



**Instruction Manual**  
for the  
**AquaPlus™ Series**  
**Optical Dissolved Oxygen**  
**Meters, Probe, Utilities & Accessories**

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## 1. Introduction

This manual covers the setup, operation, calibration and maintenance of the AquaPlus™ series of Meters, the AquaPlus™ Probe and the associated OxiLink PC software.

### 1.1. About the AquaPlus™ System

Thank you for choosing the Aquaread™ AquaPlus™, the world's most advanced portable Optical Dissolved Oxygen measurement system for field use.

### 1.2. Why Optical?

Traditionally, DO measurement in portable field equipment has been done using membrane covered detectors known as Clark Cells. This type of cell suffers from problems including membrane fouling, calibration instability and worst of all, oxygen consumption. During measurement, a Clark Cell will consume oxygen making it necessary to have a constant flow of water over the cell.

Optical technology eliminates all these problems allowing high precision, membrane-free, long-term stability along with infrequent calibration and immunity to fouling by sulphide and other gases. See [Appendix 1. The Tech Behind AquaPlus™](#) for further details.

### 1.3. Why include other parameters in a DO meter?

To accurately calculate the DO content in a sample of water, it is essential to know the temperature and salinity of the sample as well as the atmospheric pressure.

The AquaPlus™ Meter includes a precision barometric sensor. The AquaPlus™ Probe contains the optical DO sensor, **plus** a precision temperature sensor and an electrical conductivity (EC) sensor. From measurements taken by the EC sensor, the salinity of the sample can be accurately determined.

The Aquaread™ AquaPlus™ is the **only** optical DO system that measures salinity directly. Whilst our competitors' units will correct DO measurements for salinity, they ask for the salinity value to be input manually. Unless the operator is carrying a separate EC meter or is good at guessing, this method introduces a massive opportunity for inaccuracy.

Another **plus** gained by including direct EC measurement is that Resistivity (RES), Total Dissolved Solids (TDS) and Specific Seawater Gravity (SSG) can be calculated. These parameters are also displayed on the AquaPlus™ Meter.

### 1.4. Why include GPS?

The inclusion of GPS in the AquaPlus™ Meter is extremely important for fieldwork. Data collected in the field is meaningless if the locations at which the readings were taken is not accurately known.

With the AquaPlus™ system, up to 3000 sets of readings tagged with time, date and position can be taken, then downloaded from the AquaPlus™ Meter onto a PC using the included USB cable and OxiLink™ software utility.

Once the data is transferred, OxiLink™ can produce a comprehensive analytical report in text format, or export the logged data to most popular spreadsheets as well as Google™ Maps and Google™ Earth, where the readings can be overlaid on either maps or satellite photos.

## 2. What's in the Box?

The AquaPlus™ Meter is supplied with the following:

- The AquaPlus™ Meter unit.
- Quick release lanyard.
- Set of 5 AA Alkaline batteries.
- USB Cable for downloading logged data to a PC.
- Cross-head screwdriver for fitting the batteries.
- Getting started cards for quick reference.

The AquaPlus™ Probe is supplied with the following:

- The AquaPlus™ Probe unit.
- Sensor Cap (pre-fitted)
- Two mounting nuts.
- Getting started card for quick reference.

### 2.1. Probe and Meter Compatibility

The AquaPlus™ Probe and AquaPlus™ Meter both contain microprocessors running their own software. Over the years a number of enhancements have been made to both sets of software so it is important to check that the Meter and Probe software versions are compatible with one another. The software revision level of both the Meter and the Probe (when connected) is shown on the Meter screen directly after switching the unit on.

If the AquaPlus™ Meter is running software revision 2.02 or lower, then the AquaPlus™ Probe must be running software revision 3.06 or lower to be fully compatible.

If the AquaPlus™ Meter is running software revision 2.10 or higher, then the AquaPlus™ Probe must be running software revision 3.10 or higher to be fully compatible.

If your Meter and Probe are incompatible, the unit with the earlier software revision can be upgraded by Aquaread Ltd to the current standard. Please contact your dealer for further details.

### 2.2. The AquaPlus™ Meter and the Environment

The AquaPlus™ Meter is designed to be used outdoors and is rated to IP67, that is to say it is waterproof but it **is not** designed for submersion. In order to prevent accidental dunking or loss, a lanyard is supplied.

**Please note that the AquaPlus™ Meter is only waterproof when the associated AquaPlus™ Probe plug is fitted. Without the plug fitted, water can enter the Meter through the socket. Damage caused by water ingress through the socket is not covered by your warranty.**

You may notice a small hole on the rear of the unit. This is a waterproof vent for the internal barometric sensor. **Do not poke anything into this hole!** Doing so will cause major damage to the vent's waterproof membrane and invalidate your warranty.

### 2.3. The AquaPlus™ Probe and the Environment

The AquaPlus™ Probe is designed to be fully submerged in water and is rated to IP68, that is to say, it is rated for continual immersion to a depth of 10 meters, and short term immersion to 50 meters

#### 2.4. About the Probe Sleeve

The AquaPlus™ Probe is constructed with a protective aluminium sleeve surrounding the more delicate sensing electrode.

The Probe Sleeve can be easily removed by unscrewing to allow cleaning of the electrode, however, **the Probe sleeve forms an integral, working part of the Probe's EC measurement system, and MUST be fitted for correct operation.**

The only exception to this rule is when a DO Flowcell is being used. In this case, the plastic tube in the Flowcell replaces the function of the Probe sleeve.

#### 2.5. About the Lanyard

The lanyard supplied with the AquaPlus™ Meter may, at first, appear to be a little long. This is intentional. In order to keep the Meter out of the way whilst your hands are full, the lanyard has been made long enough to wear round your neck and over your shoulder so the Meter sits on your hip.

The extra length also allows the meter to be held in a comfortable position in front of you during normal use. In order to prevent you being dragged into the water in the event of the Probe cable becoming snagged, the lanyard includes a quick-release clip.

### 3. Battery Installation and Care

The AquaPlus™ Meter requires five AA size batteries. To install the batteries, loosen the two screws on the centreline of the rear of the meter and remove the battery compartment lid. Following the battery polarity markings inside the battery compartment, insert five AA cells then replace the compartment lid and tighten the screws.

#### 3.1. Choice of Battery Type

Alkaline or rechargeable batteries may be used, but never mix battery types in the meter. If you choose to use rechargeable batteries, we recommend *Energizer* 2500mAh (or greater) Nickel-Metal Hydride cells, which are widely available. If the Meter is to be out of use for a long period, remove the batteries to prevent damage due to possible leakage.

#### 3.2. Battery Life

A set of fresh alkaline cells will give over 20 hours use in the DO-200 (GPS AquaPlus™ Meter) and up to 40 hours use in the DO-100 (Non GPS AquaPlus™ Meter). A fully charged set of 2500mAh NiMH cells will give up to 40 hours use in the DO-200 (GPS AquaPlus™ Meter) and up to 60 hours use in the DO-100 (Non GPS AquaPlus™ Meter).

#### 3.3. Battery Charging

During the charging process, batteries generate heat and vent gasses, and must never be charged inside a sealed unit. Because the AquaPlus™ Meter is a sealed unit, we do not allow charging in situ. Batteries must be removed and charged with a suitable battery charger outside the Meter. We recommend the use of one of the *Energizer* range of NiMH chargers.

#### 3.4. Battery Condition Icon

On all the main AquaPlus™ Meter screens, a battery condition icon is displayed in the top left corner. The icon shows full when the batteries are fresh, and gradually empties as the batteries are used. When the batteries need replacing, the empty battery icon will flash on and off. If you ignore this, the Meter will automatically switch itself off when the battery voltage becomes too low for reliable operation.

When using rechargeable batteries, the battery icon will not show completely full, even with freshly charged cells. This is due to the fact that rechargeable batteries are only rated at 1.2V per cell compared to 1.5V per cell for alkaline batteries. This indication does not affect battery life. The icon will simply sit at the  $\frac{3}{4}$  full mark for a longer period of time.

#### 3.5. Battery Saver Functions

The AquaPlus™ Meter is designed to switch off automatically if you do not touch any of the keys for 30 minutes. The only exception to this is if you have activated the [Automatic Data Logging](#) feature. In this case, the Meter will continue to operate until either the memory is full or the batteries go flat.

The display on the AquaPlus™ Meter incorporates a white backlight to improve visibility in low-light conditions. As on a mobile phone, the backlight switches on each time a key is pressed, and stays on at full brightness for 15 seconds. After 15 seconds, the backlight will fade to half brightness. After a further 15 seconds the backlight will switch off.

During normal operation, if you want to activate the backlight without changing the Meter function, simply press the **OK** key.



## 4. Overview of the Operating System

The operating software in the AquaPlus™ Meter has been designed for simple, intuitive use. Similarly, a great deal of development work has been put into simplifying and automating the calibration procedures in the AquaPlus™ Meter in order to allow normal field operatives (as opposed to trained lab technicians) to achieve quick and accurate results.

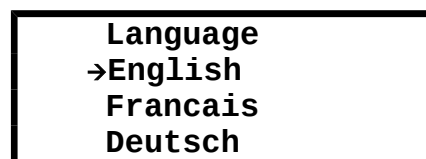
If you are used to operating a mobile phone or programming audio/visual equipment using a remote control, you should feel at home with the familiar up/down left/right arrow shaped navigation keys and central **OK** key.

The tree structure behind the **MENU** key should also be very familiar. Each item on the menu leads to a sub menu and then either onto further menus or final choices. Each branch of the menu system is navigated using the arrow keys. At each point, selections can be made by either pressing the **OK** key or the right arrow key.

To reverse along a branch of the menu system, use the **ESC** (escape) key or left arrow key. After a short time, you should be able to navigate around the entire menu system at speed using just the four arrow keys. If, at any time, you leave the Meter in one of the sub-menu screens, it will automatically back out to the main operating screen after 15 seconds.

### 4.1. Initial Switch On, Language and Clock Setup

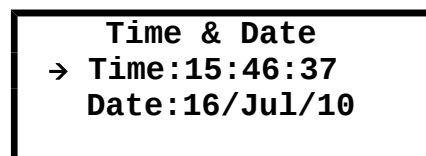
To switch the meter on or off, briefly press the red key. **Do not hold it down.** The meter contains a clock and is capable of operating in several different languages. When switching on for the first time, you must select an operating language and set the clock. The first screen you will see is the Language Selection Screen.



A screenshot of the Language Selection Screen. The text is centered and reads: Language, followed by a right-pointing arrow and English, then Francais, and finally Deutsch.

To select the language, move the cursor down the list using the down arrow key. To enter your selection, press the **OK** key or the right arrow key.

The next screen to be displayed is the Time & Date Setting Screen.



A screenshot of the Time & Date Setting Screen. The text is centered and reads: Time & Date, followed by a right-pointing arrow and Time:15:46:37, and finally Date:16/Jul/10.

To set the time and date, use the arrow keys to move the cursor around the screen. Use the up and down arrow keys to adjust values. When the time and date are correct, press the **OK** key. Don't worry if you make a mistake first time round. You can easily get back to these screens later through the **MENU** key.

## 5. Connecting an AquaPlus™ Probe

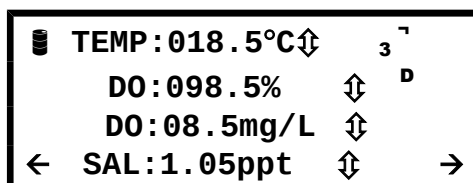
The AquaPlus™ Meter is designed to operate in conjunction with the AquaPlus™ Probe.

To connect an AquaPlus™ Probe, align the key slot of the AquaPlus™ Probe plug with the AquaPlus™ Meter socket, then press the plug into the socket and tighten the retaining collar. **Always ensure the AquaPlus™ Meter is switched off prior to connecting or disconnecting an AquaPlus™ Probe.**

## 6. Taking Measurements

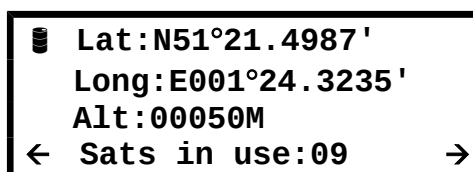
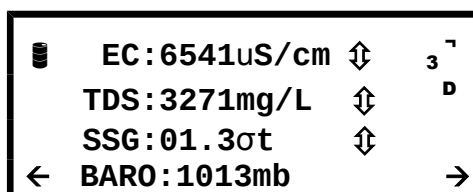
Ensure the protective Sleeve is fitted, then immerse the AquaPlus™ Probe in the sample water, making sure that the water level comes up to the top set of holes on the Probe sleeve. Give the probe a shake to disperse any air bubbles that may be trapped on the DO or EC sensors. Switch the AquaPlus™ Meter on.

If the AquaPlus™ Probe is connected correctly, the meter will briefly display the Probe's serial number, then will automatically start reading. Initial Probe readings will be displayed on the meter's screen along with the current GPS status (GPS model only). The initial data screen is shown below.



The AquaPlus™ Meter is capable of reading more than four parameters. The left/right arrows at the bottom corners of the screen indicate further data screens are available by pressing the left or right arrow keys.

Any value that is out of range will be displayed as dashes. The other two screens available on the DO-200 are shown below.



### 6.1. What Does It All Mean?

The screens above show the full default range of readings for the DO-200. If you are using a DO-100 (Non GPS Meter), you will have just the first two screens to choose from.

If an asterisk (\*) character is flashing just below the battery symbol, this indicates that Auto Data Logging is switched on. See [Automatic Data Logging](#) in section 8.

In the top right hand corner of the screen the GPS status is displayed (DO-200 only). If an [ A ] is displayed, this means the GPS receiver is Acquiring satellite data but is not calculating position. If [ <sup>2</sup>D ] is displayed, this means the GPS receiver is calculating position in two dimensions only, i.e. no altitude. If [ <sup>3</sup>D ] is being displayed, this means that the GPS receiver is calculating position in all three dimensions. See section 7: [GPS Reception](#).

The table below explains the other readings

Prefix	Meaning	Units
TEMP	Probe Temperature	°C or °F*
DO	Dissolved Oxygen	%Sat and mg/L
EC	Electrical Conductivity	µS/cm or mS/cm <sup>†</sup>
TDS	Total Dissolved Solids	mg/L or g/l <sup>†</sup>
SAL	Salinity	PSU or ppt*
SSG	Seawater Specific Gravity	σ <sub>t</sub>
BARO	Barometric Pressure	mb or mmHg*
Lat	Latitude	Degrees & Mins
Long	Longitude	Degrees & Mins
Alt	Altitude above Sea Level	Meters or Feet*

Items in the Units column marked with an asterisk (\*) can be selected as alternative units of measurement in the Settings Menu (see section 9: [Setting Units of Measurement](#)).

Items in the Units column marked with a dagger (†) are auto-ranging, i.e. when the values become too large to display, the units of measurement automatically re-scale.

The EC field can be replaced by its reciprocal value, RES (Resistivity), if selected in the Settings Menu. If selected, readings will be displayed in either Ω•cm or KΩ•cm, depending on the value.

GPS position information can also be displayed in the UK as an Ordnance Survey Grid Reference. See section 9: [Setting Units of Measurement](#) for more details.

## 6.2. Trend Indication

To the right of each reading, (except position and BARO), a trend indication is given. This consists of either an upwards facing arrow (which indicates the numeric value of the reading is rising), a downwards facing arrow (which indicates the numeric value of the reading is falling) or a two-headed arrow which indicates a steady reading.

When taking a set of readings, wait until the temperature value is steady. By this time the other values should be reasonably steady and ready for reading or saving.

## 6.3. Temperature Compensation

The electrochemical properties of all solutions change as the solutions' temperature changes. In addition, the response of electrochemical measuring electrodes change with temperature. It is a fundamental, practical requirement in the field of water quality monitoring that test measurements taken at different temperatures can be compared.

In order to facilitate this, the AquaPlus™ Probe automatically applies corrections for temperature wherever required.

During calibration of the EC electrode, the variation in the calibration buffer solution due to temperature is automatically corrected for. During measurement of EC, the readings can be displayed without any temperature correction, corrected to 20°C, or corrected to 25°C. See section 9: [Setting Units of Measurement](#) for more details.

During calibration of the DO electrode, variations due to temperature and air pressure are automatically compensated for. During the measurement of DO, temperature, air pressure and salinity are automatically compensated for.

#### 6.4. Using the AquaPlus™ Probe with an Existing Aquameter™

The AquaPlus™ Probe can be used with any existing Aquaread™ Aquameter™. When the AquaPlus™ Probe detects that it has been connected to an Aquameter™, it re-configures its output to emulate an Aquaprobe™ model AP-300.

If you are using the equipment in this configuration, please refer to the instruction manual that was supplied with your Aquameter™ for details of the screen layouts and setup options, which differ slightly from the AquaPlus™ Meter.

**Important:** if you are using the AquaPlus™ Probe with an Aquameter™ and you receive error messages during calibration or use, please refer to the error chart in Section 11: [Calibration Error Codes](#) and to the [TROUBLESHOOTING](#) section in this manual, rather than the Aquameter™ manual.

Please also note, existing Aquameters™ are not compatible with OxiLink™ software. To download and view data logged with an Aquameter™, use the AquaLink™ software supplied with the Aquameter™.

## 7. GPS Reception

The GPS version of the AquaPlus™ Meter (DO-200) contains a built-in GPS receiver and antenna. The antenna is situated at the top of the case, just behind the AQUAREAD Logo.

For optimum signal reception, the antenna must be able to 'see' a reasonably large amount of the sky. **The GPS receiver will not work indoors or when shielded from the sky by any solid structure.**

After switch-on, the GPS receiver will automatically start to search for satellites. During this phase an 'A' character will be shown at the top right of all the screens.

As soon as three satellites are acquired, two dimensional position (no altitude) will be calculated and a '2D' character will be shown at the top right of all the screens.

Once a fourth satellite is acquired, altitude will be calculated and a '3D' character will be shown at the top right of all the screens. With a good view of the sky, position should be calculated within ninety seconds of switch-on. To see your geographic position and the number of satellites in use, use the left or right arrow keys to scroll to the Position page.

If you switch the meter on indoors, then carry it outside after several minutes, there may be a considerable delay in acquiring satellites. In this case, switch the meter off, then back on again to reset the acquisition process.

## 8. Memory Mode

### 8.1. Manually Saving Readings

When you are happy that the readings are stable, press the **M+** key to snapshot the readings along with the time, date, GLP (calibration) data and position (GPS models only).

As each reading is saved, a numeric memory location 'Tag' will be briefly displayed which you can note down. This Tag can be used to identify readings at a later date, both on the AquaPlus™ Meter and when using OxiLink software.

### 8.2. Recalling and Viewing Saved Readings

To recall your readings, press the **MR** key. On entering Memory Recall mode, the most recent Tag and set of readings are displayed first.

M	TEMP:12.5C	M
	DO:098.5%	
	DO:08.5mg/L	
	SAL:1.05ppt	

During Memory Recall, an 'M' is flashed in the top left and right corners of the screen alternatively with an up/down arrow and a left/right arrow. This is to indicate that the Meter is in Memory Recall mode and that other screens can be accessed using the arrow keys.

To see earlier readings, press the up arrow key. Just before each set of readings is displayed, the Tag, along with the date and time the readings were taken will be briefly displayed. The date and time the readings were taken are also displayed on the bottom line of the GPS Position Screen during Memory Recall.

To view all the parameters within one set of readings, use the left/right arrow keys as described earlier. To exit Memory Recall mode, press the **ESC** key. If no key is pressed for 30 seconds, Memory Recall mode will be automatically cancelled.

### 8.3. Recalling GLP Data

Each time a set of readings is added to memory, the date of the last successful calibration of each function is also appended. This is called GLP (Good Laboratory Practice) Data. In addition to the date of the last successful EC calibration, the Calibration Standard value at which the EC was calibrated is also displayed (see [Calibrating EC](#) in section 12 for further details).

To view the last successful calibration date for the DO and EC electrodes for any particular stored reading, enter Memory Recall mode, scroll to the reading you are interested in using the up/down keys, then press the **MENU** key. The screen below will be displayed.

<b>GLP DATA</b>	
DOZero	[31/Jan/10]
DO100%	[07/Feb/10]
EC2570	[09/Feb/10]

This tells you that the last successful calibration, **prior to the recorded reading being taken**, was January 31<sup>st</sup> for the DO Zero point, February 7<sup>th</sup> for the DO 100% point and February 9<sup>th</sup> for the EC 2570µS/cm point.

To exit this screen press the **ESC** key or the left arrow key.

#### 8.4. Clearing the Memory

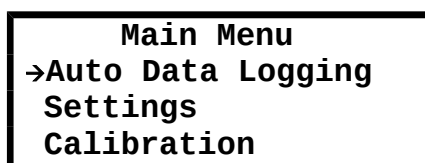
The memory within the AquaPlus™ Meter is capable of storing up to 3000 full sets of readings.

To clear the entire memory, switch the Meter off, hold down the **M+** key, then switch the Meter back on. A screen will be displayed asking you to confirm your request. Press OK to clear the memory or ESC to cancel and return to normal operation.

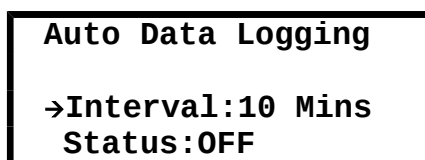
#### 8.5. Automatic Data Logging

If you want to save readings automatically on a regular basis, in order, say, to check water quality at a certain location over a period of time, you can set the Meter to record readings automatically.

To do this, press the **MENU** key. The Main Menu screen will be displayed.



Select **Auto Data Logging** by pressing the right arrow key or the **OK** key. The Auto Data Logging screen will be displayed.



Using the arrow keys to navigate, set the desired logging interval, then set the **Status** to **ON**.

To leave this screen, reverse back to the Main Menu screen then the normal operation screen by pressing the left arrow key. The Meter will now record a full set of data automatically at the set rate until either the memory is full or the batteries go flat.

To remind you that Auto Data Logging is switched on, an asterisk (\*) character will flash on and off just below the battery symbol on all the main reading screens.

You can cancel Auto Data Logging at any time by going back into the screen above and setting the **Status** to **OFF**. Auto Data Logging will also be cancelled if you switch the Meter off.

## 8.6. Important Information About Memory Mode

When data is saved in the Meter, it is compressed in raw Probe format. In other words, the same way that it came up from the Probe. When you recall the data in Memory Recall mode, the data is decompressed, then processed for display.

The advantage of this is that the readings will always appear in the current Meter configuration. For example, if you spent a day taking readings with the Meter set to read EC corrected to 20°C, then when you got back you really want to see EC corrected to 25°C, you can do this by simply changing the Meter settings (see section 9: [Setting Units of Measurement](#)).

The stored data can be displayed any way you want on recall. You are not limited to viewing the data in the same way it was logged. This is a major advantage and allows you to actually store and recall more parameters than can be displayed at any one time.

The same rules apply when data is output to a PC running OxiLink™ Software via the USB cable. The data that is output is always as per the Meter's **current** configuration. You can output the data as many times as you like in various Meter configurations.

## 9. Setting Units of Measurement

To alter the way the AquaPlus™ Meter displays readings, press the **MENU** key to get to the Main Menu, then choose **Settings**. The Settings Menu will be displayed.

```
Settings Menu
→Units
Time & Date
Language
```

From this screen choose **Units**. The Units Menu will be displayed. Remember, you can use just the arrow keys to navigate through the branches of the menus. You don't need to press **OK** or **ESC** at each level.

```
Units Menu
→EC/TDS
TEMP/SAL
BARO/Alt/Pos
```

At the Units Menu, you have a choice of which units you want to adjust. Choose the first line if you want to adjust Electrical Conductivity or TDS. Choose line 2 if you want to adjust Temperature or Salinity. Finally, line 3 will give access to Barometric Pressure, Altitude and Position settings.

Moving the cursor right onto the first line will display the following screen.

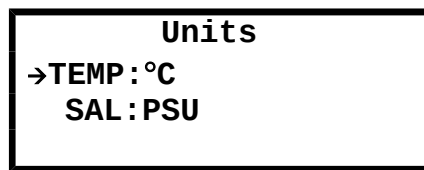
```
Units
→ EC:Ref 25°C
TDS Fact:0.65
```

The first option on this screen allows you to choose how the Meter displays Electrical Conductivity. There are four options. EC can be displayed as 'Absolute EC' without any temperature correction [ABS EC], as 'Specific EC' referenced to 20°C [Ref 20°C], as 'Specific EC' referenced to 25°C [Ref 25°C] or as a reciprocal of Absolute EC, which is Absolute Resistivity [ABS RES].

The second option allows you to set the factor that the Meter uses to calculate Total Dissolved Solids from Specific EC. This is the TDS Fact: (TDS = EC x TDS Fact) and can be set anywhere between 0.00 and 1.00. Default value is 0.65.



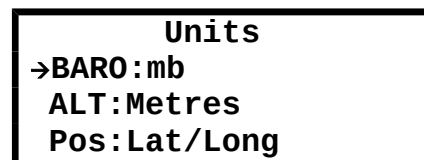
Selecting the second line of the Units Menu will display the following screen.



The first option on this screen allows you to change the temperature display between °C and °F.

The second option allows you to choose between displaying salinity in Practical Salinity Units (PSU), or parts per thousand (ppt), which is the same as grams per litre.

Selecting the third line of the Units Menu will display the following screen.



The first line allows you to choose between displaying Barometric pressure in millibars (mb) or in millimetres of mercury (mmHg).

The second line allows you to choose between displaying altitude in metres (M) or feet (F) above mean sea level.

The third line allows you to choose between displaying position in Latitude and Longitude or as an Ordnance Survey Grid Reference (OSGB). OSGB co-ordinates can only be displayed for positions within the British Isles. The system is not valid elsewhere.

If you need to see the position displayed in UTM (Universal Transverse Mercator) co-ordinates, this is available in the OxiLink™ software.

## 10. Cleaning the Probe

The Sleeve on the AquaPlus™ Probe is easily removed by unscrewing to allow cleaning of the electrode.

After every use, remove the sleeve as shown.

With the Sleeve removed, the electrode is very vulnerable, so please handle the Probe with extreme care. If you drop it, it's going to break!

Rinse the electrode and the inside of the Sleeve under a running cold tap.

Alternatively, agitate the Probe vigorously in a bucket or jug of fresh water using an up and down movement.

A soft cloth or toothbrush and some mild detergent may be used to remove stubborn dirt from the EC Sensor wires.

It is especially important to keep the black rubber tip of the DO Cap clean, since organic fouling may consume oxygen which can affect DO measurements.

To clean the DO Cap, gently wipe away any fouling with a soft cloth that has been moistened with fresh water.

Dry the electrode using a soft cloth. Shake the water from inside the Sleeve, then reattach. Dry the outside of the Probe using a soft cloth.

**Never clean the any part of the Probe with solvents, alcohol or concentrated acid / alkaline based cleaning products such as Decon 90.**

**These products can strip the anodised finish from the Probe and damage the plastic and rubber components. Damage caused by the use of aggressive cleaning agents or solvents is not covered by your warranty.**

**TIP:** Occasional application of a smear of silicone grease or similar lubricant to the Sleeve thread and O ring will make fitting and removal of the Sleeve easier.



## 11. About Calibration

Calibration is a very important part of successful water quality measurement and should be carried out regularly as detailed in each separate section of this manual. A great deal of development work has been put into simplifying and automating the calibration procedures in the AquaPlus™ Meter in order to allow normal field operatives (as opposed to trained lab technicians) to achieve quick and accurate results.

**The Probe sleeve forms an integral, working part of the Probe's EC measurement system, and MUST be fitted during calibration for correct operation.**

### 11.1. Calibration Error Codes

If the AquaPlus™ Meter detects a problem with either the AquaPlus™ Probe or the calibration solution during the calibration procedure, an error will be indicated accompanied by an error code number. The chart below shows the possible errors and how to correct them.

Error Code	Problem	Action
Error 01	Full re-calibration required or DO Cap needs replacing	See note 1 below.
Error 06	Battery Voltage is too low for reliable calibration	Replace the batteries
Error 07	The Probe is not responding	Check connections / cycle power
Error 08	Readings are unstable	Top up / replace calibration solution
Error 09	Readings are outside calibration limits	Top up / replace the calibration solution. Ensure the Probe Sleeve is fitted and tight.
Error 11	Temperature is outside 5°C – 40°C limit	Warm / cool the calibration solution

#### Notes:

1. Error 1 during DO Zero calibration usually indicates that the DO Cap needs replacing. Perform a full DO calibration first at DO Zero then at 100% DO. If that does not cure the problem, replace the DO Cap (see [Replacing the DO Cap](#) in Section 12).
2. If the corrective actions shown above for Errors 08 and 09 do not work, thoroughly clean the Probe and try again.
3. If Error 09 persists and you are certain your calibration standards (solutions) are correct, reset the calibration values to Factory Defaults then try again.
4. If Error 09 persists when calibrating DO, replace the DO Cap (see [Replacing the DO Cap](#) in Section 12).
5. If Error 09 persists when calibrating EC, check you are using the correct EC Calibration Standard and that the Probe Sleeve is fitted and tight.

Remember: **The Probe sleeve forms an integral, working part of the Probe's EC measurement system, and MUST be fitted during calibration and measurement for correct operation. If you try to calibrate the Probe without the sleeve fitted, you will get an error message.**

### 11.2. Resetting to Factory Calibration Defaults

In some cases, if there has been a serious calibration error, the easiest way to rectify the situation is to reset the Probe to its factory defaults. To do this, first bring up the Calibration screen:

```
Calibration
→DOZero?[01/Jun/10]
DO100%?[01/Jun/10]
EC2570?[01/Jun/10]
```

Press the **MR** key. A confirmation screen will be displayed.

```
Are you sure you
want to restore the
factory calibration
values? [ESC]=NO
```

If you are sure, press the **OK** key. If you want to change your mind, press the **ESC** key. If you press OK, you will see a message that says CAL RESTORED.

Once factory calibration defaults have been restored, you **must** carry out a **full calibration** of DO Zero, DO 100% and EC.

### 11.3. Calibration Data Storage

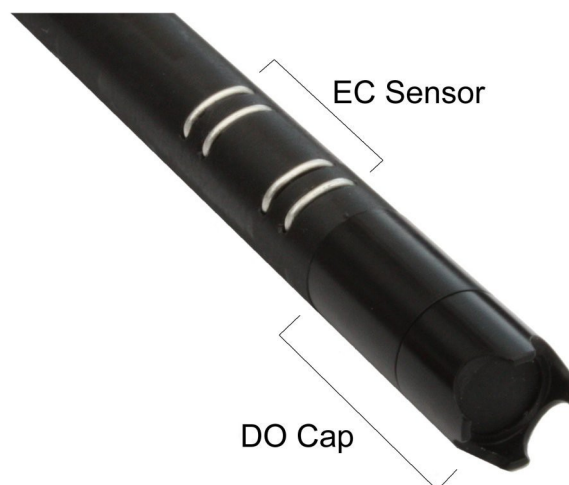
Each AquaPlus™ Probe contains its own microprocessor and memory. All calibration data, including the GLP data, is stored within the Probe's memory. When a Probe is connected to a Meter, this data is transferred for display and logging.

This is a major advantage and allows you to use a variety of different Probes with a single Meter, without the need for re-calibration.

## 12. DO/EC Electrode Calibration and Maintenance

### 12.1. Recognising the individual sensors

Dissolved Oxygen (DO) is measured at the end of the electrode by the DO Sensor Module behind the removable DO Cap. Electrical Conductivity (EC) is measured on the side of the electrode by four stainless steel contacts.



### 12.2. Precautions During Use

EC measurement is not possible with the Probe sleeve removed as the sleeve forms an integral part of the measurement system. The only exception to this rule is when a DO Flowcell is being used. In this case, the plastic tube in the Flowcell replaces the function of the Probe sleeve.

**Never immerse the Probe without the DO Cap fitted. If the electronic components at the end of the DO Sensor Module come into contact with the liquid being tested, serious damage can occur to the Sensor Module circuitry.**

### 12.3. Calibrating DO

The DO section of the electrode should be calibrated at the Zero saturation point at least once a month. Before each day's use, the 100% saturation point should be checked in moist air and re-calibrated if necessary. For optimum accuracy, calibrate the DO100% point as near to your sample temperature as possible (within the calibration temperature limits of 5°C - 40°C).

If you are going to calibrate both the Zero and 100% points at the same time, **ALWAYS calibrate the Zero point first**, then the 100% point. To calibrate DO follow these steps:

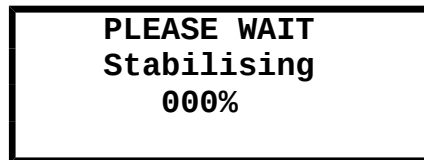
### 12.4. Calibrating the DO Zero Point

1. Remove the lid from a bottle of Aquaread™ DO Zero calibration solution, wash the Probe in distilled water, dry thoroughly, then drop the Probe in all the way. Tap the probe to remove any air bubbles that may be adhering to the sensor.
2. Switch the AquaPlus™ Meter on and wait until the DO reading is completely stable. The longer you can leave the probe to achieve thermal equilibrium before proceeding, the better.
3. Ensure the temperature of the solution is between 5°C and 40°C (41°F - 104°F).
4. Press the **MENU** key then select **Calibration**. The following screen will be displayed.

<b>Calibration</b> →DOZero?[01/Jun/10] DO100%?[01/Jun/10] EC2570?[01/Jun/10]
---

The dates shown to the right of the screen are the dates of the last successful calibration.

5. Select DOZero. The screen will change to:



The Meter will wait until the readings are stable, then it will send the calibration command to the Probe, where the calibration takes place. During calibration, the Calibrating screen is displayed and the progress counter counts up. If the calibration is successful, the counter will reach 100% and the following screen will be displayed.



When calibration is complete, press the **OK** key then the **ESC** key repeatedly to return to normal operating mode.

If a problem occurs during calibration, an error message will be displayed. Refer to [Calibration Error Codes](#) in Section 11 for error message handling. If Error 09 persists when calibrating DO, replace the DO Cap.

Remove the Probe from the calibration bottle, rinse thoroughly in fresh water, shake off any excess and dry with a soft cloth. **After calibrating the Zero point, ALWAYS re-calibrate the 100% point.**

#### 12.5. Checking and Calibrating the DO 100% Saturation Point in Moist Air

1. Wash the probe in fresh water, then shake off ensuring there are no droplets adhering to the end face of the DO Cap.
2. Wrap the end of the Probe in a clean cloth or a piece of tissue paper that has been moistened with clean water. Ensure all the end holes are blocked.
3. Wait until the temperature measurement is **completely stable. This is very important.** The longer you can leave the probe to achieve thermal equilibrium before proceeding, the better.
4. Check the DO reading. If the Meter reads DO: 100% +/- 1% there is no need to re-calibrate.
5. If re-calibration is necessary, refer back to the screen shown in 12.4.4 above and select **DO100%**
6. Wait while the AquaPlus™ Meter carries out the calibration procedure.
7. When the 'Calibrating 100%' screen (shown above) is displayed, press OK then ESC repeatedly to return to normal reading mode.



If a problem occurs during calibration, an error message will be displayed. Refer to [Calibration Error Codes](#) in Section 11 for error message handling. If Error 09 persists when calibrating DO, replace the DO Electrode Membrane.

## 12.6. Replacing the DO Cap

The DO Cap contains a lens, which is coated with an oxygen sensitive luminophore, which is in turn coated with a black rubber compound that provides optical isolation but is permeable to oxygen. Oxygen molecules pass through the rubber into the luminophore.

**Never touch the black rubber end of the DO electrode as the oils in your skin can block the pores in the rubber coating and stop it from working correctly.**

The luminophore within the DO Cap will eventually need replacing as it is a consumable item. Since the luminophore is an integral part of the DO Cap, the entire DO Cap is replaced. A DO Cap can last up to ten years dependent upon the amount of use it gets. See [Sensor Cap Life](#) in section 19 for further information.

Caution: The inside of the DO Cap is very sensitive to light and can be ruined (bleached) if it is exposed to bright light for any length of time.

Never remove the DO Cap from the Probe unless you intend to replace it with a new one. When replacing a DO Cap, do so under subdued light.

To replace the DO Cap, follow these simple steps.

1. Remove the Probe sleeve.
2. Unscrew the DO Cap from the end of the DO/EC electrode by rotating it anti-clockwise. **Do not touch the exposed optical components.**
3. Apply a light smear of silicone grease to the thread and O ring.
4. Remove the new DO Cap from its light-proof bag and quickly screw it onto the end of the DO/EC electrode.
5. Carry out both Zero point and 100% point DO calibration as described earlier.

**Please Note: It is essential when replacing the DO Cap to calibrate the Zero point BEFORE calibrating the 100% point.**

## 12.7. Calibrating EC

EC calibration is always carried out at a single point. There is a choice of three calibration points. These vary with the AquaPlus™ software revision.

If your AquaPlus™ Probe is running software revisions 3.05 or less the three single points are: 1413µS/cm, 2570µS/cm (using Aquaread™ RapidCal™ solution) and 12,880µS/cm.

If your AquaPlus™ Probe is running software revisions 3.10 or higher the three single points are: 1413µS/cm, 2570µS/cm (using Aquaread™ RapidCal™ solution) and SC-35, which is a sodium chloride calibration standard specifically for use in sea water.

For taking measurements in fresh surface or ground water, use Aquaread™ RapidCal™ solution. If this is not available, use a third party 1413µS/cm EC Calibration Standard.

For taking readings in brackish or salt water, use a third party 12,880µS/cm (12.88mS/cm) EC Calibration Standard (if running software versions 3.05 or less) or, if running software version 3.10 or higher use SC-35 calibration solution (35ppt sodium chloride solution).

SC-35 calibration solution is available from Aquaread™ dealers or can be easily manufactured by adding 33.03 grams of laboratory grade sodium chloride (99.9% pure) to 1 litre of deionised water.



**The Probe sleeve forms an integral, working part of the Probe's EC measurement system, and MUST be fitted during calibration for correct operation.**

For best results, calibrate weekly as close to 25°C as possible. The probe will compensate for temperature variation in the Calibration Standard during calibration.

1. Wash the Probe in distilled water and dry thoroughly, then drop the Probe into a calibration bottle filled with your chosen EC Calibration Standard. **Ensure the liquid level is all the way up to the top sleeve holes. Low liquid level will result in erroneous EC calibration.**
2. Tap the probe to remove any air bubbles that may be adhering to the sensor.
3. Switch the AquaPlus™ Meter on and wait until the temperature and EC measurements are completely stable. The longer you can leave the probe to achieve thermal equilibrium before proceeding, the better.
4. Ensure the temperature of the solution is between 5°C and 40°C (41°F - 104°F).
5. Press the **MENU** key then select **Calibration**. The following screen will be displayed.

```
Calibration
→DOZero?[01/Jun/10]
DO100%?[01/Jun/10]
EC2570?[01/Jun/10]
```

The dates shown to the right of the screen are the dates of the last successful calibration. The value shown on the bottom line next to 'EC' is the value the EC electrode was last calibrated to.

6. Move the pointer down to the bottom line using the down arrow key.

```
Calibration
DOZero?[01/Jun/10]
DO100%?[01/Jun/10]
→EC2570?[01/Jun/10]
```

If the Calibration Standard value you are using is already displayed, press the **OK** key to start calibrating. Remember, if you are using RapidCal solution, the EC value on this line should be 2570.

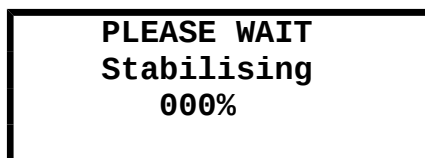
If the value of the EC Calibration Standard you are using is not displayed, press the right arrow key. The bottom line will change to:

```
Calibration
DOZero?[01/Jun/10]
DO100%?[01/Jun/10]
EC→2570?[01/Jun/10]
```



You can now use the up and down arrow keys to select one of three EC Calibration Standard values (1413, 2570 or 12880/SC-35).

7. Once the correct Calibration Standard value is being displayed, press the **OK** key. The screen will change to:



8. When the 'Calibrating 100%' screen is displayed, press OK.

### Special Notes:

- The Calibration Standard value is stored in the Probe, **not** the Meter. If you use one Meter with several different Probes, you will have to set the Calibration Standard value for each probe individually during calibration.
- If you select a Calibration Standard value but do not press **OK**, the information will not be sent to the Probe and the change will not be registered.

### 12.8. Errors During Calibration

At the beginning of the calibration routine, a sanity check is done. If the probe detects that the Calibration Standard value set and the Calibration Standard being used differ, Error 09 will be reported. If any other problems occur during calibration, an error message will be displayed. Refer to [Calibration Error Codes](#) in Section 11 for error message handling.

### 12.9. Cleaning the EC Contacts

On a regular basis, remove the Probe sleeve and thoroughly clean the four stainless steel EC contacts situated on the side of the DO/EC electrode with a soft cloth or toothbrush and non-abrasive detergent. **Never use solvent or alcohol based products to clean the DO/EC electrode.** After cleaning, replace the Probe sleeve and re-calibrate.

### 13. OxiLink™ PC Software

OxiLink is a utility program designed to run under Microsoft® Windows® XP®, Vista® or 7 on a stand-alone PC with a minimum screen resolution of 800 x 600, a CD drive and an available USB 2.0 socket.

Please also note, existing Aquameters™ are not compatible with OxiLink™ software. To download and view data logged with an Aquameter™, use the AquaLink™ software that was supplied with the Aquameter™.

#### 13.1. Downloading OxiLink™ PC Software from the Aquaread® website

The OxiLink™ PC Software is available for download using the following link:  
<http://www.aquaread.com/downloads.php>

From the Aquaread® Downloads page, select 'OxiLink-AquaPlus Utility'. The software will be downloaded as a .ZIP file.

#### 13.2. Software Installation

Unzip the downloaded .ZIP file into a temporary directory . Browse the temporary directory and click on '**setup.exe**'. You will be given the usual Windows® security warnings. Allow the software to install. Once installed, OxiLink™ will run automatically.

To communicate with the AquaPlus Meter, two further software 'drivers' need to be installed. These are the '**AquaPlus Meter**' driver and a '**USB Serial Port**' driver.

#### 13.3. Driver Installation

Connect the AquaPlus Meter to your PC using the USB cable provided. The 'Found New Hardware' wizard on your PC should activate automatically.

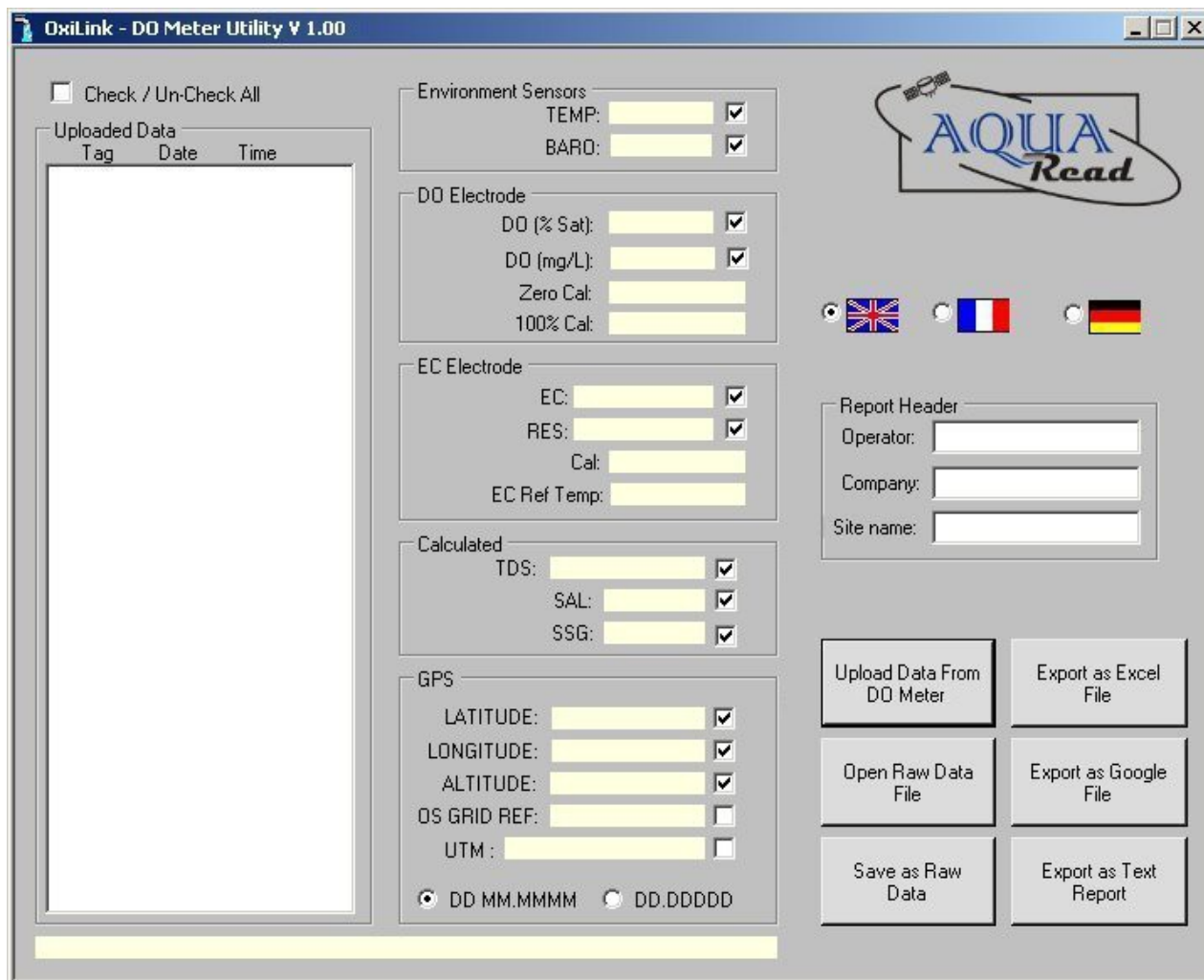
Different versions of Windows® react to plugging USB devices in differently. Earlier versions will give you the option to '**locate and install driver software**'. If this happens, direct Windows® to your temporary directory containing the unzipped download.

If your version of Windows® tries to search the Internet or 'Windows Update' for the drivers, stop the search and direct Windows® to your temporary directory.

If Windows® reports a problem installing the drivers, go to your Windows® Device Manager, locate the 'AquaPlus Meter' device and update the driver forcing Windows® to search your temporary directory for the driver. Repeat this process for the USB Serial Port.

### 13.4. Running OxiLink

Select OxiLink from your Programs menu. After an introductory splash-screen has been displayed, the following screen will appear:



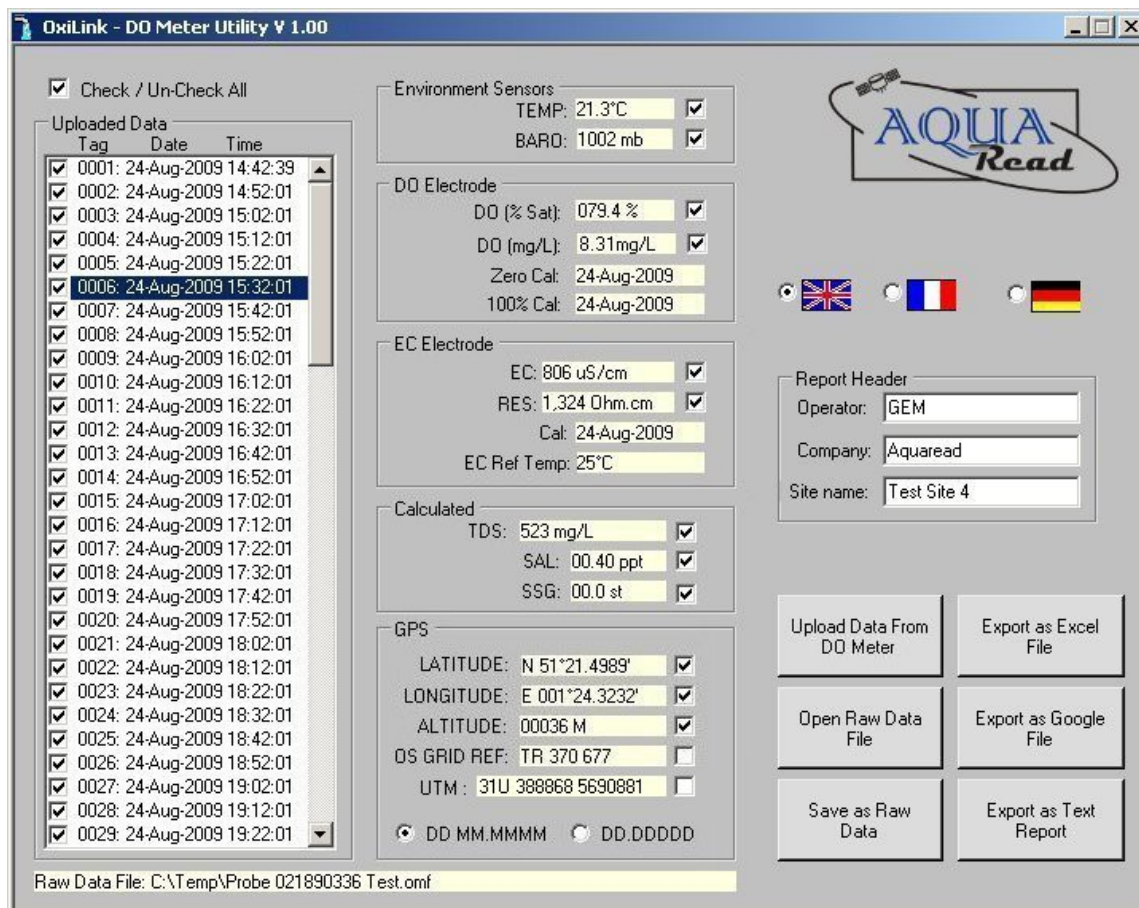
Select your preferred operating language by clicking on one of the national flags.

### 13.5. Uploading Data From Your AquaPlus™ Meter

Ensure your AquaPlus™ Meter has batteries installed but is switched off. Connect the AquaPlus™ Meter to your PC using the USB cable supplied. The AquaPlus™ Meter should switch itself on automatically and display 'USB CONNECTED' on its screen.

Click the '**Upload Data From DO Meter**' button. OxiLink will search for the AquaPlus™ Meter then upload all the available logged data from the Meter to your PC. A progress bar and file counter will be displayed during this process.

Once upload is complete, the memory Tag, date and time for all the logged data that has been uploaded will be displayed in the **Uploaded Data** column on the left of the screen.



To view any of the logged data records, simply click on the desired Tag, date and time label as shown above. The data for the highlighted label will be displayed in the individual data boxes, which are grouped by electrode function. Any data that is unavailable or out of range will be displayed as dashes. To move up and down the Tag/date/time column, use either your mouse or the cursor up/down keys.

Remember, the AquaPlus™ Meter stores all logged data in a raw Probe format, so can be made to output logged data in several different forms, dependent upon the Meter's current settings. See [Important Information About Memory Mode](#) in Section 8 for more information.

### 13.6. Displaying GPS Co-ordinates

On the right of the screen, the position at which the data was logged is displayed in the GPS boxes (when logged using an AM-200 GPS AquaPlus™ Meter only). Latitude and longitude can be displayed as Degrees and decimal Minutes (DD MM.MMMM) or as decimal Degrees (DD.DDDDD). Select one format or the other by clicking one of the two options at the bottom of the GPS box. Positional accuracy of lat/lon co-ordinates is +/- 10 meters with a 3D Position fix.

GPS position is also displayed as an Ordnance Survey Great Britain (OSGB) grid reference, (if the position falls within the United Kingdom) and UTM (Universal Transverse Mercator) co-ordinates. Positional accuracy of OSGB co-ordinates is +/- 1 digit (i.e. +/- 100 metres). Positional accuracy of UTM co-ordinates is +/- 10 metres with a 3D Position fix.

### 13.7. On Screen Help

Help has been provided in this software in the form of 'Tool Tips'. If you want to know what a control button does or what a data box displays, simply move your mouse pointer over the item in question. A multi-lingual Tool Tip will appear after a few seconds to give you more information.

### 13.8. Saving Logged Data

Once a set of logged data has been uploaded from the AquaPlus™ Meter, it can be saved on your PC as a Raw Data file. These files use a proprietary Aquaread format and are saved with a .omf (**oxygen meter file**) extension.

To save the uploaded data, click the '**Save as Raw Data**' button. You will be asked for a file name in the normal Windows® format. The file name you choose will automatically be given the .omf extension.

**Useful Tip:** Once you have saved the logged data, it is a good idea to clear the AquaPlus™ Meter's memory so next time you log data, you don't get both your old data and new data uploaded to your PC. See [Clearing the Memory](#) in section 8.

### 13.9. Retrieving Logged Data

Once a Raw Data file has been saved using the above technique, it can be easily retrieved by clicking on the '**Open Raw Data**' button. When a raw data file is opened, it will appear exactly as uploaded data and the file name will be displayed in the box below the Report Header box.

### 13.10. Exporting Data

OxiLink can export data in three different formats. Before exporting data, the actual data to be exported must be selected.

First, select which data records you want to export by checking the relevant check-boxes in the Uploaded Data column. You can check or un-check all data records simultaneously by checking or un-checking the 'Check / Un-Check All' box above the Uploaded Data column.

Next, select which individual data classes you want to export by checking or un-checking the check-boxes next to each individual data box. You are now ready to export your data.

### 13.11. Exporting Text Reports

To export a text report, first fill in the boxes in the group marked **Report Header** on the left of the screen. This information will be used at the beginning of your report. Next, click on the '**Export as Text Report**' button. You will be asked to specify a file name. A .txt extension will automatically be added.

A report will be generated that consists of a cover page giving the start and end date, time and position, the total number of readings, an analysis of the highest and lowest readings, the variance between the highest and lowest readings, the average readings and the GLP data. Each block of individual readings, laid out in chronological order, follows this page.

This report can be imported into any text editor or word processor package.

**Useful Tip:** Of the two text editors supplied with Windows®, Microsoft® WordPad is the preferred text editor for viewing OxiLink Text Reports as this handles text file formatting better than Microsoft® Notepad.

A typical Text Report cover page follows:

OXILINK REPORT			
-----			
File name:	C:\Test\3 day test 024690136.txt		
Operator name:	G.E.M.		
Company name:	Aquaread Ltd		
Site name:	Test Site 4		
Start date and time:	24-Jun-2010 10:09:33		
Start position:	Lat: N 51°21.4988' Lon: E 001°24.3232' OSGB: TR 370 677		
End date and time:	27-Jul-2009 13:01:00		
End position:	Lat: N 51°21.4988' Lon: E 001°24.3233' OSGB: TR 370 677		
Total number of readings: 877			
-----			
Highest readings			
-----			
Temp:	19.8C	Tag: 0648	Date: 26-Jul-2009
Baro:	1020mb	Tag: 0315	Date: 25-Jul-2009
DO:	79.4% Sat	Tag: 0742	Date: 27-Jul-2009
DO:	8.37mg/L	Tag: 0742	Date: 27-Jul-2009
EC:	810uS/cm	Tag: 0588	Date: 26-Jul-2009
RES:	1,445 Ω·cm	Tag: 0285	Date: 25-Jul-2009
TDS:	526mg/L	Tag: 0588	Date: 26-Jul-2009
SAL:	0.40ppt	Tag: 0001	Date: 24-Jul-2009
SSG:	0.0st	Tag: 0001	Date: 24-Jul-2009
Time:	15:51:00		
Time:	12:19:00		
Time:	01:46:00		
Time:	01:46:00		
Time:	10:51:00		
Time:	09:49:00		
Time:	10:51:00		
Time:	10:09:33		
Time:	10:09:33		
-----			
Lowest readings			
-----			
Temp:	17.9C	Tag: 0254	Date: 25-Jul-2009
Baro:	1005mb	Tag: 0838	Date: 27-Jul-2009
DO:	30.1% Sat	Tag: 0427	Date: 25-Jul-2009
DO:	3.24mg/L	Tag: 0742	Date: 27-Jul-2009
EC:	782uS/cm	Tag: 0149	Date: 24-Jul-2009
RES:	1,358 Ω·cm	Tag: 0651	Date: 26-Jul-2009
TDS:	508mg/L	Tag: 0145	Date: 24-Jul-2009
SAL:	0.39ppt	Tag: 0017	Date: 24-Jul-2009
SSG:	0.0st	Tag: 0001	Date: 24-Jul-2009
Time:	07:14:01		
Time:	09:46:00		
Time:	21:39:00		
Time:	01:46:00		
Time:	22:29:01		
Time:	18:11:13		
Time:	22:09:01		
Time:	11:29:01		
Time:	10:09:33		
-----			
	Variance	Average values	
-----			
Temp:	1.9C	18.81C	
Baro:	15mb	1013mb	
DO:	49.3% Sat	59.10% Sat	
DO:	5.12mg/L	6.25mg/L	
EC:	28uS/cm	792.2uS/cm	
Res:	87 Ω·cm	1,415.4 Ω·cm	
TDS:	18mg/l	514.4mg/l	
SAL:	0.01ppt	0.391ppt	
SSG:	0.0st	0.00st	
-----			
Calibration (GLP) data			
-----			
DO Zero:	23-Jul-2009		
DO 100%:	24-Jul-2009		
EC:	24-Jul-2009		
-----			

Blocks of individual readings, laid out in chronological order, follow this cover page. The readings picked out on the cover page can be cross-referenced to the blocks of individual readings using the Tag numbers.

### 13.12. Exporting Excel® Files

To export an Excel® file, click on the 'Export as Excel File' button. You will be asked to specify a file name. A .xls extension will automatically be added. Excel® files are exported in a Tab delimited text format. This means that each data field is separated by a Tab, and each data record appears on a new line.

Excel® files are saved with a .xls extension and can be opened directly in Microsoft® Excel®. When opening a .xls file created by OxiLink for the first time, Excel® may automatically run a 'Text Import Wizard'. Follow the three simple steps to import the file. Save the file afterwards as a 'Microsoft Excel Workbook'.

### 13.13. Exporting Google™ Files

To export a Google™ file, click on the '**Export as Google File**' button. You will be asked to specify a file name. A .kml extension will automatically be added. **Please note: only data logged with a valid GPS position can be exported to Google™ files.**

Google™ files are exported in Google's proprietary Keyhole Markup Language with a .kml extension, and can be directly imported into Google™ Earth, where the data is overlaid on satellite images.

### 13.14. Importing Files into Google™ Earth

To view your files in Google™ Earth, you will need to log on to the Google™ website and install the Google™ Earth application on your computer. This is free of charge at present.

Once you have downloaded Google™ Earth and have it running, either double click on your .KML file or follow these steps:

3. Click on '**File**'.
4. Select '**Open**' from the list.
5. Browse for the .KML file you exported from AquaLink, and select it.

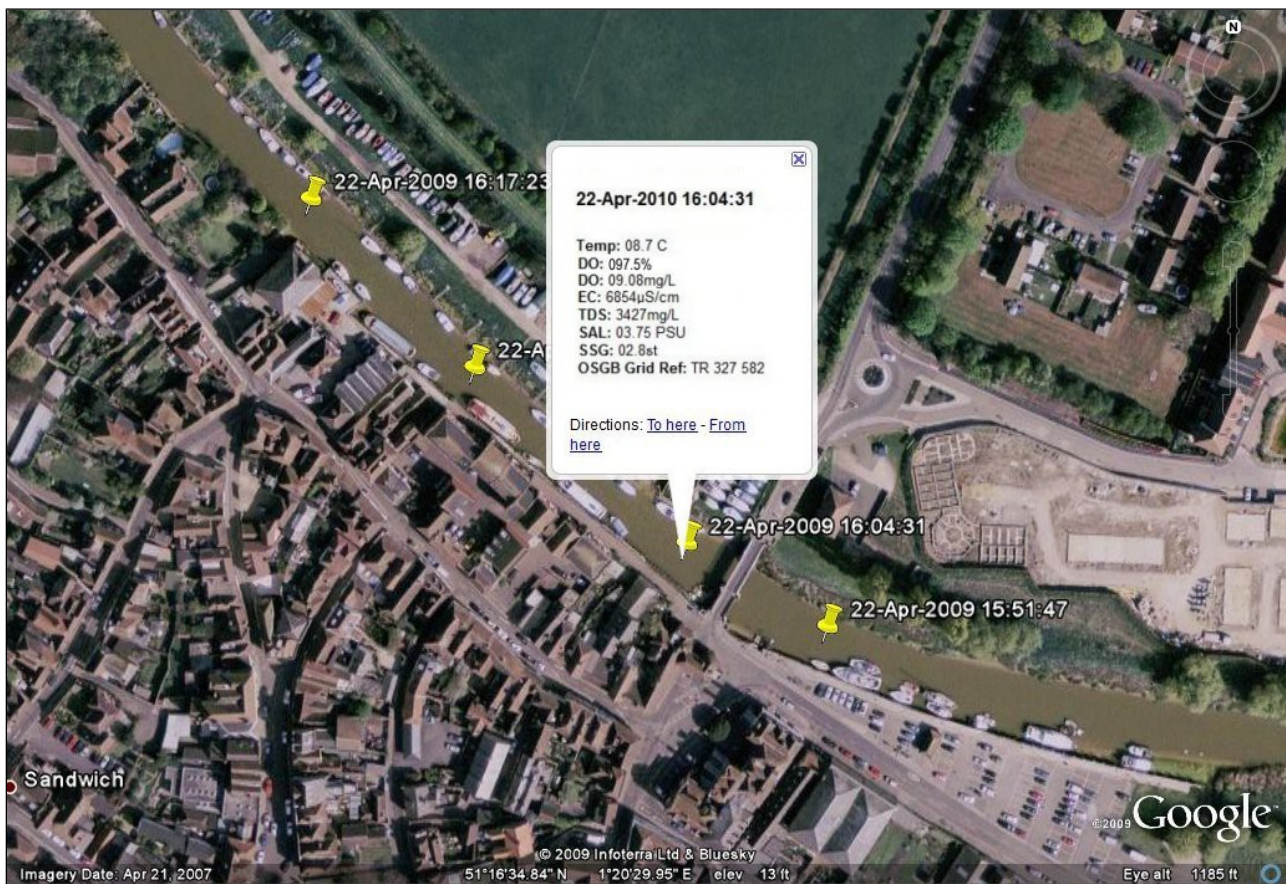
You will now be able to view your data overlaid on Google™ Earth Satellite images. Each data point is represented by a yellow pushpin, and all the data points are listed in a column on the left of the screen. To view the data associated with each pin, either click on the pin or click on the data point in the list.

Please note: Although you have downloaded the Google™ Earth application and are running it from your PC, you still need to be connected to the Internet in order for the application to access satellite images.

A typical Google™ Earth image follows.



### 13.15. Google™ Example



Zooming in on the satellite photos in Google™ Earth is a great way to spot potential sources of pollution. If one of the readings you have taken shows an abnormality, the chances are that you will be able to spot the possible source of the problem (a riverside factory for example) directly on the satellite photo.



## 14. Specification

### 14.1. AquaPlus™ Probe Mechanical Specification

<b>Protection Class</b>	IP68 (permanent immersion)
<b>Immersion Depth</b>	Min 75mm (3"). Max 30m* (100')
<b>Operating Temperature</b>	-5°C – +50°C (23°F – 122°F)
<b>Storage Temperature</b>	-10°C – +60°C (14°F – 140°F)
<b>Dimensions (L x Dia)</b>	250 mm x 24 mm (9.8" x 0.94")
<b>Weight (including cable)</b>	400g (14oz)

\*AquaPlus™ Probes are supplied as standard with a 3M cable. Extension cables with in-line connectors are available in 5M, 10M and 30M lengths, but are limited to a maximum of 10M immersion depth by the integrity of the connectors. Custom cable lengths up to 30M can be fitted at the time of ordering to eliminate extension cables and in-line connectors, thereby allowing use of the Probe down to 30m depth.

### 14.2. AquaPlus™ System Measurement Specification

<b>DO % Saturation</b>	Range	0 – 500.0%
	Resolution	0.1%
	Accuracy	0 - 200%: ± 1% of reading. 200% - 500%: ± 10% of reading
<b>DO mg/L</b>	Range	0 – 50.00 mg/L
	Resolution	0.01mg/L
	Accuracy	0 – 20mg/L: ±1% of reading. 20mg/L – 50mg/L ± 10% of reading
<b>Conductivity</b>	Range	0 – 200 mS/cm (0 - 200,000 µS/cm)
	Resolution	3 Auto-range scales: 0 – 9999 µS/cm, 10.00 – 99.99 mS/cm, 100.0 – 200.0mS/cm
	Accuracy	± 1% of reading or ± 1µS/cm if greater
<b>TDS</b>	Range	0 – 100,000 mg/L (ppm)
	Resolution	2 Auto-range scales: 0 – 9999mg/L, 10.00 – 100.00g/L
	Accuracy	± 1% of reading or ± 1mg/L if greater
<b>Resistivity</b>	Range	5 Ω•cm – 1 MΩ•cm
	Resolution	2 Auto-range scales: 5 – 9999 Ω•cm, 10.0 – 1000.0 KΩ•cm
	Accuracy	± 1% of reading or ± 1 Ω•cm if greater
<b>Salinity</b>	Range	0 – 70.00 PSU / 0 – 70.00 ppt (g/Kg)
	Resolution	0.01 PSU / 0.01 ppt
	Accuracy	± 1% of reading or ± 0.1 unit if greater
<b>Seawater Specific Gravity</b>	Range	0 – 50 σ <sub>t</sub>
	Resolution	0.1 σ <sub>t</sub>
	Accuracy	± 1.0 σ <sub>t</sub>
<b>Temperature</b>	Range	-5°C – +50°C (23°F – 122°F)
	Resolution	0.1° C/F
	Accuracy	± 0.5° C

The accuracy figures quoted above represent the equipment's capability at the calibration points at 25°C. These figures do not take into account errors introduced by variations in the accuracy of calibration solutions and errors beyond the control of the manufacturer that may be introduced by environmental conditions in the field.

**14.3. AquaPlus™ Meters Specification**

<b>Meter Model</b>	<b>DO-200</b>	<b>DO-100</b>
<b>Dimensions (W x H x D)</b>	90mm x 180mm x 39mm (3.5" x 7" x 1.5")	90mm x 180mm x 39mm (3.5" x 7" x 1.5")
<b>Weight (including batteries)</b>	450g (15.9oz)	440g (15.5oz)
<b>Display</b>	80 character FSTN LCD with backlight	80 character FSTN LCD with backlight
<b>Data Memory</b>	3000 full sets including GLP data	3000 full sets including GLP data
<b>GPS Receiver</b>	12 channel, internal antenna	—
<b>GPS Accuracy</b>	+/- 10 metres in all 3 dimensions	—
<b>Atmospheric Pressure</b>	150mb – 1150mb Accuracy +/- 1mb	150mb – 1150mb Accuracy +/- 1mb
<b>Languages</b>	English / French / German	English / French / German
<b>PC Interface</b>	USB (cable provided)	USB (cable provided)
<b>Power Supply</b>	5 x AA cells. Alkaline or Ni-MH rechargeable	5 x AA cells. Alkaline or Ni-MH rechargeable
<b>Battery Life</b>	Alkaline > 20 hours. Ni-MH > 40 hours	Alkaline > 40 hours. Ni-MH > 60 hours
<b>Operating Temperature</b>	-20°C to +70°C	-20°C to +70°C
<b>Protection Class</b>	IP67	IP67

**Aquaread Ltd reserves the right to change specifications without notice**

## 15. Limited Warranty

All Aquaread Meters are guaranteed for three years, Probes, Flow-Through Cells and individual electrodes are guaranteed for one year from date of purchase against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. You must return your warranty card within 30 days of purchase to activate your warranty.

This warranty is limited to repair or replacement free of charge. Accidental damage, misuse, tampering, lack of prescribed maintenance, water ingress through unprotected Meter and Probe sockets, and damage caused by leaking batteries are not covered.

If service is required, contact our Service Department directly by email in the first instance ([service@aquaread.com](mailto:service@aquaread.com)). Report the model number, date of purchase, serial number and problem. You will be given a Returns Authorisation number by our Service Department. You should then return the equipment, **thoroughly cleaned**, properly packaged, carriage paid, to the address you are given. If the equipment is within warranty, any necessary repairs will be carried out and your equipment will be returned free of charge.

If the repair is not covered by the warranty, you will be given an estimate for the costs of repair and return carriage. Upon receipt of payment, your equipment will be repaired and returned.

**Please note:** The majority of perceived problems can be rectified by careful study of this instruction manual, use of the **TROUBLESHOOTING** section below, or with a little help from our engineers over the phone. **Always contact our Service Department prior to returning any equipment.**

### 15.1. Cleaning Prior To Return

In order to protect the health and safety of our employees, any equipment returned for service must be thoroughly cleaned and decontaminated prior to despatch, and must be accompanied by a completed copy of the Decontamination Certificate printed below. Any equipment returned for service without a satisfactory Decontamination Certificate, or any equipment deemed by our engineers to be contaminated, will be quarantined pending receipt of a properly completed Decontamination Certificate.

**Never clean the Probe with solvents or concentrated acid/alkaline based cleaning products such as Decon 90. These products can strip the anodised finish from the Probe and damage some of the plastic and rubber components.**

**15.2. Decontamination Certificate**

Please print this certificate, complete all sections, and enclose it with any returned equipment.

**Decontamination Certificate**

Company Name: \_\_\_\_\_

Address:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Postal code: \_\_\_\_\_

Country: \_\_\_\_\_

Phone: \_\_\_\_\_

email: \_\_\_\_\_

Product: \_\_\_\_\_

Serial No.: \_\_\_\_\_

Contaminant (if known):

\_\_\_\_\_

Decontamination Procedure:

\_\_\_\_\_  
\_\_\_\_\_

Certified by (print name) : \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Signature: \_\_\_\_\_

## 16. TROUBLESHOOTING

This section details some of the common difficulties you may encounter when using the AquaPlus™ Meter, AquaPlus™ Probes and OxiLink software. Try all the suggested remedies. If your problem is still unresolved, contact our Service Department ([service@aquaread.com](mailto:service@aquaread.com)).

Problem	Cause / Remedy
The AquaPlus™ Meter will not turn on when the on/off key is pressed.	✓ Batteries are probably dead or incorrectly fitted. Check you have fresh batteries fitted and that they are inserted the correct way round.
The AquaPlus™ Meter turns on but turns off again almost immediately.	✓ Batteries are probably nearly dead or incorrectly fitted. Check you have fresh batteries fitted and that they are inserted the correct way round.
The AquaPlus™ Meter can not find the AquaPlus™ Probe.	✓ Probably a poor connection. Switch the Meter off, disconnect the Probe plug, ensure there is no debris or moisture in the plug, then re-connect the plug ensuring it is fully inserted and that the screw collar is fully tightened.
The GPS AquaPlus™ Meter will not show a position fix.	✓ The Meter probably does not have a good enough view of the available satellites. Ensure there are no obstructions between the Meter and the open sky. Remember, GPS <b>does not</b> work indoors.
The OxiLink software can not find the AquaPlus™ Meter.	<ul style="list-style-type: none"> <li>✓ The USB drivers may not be properly installed. Reinstall the USB drivers carefully following the instructions.</li> <li>✓ There may be a problem with the USB socket on the PC, try an alternative socket.</li> </ul>
The 'USB CONNECTED' message does not appear on the AquaPlus™ Meter when it is connected to a PC.	<ul style="list-style-type: none"> <li>✓ The batteries in the Meter may be dead or incorrectly fitted. Check you have fresh batteries fitted and that they are inserted the correct way round. The USB cable <b>does not</b> power the AquaPlus™ Meter.</li> <li>✓ There may be a problem with the USB socket on the PC, try an alternative socket.</li> </ul>
ERROR 01 appears on the AquaPlus™ Meter / Aquameter™ screen.	✓ This indicates that the DO sensor needs re-calibration or the DO Cap needs replacing. Perform a full DO calibration first at Zero then at 100% DO. If that does not cure the problem, replace the DO Cap.
ERROR 07 appears on the AquaPlus™ Meter / Aquameter™ screen.	✓ This indicates that the Probe has stopped responding to requests for data from the Meter. Check the Probe plug is fully inserted. Cycle the power to reset the Probe.
Battery electrolyte leakage detected in the battery compartment.	✓ Remove and discard the batteries immediately. Thoroughly clean the battery compartment and terminals. If the battery terminals are corroded, contact our Service Department for return instructions.

## Troubleshooting Continued ...

Problem	Cause / Remedy
Dissolved Oxygen readings are inaccurate or unstable.	<ul style="list-style-type: none"> <li>✓ The DO sensor may need calibrating. Recalibrate.</li> <li>✓ The DO sensor cap may be fouled. Clean the DO Cap.</li> <li>✓ The DO Cap may be damaged. Inspect and replace if necessary.</li> <li>✓ Calibration may have been carried out at an extreme temperature. Recalibrate at a temperature as close to the sample temperature as possible.</li> </ul>
EC readings are inaccurate or unstable. Error 09 shows during calibration of EC.	<ul style="list-style-type: none"> <li>✓ Have you got the Probe Sleeve fitted? EC will not work without the Probe Sleeve fitted. The only exception to this rule is if the Probe is being used with a Flowcell.</li> <li>✓ The Probe may not be inserted deep enough into the sample being measured. Ensure the sample level reaches the top set of holes on the Probe sleeve.</li> <li>✓ Trapped air bubbles may be causing problems. Tap and swish the Probe to dislodge them.</li> <li>✓ The Probe Sleeve may be loose. The Probe Sleeve must be absolutely rigid with respect to the Probe Body for correct EC operation.</li> <li>✓ The EC electrode may need recalibrating. Recalibrate.</li> <li>✓ The EC electrode may be dirty. Clean the EC electrode then recalibrate.</li> </ul>

**17. DECLARATION OF CONFORMITY**

Aquaread Ltd declares that the equipment described herein is in compliance with the essential requirements and other relevant provisions of Directives 2004/108/EC and 1999/5/EC.

## 18. Appendix 1. The Tech Behind AquaPlus™

### 18.1. Principle of Operation

The Aquaread™ AquaPlus™ works on the principle of Dynamic Luminescence Quenching. A gas-permeable chemical known as a luminophore is excited with short bursts of blue light, which causes molecules in the luminophore to emit red photons. The presence of oxygen in contact with the luminophore causes the emission of the red photons to be quenched or delayed. By measuring the delay of the returned red photons with respect to the blue excitation, it is possible to determine the level of dissolved oxygen present.

Whilst this sounds very simple in principle, the optical system and the high-speed electronics required to obtain good accuracy are extremely complex. Calling on many years' experience designing military Night Vision Goggle (NVG) compatible optics, Aquaread engineers have produced an amazingly small and elegant solution.

Housed in a resin filled, marine grade aluminium body that measures just 8mm (0.3") diameter by 13mm (0.5") long, the fully waterproof AquaPlus Sensor Module contains blue excitation and red reference LEDs, optical filters, a photon detector, temperature sensor, driver circuitry and high gain amplification circuitry.



The nano-engineered AquaPlus™ Sensor Module

The incredibly small size of the Sensor Module allows it to fit comfortably into the end of a standard 12mm diameter DO electrode in place of a traditional Clark Cell. The addition of a replaceable cap containing a lens coated with the luminophore material completes the DO section of the electrode.

The other big **plus** this compact design gives is that it leaves space within the 12mm electrode to include a four ring EC cell. Essential for accurate DO calculation.

## 18.2. Sensor Cap Life

All optical dissolved oxygen sensors work on the same principle, and all must have the sensor cap containing the luminophore replaced periodically due to a phenomenon known as photo bleaching. When a sensor cap is new, the luminophore will return a large number of red photons when excited. As time goes on, a bleaching effect takes place and the number of red photons returned reduces to a point where they are no longer detectable.

The amount of photo bleaching that the luminophore suffers is in direct proportion to the amount of time it is excited by the sensor's blue light source. It therefore follows that the faster a reading can be taken, the less time the luminophore needs to be excited and the longer it will last.

The high-speed circuitry within the AquaPlus™ Probe requires just eleven milliseconds to take a reading. This incredibly fast reading time increases the useful life of the luminophore considerably.

Another technique used to prolong the life of the luminophore in the AquaPlus™ is variable excitation brightness. When the luminophore is new, the brightness of the excitation is reduced to a minimum in order to prevent unnecessary photo bleaching. As the output from the luminophore gradually reduces, the brightness of the excitation is increased in order to squeeze the maximum possible life from the sensor cap.

The combination of low duty cycle and variable excitation brightness can stretch the useful life of a sensor cap as far as several years.



## 19. Appendix 2. DO Flow Through Cell

### 19.1. Introduction

The Aquaread DO Flow Through Cell (DO Flowcell) is designed for use with the AquaPlus™ Probe and most third party pumping device.

The Flowcell allows sample water to flow up through and around the AquaPlus™ Probe, passing over both the DO and EC sensors simultaneously. This eliminates air contact with pumped samples from groundwater boreholes allowing truly representative measurements to be obtained.

Made from marine grade aluminium and tough acrylic, the Flowcell is ruggedly constructed for hard use in the field. The base flange includes four holes to allow the unit to be pegged down if necessary.

### 19.2. Spigot Installation

The DO Flowcell is supplied with two pairs of spigots, one pair to fit 6mm (1/4") ID tube and one pair to fit 10mm (3/8") ID tube.

The spigots have a tapered thread so should be screwed into the inlet and outlet holes of the Flowcell until they are tight. At this point, they should seal due to the taper. If a spigot will not seal properly, remove it then re-insert with some PTFE plumber's tape wrapped around the thread.

### 19.3. AquaPlus™ Probe Installation

Remove the sleeve from the AquaPlus™ Probe and apply a little silicone grease to the thread and O ring.

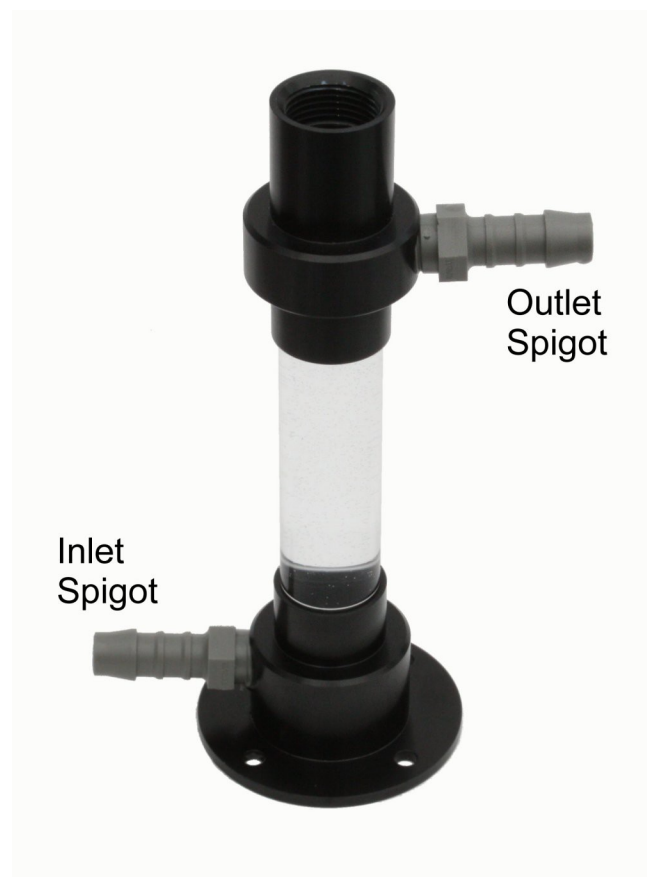
Insert the Probe into the DO Flowcell and screw down tight.

### 19.4. Operation

Connect the Flowcell to a pumping device so that sample water enters at the bottom and exits at the top. Adjust the flow rate so that there is no visible turbulence or cavitation within the Flowcell. Connect an AquaPlus™ Meter and monitor the readings.

If the readings are jumpy or erratic, reduce the flow rate.

Flow rates above 40 litres/hour (10 US gallons/hour) are not recommended.



**19.5. Caution**

The maximum operating pressure of the Flowcell is 300mb (4.4 PSI). Select your pumping device accordingly. If necessary, use a three-way bypass valve so that this limit is not exceeded.

**CAUTION: If you subject the DO Flowcell to excess pumping pressure there is a danger it may explode causing damage and injury.**

As a safety feature, the base of the Flowcell is attached using a flexible adhesive that is designed give way under excess pressure long before there is a risk of the acrylic tube shattering.

**In no event will Aquaread Ltd be liable for any incidental, special, indirect or consequential damages resulting from the misuse of this equipment.**

**19.6. Cleaning**

After use, rinse the Flowcell thoroughly with fresh water. To remove stubborn deposits, scrub the inside of the Flowcell with a bottle brush and non-abrasive detergent, then rinse thoroughly.

**Never clean the Flowcell with solvents or concentrated acid/alkaline based cleaning products such as Decon 90. These products can strip the anodised finish from the Flowcell and damage the plastic and rubber components.**

**19.7. Flowcell Troubleshooting**

<b>Problem</b>	<b>Cause / Remedy</b>
DO or EC readings are abnormally high or are fluctuating wildly.	Aeration of sample water. Check all joints for air leaks. Reduce flow rate to avoid cavitation.
Sample water is leaking from around the top of the Flowcell.	Probe is not screwed in tight enough. Tighten up. Operating pressure is too high. Reduce pressure / flow rate.
Sample water is leaking from around the joints between the tube and end caps.	Operating pressure is too high. Reduce pressure / flow rate.
Flowcell base has become detached.	Operating pressure has been too high. This is a safety feature. Re-attach the base using a smear of silicone sealant and reduce the operating pressure.

## 20. Appendix 3. Probe Hanger

Aquaprobes and AquaPlus Probes can be used with up to 100m of cable.

When using long cable lengths, especially down boreholes, it is advisable to support the Probe on a separate steel cable using a Probe Hanger.

To attach a Probe Hanger to an Aquaread Probe, first remove the cable gland collar (if fitted) then remove the top plastic nut that is attached to the top of the Probe and slide them both a little way up the cable. Ensure the bottom nut is tight against the top of the probe.

Slide the Probe Hanger over the cable then down onto the threaded part of the Probe.

Bring the top nut down onto the thread, then use the Probe Hanger as a spanner to tighten the nut. Re-fit and tighten the cable gland collar. The final assembly should be as shown below (cable gland not shown).



Attach your steel support cable to the Probe Hanger with the snap ring provided.