



## Aquaread Webinar –

The AP2000, guidance for using the probe  
in the field and updates.

## Outcomes from this webinar -

### Product - AP2000

- What it is.
- How it works.
- Communication Options.
- Aquameter, downloading data, GPS Plotting, Stabilisation.
- Advice and Tips on pH use and calibration.
- Optical electrode calibration tips and a turbidity update.
- Flow cell.

### Technical -

- New end cap and sleeve.
- Sleeve liner for EC applications.

# Introduction to Aquaread

- **Our Company** – Aquaread, based in Broadstairs UK, was established in 2008 and launched with a new range of water monitoring, multiparameter probes measuring pH, EC, ORP, DO, and temperature initially. Future developments would bring Optical DO, Depth and numerous other ISE and optical sensors to our list of options and various new probes to offer a full range of equipment.
- **Our Staff** – Our founding members have a wide range of specialist skills that have allowed us to bring innovative new products quickly and successfully into the water monitoring market. Skills include, Product design and development, engineering, scientific research, advanced circuit board layout and design and streamlined supplier management. Our company is currently at 25. We have recently expanded our sales team with a dedicated sales manager for the UK.
- **Our Products** – We offer a full range of options from single parameter systems to more advanced portable packages to fully featured self cleaning systems for fixed use. Even permanent monitoring stations with solar power and auto calibration.
- **Our Presence** – Aquaread have distributors in over 50 countries all over the world, and growing.
- **Our Quality and Environmental policy** – Aquaread are ISO 9001 and 14001 Certified.

# The AP-2000



The AP2000 – 13 Parameters in a 42mm probe.

### Applications:

- Groundwater Monitoring – with a flow cell.
- Chemistry profiling down well.
- Surface water spot measurement.

### Advantages:

- Optical Dissolved oxygen sensor, see advantages below
- Exchangeable cables
- 2 Auxiliary ports allowing you to add 1 ISE and 1 Optical sensor to the probe
- Marine grade aluminium construction with an anodized coating.
- Versatile, can be used with a logger or added to telemetry.



The AP-2000 features advanced optical DO technology offering some significant advantages

- No flow of water required for stable reading
- Reduced maintenance: holds calibration for up to 6 months and does not need cap and solution replacement
- Reduced membrane fouling optimises sensor for long term deployment

**Included Sensors**  
Optical DO, Conductivity\*, pH/ORP, Temperature,  
2 customisable sensor ports and the option to add depth

### AP-2000/2000-D Mechanical Specification

Protection Class	IP68 (permanent immersion)
Immersion Depth	Min 75mm. Max 100m * *
Operating Temperature	-5° C - +50° C
Dimensions (L x Dia)	290mm x 42mm
Weight	700g

\* Additional parameters Salinity, TDS, SSG and Res are calculated from the EC and Temperature readings.

\*\* 100m submersion for period of 1 week, 30m submersion suitable for permanent deployment, depth measurement up to 60m.

# AP2000 Available Parameters

Aquaread offer the following parameters: Follow the links for more details...

## Standard Parameters

[Optical Dissolved Oxygen](#)

[pH](#)

[ORP](#)

[Electrical conductivity](#)

[Salinity](#)

[Resistivity](#)

[TDS](#)

[SSG](#)

[Temperature](#)

[Depth / Level](#)

## Ion Selective Electrodes

[Ammonium / Ammonia](#)

[Nitrate](#)

[Chloride](#)

[Calcium](#)

[Fluoride](#)

## Optical Sensors

[Turbidity](#)

[Chlorophyll a](#)

[Phycocyanin](#) (BGA-PC)

[Phycoerythrin](#) (BGA-PE)

[Rhodamine](#)

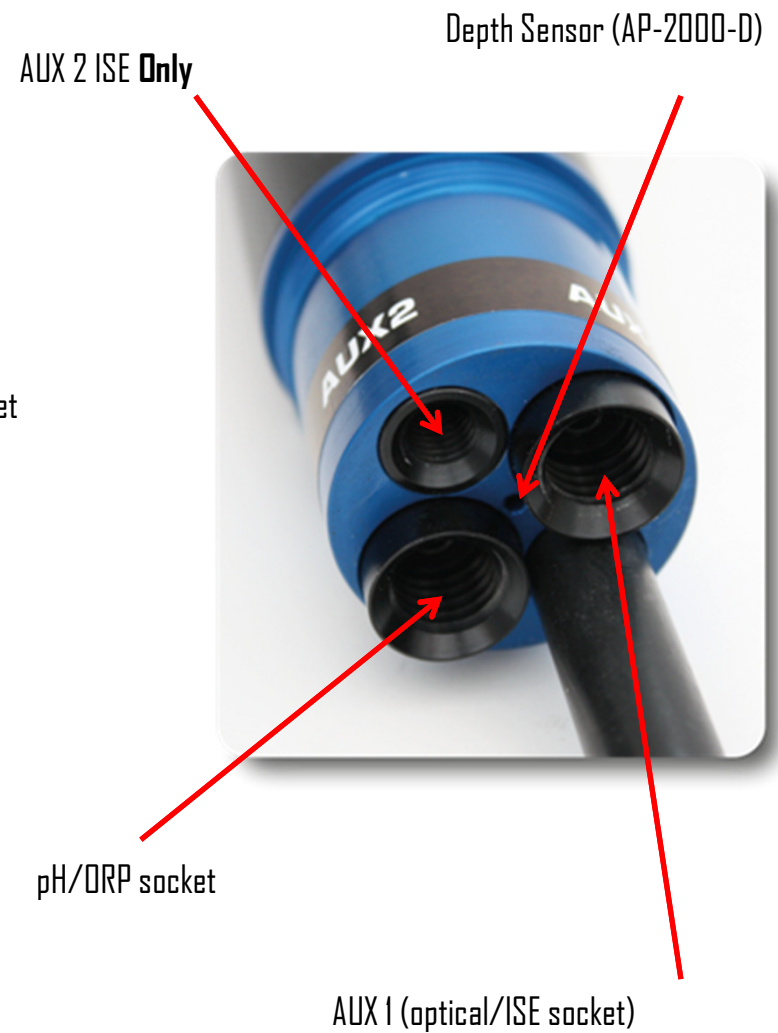
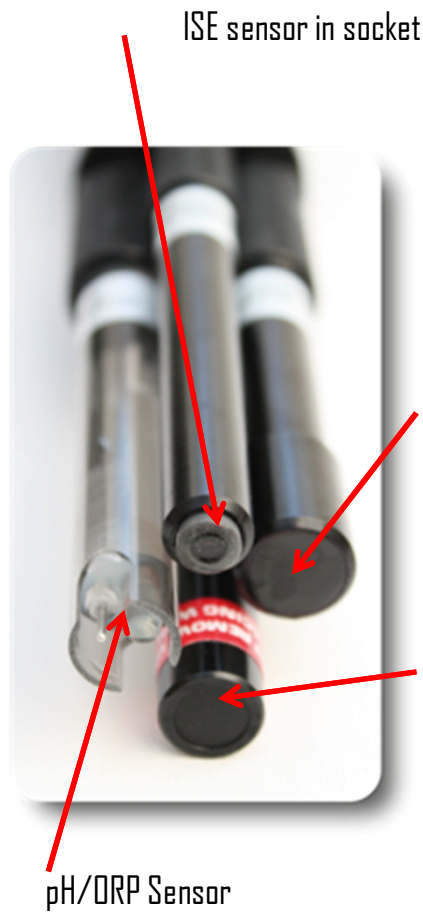
[Fluorescein](#)

[Refined Oil](#)

[CDOM / FDOM](#)

For further information on **Turbidity measurement** our sensor conforms to the ISO standard 7027 which can be seen [here](#)

# AP-2000 Aquaprobe – How it works



# Aquaread Logging Options



## GPS Aquameter

The GPS Aquameter is rated IP67 for use outside even in the rain. It is rugged and very easy to use. Record your data at the push of a button and download the data to a PC for manipulation and reporting. The integrated GPS means you will always know where your data was captured



New low power auto data logging mode sends the meter to sleep between readings allowing it to log data automatically for up to 38 days on a single set of batteries

## AquaLogger

The AquaLogger is designed for long term unmanned logging. It is available in 2 different sizes, the AquaLogger-2000 is for use with the AP-LITE, and the AP-2000. The AquaLogger-7000 is for use with the AP-5000 and the AP-7000. Both systems will record data for up to 6 months on standard alkaline 'C' cell batteries and can hold up to 32,000 full data sets



## BlackBox

The BlackBox is a data converter that facilitates connection of any Aquaprobe to existing data networks via SDI-12 and Modbus. Use it to connect to third party loggers, telemetry devices and PLC systems

# Basic Intro to the Aquameter...

our GPS handheld meter



# Aquameter and Google Maps/Earth



## 18.14. 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.

## 18.15. 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.

**AquaLink - Aquameter Data Utility V 5.00**

Check / Un-Check All

Uploaded Data

Tag	Date	Time

**Environment Sensors**

TEMP:

BARO:

DEPTH:

**Turb Electrode**

TURB:

TURB Zero Cal:

TURB 1000 Cal:

**pH / ORP (REDOX) Electrode**

pH:

pHmV:

ORP (REDOX):

pH 7.00 Cal:

pH 4.01 Cal:

pH 10.0 Cal:

ORP Cal:

**DO Electrode**

DO:

Zero Cal:

100% Cal:

**EC Electrode**

EC:

RES:

Cal Report:

Cal Value:

EC Ref Temp:


**Calculated**

TDS:

SAL:

SSG:

Ammonia:



**AUX 1 Electrode**

Type:

Output:

Point 1 Cal:

Point 2 Cal:

Point 3 Cal:

GS Fact:

**AUX 2 Electrode**

Type:

Output:

Point 1 Cal:

Point 2 Cal:

Point 3 Cal:

GS Fact:

**AUX 3 Electrode**

Type:

Output:

Point 1 Cal:

Point 2 Cal:

Point 3 Cal:

GS Fact:

**AUX 4 Electrode**

Type:

Output:

Point 1 Cal:

Point 2 Cal:

Point 3 Cal:

GS Fact:

**AUX 5 Electrode**

Type:

Output:

Point 1 Cal:

Point 2 Cal:

Point 3 Cal:

GS Fact:

**AUX 6 Electrode**

Type:

Output:

Point 1 Cal:

Point 2 Cal:

Point 3 Cal:

GS Fact:

**GPS**

LATITUDE:

LONGITUDE:

ALTITUDE:

OS GRID REF:

UTM:

DD MM.MMMM  DD.DDDDD

Upload Data From  
Aquameter

Export as Excel  
File

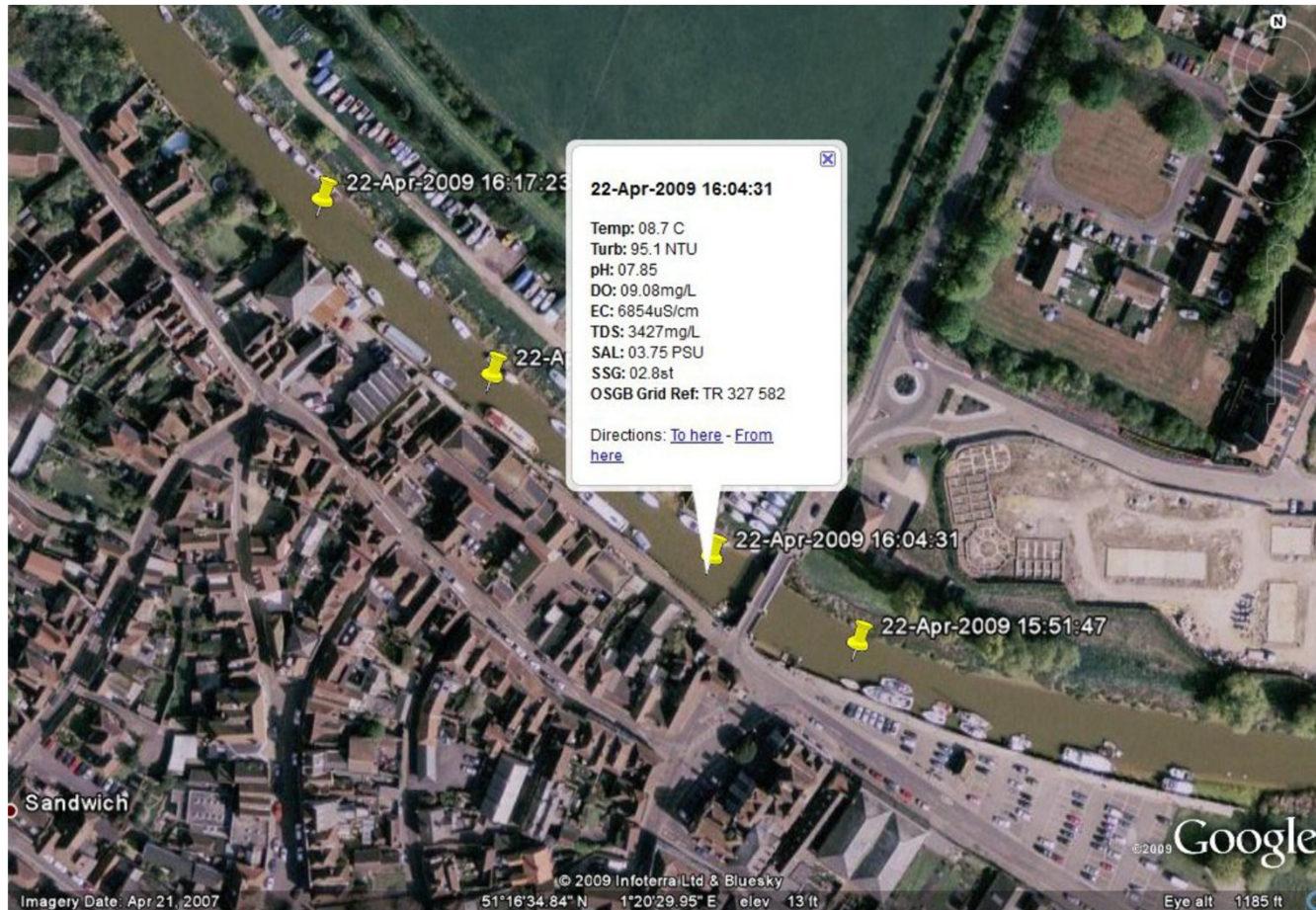
Open Raw Data  
File

Export as Google  
File

Save as Raw  
Data

Export as Text  
Report

# Aquameter and Google Maps/Earth



# Guidance Notes

## Guidance Notes - #1 Importance of the sleeve and end cap.

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 measurement system, and MUST be fitted for correct operation.**

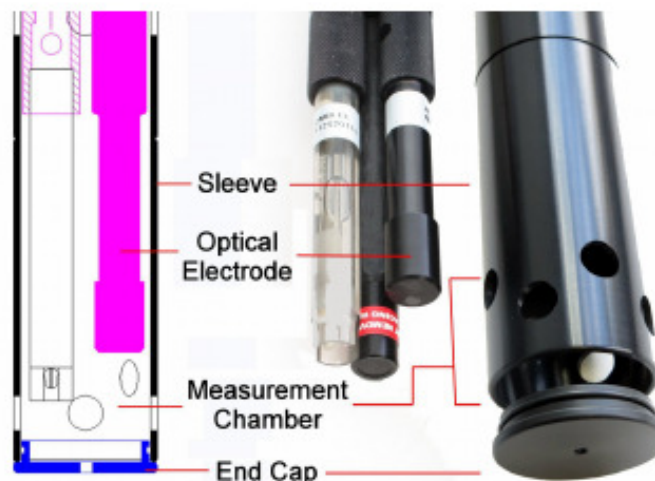
All Aquaread® Optical Electrodes are incredibly sensitive. For example, the Turbidity electrode is capable of measuring between 0 and 3000NTU with an internal resolution of greater than 0.1NTU. This means that the electrode is able to detect changes in turbidity that are less than 0.003% of the full range! The other optical electrodes have a similar level of sensitivity.

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.

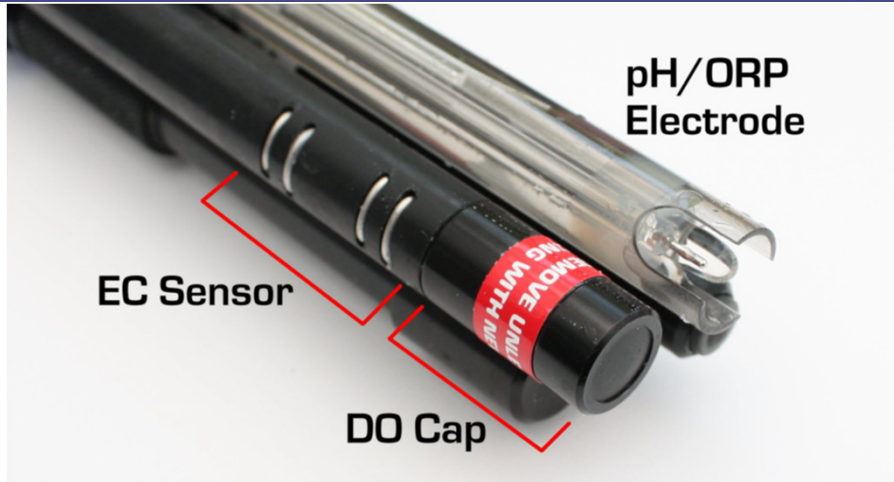
**This is essential for the correct calibration and operation of all types of optical electrodes.**

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



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

## Guidance Notes - #2 pH/ORP Combination Electrode



### pH Sensor – Key Points

- We use a combined pH/ORP sensors.
- It is gel filled, reducing maintenance and improving stability.
- It has a fixed life time of 12 months from first use.
- It is user replaceable.
- It has single or multi point calibration options.
- **New, two optional electrodes to choose from.**

### New pH sensor options -

**2000-pH/ORP-SW:** This will be our Salt Water version of the sensor, it features a double junction within the sensor which aims to reduce the ionic gradient between the internals of the sensor and the external salt water environment. This will increase the life of the sensor when deployed in salt water.

**2000-pH/ORP-DW:** This will be our Dirty Water version of the sensor, it features a completely different kind of junction, the small Teflon junction is gone, instead the entire end of the sensor is a ceramic junction, it has a considerably larger surface area, which means it will take much longer for the junction to become fouled over time, maximising the life of the sensor in these demanding environments.

## Guidance Notes - #3 pH/ORP Combination Electrode - Continued

### 13.4. 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 and/or pH 10.00. The Aquaprobe® allows for both two and three point pH calibration. Should you decide to carry out just a two point calibration, the probe will automatically calculate and save a calibration value for the uncalibrated third point in order to maintain the electrode's linearity over the full range of 0 – 14.

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

### 13.5. Special Notes Concerning ISE Electrodes

The high ionic concentration of pH calibration solutions (buffers), including RapidCal, can cause significant offsets in ISE electrodes.

These offsets are temporary, but best avoided because they can cause significant errors during both calibration and normal operation.

For this reason all ISE electrodes are supplied with a red rubber sealing cap.

**The caps should be fitted to all ISE Electrode during pH calibration** in order to protect the ISE electrodes from the effects of the buffer solution.



At all other times, the ISE electrodes should be left uncovered.

## Guidance Notes - #4 pH/ORP Combination Electrode - Continued

### 11. After Use

The Aquaprobe® should always be cleaned after every use.

**It is advisable to clean the Probe after use with the cable attached. This will prevent any water entering the Probe's socket and will allow any deposits to be removed from the connector collar and shell.**

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 13.

**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.

## Guidance Notes - #5 pH/ORP Combination Electrode – Takeaway Points

- Keep the pH sensor stored correctly, with the red lanyard cap and SS-25 solution after each days sampling is finished.
- Calibrate the sensor at least once per week.
- Calibrate to your desired chemistry range.
- Calibrate as close to 25 Degrees as possible.
- Use fresh, NIST traceable solutions.
- When calibrating using Rapid Cal, always fit the sleeve.
- Replace the sensor every 12 months.

## Guidance Notes - #6 Optical Sensors.

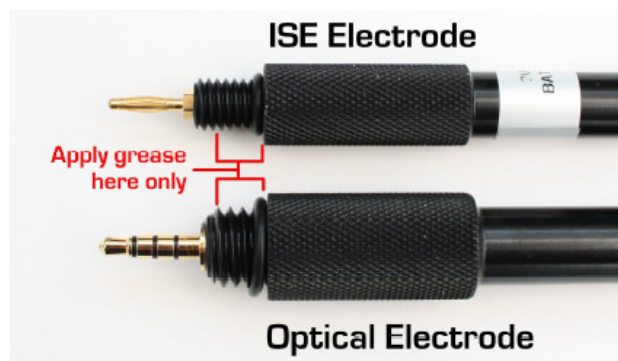
## Guidance Notes - #7 Optical Sensor Calibration

- 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. This is especially important with the Ref-Oil electrode.
- Always zero the optical electrodes just prior to use in clean water (bottled still mineral water is ideal) then deploy **without disturbing the measurement chamber**. This is especially important when using the Turbidity and Ref-Oil electrodes.

# Guidance Notes - #8 Fitting additional sensors.

## 24. Appendix 3. Fitting AUX Electrodes

There are two different types of AUX Electrodes designed for use with the Aquaprobe®. These are Optical Electrodes and ISE Electrodes. Optical Electrodes can be identified by the four-section gold connector whilst ISE Electrodes feature a single pin gold connector.



**ENSURE NO GREASE IS APPLIED TO THE GOLD CONTACTS**

Optical Electrodes are designed to fit into the AP-800 and AP-2000 socket labelled AUX1. ISE Electrodes are designed to fit into the AP-2000 socket labelled AUX2.

### 24.1. Installing AUX Electrodes

First, identify the type of electrode you are installing, then remove the blanking plug from the relevant AUX socket on the Aquaprobe®. To remove the blanking plug and subsequently tighten the AUX Electrode, use the red lanyard that is attached to the pH/ORP storage cap as a belt wrench as shown below.



Apply a small amount of silicone grease (supplied with the Aquaprobe®) to the threaded section and the O-ring of the AUX Electrode (see photograph). **ENSURE NO GREASE IS APPLIED TO THE GOLD CONTACTS.**

## Guidance Notes - ~#9 Optical Electrodes – Takeaway Points

- Ensure the sleeve and end cap are correctly fitted.
- Ensure the probe sleeve is clean.
- Calibrate using a minimum of two points.
- Calibrate to your temperature range.
- Use fresh, NIST traceable solutions.
- Avoid reflective surfaces.
- Regular calibration is key.

# Guidance Notes - #10 Turbidity Updates

## Turbidity overview and recent updates

### TURBIDITY

- How the sensor works
  - Previous changes
    - New issues
  - Final solution



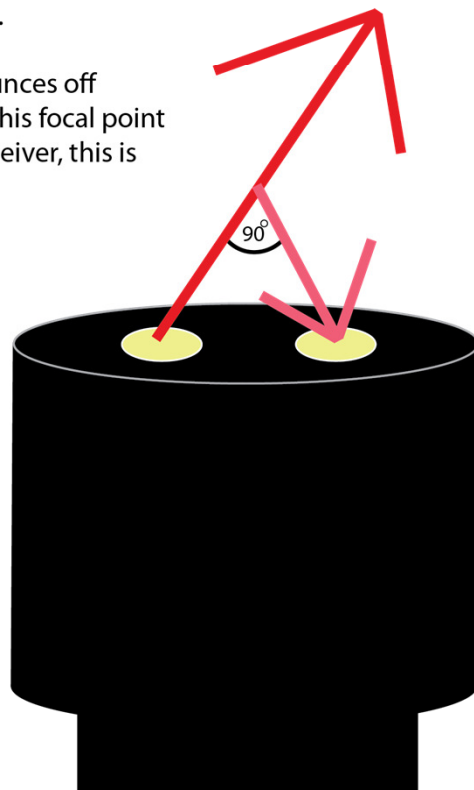
## How the sensor works...

Infra red light leaves the LED at a 45 degree angle.

The receiver is angled at the opposing 45 degree angle.

Results in a focal point at 90 degrees as per the ISO 7027 for light scatter at 90 degrees using formazin solution.

Infra red light bounces off particles around this focal point sending it to a receiver, this is how turbidity is measured.



## Previous changes...

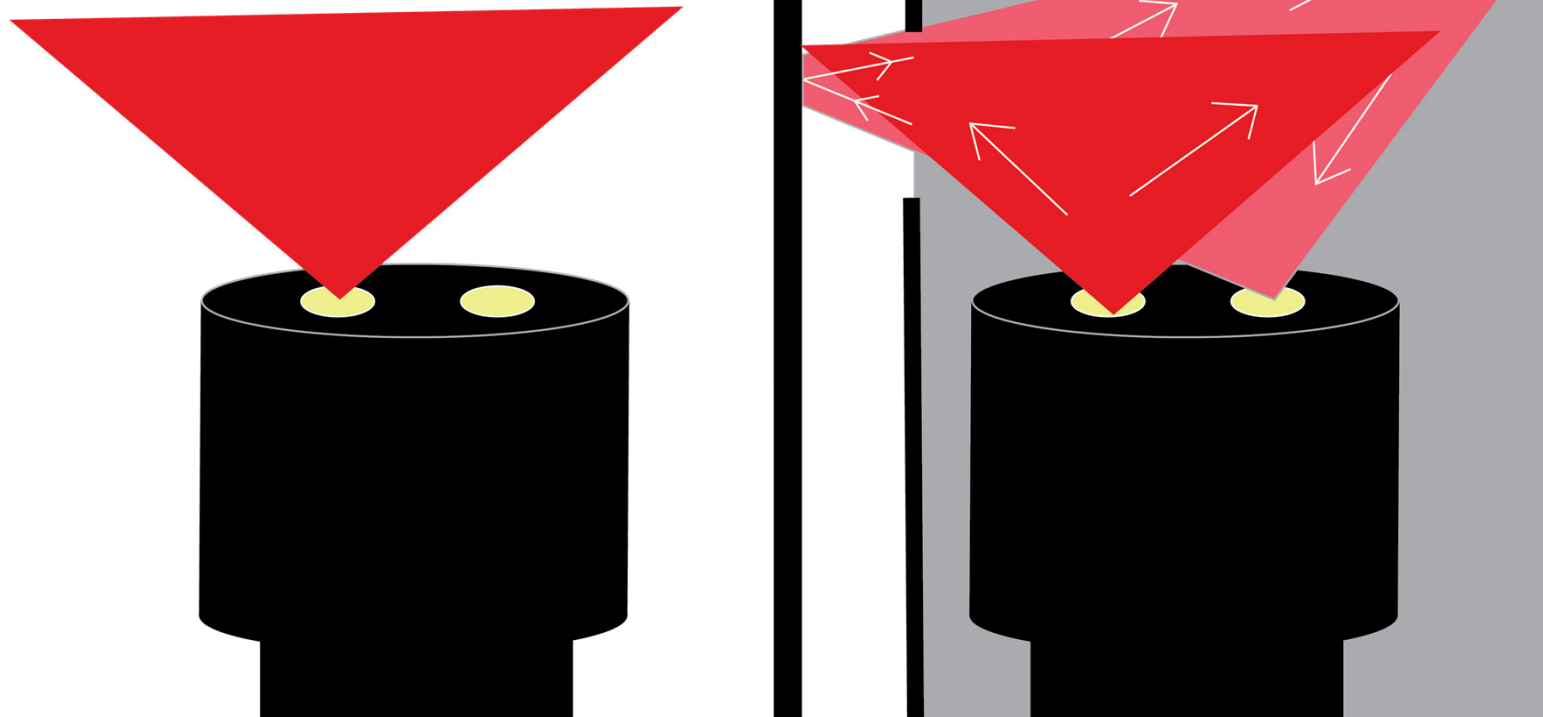
- LED position and angle refinement to bring focal point closer to the sensor to reduce effects from certain external light situations, like monitoring water close to zero in shallow streams
- Implementation of -'ve NTU readings, designed to indicate a poor zero calibration
- New end cap with a smaller hole in the center was introduced

## New Issues following changes...

In reality the light is not a straight laser beam, its a spread.

Some of this light leaves the sensor and will bounce off the inside of the sleeve. **This is fine because its constant during calibration and use.**

However if light passes through the holes in the sleeve and bounces off the calibration cup back into the receiver, when the calibration cup is removed this reflection is not present and would cause a negative reading, because the receiver was detecting less light.



## New Issues following changes...

- Infra red light was now able to escape the probe sleeve and bounce off the inside of the calibration cup during calibration under certain conditions; where a hole lines up with the sensor tip (hole location is random due to the thread on the sleeves).
- When the calibration cup was removed this would result in a negative reading for turbidity in low turbidity solutions.
- The idea for negative readings was to highlight poor zero calibration, however this reflection issue also caused it.
- This is because the signal was less than that during the calibration.

## Interim solution as we investigated the problem...

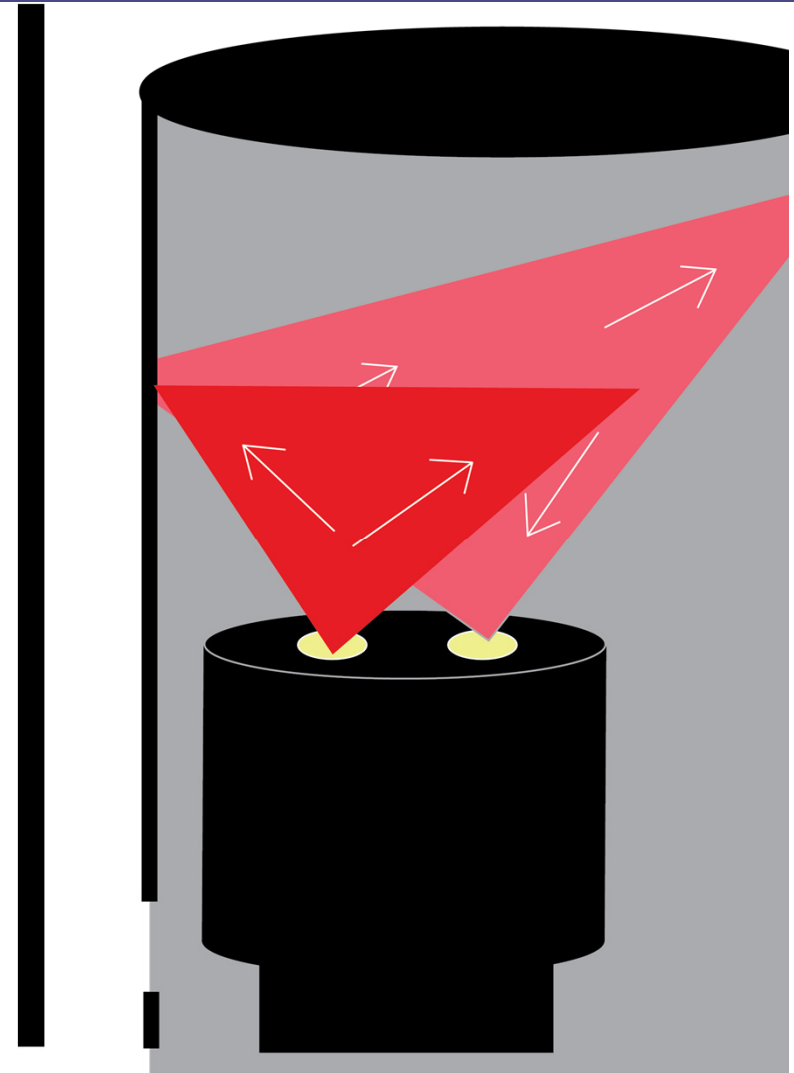
- We introduced matt black calibration bottles that largely reduced the light reflection bouncing back in from the calibration cup.
- A new end cap was designed with an angled inside to reduce light bounce.

However the black bottles were an not ideal solution and the new end cap did not completely solve the issue.

The decision was made to completely re-design the probe sleeve.

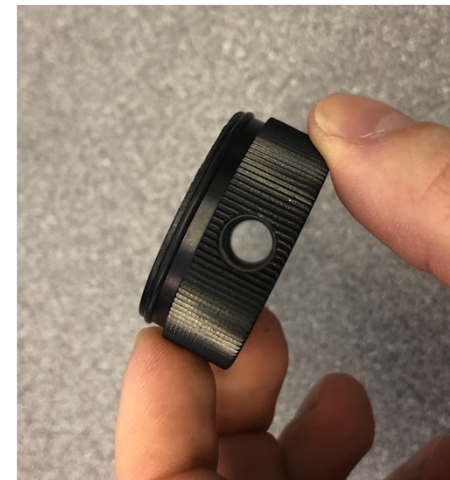
## Changes made...

- The issue was light escaping through the sleeve holes as they were along side the end of the turbidity sensor.
- The sleeve holes were moved away from the end of the sensors towards the body of the probe, stopping light from escaping coming out of the turbidity sensor.
- Now any reflected light is constant during calibration and use, solving the issue.



## New end cap...

- The end cap was also completely re-designed. Its now longer and features no hole at the end, instead there are 4 holes at the sides to allows water to leave the end of the probe easier.
- This new design also reduces light bouncing inside the end of the 'measurement chamber' improving stability.



## End Result...

- These new changes have completely solved the issues of negative readings and instability of low level turbidity measurement.
- Black bottles are no longer required.
- New sleeves and end caps can be retro-fitted to older probes
- Probes no longer read a negative value, instead a '-' symbol is displayed if the reading is below zero. Software can be updated using the programmer device
- Probes no longer read a negative value, instead a '-' symbol is displayed if the reading is below zero. Software can be updated using the programmer device
- Sleeve liner has been introduced to maintain a perfect EC constant.

## Guidance Notes - #11 Flow Cell



- Flow cell is available for all Aquaprobes, including the AP-2000.
- Simple screw and seal set up with pre drilled holes for mounting to base.
- Ideal for low flow sampling, the flow cell is provided with two common spigot sizes.
- The Aquameter will audibly indicate stability of readings.

## Guidance Notes - #12 Flow Cell

### 23.3. Aquaprobe® Installation

The Probe sleeve must be fitted to the Aquaprobe®, but the protective **Sleeve End Cap should not be fitted.**

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.

### 23.4. Zeroing Optical Electrodes

If you have any optical electrodes fitted, prior to inserting the Aquaprobe® in the Flowcell, block the inlet spigot and fill the Flowcell with clean, still mineral water. Now insert the Aquaprobe® and zero each optical electrode in turn.

**Thanks and Questions!**