1114 - Wireless O2 Dissolved Sensor

Revision: 0 | DS183

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Introduction

Thank you for purchasing the Smart Wireless O_2 Dissolved Sensor. We pride ourselves on producing high quality products that meet with the demands of the busy classroom environment. If you have any problems using this sensor, please read this documentation in full before contacting the Data Harvest support team.

Overview

The Smart Wireless O2 Dissolved Sensor is USB and Bluetooth compatible. Using Bluetooth, a sensor can connect to mobile devices, tablets, laptops, and desktops.

The dissolved oxygen sensor is a Clark oxygen electrode. The Clark electrode was designed as a gold – platinum electrochemical cell that had the electrodes covered by a non-conducting membrane. Oxygen crossing the membrane changes the characteristics of the cell and changes the output voltage. The change in voltage can be measured and is directly proportional to the oxygen at the membrane. The electrode used by Data Harvest and others is modified to use silver and gold; this gives a considerable cost saving with very similar performance. The main difference with the silver replacing the platinum is the need for maintenance of the silver electrode.

The electrode is subject to the effects of pressure and temperature, as is the dissolved oxygen value reported.

The sensor can return the oxygen values as a % of the potential saturation of the solution or (if pressure over the solution and temperature of the solution are provided) the oxygen content as an absolute value in mg/mL

Pack Contents

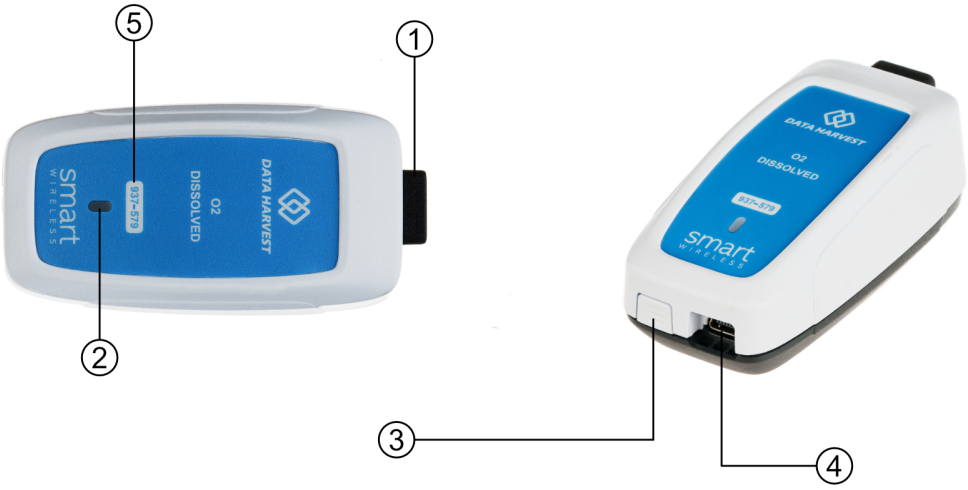
This product is supplied with the following items:

- 1 x Oxygen Electrode
- 2 x membrane Caps
- 1 x KCl Electrolyte
- 1 X Filling Pipette
- 1 x Smart Wireless O2 Dissolved Sensor
- 1 x USB Connecting Lead

Operational Overview

The diagram below shows the specific parts of the sensor. Read further to explore the functionality of each part of the sensor.

The dissolved oxygen sensor has two component parts:the wireless sensor body and the electrode.



1. Sensor End Cap
2. Status Indicator
3. On/Off Switch
4. USB Port
5. Unique ID Number

Sensor End Cap (1)

Most Smart Wireless Sensors feature an end cap that is specific to the requirements of the device's internal sensor. The sensor's end cap is the direct interface between the device's internal sensor and your experiment.

The Status Indicators (2)

The sensor features a single status indicator that changes colour and flashes. See the table below for further information.

Status Light		Indicates
No light		Sensor is Off. Short press the On/Off switch
Blue flashing		Sensor is On and Bluetooth advertising
White flashing		Charging via USB mains charger or USB port, Sensor is On and Bluetooth advertising

Red, Green, Blue Flashing		Charging via USB mains charger or USB port, Sensor is Off
Green flashing		Communication with the EasySense2 app (via USB or Bluetooth) has been established
Solid Green		Fully charged
Orange flashing		Recording data
Red flashing		Battery is low

On/Off Switch (3)

The sensor's on/off switch allows you to turn the sensor on, off or perform a hard reset.

To switch the sensor off

- Press and hold down the On/Off switch until the white light shows, then release.
- If not communicating with the EasySense2 app, the sensor will turn off after a period of one hour of inactivity.

Hard resetting the sensor

- If necessary, attach the sensor to power.
- Press and hold down the On/Off button for at least 8 seconds until the status LED gives a flash of blue light, then release.
- If the sensor fails to respond, contact Product Support at Data Harvest. Please provide details of:
  - The computer platform it is being used with and the EasySense2 app's version number.
  - A description of the problem being encountered.

USB Port (4)

Use to connect to a computer or a charging unit.

For specific USB or Bluetooth connectivity instructions, please see the 'Connectivity' section of this documentation.

For instructions on charging your device, see the section on 'Charging the Sensor'.

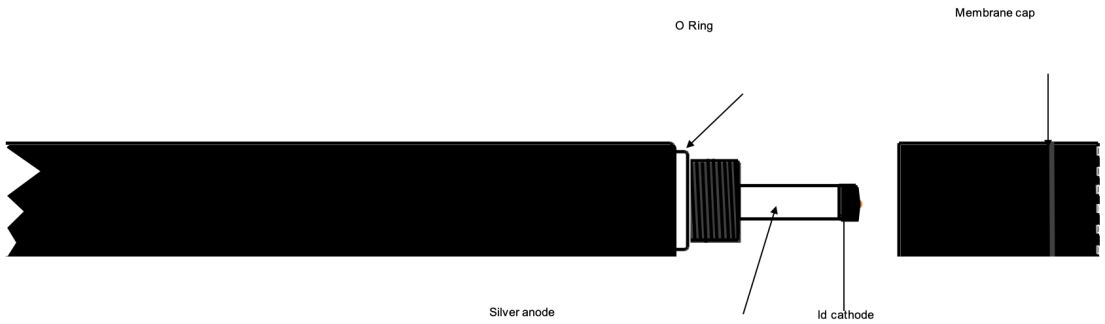
Unique ID Number (5)

All Smart Wireless Sensors are labelled with a unique ID number. This number is used in the EasySense2 app, so that you can identify each sensor when making a connection wirelessly.

The Electrode

The electrode is an epoxy bodied probe with an electrode at one end. The electrode that makes the electrochemical cell is a silver anode (the long section) and a gold cathode (the end point electrode).

A membrane cap goes over the electrode. When correctly in place, the membrane presses down (lightly) on the gold cathode and electrically isolates it from the silver anode. The membrane cap is filled with an electrolyte solution. The electrolyte solution for this electrode is KCl; it is not advised that NaCl based electrolyte is used as an alternative.



The electrolyte will have absorbed oxygen during storage (more so if the bottle is becoming depleted). This dissolved oxygen in the electrolyte will have to be scavenged out before readings will have any accuracy.

When filling the membrane cap, ensure that no air bubbles are trapped in the cap. If the cap is slightly overfilled to create a positive meniscus, then as you tighten the membrane onto the electrode body, excess electrolyte will escape via the screw thread, therefore take time attaching the cap to let any excess fluid escape.

Preparing the electrode for use.

- Place the membrane cap, with the membrane downward, on a clean surface.
- Half fill the cap with the electrolyte supplied. Tap the cap gently to remove any air bubbles from the electrolyte.

Note: It is important to remove trapped air bubbles because they will feed oxygen to the cathode and hence cause extra signal current to flow regardless of the oxygen concentration in the sample.

- Hold the electrode body vertically (with the cable uppermost) and screw on the membrane cap. One side of the thread is flat which will allow any surplus electrolyte to escape. Unscrew slightly to release any pressure and then gently screw the cap on until it is just tight.

Note: Do not over tighten – the membrane should not be pressurised (bulging away from the cathode tip), as it will become thin and oversensitive.

The assembled electrode must stay connected to an awake sensor unit to keep it polarised. If disconnected, reconnect for 10 minutes before use.

Before use go to Devices and select the appropriate range.

There is a choice of:

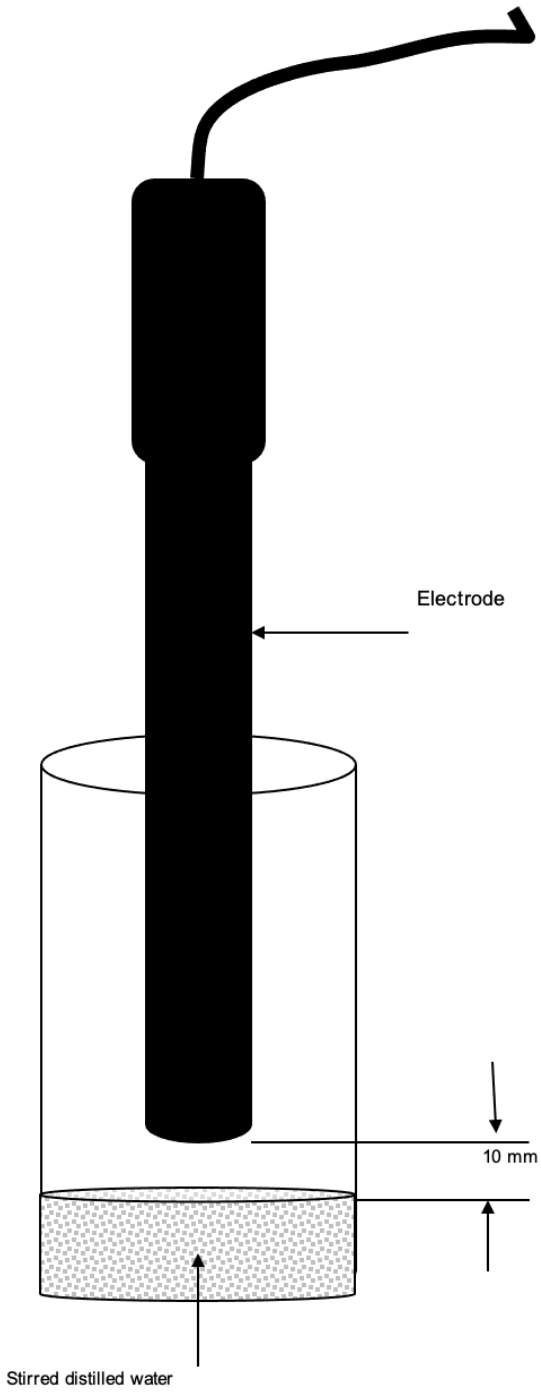
- 0 – 150 %Sat
- 0 – 250% Sat
- 0 – 15 mg/L
- 0 -20 mg/L

Unless the sensor is being used for comparative work it will need calibrating before use.

To calibrate for use in an Aqueous solution e.g. water

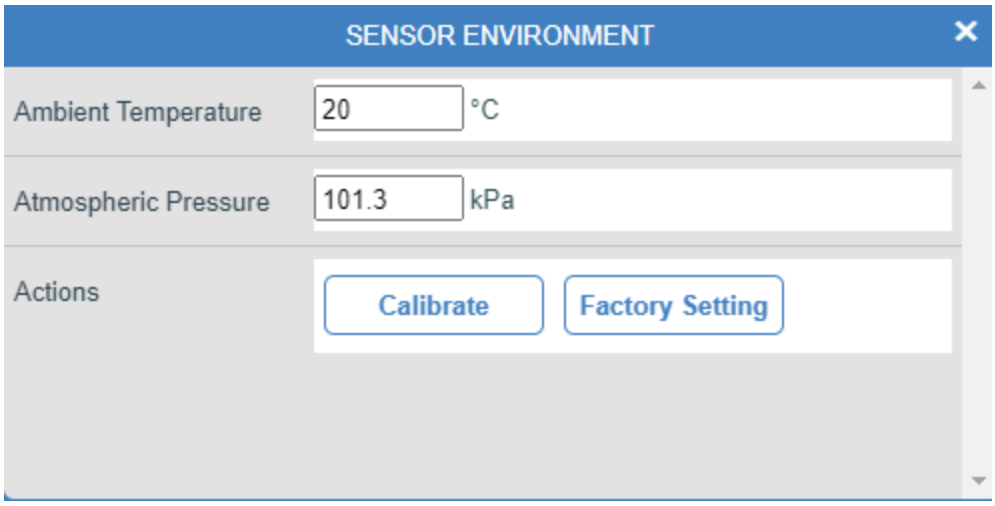
1. The range of the Sensor should be set to measure oxygen in water, 0 – 150 (%Sat).
2. After the electrode has been polarised for at least 30 minutes, hold the electrode vertically 10 mm above a sample of stirred distilled water (so the air is saturated with water vapour) for about 60 seconds. Do not let the membrane get wet.
3. Select Devices > Calibrate

4. Follow the instructions.



Using the mg/L range

You will need to supply a value for air pressure and the temperature of the aqueous solution. These functions assume the temperature and pressure are constant and that the effect of dissolved solutes is negligible e.g. water. 1mg/L = 1 ppm.


SENSOR ENVIRONMENT
Ambient Temperature
20
°C
Atmospheric Pressure
101.3
kPa
Actions
Calibrate
Factory Setting

Connectivity

The sensor is both USB and Bluetooth compatible. Install the EasySense2 app, if it is not already on your device. For details of how to operate the EasySense2 app, please refer to the EasySense2 documentation.

USB Connectivity

Quick Steps

1. Connect the sensor to the computer's USB port using the USB cable supplied.
2. The computer will automatically detect a new device and depending on your operating system, will install any applicable device drivers.
3. Start EasySense 2 app.
4. Within the EasySense2 app, the Devices icon will change to green to show that the sensor is connected, and the status light on the sensor will also turn green.
5. Begin your practical investigations.

Bluetooth Connectivity

Using Bluetooth, the sensor can wirelessly connect to mobile devices such tablets and mobile phones, as well as desktop or laptop computers, giving students the ability to run experiments independently without being tethered to a device.

See the EasySense2 app user manual system requirements for further details.

Quick Notes on Bluetooth Connectivity

Only use with the EasySense2 app, you do not need to pair the device. If paired, the sensor will not be available to the EasySense2 app.

Computers or devices will need to support Bluetooth Low Energy (BLE). For further information refer to the instructions provided for the EasySense2 app.

Quick Steps

1. Short press the on/off switch to turn the sensor on, blue LED will flash.
2. Open the EasySense2 app.
3. Select the Devices icon.
4. Select your sensor from the list of available sensors to connect to the device. Your sensor is identified by its unique ID in the list.
5. Click on connect at the side of your sensor in the list.
6. The Devices icon will change to green and the status light on the sensor will flash green to indicate a connection has been established.
7. Begin your practical investigations.

Charging the Sensor

The Smart Wireless sensors are fitted with a rechargeable lithium-ion battery and can be charged via the USB port. Use the supplied USB lead to connect the sensor either directly to a USB port on your computer, a powered USB hub or a USB mains charger that outputs 5 V at 500 mA or more.

A full charge can take up to 4 hours.

Additional Information

Whenever the sensor is connected to the USB port on the computer or to a USB mains charger (output 5 V at 500 mA or more), it will automatically recharge the battery (LED status flashing white).

When connected to a computer, the computer should be turned on and not in sleep or standby mode, as the battery may drain instead of charge.

The sensor will stay awake for 5 minutes when Bluetooth advertising (LED status flashing blue).

Lithium-ion batteries are ‘memory-free’ and prefer a partial rather than a full discharge. Constant partial discharges with frequent recharges will not cause any harm. Frequent full discharges should be avoided whenever possible. Ideally the sensor should be stored at about 40% or more charge.

The speed at which a lithium-ion battery will age is governed by both its storage temperature (preferably less than 40℃) and state-of-charge.

Firmware Updates

Occasionally Data Harvest may release updated firmware which will contain improvements or new features.

Updates will take place when you connect your sensor to the EasySense2 app. You will be given the option to decline an update.

Updates can be performed over USB or Bluetooth and will typically take less than one minute. Updating firmware over USB will be quicker than Bluetooth.

Do not disconnect the sensor, or power off during the update.

If you have a wireless connection to the EasySense2 app, the sensor will have to be reconnected after performing the update.

Usage Information

- The electrochemical reaction within the Sensor removes oxygen from the thin layer of water in contact with the membrane, so it is necessary to renew this layer i.e. by moving the Sensor through the water, or by natural water flow, or by means of a suitable stirrer. This flow must be induced without the entrapment of air bubbles.
- You will notice that as the electrode is positioned deeper in the water that the %dissolved oxygen etc. will change. This is due to pressure in the water column affecting the %oxygen calculation. Therefore make measurements, wherever possible, at the same depth.
- Do not touch the membrane or allow it to touch the bottom of a container.
- Try to keep the electrode vertical during use.
- If the membrane cap is wet, shake gently to remove residual fluid. Do not use a cloth to dry.
- When an electrode is placed in a solution, allow to stabilise before starting to record measurements.
- If you put pH, Oxygen and Conductivity Sensors (electrochemical type) in the same solution at the same time you may notice interference.
- The gas permeable membrane isolates the sensor elements from the solution on test but allows the oxygen to enter. This transport can cause the readings to begin to shift after 4 to 5 hours. If possible, recalibrate every two hours.
- Although the electrode part of the sensor is waterproof, its plug and the Smart Q Oxygen adaptor are not waterproof.
- The Oxygen electrode is supplied with 2 membrane caps, 60 ml of electrolyte and a piece of polishing paper. Further membranes are available as part of the oxygen maintenance kit.
- Treat the membrane carefully as it is fragile. The membrane is PTFE so is very resistant to chemical attack. However it should not be used with wetting agents such as detergents and soaps as they break down surface tension and allow water to pass through the membrane. No grease, oil or organics should come into contact with the membrane.
- Hydrogen Sulphide (H2S) - a by-product of anaerobic respiration recognised by its rotten egg smell - can be a problem as H2S can pass as a gas through the membrane and attack the silver anode to form Ag2S (a black precipitate). The electrode will not function with this coating, which can be difficult to remove. See cleaning.
- The gas permeable membrane may be deformed by pressure if the electrode is immersed to any depth, making the results unreliable.
- The oxygen permeability of the membrane is temperature dependent. This variation in permeability is automatically compensated by the temperature compensation thermistor over the 5 to 45°C operating range. The compensation will lag, the temperature compensator is inside the anode.
- No compensation is provided for the effect of atmospheric pressure. Calibration should therefore be carried out at the pressure at which measurements are to be made.
- Long-term immersion will see drift in the output; the reactions taking place by the silver anode will start to produce less conductive silver salts (mainly AgCl) on the anode and change the conductivity of the anode – cathode circuit. The silver chloride will be seen as dark patches or dulling on the anode.

Cleaning and maintenance

- Take care not to over stretch the membrane when assembling the electrode, as it will become thinner and over sensitive. A membrane that has been damaged in this way will have an opaque white appearance and should be replaced.
- After extensive use, the electrode may become sluggish and erratic due to surface contamination of the gold cathode. If this occurs, polish the tip of the electrode with the fine crocus paper provided i.e. lay the crocus paper on a smooth flat surface, hold the electrode vertically on it and polish gently with a circular motion. Polish only enough to restore to a bright clean surface.

- A net result of the anodes reaction with the electrolyte (KCl) can be a build-up of AgCl on the silver anode. If the anode is covered in an AgCl deposit (black/brown stains) the electrode will give unreliable results. This deposit may be removed by:
- Make up a paste of baking soda (bicarbonate of soda - NaHCO3) with some water, leave the tip in the paste for at least an hour then rub with some of the paste until the tip is clean and shiny. Or
- Soaking the electrode tip overnight in a neat ammonia solution.
- If neither of these methods works use either the crocus paper supplied or jeweller's rouge to remove the stains. Do not scratch the silver; the surface must remain even, or you will create long-term stability problems.

Note: Ammonia solution is toxic, corrosive and irritant. Please refer to local safety regulations for handling instructions.

Practical Investigations

The Smart Wireless O_2 Dissolved Sensor can be used to investigate a number of scientific experiments such as:

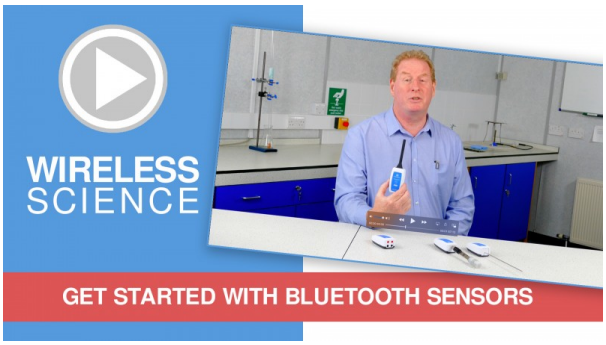
- On-site testing in streams & ponds
- Lake survey to evaluate the capability of the water to support different types of plant and animal life
- Change in oxygen levels around an aquatic plant
- Part of data for water quality
- Fish tank / aquaria water quality
- Cellular respiration of yeast cells / suspension
-

Online Videos

Learn how to use data logging in the classroom with our Secondary Science Academy demonstration videos, which will walk you through using the new EasySense2 app and show you how to get hands-on with the latest Bluetooth wireless sensors. The video experiments will show you how to get the best out of your science lessons.

New online content is being continuously uploaded onto our YouTube channel, including practical worksheets as well as videos.

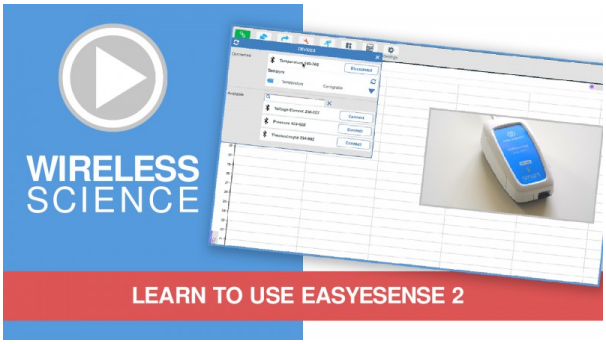
See our website for further information and links.



Explore Bluetooth Sensors

Are you looking to make the jump to our smart wireless sensors? Or have you recently purchased them and want to know more about how they work?

View video playlist



Explore EasySense2

The core of our science platform is our EasySense2 software. In these videos you will learn everything from the basics of our software to the most in-depth features.

View video playlist

Explore Science Practicals

See our Smart Wireless Sensors in action with a range of practical experiments. This is the best way to get started with the new Bluetooth sensors!

View video playlist

Sensor Specifications

Please read the following table for sensor specifications.

Feature	Detail
Measurement Ranges	O_2 0-150%SAT O_2 0-250%SAT O_2 15mg/L O_2 20mg/L
Resolution	O_2 0-150%SAT, 0.1%SAT O_2 0-250%SAT, 0.1%SAT O_2 15mg/L, 0.01mg/L O_2 20mg/L, 0.01mg/L
Fastest logging speed	20ms (50Hz)
Connectivity	Wired via USB Wireless via Bluetooth
Bluetooth Specifications	Bluetooth 4.2 low energy radio, single mode compliant Transmit (TX) power: 0 dBm Receiver (RX) sensitivity: - 90 dBm Usable transmission range: up to 10 m in open air Frequency Range: 2.402 to 2.480 GHz operation
Internal Battery	Rechargeable internal lithium-ion 3.7 V Power specification: 5 V at 500 mA
Storage/Operating Temperature	0 - 40℃
Humidity	0 to 95% RH (non-condensing)
Physical Specifications	Weight: approx. 68 g External dimensions: approx. height 33 mm x width 47 mm x length 96 mm

Limited Warranty

For information about the terms of the product warranty, see the Data Harvest website at: https://data-harvest.co.uk/warranty

Product Repairs

When returning goods to Data Harvest, please download and complete the repair return form to ensure you have sent us all the information we require, and send it to us alongside the item to be repaired. The second page of this form includes a return address label.

If you have purchased a Data Harvest manufactured product via a different company, please also supply proof of purchase.

Postage Charges

- In the event of a fault developing, the product must be returned in suitable packaging to Data Harvest for repair or replacement at no expense to the user other than postal charges.
- There will be no postal charge for the return of repaired goods to any mainland UK address (for other areas, additional shipping charges may apply).

Out of Warranty Repairs

Please visit https://data-harvest.co.uk/repairs for the most up to date charges for out of warranty repairs.

Warranty on Repaired Items

Once an item has been serviced and repaired, the product will have 1 year warranty against further failure of the component repaired.

International Returns

Please contact the authorised Data Harvest representative in your country for assistance in returning equipment for repair.

Compliance

This product complies to the following standards

Waste Electrical and Electronic Equipment Legislation

Data Harvest Group Ltd is fully compliant with WEEE legislation and is pleased to provide a disposal service for any of our products when their life expires. Simply return them to us clearly identified as 'life expired' and we will dispose of them for you.

FCC Details

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CE

This product conforms to the CE specification. It has been assessed and deemed to meet EU safety, health and environmental protection requirements as required for products manufactured anywhere in the world that are then marketed within the EU.

UKCA

This product conforms to the UKCA specifications.

Troubleshooting

If you experience any problems with your product, please try the following troubleshooting tips before contacting the Data Harvest support team.

Feature	Detail
Loss of Bluetooth Connectivity	**If the sensor loses Bluetooth connection and will not reconnect try:** Closing and reopening the EasySense 2 app. Switching the sensor Off and then On again. If you are using a Bluetooth Smart USB Adaptor on your computer, unplug the adaptor, plug back in again and try to reconnect. Hard reset the sensor and then try to reconnect.
Output too high to calibrate, slow drift or unstable readings	Membrane stretched - renew membrane
Sluggish response:	Cathode / anode in need of cleaning
Drifting or odd results:	• If other electrochemical sensors (e.g. pH, Conductivity) are present in the same solution, they could be causing interference as they all make an electrical connection to the solution. Try removing the other sensors, moving them as far apart as possible. • Electrode not fully polarised - leave set up for 30 to 60 minutes and then recalibrate. • Water too still – move the sensor through the water or use a suitable stirrer (fish in an aquarium can make good stirrers!).

Notices

Please read the following notices with regards to using your sensor

1. The sensor is much smarter than traditional Bluetooth sensors and you are not required to pair the device. If paired, the sensor will not be available to the EasySense 2 app.
2. When the sensor is connected to a computer, the computer should be turned on and not in sleep or standby mode or the battery may drain instead of charge.
3. Data Harvest products are designed for educational use and are not intended for use in industrial, medical or commercial applications.
4. The sensor is not waterproof.
5. Plastic parts may fade or discolour over time if exposed to UV light. This is normal and will not affect the operation of the sensor.

Contact Information

To contact Data Harvest directly, please use any of the following channels

Traditional Communications

Data Harvest Group Ltd.
1 Eden Court, Eden Way,
Leighton Buzzard,
Bedfordshire,
LU7 4FY
United Kingdom

Tel: +44 (0) 1525 373666
Fax: +44 (0) 1525 851638
Sales email: sales@data-harvest.co.uk
Support email: support@data-harvest.co.uk

Online Communications

We have active social media support channels using the following platforms

- Facebook
- Twitter
- YouTube

Office Opening Hours

Monday to Thursday - 08:30 to 16:45
Friday - 08:30 to 13:30
Saturday & Sunday & UK Bank Holidays - Closed

PDF Translations

The PDF formatted download of this manual is by default provided in the English (United Kingdom) language. If an alternative translation is available, it will be listed here.

We have for your convenience included a webpage translation feature to the online documentation which will allow you to translate and print individual pages of this documentation.
