



CHLOROLAB 3 SYSTEM

- Convenient, system for the advanced study of photosynthesis & respiration measurements in liquid-phase samples under illumination.
- DW3 oxygen electrode chamber for larger sample volumes up to 20 ml.
- Oxylab unit for direct PC control and data acquisition.
- Sample mixing by integral stirrer driving a magnetic follower.
- Illumination via LH36/2R red LED array via front optical port.
- Quantitherm light/temperature sensor for light calibration.
- System calibration & control via Windows® Software.

Overview

Chlorolab 3 provides a sophisticated system for the advanced study of respiration and photosynthesis from larger liquid-phase sample volumes up to 20ml. The system is ideally suited to busy research facilities where demands on equipment performance are high but is equally at home in teaching environments for under & post-grad plant biology studies of the photosynthetic processes.

The DW3 is best suited to measurements of larger samples such as macroalgae or seaweed sections which can be suspended securely in liquid a medium of up to 20ml. DW3 is also suitable for suspensions of extracted chloroplasts, micro-algae etc when larger sample volumes are required. Changes in oxygen concentration of the sample medium are determined by the integral oxygen electrode mounted in the base of the chamber.

The system comprises the Oxylab control unit, S1 Clark type electrode disc, DW3 liquid-phase electrode chamber, LH36/2R red LED light source and QRT PAR/temperature sensor for light source

calibration. All necessary accessories and spares are also included (excluding circulating water bath and PC).

Components of the System

The Chlorolab 3 system consists of the following individual items:

OXYLI Oxylab Control Unit

The Oxylab oxygen electrode control unit is designed to provide PC control of oxygen uptake or evolution measurements across a broad range of applications from studies of mitochondrial and cellular respiration to measurements of isolated chloroplast suspensions or solid state leaf samples in photosynthesis research.

The Oxylab allows simultaneous recording of the output from the S1 oxygen electrode, an optional auxiliary input signal (e.g. temperature, pH, chlorophyll fluorescence, TPP+ or other specific ion electrodes etc) is also possible using the appropriate apparatus.

The Oxylab control unit connects to the serial port of a Windows® PC either directly or using a HAN/USB adapter (for newer PC's with no serial ports). The control unit features a built-in magnetic stirrer (for liquid-phase measurements) and all the electronics required to control and measure the signal from the S1 oxygen electrode disc. Additional Oxylab functionality provides automation of complex light intensity changes during light response assays. Light tables (or photon flux density tables) are created within the Oxylab software via a user-friendly interface.

Oxylab32 Windows® software controls all major hardware and data acquisition functions including signal gain and back-off and simple calibration routines for both liquid and gas-phase measurements. Data from the S1 electrode disc, optional auxiliary input signal and temperature signal from a QTP1 PAR/Temperature probe sensor (not supplied) are plotted as a chart recorder emulations in "real-time" with post-measurement data analysis tools included within the program. Completed experiments may be exported as an ASCII file which then may be opened in other Windows® data analysis applications such as Excel®.

DW3 Electrode Chamber



The DW3 large volume electrode chamber is particularly suited to oxygen evolution / uptake measurements of macroalgae in seawater samples up to 20ml. (15-20ml if illumination is required). The square section borosilicate glass reaction vessel & quartz front window provides good optical qualities over a large surface area when illuminating the sample using the LH36/2R red LED light housing. Samples may either be in stirred suspension or in the case of laminar material, may be vertically supported & retained by the plunger assembly such that they may be fully illuminated.

A prepared S1 oxygen electrode disc is mounted beneath the reaction vessel and forms the floor of the vessel itself providing

a highly sensitive & rapid response to small changes in oxygen tension within the sample. A rear optical window allows optional insertion of the fibre-optic cable from either the FMS 1 or FMS 2 pulse modulated chlorophyll fluorimeter (using DW3/FA adapter) to provide simultaneous fluorescence measurements.

S1 Oxygen Electrode Disc

The S1 is a Clark type polarographic oxygen electrode disc and comprises a central platinum cathode and a concentric silver anode. Preparation includes the addition of electrolyte and the application of a thin oxygen permeable P.T.F.E. membrane to the electrode dome. Once prepared and positioned in the electrode chamber, the disc is connected to the Oxylab control circuitry which applies a small polarising voltage between the electrodes. In the presence of oxygen, a small current is generated proportional to oxygen activity in the sample.



LH36/2R Red LED Light Source



The LH36/2R consists of an array of 36 red LED's with a peak wavelength of 650nm. When mounted on the quartz front window of the DW3 electrode chamber, the LH36/2R provides a uniform, stable light output up to a maximum intensity of 900 $\mu\text{mol m}^{-2} \text{s}^{-1}$. An integral cooling fan automatically switches on as necessary to cool the housing ensuring stability of the light intensity.

QRT1 PAR/Temperature Sensor

The QRT1 with QTP1 probe sensor is a handheld PAR sensor combined with a thermometer. The QTP1 probe mounts vertically in the reaction vessel of the DW3 electrode unit & permits calibration of incident light & temperature in the chamber.



Technical Specifications

OXYLI Oxylab Electrode Control Unit

Measuring Range	0 - 40% oxygen
Min. O ₂ Resolution	Typically 10 x 10 ⁻⁵ $\mu\text{mol/ml}$ at 20 °C
Integral Magnetic Stirrer	Yes (software controlled 150 - 900 rpm)
Polarising Voltage	700 mV
Gain/Back Off Control	Software adjustable. Gain: up to x50 (10 bit resolution) Back off: 12 bit resolution
Integral Test Resistor	Yes
Data Acquisition Rate	Software selectable between 0.2 - 10 readings per second
Signal Inputs	Electrode disc, Auxiliary input, QTP1 PAR/temperature probe
Communications	Bi-directional RS232. USB using HAN/USB adapter
Dimensions	250 (w) x 126 (d) x 65mm (h). Weight: 650gms
Power Supply	95 - 260V universal input mains supply. Output 12V DC 2.5A
Electrode Chamber Compatibility	All Hansatech Instruments electrode chambers
Additional Information	Automated control of external LH11/2R or LH36/2R LED arrays

DW3 Oxygen Electrode Chamber

Measurement Suitability	Liquid-phase (sea water) respiration/photosynthesis
Construction	Black acetal
Sample Chamber	Square section borosilicate glass
Sample Volume	1 - 20ml (min. 15ml if illuminated)
Optical Ports	Optical port (26mm dia), quartz window (36mm dia)
Temperature Control	Water jacket connected to circulating water bath
Dimensions	110mm (w) x 75mm (d) x 100mm (h). Weight: 400gms
Additional Information	Reducing adapters available for optical ports

S1 Oxygen Electrode Disc

Electrode Type	Clark type polarographic oxygen sensor
Electrode Output	Typically 1 μA at 21% O ₂ . Residual current in 0% O ₂ typically 0.02 μA
Response Time	10 - 90% typically < 5 seconds
Oxygen Consumption	Typically < 0.015 $\mu\text{mol hr}^{-1}$

LH36/2R Red LED Light Source

Lamp Type	36 x red LED (650 nm peak)
Power Supply	Requires Oxylab oxygen electrode control unit for power
Intensity Adjustment	Automatic intensity control via Oxylab oxygen electrode control unit & software
Dimensions	74 mm (dia) x 52 mm (h). Weight: 270g
Max. Intensity in Chambers	750 $\mu\text{mol m}^{-2} \text{s}^{-1}$ in LD1/2 & LD2/3 900 $\mu\text{mol m}^{-2} \text{s}^{-1}$ in DW3

QRT1 PAR/Temperature Sensor

Measuring Range	0 - 50000 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (+/- 5%) in 2 ranges (0 - 5000 and 0 - 50000) in 400 - 700nm waveband
Resolution	1 $\mu\text{mol m}^{-2} \text{s}^{-1}$ at 0 - 5000, 10 $\mu\text{mol m}^{-2} \text{s}^{-1}$ at 5001 - 50000
PAR Sensor	Silicon photodiode/optical filter combination with white acetal diffuser (7mm diameter)
Temperature Sensor	RT curve matched bead type thermistor. 0 - 50°C/32 - 122°F. 0.02°C resolution
Signal Display	Handheld display unit. 16 x 2 LCD display. 0 - 5V analogue output of PAR/temperature values
Power Requirement	4 x 1.5V AA (LR6) cells. Typically 100 hours battery life
Dimensions	Display: 146 (h) x 92 (w) x 32mm (d). Weight: 300g (including batteries). QTP1 probe: 9.5 (dia.) x 107mm (length). Weight: 50g