LC*pro+*

The intelligent portable photosynthesis system

Putting you in complete control

- **Fully programmable environmental control**
- **Unparalleled portability**
- **Graphic display**
- **Miniaturised IRGA in leaf chamber**
- **Unlimited data storage**
- **Powerful yet affordable**

Introducing the **First** truly portable and affordable gas exchange system with full environmental control.

Fully programmable environmental control

The LC*pro+* provides full automatic and independent control of the environmental conditions within the plant leaf chamber. Utilising the latest microclimate management technology, automatic control of parameters is achieved both above and below ambient conditions. Gas control is user selectable to either the reference or analysis gas streams.

CO_2 control:
Miniaturised integral CO_2 supply system

H_2O control:
On board conditioning chemicals

Temperature control:
Peltier heat transfer controller

PAR control:
Mixed red / blue LEDs

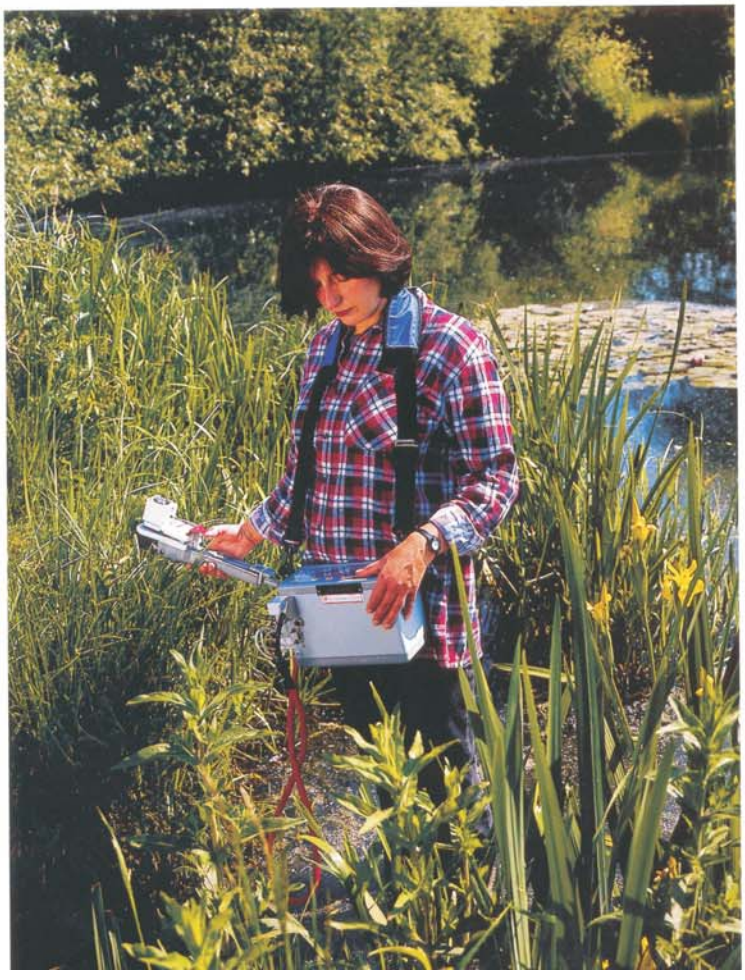
Unparalleled portability

The LC*pro+* offers all the facilities and features required by the world's leading plant science researchers in the most portable format available. The LC*pro+* is the smallest, lightest and most user-friendly IRGA with microclimate control ever developed.

Featuring ADC's new miniaturised infrared gas analyser and surface mount technology, the LC*pro+* is, at 4kg, less than half the weight and half the size of conventional systems offering microclimate control. Full programmability, flow control and unlimited data storage are contained within the compact LC*pro+* console.

Powered by a small 12V rechargeable battery and incorporating the latest in low power consumption components, the LC*pro+* will function for up to 16 hours, depending on the environmental controls being operated. Batteries can be quickly and easily changed in the field.

Designed for rugged and reliable use in harsh field conditions, the LC*pro+* maintains optimal experimental performance even in high humidity or dusty environments.



Miniaturised IRGA in chamber head

With over three decades of experience of being world leaders in the design and manufacture of infrared gas analysers, ADC BioScientific has now developed a miniaturised format of the proven portable IRGA. The Mini-IRGA housed inside the new LC*pro+* plant leaf chamber provides accurate, fast and reliable gas exchange performance for classic photosynthesis experimentation.

By housing the improved gas analyser directly in the leaf chamber head, response delays in either gas exchange measurements or environmental control are, effectively, eliminated. The ADC miniaturised IRGA carries out an automatic zero in the standard operational cycle, ensuring long term stability. All CO_2 measurements are automatically compensated for atmospheric pressure and temperature.

To provide the researcher with full photosynthesis data, the LC*pro+* plant leaf chamber encloses a number of high quality environmental sensors. Two laser trimmed water vapour sensors provide reliable transpiration data, while high calibre sensors measure Photosynthetic Active Radiation and chamber temperature. The LC*pro+* offers the user a choice of accurate leaf temperature determination methods. A new, easy to use, self-positioning sensor is provided as standard in many chambers. Alternatively, a manual placement sensor can be selected or the proven Energy Balance equation used.

User-friendly sophistication

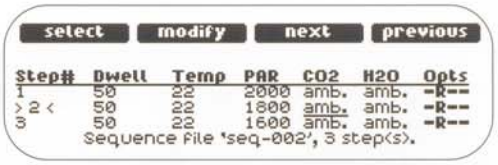
The LC*pro+* has been designed to provide researchers with the highest level of sophistication in the easiest to use format. It is not only highly portable but also ergonomically conceived to be easy to operate and maintain.

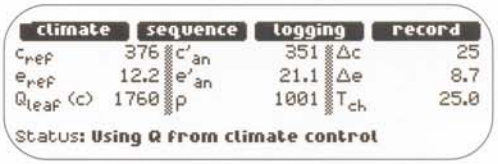
Operation and experimental programming is effortless. Complete functionality is achieved with just five fast keys driving a series of simple and intuitive menus. No separate "bolt on" PC or laptop is required.

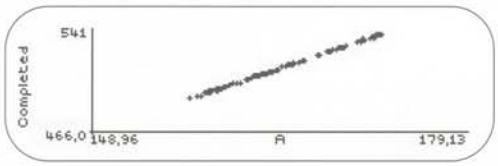
The LC*pro+*'s versatile software enables the system to be effortlessly set for the automatic control of individual parameters or multiple environmental parameters within the leaf chamber. This control may be at a single point or at multiple, sequential control points. Climate concentrations and dwell times may be pre-selected to generate automatic experiments such as light response curves and A/Ci curves.

All real time photosynthesis data, calculations and graphs are clearly presented on a large, high definition liquid crystal display.

In addition to classical photosynthesis and transpiration calculations, the LC*pro+* provides soil respiration rate calculations for when the soil chamber head is employed.







Graphic display

Data recording can be initiated both automatically and manually. Automatic data recording can be programmed to take place as part of a simple or detailed experiment, such as an A/Ci curve. Alternatively, manual recordings can be made either via the keypad or the button on the chamber handle.

Experimental data may be presented on the real time graphic display. Parameters may be plotted against time or record number. Two parameters may also be plotted against each other, such as in the case of A/Ci curve experimentation.

The LC*pro+* features unlimited data storage. All experimental protocols, photosynthesis data and calculations are stored on easily exchangeable PC (PCMCIA) cards. This popular feature, already incorporated in other ADC gas exchange instrumentation, allows separate PC cards to be used for individual users or for specific experimental applications.

Stored experimental data may be reviewed on the display screen in the field. Downloading of data may be conducted directly from the PC cards or via the RS232 output.

Interchangeable chamber heads

The *LCpro+* is available with a range of interchangeable heads. These are easily and quickly exchanged in the field using only a small coin.

Boundary layer resistances and concentration gradients are minimised irrespective of which head is in use. Chamber materials have been carefully chosen to ensure that there is minimal interaction with CO_2 or water vapour. Chamber windows are silica coated to reduce scratching. On fitting, each chamber is autoconfigurable, removing the requirement for complex reprogramming whenever a different head is used.

The *LCpro+* chamber is simple to operate with a thumb trigger opening mechanism. All areas of the chamber are easily accessed for cleaning.

Broad Leaf Chamber
The broad leaf chamber is the most widely used chamber and the one most suited for the largest number of plant species. It features both a self-positioning leaf temperature sensor and a manual placement temperature sensor. The chamber window area is 6.25cm^2.

Narrow Leaf Chamber
This is designed especially for long grasses and narrow leaves under 1cm in width. For leaves wider than 1cm, we recommend the broad leaf chamber. The *LCpro+* narrow leaf chamber features both a self-positioning leaf temperature sensor and a manual placement sensor. The chamber window area is 5.8cm^2.

Conifer Leaf Chamber
The unique "staircase" design of the dedicated LED unit allows automatic light response curves to be conducted even on pine needles and conifers. It is also suitable for small fruits and composites of very small leaves. The total chamber volume is 175cm^3.

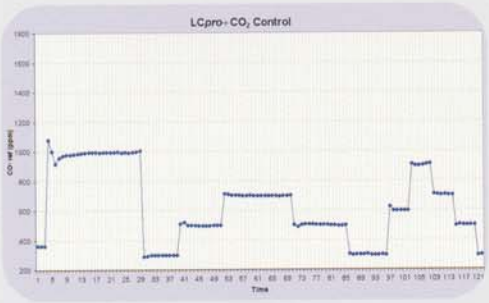
Arabidopsis Leaf Chamber
The Arabidopsis leaf chamber features a unique flexible arm that allows you to easily position the chamber onto the Arabidopsis leaf, even when the leaf is close to the soil surface, without damaging the sample leaf or others in its proximity. The arm is then locked into position allowing accurate gas exchange measurements to be conducted. The chamber is available with a window diameter of up to 1.4cm.

Soil Chamber
For soil CO_2 flux measurements in ambient field conditions. The practical design, which includes an internal circulatory fan, eliminates pressure gradients and therefore ensures accurate soil respiration determinations. It features a soil temperature sensor and a detachable soil collar. The total chamber volume is 1 litre.

Fluorometer Adapter Chambers
For simultaneous gas exchange/chlorophyll fluorescence studies. The chambers feature a fibre optic cable adapter to allow use with chlorophyll fluorescence devices. Broad and narrow leaf chambers are available that are compatible with the majority of commercially available fluorometers.

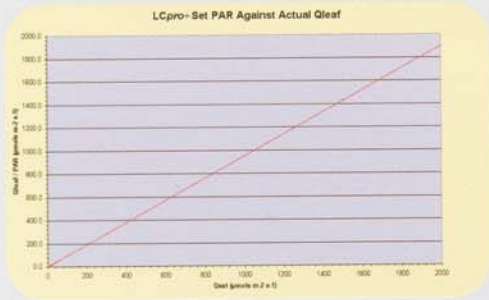
Complete control in a single compact console

Complete, software controlled, environmental control facilities are contained within a single compact and lightweight console. Environmental parameters may be controlled at single or multiple concentrations. A single or combination of parameters may be controlled at any one time. The LC*pro*+ internal battery powers all environmental control facilities. These controls have been especially designed using low power consumption components so maximising battery life. There is no requirement for an external PC, batteries or control units.



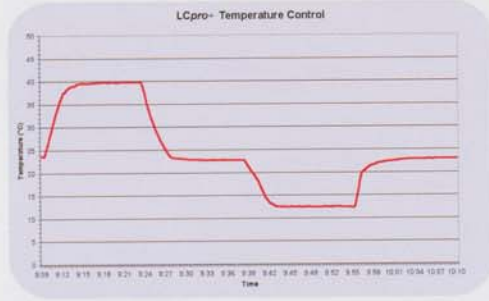
CO_2 control:

The LC*pro*+ features a compact integral elevated CO_2 supply system. This miniaturised regulatory system is internally housed and, therefore, protected from any potential environmental or physical damage. A small pure CO_2 delivery cartridge is used to provide a stable elevated supply within the system. This is combined with ambient air stripped of CO_2 to accurately and effectively maintain the leaf chamber CO_2 at user-selected concentrations. The CO_2 cartridges are conveniently located for speed of exchange. Automatic A/Ci curves may be easily performed by programming a number of sequential control levels with required dwell times and automatic data recording. This highly efficient system enables a 4g CO_2 cartridge to provide up to 32 hours of continuous field operation.



PAR control:

A lightweight, detachable mixed Red/Blue LED array provides reliable, sequential control of light between 0-2000 umols. The unit is designed to closely replicate the PAR spectrum evenly throughout the leaf chamber window. It also maintains spectral quality over the whole intensity range with absolute minimal or no heating. A micro PAR sensor measures the light emitted from the LED array onto the leaf surface. The LC*pro*+ can be easily programmed to generate automatic light response curves. To ensure the optimal light control on the widest possible number of plant species, each type of LC*pro*+ chamber head (Broad, Narrow and Conifer) is supplied with its own dedicated LED unit. Full experimental programming is quick and uncomplicated to perform using the user-friendly LC*pro*+ menu driven software. All environmental control facilities are supplied as standard.



Temperature control:

For the optimised regulation of temperature above and below ambient (+/- 10°C), the leaf chamber incorporates a compact peltier heat transfer controller. This unit provides responsive and stable temperature control.

H_2O control:

Sequential control of H_2O concentrations is achieved using on-board conditioning chemicals. Housing the gas analysis system within the leaf chamber results in faster responses to leaf gas exchanges, fast chamber environmental equilibrium and also assures long term stability. The use of self-indicating chemicals ensures that optimal control is maintained at all times.

ADC: Never compromise on quality

ADC's name is synonymous with photosynthesis research. Since the introduction of the first gas exchange systems, ADC has continued to be at the forefront of instrumentation developments. These are designed to make your research evermore sophisticated, using ADC's evermore user-friendly, portable and affordable equipment.

ADC is committed to Quality:

"quality of product and quality of service."

From design to delivery, ensuring optimal performance and reliability is of paramount importance to our team of experienced engineers. Once in the field, you are supported by our network of over 30 customer support centres worldwide.

As an independent company dedicated solely to the requirements and aspirations of plant science researchers, ADC BioScientific now introduces the future of sophisticated portable photosynthesis measurement instrumentation: the LC*pro+*.

ADC BioScientific Ltd.

12 Spurling Works
Pindar Road
Hoddesdon
Herts EN11 0DB
England

Tel: +44 (0)1992 445995
Fax: +44 (0)1992 444567
E-mail: sales@adc.co.uk
Website: www.adc.co.uk

Technical Specification

Measurement range and technique:	
CO_2:	0-2000ppm, 1ppm resolution. Infrared gas analysis, differential open system, auto zero, automatic atmospheric pressure and temperature compensation.
H_2O:	0-75mbar, 0.1mbar resolution. Two laser trimmed, fast response water vapour sensors.
PAR:	0-3000µmols m^{-2} sec^{-1} Silicon photocell. Cosine corrected.
Chamber temperature:	–5°C-50°C Precision thermistor.
Leaf temperature:	–5°C-50°C Self positioning microchip thermistor/Energy balance/manually positioned thermistor.
Flow rate to Plant Leaf Chamber:	100ml to 500ml min^{-1}
Automatic environmental control:	
Programming:	Internal LC*pro+* menu driven software. Automatic and independent control of environmental conditions within the leaf chamber. For automatic response curves, sequential control levels and dwell times may be set.
CO_2:	Up to 2000ppm CO_2, by the integral elevated CO_2 supply system.
H_2O:	Above and below ambient (dependent on ambient conditions), by on-board self-indicating conditioning chemicals.
Temperature:	+ / - 10°C above and below ambient, by micro-peltier element.
PAR:	Up to 2000µmols m^{-2} sec^{-1}, (up to 1500µmols m^{-2} sec^{-1} for conifer) by high efficiency, low heat output, mixed red/ blue LED array unit.
Display:	240 x 64 dot matrix super twist LCD.
Recorded data:	Removable RAM cards store up to 2,700 sets of data on a 256K Byte card. Up to 2M Byte cards are supported.
Battery:	6.8 Ah rechargeable lead acid battery. Life up to 16 hours. Battery charger: Universal input voltage, intelligent control.
RS232 output:	User-selectable rates of up to 38400 baud for printer or computer connection.
Analogue output:	Two channels. 0-5v user selectable parameters.
Operating temperature:	5°C-45°C
Weight and Dimensions:	
Console:	4.4kg, 23 x 11 x 17cms
Plant Leaf Chamber:	0.8kg, 30 x 7 x 7 cms