AquaDY

Dissolved Oxygen -Temp. Meter

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Congratulations !

You have purchased the latest in Handheld, Waterproof Dissolved Oxygen - Temperature instrumentation. This manual is for the **Aqua-DY**.

The **Aqua-DY** is a breeze to operate. This manual has been designed to help you get started, and also contains some handy application tips. If at any stage you require assistance, please contact either your local TPS representative or the TPS factory in Brisbane.

The manual is divided into the following sections:

1. **Table of Contents**
   Each major section of the handbook is clearly listed. Sub-sections have also been included to enable you to find the information you need at a glance.

1. **Introduction**
   The introduction has a diagram and explanation of the display and controls of the **Aqua-DY**. It also contains a full listing of all of the items that you should have received with your **Aqua-DY**. Please take the time to read this section, as it explains some of items that are mentioned in subsequent sections.

1. **Main Section**
   The main section of the handbook provides complete details of the **Aqua-DY**, including operating modes, calibration, troubleshooting, specifications, and warranty terms.

1. **Appendices**
   Appendices containing background information and application notes are provided at the back of this manual.

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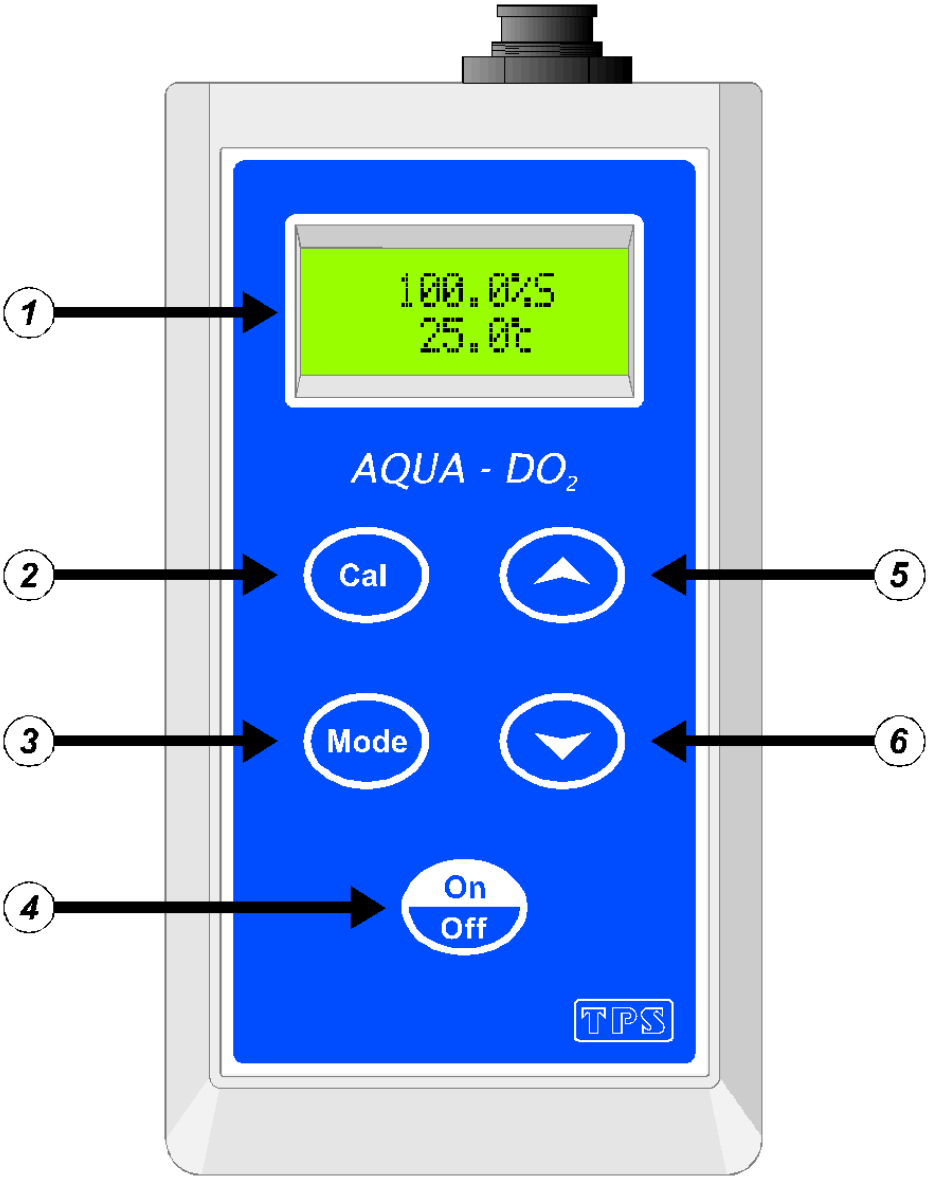
Contents

1. Introduction

1.1 Aqua-DY Display and Controls



Display

24 character alpha-numeric display. Can show any of the following combinations of readouts (see section 2).

% Saturation + Temperature	Salinity-corrected ppM (mg/L) + Temperature
Salinity Correction Value (in ppK)	Temperature only

A unique “Large Digit” mode nearly doubles the size of the digits (section 2).

User-friendly prompts and error messages are also provided.


Used to calibrate all parameters. See sections 3, 4 and 5.


Used to select % Saturation, ppM, Manual Salinity or Temperature modes. See section 2.


Switches the **Aqua-DY** on and off.

Hold this key for 3 seconds to invoke Battery Saver mode. See section 6.



and

These keys toggle the **Aqua-DY** between Large Display mode and Dual Display mode. See section 2.

NOTE: The digits in Large Display mode are made by combining the two rows of the display. This results in a small gap approximately half way up the digits.

1.2 Unpacking Information

Before using your new **Aqua-DY**, please check that the following accessories have been included:

		Part No
1.	**Aqua-DY** Dissolved Oxygen-Temperature Instrument	123144/1 123144/3 123144/5
2.	Oxygen sensor	123204
3.	Oxygen sensor cable: *(see cable label for part No)*	1, 3 or 5m cable
4.	Membrane kit for oxygen sensor	123300
5.	Manual	

*Options that may have been ordered with your **Aqua-DY:***

1.	Extended cable (ordered by the metre)	130040
2.	Carry Case	130057

1.3 Specifications

	Range	Resolution	Accuracy
% Saturation	0 to 250.0 % Sat'n	0.1 % Sat'n	±0.3 % Sat'n
ppM (mg/L)	0 to 25.0 ppM	0.1 ppM	±0.1 ppM
Salinity	0 to 50.0 ppK (Manually set)	0.1 ppK	Not Applicable
Temperature	-10.0 to 120.0 ^{O}C (dissolved oxygen sensor limited to 45 ^{O}C)	0.1 ^{O}C	±0.2 ^{O}C

Additional Dissolved Oxygen Specifications

Temperature Compensation Dual automatic system for:

1. Membrane permeability
2. Solubility in ppM mode

Sensor Zero Range 0 to 7%

Sensor Span Range 70.0 to 135.0%

Calibration One-touch automatic calibration in Zero and in Air.

Additional Temperature Specifications

Temperature Sensor Offset Range -10.0°C to +10.0°C

General Specifications

Display	24 Character alphanumeric LCD, with full text prompts and error messages.		
Power	9V Alkaline Battery for 100+ hours operation.		
Battery Saver	On	:	Auto switch-off after 5 minutes
	Off	:	Continuous use
Dimensions	165 x 85 x 35 mm		
Mass	Instrument only	:	Approx 280g
	Full Kit	:	Approx 2.0kg
Environment	Temperature	:	0 to 45 ^{O}C
	Humidity	:	0 to 95 % R.H.

2. Operating Modes

Press the (Mode) key to select the desired operating mode. The sequence is shown in the following table…

% Saturation Mode	100.0%S 25.0°C
Dissolved Oxygen data in % Saturation units is shown on the top line and Temperature data is shown on the bottom line. Select this mode to calibrate the % Saturation readout. Press ⌃ or ⌄ to toggle between dual readout or large digit readout.	
↓ Mode	
ppM Mode	8.24ppMS 25.0°C
Dissolved Oxygen data in ppM (mg/L) units is shown on the top line and Temperature data is shown on the bottom line. Select this mode to calibrate the ppM readout. The "**S**" is shown after the "**ppM**" units when the Salinity correction value is set to greater than 0.0ppK (see section 5). Press ⌃ or ⌄ to toggle between dual readout or large digit readout.	
↓ Mode	
Salinity Mode	36.0ppK
The Salinity correction value only is shown on the top line. Select this mode to set the Salinity correction value. Press ⌃ or ⌄ to toggle between regular readout or large digit readout.	
↓ Mode	

Continued over the page…

Operating modes, continued…

Temperature Mode	25.0°c
Temperature data only is shown on the top line. Select this mode to calibrate Temperature. Press ⏶ or ⏷ to toggle between regular readout or large digit readout.	
↓ Mode	
Back to % Saturation mode	

Note: The decimal point is replaced by a " ***** " if a Dissolved Oxygen or Temperature calibration has failed (see sections 3 and 4), if the unit is initialised (see section 7), or if the unit has lost its factory calibration (see section 9.1).

3. Dissolved Oxygen Calibration

A " * " in place of the decimal point indicates that the Dissolved Oxygen readout is not calibrated, or a past calibration has failed. The " * " will be removed once an Air calibration has been successfully performed.

3.1 Calibration

1. Switch the **Aqua-DY** on.
2. Select the desired % Saturation or ppM Mode (see section 2). Each mode should be calibrated separately for optimum accuracy.
3. Plug the Dissolved Oxygen sensor into the sensor socket.
4. Ensure that temperature has already been calibrated (see section 4). NOTE: If the decimal point in the temperature reading is replaced by a " * ", then the temperature readout is not calibrated.
5. Rinse the Dissolved Oxygen sensor in distilled water and blot dry.
6. **Zero Calibration**
   (a) Place the sensor into an oxygen-free solution. This solution may be prepared by dissolving 2g of Sodium Sulphite in 100mL of distilled water. A 50g bottle of Sodium Sulphite powder is supplied with a new Dissolved Oxygen sensor for this purpose (part number 123302).
   (b) Allow the reading to stabilise at or near zero. This may take 2-3 minutes.
   (c) Press and hold the Cal key for 2 seconds to calibrate.
   (d) Discard the oxygen-free solution after use.
   (e) A " * " will not be removed from the display after a Zero Calibration.
7. Rinse the Dissolved Oxygen sensor in distilled water and blot dry.

8. **Air Calibration**

   (a) Hang the Dissolved Oxygen sensor in air. The tip of the sensor should be pointing downwards.

   (b) Allow the reading to stabilise. After a zero calibration, this may take up to 5 minutes.

   (c) Press and hold the Cal key for 2 seconds to calibrate.

   (d) A * in the display will be replaced by a decimal point after a successful air calibration.

9. The **Aqua-DY** is now calibrated for Dissolved Oxygen and is ready for use in the mode that was selected during calibration.

NOTES:

When taking sample measurements, always ensure that there is adequate flow of solution past the membrane for accurate, stable readings. See section 10.6.

If salinity-corrected ppM Dissolved Oxygen readings are required, set the salinity correction value before taking sample measurements. See section 5.

3.2 Dissolved Oxygen Calibration Notes

1. A zero calibration should be performed at least monthly. In applications where there is a low level of dissolved oxygen, a zero calibration may have to be done weekly.
2. An air calibration should be performed at least weekly. Of course, more frequent calibration will result in greater confidence in results.
3. All calibration information is retained in memory when the **Aqua-DY** is switched off, even when the battery is removed.
4. The salinity correction value is ignored during zero and air calibration. There is therefore no need to re-set the salinity correction value when calibrating Dissolved Oxygen.

3.3 Dissolved Oxygen Calibration Messages

1. If a zero calibration has been successfully performed, the **Aqua-DY** will display the following message, and then display the zero response of the sensor.

```
Cal. OK
Zero= 1.0%
```

2. If a zero calibration has failed, the **Aqua-DY** will display the following message, then the failed zero value of the sensor.

```
Cal. Failed
Zero= 10.0%
```

3. If an air calibration has been successfully performed, the **Aqua-DY** will display the following message, and then the span value of the sensor.

```
Cal. OK
Span=100.0%
```

4. If an air calibration has failed, the **Aqua-DY** will display the following message, and then the failed span value of the sensor.

```
Cal. Failed
Span= 70.0%
```

4. Temperature Calibration

A " * " in place of the decimal point indicates that the Temperature readout is not calibrated, or a past calibration has failed. The " * " will be removed once Temperature has been successfully calibrated.

4.1 Calibration

1. Switch the **Aqua-DY** on.
2. Select Temperature mode (see section 2).
3. Plug the Dissolved Oxygen sensor into the sensor socket
4. Place the sensor into a beaker of room temperature water, alongside a good quality mercury thermometer. Stir the sensor and the thermometer gently to ensure an even temperature throughout the beaker.
5. When the reading has stabilised, press and hold the Cal key for 2 seconds.
6. The reading from the sensor is now displayed on the top line, and the value you are going to set is on the bottom line. For example…

   ```
   Enter  25.0°c
   Temp ↑ 26.0↓
   ```

7. Press the ▲ and ▼ keys until the bottom line shows the same temperature as the mercury thermometer.
8. Press the Cal key to calibrate the temperature readout.

   Alternatively, press the Mode key to abort temperature calibration.

4.2 Calibration Notes

1. Temperature calibration information is stored in memory when the meter is switched off, even if the battery is removed.
2. Temperature does not need to be re-calibrated unless the Dissolved Oxygen sensor is replaced or the meter is initialised.

4.3 Calibration Messages

1. If a temperature calibration has been successfully performed, the **Aqua-DY** will display the offset value of the sensor. For example…

```
Cal. OK
Offset= 1.0°c
```

2. If a temperature calibration has failed, the **Aqua-DY** will display the failed offset value of the sensor.

```
Cal. Failed
Offset=10.5°c
```

5. Setting the Salinity Correction Value

The salinity of the sample affects the Dissolved Oxygen reading in ppM mode. As the salinity increases, the solubility of Oxygen decreases. The Dissolved Oxygen sensor is not able to detect the salinity of the sample, so the operator must enter this value manually for salinity-corrected ppM Dissolved Oxygen readings.

To set the salinity correction value:

1. Measure the salinity of the sample solution. For best results, use a good quality salinity meter, such as a TPS model Aqua-C or WP-84. Note the reading.
2. Switch the **Aqua-DY** on.
3. Press the Mode key until the meter is in Salinity mode (see section 2). The currently selected salinity correction value is displayed.
4. Press and hold the Cal key for 2 seconds.
5. The display should now look like this:

```
Enter Man.
Sal   ↑ 36.0↓
```

6. Press the ▲ and ▼ keys until the bottom line shows the salinity value obtained in step 1.
7. Press the Cal or Mode key to set the salinity correction value.

NOTES:

1. For non salinity-corrected readings in ppM mode, simply set the salinity correction value to 0.0 .
2. If the salinity correction value is set to above zero, an "**S**" is added to the display in ppM mode, to signify that salinity correction is being applied. For example…

```
    8.24ppMS
    25.0°C
```

3. The salinity correction value is ignored during zero and air calibration. There is therefore no need to re-set the salinity correction value when calibrating Dissolved Oxygen.

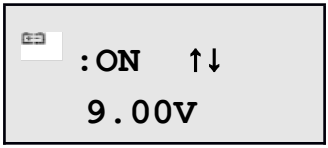
6. Battery

6.1 Battery Saver Function

The **Aqua-DY** is equipped with a battery saver function. If no button has been pressed for five minutes, the unit beeps and flashes the display for 20 seconds, and then shuts off. This function can be disabled for continuous use.

To enable or disable the battery saver function:

1. Switch the **Aqua-DY** on.
2. With the meter already switched on, press and HOLD the On/Off key for 3 seconds.
3. The battery saver menu is now displayed. For example…



4. In this mode, use the ▲ or ▼ keys to toggle the battery saver function on or off.

   ON enables the battery saver function. The unit will turn itself off after 5 minutes.

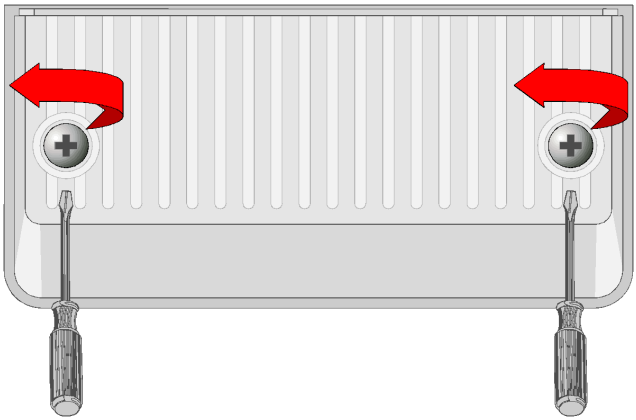
   OFF disables the battery saver function. The unit will not switch itself off.

   NOTE: The display also shows the battery volts. This gives the operator an idea of how much battery life is remaining. The symbol flashes when the battery volts drops below 7.50 volts. At 6.00 volts the meter turns itself off.

5. When you have set the battery saver function to the desired position, press the Mode key to return to normal measurement mode.

6.2 Changing the Battery

1. Turn the instrument over and locate the 2 battery cover screws on the rear. See the diagram below.



2. Raise the fold out stand (so it is out of the way) and then fully loosen both screws. It is not necessary to pull the screws all the way out. Lift off the battery cover.
3. Replace the battery with a new alkaline 9V battery.
4. Re-fit the battery cover and tighten the screws. **Do not over-tighten**.

7. Initialising the Aqua-DY

If the calibration settings of the **Aqua-DY** exceed the allowable limits, and the unit cannot be re-calibrated, then it may need to be initialised to factory default values. This action may be required if a sensor is replaced.

To initialise the **Aqua-DY**…

1. Switch the **Aqua-DY** off.
2. Press AND HOLD the ⏎ key while switching the **Aqua-DY** on.
3. The following messages are now displayed…

Memory & Cal Reset !
↓
You MUST Re-Calibrate
↓
TPS AQUA-DY V1.0 S1234

4. The meter then displays % Saturation and Temperature. Note that the decimal points have been replaced with a " * ", to indicate that the unit requires re-calibration.

8. Instrument software version number.

If you need to phone or fax TPS for any further technical assistance, the version number of your **Aqua-DY** firmware may of benefit to us. Please obtain the version number before phoning or faxing.

The version number is displayed on the bottom left of the display when the **Aqua-DY** is switched on. For example…

TPS AQUA-DY V1.0 S1234

“**V1.0**” in this example is the firmware version number.

“**S1234**” in this example is the instrument’s serial number.

9. Troubleshooting

9.1 General Error Messages

Error Message	Possible Causes	Remedy
Factory Cal. Fail **See Handbook**	The EEPROM chip which contains the factory calibration information has failed.	The unit must be returned to TPS for service.
Memory Failed **Calib. Lost** **Memory Reset !** **You MUST Re-Cal.**	User calibration settings have been lost or corrupted.	Re-calibrate the instrument. Both a Zero and an Air calibration are required for Dissolved Oxygen (section 3) and a 1 point calibration for temperature (section 4).
Meter displays the word **OFF**, and switches off.	Battery is below 6.00 volts.	Replace the battery.
Meter will not turn on.	Battery is exhausted.	Replace the battery.
Flashing  symbol.	Battery is below 7.50 volts.	Replace the battery soon. Note that the unit will switch itself off when the battery falls below 6.00 volts.

9.2 Dissolved Oxygen Troubleshooting

Symptom	Possible Causes	Remedy
Unit fails to calibrate, even with new sensor.	Calibration settings outside of allowable limits due to previous failed calibration.	Initialise the unit. See section 7.
Zero calibration fails (Zero is greater than 7.0%) Air calibration fails (Span is less than 70% or	1. Membrane is leaking or broken. 1. Gap between membrane and gold cathode is dry.	Replace membrane and refill sensor. YSI Gently pump the pressure compensation diaphragm several times.

greater than 135%). Unstable or inaccurate readings.	2. Incorrectly fitted membrane. 3. Sensor is empty. 4. Sensor is faulty.	Membrane should be smooth and convex with no wrinkles. Re-fit membrane if necessary. Replace membrane and re-fill sensor. Return sensor to factory for repair or replacement
Blackened Silver anode	Sensor has been exposed to sulphides or other chemical poisoning.	Return to the TPS factory for cleaning and service.
Tarnished or scratched Gold cathode.	Sensor has been chemically poisoned or physically damaged.	Return to the TPS factory for cleaning and service.
Meter reads **OVR ppM** or **OVR%**.	1. Sensor has not yet polarised. 1. Sensor is faulty	Wait for 2-3 minutes for the sensor to polarise after the **Aqua-DY** is switched on. Return sensor to factory for repair or replacement.

For complete details on the operation, care and maintenance of your YSI dissolved oxygen sensor, see the separate leaflet that is supplied with the sensor.

9.3 Temperature Troubleshooting

Symptom	Possible Causes	Remedy
Displays “**OVRºC**” when sensor is plugged in.	1. Faulty detachable cable. 2. Faulty sensor. 1. Faulty instrument.	Fit new detachable cable. Fit new sensor. Return instrument to factory for repair.
Temperature inaccurate and cannot be calibrated.	1. Faulty detachable cable. 1. Faulty sensor. 1. Faulty instrument.	Fit new detachable cable. Fit new sensor. Return instrument to factory for repair.

10. Dissolved Oxygen Sensor Fundamentals

The sensor used is the amperometric type of Clark Sensor and is suitable for the measurement of oxygen pressures in the range 0 to 100 cm of mercury. While the sensor actually reads partial pressure of oxygen, the circuit is calibrated to be read in percentage saturation or parts per million (Milligrams/litre). The operation of the Clark type sensor relies on the diffusion of oxygen through a suitable membrane into a constant environment of potassium chloride. Solution measurements are best performed with a reasonable flow past the membrane. At sufficiently high flow rates, the oxygen current is totally independent of the flow (a few cm/sec is sufficient). The cell must not be shaken however or unstable readings will result from electrolyte surge bringing new oxygen from the reservoir to the working cathode surface.

10.1 Operating Principle

The Clark oxygen sensor consists of a gold cathode and a silver/silver chloride anode, placed in an electrolyte solution. This solution is contained behind a plastic membrane. In this case the plastic is 0.001 inch PTFE (Teflon) sheet. It must be realised that using membranes of very different thicknesses will result in an error in the temperature compensation that is applied in the instrument for the membrane permeability. This coefficient is +4.2%/^{o}C at 25^{o}C for this thickness membrane.

A polarising voltage of about 800 millivolts is applied between the two electrodes. The gold electrode is placed close to the membrane and because of the polarising voltage, oxygen diffusing through the membrane will be reduced at the gold electrode.

Equation : $O_2 + 2H^+ + 2\ \text{electrons} \rightarrow H_2O_2$

This reduction process will produce a current through the oxygen sensor. A load resistor (actually a thermistor in this case) situated in the sensor itself, converts this current into a voltage proportional to the oxygen partial pressure. The thermistor provided within the body of the sensor has a temperature coefficient of -4.2%/^{O}C. This gives an accurate temperature compensation for the temperature/permeability effect of the membrane, over a range of about 5 to 45 ^{O}C about a centre value of 25^{O}C. Note this compensation is not for the solubility effects. A separate sensor also built into the tip of the sensor achieves this.

10.2 Maintenance Of The Membrane

The membrane does not require replacement as long as it remains intact. If punctured or suspected of leaking around the edges, it must be replaced.

Oils, fats or other greasy build-ups will reduce the sensitivity of the sensor, eventually making it fail to calibrate. When this occurs, it may be easier and more effective to change the membrane rather than clean it.

Please see the separate instruction leaflet supplied with the Dissolved Oxygen sensor for details on how to change the membrane.

10.3 Sensor Storage

The Dissolved Oxygen sensor should be kept moist when not in use to prevent the thin film of electrolyte behind the membrane from drying out. To achieve this, the sensor can be stored with the tip in water. Alternatively, use a wetting cap, such as those supplied with pH sensors.

For long term storage of several weeks or more, the Dissolved Oxygen sensor is best stored dry. For the YSI sensor, remove the membrane, pump the diaphragm (with the tip point down) until no more solution is expelled, and fit a new membrane.

When the sensor is stored in this way, the membrane should be replaced and the sensor refilled before use.

10.4 Notes On Units Of Dissolved Oxygen

The terms "Oxygen Concentration" and "Oxygen Partial Pressure" frequently give rise to some confusion.

Oxygen Concentration is the absolute quantity of oxygen present per unit mass of the liquid.

Oxygen Partial Pressure is the oxygen fraction of the total pressure of all of the gases present.

For any one liquid system, Oxygen Concentration and Oxygen Partial Pressure are proportional. However, if the solubility of oxygen in the liquid should change owing to increased quantities of solutes, etc., then the ratio of the Concentration to the Partial Pressure must change. Thus, if one saturates distilled water and a 25% solution of Sodium Chloride with air at atmospheric pressure (25°C) both solutions will have almost exactly the same Oxygen Partial Pressure, namely 15.5 cm of mercury. However, the dissolved Oxygen Concentration parts per million (milligrams per litre) will be 8.2 in the distilled water and 2.01 in the salt solution. This is a rather extreme example, as ocean water is only 3.6% saline. It does however stress the importance of correct interpretation of the salinity.

The Clark Sensor measures the partial pressure of oxygen diffusing through a membrane. The current is a linear measure of this partial pressure, assuming sufficient liquid flow conditions.

With air at sea level, the 20.9% oxygen exerts about 15.5 cm of Mercury pressure. Water in equilibrium with air and with no oxygen demand (C.O.D., B.O.D. etc.), is saturated and has this dissolved oxygen partial pressure. If we define 100% Saturation in Partial Pressure terms, then 15.5 cm. Hg = 100% Saturation. This is a practical unit to use. The sensor readout is then a linear function of % Saturation. Organic cell walls and the Dissolved Oxygen sensor behave in the same way, so % Saturation units are a more meaningful measure of the Dissolved Oxygen requirement of biological organisms (eg fish).

% Saturation is the best unit for industrial control and not ppM, contrary to popular beliefs. The partial pressure (and consequently the pressure defined % Saturation) varies only slightly with temperature. (Recall at this stage that the permeability of the membrane has a temperature coefficient, but the electronics has scaled this out by the operation of the Automatic Membrane Temperature Compensator Thermistor incorporated in the D.O. sensor).

If mass units are used for measurement of Dissolved Oxygen, the temperature problem of relating the linear partial pressure reading of the sensor to the mass (ppM or mg/L) at different temperatures becomes more involved. As well, there is the mass variation due to dissolved salts (salinity correction). Therefore, the fully corrected instrument would need 3 correction systems.

(a) Membrane correction for temperature permeability effects ;

(b) Solubility correction of Dissolved Oxygen with temperature and ;

(c) Salinity correction of Dissolved Oxygen by weight (Salinity has no effect on pressure units readout).

In the **Aqua-DY** instrument,

(a) Membrane correction is achieved AUTOMATICALLY ;

(b) To provide the mass units (ppM) readout (so popular due to the Winkler process used in the past), the **Aqua-DY** Meter has Solubility Correction via an additional temperature sensor in the sensor ;

(c) Salinity correction is performed automatically once the Salinity value of the solution is entered (section 5).

10.5 Equilibrium Conditions

Whilst Saline Water has a lower ppM than does Fresh Water, it does not mean it necessarily has less biologically available oxygen. Both have 100% Saturation (presuming no Chemical Oxygen Demand (C.O.D.), Biological Oxygen Demand (B.O.D.), etc.) because both are in partial pressure equilibrium with air. Any usage of oxygen is immediately replenished by the dissolving of more from air to meet partial pressure equilibrium requirements. This is so for both saline and fresh water. The reporting of oxygen at a lower level (in ppM units) in Salt Water is therefore QUITE MISLEADING !

In closed systems, such as tanks, pipes and deep waters, equilibrium is not so readily available and the Salinity Effect gains importance in the reporting of Dissolved Oxygen. It is suggested, unless such closed (or deep, low diffusion) systems are encountered, that Oxygen should be reported in % Saturation or ppM of equivalent Fresh Water.

10.6 Velocity Past The Membrane

Workers have shown that the relationship between the diffusion current (oxygen current) and the external velocity of the liquid is expotential. Some workers using thicker membranes have shown even less dependence of the diffusion current on liquid velocity. Because of the expotential nature of the relationship, considerable changes in velocity have to be made before noticing any change in the diffusing current once the flow is sufficiently high. Tests with this sensor have shown that flow rates above 0.2 litres/minute past the membrane give results indistinguishable from those with appreciably higher flow rates (5 litres/minute). Fluctuations in readings due to air bubbles passing through the membrane are a different matter, however.

With the type of sensor to be used with this instrument, very little change in diffusion current is caused by altering the pH of the external environment. Pressure changes over a moderate range exerted on the membrane also cause no change. The EDYSI has a pressure compensation diaphragm to allow submersion to 60 metres.

11. Warranty

TPS Pty Ltd guarantees all instruments and sensors to be free from defects in material and workmanship when subjected to normal use and service. This guarantee is expressly limited to the servicing and/or adjustment of an instrument returned to the TPS Pty Ltd Factory Service Centre, freight prepaid, within twelve (12) months from the date of delivery, and to the repairing, replacing, or adjusting of parts which upon inspection are found to be defective. Warranty period on sensors is six (6) months.

Freight costs to and from the factory are the responsibility of the purchaser. Shipping damage is not covered by this warranty.

TPS Pty Ltd accepts no liability for any incidental or consequential damages caused by or resulting from the use or misuse of this equipment either due to failure of the equipment, incorrect calibration, incorrect operation, or from interpretation of information derived from the equipment. Specifications are subject to change without notice. This warranty becomes invalid if modifications or repairs are carried out on this unit by unauthorised persons. There are no express or implied warranties which extend beyond the face hereof.

Procedure for Service

Please read service details on our '**Service and Repair'** page at **www.tps.com.au.**

TPS Pty Ltd has a reputation for prompt and efficient service. If you feel that this equipment is in need of repair, please re-read the manual. Sometimes, instruments are received for "repair" in perfect working order. This can occur where batteries simply require replacement or re-charging, or where the sensor simply requires cleaning or replacement.

Return the instrument AND ALL SENSORS to TPS Pty Ltd freight pre-paid. It is your responsibility as the sender to ensure that TPS Pty Ltd receives the unit, so consider using a traceable freight service.

Please check that the following is enclosed with your equipment:

A TPS ‘Service / Return Goods Form’ – from our website

Your full name

Your company name

Your email address

Your return street address

A description of the fault. (Please be specific - "Please Repair" does not describe a fault.)

Your equipment will be repaired and returned to you by express air freight where possible.

For instruments beyond warranty period, a repair cost will be calculated from parts and labour costs and emailed to you. If you decline to have the equipment repaired, the complete instrument will be returned to you freight paid, not serviced.