S1899

Using the Oxygen sensor

The instructions in this paper are designed to show:

- How to set-up an Oxygen sensor and use the calibration function of the sensor.
- How to care for your Oxygen probe before long-term storage.
- How to set up a simple investigation using an Oxygen sensor, Datadisc and a Logbook Datalogger.

Setting the Calibration of the Oxygen sensor

The ScienceScope Oxygen sensor has two ranges:

- 0-200%. This is a measurement of relative oxygen concentration based around air (i.e.21% oxygen). An output of 100% from the sensor represents air saturated water at that temperature. When a plant photosynthesises it produces pure oxygen and hence the % shown by the sensor can rise well about 100%.
- 0-18mg dm^{-3}. This is a measurement of absolute oxygen concentration and indicates the quantity of air in milligrams dissolved in a unit volume of water.

Before using the Oxygen sensor we recommend that it should be calibrated. To do this proceed as follows:

- Prepare a beaker of water at a temperature of between 20 and 30 ºC which is saturated with air. This can be achieved by bubbling air through the water for 30 minutes. Make sure the sensor has both the oxygen and temperature probes plugged into the sensor case. It does not matter which probe sockets the probes are plugged into, the sensor will auto-detect them.
- Suspend the oxygen probe and temperature sensor in the water as close together as possible.
- Connect the sensor to a Logbook datalogger and switch the logger on. The sensor can be calibrated in wither of its two ranges.
- Press and hold the 'Range' button on the sensor for at least 5 seconds. If the sensor is on the % range when calibrated the meter on the logger should read 100%. If calibrating on the mg dm^{-3} range the value at the calibration point will depend on the water temperature but will be in the region of about 10.

If the sensor is being used to make absolute oxygen readings it is recommended that the sensor is calibrated prior to use.

Setting the Calibration of the Oxygen sensor when used directly with Datadisc

Please note that this sensor, S1899, is a new design (Jan 2008) and when connected to Datadisc Pt (top level) the meter for the Oxygen sensor will show a 'Set 100%' button. This is legacy support and should not be used to calibrate this new sensor. Use the button on the sensor as described above.

Electrode Care and Long-term storage

- The Oxygen sensor must be stored in distilled water in the protective bottle. The bottle must be tightly screwed down to ensure the water does not slowly evaporate from the bottle.

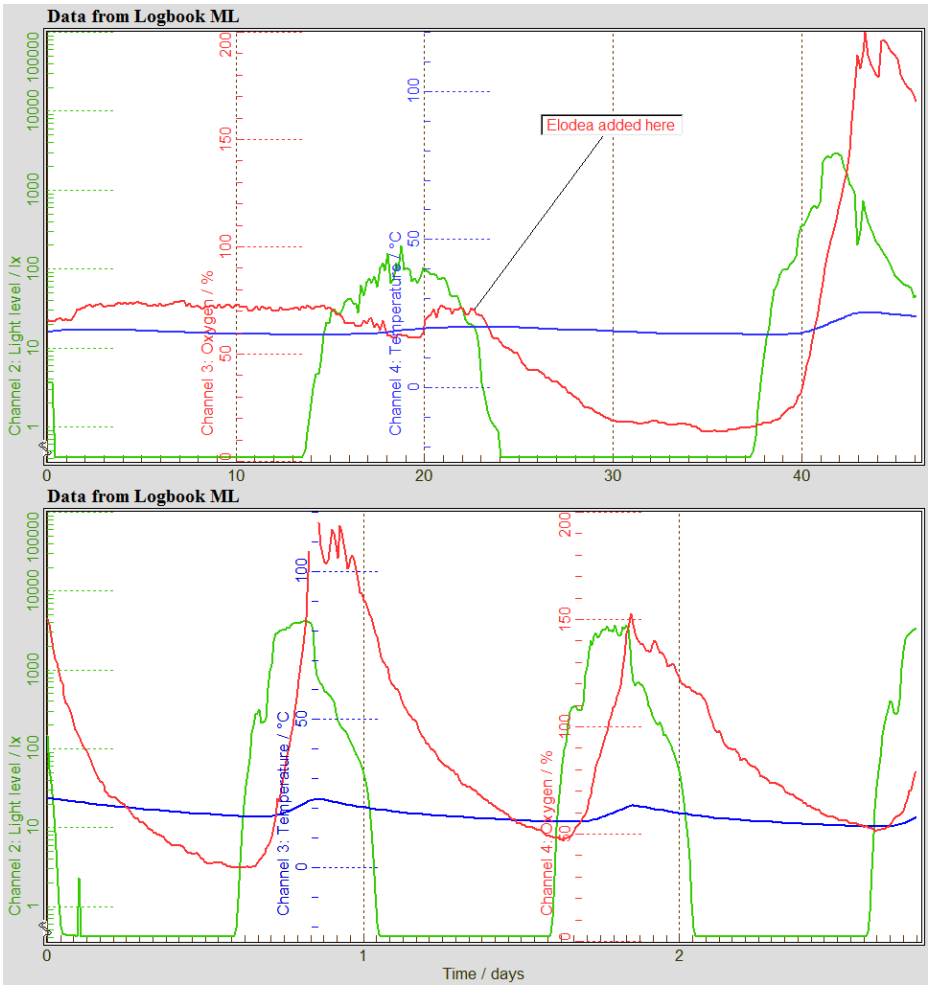
An investigation into Oxygen Concentration and Photosynthesis using Elodea

Using a Logbook and an Oxygen sensor, Light sensor and Temperature probe, a vessel containing some healthy Elodea, a relatively warm environment and a good light source (ie, a window sill), it is possible to monitor the variations in Oxygen concentration of the water surrounding the Elodea, along with light and temperature variations. A recording made over at least a 24 hour period can be made and then studied using Datadisc. To carry out this simple investigation proceed as follows:

1. Place a suitable container on a window sill and fill with tap water, and use an air pump to saturate the water with air. Using a clamp stand and attachments, hold the oxygen sensor, and its temperature probe, in the centre of the water body. Leave the sensor in this arrangement for at least half an hour to allow it to equilibrate, and then press the calibration button, as described above. You must decide which range you wish to record with, % saturation with air, or mg dm^{-3} , and select the range on the sensor.
2. You may wish to record a control with no elodea, and show the effect of turning off the air pump and allowing the water to equilibrate with the atmosphere, for a 24 hour period, before introducing any elodea. If so, using a Logbook datalogger remotely, start an auto time log, and place the logbook in a position next to the container to allow the inbuilt light sensor to record the light levels, and perhaps the external temperature probe could be use to monitor the water temperature at the same time, by arranging it with the oxygen probe and its temperature-compensation probe in the water.

3. Next introduce a good handful of Elodea, and at the same time introduce a slow Carbon Dioxide supply, either from a gas cylinder or from a fermentation vessel setup for the purpose. The introduction of CO_2 has a dramatic effect on the photosynthetic rate, and will ensure Oxygen is produced in daylight, even at relatively low light levels.
4. When at least 24 hours has passed stop the remote recording, and then connect the Logbook datalogger to a computer with Datadisc installed and download the remote log from the Logbook, and save the data.
5. The Logbook datalogger can be attached to computer, if convenient, to allow the data to be viewed as it is logged, and to control the logging process more precisely.
6. The recordings shown below are from 2 separate recordings, the first starts with 24 hours control, with no Elodea, and the second from 2 days with Elodea. The first recording shows the dramatic effect introducing Elodea has on the dissolved oxygen. The first 24 hours of the recording show relatively stable dissolved oxygen level. This alters to huge swings in dissolved oxygen levels after Elodea is introduced. At night the Elodea respires reducing the dissolved oxygen concentration. During the day the Elodea photosynthesises resulting in a large increase in dissolved oxygen concentration.
7. The second recording underlines the diurnal changes in dissolved oxygen changing with light levels.

On these graphs dissolved oxygen levels are shown in red, temperature in blue and light level in green.



Equipment List:

- A Logbook datalogger, a connection to the computer, a PC computer with **Datadisc Pt** software installed.
- An Oxygen sensor.
- A temperature probe and Light sensor if there are none internal to the Logbook.
- A clear container.
- A small amount of Elodea.
- A supply of Carbon Dioxide