



LEAFLAB 2 SYSTEM

- Research-grade system for the study of photosynthesis & respiration measurements in gas-phase samples under illumination.
- LD2/3 chamber suitable for leaf discs up to 10cm² cut from whole leaves, algae or moss etc.
- Double water jacket provides enhanced temperature control of sample and electrode disc.
- Illuminated by LH36/2R red LED array located on the upper optical port.
- Electrode control and direct signal acquisition to a PC via the Oxylab control unit.
- Windows® software control over all hardware functions & data acquisition.

Overview

Leaflab 2 facilitates advanced studies of photosynthesis and respiration from solid-state samples. 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.

Samples typically consist of leaf discs which are either cut from a broad leaf or made up of a "mat" of smaller leaves to form a circular disc of 10cm². These samples are cut using a supplied leaf disc cutter. Changes in oxygen content of the sealed sample chamber are determined by the integral oxygen electrode mounted in the base of the chamber.

The system comprises the Oxylab electrode control unit, S1 Clark type electrode disc, LD2/3 advanced gas-phase electrode chamber, LH36/2R high intensity red LED light source, QSRED large area quantum sensor (red filtered for 550 - 750nm waveband) and Oxylab control and data acquisition software. All necessary accessories and spares are also included (excluding circulating water bath and Windows® PC).

Components of the System

The Leaflab 2 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 control unit provides an effective tool for the measurement of oxygen signals from the S1 Clark type oxygen electrode. Simultaneous recording of 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. Data from the S1 electrode disc, optional auxiliary signal and temperature signal from a QTP1 PAR/Temperature sensor (not supplied) are plotted as a chart recorder emulations in “real-time” with post-measurement data analysis tools included. Completed experiments may be exported as an ASCII file for more detailed analysis in applications such as Excel®.


LD2/3 Electrode Chamber



The LD2/3 leaf-disc electrode chamber allows oxygen uptake / evolution measurements to be performed from leaf-discs, excised needles, algae, mosses, lichens etc with a surface area of up to 10cm². A prepared S1 oxygen electrode disc is mounted directly below the sample chamber with the dome of the electrode forming the chamber floor. Upper and lower water jackets ensure superior temperature control of the sample and electrode when linked to a temperature controlled circulating water bath. The leaf chamber section has 2 gas ports providing both a calibration and flow-through capability for rapid changes in the gaseous environment above the sample.

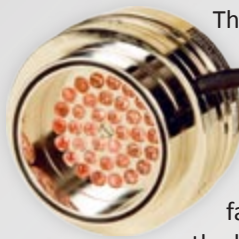
A clear cast acrylic top window allows illumination of the sample via the LH36/2R LED light source with 1 additional optical port provided for either additional illumination or insertion of a quantum sensor, etc. A further port is orientated more vertically towards the sample and allows the fibre optic cable from the FMS modulated fluorimeters to be positioned close to the sample allowing simultaneous measurement of chlorophyll fluorescence.

S1 Oxygen Electrode Disc




The S1 Clark type polarographic oxygen electrode disc provides a sensitive and rapid response to small changes in oxygen within the sample chamber. The electrode 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 connected to the Oxylab, a small polarising voltage is applied between the electrodes. In the presence of oxygen, a small current is generated proportional to oxygen activity in the sample chamber.

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 upper window of the LD2/3 electrode chamber, the LH36/2R provides a uniform, stable light output up to a maximum intensity of 750 μmol m⁻² s⁻¹. An integral cooling fan automatically switches on as necessary to cool the housing ensuring stability of the light intensity.

QSRED Quantum Sensor



The QSRED quantum sensor consists of a handheld display unit and matched cosine corrected sensor head containing a special high grade photocell filtered for the 550 - 750nm waveband. The linearity of response is excellent with a maximum deviation of 1% up to levels of 3000 watts/m² (greater than normal solar irradiance). The μmol m⁻² s⁻¹ value from the sensor is displayed on the LCD display. 3 measurement ranges allow maximum sensitivity from 0 - 2000 μmol m⁻² s⁻¹. QSRED is intended to be used primarily as a calibration tool for Hansatech Instruments red LED light sources.

Technical Specifications

OXYLI Oxylab Electrode Control Unit

Measuring Range	0 - 40% oxygen
Min. O ₂ Resolution	Typically 10 x 10 ⁻⁶ μmols/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

LD2/3 Oxygen Electrode Chamber

Measurement Suitability	Gas-phase respiration/photosynthesis
Construction	Black acetal
Sample Chamber	Leaf chamber (7.5cc)
Sample Area	10cm ²
Optical Ports	Cast acrylic top window, optical port (16mm dia), fluorimetry port (FMS1 & 2)
Temperature Control	Double water jacket connected to thermoregulated circulating water bath
Dimensions	100mm (d) x 130mm (h). Weight: 650gms
Additional Information	2 gas-ports for calibration & flow-through capability

S1 Oxygen Electrode Disc

Electrode Type	Clark type polarographic oxygen sensor
Electrode Output	Typically 1μA at 21% O ₂ . Residual current in 0% O ₂ typically 0.02μA
Response Time	10 - 90% typically < 5 seconds
Oxygen Consumption	Typically <0.015μmol 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 μmol m ⁻² s ⁻¹ in LD1/2 & LD2/3 900 μmol m ⁻² s ⁻¹ in DW3

QSRED Quantum Sensor

Measuring Range	0 - 2000 μmol m ⁻² s ⁻¹ in 3 ranges (0 - 20.00, 0 - 200.0, 0 - 2000) in the 550 - 750nm waveband
Resolution	1 μmol m ⁻² s ⁻¹ at 0 - 2000 0.1 μmol m ⁻² s ⁻¹ at 0 - 200.0 0.01 μmol m ⁻² s ⁻¹ at 0 - 20.00
PAR Sensor	Silicon photodiode/optical filter combination with white acetal diffuser (37mm diameter)
Signal Display	Handheld display unit with LCD. 0 - 2V analogue output of measured values
Power Requirement	1 x 9V PP3 cell
Dimensions	Display: 146 (h) x 78 (w) x 35mm (d) Weight: 238g (including battery) Sensor: 45 (dia.) x 56 (length) Weight: 164g