



Instruction Manual

for the

Aquaprobe® AP-700 & AP-800

Multiparameter Water Quality Probes

and associated

Aquameter®, Utilities & Accessories

Aquaprobe® Software Version 3.53 and Above

Aquameter® Software Version 4.56 and Above

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Aquaread® Ltd

Bridge House
Northdown Industrial Park
Broadstairs
Kent
CT10 3JP
ENGLAND

Phone: +44 1843 600 030
www.aquaread.com

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1. Introduction

This manual covers the setup, operation, calibration and maintenance of the Aquaprobe® AP-700 & AP-800 V3.53+, the Aquameter® V6.00+ Meter, the AquaLink V4.00+ PC software and associated Aquaprobe® accessories. The AP-700/800 will operate with any Aquameters running software revision V3.00 or above, although screen layouts and features may differ from those shown in this document.

2. What's in the Box?

The Aquameter® is supplied with the following:

- The Aquameter® 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 and Probe maintenance.
- Getting started card for quick reference.

The Aquaprobe® is supplied with the following:

- Protective Sleeve End Cap
- Calibration bottle filled with RapidCal Solution.
- Spare calibration / rinse bottle.
- Getting started card for quick reference.
- Spare Galvanic DO Cap
- 25mL bottle of DO filling solution
- 25mL bottle of pH storage solution

2.1. The Aquameter® and the Environment

The Aquameter® 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 socket on the Aquameter® is only waterproof when the associated plug is fitted. Without the plug fitted, water can enter 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 near the top. This is a waterproof vent for the internal barometric sensor. **Do not poke anything in this hole!** Doing so will cause major damage to the vent's waterproof membrane and invalidate your warranty.

2.2. The Aquaprobe® and the Environment

The Aquaprobe® 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.

2.3. Important Information about the Probe Sleeve

The Aquaprobe® is constructed with an aluminium sleeve surrounding the delicate sensing electrodes. The Sleeve can be easily removed by unscrewing to allow cleaning of the individual electrodes, however, **the Probe sleeve forms an integral, working part of the Probe's EC and Turbidity measurement system, and MUST be fitted for correct operation.**

2.4. About the Lanyard

The lanyard supplied with the Aquameter® 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 Aquameter® 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 AM-200 GPS Aquameter®. A fully charged set of 2500mAh NiMH cells will give up to 40 hours use in the AM-200 GPS Aquameter®.

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 Aquameter® 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 Aquameter® 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 Aquameter® 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 Aquameter® 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 **ESC** or **OK** key.

4. Overview of the Operating System

The operating software in the Aquameter® 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 Aquameter® in order to allow normal field operatives (as opposed to trained lab technicians) to achieve quick and accurate results.

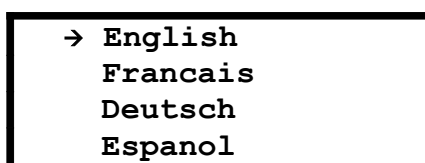
If you are used to operating a mobile phone or programming audio/visual equipment using a remote control, you should feel at home with the familiar up/down left/right arrow shaped navigation keys and central **OK** key.

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

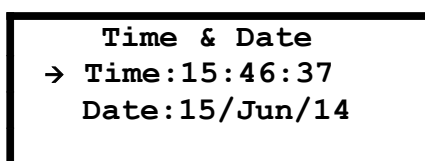
To switch the meter on or off, briefly press the red key. **Do not hold it down.** The meter contains a clock and is capable of operating in several different languages. When switching on for the first time, you must select an operating language and set the clock. The first screen you will see is the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



```
→ English
   Francais
   Deutsch
   Espanol
```

To select a 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.



```
Time & Date
→ Time:15:46:37
   Date:15/Jun/14
```

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 the Aquaprobe®

The Aquaprobe® is designed to connect to the Aquameter® using the built in cable which features a rugged metal connector.



Always ensure the Aquameter® is switched off prior to connecting or disconnecting an Aquaprobe®. Align the ◀Aquaread® logo on the plug body with the red on/off switch on the Aquameter®, then press the plug into the socket and tighten the retaining collar.

DO NOT TWIST THE CONNECTOR BODY WITH RESPECT TO THE METER.

Once the Aquaprobe® is connected to the Aquameter®, switch the Meter on by briefly pressing the red on/off switch. The Aquameter® should detect the Probe and automatically start displaying readings.

5.1. Notes Concerning the Aquaprobe® Cable

Whilst the cable fitted to the Aquaprobe® is reinforced with Kevlar® and is extremely tough, excessive sharp bending and twisting where it enters the probe through the strain-relief gland could result in damage to the outer sheath. **Damage of this kind is not covered by your warranty. You will be charged for cable repair or replacement.**

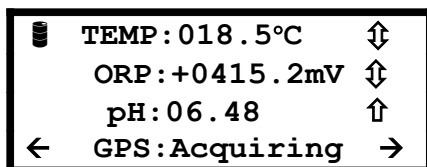
6. Taking Measurements

The Aquaprobe® includes a pH/ORP electrode, which is kept moist by a storage cap. Remove the storage cap by pulling the red lanyard marked 'Remove Before Use / Replace After Use' straight down. **Do not use a twisting motion to remove or replace the cap as this can unscrew the electrode from the Probe body.** Rinse any salty deposits from the pH/ORP electrode with fresh water.

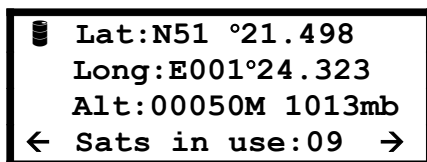
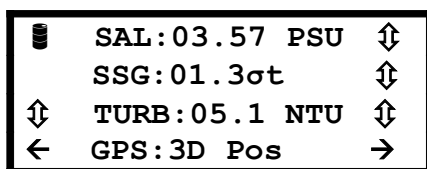
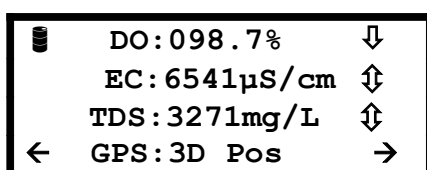
Fit the protective Sleeve End Cap into the end of the Probe sleeve. Switch the Aquameter® on and immerse the Aquaprobe® in the sample water, making sure that the water level covers the minimum immersion depth groove halfway up the Probe sleeve.

TIP: Occasional application of a smear of silicone grease or similar lubricant to the protective Sleeve End Cap O ring and the inside rim of the Probe sleeve will make fitting and removal of the Cap easier.

If the Aquaprobe® is connected correctly, the meter will read the Probe's serial number and model number, then will automatically configure itself to display only those readings the current Aquaprobe® is capable of taking. Initial Probe readings will be displayed on the meter's screen along with the current GPS status. The initial data screen for the GPS Aquameter® in conjunction with the Aquaprobe® is shown below.



Left/right arrows at the bottom corners of the screen indicate further data screens are available. To access these screens, simply press either the left or right arrow keys. Any value that is out of range or unavailable will be displayed as dashes. The other three screens available with the standard AM-200/AP-800 combination are shown below.



6.1. What Does It All Mean?

The screens above show the full default range of readings for the AM-200/AP-800 combination. If you are using an AP-700, the Turbidity value will be replaced by the barometric pressure.

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 7.

The table below explains the screen abbreviations.

Prefix	Meaning	Units
TEMP	Probe Temperature	°C or °F*
pH	pH (Acidity/Alkalinity)	pH or pHmV*
ORP	Oxidation Reduction Potential	mV
GPS	GPS Status	See section 6.5
DO	Dissolved Oxygen	%Sat or mg/L*
EC	Electrical Conductivity	µS/cm or mS/cm [†]
TDS	Total Dissolved Solids	mg/L or g/l [†]
SAL	Salinity	PSU or ppt*

SSG	Sea Water Specific Gravity	σ_t
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 8 [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 $\Omega\cdot\text{cm}$ or $\text{K}\Omega\cdot\text{cm}$, depending on the value. See section 8 [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 stable reading. Readings are judged to be stable when the variation over a ten second period drops below 1%.

6.3. Global Stability Indication

In addition to the individual trend indications, there is a global stability indication, which is displayed when **all** readings are stable. This takes the form of a flashing double headed arrow which is displayed at the start of the third line of the display.

When taking a set of readings, gently stir the Probe, or raise and lower it in the sample (if there is no natural water flow) until the global stability icon appears. The initial display of the global stability icon will be accompanied by a double beep. When this occurs, all values are stable and ready for reading or saving.

6.4. Temperature Compensation

The electrochemical properties of all solutions change with the solution's temperature. 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 Aquaprobe® 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 8 [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.

During calibration of the ORP electrode, the variation in the calibration buffer solution due to temperature is automatically corrected for.

During measurement of ORP however, temperature corrections are not applied as the correction factors are system and chemical dependent and are not easily determined.

ORP potential measurements are mostly made to follow reactions rather than for their own sake. The completion of an ORP reaction is normally accompanied by a sharp change in the ORP millivolts reading.

This change is usually much larger than the errors induced by temperature side effects.

During calibration of the pH electrode, the small variation in the calibration buffer solutions due to temperature is not compensated for due to the differences in thermal coefficient between various buffer manufacturers. For this reason, the two pH points should be calibrated as close to the buffer manufacturer's specified temperature as possible (usually 20°C or 25°C) although a variation of up to +/-10°C makes very little difference in reality.

During pH measurement, temperature variation is automatically compensated for.

6.5. GPS Reception

The GPS version of the Aquameter® (AM-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, the message **GPS:Acquiring** will be shown on the bottom line of all the screens. As soon as three satellites are acquired, two dimensional position (no altitude) will be calculated and the message **GPS:2D POS** will be shown on the bottom line of the screens.

Once a fourth satellite is acquired, altitude will be calculated and **GPS:3D POS** will be shown on the bottom line of 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.

7. Memory Mode

7.1. Manually Saving Readings

When you are happy that the readings are stable (see section 6.3: [Global Stability Indication](#)), 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 Aquameter® and when using AquaLink software.

7.2. 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 along with the date and time the readings were taken shown on the bottom line of the screen.

```
M  TEMP:012.5°C  M
      ORP:0415.2mV
      pH:08.21
02/Apr/13 15:04:01
```

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 will be briefly displayed. 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.

7.3. Recalling GLP Data

Each time a set of readings is added to memory, the date of the last successful calibration of each electrode 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 section 13: [Calibrating EC](#) for further details).

To view the last successful calibration date for each electrode 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.

```
GLP DATA
>pH/ORP
DO/EC
TURB
```

Using the up/down keys, select the electrode you are interested in, then press either the OK key or the right arrow key. If, for instance, you selected pH/ORP, the screen below would be displayed.

```
pH7.00? [31/Jan/13]
pH4.01? [07/Feb/13]
ORP?    [09/Feb/13]
```

This tells you that the last successful calibration, **prior to the recorded reading being taken**, was January 31st for the pH 7.00 point, February 7th for the pH 4.01 point and February 9th for ORP. If the date field is dashed (==/==/==), this means the electrode was either not fitted or had never been calibrated.

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

7.4. Clearing the Memory

The memory within the Aquameter® is capable of storing over 1000 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.

7.5. Automatic Data Logging

If you want to save readings 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.

Readings can be logged for short periods with the Meter permanently displaying readings, or for much longer periods in a Low Power Mode, where the Meter switches itself off between readings in order to extend the battery life.

To activate Automatic Logging, press the **MENU** key. The Main Menu screen will be displayed. Please note, the first item on the menu, 'Clean Probe', will only be active if an Aquaprobe® AP-7000 (which has an automatic cleaning system) is connected.

```
→ Clean Probe
   Auto Data Logging
   Calibration
   Setup & Install
```

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

```
Auto Data Logging

→Interval:10 Mins
   Status:OFF
```

Using the arrow keys to navigate, set the desired logging interval anywhere between 1 and 90 minutes.

To select permanent display logging mode, set the Status to **ON**. To select Low Power logging mode, set the Status to **LOW POWER**.

To activate the selected logging mode, press the **OK** key then revert back to the normal operation screen from the Main Menu by pressing the left arrow key.

To indicate 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.

If permanent display logging mode was selected (Status set to **ON**), the Meter will record a full set of data automatically at the set rate until either the memory is full or the batteries go flat.

If Low Power Logging Mode was selected (Status set to **LOW POWER**), the Meter will switch itself off 30 seconds after your last key-press. Thereafter it will switch back on at the set rate, stay on for 30 seconds, log the data, then switch back off again. This will be repeated until either the memory is full or the batteries go flat.

If you press any key while the Meter is off between readings in low power mode, the Meter will switch back on. If no further key is pressed, the Meter will switch back off again after 30 seconds and resume Low Power Mode.

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 manually.

7.6. Battery and Memory Duration in Low Power Logging Mode

Low Power Logging Mode is specifically designed for long term data logging. In order to estimate battery life and memory usage, the following table can be used.

The battery life figures quoted below are based on fresh, good quality alkaline batteries at a Meter temperature of 21°C or over. Colder Meter temperatures will drastically reduce the battery life. For example, at 5°C, the battery life will be approximately half that quoted.

Logging Rate	Battery Life (at 21°C)	Memory Duration
90 mins	38 Days	66 Days
60 mins	36 Days	44 Days
45 mins	34 Days	33 Days
30 mins	30 Days	22 Days
15 mins	20 Days	11 Days
5 mins	10 Days	3.6 Days
1 min	2 Days	17 Hours

So, it can be seen that although the Meter has a maximum data capacity of 66 days, for logging rates above 45 minutes, fresh batteries would need to be fitted after approximately one month in order to make use of the Meter's full memory capacity.

Conversely, logging rates below 45 minutes will fill the Meter's memory on a single set of batteries (at 21°C or greater).

Useful Tip: If you want GPS data logged in association with your other data, ensure the Meter is positioned face up with a clear view of the sky.

7.7. 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 Dissolved Oxygen in %Saturation, then when you got back you really want to see Dissolved Oxygen displayed in mg/L, you can do this by simply changing the Meter settings (see section 8 [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 far more parameters than can be displayed at any one time.

The same rules apply when data is output to a PC running AquaLink 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.

8. Setup & Install

To alter the way the Aquameter® displays readings, press the **MENU** key to get to the Main Menu, then choose **Setup & Install**. The Settings Menu will be displayed. Please note, the 'Socket Assignment' option on this screen is for use with AP-2000 probes and above.

```
→ Time & Date
Units
Language
Socket Assignment
```

8.1. Setting Units of Measurement

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
→ DO/EC/TDS
TEMP/pH/ORP/SAL
BARO/Alt & Depth
```

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

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

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

On this screen you can adjust the DO: setting between %Sat and mg/L. This will set the Meter to display Dissolved Oxygen as either % Saturation or in milligrams/Litre (which is the same as parts per million). Both readings are automatically corrected for atmospheric pressure, sample temperature and sample salinity.

The second 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].

Finally, this screen allows you to set the factor that the Meter uses to calculate Total Dissolved Solids from Specific EC. This is the TDS Fact: ($TDS = EC \times TDS \text{ Fact}$) 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.

```
Units
→ TEMP:°C
    pH:pH
    SAL:PSU
```

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

The second option allows you to change the pH display between plain pH and pHmV. Plain pH displays normal, temperature compensated pH values in the range 0 - 14.

pHmV displays the actual voltage being generated by the pH electrode in +/- millivolts (mV) over a range of +/- 625mV. This is not temperature compensated.

The last option on this screen 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.

```
Units
→ BARO:mb
    ALT:Metres
```

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

The second line allows you to choose between displaying altitude in metres (M) or feet (F). Altitude is displayed with respect to mean sea level.

9. RapidCal Calibration Method

9.1. 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 Aquameter® in order to allow normal field operatives (as opposed to trained lab technicians) to achieve quick and accurate results.

As a general rule, pH and EC should be calibrated as close to 25°C as possible. Turbidity electrodes should be calibrated as close to their deployment temperature as possible.

In order to standardise calibration techniques, Aquaread® provide plastic calibration bottles into which the Aquaprobe® can be directly inserted. The Aquaprobe® is designed to be calibrated in these calibration bottles **with the Probe Sleeve fitted. If you are using an AP-800, the Sleeve End Cap must also be fitted.**

The Probe Sleeve and Sleeve End Cap form an integral, working part of the Probe's measurement system, and MUST be fitted during calibration and measurement for correct operation.

9.2. Using RapidCal

RapidCal is an easy way to calibrate the Aquaprobe® in the field using just one calibration solution. RapidCal calibrates EC at 2570µS/cm, the pH7.00 point and the Turbidity Electrode Zero point (AP-800 only) simultaneously. Ideally, this procedure should be carried out at the beginning of each day the Probe is to be used. To use RapidCal:

1. Remove the lid from a fresh bottle of RapidCal solution, remove the storage cap from the pH electrode if fitted, wash the Probe in distilled water, then drop the Probe in all the way. Bang the Probe against the bottom of the bottle several times in order to remove any air bubbles that may be clinging to the electrodes.
2. When the Probe is inserted, **ensure the level of the solution is right up to the neck of the bottle.** If the level is low, the EC electrodes will not be covered and EC will not calibrate properly. If the level is low, top up with fresh RapidCal solution.
3. Switch the Aquameter® on and wait until all readings 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). The closer to 25°C the better.
5. Press the **MENU** key then select **Calibration**. The following screen will be displayed.

<p>Calibration → RapidCal DO 100% Full Cal</p>
--



6. Select **RapidCal**. The screen will change to:

PLEASE WAIT
Stabilising
000%

The Meter will wait until all readings are stable, then it will send the RapidCal 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.

Calibrating
100%
Press [OK]

When calibration is complete, press **OK** then **ESC** to return to normal reading mode.

Now the DO 100% saturation point should be calibrated in damp air.

To Calibrate the 100% Saturation Point in Damp Air

1. After calibrating with RapidCal, remove the Probe from the bottle, wash in fresh water, then shake off ensuring there are no droplets adhering to the DO membrane.
2. Moisten a clean cloth or piece of tissue paper with fresh water and wrap it around the open end of the probe ensuring all the holes are covered. Place the probe on a flat surface. Do not hold the probe, the heat from your hands will warm the probe up and interfere with calibration.
3. Wait until the temperature measurement is **completely stable. This is very important.**
4. Referring back to the screen shown in item 5 above, select **DO 100%**.
5. Wait while the Aquameter® carries out the calibration procedure.
6. When the 'Calibrating 100%' screen (shown above) is displayed, press OK then ESC repeatedly to return to normal reading mode.



9.3. Calibration Error Messages

If the Aquameter® detects a problem with either the Aquaprobe® or the calibration solution during the calibration procedure, an error will be indicated. The chart below shows the possible errors and how to correct them.

Error Message	Problem	Action
BATTERIES TOO LOW	Battery Voltage is too low for reliable calibration	Replace the batteries
NO PROBE RESPONSE	The Probe is not responding	Check connections / cycle power
READINGS UNSTABLE	Readings did not stabilise within the expected period	Top up / replace the RapidCal Allow longer for stabilisation.
OUT OF CAL RANGE	Readings are outside calibration limits (can be caused by low level / incorrect calibration solution). Or the Probe Sleeve is not fitted	Top up / check calibration solution is correct type. Ensure the Probe Sleeve is fitted
OUT OF TEMP RANGE	Temperature is outside 5°C – 40°C limit	Warm / cool the RapidCal
CAL ZERO FIRST	You are trying to calibrate an upper calibration point on the turbidity electrode without first calibrating the zero point in the current session.	Calibrate the zero point first, then without switching the Aquameter off, calibrate the upper points.

If the corrective actions shown above for 'READINGS UNSTABLE' or 'OUT OF CAL RANGE' errors do not work, thoroughly clean the Probe and try again. If the 'OUT OF CAL RANGE' error persists, reset the calibration values to Factory Defaults then try again.

If the 'OUT OF CAL RANGE' error persists when calibrating EC, check you are using the correct EC Calibration Standard and that the Probe Sleeve is fitted and tight.

If the 'OUT OF CAL RANGE' error persists when calibrating pH, check you are using the correct pH Calibration Standard for the calibration point selected.

Remember: **The Probe sleeve forms an integral, working part of the Probe's 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.**

9.4. 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
→ RapidCal
   DO 100%
   Full Cal
```

Select Full Cal. This will give you a choice of electrodes:

```
Calibration
→ pH/ORP
   DO/EC
   TURB
```

Move the cursor arrow to the electrode you want to reset, then 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 the electrode in question.

9.5. Calibration Data Storage

The Aquaprobe® 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.

9.6. Calibration Reports

At the conclusion of each successful individual electrode calibration, a single line Calibration Report is displayed. This report contains the raw output of the electrode under calibration, uncorrected for temperature.

These values can be recorded and used to track the performance and ageing of the individual electrodes. Please note however, in order to maximise the value of this feature, all calibrations must be performed at the same temperature otherwise the recorded values will not be comparable over time.

No calibration report is generated when using RapidCal.

10. After Use

The Aquaprobe® should always be cleaned after every use.

The Sleeve on the Aquaprobe® can be removed by unscrewing to allow cleaning of the individual electrodes. After every use, remove the protective Sleeve End Cap then unscrew the sleeve. With the Sleeve removed, the individual electrodes are very vulnerable, so please handle the Probe with extreme care. If you drop it, it's going to break!

Rinse the exposed electrodes, the inside of the Sleeve and the Sleeve End Cap with fresh, clean water. Shake the water from inside the Sleeve, then reattach. Dry the outside of the Probe using a soft cloth.

Remember to replace the pH/ORP storage cap after use. Failure to do so will damage the electrode. For more details, see [Keeping the Electrodes Moist](#) in section 11.

Never clean 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.

Store the Probe without the protective Sleeve End Cap fitted in order to allow free air circulation around the individual electrodes.

TIP: Occasional application of a smear of silicone grease or similar lubricant to the connector O-rings and thread, Sleeve thread, the protective Sleeve End Cap O-ring and the inside rim of the lower Probe Sleeve will make fitting and removal of these parts easier.

10.1. General Probe Maintenance

Other than regular cleaning and calibration, very little in the way of maintenance is needed.

11. pH/ORP Electrode Calibration and Maintenance

11.1. Recognising the pH/ORP Electrode

The combined pH/ORP electrode is easy to recognise because it is the only electrode that is not black. This electrode has a clear, gel filled body.

11.2. Electrode Removal and Replacement

The pH/ORP electrode can be unscrewed from the Probe body by rotating it anti-clockwise. When replacing an electrode, apply a little silicone grease or similar lubricant to the thread and O ring, then screw fully in.

Gripping the black collar at the top of the electrode, tighten until the O ring is fully compressed. **Do not twist the clear section of the electrode whilst tightening.**

Useful Tip: The red lanyard that is attached to the pH/ORP storage cap makes a very useful belt wrench for tightening and loosening the pH/ORP electrode.



Slide the lanyard over the electrode and use it to grip the knurled body.

Never immerse an Aquaprobe® with the pH/ORP electrode removed. This will cause serious damage to the electrode socket. **This is not covered by your warranty.**

11.3. Keeping the Electrodes Moist

It is very important that the pH/ORP electrode is kept moist when not in use. This is achieved by always fitting the storage cap, which incorporates a sponge that should be soaked in a special storage solution.

The sponge within the storage cap should be moistened with a few drops of pH Electrode Storage Solution each time it is removed and replaced. If a pH/ORP electrode is inadvertently allowed to dry out, it must be re-hydrated by soaking in storage solution for at least one hour prior to use.

11.4. Calibrating pH

pH electrodes should be calibrated fully at least once a week to ensure optimum accuracy. Full calibration involves calibrating at pH 7.00 first, then at pH 4.01. Although the AP-700/800 allows only two point pH calibration, the pH electrodes are extremely linear and once calibrated, will read accurately over the full range of 0 – 14.

Due to the way in which pH calibration works, **the Probe must be calibrated at pH7.00 before calibrating at pH 4.01.** Never calibrate at pH 4.01 before first calibrating at pH7.00.

For best results, calibrate as close to 25°C as possible.

To calibrate the pH electrode follow these steps:

1. Fill a calibration bottle with fresh pH 7.00 solution or RapidCal, remove the storage cap from the pH electrode, wash the Probe in distilled water, then drop the Probe in all the way.
2. Switch the Aquameter® on and wait until the temperature and pH measurements are completely stable.
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.

```
Calibration
→ RapidCal
DO 100%
Full Cal
```

5. Select **Full Cal**. The screen will change to:

```
Calibration
→ pH/ORP
DO/EC
TURB
```

6. Select **pH/ORP**. The screen will change to:

```
→ pH7.00? [01/Jan/12]
pH4.01? [01/Jan/12]
ORP? [01/Jan/12]
```

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

7. Select pH7.00. The screen will change to:

```
PLEASE WAIT
Stabilising
000%
```

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.

```
Offset: -1.2mV
Calibrating
100%
Press [OK]
```

The top line displays the voltage offset from zero for the pH electrode in +/-millivolts (mV). If this offset goes beyond +/-25mV at 25°C, the pH electrode should be serviced.

This value is not stored in memory so should be noted down in a calibration record book for the Probe. When the offset voltage details have been noted down, press **OK** then **ESC** repeatedly to return to normal reading mode.

Remove the Probe from the calibration bottle, rinse thoroughly in de-ionised water, shake off any excess and dry the outer sleeve with a soft cloth.

11.4.1. Calibrating the Second Point

The pH electrode should now be calibrated at pH 4.01. To calibrate the second point, fill a calibration bottle with fresh pH 4.01 solution and drop the Probe in all the way.

Follow the procedure detailed above, but at step 6, select pH4.01. Wait while the Meter stabilises and calibrates.

When the 'Calibrating 100%' screen is displayed, the calibration report will display the slope for the pH electrode in millivolts (mV) per pH unit. If this slope goes below 45mV/pH at 25°C, the pH electrode should be serviced.

Press **OK** then press the **ESC** key repeatedly to get back to the main display.

Remove the Probe from the calibration bottle, rinse thoroughly in fresh water, shake off any excess and dry the outer sleeve with a soft cloth.

11.5. Errors During Calibration

If a problem occurs during calibration, an error message will be displayed. Refer to [Calibration Error Messages](#) in section 9 for error message handling.

11.6. pH Electrode Efficiency

If the pH electrode becomes worn or clogged, its efficiency and response time can be reduced. The efficiency of the pH electrode is constantly monitored and in the event of the efficiency dropping below 85%, 'ERROR 01' will be flashed on the bottom line of the display. If this occurs, or if the pH reading response becomes slow, recondition the electrode as described below.

11.7. Servicing the pH Electrode

1. Remove the pH or combined pH/ORP electrode from the Probe body (see [Electrode Removal and Replacement](#)).
2. Rinse with methyl alcohol.
3. Replace the electrode.
4. Re-calibrate.

Never place the entire Aquaprobe® in methyl alcohol, as this will cause irreparable damage to the DO and EC electrodes. Damaged caused in this way is not covered by the warranty.

If the methyl alcohol rinse does not restore the electrode, perform the following actions:

1. Remove the electrode from the body again.
2. Soak in 0.1M HCl for 5 minutes.
3. Rinse in de-ionised water.
4. Soak in 0.1M NaOH for 5 minutes.
5. Rinse in de-ionised water.
6. Soak in pH4.01 buffer for 10 minutes.

If the above procedure still does not restore performance, replace the electrode.

11.8. Calibrating ORP

ORP electrodes should be calibrated at least once a month to ensure optimum accuracy. Full calibration involves calibrating at a single point, (250mV at 25°C) using a 250mV ORP calibration standard such as **Reagecon RS250 Redox Standard**, or similar.

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

To calibrate the ORP electrode follow these steps:

1. Fill a calibration bottle with fresh calibration solution, remove the storage cap from the pH/ORP electrode, wash the Probe in distilled water, then drop the Probe in all the way.
2. Switch the Aquameter® on and wait until the temperature and ORP measurements are completely stable.
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.

```
Calibration
→ RapidCal
   DO 100%
   Full Cal
```

5. Select **Full Cal**. The screen will change to:

```
Calibration
→ pH/ORP
   DO/EC
   TURB
```

6. Select **pH/ORP**. The screen will change to:

```
→ pH7.00? [01/Jan/12]
   pH4.01? [01/Jan/12]
   ORP?   [01/Jan/12]
```

7. Select ORP. The screen will change to:

<p>PLEASE WAIT Stabilising 000%</p>

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.

<p>Offset: 5.5mV Calibrating 100% Press [OK]</p>
--

The Calibration Report on the top line displays the voltage offset between the ORP electrode output and the value of the calibration solution at the calibration temperature in +/-millivolts (mV). During normal operation this offset will be subtracted from the ORP electrode output to give a corrected ORP display.

This value is not stored in memory so should be noted down in a calibration record book for the probe. When calibration is complete, press the **OK** key then the **ESC** key repeatedly to return to normal operating mode.

Remove the Probe from the calibration bottle, rinse thoroughly in fresh water, shake off any excess and dry the outer sleeve with a soft cloth. Dampen the sponge in the storage cap with storage solution and fit it to the pH/ORP electrode. ORP calibration is now complete.

11.9. Converting ORP Readings to the Hydrogen Scale

Electrochemical measurements are ultimately referred to the so-called hydrogen scale, the convention for which is that the electrochemical potential of a hydrogen electrode in contact with hydrogen gas at one atmosphere partial pressure and a solution containing hydrogen ions at unit activity is zero at all temperatures.

The ORP reference electrode used in Aquaread® combination electrodes is a 3MPK1 silver chloride type, and exhibits potentials on the hydrogen scale of:

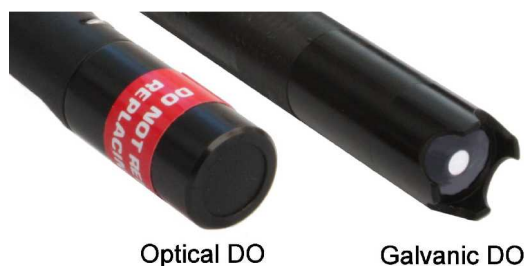
Temperature	Potential
5°C	221 mV
10°C	217 mV
15°C	214 mV
20°C	210 mV
25°C	207 mV
30°C	203 mV
35°C	200 mV
40°C	196 mV

Thus, to refer an ORP potential value measured with the Aquaprobe® to the hydrogen scale, the appropriate value above should be added to the measured value.

12. DO Electrode Calibration and Maintenance

12.1. Recognising the DO Electrode Type

Your AP-700/800 may be fitted with either an Optical DO or Galvanic DO electrode. Refer to the photograph on the right to identify your DO electrode type. If your Aquaprobe features an Optical DO electrode, skip to section 12.6.



12.2. Galvanic DO Electrode

The Galvanic DO electrode consists of an electrolyte filled DO sensor cap with a clear, gas-permeable membrane stretched across a silver electrode.

12.3. Precautions During Use

In order to achieve accurate Dissolved Oxygen readings with the Galvanic DO electrode, the Probe needs to be either placed in flowing water, or needs to be stirred or raised and lowered continuously to ensure a minimum flow rate of 0.3m/s over the DO Electrode. **If there is no water flow across the Probe, the oxygen in the immediate area of the DO Electrode will be consumed and the reading will start to fall.**

12.4. Calibrating the Galvanic DO Electrode

The DO 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 recalibrated 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.

12.4.1. Calibrating the DO Zero Point

1. Remove the lid from a 150mL bottle of DO Zero calibration solution, remove the storage cap from the pH electrode if fitted, wash the Probe in distilled water, then drop the Probe in all the way.
2. Switch the Aquameter® on and wait until the DO reading is completely stable.
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.

```

Calibration
→ RapidCal
   DO 100%
   Full Cal
  
```

5. Select **Full Cal**. The screen will change to:

```

Calibration
→ pH/ORP
   DO/EC
   TURB
  
```

6. Select **DO/EC**. The screen will change to:

Calibration
→ DOZero? [01/Jan/12]
DO100%? [01/Jan/12]
EC2570? [01/Jan/12]

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

7. Select DOZero. The screen will change to:

PLEASE WAIT
Stabilising
000%

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.

Output:0.4
Calibrating
100%
Press [OK]

The Calibration Report on the top line will display the voltage output from the DO cell in millivolts (mV). This value should be between 0.0 and 3.0 (at 25°C). If the value returned is more than 3.0, the DO Cap should be replaced.

This value is not stored in memory so should be noted down in a calibration record book for the probe. When the Cell offset voltage details have been noted down, 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 Messages](#) in section 9 for error message handling. If the 'OUT OF CAL RANGE' error persists when calibrating the DO sensor, replace the DO Electrode Membrane Cap.

Remove the Probe from the calibration bottle, rinse thoroughly in fresh water, shake off any excess and dry the outer sleeve with a soft cloth.

12.4.2. Calibrating the DO 100% Saturation Point in Moist Air

1. Wash the probe thoroughly in fresh water, then shake off ensuring there are no droplets adhering to the DO membrane.

2. Moisten a clean cloth or piece of tissue paper with fresh water and wrap it around the open end of the probe ensuring all the holes are covered. Place the probe on a flat surface. Do not hold the probe, the heat from your hands will warm the probe up and interfere with calibration.
3. Switch the Aquameter® on and wait until the temperature measurement is **completely stable. This is very important.**
4. Referring back to the screens shown in items 4 or 6 above (dependent on software version), select **DO100%**
5. Wait while the Aquameter® carries out the calibration procedure.
6. When calibration is complete, the Calibration Report will be displayed.

The top line will display the voltage output from the DO cell in millivolts (mV). This value should be over 20.0 (at 25°C). If the value returned is less than 20.0, the DO Cap should be replaced.

These values are not stored in memory so should be noted down in a calibration record book for the probe. If a problem occurs during calibration, an error message will be displayed. Refer to [Calibration Error Messages](#) in section 9 for error message handling.

12.5. Replacing a Galvanic DO Electrode Membrane Cap

The Galvanic DO electrode membrane is a very thin sheet of special plastic, which is permeable to oxygen. Oxygen molecules pass through this membrane into the Oxygen sensor. The membrane is extremely delicate and is factory fitted into the DO Membrane Cap. To ensure optimum performance, the DO Membrane Cap must be replaced every 1-2 months.

Never touch the plastic membrane as the oils in your skin will block the pores in the membrane and stop it from working correctly.

To replace the DO Membrane Cap, follow these simple steps.

1. Remove the Probe sleeve.
2. Unscrew the DO Cap from the end of the DO electrode by rotating it anti-clockwise.
3. Gently brush away any scaly grey deposits from the zinc shaft of the electrode with a soft toothbrush, taking care not to damage the electrode in the process.
4. After removing the deposits, rinse the electrode with DO Electrode Filling Solution.
5. Rinse a new DO Membrane Cap with DO Electrode Filling Solution then tap it out so that it is completely empty.
6. Using the DO Electrode Filling Solution dropper bottle, half fill the DO Membrane Cap. Gently tap the cap to ensure any trapped air bubbles are released.
7. Holding the Probe so that the DO electrode is facing downwards, **slowly** screw the half-filled DO Membrane Cap back onto the DO electrode then tighten the cap. **Do not over-tighten.** Finger tight is fine. Some solution will overflow. This is normal.
8. Wash the DO electrode with fresh water then replace the lower Probe sleeve.
9. Wait at least six hours (preferably over-night) to allow any oxygen dissolved in the filling solution to be consumed.
10. Carry out both Zero point and 100% point DO calibration as described earlier.



NEVER re-install a Galvanic DO Membrane Cap once it has been fully tightened. The membrane will be stretched and will not seal properly over the silver cathode a second time. If the membrane does not create a proper seal over the silver cathode, the DO sensor will not operate correctly and any readings given will be erroneous.

12.6. Optical DO Electrode

If your AP-700/800 is fitted with an Optical DO electrode, the following sections apply.

Unlike the Galvanic DO electrode, the Optical DO electrode does not consume oxygen during operation so does not require a constant flow of water or stirring.

12.7. Calibrating the Optical DO Electrode

The DO 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.

12.8. Calibrating the DO Zero Point

1. Remove the lid from a 150mL bottle of DO Zero calibration solution, remove the storage cap from the pH electrode if fitted, wash the Probe in distilled water, then drop the Probe in all the way.
2. Switch the Aquameter® on and wait until the DO reading is completely stable.
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.

```
Calibration
→ RapidCal
  DO 100%
  Full Cal
```

5. Select **Full Cal**. The screen will change to:

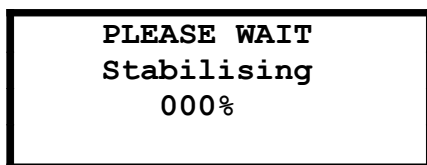
```
Calibration
→ pH/ORP
  DO/EC
  Aux Electrodes
```

6. Select **DO/EC**. The screen will change to:

```
Calibration
→ DOZero? [01/Jan/12]
  DO100%? [01/Jan/12]
  EC2570? [01/Jan/12]
```

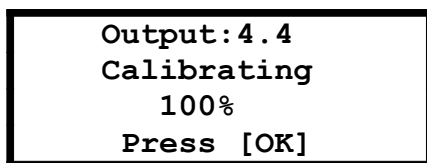
The dates shown to the right of the screen are the dates of the last successful calibration.

7. Select DOZero. The screen will change to:



PLEASE WAIT
Stabilising
000%

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.



Output: 4.4
Calibrating
100%
Press [OK]

The top line will display a value which represents the health of the luminophore. This value should be between 3.5 and 4.5 (at 25°C). If the value returned is less than 3.5, the Optical DO Cap should be replaced.

This value is not stored in memory so should be noted down in a calibration record book for the probe. When the Cell offset voltage details have been noted down, 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 Messages](#) in section 10 for error message handling.

Remove the Probe from the calibration bottle, rinse thoroughly in fresh water, shake off any excess and dry the outer sleeve with a soft cloth.

12.9. Calibrating the DO 100% Saturation Point in Moist Air

1. Wash the probe thoroughly in fresh water, then shake off ensuring there are no droplets adhering to the DO membrane.
2. Moisten a clean cloth or piece of tissue paper with fresh water and wrap it around the open end of the probe ensuring all the holes are covered. Place the probe on a flat surface. Do not hold the probe, the heat from your hands will warm the probe up and interfere with calibration.
3. Switch the Aquameter® on and wait until the temperature measurement is **completely stable. This is very important.**
4. Referring back to the screens shown in items 4 or 6 above (dependent on software version), select **DO100%**
5. Wait while the Aquameter® carries out the calibration procedure.
6. When calibration is complete, the Calibration Report will be displayed.

The top line will display a value which represents the health of the luminophore. This value should be between 0.8 and 1.5 (at 25°C). If the value returned is less than 0.8, the Optical DO Cap should be replaced. These values are not stored in memory so should be noted down in a calibration record book for the probe.

If a problem occurs during calibration, an error message will be displayed. Refer to [Calibration Error Messages](#) in section 10 for error message handling.

12.10. Replacing the Optical DO Cap

The Optical 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 need replacing every few years, as it is a consumable item. Since the luminophore is an integral part of the DO Cap, the entire DO Cap is replaced. An Optical DO Cap can last up to ten years dependent upon the amount of use it gets.

Caution: The inside of the Optical 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 Optical DO Cap from the Probe unless you intend to replace it with a new one.** When replacing an Optical DO Cap, do so under subdued light.

To replace the Optical DO Cap, follow these simple steps.

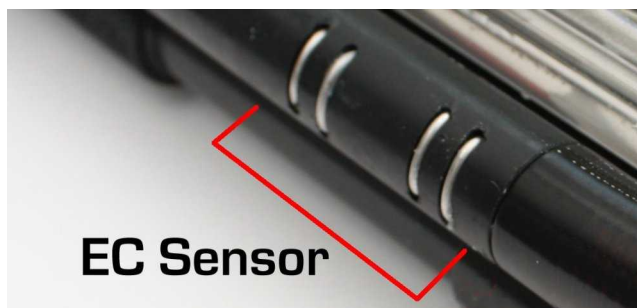
1. Remove the Probe sleeve.
2. Unscrew the Optical DO Cap from the end of the DO/EC electrode by rotating it anti-clockwise. **Do not touch the exposed optical components.**
3. Apply a light smear of silicone grease to the thread and O ring.
4. Remove the new Optical DO Cap from its light-proof bag and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

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

13. EC Electrode Calibration and Maintenance

13.1. Recognising the EC Sensor

The EC electrode is easy to recognise because it has and four stainless-steel contacts on the side which, in conjunction with the sleeve, form the EC sensor (or cell). Temperature is also measured in the EC electrode. The temperature sensor is located in the aluminium tip.



13.2. Calibrating EC

Calibration of the EC electrode is normally carried out during RapidCal (see [RapidCal Calibration Method](#)). EC can also be calibrated separately using different EC Calibration Standards.

EC calibration is always carried out at a single point. There is a choice of three single points. These are: 1413 μ S/cm, 2570 μ S/cm (using Aquaread® RapidCal solution) and 12,880 μ S/cm. These values have been chosen to allow accurate readings to be taken in a variety of water types.

For taking measurements in fresh surface or ground water, use Aquaread® RapidCal solution. If this is not available, use a third party 1413 μ S/cm EC Calibration Standard. For taking readings in brackish or salt water, use a third party 12,880 μ S/cm (12.88mS/cm) EC Calibration Standard.

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 the 'OUT OF CAL RANGE' error message.

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

1. Remove the storage cap from the pH electrode if fitted, wash the Probe in distilled water, then drop the Probe into a calibration bottle filled with your chosen EC Calibration Standard.
2. **Ensure the liquid level is all the way up to the neck of the bottle. Low liquid level will result in erroneous EC calibration.**
3. Switch the Aquameter® on and wait until the temperature and EC measurements are completely stable.
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
→ RapidCal
DO 100%
Full Cal
```

6. Select **Full Cal**. The screen will change to:

```
Calibration
→ pH/ORP
DO/EC
TURB
```

7. Select **DO/EC**. The screen will change to:

```
Calibration
→ DOZero? [01/Jan/12]
DO100%? [01/Jan/12]
EC2570? [01/Jan/12]
```

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.

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

```
Calibration
DOZero? [01/Jan/12]
DO100%? [01/Jan/12]
→ EC2570? [01/Jan/12]
```

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/Jan/12]
DO100%? [01/Jan/12]
EC→2570? [01/Jan/12]
```

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

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

PLEASE WAIT
Stabilising
000%

10. If the calibration is successful, the counter will reach 100% and the following screen will be displayed.

Cell constant:0.98
Calibrating
100%
Press [OK]

The Calibration Report on the top line displays the EC Cell Constant. This value is not stored in memory so should be noted down in a calibration record book for the probe.

When the cell constant details have been noted down, press **OK** then **ESC** repeatedly to return to normal reading mode.

Special Notes:

- If you have selected a Calibration Standard value other than 2570 (RapidCal), then you subsequently use the RapidCal calibration technique described in section 9, the Calibration Standard value will automatically be reset to 2570.
- 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.

13.3. Verifying EC Calibration

Due to the fact that debris and air bubbles can adversely affect EC calibration, it is advisable to verify calibration has been properly achieved. To do this, follow item nine above with this procedure.

1. Remove the probe from the calibration bottle, shake it off, then reinsert.
2. Press the **ESC** key repeatedly to get back to the Main Menu.
3. Go into settings and make sure EC is set to read with reference to 25°C. If it's not, set it that way. See section 8 [Setting Units of Measurement](#).
4. Go back to the main screen, wait until the temperature and EC readings are stable, then check that the EC is reading +/- 1% of the Calibration Standard value.
5. If the EC reading is outside the 1% limit, recalibrate, this time leaving more time for stabilisation.

If you can not successfully verify the EC calibration after several attempts, replace the Calibration Standard. If the problem persists, strip the probe down as described below and thoroughly clean the EC contacts.

13.4. 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, the 'OUT OF CAL RANGE' error will be reported. If any other problems occur during calibration, an error message will be displayed. Refer to [Calibration Error Messages](#) in section 9 for error message handling.

13.5. Cleaning the EC Contacts

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

14. Turbidity Electrode Calibration and Maintenance (AP-800 Only)

14.1. About the Turbidity Electrode

The Turbidity electrode employs a Nephelometric technique in accordance with ISO 7027, which uses Formazin as a reference standard. The Aquameter® displays turbidity in Nephelometric Turbidity Units (NTU) which are nominally equivalent to Formazin Turbidity Units (FTU).

Turbidity can be calibrated with either Formazin Turbidity Standards or Suspended Polymer Turbidity Standards, depending upon your preferred turbidity reference. Be aware, these two standards will give very different results. Factory calibration is carried out with a 1000 NTU Stabilised Formazin Turbidity Standard in accordance with ISO 7027.

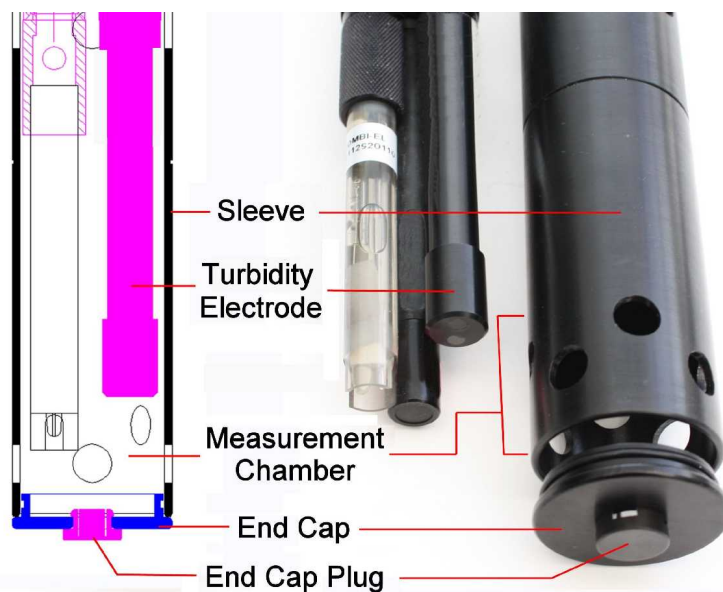
The Aquaread® Turbidity Electrode is incredibly sensitive and is capable of measuring between 0 and 3000NTU with an internal resolution of greater than 0.1NTU. This means that the electrode is able to detect changes in turbidity that are less than 0.003% of the full range!

It follows, therefore, that in order to provide stable, repeatable readings, the environment in which the measurements are made must be completely stable and repeatable.

For this reason, the Aquaprobe® is constructed with a matt black aluminium sleeve and end cap that enclose the sensing electrodes and provide a closed, constant condition, non reflective measurement chamber.

This is essential for the correct calibration and operation of the Turbidity electrode.

A diagram of the Aquaprobe's measurement chamber is shown here.



Please note: Later model End Caps have a 3mm central hole and do not require an End Cap Plug.

In order to obtain consistent results, the measurement chamber created within the Aquaprobe® must remain physically constant during both calibration and measurement.

If the Turbidity electrode is calibrated under one set of conditions then used to measure under another set of conditions, the readings will naturally be erroneous, especially at low turbidity levels.

A perfect example of this is calibrating with the end cap removed then measuring with the end cap fitted (or vice-versa). By changing the physical characteristics of the measurement chamber, you also change the calibration and response of the electrode.

Another particular problem when trying to measure very low concentrations is air in the form of both visible and microscopic bubbles.

These act like tiny prisms and can refract and reflect both the excitation light and the return signal being measured.

The photograph to the right was taken in a calibration bottle after fresh water was poured in. The bubbles are clearly visible in the light beam.



This level of aeration will register the equivalent of around 5NTU as each bubble is seen as a solid particle.

14.2. Top Tips for Successful Turbidity Measurement

- Always keep the measurement chamber and electrode lenses clean.
- Always fit the sleeve and end cap during both calibration and measurement.
- Always allow the readings to settle completely during both calibration and measurement.
- Always try to eliminate air bubbles by agitating the Probe after insertion both during calibration and measurement.
- Always calibrate and zero the electrode as close to your sample temperature as possible.
- Always zero the turbidity electrode just prior to use in clean water (bottled still mineral water is ideal) then deploy **without disturbing the measurement chamber**.

14.3. Turbidity Electrode Calibration Sequence

When calibrating the turbidity electrode, **the Zero point must be calibrated first.**

If you are performing a two or three point calibration, all calibration points must be calibrated within the same calibration session (i.e. without turning the Aquameter® off or disconnecting the Aquaprobe).

If you attempt to calibrate the 20NTU or 1000NTU point without first calibrating the ZERO point, a calibration error will occur.

14.4. About Turbidity

Turbidity is a measurement of the light scattering properties of solids suspended within a liquid and is therefore an **indirect** measurement of clarity. Turbidity is not a direct measurement of suspended solids, clarity or colour.

Particle size relative to the wavelength of the transmitted light, particle shape and refractive index modify the distribution of scattered light. Sample colour, (particularly dark colours) can also reduce a certain portion of the scattered light by varying degrees.

Combined, these effects result in wide variability in the distribution and intensity of light scattering from a turbid water sample. As a result, different combinations of particle shape, size, colour and refractive index can produce similar turbidity effects.

By contrast, changing only the incident light wavelength and detector distance can dramatically change the measured turbidity of a given sample. As a result, different model sensors from different manufacturers can measure different turbidity values for the same sample. This highlights the qualitative nature of turbidity measurements.

Integrated monitoring programs, where turbidity measurements from different locations are to be compared, **must** use a single model of sensor and maintain a strict QA and calibration program to accurately characterise, compare, and interpret observed turbidity values.

14.4.1. Precautions During Use

In common with all other submersion type Turbidity Probes, air bubbles and stray reflections can be a problem when trying to measure low turbidity values. In order to avoid air bubbles, keep the Turbidity electrode clean, and agitate the Probe after submersion to dislodge any air bubbles which may be clinging to the lenses. In order to maintain a common reflective pattern between calibration and use, **always calibrate and measure turbidity with the protective Sleeve End Cap fitted.**

14.4.2. Negative Turbidity Readings

When a Probe is deployed in clean/clear water and negative turbidity readings occur, the cause is usually an erroneous zero point calibration, caused either by contaminated calibration solution, aeration or changes in the measurement chamber between zeroing and deployment.

It follows that if the Probe has been zeroed in a solution that has a turbidity greater than true zero, subsequent measurements taken in a less turbid sample will be displayed as negative. If you experience negative turbidity readings, thoroughly clean the Probe then re-zero in completely clean water. Still, bottled mineral water is recommended for zeroing the electrode as it is cheap and readily available. **Never use sparkling or carbonated water.**

If you still experience negative turbidity readings and you are certain that your zero calibration solution is completely clear water, the problem is almost certainly aeration, i.e. air in the form of both visible and microscopic bubbles. These act like tiny prisms and can refract and reflect both the excitation light and the return signal being measured.

If your zero calibration water is aerated, allow it to stand for a while until the air has all dispersed, then re-insert the Probe and re-calibrate. **Do not leave the Probe sitting in aerated water, the bubbles will simply cling to the inside surface of the Probe and make the problem worse.**

14.4.3. Calibrating the Turbidity Electrode

The Probe Sleeve and Sleeve End Cap form an integral, working part of the Probe's turbidity measurement system, and MUST be fitted during calibration and measurement for correct operation.

14.4.4. Calibration Points

Turbidity electrodes in the AP-800 have three calibration points. Careful calibration is essential in order to ensure consistent and reliable results across the full measurement range.

When a turbidity electrode is first installed, it MUST be calibrated at three points in order to establish the individual electrode's slope. The Zero NTU point must always be calibrated first, followed by the other two points, all within the same calibration session (i.e. without turning the Aquameter® off).

The Turbidity electrode should subsequently be Zeroed (calibrated at the Zero NTU point) before each day's use. A three point calibration should be carried out once a month to ensure optimum accuracy.

Zeroing of the Turbidity electrode is normally carried out automatically during RapidCal (see [RapidCal Calibration Method](#)).

14.4.5. Turbidity Zero Point Calibration

To calibrate the Turbidity zero point (zero the electrode), follow these steps:

1. Three-quarters fill a calibration bottle with clean water (bottled still mineral water is recommended), remove the storage cap from the pH electrode if fitted, wash the Probe in clean water, then drop the Probe in all the way. **The Sleeve End Cap must be fitted.** Agitate the Probe and swirl the bottle several times in order to remove any air bubbles that may be clinging to the Turbidity electrode.
2. Switch the Aquameter® on and wait until the temperature and turbidity readings are stable. If the turbidity reading is very high, there are probably air bubbles adhering to the lenses. Agitate the Probe to remove.
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.

```
Calibration
→ RapidCal
DO 100%
Full Cal
```

5. Select **Full Cal**. The screen will change to:

```
Calibration
→ pH/ORP
DO/EC
TURB
```

6. Select **TURB**. The screen will change to:

```
CALIBRATE TURB
→ ZERO? [01/Jan/14]
1000? [01/Jan/14]
20? [01/Jan/14]
```

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

7. Select **ZERO**. The screen will change to:

```
PLEASE WAIT
Stabilising
000%
```

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.

```
Output: 1318mV
Calibrating
100%
Press [OK]
```

The Calibration Report on the top line displays the voltage output from the Turbidity Receiver Electrode in millivolts (mV). This value is not stored in memory so should be noted down in a calibration record book for the probe if required. Press [OK] then [ESC] repeatedly to return to the screen displaying the turbidity reading.

14.4.6. Verifying the Zero Calibration

An accurate zero point calibration is essential to the correct operation of the turbidity electrode. The zero point calibration can sometimes be erroneous due to small air bubbles or microscopic suspended solids in the calibration solution. For this reason, it is important to verify the zero point calibration before proceeding to calibrate the other points.

After calibrating the zero point, remove the Probe from the calibration bottle then reinsert, agitate and allow the reading to settle. Check the turbidity reading is within +/- 1NTU of zero. If not, re-calibrate the zero point.

14.4.7. Calibrating the Turbidity 20 NTU & 1000 NTU Points

When calibrating the 20 NTU and 1000 NTU points, **the Zero point must be calibrated first within the same calibration session (i.e. without turning the Aquameter® off).**

Remove the Probe from the zero calibration bottle, rinse thoroughly in fresh water (if using RapidCal solution), shake off any excess and dry the outer sleeve with a soft cloth.

Gently invert, **do not shake**, a bottle of **20 NTU or 1000 NTU Stabilised Formazin Turbidity Standard** solution (available from most lab supply companies) several times to thoroughly mix.

Formazin Turbidity Standard is hazardous to your health. Be sure to handle with care and to read and comply with all health and safety advice.

Three-quarters fill a calibration bottle with the solution and drop the Probe in all the way. Again, agitate and swirl the Probe and bottle several times in order to remove any air bubbles that may be clinging to the Turbidity electrode.

Follow the procedure detailed above for Zero point calibration as far as step 6, then select either 20 or 1000, dependant upon the solution the probe is in. Wait while the Meter stabilises and calibrates.

After successful calibration, the 'Calibrating 100%' screen will be displayed along with the Calibration Report, which will show the voltage output from the Turbidity Receiver Electrode in millivolts (mV). Press the **OK** key to continue.

Rinse the probe thoroughly then repeat this procedure for the third point.

14.5. Errors During Calibration

If a problem occurs during calibration, an error message will be displayed. Refer to [Calibration Error Messages](#) in section 9 for error message handling.

14.6. Lens and Sleeve Maintenance

On a daily basis, the lenses on the electrode should be wiped over with a soft damp cloth.

Similarly, the inside of the Probe Sleeve and Sleeve Cap should be kept clean and free from any deposits that may cause stray reflections.

Always re-calibrate the zero point after cleaning the sleeve or lenses or removing the end cap.

14.7. References

The summary on turbidity at the beginning of this section is based on information from the following sources.

- National Field Manual For the Collection of Water-Quality Data, Turbidity section 6.7, Revised by Chauncey w. Anderson, USGS, 2004.
- Environmental Instrumentation and Analysis Handbook, Randy D. Down and Jay H. Lehr, Chapter 24 Turbidity Monitoring, John Downing, John Wiley & Sons, Inc. 2005
- Turbidity Science, Michael J. Sadar, Hach Company 1998.
- Guidelines and Standard Procedures for continuous Water-Quality Monitors: Site Selection, Field Operation, Calibration, Record Computation and Reporting, Richard J. Wagner et al., USGS Reston VA Meeting, 2000.

15. AquaLink PC Software

AquaLink 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 1024 x 768, a CD drive and an available USB 2.0 socket.

15.1. Downloading AquaLink™ PC Software from the Aquaread® website

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

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

15.2. 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, AquaLink™ will run automatically.

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

15.3. Driver Installation

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

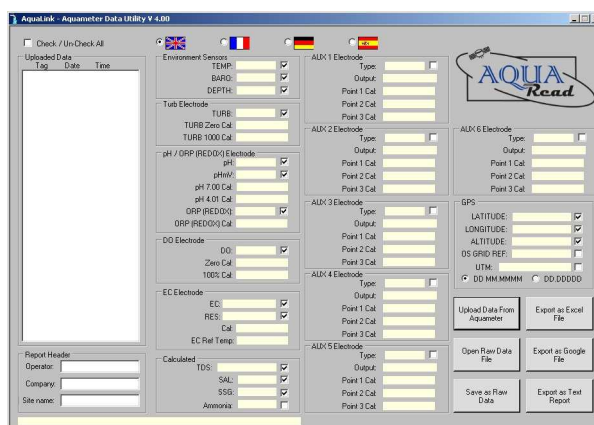
Different versions of Windows® react to plugging USB devices in differently. Earlier versions will give you the option to '**locate and install driver software**'. If this happens, direct Windows® to your temporary directory containing the unzipped download.

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 'Aquameter' device and update the driver forcing Windows® to search your temporary directory for the driver. Repeat this process for the USB Serial Port.

15.4. Running AquaLink

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

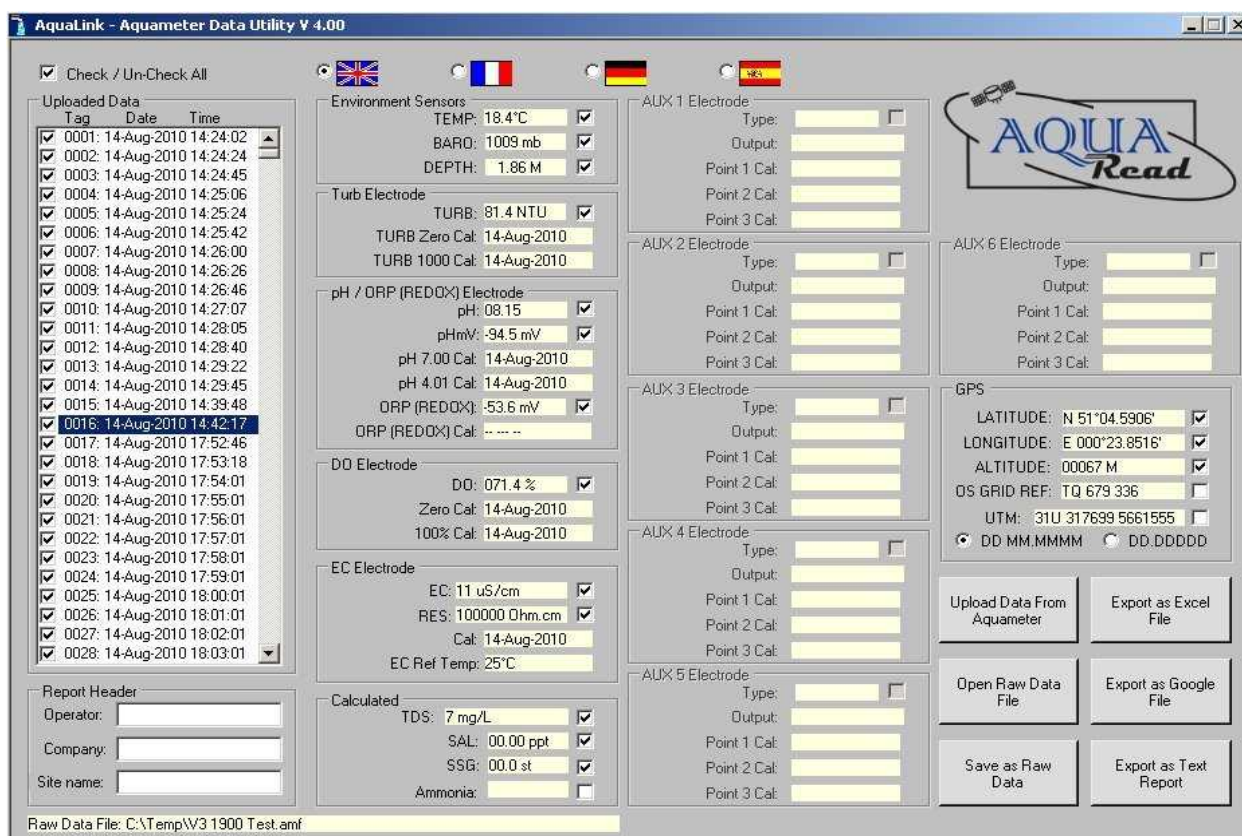


Select your preferred operating language by clicking on one of the national flags.

15.5. Uploading Data From Your Aquameter®

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

Click the 'Upload Data From Aquameter®' button. AquaLink will search for the Aquameter® 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 Aquameter® 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 7 for more information.

15.6. 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 Aquameter® 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.

15.7. 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.

15.8. Saving Logged Data

Once a set of logged data has been uploaded from the Aquameter®, it can be saved on your PC as a Raw Data file. These files use a proprietary Aquaread® format and are saved with a .amf (**Aquameter®** 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 .amf extension.

Useful Tip: Once you have saved the logged data, it is a good idea to clear the Aquameter®'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 7.

15.9. 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.

15.10. Exporting Data

AquaLink 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.

15.11. 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 AquaLink Text Reports as this handles text file formatting better than Microsoft® Notepad.

A typical report cover page follows.

15.12. Typical Text Report Cover Page

AquaLink 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-Jul-2009 10:09:33		
Start position:	Lat: N 51°21.4989' 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
Turb:	05.8 NTU	Tag: 0560	Date: 26-Jul-2009
pH:	7.63	Tag: 0565	Date: 26-Jul-2009
pHmV:	-36.3mV	Tag: 0009	Date: 24-Jul-2009
ORP:	365.7mV	Tag: 0320	Date: 25-Jul-2009
DO:	79.4% Sat	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:	08:46:00		
Time:	09:09:00		
Time:	10:49:01		
Time:	12:44:00		
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
Turb:	04.1 NTU	Tag: 0830	Date: 27-Jul-2009
pH:	7.55	Tag: 0003	Date: 24-Jul-2009
pHmV:	-40.8mV	Tag: 0556	Date: 26-Jul-2009
ORP:	354.4mV	Tag: 0820	Date: 27-Jul-2009
DO:	30.1% Sat	Tag: 0427	Date: 25-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:	09:06:00		
Time:	10:19:01		
Time:	08:24:00		
Time:	08:16:00		
Time:	21:39:00		
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	
Turb:	1.7 NTU	4.87 NTU	
pH:	0.08	7.60	
pHmV:	4.5mV	-39.09mV	
ORP:	11.3mV	358.45mV	
DO:	49.3% Sat	59.10% Sat	
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			

Turb Zero:	24-Jul-2009	Turb 1000:	23-Jul-2009
pH 7.00:	24-Jul-2009	pH 4.01:	23-Jul-2009
DO Zero:	23-Jul-2009	DO 100%:	24-Jul-2009
EC:	24-Jul-2009	ORP:	23-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.

15.13. 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 AquaLink 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'.

15.14. 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.

15.15. 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:

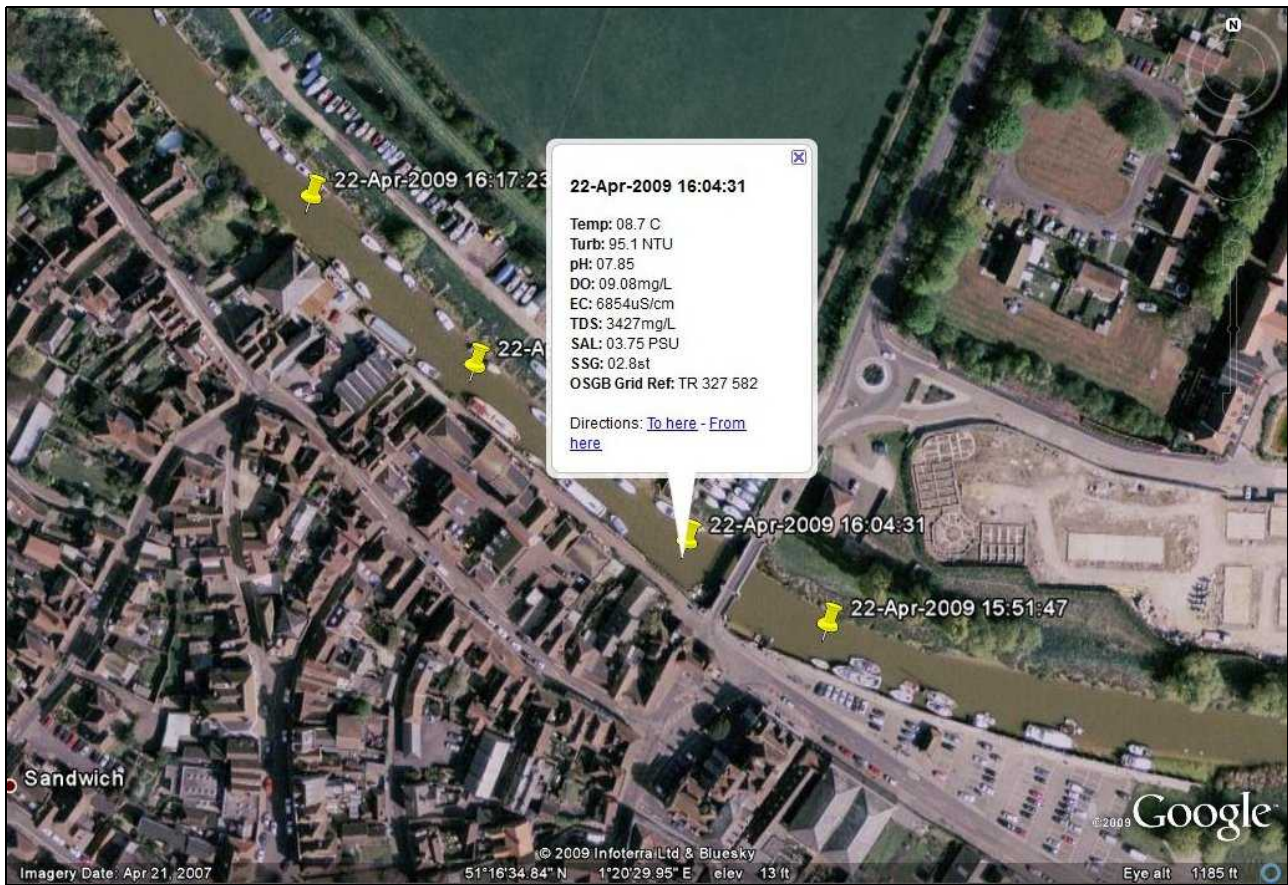
1. Click on '**File**'.
2. Select '**Open**' from the list.
3. Browse for the .KML file you exported from AquaLink, and select it.

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.

15.16. 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.

16. 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.

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). 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.**

16.1. 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 concentrated acid or alkaline based cleaning products such as Decon 90. These products can strip the anodised finish from the Probe and damage some of the plastic components.

16.2. 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:	_____

17. TROUBLESHOOTING

This section details some of the common difficulties you may encounter when using the Aquameter®, Aquaprobe®s and AquaLink software. Try all the suggested remedies. If your problem is still unresolved, contact our Service Department (service@aquaread.com).

Problem	Cause / Remedy
The Aquameter® 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 Aquameter® 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 Aquameter® can not find the Aquaprobe®.	✓ Probably a poor connection. Switch the Aquameter® off, disconnect the Aquaprobe®, ensure there is no debris or moisture in the plugs and sockets, then re-connect ensuring they are fully inserted and that the screw collars are fully tightened.
The GPS Aquameter® will not show a position fix.	✓ The Aquameter® probably does not have a good enough view of the available satellites. Ensure there are no obstructions between the Aquameter® and the open sky. Remember, GPS does not work indoors.
The AquaLink software can not find the Aquameter®.	<ul style="list-style-type: none"> ✓ The USB drivers may not be properly installed. Reinstall the USB drivers carefully following the instructions. ✓ There may be a problem with the USB socket on the PC, try an alternative socket.
The 'USB CONNECTED' message does not appear on the Aquameter® when it is connected to a PC.	<ul style="list-style-type: none"> ✓ The batteries in the Aquameter® may be dead or incorrectly fitted. Check you have fresh batteries fitted and that they are inserted the correct way round. The USB cable does not power the Aquameter®. ✓ There may be a problem with the USB socket on the PC, try an alternative socket.
ERROR 01 appears on the Aquameter® screen.	✓ This indicates that the pH electrode has dropped below 85% efficiency. Try cleaning the pH electrode and re-calibrating as described in the relevant section of this manual. If that does not cure the problem, replace the electrode.
COMMS ERROR appears on the Aquameter® screen.	✓ This indicates that the Aquaprobe® has stopped responding to requests for data from the Aquameter®. Check the Aquaprobe® plug is fully inserted. Cycle the power to reset the Aquaprobe®.
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.
Dissolved Oxygen readings are inaccurate or unstable.	<ul style="list-style-type: none"> ✓ The DO electrode may need calibrating. Recalibrate. ✓ The DO membrane may be worn out. Replace the DO cap. ✓ Calibration may have been carried out at an extreme temperature. Recalibrate at a temperature as close to the sample temperature as possible.

Troubleshooting Continued ...

Problem	Cause / Remedy
pH and/or ORP readings are slow, inaccurate or unstable or calibration is impossible.	<ul style="list-style-type: none"> ✓ The electrodes may need re-calibrating. Recalibrate. ✓ The electrodes may need cleaning. Clean as described in the relevant section of this manual. ✓ The electrodes may have been allowed to dry out. Re-hydrate as described in the relevant section of this manual. ✓ The electrodes may be damaged. Replace the electrodes. ✓ The electrode may be loose allowing water to enter the electrode socket. Remove the electrode, blow out the socket with compressed air then leave the probe and electrode in a warm place for at least 48 hours to dry out.
<p>EC readings are inaccurate or unstable.</p> <p>OUT OF CAL RANGE error shows during calibration of EC.</p>	<ul style="list-style-type: none"> ✓ Have you got the Probe Sleeve fitted? EC will not work without the Probe Sleeve fitted. ✓ The Aquaprobe® may not be inserted deep enough into the sample being measured. Ensure the sample level reaches the minimum depth line on the outside of the Aquaprobe®. ✓ Trapped air bubbles may be causing problems. Tap and swish the Aquaprobe® to dislodge them. ✓ The Probe Sleeve may be loose. The Probe Sleeve must be absolutely rigid with respect to the Probe Body for correct EC operation. If you can move the Probe Sleeve to and fro whilst holding the Probe Body, tighten then recalibrate. ✓ The EC electrode may need recalibrating. Recalibrate. ✓ The EC electrode may be dirty. Clean the EC electrode then recalibrate.
Turbidity readings are inaccurate or unstable.	<ul style="list-style-type: none"> ✓ Have you got the Probe Sleeve, end cap and end cap plug fitted? Turbidity will not work without these parts fitted. ✓ Trapped air bubbles may be causing interference. Tap and swish the Aquaprobe® to dislodge them. ✓ The sample being measured may contain air bubbles. Under these conditions, optical turbidity measurements can not be taken. ✓ The Aquaprobe® may not be inserted deep enough into the sample being measured. Ensure the sample level reaches the minimum depth line on the outside of the Aquaprobe®. ✓ The Probe Sleeve may be loose. The Probe Sleeve must be absolutely rigid with respect to the Probe Body for correct turbidity operation. If you can move the Probe Sleeve to and fro whilst holding the Probe Body, tighten then recalibrate. ✓ The Turbidity electrodes may need recalibrating. Recalibrate. ✓ The lenses on the turbidity electrode may be dirty. Clean the lenses then recalibrate.
Turbidity readings are negative in clear water.	<ul style="list-style-type: none"> ✓ Erroneous zero point calibration caused either by contaminated calibration solution or changes in the measurement chamber between zeroing and deployment. Thoroughly clean the Probe then re-zero in completely clean/clear water.

18. 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.

19. Appendix 1. Flow Through Cell

19.1. Introduction

The Aquaread® Flow Through Cell (Flowcell) is designed for use with any model of Aquaread® Aquaprobe® and most third party pumping device.

The Flowcell allows sample water to flow up through the Aquaprobe®, passing over all the individual electrodes simultaneously. This eliminates air contact with pumped samples from groundwater boreholes allowing truly representative measurements to be obtained.

Made from marine grade aluminium and 6mm wall thickness 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 Aquaread® 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. Aquaprobe® Installation

The probe sleeve and protective Sleeve End Cap must be fitted to the Aquaprobe®.

Loosen the screw collar located at the top of the Flowcell and slide the Aquaprobe® in all the way, ensuring it is properly seated in the recess where the clear tube enters the base. Tighten the collar to clamp the Aquaprobe® in place.

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 Aquameter® and monitor the readings. If the readings are jumpy or erratic, reduce the flow rate. The ideal flow rate is around 30 litres/hour (8 US gallons/hour), although the Aquaprobe® is capable of operating at flow rates as low as 15 litres/hour (4 US gallons/hour). Flow rates above 60 litres/hour (16 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.

19.6. Cleaning

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

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

19.7. Flowcell Troubleshooting

Problem	Cause / Remedy
DO readings are abnormally high or are fluctuating wildly.	Aeration of sample water. Check all joints for air leaks. Reduce flow rate to avoid cavitation.
Turbidity readings are abnormally high.	Air bubbles adhering to the Turbidity Electrode lenses. Agitate Flowcell to dislodge. 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 screw collar.	Screw collar is not tight enough. Tighten up. Grease / PTFE tape has not been applied to the joint between the Probe Sleeve and Probe Body (single part sleeves only). See 'Aquaprobe® Preparation Prior to First Use' on previous page. Operating pressure is too high. Reduce pressure / flow rate.
Probe is forced up out of the Flowcell during use.	Operating pressure is much too high. Reduce pressure / flow rate.

20. Appendix 2. Electrodes Detailed Specification

Dissolved Oxygen	Range	0 – 500.0% / 0 – 50.00 mg/L
	Resolution	0.1% / 0.01mg/L
	Accuracy ⁽³⁾	0 - 200%: ± 1% of reading. 200% - 500%: ± 10%
Conductivity (EC)	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 ^(3,4)	± 1% of reading or ± 1µS/cm if greater
TDS ⁽¹⁾	Range	0 – 100,000 mg/L (ppm)
	Resolution	2 Auto-range scales: 0 – 9999mg/L, 10.00 – 100.00g/L
	Accuracy ^(3,4)	± 1% of reading or ± 1mg/L if greater
Resistivity ⁽¹⁾	Range	5 Ω•cm – 1 MΩ•cm
	Resolution	2 Auto-range scales: 5 – 9999 Ω•cm, 10.0 – 1000.0 KΩ•cm
	Accuracy ^(3,4)	± 1% of reading or ± 1 Ω•cm if greater
Salinity ⁽¹⁾	Range	0 – 70 PSU / 0 – 70.00 ppt (g/Kg)
	Resolution	0.01 PSU / 0.01 ppt
	Accuracy ^(3,4)	± 1% of reading or ± 0.1 unit if greater
Seawater Specific Gravity ⁽¹⁾	Range	0 – 50 σ _t
	Resolution	0.1 σ _t
	Accuracy ^(3,4)	± 1.0 σ _t
pH	Range ⁽⁵⁾	0 – 14 pH / ± 625mV
	Resolution	0.01 pH / ± 0.1mV
	Accuracy ⁽³⁾	± 0.1 pH / ± 5mV
ORP	Range ⁽⁵⁾	± 2000mV
	Resolution	0.1mV
	Accuracy ⁽³⁾	± 5mV
Turbidity (AP-800 Only)	Range	0 – 3000 NTU
	Resolution	2 Auto-range scales: 0.0 – 99.9 NTU, 100 – 3000 NTU
	Accuracy ⁽³⁾	± 5% of auto-ranged scale
	MLR ⁽²⁾	5.0 NTU
Temperature	Range	-5°C – +50°C (23°F – 122°F)
	Resolution	0.01° C/F
	Accuracy ⁽³⁾	± 0.5° C

Aquaread® Ltd reserves the right to change specifications without notice

Notes:

1. Readings calculated from EC and temperature electrode values
2. MLR (Minimum Level of Repeatability) is the value below which optical electrode readings become generally unreliable and unrepeatable (unless taken under ideal conditions) due to interfering factors such as refraction from visible air bubbles and microscopic aeration.
3. The accuracy figures quoted throughout this document 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. Accuracy in the field is also dependent upon full calibration and minimal time between calibration and use.
4. The EC electrode can be calibrated at various points for use in fresh, brackish or salt water. The quoted accuracy of the electrode, and therefore all derived readings, relies upon the readings being within a reasonable range of the calibration point. 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.
5. The measurement of pH and ORP relies upon the ability of the electrode to pass a minute electrical current through the water under test. For this reason, when using the standard pH/ORP electrode, the water under test must have a minimum EC (electrical conductivity) of 100µS/cm. Special low EC pH electrodes are available to special order.