Instruction Manual R1.0
Santacary Technology Co., Ltd.
MHK-W30 Portable Dissolved Oxygen Meter

INTRODUCTION

Thank you for selecting the MHK-W30 portable Dissolved Oxygen Meter. The MHK-W30 is a precise portable dissolved oxygen (DO) meter that measures dissolved oxygen in % and mg/L and temperature in water and is suitable for a wide range of applications, such as educational and aquaculture, as well as water and environmental analysis. It is suitable for monitoring the oxygen levels of lakes, shrimp and fish tanks.

MHK-W30's field probe uses a polarographic electrode with convenient and easy to replace screw-on cap membranes. It features a built-in temperature probe for automatic temperature compensation. A built-in microprocessor stores, calculates, and compensates for all parameters related to DO determinations. The MHK-W30 calibrates easily in 2 points (at 100% water-saturated air and in 0 oxygen solution) and has Automatic Temperature Compensation which guarantees the highest accuracy.

Please read this manual carefully to properly use and maintain the meter.

Santacary Technology reserves the right to update the contents of this manual without giving prior notices.

DESCRIPTION

Features

- Measures dissolved oxygen in % and mg/L plus temperature

- Automatic temperature compensation via temperature in probe provides accurate reading over the entire range
- Adjustable barometric and salinity compensation
- °C or °F unit switchable with 0.1°C/0.1°F resolution
- Hold function freezes readings for easy viewing and recording
- Support 1 and 2 points dissolved oxygen calibration at 100% water-saturated air and in 0 oxygen solution
- Comes with a plastic toolbox convenient for in-field use
- Powered by 3 AA alkaline batteries

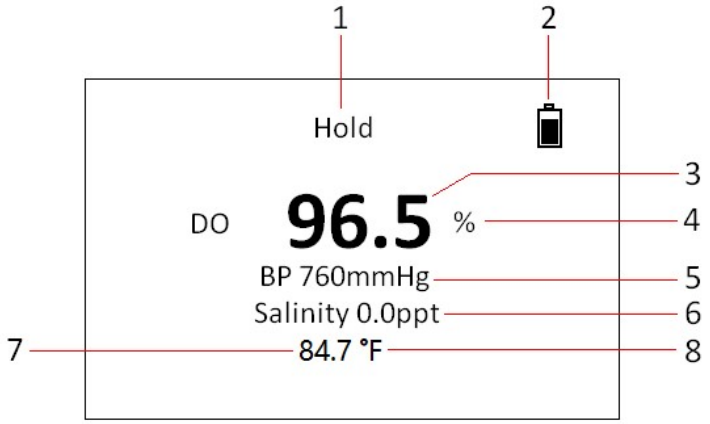
Applications

- Municipal wastewater/sewage treatment
- Environmental water testing
- Aquaculture/aquariums for measuring oxygen level in fish and shrimp farming
- Natural stream purification system
- Boilers
- Educational in laboratories and schools
- Biochemical manufacturing

Device

1. TFT display
2. Power button
3. Select button
4. Enter button
5. Dissolved oxygen polarographic electrode probe
6. Probe socket
7. Battery compartment cover

TFT LCD Display



1. Hold function prompt
2. Battery gauge
3. Dissolved oxygen value
4. Dissolved oxygen units (% or mg/L)
5. Barometric pressure (mmHg)
6. Salinity (in ppt)
7. Temperature
8. Temperature Unit

PRINCIPLES OF OPERATION

The dissolved oxygen polarographic electrode probe consists of a silver body as the anode and a circular gold cathode embedded in the end. The polarographic probe requires an applied voltage for operation while the galvanic probe electrode potentials are dissimilar enough to reduce oxygen with applied voltage.

The probe has a thin semi-permeable membrane, stretched over the probe, which isolates the electrodes from the environment, while allowing gases to enter. In operation, this end of the probe is filled with a solution of electrolyte containing a small amount of surfactant to improve wetting action.
When a polarizing voltage is applied to the polarographic probe electrodes, oxygen that has passed through the membrane reacts at the cathode causing a current to flow. Oxygen diffuses through the membrane at a rate proportional to the oxygen pressure difference across it. Since oxygen is rapidly consumed at the cathode, it can be assumed that the oxygen pressure inside the membrane is zero. Hence, the amount of oxygen diffusing through the membrane is proportional to the absolute pressure of oxygen outside the membrane. If the oxygen pressure increases, more oxygen diffuses through the membrane and more current flows through the probe. A lower pressure results in less current. Therefore, the current flowing through the probe is proportional to the absolute pressure of oxygen outside the membrane. After calibration, the oxygen content (absolute pressure) outside the membrane can be obtained by measuring the current.

OPERATION

The MHK-W30 Dissolved Oxygen Meter is powered by 3 AA alkaline batteries.

Keypad Operation

1. Power Button

1.1 Turn On/Turn Off Meter

1) When the meter is turned off, press Power button to turn on the unit.

2) When the meter is turned on, press Power button for 2 seconds to turn off the unit.

When the unit is first turned on, it performs 1 second countdown for meter warm up, then enters normal display with current dissolved oxygen readings displayed. The meter starts taking measurements when power on and updates readings every 2 seconds.

1.2 Hold function

Hold function keeps a reading on the display. In normal measurement state, press the Power button shortly to select Hold function. The meter then stops all further measurements and the display will display “Hold” on screen. Press the Power button shortly to exit Hold function. It will resume normal operation.

2. Select button SELECT

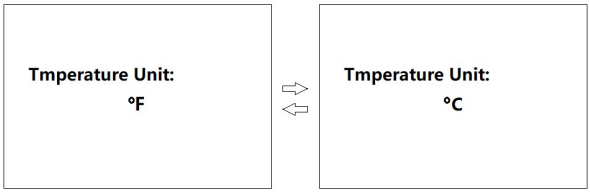
Press Select button SELECT shortly to toggles the DO units of measurement (% or mg/L).

3. Enter Button ENTER

By pressing the Enter button ENTER shortly, the meter enters into Menu operation. There are seven menu items by pressing the enter button ENTER shortly to loop. The menu items are described in table 1.

Table 1 Menu Operations

Menu Items	Description and Operation
Single Point Calibration 100% Saturation	User presses the SELECT button to implement the one point DO Calibration: single point calibration with 100% water-saturated air.
Single Point Calibration Zero Oxygen	User presses the SELECT button to implement the one point DO Calibration: single point calibration with zero oxygen
Barometric Pressure	Setting the barometric pressure value in mmHg for compensation. User presses ↺ to increase or SELECT button decrease value with one step of 5 mmHg. The range of barometric pressure value is 0 to 1000 mmHg. Press ENTER button to confirm the setting and enter the next menu item: “Salinity”.
Salinity	Setting the salinity value in ppt for compensation. User presses ↺ to increase or SELECT button to decrease value with one step of 0.1 ppt. The range of salinity value is 0 to 70.0 ppt. Press ENTER button to confirm the setting and enter the next menu item: “Temperature Offset”.

Temperature Offset	Setting the temperature offset value manually in °C for water temperature calibration. User presses ⏻ to increase or SELECT button to decrease value with one step of 0.1 °C. The range of temperature offset value is -2.0 to +2.0 °C. Press ENTER button to confirm the setting and enter the next menu item: “Temperature Unit”.
Temperature Unit	1) Pressing Select button SELECT shortly to switch two temperature units: °F and °C.  2) Pressing the Enter button ENTER shortly to confirm and enter next menu item.
EXIT	1) User presses Select button SELECT to exit the MENU operation and return to the normal measurement state. 2) Or pressing the Enter button ENTER shortly to lop back to the first menu item: “Single Point Calibration 100% Saturation”.

BAROMETRIC AND SALINITY COMPENSATION

Barometric Pressure Compensation

The MHK-W30 uses a user inputted barometric pressure value in

mmHg to compensate dissolved oxygen mg/L values. The barometric compensation value entered in the MHK-W30 should be the local barometric pressure value.

Do not use a barometer value that is corrected to sea level. Laboratory barometer readings are usually uncorrected values of air pressure and can be used for barometer calibration. An approximate formula for this “uncorrection” is:

True Barometric Pressure (mmHg) =

[Corrected BP mmHg] – [2.5 * (Local Altitude in ft. above sea level/100)]

Prior to the calibration or measurement, if true barometric pressure is unknown, users need to set the compatible parameter according to the local altitude. The following table 2 describes the relationship between altitude and barometric pressure.

Table 2 Relationship between Altitude and Barometric Pressure

Altitude (m)	**mmHg**	**Altitude (m)**	**mmHg**
0	760	1600	622
100	750	1700	614
200	741	1800	607
300	732	1900	599
400	723	2000	592
500	714	2100	584
600	705	2200	577
700	696	2300	570
800	688	2400	563
900	679	2500	556
1000	671	2600	549

1100	662	2700	542
1200	654	2800	536
1300	646	2900	529
1400	638	3000	522
1500	630	3100	515

See the “Barometric Pressure” item in table 1 of Menu Mode Operations section to adjust the barometric pressure compensation value. The barometric pressure can be adjusted any time without the need to recalibrate dissolved oxygen.

Salinity Compensation

The MHK-W30 uses a user inputted salinity value in ppt (parts per thousands) to compensate dissolved oxygen mg/L values. The salinity compensation value entered in the MHK-W30 should be the salinity value of the water you are testing.

See the “Salinity” item in table 1 of Menu Mode Operations section to adjust the salinity compensation value. The salinity can be adjusted any time without the need to recalibrate dissolved oxygen.

DISSOLVED OXYGEN CALIBRATION

It is not necessary to calibrate in both % and mg/L. Calibrating in % will simultaneously calibrate mg/L and ppm and vice versa. MHK-W30 supports calibrating dissolved oxygen in % for both ease and accuracy.

MHK-W30 is able to perform either 1 or 2 points calibration. For

single point calibration, we recommend that you perform 100% saturation calibration in the air at 100% relative humidity or the air-saturated water. If the 2 points calibration is selected, the zero oxygen solution needs to be used.

Before calibration, set the approximate true barometric pressure (in mmHg) of the location at the time of calibration. See the barometric pressure setup menu in table 1.

Set the approximate salinity of the water to be analyzed. See the salinity setup menu in table 1. For approximate salinity of the water to be analyzed, fresh water's salinity value is approximately 0 ppt and seawater has an approximate salinity of 35 ppt.

For highest accuracy, complete all calibrations at a temperature as close as possible to the sample temperature.

Single Point Calibration - 100% Saturation

1) Press the Enter ENTER button, the meter shows “Single Point Calibration 100% Saturation” item. See the menu operations in table 1.
2) Hold the dissolved oxygen probe in the air at 100% relative humidity or place the probe into the air-saturated water for 15 minutes. Press the SELECT button, the meter begins the calibration. An air environment with 100% humidity air can be prepared as follows. For example, use a bottle with a narrow neck. Add a small amount (1-cm) of water to the bottle, stopper and shake vigorously for several minutes, then insert the probe.
3) Wait for the reading to stabilize until the meter automatically shows “Calibration was finished”. Calibration is completed.

Single Point Calibration - Zero Oxygen

1) Press the ENTER button shortly twice, the meter shows “Single Point Calibration Zero Oxygen” item. See the menu operations in table 1.
2) Immerse the dissolved oxygen probe into the zero oxygen solution for at least 10 minutes. Press the SELECT button, the meter begins the calibration.

3) Wait for the reading to stabilize until the meter automatically shows “Calibration was finished”. Calibration is completed.

Two Points Calibration

Repeat the steps above to calibrate with the zero point and 100% water-saturated air.

The DO calibration summary is as table 3.

Table 3 DO Calibration Procedure

	Calibration Step(s)
1-Point Calibration	Single point calibration - 100% saturation
2-Point Calibration	1) Single point calibration - zero oxygen 2) Single point calibration - 100% saturation

All new calibration values will automatically override existing calibration data. The non-volatile memory will retain calibration values upon power shut-off.

Notes:

- It is recommended to calibrate the meter whenever probe, membrane or electrolyte is changed and recalibrate as necessary to prevent drift. Dissolved oxygen readings are only as good as the calibration.
- Switching from readings in % DO to readings in mg/L does not require recalibration.

DISSOLVED OXYGEN MEASUREMENTS

The MHK-W30 portable dissolved oxygen meter is suitable for measuring the water, wastewater, brine and other liquids. The DO measurement process is described as follows.

1) Connect the dissolved oxygen probe to meter and wait for

15 minutes to polarize the probe.

2) The temperature displays in the display.
3) If the sample contains salts or if the measurement is performed at altitude different from sea level, the readout values must be corrected, taking into account the lower degree of oxygen solubility. User should set barometric and salinity compensations before performing calibration and taking measurements. The meter will automatically compensate for these factors.
4) Immerse the tip of the probe in the sample to be tested, make sure the temperature probe on the probe is fully immersed. If possible, do not allow probe to touch any solid object in the solution. Allow no air bubbles around the probe.
5) Stir the probe gently. Record the measured value when the reading is stable. For accurate dissolved oxygen measurements, a water movement of at least 0.3 m/sec is required. This is to ensure that the oxygen-depleted membrane surface is constantly replenished. A moving stream will provide an adequate circulation. To quickly check if the water speed is sufficient, wait for the reading to stabilize and then move the DO probe. If the reading remains 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 in the solution are reduced to a minimum.

Wait the time necessary for thermal equilibrium to occur between the probe and the sample (a few minutes for temperature difference of several degrees).

6) This meter provides three distinct measurements: Temperature, Dissolved Oxygen in % saturation, and Dissolved Oxygen in mg/L (ppm). The meter can display DO readings in mg/L (ppm) with scale from 0 to 50 mg/L and in % O2 (rate of Oxygen saturation with reference to 100% at sea level) from 0 to 500%. The temperature measurement is always displayed on the LCD.

Some gas and steam such as chloride, sulfur dioxide, sulfureted hydrogen, ammonium, carbon dioxide and iodin can permeate the membrane via diffusion. So their existence will influence the measurement of dissolved oxygen. If the sample contains the solvent, grease, sulfide and alga, the membrane on the probe will be blocked, damaged or eroded.

TECHNICAL SPECIFICATIONS

This section describes the specifications of the meter and the technical information.

Dissolved Oxygen Specification:

Range	0 to 500%
	0 to 50.0 mg/L
Measuring principle	Dissolved oxygen polarographic

	electrode
Resolution	0.1 %
	0.1 mg/L
Accuracy	0 to 200% air saturation ： ±2% of the reading or ± 2% air saturation, whichever is greater
	200 to 500% air saturation ： ±6% of the reading
	0 to 20 mg/L ： ±2% of the reading or ±0.2 mg/L, whichever is greater
	20 to 50 mg/L ： ±6% of the reading
Calibration Points	1 to 2 points
Barometric pressure compensation	0 to 1000 mmHg
Salinity compensation	0 to 70.0 ppt
Auto Temperature Compensation	0 to 50.0 °C (32.0 to 122.0 °F)

Temperature Specification:

Temperature Range	0 to 50.0 °C (32.0 to 122.0 °F)
Resolution	± 0.1°C (± 0.1°F)
Display Options	°C/°F switchable
Accuracy	±0.5°C (±0.9°F)

General Specification:

Display	2.2" TFT LCD
Operating Temperature	0 to 50.0 °C (32.0 to 122.0 °F)
Power Supply	Three AA alkaline batteries

Dimensions	74x156x26.5mm (2.91x6.14x1.04")
Weight	125 grams (4.41 oz.)

PROBE MAINTENANCE

The DO probe body is made of reinforced plastic for maximum durability. A probe includes a polarographic dissolved oxygen probe and temperature probe. The thermistor temperature probe provides temperature measurements of the tested sample.

If the probe is used for a long time, its accuracy will decrease. Factors affecting the accuracy of polarographic dissolved oxygen probe include:

1) Membranes last longer if properly installed and regularly maintained. Erratic readings can result from damaged or fouled membranes or from large bubbles in the electrolyte reservoir. If unstable readings or membrane damage occurs, replace both the membrane cap and oxygen probe filling electrolyte. The average replacement interval is 4 to 8 weeks, although they may last longer if kept clean. Harsh environments, such as wastewater, may require membrane replacement every 2 to 4 weeks. Unstable readings may occur if membrane cap is coated with oxygen consuming or oxygen evolving organisms such as bacteria or algae.
2) Chlorine, sulfur dioxide, nitric oxide and nitrous oxide can affect readings by behaving like oxygen at the probe.
3) Avoid substances that may damage probe materials such as concentrated acid, caustics and strong solvents.

4) Keep the probe's gold cathode clean and textured (when properly maintained it has a matte finish). If it is tarnished (from contact with certain gases), or plated with silver (from extended use with a loose or wrinkled membrane), then clean it.
5) To prevent the membrane and electrolyte from drying out, store the probe in a clean bottle with 1 inch of water to keep the probe in a water-saturated air environment.

Fill With Electrolyte

The electrolyte (oxygen probe filling electrolyte) is generally replaced every 2 months. If the sample containing strong acid, strong base, organic solvent and easily polluted is measured, it is better to replace it every 2 weeks.

Drain the original electrolyte in the probe during replacement. Then inject a small amount of new probe filling electrolyte to wash the inside of the probe. Pour it out. Finally, add new electrolyte.

To fill the probe with electrolyte, proceed as follows:

1) Unscrew the membrane by turning it counterclockwise
2) Rinse the membrane supplied with meter with electrolyte, while shaking it gently. Fill with clean electrolyte.

3) Gently tap the sides of the membrane with the finger tip to ensure that no air bubbles remain trapped. Do not directly tap the bottom with the finger as this will damage the membrane.
4) With the probe facing down, screw the membrane cap clockwise. Some electrolyte will overflow.

Replace the Membrane

To obtain accurate and stable measurements, it is important that the surface of the membrane be in perfect condition. This semipermeable membrane isolates the probe 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), replace the membrane.

1) To replace the membrane or refill it with electrolyte, proceed as follows:
2) Unscrew the membrane by turning it counterclockwise
3) Wet the probe by soaking the bottom 2.5 cm of the probe in electrolyte for 5 minutes.
4) Rinse the membrane supplied with meter with electrolyte, while shaking it gently. Refill with clean electrolyte.
5) Gently tap the sides of the membrane with the finger tip to ensure that no air bubbles remain trapped. Do not directly tap the bottom with the finger as this will damage the membrane.
6) With the probe facing down, screw the membrane cap clockwise. Some electrolyte will overflow.

Clean the Dissolved Oxygen Probe

Clean the probe whenever it won't calibrate or the readings are unstable and changing the membrane does not solve either issue. The Platinum cathode may be tarnished or stained, which could be due to contact with certain gases or to an extended use with a loose or damaged membrane, it should be cleaned. On average, the probe should only be cleaned about once or twice per year.

To clean the probe, clean the electrodes according the directions below.

1) Turn meter off, or disconnect probe.
2) Remove membrane cap and rinse the probe with clean water (tap, distilled, or deionized).
3) Use a clean lint-free cloth and rub the cathode very gently side to side 4-5 times. This will be enough to polish it and remove any stains without damaging the platinum tip.
4) Afterwards, rinse the probe with deionized or distilled water

and install the membrane cap using fresh electrolyte.

5) Recalibrate the meter.

PROBE STORAGE

Short-term Storage

When the DO probe is not in use, store it in a moist environment. For short-term storage (less than 30 days), moisten a sponge with a small amount of clean water and place this over the probe with the membrane cap. This will provide a 100% water-saturated air environment.

Long-term Storage

DO probe should always be stored long term in a dry state. When storing for more than 30 days, remove the membrane cap and thoroughly rinse the probe. Once the probe has been rinsed either blow it dry with compressed air or allow to air dry completely. Use a clean, dry new membrane cap to screw over the probe to keep it dry and to protect the anode and cathode.

After storing the probe for a long period of time it is necessary to "condition" the probe by putting a new membrane with electrolyte solution on the probe.

Long Term Storage Temperature: -5 to 70°C (23 to 158°F)

TROUBLESHOOTING

Symptom / Issue	Possible Cause / Resolution
Meter will not turn on	1) Low battery voltage, replace batteries. 2) Batteries installed incorrectly, check battery polarity.
Meter readings are inaccurate	1) Check membrane and electrolyte solution. Clean anode and cathode. 2) Verify calibration, barometric pressure and salinity settings are correct and recalibrate. 3) Verify accurate temperature readings. 4) Sample temperature is over 50 °C, the temperature compensation range. 5) Probe may not have been in 100% water saturated air during calibration procedure. Please recalibrate. 6) Replace membrane and electrolyte, recalibrate. 7) Clean probe electrodes. 8) Return meter for service.

PACKAGE INCLUDED

1. Dissolved oxygen Meter
2. Dissolved oxygen probe
3. Oxygen probe filling electrolyte
4. One set of zero oxygen reagent
5. One membrane cap
6. Plastic toolbox
7. Instruction manual

SUPPORT

The quickest way to obtain technical support is via email. Please send all support inquires to **info@santacary.com**.
Please include a clear, concise definition of the problem and any relevant troubleshooting information or steps taken so far, so we can duplicate the problem and quickly respond to your inquiry.

WARRANTY

This meter is supplied with a warranty against significant deviations in material and workmanship for a period of TWO years from date of purchase whereas probe with a SIX month warranty.
If repair or adjustment is necessary and has not been the result

of abuse or misuse within the designated period, please return and correction will be made without charge.
Santacary Technology will determine if the product problem is due to deviations or customer misuse. Out of warranty products will be repaired on a charged basis.

Exclusions
The warranty on your meter shall not apply to defects resulting from:

- Improper or inadequate maintenance by customer
- Unauthorized modification or misuse
- Operation outside of the environment specifications of the products

RETURN

Authorization must be obtained from our Customer Service Department or authorized distributor before returning items for any reason.
Please include data regarding the reason the items are to be returned. For your protection, items must be carefully packed to prevent damage in shipment and insured against possible damage or loss.
Santacary Technology will not be responsible for damage resulting from careless or insufficient packing. A restocking charge will be made on all unauthorized returns.

NOTE: Santacary Technology Co., Ltd. reserves the right to make

improvements in design, construction, and appearance of products without notice.

CONTACT US

Santacary Technology Co., Ltd.
Zhaobei Building B, the 7th Industrial Road 75#,
Shekou, Shenzhen, 518067,
Guangdong, China
Email: info@santacary.com

www.santacary.com