11.1	10.8	10.6	10.3	10.1	9.8	9.6	9.3	46.4
10	11.3	11.0	10.8	10.6	10.3	10.1	9.8	9.6	9.4	9.1	8.9	50.0
12	10.7	10.5	10.3	10.1	9.9	9.6	9.4	9.2	9.0	8.8	8.5	53.6
14	10.3	10.1	9.9	9.7	9.4	9.2	9.0	8.8	8.6	8.4	8.2	57.2
16	9.8	9.6	9.4	9.3	9.1	8.9	8.7	8.5	8.3	8.1	7.9	60.8
18	9.4	9.3	9.1	8.9	8.7	8.5	8.3	8.2	8.0	7.8	7.6	64.4
20	9.1	8.9	8.7	8.5	8.4	8.2	8.0	7.8	7.7	7.5	7.3	68.0
22	8.7	8.6	8.4	8.2	8.1	7.9	7.7	7.6	7.4	7.2	7.1	71.6
24	8.4	8.2	8.1	7.9	7.8	7.6	7.4	7.3	7.1	7.0	6.8	75.2
25	8.2	8.1	7.9	7.8	7.6	7.5	7.3	7.1	7.0	6.8	6.7	77.0
26	8.1	7.9	7.8	7.6	7.5	7.3	7.2	7.0	6.9	6.7	6.6	78.8
28	7.8	7.7	7.5	7.4	7.2	7.1	6.9	6.8	6.6	6.5	6.3	82.4
30	7.6	7.4	7.3	7.1	7.0	6.8	6.6	6.5	6.3	6.2	6.0	86.0

For example, if the measurement displayed at 10°C is 5 ppm, but the sample has 20 g/L of chloride, to correct your measurement multiply the displayed measurement by the ratio of (ppm reading at 20 g/L) / (ppm reading at 0 g/L) = 5.0 ppm X (8.9 ppm/11.3 ppm) = 3.93 ppm (or 3.9 ppm Chloride or Salinity corrected).

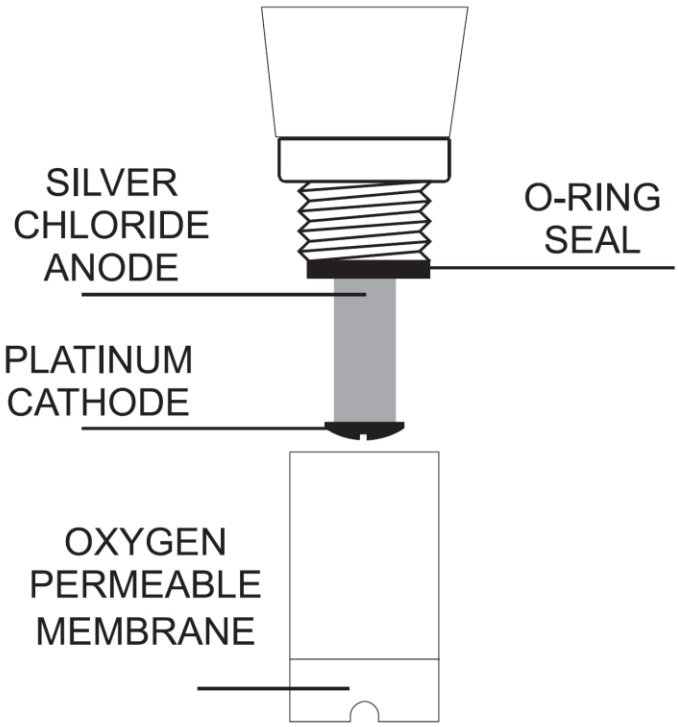
PROBE & MEMBRANE MAINTENANCE:

The D.O. probe body is made of reinforced plastic for maximum durability.

A thermistor temperature sensor provides temperature measurements of the tested sample. It is always recommended to keep the protective cap on the probe when not in use, to protect the membrane against damage and dirt.

To replace the membrane or refill it with electrolyte, see page 1.

The Platinum cathode should always be bright and untarnished. If it is tarnished or stained, due to contact with certain gases or a damaged membrane cap, the cathode should be cleaned. You can 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.



Rinse the probe with deionized or distilled water and install a new membrane cap using fresh electrolyte (see page 1). Recalibrate the instrument/probe.

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

BATTERY REPLACEMENT:

When the battery becomes weak the meter will display the low battery indicator "".

When this appears, only a few hours of battery life remain. A low battery will result in unreliable measurements. Prompt battery replacement is required.

Battery replacement must take place in a non-hazardous area using an alkaline 9V battery.

Turn the meter off, slide the battery compartment cover located at the rear of the meter off and replace the 9V battery with a new one. Make sure the battery contacts are fully engaged in the connector, seat the battery in its compartment and replace the cover.



OPTIONAL ACCESSORIES:

MA9070	Zero Oxygen calibration solution, 220 mL
MA9071	Refilling Electrolyte solution, 220 mL
MA841	Spare membrane, 5 pcs
MA840	D.O. probe

SPECIFICATIONS:

	MW600
RANGE	0.0 to 19.9 mg/L
RESOLUTION	0.1 mg/L
ACCURACY (@25°C)	±1.5% Full Scale
TEMPERATURE COMPENSATION	Automatic from 0 to 30°C
CALIBRATION	Manual on 2 points (zero and slope)
LCD	3½ digits with symbols
PROBE	**MA840** (included)
ENVIRONMENT	0 to 50°C, 95% RH max.
BATTERY TYPE	9V alkaline (included)
BATTERY LIFE	approximately 70 hours of use
DIMENSIONS	143 x 80 x 32 mm
WEIGHT	220 g (with battery) meter only

WARRANTY:

This instrument is warranted from all defects in materials and manufacturing for a period of two years from the date of purchase. The probe is warranted for a period of 6 months.

If during this period, the repair or replacement of parts is required, where the damage is not due to negligence or erroneous operation by the user, please return the parts to either dealer or our office and the repair will be effected free of charge.

Note: We reserve the right to modify the design, construction and appearance of our products without advance notice.