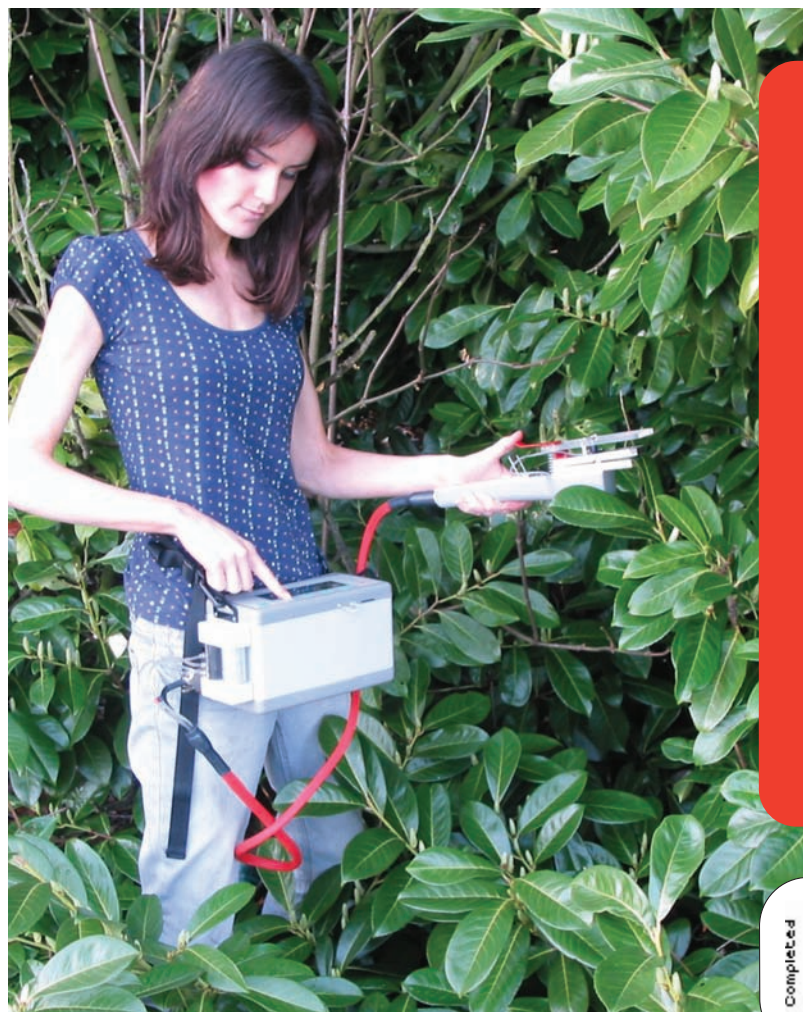




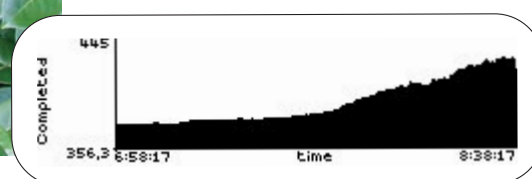
# LCi-SD

## The ultra compact photosynthesis system



### Designed for field use

- Ultra compact
- Weighs only 2kg
- Miniaturised analyser in chamber head
- New Graphic display
- Advanced data capture and output capabilities
- Wide range of experimental applications
- Affordable research instrument



### Ultra compact and field portable

The LCi-SD is our smallest, lightest and most user-friendly portable photosynthesis measurement system ever. It allows access to field sites previously considered unsuitable for conventional gas exchange systems.

#### Weighs only 2kg

Featuring ADC's highly accurate miniaturised infrared gas analyser and surface mount technology, the LCi-SD weighs only 2kg, a fraction of the weight and size of most traditional photosynthesis systems. Full functionality, flow control, graphic display and data capture is contained within the ultra compact and rugged LCi-SD console.

The LCi-SD is light enough to be carried and operated using a shoulder strap or even worn on a belt.

#### 10 hour battery

Powered by a single, small 12V rechargeable battery and incorporating the latest in low power consumption components, the LCi-SD will function continuously for up to 10 hours between charges.

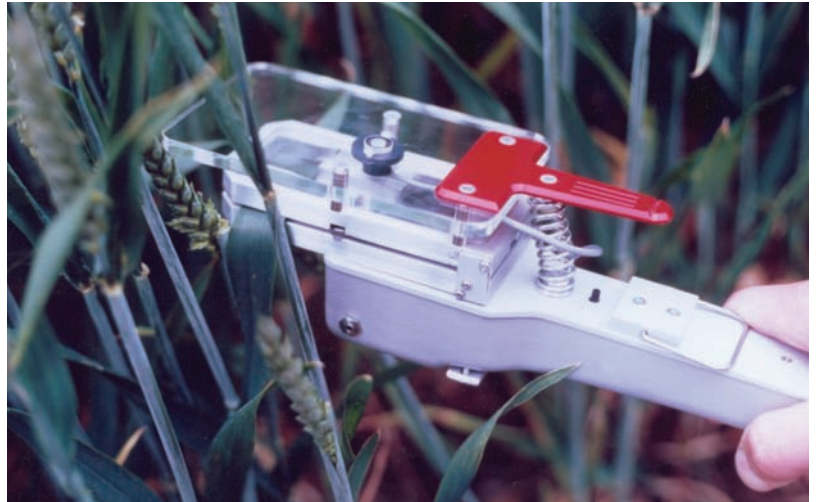
Designed for prolonged reliable operation in harsh field conditions, the LCi-SD maintains optimal experimental performance even in high humidity and dusty climates.

Researcher from the University of Aberdeen compares light-saturated photosynthesis of Giant Knotweed (*Fallopia Sachalinensis*) to other nearby species using the L*Ci*.



## Miniaturised analyser in chamber head

For over four decades ADC have been world leaders in the design and manufacture of infrared gas analysers (IRGA). ADC BioScientific has now developed a miniaturised format of their proven, portable IRGA. The gold-plated IRGA, housed inside the L*Ci*-**SD** plant leaf chamber, provides accurate, fast, reliable and stable gas exchange performance. By housing the gas analyser directly in the leaf chamber head, response delays in gas exchange measurements are effectively eliminated. The proximity of the chamber and the analyser also reduces the risk of gas hang-up or water vapour drop out in long lengths of gas tubing.



## New and enhanced L*Ci*-**SD**

The L*Ci*-**SD** provides all the facilities and features required for classical field experimentation, in the world's most portable format.

ADC BioScientific's L*Ci* has proved to be an invaluable field research tool for plant scientists across the globe, with countless scientific publications referencing the system. The new L*Ci*-**SD** employs the latest advances in gas exchange and user interface technology to raise field researchers' expectations and capabilities still further. The latest enhancements to the L*Ci*-**SD** include:

### **Data presentation, capture and output**

**capabilities:** New graphic display. Data storage on removable SD cards, data transfer now also via USB. Expanded data initiation functions.

### **Gas exchange and environmental sensor**

**performance:** Response times further reduced. New self-positioning leaf temperature sensor.

**Experimental versatility:** Widest range of chambers for the widest range of applications.

**User interface:** New microprocessor significantly improves interface response during programming and operation.

**Field reliability:** Increased use of long-life, lower power consumption components, maintaining performance even in harsh environments.

### **Long-term stability**

The miniaturised IRGA carries out an automatic zero in the standard operational cycle, ensuring long-term measurement stability. This auto-zero cycling time has been reduced in the L*Ci*-**SD** to significantly improve system response without any loss in analyser stability. All CO<sub>2</sub> measurements are automatically compensated for atmospheric pressure, temperature and the affects of water vapour broadening and dilution.

The novel differential in time IRGA design removes the need to constantly balance dual IRGA systems to prevent the calibration of the two cells drifting apart.

### **High quality environmental sensors**

To provide the researcher with full photosynthesis data the L*Ci*-**SD** plant leaf chamber encloses a number of high quality environmental sensors. Two highly accurate laser trimmed humidity sensors provide exceptionally reliable transpiration data, while high calibre sensors measure Photosynthetic Active Radiation (PAR) and chamber temperature.

The L*Ci*-**SD** offers the user a choice of accurate leaf temperature determination methods. A new, innovative, self-positioning sensor is provided as standard in many chambers. Alternatively, a manual placement sensor can be employed or the proven Energy Balance equation can be used with any chamber.

System flow rates are controllable in the range 100-500ml min<sup>-1</sup>.

## Wide range of interchangeable chamber heads

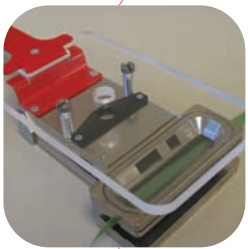
The LCi-SD is available with an expanded range of interchangeable heads for the widest range of experimental applications. These chambers are easily and quickly exchanged by hand in the field.

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<sub>2</sub> or water vapour. Chamber windows are silica coated to reduce scratching. On fitting, each chamber is auto-configurable, removing the requirement for complex reprogramming whenever a different head is used.



### **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<sup>2</sup>.



### **Narrow Leaf Chamber**

This is designed specially for long grasses and narrow leaves under 1cm in width. For leaves wider than 1cm, we recommend the Broad leaf chamber. The LCi-SD narrow leaf chamber features both a self-positioning leaf temperature sensor and a manual placement sensor. The chamber window area is 5.2cm<sup>2</sup>.



### **Conifer Leaf Chamber**

Transparent cylindrical design, suitable for 3D plant tissue such as pine needles and conifers. It is also suitable for small fruits and composites of very small leaves. The total chamber volume is 175cm<sup>3</sup>.



### **Arabidopsis/Small Leaf Chambers**

The Small leaf chamber features a unique flexible arm that allows you to easily position the chamber onto the leaf, even when the leaf is close to the soil surface, without damaging the sample leaf or others in the proximity. The Small leaf chamber window diameter is 16.5mm.



### **Small Canopy Chamber**

Rugged cylindrical construction designed for turf grasses and small whole plants up to 55mm in height.



#### **Whole Arabidopsis Plant Chamber**

Arabidopsis plants and other small plants can be grown in, low cost, sealed pots constructed from standard size soil waste pipes. Adapters allow the direct connection to the Small canopy chamber.



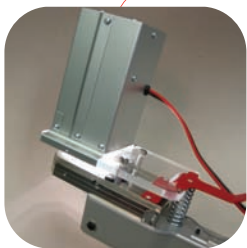
#### **Fruit Chamber**

Two part chamber with transparent upper compartment and sealed base for fruit. The chamber volume is 1l.



#### **Fluorometer Adapter**

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 including the OS5p Portable pulse modulated fluorometer.



#### **Detachable Light Unit**

The lightweight, detachable light unit provides as even a distribution of light as possible inside the leaf chamber. The dichroic lamp provides a maximum of  $2300 \mu\text{mol m}^{-2} \text{s}^{-1}$  with intensity being adjusted by use of a series of neutral density filters.

### **Soil respiration measurements**

The **LCi-SD** can also be fitted with a high quality, field rugged Soil chamber that comprises an upper compartment and a detachable lower collar. The upper compartment features a pressure release valve that ensures accurate field soil flux measurements, by minimising any potential pressure gradients and by also being insensitive to wind flows across it. The chamber volume is 1l.

The **LCi-SD** is auto-configured to provide soil respiration data and calculations when the soil chamber is fitted. A soil temperature sensor is supplied with the Soil chamber.

For spatial distribution studies multiple collars may be placed over a large experimental site and left in the soil for long-term comparative studies.





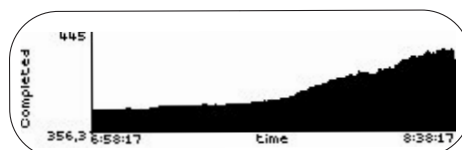
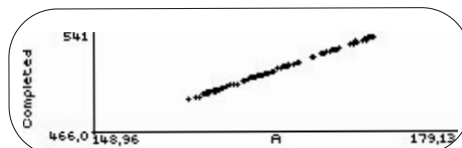
## Classical photosynthesis experiments made simple

ADC BioScientific has a reputation for developing the world's easiest to use gas exchange instrumentation. The LCi-SD has been designed to be the most user-friendly photosynthesis system ever, making it both a powerful research tool and also the ideal device for photosynthesis teaching.

Operation and experimental programming is fast and straight forward using the new LCi-SD microprocessor. Complete functionality is achieved with just five keys driving a series of simple and intuitive menus. No separate "bolt on" PC or laptop is required.

The LCi-SD is also simple to maintain with many serviceable parts including filters, chemical columns and batteries being easy to replace even in the most remote field location.

climate	sequence	logging	record
C <sub>ref</sub>	376	C <sub>an</sub>	351
E <sub>ref</sub>	12.2	e <sub>an</sub>	21.1
Q <sub>leaf</sub>	1760	p	1001
		Δc	25
		Δe	8.7
		T <sub>ch</sub>	25.0



## New LCi-SD graphic display

All real time photosynthesis data, calculations and graphs are clearly presented on the new LCi-SD large, high definition, graphic display.

Parameters may be plotted against time or record number enabling measurement trends to be easily monitored and observed. Two parameters may also be plotted against each other, such as in the case of light response curve experimentation.

In addition to classical photosynthesis and transpiration calculations, the LCi-SD provides soil respiration calculations, including NCER, when the soil chamber is employed.



## Unlimited data storage

The LCi-SD features unlimited data storage. All experimental protocols, photosynthesis data and calculations are stored on easily exchangeable Secure Digital (SD) cards. Use of these widely available cards allows separate cards to be used for individual users or for specific experimental applications.

Data recording can be initiated both automatically and manually. Automatic data recording can take place at timed intervals, synchronised to the same point of the measurement cycle. Alternatively manual recordings can be made either via the keypad or the button on the chamber handle.

Downloading of data is directly from the SD cards, via RS232 or through the USB output.



## ADC experience, innovation and quality

For over 40 years ADC's name has been synonymous with photosynthesis measurements. During this time ADC has constantly been an advocate of utilising the open mode of operation, a technique now accepted within the scientific community as the most accurate and versatile operation system for photosynthesis experimentation. Since the introduction of the first gas exchange systems, ADC has been at the forefront of instrument developments designed to meet ever-increasing research goals using more 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 40 customer support centres worldwide.

**The LCi-SD is supplied as standard with a two year warranty.**



ADC BioScientific Ltd  
1st Floor Charles House,  
Furlong Way, Great Amwell,  
Hertfordshire SG12 9TA, UK

Tel: +44 (0)1920 487901  
Fax: +44 (0)1920 466289  
E-mail: sales@adc.co.uk  
www.adc.co.uk

## Technical Specification

### Measurement range and technique:

CO<sub>2</sub>: 0-2000ppm, 1ppm resolution  
Infrared gas analysis, differential open system, auto zero, automatic atmospheric pressure and temperature compensation

H<sub>2</sub>O: 0-75mbar, 0.1mbar resolution  
Two laser trimmed, fast response water vapour sensors

PAR: 0-3000μmols m<sup>-2</sup> sec<sup>-1</sup>  
Silicon photocell

Chamber temperature: -5°C to 50°C  
Precision thermistor  
+/- 0.2°C accuracy

Direct leaf temperature: -5°C to 50°C Self positioning microchip thermistor/Energy balance/manually positioned thermistor

**Flow rate to leaf chamber:** 100 to 500ml min<sup>-1</sup>

**Gas connections:** 3mm barbed

**Warm up time:** 5 minutes @ 20°C

**Display:** 240 x 64 dot matrix super twist graphic LCD

**Recorded data:** Removable SD cards typically store 16 million sets of data on a 1Gb card

**Battery:** 2.8Ah 12V lead acid battery  
Up to 10 hours life between charges

**Battery charger:** Universal input voltage, Intelligent control

### Electrical outputs:

USB connection: Mini-B  
Function as mass storage device

RS232 output: 9 Pin "D" type  
User-selectable rates of up to 230400 baud for computer or printer connection

**Operating temperature range:** 5°C to 45°C

### Dimensions H x W x D:

Console: 240 x 125 x 140mm

Plant leaf chamber: 300 x 80 x 75mm

### Weight:

Console: 2.4kg

Plant leaf chamber: 0.6kg