EXTECH® INSTRUMENTS

ExStik® DO600

Dissolved Oxygen Meter

Introduction

Congratulations on your purchase of the ExStik® DO600 dissolved oxygen / temperature meter which simultaneously displays dissolved oxygen and temperature. Units of measure are % saturation, mg/l or ppm for dissolved oxygen, and °C or °F for temperature. Advanced features include Data Hold, 25 points memory, auto power off, automatic temperature compensation, salinity and altitude compensation. This meter is shipped fully tested and calibrated and, with proper use, will provide years of reliable service. Please visit our website (www.extech.com) to check for the latest version of this User Guide, Product Updates, and Customer Support.
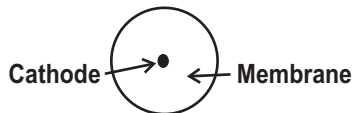
Meter Description

Front Panel Description

1. Battery compartment cover
2. LCD Display
3. **MODE/HOLD** button
4. **CAL/RECALL** button
5. **ON/OFF** button
6. Electrode Retaining Collar
7. Dissolved Oxygen Sensor
8. Bonded Membrane Cap assembly
9. Membrane & Cathode

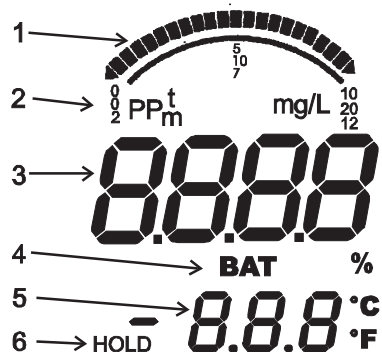   (Note: The Electrode storage cap is not shown)
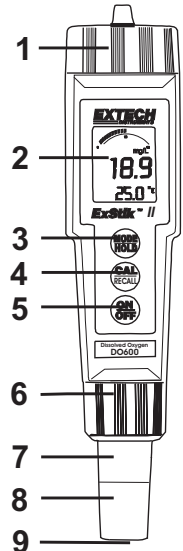
Electrode Bottom View

Cathode → • ← Membrane

LCD Display

1. Bar graph display
2. Measurement units
3. Main display
4. Low Battery indicator
5. Temperature display
6. Reading hold indicator

Operation

Prepare the Electrode

The electrode is shipped "dry" and requires filling with the supplied electrolyte solution before use. The membrane should be in place and does not need replacement. Follow the procedure at the end of this guide for filling the bonded cap.

Powering the ExStik®

The ExStik® uses four (4) CR2032 Lithium Ion Batteries. Press the **ON/OFF** button to turn the meter on or off. If the batteries are weak, the 'BAT' indicator appears on the LCD. The auto power off feature shuts the ExStik® off automatically after approximately 10 minutes of inactivity. The auto power off feature may be temporarily disabled for convenience or for extended polarization time.

Startup Polarization Period

When the ExStik® is powered up for the first time, the electrode requires polarization. In order for this to occur a three minute (approx.) polarization period must elapse before measurements can be made. A special circuit is included in this meter which, upon turn-on, maintains a very small biasing current to the electrode for a period of seven days. This keeps the electrode polarized and enables the user to make immediate measurements (within a 7 day period) without waiting for the electrode to re-polarize. Each time the ExStik® is turned on, the polarization timer is reset and the 7 day polarization period is initiated. A small asterisk at the bottom right corner of the display is used to indicate that the polarization timer circuit is active even when the meter is off. If the ExStik is not used for more than seven day, a 3 minute waiting period is required before a measurement can be made.

Turn-On Diagnostics

1. When the meter is turned ON the LCD displays "SELF" and "CAL" while the meter runs a diagnostic routine.
2. During this time the meter is recalling the User Calibration data, performing self diagnostics & initializing the circuitry.
3. After this function is complete, the meter proceeds to the normal measurement mode.

Measurements

1. Cover the electrode with the electrode cap. The sponge contained in the cap should be moistened (not soaked) with DI (distilled water) or clean tap water.
2. Pressing the **ON/OFF** button turns the meter ON or OFF. When turned ON, the meter's display switches on and the Self Calibration utility runs (see above). The unit of measure selected when the meter was last turned OFF will remain on the display.
3. If this is the first time the meter is powered up, wait approx. **3** minutes for the probe to polarize (please disable auto-power off; Instructions for disabling auto-power off are provided in a later section). For more details, please read the *Startup Polarization Period* paragraph earlier in this manual before continuing.
4. Select the desired units of measure by pressing and holding the **MODE/HOLD** button until the proper units are shown in the display. Remove the electrode cover and place the electrode in the sample to be measured. Stir the electrode in the sample to remove any trapped air bubbles from the membrane surface. Do not submerse the electrode to the point that the sample liquid reaches the meter's electrode collar.
5. Allow the meter time to settle to the final measurement value.
   Note: The larger the difference in temperature between the electrode and the solution the longer it will take for the reading to stabilize. Stabilization time can vary from ten (10) seconds to five (5) minutes.

Calibration

1. Calibration should be performed on a daily basis.
2. Turn the meter ON
3. Press and hold the **MODE/HOLD** button until **%** is displayed on the LCD.
4. If the meter has not been used for seven (7) days or longer, allow the electrode to fully polarize. This may take 2-3 minutes. The asterisk will appear.
5. Place the electrode cap onto the electrode. The sponge contained in the cap should be only moistened (not soaked) with DI (distilled water) or clean tap water. Be sure that the electrode membrane is clean and dry or the calibration will be incorrect. There needs to be an air gap between the membrane and the sponge. Never touch the membrane, as skin oil will affect the electrode response.
6. Wait until the reading stabilizes then press and hold the **CAL/RECALL** button until **CAL** is shown in the lower display. The readings will blink "101.7" and "SA" will appear.
7. When the calibration is complete **"End"** will appear and then the meter will return to the normal measurement mode.

   Note: The "SA" will not appear if the calibration fails.

8. Optional 'zero oxygen' calibration (improves measurement accuracy for very low or very high DO measurements):
   Place the electrode in a zero oxygen calibration solution, such as 5% sodium sulfite, wait for stability and press the **CAL/RECALL** button until CAL is shown in the in the lower display. Stability in a zero solution may take many minutes, depending on electrode history.
   Note: Sodium Sulfite can become deposited on the electrode and on the "coined" surface of the electrode retaining collar. The presence of the Sodium Sulfite will negatively affect future DO measurements until such a time where ALL of it is removed from the electrode.

Measurement Units

The meter can be set to measure % saturation, dissolved oxygen in mg/l, and dissolved oxygen in parts per million (ppm). To change the mode:

1. Press and hold the **MODE/HOLD** button for 2 seconds and the display will begin to scroll through the different units of measure :

   % saturation; D.O. in mg/l; D.O. in ppm (parts per million)

2. When the desired units are displayed, release the **MODE/HOLD** button and the unit will return to normal operating mode.

Note: The "HOLD" function cannot be on when changing the measurement function. If "HOLD" is displayed in the lower left corner of the display, briefly press the **MODE/HOLD** button to turn it off.

Temperature Units (ºF / ºC)

1. With the unit OFF, press and hold the **CAL/RECALL** button.
2. With the **CAL/RECALL** button depressed, momentarily press the **ON/OFF** button to turn the unit ON.
3. The **CAL/RECALL** button can be released when 'Self Cal' is shown in the display.

Salinity Compensation

1. With the unit ON, momentarily press the **CAL/RECALL** button twice in quick succession ('SAL' is shown in the lower temperature display).
2. Momentary press the **MODE/HOLD** button. Each press of the **MODE/HOLD** button increases the compensation by 1ppt (part per thousand); the available range is 0 to 50ppt.
3. Momentarily press the **CAL/RECALL** button to save the compensation setting and return to the normal measurement mode.

Altitude Compensation

1. With the unit ON, momentarily press the **CAL/RECALL** button twice in quick succession ('SAL' is shown in the lower temperature display.
2. Press and hold **CAL/RECALL** again for 2 seconds to enter the Altitude Mode ('Ald' will be shown in the lower temperature display).
3. The factory default value is sea level. Each press of the **MODE/HOLD** button increases the compensation by 1000ft. The maximum value is 20 presses (20,000ft above sea level).
4. Momentarily press the **CAL/RECALL** button to save the compensation setting and return to the normal measurement mode.

Auto-Power OFF Feature

The auto power off feature automatically shuts the meter off 10 minutes after the most recent button press. To disable this feature, refer to the Disable Auto-Power OFF section.

Disable Auto-Power OFF Feature

With the unit ON, momentarily press the **CAL/RECALL** button, then quickly press and hold both the **MODE/HOLD** and **ON/OFF** buttons until 'off' is displayed. To restore the Auto Power Off Feature (auto power OFF enable) simply turn the meter off and on again using the **ON/OFF** button.

Low Battery Indication

When the battery voltage falls below the operating threshold, 'BAT' will appear on the display. Refer to the Maintenance section for battery replacement information.

Storing Readings

1. Press the **MODE/HOLD** button to store a reading. The storage location number will be displayed on the lower display, while the main display shows the stored reading. The meter will enter the HOLD mode and the "HOLD" indicator will appear on the LCD.
2. Press the **MODE/HOLD** button again to exit the HOLD mode and return to normal operation. The next time **MODE/HOLD** is momentarily pressed another reading is stored and so on.
3. If more than 25 readings are stored, previously stored readings (starting with reading number 1) are overwritten.

Recalling Stored Readings

1. Momentarily press the **CAL/RECALL** button and then with in 4 seconds momentarily press the **MODE/HOLD**. The last stored data point location will be displayed (1 to 25). Each time the **MODE/HOLD** button is momentarily pressed the next most recently stored data point will be displayed.
2. After the last data point stored is displayed, pressing the **MODE/HOLD** button again returns the display to the beginning of the list.
3. Pressing the **CAL/RECALL** button at anytime stops the data retrieval process and returns the meter to the normal measurement mode.

Clearing Stored Readings

1. With the unit ON press and hold the **ON/OFF** button for 4 seconds
2. When "clr" is shown in the main display the memory is cleared.

Measurement and Display Considerations

- The DO600 uses a polarographic sensor, which consumes oxygen at the sensing surface. This requires a constant movement of the sample across the membrane to maintain a constant dissolved oxygen level. It is recommended that the probe be moved in the sample as the measurement is made, or if in a laboratory environment, the sample be stirred using a stir plate.
- If the unit appears to be locked (display frozen). It is possible that the Data Hold mode has been inadvertently accessed by a press of the **MODE/HOLD** button (HOLD will be displayed in the bottom left of the LCD). Simply press the **MODE/HOLD** button again or turn the meter off and back on again.
- If the meter does latch up and no button presses revive it, remove the batteries and restart.
- For maximum accuracy, allow sufficient time for the temperature of the probe to reach the temperature of the sample before taking a reading. This will be indicated by a stable temperature reading on the display.

Maintenance

Battery Replacement

1. Twist off the battery compartment cover.

2. Holding the battery housing in place with a finger, pull out the battery carrier using the two small tabs.

3. Replace the four (4) CR2032 batteries observing proper polarity.

4. Replace the battery carrier, reattach the battery compartment cap and tighten securely.
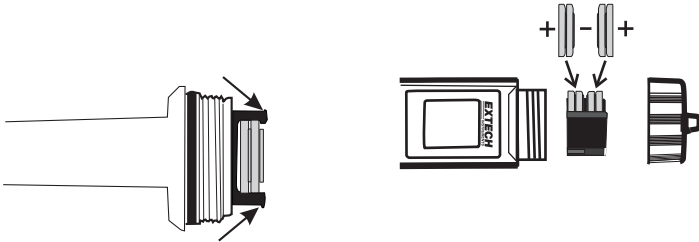
Never dispose of used batteries or rechargeable batteries in household waste. As consumers, users are legally required to take used batteries to appropriate collection sites, the retail store where the batteries were purchased, or wherever batteries are sold.

Disposal: Do not dispose of this instrument in household waste. The user is obligated to take end-of-life devices to a designated collection point for the disposal of electrical and electronic equipment.

Other Battery Safety Reminders
o Never dispose of batteries in a fire. Batteries may explode or leak.
o Never mix battery types. Always install new batteries of the same type.

Electrode Replacement

1. To remove the electrode, first turn the instrument OFF and then unscrew and remove the electrode retaining collar. (turn the collar counter-clockwise to remove).

2. Gently rock the electrode from side to side, pulling it away from the meter until it disconnects.

3. To attach an electrode, align the positioning "keys" on the electrode and the main body housing and then carefully push the electrode into the meter socket until it is fully seated.

4. Tighten the electrode retaining collar firmly enough to seal the electrode with the meter.

DO Bonded Membrane Cap replacement

Important Note : Do not touch the membrane as skin oils will interfere with the oxygen permeability rate of the membrane. Use caution when replacing the bonded cap.

1. It is recommended that the electrode remain attached to the meter during this replacement process.

2. To remove the bonded cap from the electrode, unscrew the cap firmly and carefully counter-clockwise from the electrode (see diagram below).

3. Discard the used cap. Please Note: The installation of a bonded cap causes the membrane to be tightly streched over the cathode. Once a bonded cap is removed reinstallation is not possible as the membrane will no longer be properly streched over the cathode.

4. Rinse the old electrolyte solution from the Cathode and Anode before continuing.

5. Use the supplied Polishing Paper (See Accessories table) to clean, polish, shine, and/or remove scratches from the cathode. Be sure to moisten the cloth before polishing the cathode. Do not over-polish the sensitive gold cathode.

6. Set the new replacement bonded cap on a flat surface. Leave the cap in this position throughout the replacement process.

7. Fill the bonded cap with the electrolyte solution up to the bottom of the threads on the inside of the cap.

8. Tap the side of the bonded cap to help jar free any trapped air bubbles from the electrolyte solution.

9. Keeping the cap in a fixed position on a flat surface, carefully insert the electrode into the new bonded cap by first dipping and removing the electrode several times from the cap. With each dip, push the electrode progressively deeper into the bonded cap. Finally, screw the electrode slowly onto the bonded cap (clockwise) until fully tightened. The dipping and removal technique minimizes the introduction of air bubbles into the electrolyte solution. Air bubbles in the electrolyte can compromise measurements.

10. During the tightening of the bonded cap, excess electrolyte solution will leak out, this is normal and desireable since it minimizes the introduction of air pockets. Clean off the excess electrolyte before use.

BONDED CAP

Clockwise to tighten
Counter-clockwise to loosen

Electrode

Anode

Cathode

Bonded Cap

Air Vents
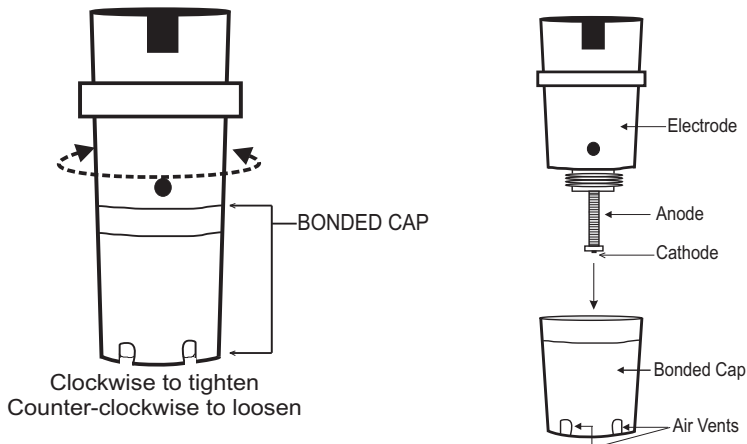
Specifications

Display	2000 count, Dual function 3 ½ digit LCD with Bargraph, Display size: 24 mm x 20 mm
Sensor	Polarographic type
Membrane	Bonded membrane cap with threaded fitting
Operating Temp. Range	0 to 50°C (32 to 122°F)
ATC Range	0 to 50°C (32 to 122°F)
Salinity Compensation	0 to 50 ppt in 1 ppt (part per thousand) increments
Altitude compensation	6000 m (0 to 20,000 ft) in 300m (1000 ft) increments
Measurement Storage	25 tagged (numbered) data sets with recall
Battery Power	Four (4) CR2032 button batteries
Low Battery Indication	'BAT' appears on the LCD
Auto Power Off	After 10 minutes of inactivity (APO override available)
Dimensions/Weight	36 x 173 x 41mm (1.4 x 6.8 x 1.6"); 110g (3.8 oz)

Measurement	Range	Resolution	Accuracy
% Saturation	0 to 200.0%	0.1%	±2.0% FS (full scale)
Dissolved Oxygen Concentration	0 to 20.00 mg/l	0.01 mg/l	±2% FS
	0 to 20.00 ppm	0.01 ppm	±2% FS
Temperature	0 to 50 °C	0.1 °C	±1.0 °C
	32 to 122°F	0.1 °F (0 to 99ºF); 1.0 °F (>100°F)	±1.8°F

Appendices

Troubleshooting Guide

Symptom	*Possible Causes*	*Action*
Unit will not power on	-Batteries not in place -Dead batteries -Battery polarity incorrect	-Replace Batteries -Replace Batteries -Reorient/Replace Batteries
"BAT" indicator shown on display	-Batteries are weak	-Replace Batteries
Unstable Readings	-Insufficient electrolyte in probe (Air bubbles present when probe is inverted.) -Electrolyte is depleted	-Replace electrolyte, and membrane cap assembly.
Readings drift down	-Insufficient stirring (the probe consumes oxygen at the measuring surface, requiring constant sample movement across membrane)	-Move probe in sample or stir sample
Slow Response	-Dirty or damaged membrane	-Replace electrolyte and membrane cap
Electrode cannot be calibrated	-Depleted electrolyte -Dirty or damaged membrane	-Replace electrolyte and membrane cap
Electrode cannot be calibrated after replacing the electrolyte and membrane cap	-Dirty probe (Cathode is not a shiny gold color)	-Clean cathode with Polishing paper *
Sample reading is frozen	-Unit is in "HOLD" mode -Unit is locked	-Release HOLD (momentarilly press Mode/Hold button) -Remove batteries, press ON/OFF button, replace batteries and restart

* Polishing paper is available in the DO603 membrane kit

Operational Matrix for the Model DO600

Function / Resulting Action	Power Status	Mode Setting	Required Button Press Sequence	Comments
On/Off	Any	Any	Momentary press of the ON/OFF button	
Water Saturated Air Calibration	On	Any	Place Electrode in Calibration Cap Press & hold CAL/RECALL button for 2 seconds	
Zero Calibration	On	Any	Place Electrode in Zero Solution, wait for stability Press & hold CAL/RECALL button for 2 seconds	Also works with probe removed (Cal at zero current)
Store Reading	On	Any	Momentary press of the MODE/HOLD button	Stores and holds reading "HOLD" displayed
Hold Release	On	While In Hold Mode	Momentary press of the MODE/HOLD button	
Enter Memory Retrieval	On	Any	Momentary press of the Cal button followed by a momentary press of the MODE/HOLD button (w/in 4 seconds)	If no data is stored in memory, "End" is displayed briefly, and then returns to last mode.
Scroll Stored Readings	On	Memory Recall	Momentary press of the MODE/HOLD button	
Exit Memory Retrieval	On	Memory Recall	Momentary press of the CAL/RECALL	
Clear Stored Memory	On	Any Measure-ment Mode	Press and hold the ON/OFF button for 4 seconds	"clr" is displayed.
Change Measurement Mode	On	Any	Press and hold the MODE/HOLD button for at least two seconds (the modes will scroll until the button is released)	
Enter Salinity Compensation	On	Any	Press and release the CAL/RECALL button twice (momentary) in succession (Displays SAL)	
Changing Salinity Compensation	On	SAL	Momentary press of the MODE/HOLD button (each button press increases the ratio by 1 ppt (part per thousand), the value cycles from 0 to 50)	
Exit Salinity Compensation	On	SAL	Press and release CAL/RECALL button for 2 seconds to enter Altitude Compensation, Or Press and release Cal Button one more time to enter measurement mode	It is necessary to press the CAL/RECALL button to save changes. If the unit times out, no changes are saved.
Enter Altitude Compensation	On	Any or SAL	Press CAL/RECALL twice (momentary). Unit enters Salinity Mode. Press CAL/RECALL for 2 seconds to enter Altitude Compensation Mode. (Displays Ald)	Unit times out in 5 seconds if no button is pressed, reverts to previous mode.
Changing Altitude Compensation	On	Ald	Momentary press of the MODE/HOLD button(each button-press increases altitude by 1,000ft, the value cycles from 0 to 20)	
Exit Altitude Compensation	On	Ald	Momentary press CAL/RECALL button to exit and save changes.	It is necessary to press the CAL/RECALL button to save changes. If the unit times out, no changes are saved.
Change Temperature Units	Off	n/a (off mode)	Press and hold the CAL/RECALL button then momentarily press the ON/OFF button. Release the CAL/RECALL button after the "SELF CAL" lights	
Override Autopower Off	On	Any	Press CAL/RECALL button (momentary) then simultaneously press and hold the MODE/HOLD and ON/OFF buttons for for 2 seconds.	
Default Reset	Off	n/a (off mode)	Simultaneously press ON/OFF, CAL/RECALL and MODE/HOLD momentarily. "dFLt" will be displayed.	

Re-order and Accessories Information

Part Number	Description
DO600	ExStik II Dissolved Oxygen Meter
DO600-K	ExStik II Dissolved Oxygen Meter Kit – contains DO600, DO603, EX050 cable, and weight, and CA895 case
DO605	Replacement Probe, ExStik II Dissolved Oxygen Meter
DO603	Membrane Kit for DO600 Contains: 6 Membrane Caps, 15 mL KCL Filling Solution, Polishing Paper
EX010	Extension Cable 3 feet (1 Meter) & Probe Weight
EX050	Extension Cable 16 feet (5 Meter) & Probe Weight
DO610	ExStik II DO/pH/Conductivity Meter Kit Contains: EC500 pH/Conductivity/Salinity/TDS ExStik II Meter, DO600 Dissolved Oxygen ExStik II Meter, Single use pH buffer pouches 4, 7, and 10pH, Sample Cups with Cap, Weighted Base for Sample Cups, and Batteries, all packed in a Carrying Case
CA895	Small Soft Vinyl Pouch with Belt Loop for ExStik and ExStik II