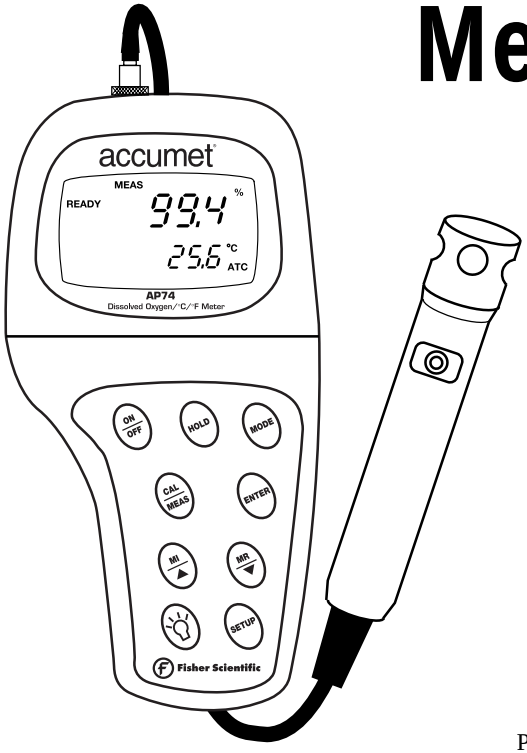
accumet®

OPERATING INSTRUCTIONS

**accumet® 13636AP74A**

# Portable Waterproof Dissolved Oxygen Meter




Printed 1/02

accumet®

# Table of Contents

1. Introduction ..... 4

2. Display and keypad functions ..... 5-6
2.1 Display ..... 5
2.2 Keypad ..... 6

3. Preparation ..... 7-8
3.1 Inserting the batteries ..... 7
3.2 Connecting the probe ..... 8

4. Calibration ..... 9-14
4.1 Preparing the meter for calibration ..... 9
4.2 Dissolved oxygen calibration in % saturation ..... 10-11
4.3 Dissolved oxygen calibration in mg/l (ppm) mode ..... 12-13
4.4 Temperature calibration ..... 14

5. Measurement ..... 15-18
5.1 Taking DO readings ..... 15-16
5.2 Taking pressure/salinity compensated DO measurements ..... 17-18

6. Hold function ..... 19

7. Memory functions ..... 20-21
7.1 Memory input ..... 20
7.2 Memory recall ..... 21

8. Advanced setup functions ..... 23-39
Advanced setup mode overview ..... 23-25
mg/l (ppm) measurement mode overview ..... 24
% saturation measurement mode overview ..... 25
8.1 Program Clr: Memory clear ..... 26
8.2 Program dPr: Dissolved oxygen parameters ..... 27-28
Pressure adjustment mode ..... 27
Salinity adjustment mode ..... 28
8.3 Program OFS: Offset for % saturation measurement ..... 29
8.4 Program CAL: Previous calibration information ..... 30

8.5 Program ELE: Electrode properties ..... 31
View probe slope ..... 31
View % saturation offset ..... 31
View 100% saturation mV value ..... 31
View 0% saturation mV value ..... 31
8.6 Program COF: Unit configuration ..... 32-34
Ready indicator and auto endpoint function ..... 32
Selecting mg/l or pm units ..... 33
Selecting °C or °F temperature readout ..... 34
8.7 Program LCd: Adjusting LCD brightness ..... 35
8.8 Program CLO: Setting the real-time clock ..... 36-37
8.9 Program rST: Resetting to factory default settings ..... 38

9. Probe care and maintenance ..... 39-42
9.1 Probe care ..... 39
9.2 Membrane replacement ..... 40-41
9.3 Electrolyte solution ..... 41

10. Troubleshooting ..... 42

11. Error Messages ..... 43

12. Specifications ..... 44

14. Appendix 1: Meter theory ..... 45

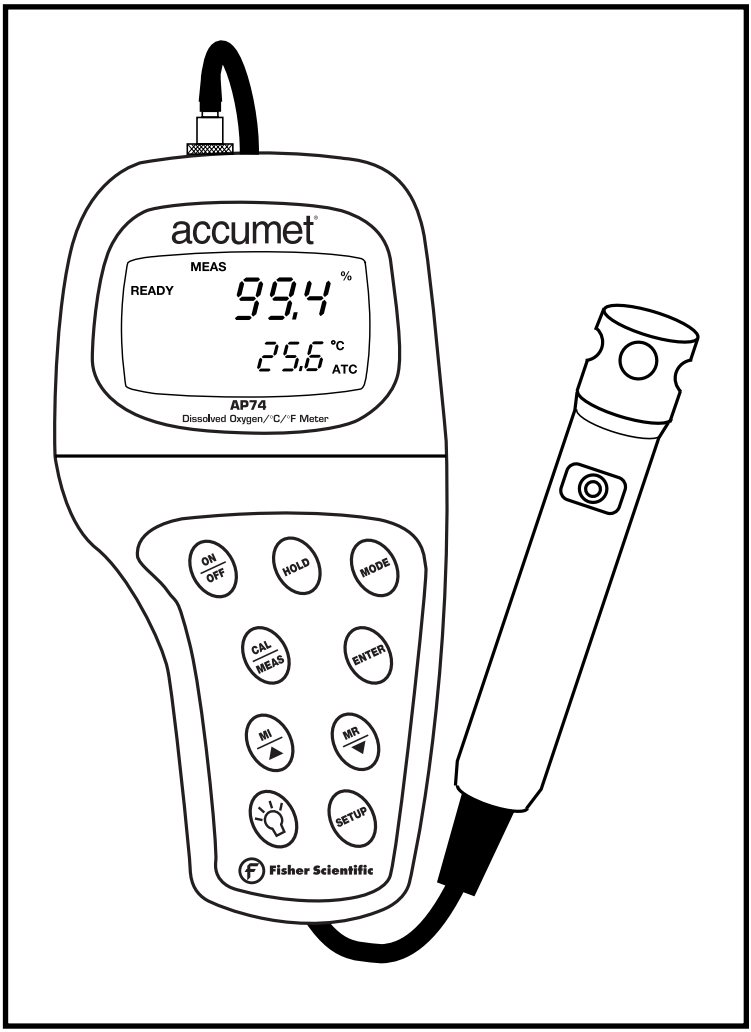
15, Appendix 2: Pressure vs. Altitude table ..... 46

16. Appendix 3: Factory default settings ..... 47

# 1. Introduction

Thank you for selecting an accumet AP74 Dissolved Oxygen meter. This portable meter is a microprocessor-based instrument that measures dissolved oxygen and temperature. It's completely waterproof—and it floats! Your meter has many user-friendly features, all of which are accessible through the membrane keypad.

Your meter includes a dissolved oxygen/temperature probe, electrolyte solution, and batteries. Please read this manual thoroughly before operating your meter.



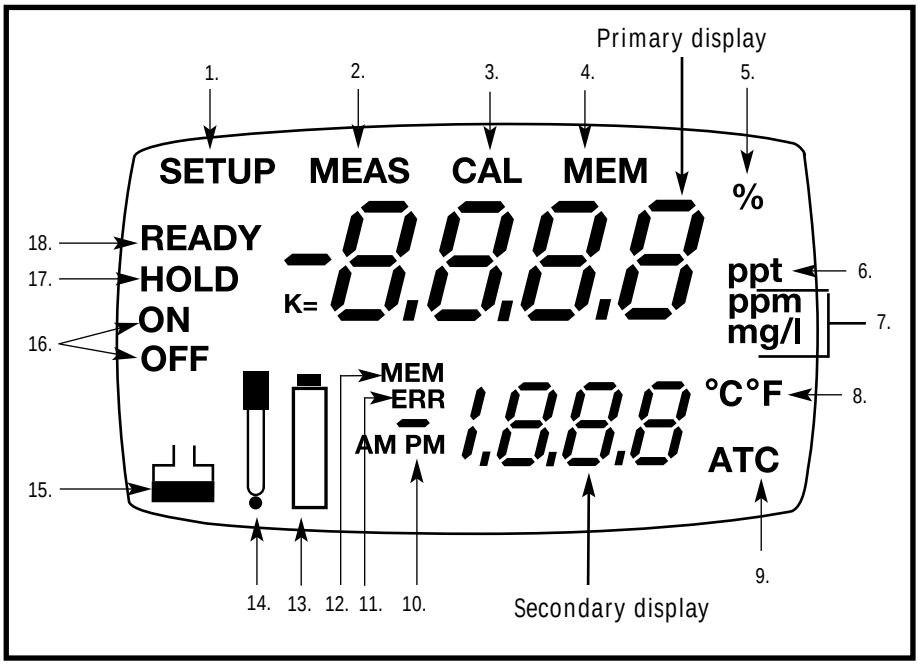
# 2. Display and Keypad Functions

## 2.1 Display

The LCD has a primary and secondary display.

- The primary display shows the measured dissolved oxygen reading.
- The secondary display shows the temperature of the reading.

The display also shows error messages, keypad functions and program functions.




1. SETup mode indicator
2. MEASurement mode indicator
3. CALibration indicator
4. MEMory recall mode indicator
5. % saturation indicator
6. Salinity input indicator
7. Oxygen solubility indicators
8. Temperature indicators
9. Automatic Temperature Compensation indicator
10. Clock indicator
11. ERRor indicator
12. MEMory location indicator
13. Low battery indicator
14. Probe indicator
15. Calibration data indicator
16. Function ON / OFF indicator
17. HOLD indicator
18. READY indicator

## 2.2 Keypad

The large membrane keypad makes the instrument easy to use. Each button, when pressed, has a corresponding graphic indicator on the LCD.

**ON/OFF**.....Powers and shuts off the meter.

**HOLD** .....Freezes the measured reading. To activate, press **HOLD** while in measurement mode. To release, press **HOLD** again.
*NOTE:* When auto endpoint feature is switched on, it automatically holds reading after 5 seconds of stability. The HOLD indicator appears on the display. Press HOLD to release auto endpoint feature.

**MODE**.....Selects the measurement parameter. Press MODE to toggle between DO % saturation; DO mg/l (ppm); and date/time. In DO calibration mode, press MODE to access temperature calibration.
*NOTE:* To switch between mg/l and ppm modes, see page 33.

**CAL/MEAS**.....Toggles user between Calibration and Measurement mode.
- If you were in DO % saturation mode, press **CAL/MEAS** to enter DO % saturation calibration mode.
- If you were in DO mg/l (ppm) mode, press **CAL/MEAS** to enter DO mg/l (ppm) calibration mode.

**NOTE:** Temperature calibration is available from DO calibration mode; see page 14 for directions.
In advanced set-up mode: Press **CAL/MEAS** to return to main menu from sub menus. Press **CAL/MEAS** again to return to measurement mode from main menu.

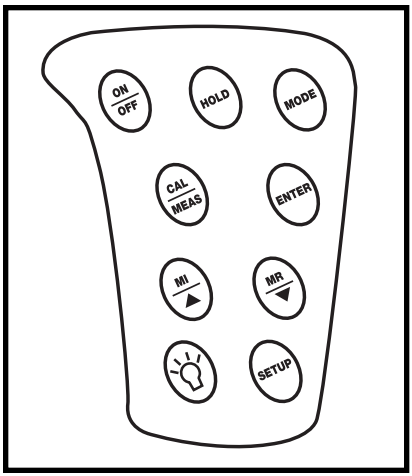
**ENTER** .....Press to confirm values in Calibration mode and to confirm selections in Setup mode.

▲ / ▼ .....Press in Setup mode to scroll through subgroups. Also lets you increment/decrement the values in the mg/l and temperature calibration modes.

**MI** / **MR** .....**MI/MR** work in the measurement mode. **MI** (memory input) stores the measured value into memory. **MR** (memory recall) recalls the sets of values stored in the memory.

**SETUP**.....Press to enter SETUP mode. SETUP mode lets you customize meter preferences and defaults, and view calibration and probe data.

.....**LIGHT** Press to activate backlit display.

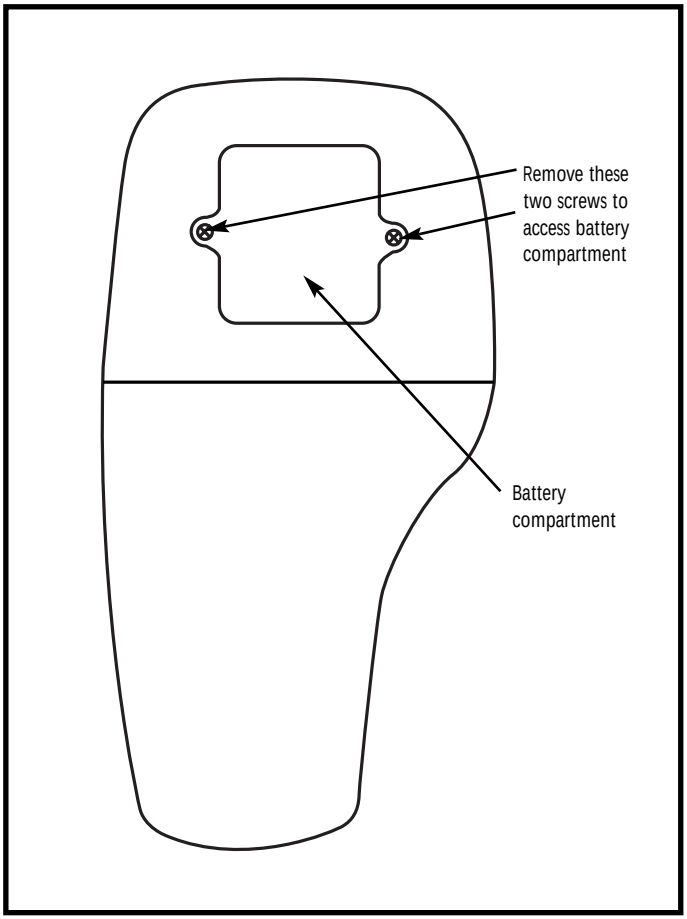


# 3. Preparation

## 3.1 Inserting the Batteries

Four AAA batteries are included with your meter.

1. Use a Phillips screwdriver to remove the two screws holding the battery cover. See figure below.
2. Lift off battery cover to expose batteries.
3. Insert batteries. Follow the diagram inside the cover for correct polarity.
4. Replace the battery cover into its original position. Screw cover back into place.



## 3.2 Connecting the probe

Your meter includes a dissolved oxygen / temperature probe. The probe cable has a notched 6-pin connector to attach the probe to the meter.

**NOTE:** Do not substitute other probes.

**NOTE:** Keep connector dry and clean. Do not touch connector with soiled hands.

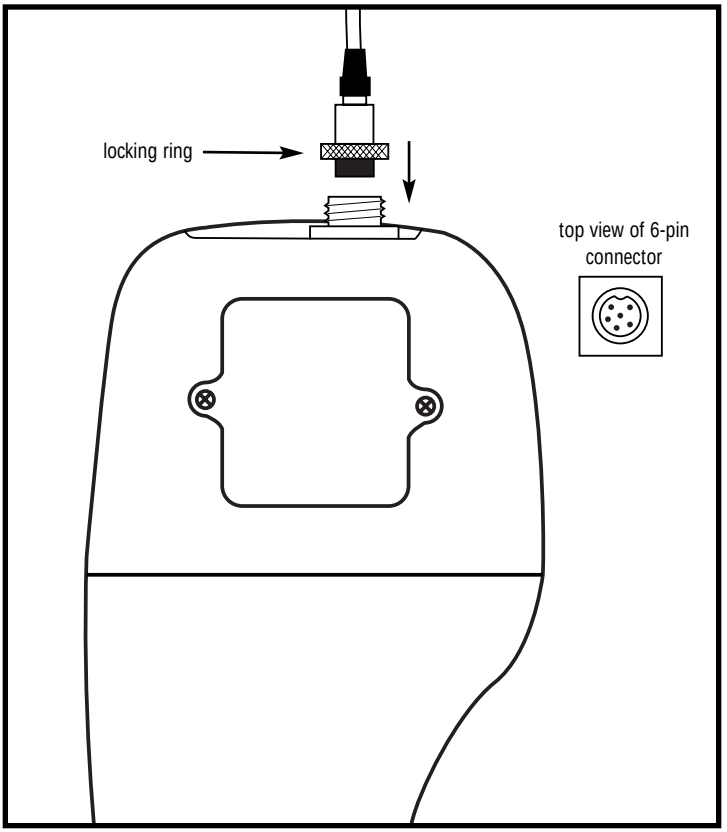
**To connect the probe:**

**1.** Line up the notch and 6 pins on the top of the meter with the holes in the probe connector. Push down and turn the locking ring to lock into place.

See figure below.

**2.** To remove probe, turn the locking ring on the probe connector. Pull probe away from the meter.

CAUTION: Do not pull on the probe cord or the probe wires might disconnect.

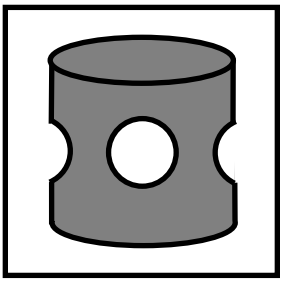


# 4. Calibration

## 4.1 Preparing the meter for calibration

Before calibrating your meter, make sure to rinse the probe well with de-ionized water or rinse solution.

**NOTE:** Do not let membrane surface of the probe touch any other surface. The probe guard (the piece with holes fitted over the end of the probe) protects the membrane; make sure this is always attached to the probe while it is in use.



Probe guard

You can calibrate for dissolved oxygen in either % saturation or mg/l (ppm). **All new calibrations automatically override existing calibration data.**

### Before calibration

Before starting calibration, make sure you are in the correct measurement mode. When you switch on the meter, the meter starts up in the units last used (either mg/l, ppm, % air saturation, or clock). For example, if you shut the meter off in "mg/l" units, the meter will read "mg/l" units when you switch the meter on.

**NOTE:** Most users will calibrate to 100% saturation even when working in mg/l. When calibrating the meter in mg/l mode, you can make fine adjustments, typically to a midrange value between 10 and 100%. If you are calibrating to a midrange value, you need to set the 100% saturation value first.

## 4.2 Dissolved Oxygen calibration in percent saturation

You can calibrate this meter quickly and easily in air. The exact calibration value depends on barometric pressure. The meter is set to a factory default of 760 mm Hg, which results in a calibration value of 100% saturation in air.

**NOTE:** If the barometric pressure setting has been changed from 760 mm Hg, the calibration value in air will automatically adjust to a value other than 100%. The adjusted value will be correct for the new barometric pressure setting.

- See page 27 to change the pressure setting.
- See Appendix 2 on page 46 for a chart of adjusted % saturation values.

### To calibrate 100 % saturation:

1. **Rinse the probe well with deionized rinse water or rinse solution.** For best accuracy, wrap the end of the probe in a damp cloth. Do not touch the membrane.
2. **Press the MODE key** to select the % saturation mode.

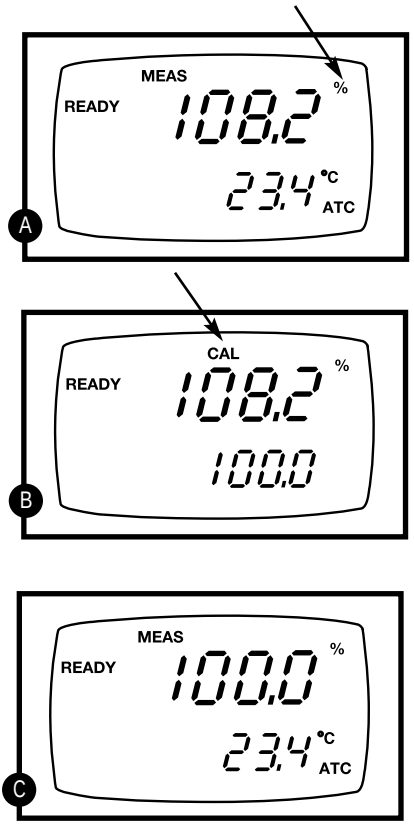
*See figure* A

3. **Press the CAL key.** The CAL indicator will appear above the primary display. The primary display shows the current value of the measurement and the secondary display will show 100.0 (see NOTE above).

*See figure* B

4. **Hold the probe in the air (or in damp cloth).** Wait for the reading to stabilize. If the Ready indicator feature is enabled, it will appear when the reading is stable (see page 32).
5. **Press the ENTER key.** The meter automatically calibrates to 100.0% air saturation and returns to Measurement mode.

*See figure* C




### Notes

The reading in the primary display in step 3 must read at 50% or above for the calibration to work correctly. Whenever an error occurs during calibration, the ERR indicator appears in the lower left hand corner of the display.

You can offset your % DO calibration: see page 29 for directions.

## To calibrate 0 % saturation:

1. **Rinse the probe well with deionized rinse water or rinse solution.** Do not touch the membrane.
2. **Press the MODE key** to select the % saturation mode.

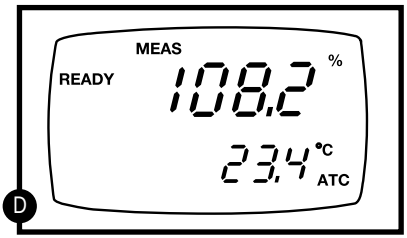
*See figure* D

2. **Place the probe in zero oxygen solution.** Stir the probe gently to homogenize the sample. Make sure that the sample is continuously flowing past the membrane sensor.
3. **Press the CAL key.** The CAL indicator will appear above the primary display. The primary display shows the current value of the measurement and the secondary display will show 0.0.

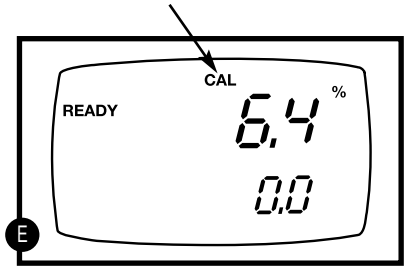
*See figure* E

4. **Wait for the reading to stabilize.** If the Ready indicator feature is enabled, it will appear when the reading is stable (see page 32).
5. **Press the ENTER key.** The meter automatically calibrates to 0.0% saturation and returns to Measurement mode.

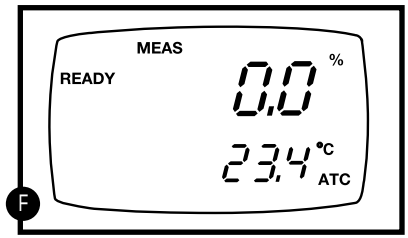
*See figure* F



D



E



F

## Notes

The reading in the primary display in step 3 must read at 10% or under for the calibration to work correctly. Whenever an error occurs during calibration, the ERR indicator appears in the lower left hand corner of the display.

You can offset your % DO calibration: see page 29 for directions.

## 4.3 Dissolved Oxygen calibration in mg/l (ppm) mode

Calibrating the meter to 100 % in saturation mode will also calibrate the mg/l mode at the value in mg/l corresponding to 100% saturation. This should produce acceptable results in most applications.

This meter also lets you make a calibration adjustment in mg/l (ppm) mode without affecting your % saturation calibration.

To select between mg/l and ppm units, see page 33.

### To calibrate in mg/l (ppm) mode:

1. Calibrate 100% saturation per section 4.1.
2. **Rinse the probe well with deionized rinse water or rinse solution.** Wipe the outside of the probe carefully (do not touch the membrane).
3. **Dip the probe into a sample of known oxygen concentration.** Wait for the reading to stabilize. If the Ready indicator feature is enabled, it will appear when the reading is stable (see page 32).

NOTE: The sample must continuously flow past the membrane for accurate readings. A stirrer can keep the solution agitated; order a magnetic stirrer on page 47.

4. **Press the MODE key** to select the mg/l (ppm) mode.

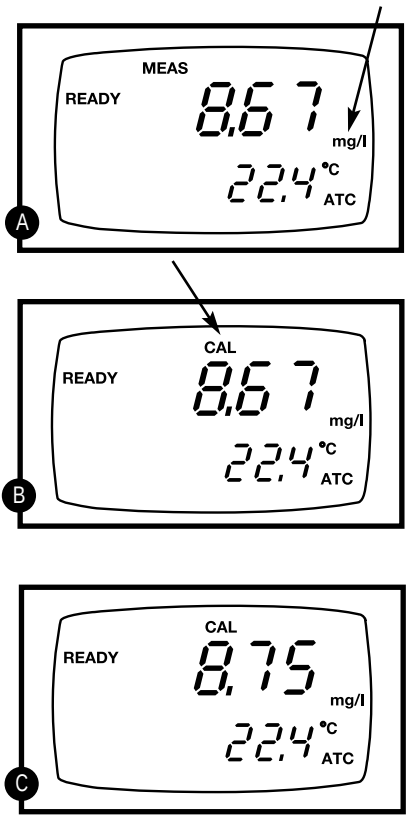
*See figure* A

5. **Press the CAL key.** The CAL indicator will appear above the primary display. The primary display shows the current value of the measurement and the secondary display shows the temperature.

*See figure* B

6. **Press the ▲ and ▼ keys** to adjust the reading.
7. **Press the ENTER key.** The meter automatically calibrates to the value you entered and returns to Measurement mode.

*See figure* C



## Notes on mg/l (ppm) mode calibration

During mg/l (ppm) calibration, the meter adjusts to the barometric pressure value that is programmed into the meter. It also adjusts to the salinity value that is programmed into the meter.

You can change the barometric pressure value and salinity value in the mg/l (ppm) Set Up mode (see pages 27-28 for directions).

Whenever an error occurs during calibration, the ERR indicator appears in the lower left hand corner of the display.

## 4.4 Temperature Calibration

The built-in temperature sensor included in the probe is factory calibrated. Calibrate your sensor only if you suspect sensor drift that may have occurred over a long period of time or if you have a replacement probe.

1. Switch the meter on. Press MODE to select mg/l (ppm) Measurement mode.
2. **Press the CAL/MEAS key to enter mg/l (ppm) calibration mode.** The CAL indicator will appear above the primary display.

*See figure* A

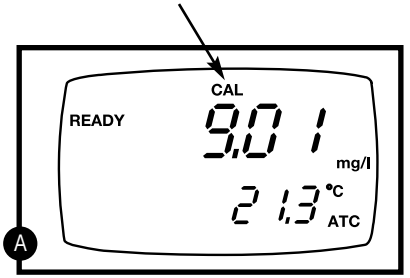
3. **While in mg/l (ppm) calibration mode, press the MODE key to enter temperature calibration mode.** The primary display shows the last set temperature reading and the secondary display shows you the factory default temperature value.

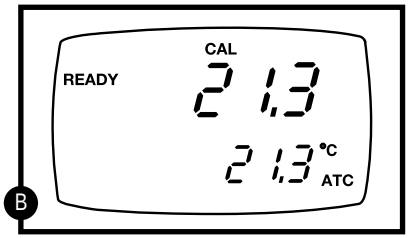
*See figure* B

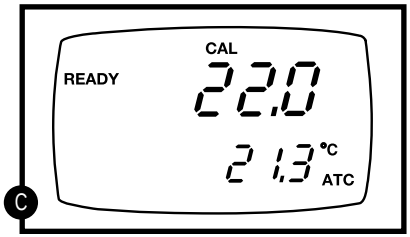
4. **Compare the primary display reading to a NIST-traceable thermometer or another thermometer known to be accurate.**
5. **Press the ▲ or ▼ keys** to adjust the primary display reading to agree with your temperature standard.

*See figure* C

6. **Press the ENTER key** to confirm temperature calibration and return to Measurement mode.




### Notes

**To exit from Temperature Calibration mode without confirming calibration,** DO NOT press ENTER in step 6. Press CAL/MEAS instead.

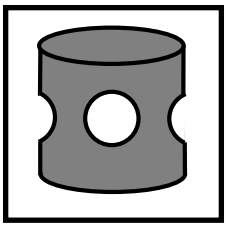
**Temperature calibration is restricted to ±5°C from the factory default value displayed during calibration** (shown in the secondary display).

# 5. Measurement

## 5.1 Taking DO readings

During measurement, the probe can be:
- fully immersed in the solution
- partially immersed in the solution

Do not allow the probe's membrane surface to touch anything! The probe guard (the piece with holes fitted over the end of the probe) protects the membrane; you should leave this piece attached to the probe at all times.



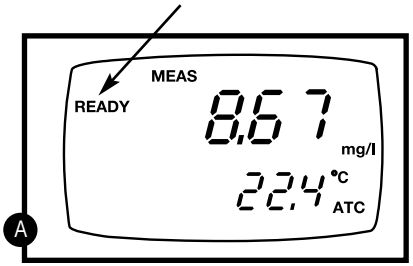
Probe guard

**IMPORTANT:** since the DO probe consumes oxygen from the sample, the sample must constantly flow past the membrane to achieve more accurate readings. You can use a stirrer to accomplish this.

### To take measurements:

1. **Rinse the probe well with deionized rinse water or rinse solution.**
2. **Select the appropriate measurement mode. Press the MODE key** to toggle between modes:
   - **%saturation.**
   - **mg/l (ppm)**,**
   - **date/time clock**
3. **Dip the probe into the sample.** Stir the probe gently to homogenize the sample. Make sure that the sample is continuously flowing past the membrane sensor.
4. **Note the reading on the display.** If the READY indicator is switched on, it will appear when the reading is stable.

*See figure* A




5. **Press the** 💡 **key** to activate the backlit LCD. This helps you read measurements in dimly lit areas. The backlit display automatically turns off 20 seconds after releasing the 💡 key to conserve batteries.

**To select between mg/l and ppm units, see page 33.

The **ATC indicator** should appear in the lower right hand corner of the display. If it does not, this indicates an error.

*CONTINUED ON NEXT PAGE*

## Taking measurements with READY indicator selected on

If the READY indicator has been activated, the **READY** annunciator lights when the reading is stable. Switch the READY indicator on or off in the Set up program—see page 32 for directions.

## Taking measurements with the auto endpoint feature selected on

When a reading is stable for more than 5 seconds, the auto endpoint feature will automatically “hold” the reading. The “hold” indicator appears on the left side of the display. Press the HOLD key to release the reading. Switch the Auto endpoint feature on or off in the Set up program—see page 32 for directions.

## 5.2 Taking pressure/salinity compensated DO measurements

If necessary, you can adjust the pressure and salinity values of your measurements in the Set Up mode. The DO meter will automatically compensate for salinity and pressure based on the values entered in the setup functions. The meter is factory set at 760 mm Hg (101.3 Pascals) pressure adjustment and a factor of 0.0 salinity adjustment. See Appendix 2 on page 46 for a “Pressure vs Altitude” table.

### Pressure adjustment

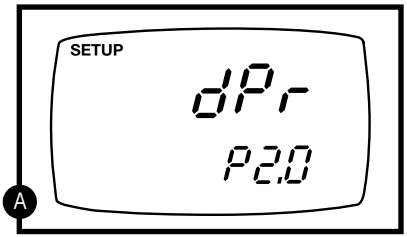
1. **Press the SETUP key** to enter Set Up mode.
2. **Press the ▲ key** once. The upper display shows “dPr”.

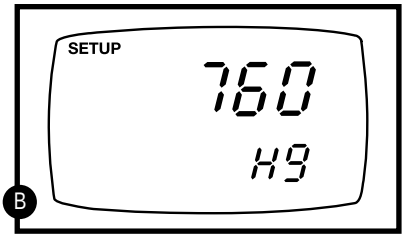
*See figure* A

3. **Press the ENTER key** until the upper display shows a number and the lower display shows “Hg” or “PA”.
4. **Use the ▲ and ▼ keys** to enter the barometric pressure. The upper display will show the value you have entered.

*See figure* B

5. **Press ENTER** to confirm pressure value.
6. Press CAL/MEAS to return to Measurement mode, or continue with step 4 on page 18 to make a salinity adjustment [available from mg/l (ppm) mode only].



## Salinity adjustment

**NOTE**: ***this mode appears in ppm (mg/l) measurement mode only.***

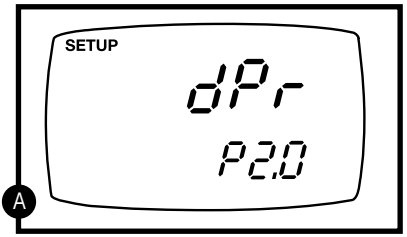
1. **Press the Mode key** to select mg/l (ppm) mode.
2. **Press the SETUP key** to enter Set Up mode.
3. **Press the ▲ key** until the upper display shows “dPr”.

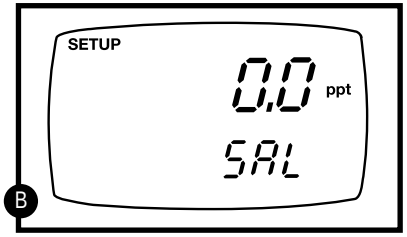
*See figure* A

4. **Press the ENTER key** until the upper display shows a number and the lower display shows “SAL”.
5. **Use the ▲ and ▼ keys** to enter the salinity of your solution in ppt. The upper display will show the value you have entered.

*See figure* B

6. **Press the ENTER key** to confirm value.
7. Press CAL/MEAS to return to Measurement mode.



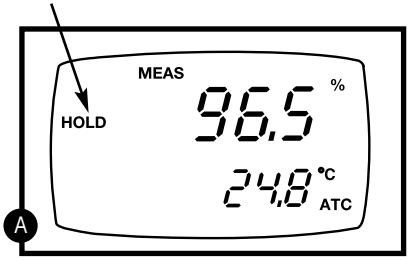
# 6. HOLD function

This feature lets you freeze the dissolved oxygen and temperature readings for a delayed observation. **HOLD** can be used any time when in **MEAS** mode.

1. To hold a measurement, press the **HOLD** key while in measurement mode. "**HOLD**" will appear on the display.

*See figure* A

2. To release the held value, press **HOLD** again. Continue to take measurements.




**NOTE:** This meter shuts off automatically after 20 minutes of nonuse. If the meter is shut off either automatically or manually, the HOLD value will be lost. For longer storage, use the memory functions (see pages 20-21).

**NOTE:** This meter has an auto endpoint feature. When this feature is switched on, the display will automatically “hold” a reading that has been stable for more than 5 seconds. The “hold” indicator appears. Press the HOLD key to release the reading. To switch on or off the auto endpoint feature, see page 32.

# 7. Memory functions

## 7.1 Memory Input

Your meter stores data in sets that include:

- dissolved oxygen with corresponding temperature reading
- time and date reading was taken

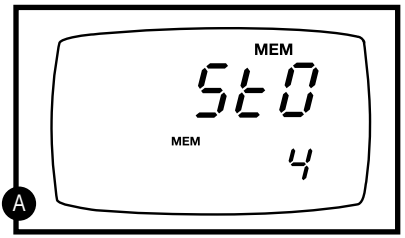
You can store up to 50 sets of data in any combination of %, mg/l, or ppm readings.

### To store a reading:

1. **During any measurement function (MEAS),** press the **MI** key to input any data into the memory.
2. **MEM, "Sto" and memory number will flash.** The meter then returns to measurement mode.

*See figure* A

**NOTE:** If the memory is full, the first value stored will be erased to create space for the new value.



## 7.2 Memory Recall

This function recalls the previous readings stored in the memory. You can only access **MR** from the **MEAS**urement mode. Memory recall is in "Last In First Out" order.

### To recall readings:

1. **Press the MR key once** to retrieve the last reading stored. The memory location screen—**MEM, "Loc" and the memory number**—will flash on the display.

*See figure* B

2. **Press the ENTER key** to recall the reading stored under that memory number.

*See figure* C

3. **Press the ENTER key** again to view the date and time the reading was taken.

*See figure* D

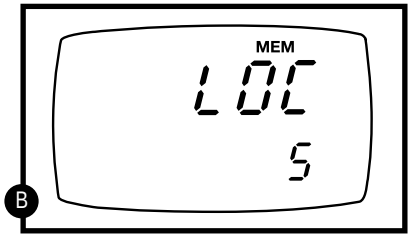
4. **Press the ENTER key** again to return to the "memory location" screen. The display automatically moves to the next memory location screen.

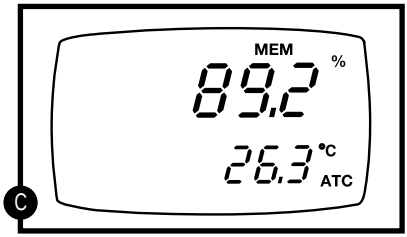
*See figure* E

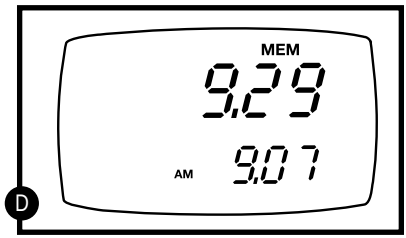
5. **If necessary, press the ▲ key** to select the next "memory location" screen; **press the ▼ key** to select the previous "memory location" screen.

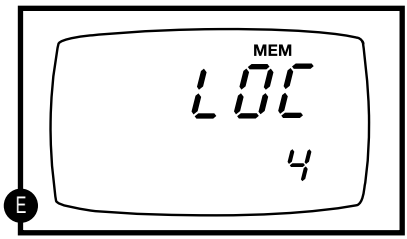
6. Repeat steps 2-5 to review additional stored data sets.

7. To exit Memory Recall, **press the MEAS key** to return to the Measurement mode.




### Notes

Readings stored in memory are retained even if the unit is turned off. To erase all readings stored in memory, use the **SETUP** mode Clr on page 26.

# 8. Advanced set up functions

The advanced set up mode lets you customize your meter's preferences and defaults. Your AP74 waterproof meter features different sub groups that organize all set-up parameters.

This meter blanks out subgroups that do not apply to the measurement mode [% saturation or mg/l (ppm)] you are in when you enter Setup mode.

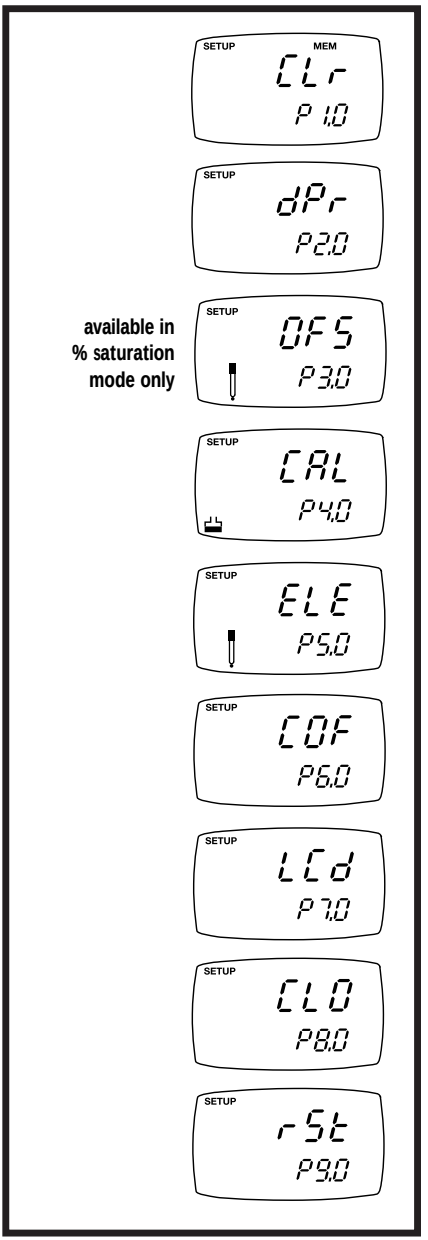
The full selection of available sub groups are:

1. **CLR:** Memory clear
2. **dPr:** Dissolved oxygen parameters
3. **OFS:** % saturation offset adjustment—*% saturation mode only*
4. **CAL:** Calibration data
5. **ELE:** Probe data
6. **COF:** Configuration
7. **LCd:** Backlit display
8. **CLO:** Setting clock
9. **rSt:** Reset meter to factory default

**IMPORTANT:** ***If a parameter is not available in a particular mode, the meter automatically skips past it. <u>The parameter numbers in the lower display adjust accordingly.</u>***

If you enter Set up mode from the date/time measurement screen, you will see % saturation set up parameters.

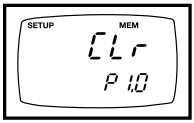
See pages 24-25 for more a detailed overview on the different parameters available in % saturation mode and mg/l (ppm) mode.



# 8.1 Advanced set-up mode detailed overview

Press the SETUP key to enter Set up mode. Press the ▲ and ▼ keys to scroll through sub groups.

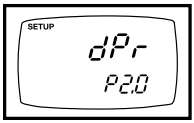
## *mg/l (ppm) measurement mode*




Instructions on page 26

### CLr: Memory clear

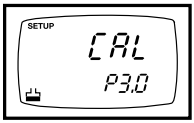
- Clear all stored readings




Instructions on pages 27-28

### dPr: Dissolved oxygen parameters

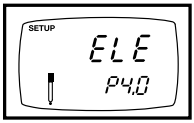
- Select Hg or Pa barometric pressure units
- Select barometric pressure
- Select salinity adjustment factor




Instructions on page 30

### CAL: Viewing previous calibration data

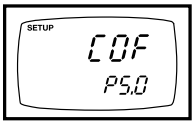
- View previous calibration data, including date / time




Instructions on page 31

### ELE: Viewing probe data

- View probe slope
- View mV value equivalent to 100% saturation
- View mV value equivalent to 0% saturation




Instructions on pages 32-34

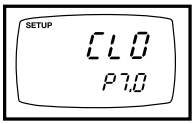
### COF: Unit configuration

- Ready indicator on or off / auto endpoint on or off
- Select mg / l or ppm units
- Select °F or °C


Instructions on page 35

### LCd: Backlit display

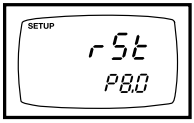
- Adjust brightness of backlit LCD




Instructions on pages 36-37

### CLO: Set clock

- Setting year
- Setting date (month / day)
- Setting time (hour / minute / second)

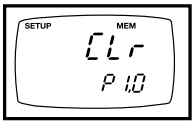



Instructions on page 38

### rSt: Reset to factory default

- Reset to factory default settings

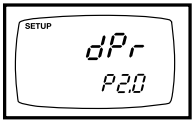
## *% saturation measurement mode*




Instructions on page 26

### CLr: Memory clear

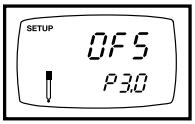
- Clear all stored readings




Instructions on pages 27-28

### dPr: Dissolved oxygen parameters

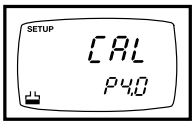
- Select Hg or Pa barometric pressure units
- Select barometric pressure




Instructions on page 29

### OFS: % saturation offset adjustment

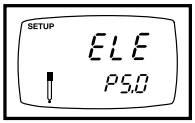
- Set % saturation offset adjustment




Instructions on page 30

### CAL: Viewing previous calibration data

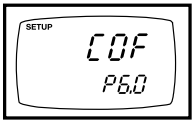
- View previous calibration data, including date / time




Instructions on page 31

### ELE: Viewing probe data

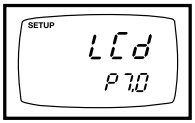
- View probe slope
- View % saturation offset
- View mV value equivalent to 100% saturation
- View mV value equivalent to 0% saturation




Instructions on pages 32-34

### COF: Unit configuration

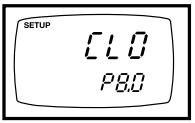
- Ready indicator on or off / auto endpoint on or off
- Select °F or °C




Instructions on page 35

### LCd: Backlit display

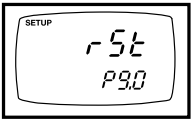
- Adjust brightness of backlit LCD




Instructions on pages 36-37

### CLO: Set clock

- Setting year
- Setting date (month / day)
- Setting time (hour / minute / second)




Instructions on page 38

### rSt: Reset to factory default

- Reset to factory default settings

## 8.2 Clr: Memory Clear

Use this sub group to clear all memory values when you need to store a new series of values. This lets you avoid confusing the old values with the new ones. NO is the default setting.

NOTE: Selecting YES will wipe out all memory.

From measurement mode:

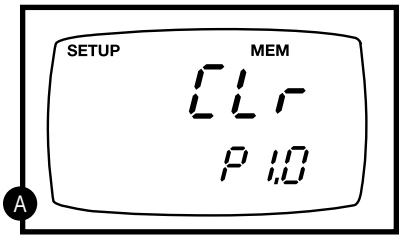
1. **Press the Set up key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter ”Clr”in the upper display.

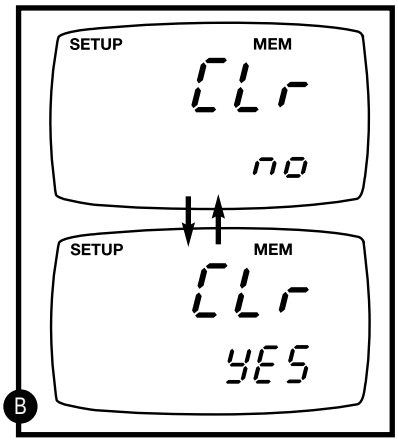
*See figure* A

3. **Press the ENTER key** to enter parameter.
4. **Press the ▲ and ▼ keys** to toggle between NO and YES.
   - NO retains current memory
   - YES clears all memory

*See figure* B

5. **Press the ENTER key** to confirm selection and return to the subgroup menu. Press the CAL / MEAS key to return to measurement mode.



## 8.3 dPr: Dissolved Oxygen Parameters

This sub group lets you adjust the barometric pressure and salinity.

### Pressure adjustment mode

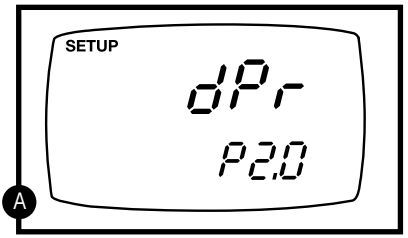
Barometric pressure is vital to correct dissolved oxygen measurements. You need to enter the correct barometric pressure of the area you are measuring. This mode lets you perform two functions:

- Select either mm Hg or Pascal barometric pressure units
- Adjust the barometric pressure. See Appendix 2 on page 46 for a "Pressure vs Altitude" table.

From measurement mode:

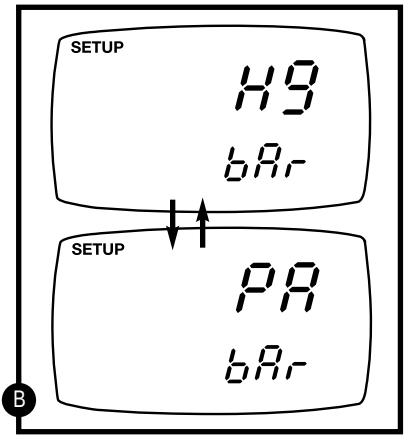
1. **Press the Set up key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter "dPr" in the upper display.

*See figure* A



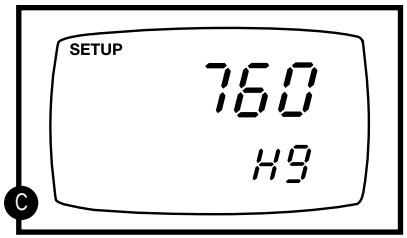

3. **Press the ENTER key twice.** The upper display shows either Hg or PA and the lower display shows bAr.
4. **Press the ▲ and ▼ keys** to toggle between mm Hg and Pascal units.

*See figure* B




5. **Press the ENTER key** to confirm selection and move to the next screen. The upper display shows the barometric pressure and the lower display shows the units selected in step 3.

*See figure* C




6. **Press the ▲ and ▼ keys** to adjust the barometric pressure. The pressure adjustment range is 500 to 1499 mm Hg (66.6 to 199.9 kPa).
7. **Press the ENTER key** to confirm selection and move to step 5 on page 28 (salinity adjustment). If instead you want to return to measurement mode, press CAL / MEAS twice.

**NOTE:** *Salinity adjustment appears in mg/l (ppm) measurement mode only.*

## Salinity adjustment mode

**NOTE:** *this mode appears in mg/l (ppm) measurement mode only.*

Salinity correction mode lets you correct for the variations in oxygen solubility due to salt concentration in the sample.

From measurement mode:

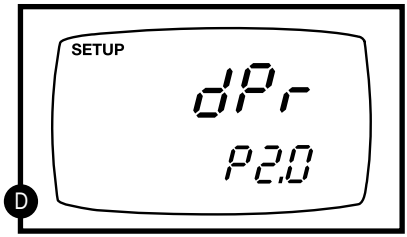
1. **Press the Mode key** to select mg/l (ppm) mode.
2. **Press the Setup key** to enter Set Up mode.
3. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter "dPr" in the upper display.

*See figure* D

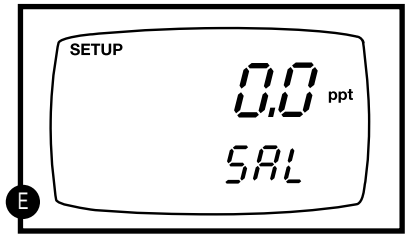
4. **Press the ENTER key five times.** The upper display shows the salinity value and the lower shows SAL.

*See figure* E

5. **Press the ▲ and ▼ keys** to enter the correct salinity adjustment factor. The salinity adjustment factor range is 0.0 to 50.0 ppt.
6. **Press the ENTER key** to confirm selection and to move back to subgroup "dPr". If you want to return to measurement mode, press CAL/MEAS.



D



E

## 8.4 OFS: Offset for % saturation measurement

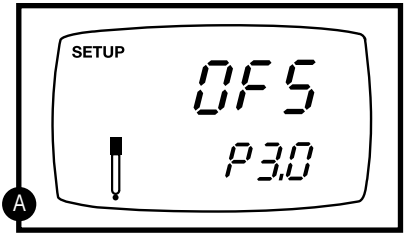
**NOTE:** *this sub group appears in % saturation measurement mode only.*

Use the offset adjustment to act as an offset at values between 0 and 100%. It is useful to match against end-user standards (i.e. a test kit value).

From measurement mode:

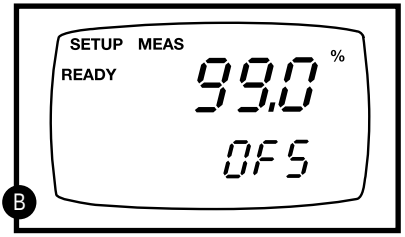
1. **Press the Mode key** to select % saturation mode.
2. **Press the Set up key** to enter Set Up mode.
3. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter "OFS" in the upper display.

*See figure* A




4. **Press the ENTER key.** The upper display shows the current measurement in % saturation and the lower shows OFS.

*See figure* B




5. **Press the ▲ and ▼ keys** to offset the % saturation measurement.
6. **Press the ENTER key** to confirm selection and to move back to subgroup "OFS". If you want to return to measurement mode, press CAL / MEAS.

## 8.5 CAL: Previous calibration information

This sub group shows you the previous calibration data, along with date and time of calibration. This is a "view only" parameter.

**In % saturation mode:** calibration information is shown in % saturation units.

**In mg/l (ppm) mode**: calibration information is shown in mg/l (ppm) units.

From measurement mode:

1. **Press the Mode key** to select the calibration data you want to view: % or mg/l (ppm).
2. **Press the Set up key** to enter Set Up mode.
3. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter "CAL" in the upper display.

*See figure* A

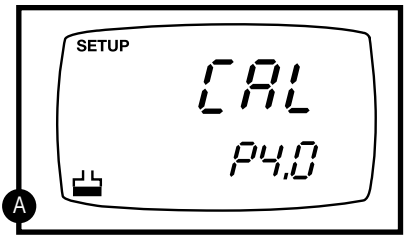
4. **Press the ENTER key.** The upper display shows the calibration data.

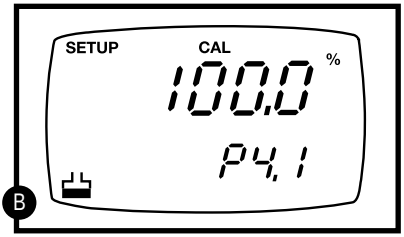
*See figure* B

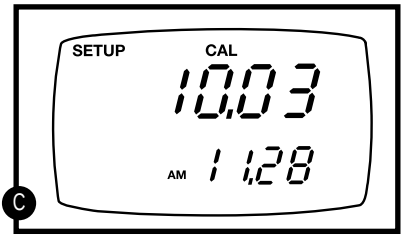
5. **Press the ENTER key again.** The display shows the date and time of the last calibration.

*See figure* C

6. **Press the ENTER key** to move back to subgroup "CAL". If you want to return to measurement mode, press CAL/MEAS.

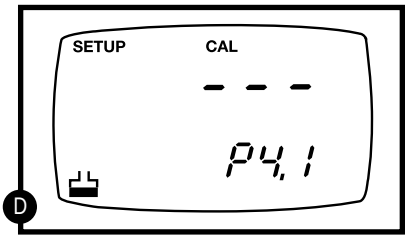



**NOTE:** If you did not calibrate this meter in a particular mode, the screen will show "– – –".

*See figure* D



## 8.6 ELE: Electrode properties

These "view only" parameters show the electrode properties for diagnostic purposes:

**A. probe slope:** lets you view the calibration slope of the probe. This mode displays slope from 0.5 to 1.999 % of slope (1.0 = 100%).

**B. % saturation offset** *(available in % saturation mode only):* lets you see the value of the % saturation offset entered in parameter "OFS" (see page 29 for instructions).

**C. 100% saturation mV value:** lets you view the sensor's mV output corresponding to 100% saturation.

**D. 0% saturation mV value:** lets you view the sensor's millivolt output corresponding to 0% saturation.

From measurement mode:

1. **Press the Mode key** to select the measurement mode for the electrode properties you want to view: % or mg/l (ppm).
2. **Press the Set up key** to enter Set Up mode.
3. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter "ELE" in the upper display.

*See figure* A

4. **Press the ENTER key.** The upper display shows the probe slope.

*See figure* B

5. **Press the ENTER key.** The upper display shows the % saturation offset. See directions for setting this offset on page 29. **NOTE:** this appears only in % saturation measurement mode. If you are in mg/l (ppm) mode, the meter skips to step 6.

*See figure* C

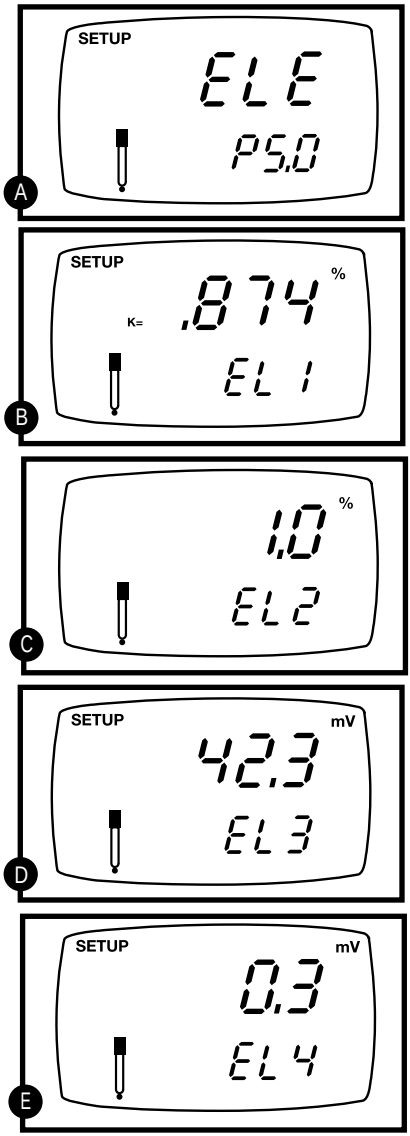
6. **Press the ENTER key.** The upper display shows the 100 % saturation mV value.

*See figure* D

7. **Press the ENTER key.** The upper display shows the 0 % saturation mV value.

*See figure* E

8. **Press the ENTER key** to move back to subgroup "ELE". If you want to return to measurement mode, press CAL/MEAS.



## 8.7 COF: Unit configuration

Unit configuration mode lets you select the following parameters:

**A. Ready indicator and auto endpoint function**
**B. mg/l or ppm units** *(available from mg/l or ppm mode only)*
**C. Temperature in °C or °F**

### READY indicator and auto endpoint function

The first program lets you select:

- **"READY indicator on"** to indicate when the reading is stable.
- **"READY indicator off"** for faster meter response.
- **Auto endpoint function on.** Select auto endpoint on to "hold" the reading when it is stable for more than 5 seconds. The display automatically freezes, and the HOLD indicator appears on the left side of the display. Press the HOLD key to release the display and access other functions.

From measurement mode

1. **Press Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter COF in the upper display.

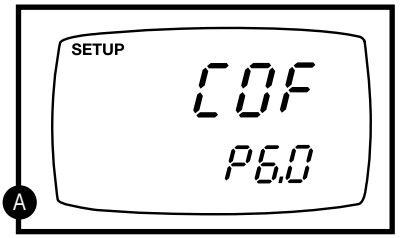
*See figure* A

3. **Press the ENTER key** to select parameter rdY (Ready).

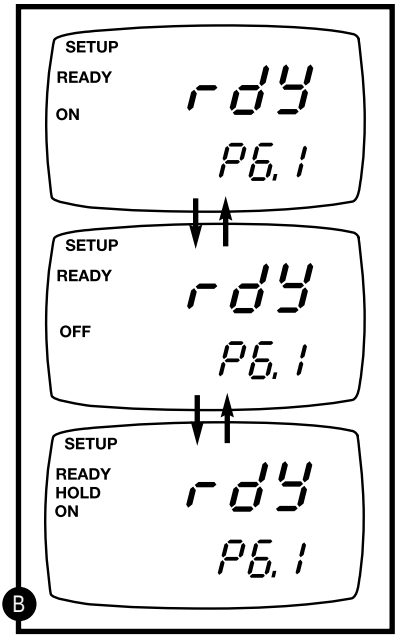
*See figure* B

4. **Press the ▲ and ▼ keys** to select the configuration you require.
   - ON switches the READY indicator on.
   - OFF switches the READY indicator off.
   - ON and HOLD together switches the auto endpoint feature on.
5. **Press the ENTER key** to confirm selection and to proceed to:
   - in % mode: step 4 on page 34.
   - in mg/l (ppm) mode: step 3 on page 33.

   Or, press the CAL/MEAS key twice to return to measurement mode.



A



B

### Notes

Meter default is set for Ready indicator on, and auto endpoint function off.

## Selecting mg/l or ppm units

**NOTE:** *this mode appears in mg/l (ppm) measurement mode only.*

This mode lets you select between mg/l or ppm dissolved oxygen units.

### From measurement mode

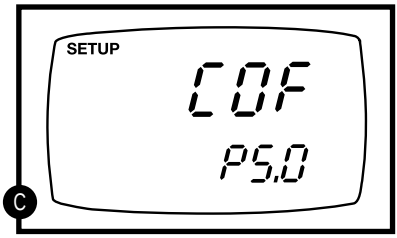
1. **Press the Mode key** to select mg/l (ppm) mode.
2. **Press Setup key** to enter Set Up mode.
3. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter "COF" in the upper display.

*See figure* C

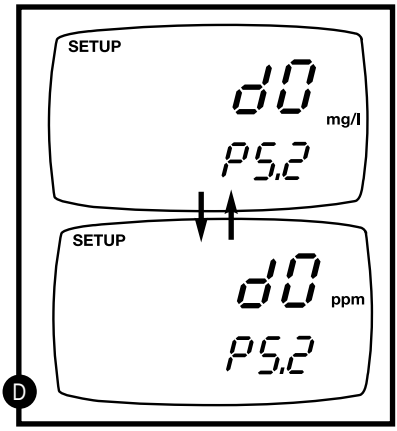
4. **Press the ENTER key** until "dO" appears in the upper display.

*See figure* D

5. **Press the ▲ and ▼ keys** to toggle between mg/l or ppm units.
6. **Press the ENTER key** to confirm selection and move to step 4 on page 34. Press the CAL/MEAS key twice to return to measurement mode.



C



D

## Selecting °C or °F temperature readout

This meter lets you select between °C and °F units for temperature readings.

### From measurement mode

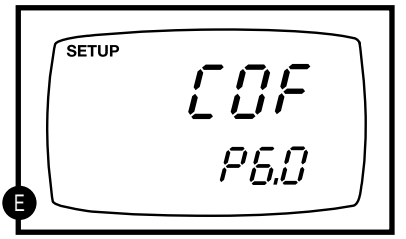
1. **Press Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter "COF" in the upper display.

*See figure* E

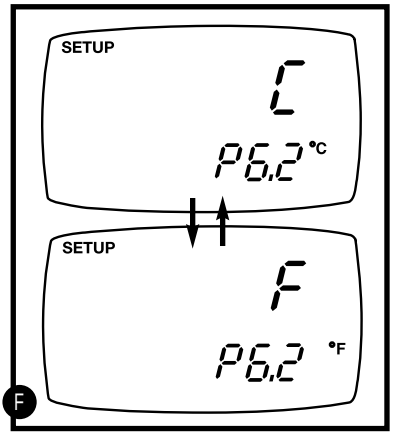
3. **Press the ENTER key** until "C" or "F' appears in the upper display.

*See figure* F

4. **Press the ▲ and ▼ keys** to toggle between °C and °F.
5. **Press the ENTER key** to confirm selection and to return to the subgroup menu. Press the CAL / MEAS key to return to measurement mode.



E



F

## 8.8 LCd: Adjusting LCD brightness

This mode lets you adjust the brightness of the backlit LCD. Selecting a dimmer backlighting level helps conserve batteries.

### From measurement mode

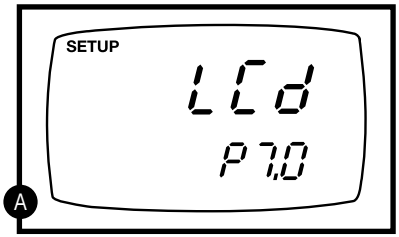
1. **Press Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter "LCd" in the upper display.

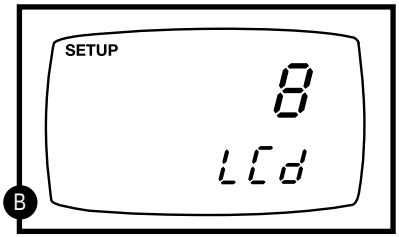
*See figure* A

3. **Press the ENTER key**. A number (0-8) appears in the upper display and "LCd" appears in the lower display.

*See figure* B

4. **Press the ▲ and ▼ keys** to select from level 0 (dimmest light) to level 8 (brightest light).
5. **Press the ENTER key** to confirm selection and to return to the subgroup menu. Press the CAL/MEAS key to return to measurement mode.



## 8.9 CLO: Setting the real-time clock

Your meter features a real-time calendar and clock. This helps you meet GLP (Good Laboratory Practice) standards.

### From measurement mode

1. **Press Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter "CLO" in the upper display.

*See figure* A

3. **Press the ENTER key** to enter parameter "CLO". The meter lets you select the century: "19-" or "20-". The century digits will flash.

*See figure* B

4. **Press the ▲ and ▼ keys** to toggle to the correct century.
5. **Press the ENTER key** to confirm the century and move to "year" selection. The "year" digits will flash.

*See figure* C

6. **Press the ▲ and ▼ keys** to toggle to the correct year.
7. **Press the ENTER key** to confirm the year and move to "month" selection. The "month" digits will flash.

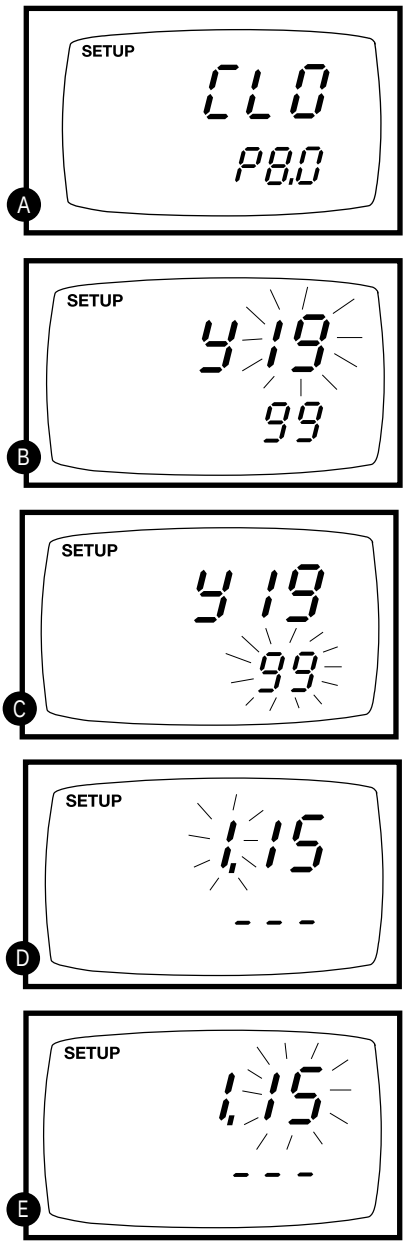
*See figure* D

8. **Press the ▲ and ▼ keys** to toggle to the correct month.
9. **Press the ENTER key** to confirm the month and move to "date" selection. The "date" digits will flash.

*See figure* E

10. **Press the ▲ and ▼ keys** to toggle to the correct date.

*CONTINUED ON NEXT PAGE*



11. **Press the ENTER key** to confirm the date and move to “hour” selection. The “hour” digits will flash.

*See figure* F

12. **Press the ▲ and ▼ keys** to toggle to the correct hour. Note the “AM” and “PM” indicator on the lower portion of the display.

13. **Press the ENTER key** to confirm the hour and move to “minute” selection. The “minute” digits will flash.

*See figure* G

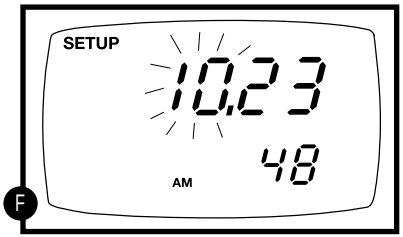
14. **Press the ▲ and ▼ keys** to toggle to the correct minutes.

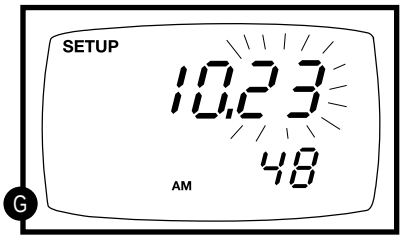
15. **Press the ENTER key** to confirm the minutes and move to “second” selection. The “second” digits will flash.

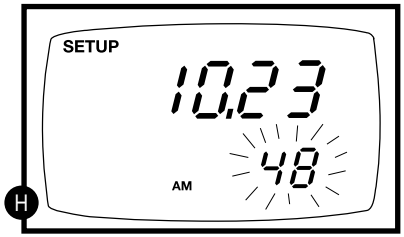
*See figure* H

16. **Press the ▲ and ▼ keys** to toggle to the correct seconds.

17. **Press the ENTER key** to confirm selection and to return to the subgroup menu. Press the CAL / MEAS key to return to measurement mode.




## Notes

Press the CAL / MEAS key at any point while setting the time to return to the subgroup menu.

## 8.8 P6.0: Resetting to factory default settings

This program lets you reset all parameters to factory default settings. This clears all calibration data, memory, and any other setup functions you might have changed. However, the following settings will remain as you have set them:

- temperature unit of measure (°C or °F)
- The temperature offset calibration value
- the LCD contrast setting
- the clock setting.

### From measurement mode

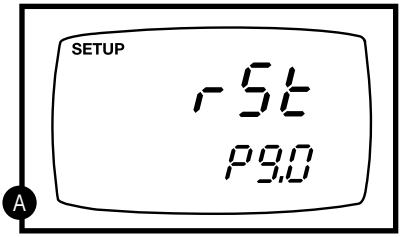
1. **Press Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter "rSt" in the upper display.

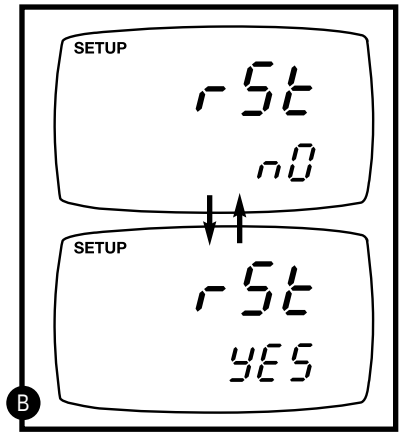
*See figure* A

3. **Press the ENTER key**.

*See figure* B

4. **Press the ▲ and ▼ keys** to toggle between NO and YES.
   - NO retains current settings
   - YES resets to factory default settings
5. **Press the ENTER key** to confirm selection and to return to measurement mode.




### Notes

See page 47 for a table of factory default settings.

# 9. Probe care and maintenance

## 9.1 Probe care

The probe is a galvanic measuring element which produces an output proportional to the oxygen present in the medium in which it is placed. The galvanic probe design lets you take measurements immediately—without the typical 15 minute wait of other dissolved oxygen probes.

The probe consists of two parts:
- an upper part consisting of an anode, a cathode, and cable
- a lower part consisting of a membrane cap, membrane, and electrolyte solution.

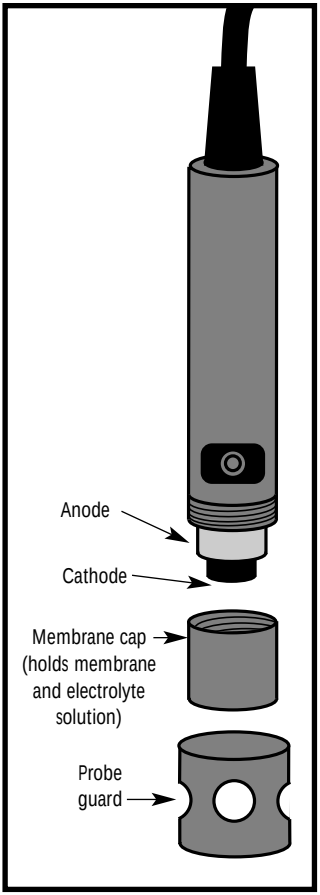
**Under typical operating conditions, the probe should last for several years.** Proper care and maintenance will help you receive the maximum probe life and ensure more accurate readings.

Since any deposits on the membrane surface act as a barrier to oxygen diffusing through the membrane, the membrane must be cleaned at regular intervals to assure maximum reliability.

After using the probe, rinse the probe in clean water and wipe it with a soft cloth or paper to avoid any hardening of deposits. If growth develops on the probe, use a disinfecting chemical to clean.

**NOTE:** Although the membrane is strong and not easily damaged, wipe it gently while cleaning it. If the membrane is damaged or torn, the probe will no longer function.

There are no special probe storage requirements.



## 9.2 Membrane replacement

Replacement of the membrane is required only when you cannot calibrate the probe, or if the membrane is damaged.

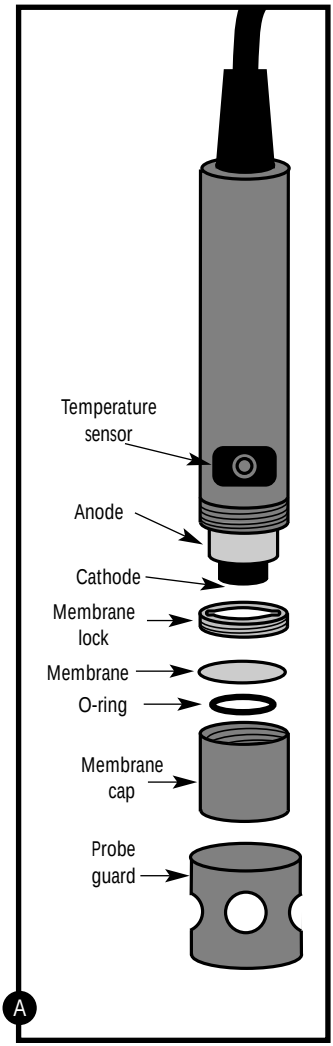
Typical membrane damages are punctures or wrinkles caused during measurements or cleaning.

### To replace the probe membrane:

1. Pull off the probe guard.
2. Unscrew the membrane cap from the probe.
3. Hold the probe under a water tap and brush away the white oxide on the cylindrical anode with a stiff plastic brush—do not use metal cleaning material.
4. It the cathode has any deposits, remove them with a light scouring powder. Do not polish the cathode.

**NOTE:** If you have purchased a replacement membrane module with preinstalled membrane, skip to step 12.

*CONTINUED ON NEXT PAGE*



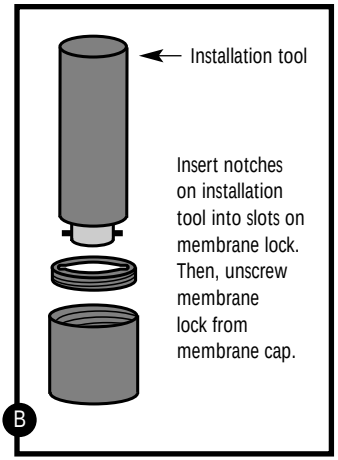
5. Using the installation tool, unscrew and remove the membrane lock from the membrane cap.

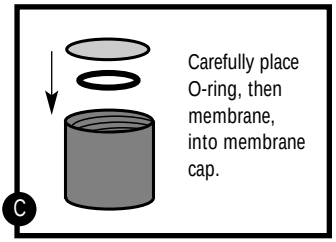
*See figure* B

6. Remove the membrane and O-ring. Discard both.
7. Rinse the membrane cap and membrane lock in tap water.
8. Install a new O-ring inside the membrane cap.
9. Install a new membrane. Make sure the membrane covers the O-ring all around its circumference.

*See figure* C

10. Using the installation tool, screw the membrane lock back into the cap. Tighten the lock firmly over the membrane and O-ring, but do not overtighten.
11. Inspect the membrane for wrinkles. If wrinkles exist, remove the membrane and repeat steps 8-11.
12. Fill the membrane cap with water and inspect the bottom for leaks. If water drops are leaking from the membrane, re-seat the membrane on the O-ring (repeat steps 8-11).
13. If the assembly is leak-free, empty the water and fill the membrane cap with electrolyte to the brim.
14. Screw the cap onto the probe. Excess electrolyte will drain out.
15. Replace probe guard.
16. Calibrate the probe (see section 4) after the % saturation readings have stabilized.



# 10. Troubleshooting

| Problem | Cause | Solution |
|---|---|---|
| **Power on but no display** | a) Batteries not in place. | a) Check that batteries are in place and making good contact. |
| | b) Batteries not in correct polarity (+ and –). | b) Reinsert batteries with correct polarity. |
| | c) Weak batteries. | c) Replace batteries. |
| **Unstable readings** | a) Insufficient electrolyte in probe. | a) Fill probe with reference electrolyte. |
| | b) Dirty probe. | b) Clean the probe and recalibrate. |
| | c) External noise pickup or induction caused by nearby electric motor. | c) Move or switch off interfering motor. |
| | e) Broken probe. | d) Replace probe. |
| **Slow response** | a) Dirty membrane. | a) Clean probe. See "Probe Care & Maintenance", page 40. |
| **Not responding to key press** | a) HOLD mode in operation. | a) Cancel HOLD mode. |
| | b) Damaged key pad. | b) Return to dealer. |
| | c) Internal program error. | c) Reset all internal programs by reinserting batteries. |

# 11. Error Messages

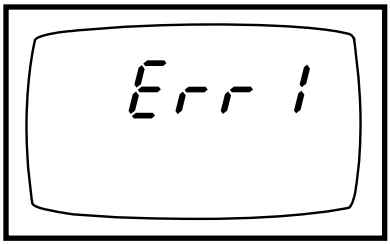
| LCD Display | Indicates | Cause | Solution |
|---|---|---|---|
| **Err annunciator** | Unrecognized input from keypad | Wrong input in selected mode. | Release key. Select valid operations depending on mode. |
| **CAL & Err annunciators blink** | Calibration error | Wrong value input at calibration. Dirty probe. | Check your input value, clean probe. See Calibration sections or Probe Maintenance section. |
| **Battery indicator blinks** | Low battery level | Need new batteries or battery connection is bad. | Clean battery contacts. Replace batteries with fresh ones, noting polarity. |
| **Err. 1 (in primary display)** | Memory write error | Hardware failure. | Turn meter on and off again. If message persists, return unit*. |

If an error message appears in the primary display (the upper row of larger digits), switching off the meter and switching it on again may eliminate the error message.

See figure at right.

If error persists, or the meter shows incorrect values, return the meter.

**For a complete diagram of the display, see page 4.**




ERR 1 in primary display

# 12. Specifications

| Mode | mg/l (ppm) | % saturation | Temperature |
|---|---|---|---|
| **Range** | 0.00 to 19.99 mg/l (ppm) | 0.0 to 199.9% | 0.0 to 50.0˚C / 32.0 to 122.0°F |
| **Resolution** | 0.01 mg/l (ppm) | 0.1% | 0.1˚C or °F |
| **Accuracy** | ±1.5% of full scale | ±1.5% of full scale | ±0.3˚C / ±0.6 °F |

**Temperature compensation:** automatic from 0 to 50°C

**Salinity correction:**
Range: 0.0 to 50.0 ppt
Resolution: 0.1 ppt
Method: Key in manually and automatic correction

**Barometric pressure correction:**
Range: 500 to 1499 mm Hg / 66.6 to 199.9 kPa
Resolution: 1 mm Hg / 0.1 kPa
Method: Key in manually and automatic correction

**Probe:** galvanic probe

**Memory:** stores and recalls up to 50 points with date/time

**Real-time clock:** stamps calibration data and stored data with time and date (month and day)

**Display:** dual LCD

**Operating temperature:** 0 to 50°C

**Power:** four 1.5 V AAA batteries (included)

**Battery life:** up to 100 hours continuous use ( depends on use of backlit display)

**Dimensions:**
Meter: 7.5"L x 3.5"W x 1.75"H (19.1 cm x 8.9 cm x 4.5 cm)
Boxed: 9.2"L x 9.2"W x 2.75"H (23 cm x 23 cm x 7 cm)
Probe: 6.8"L x 1.3" dia (17.3 cm L x 3.2 cm dia)

**Weight:**
Meter: 1.0 lb (0.5 kg)
Boxed: 2.0 lbs (0.9 kg)

# 14. Appendix 1: Meter Theory

Dissolved oxygen levels in natural and waste waters depend on the physical, chemical, and biochemical activities in the water body.

This meter uses a galvanic probe. It consists of a cell that contains electrolyte and that is enclosed by a selective membrane, and two metallic electrodes. The membrane is practically impermeable to water and ionic dissolved matter, but is permeable to oxygen and a few other gases.

The cathode consumes the oxygen passed through the membrane, and produces an electric current in the probe. This current is proportional to the partial pressure of oxygen in the sample.

Since the cathode consumes the oxygen in the sample, it is essential that the fluid must flow past the sensor to maintain accurate readings.

The solubility of oxygen in water varies with barometric pressure and temperature, and decreases as salinity increases. For the most accurate DO readings, you need to compensate for these factors. This meter automatically compensates for temperature readings. It also allows you to enter a salinity correction factor and the barometric pressure to correct for this variability.

# 15. Appendix 2: Pressure vs. Altitude table

Barometric pressure affects DO readings, therefore this meter lets you enter the correct barometric pressure at your altitude. If you do not have equipment that lets you measure the exact barometric pressure at your altitude, you can estimate it using the chart below.

If you change the barometric pressure setting from its factory setting (760 mm Hg), the % saturation calibration value in air will automatically adjust to a value other than 100% (see "corrected % saturation value" column below). The adjusted value is correct for the new barometric pressure setting.

See page 27 for information on how to adjust the barometric pressure.

## Pressure vs Altitude

| Altitude (ft) | Pressure (mm Hg) | Corrected % saturation value |
|---|---|---|
| 0 (Sea level) | 760 | 100 |
| 500 | 746 | 98.1 |
| 1000 | 732 | 96.3 |
| 1500 | 720 | 94.7 |
| 2000 | 707 | 93.0 |
| 2500 | 694 | 91.3 |
| 3000 | 681 | 89.6 |
| 3500 | 668 | 87.8 |
| 4000 | 656 | 86.2 |
| 4500 | 644 | 84.6 |
| 5000 | 632 | 83.0 |
| 5500 | 621 | 81.6 |
| 6000 | 609 | 80.0 |

# 16. Appendix 3: Factory Default Settings

Resetting the meter to factory default settings clears all calibration data and memory, and returns other setup functions to the default settings shown in the table below. However, the following settings will remain as you have set them:

- temperature unit of measure (°C or °F)
- The temperature offset calibration value
- the LCD contrast setting
- the clock setting.

See page 38 for directions on setting the meter to factory default settings.

| Program | Function | Options/settings | Default |
|---|---|---|---|
| Clr | Memory clear | yes / no | no |
| dPr | Pressure units<br>Barometric pressure<br>Salinity adjustment | Hg or Pa<br>adjust from 500-1499 mm Hg<br>adjust from 0-50 ppt | Hg<br>760 mm Hg<br>0 ppt |
| OFS | Set % saturation offset | up to ±10% | no offset |
| CAL | View calibration data | — | – – – |
| ELE | View probe slope<br>View % saturation offset<br>View mV = 100% saturation<br>View mV = 0% saturation | —<br>—<br>—<br>— | 1.000<br>0 % offset<br>37.0 mV<br>0.3 mV |
| COF | Ready indicator / auto endpoint<br>Select mg / l or ppm units<br>Select temperature units | on / off<br>mg / l or ppm<br>°C or °F | Ready on only<br>mg / l<br>retains settings |
| LCd | Adjust backlit display | levels 0 to 8 (brightest) | retains settings |
| CLO | Setting clock | year, date, time | retains settings |
| rST | Reset to factory default | yes / no | no |