



## Integrated fluorometer and gas exchange system

The most automated and accurate combined photosynthesis system for advanced plant physiology research

- Complete and full automation of multiple protocols (Inc. Laisk protocol and subsequent measurements of  $g_m$  and  $C_c$ )
- Truly portable
- Measurement of leaf absorbance, transmittance and chamber leakage for more accurate and reliable data
- Large touch screen, colour, graphic display
- Use as combined system, advanced gas exchange system or powerful chlorophyll fluorometer



### The most advanced system for plant physiology research

ADC BioScientific Ltd introduces the new iFL Integrated fluorometer and gas exchange system. Designed to provide researchers with the most advanced, accurate and reliable plant physiology experimental capabilities.

The iFL features a highly accurate, miniaturised infra red gas analyser (IRGA) and a fully integrated pulse modulated chlorophyll fluorometer; providing researchers with a direct readout of additional photosynthetic parameters than with a standard gas exchange system. These include  $\Gamma^*$  and  $R_d$ , which can be used to subsequently measure  $J$ ,  $g_m$  and  $C_c$ .

#### Additional photosynthetic parameters<sup>#</sup> include:

- $\Gamma^*$ : CO<sub>2</sub> compensation point
- $R_d$ : CO<sub>2</sub> respiration in the light (by Laisk, Kok or Yin protocols)
- Flexas chamber leakage protocol
- Leaf absorbance
- Leaf transmittance
- $g_m$ : Mesophyll conductance
- $C_c$ : CO<sub>2</sub> at site of carboxylation
- A/C<sub>c</sub> curves
- $J$ : Electron transport rate
- Fluorescence stress tests including: Fv/Fm, Yield Y (II) with multiflash, quenching tests and Rapid light curves

<sup>#</sup> compared to standard gas exchange systems

### Full automation

The unique differential in time design of the ADC IRGA means that experiments such as entire Laisk protocols may be performed, fully automatically, without any interruption for cell "matching", or any other intervention. Simply set up an experiment, walk away and return when the experiment is finished.

Several hours of automated experimentation can be initiated with one press of the screen. For example a complete Laisk may be performed together with post processing, directly followed by automated experiments to measure  $g_m$  and  $C_c$  including A/C<sub>c</sub> curves. The highly power efficient iFL operates continuously from a single battery charge for up to 8 hours.



## Measurement of leaf absorptance

The iFL provides the most highly accurate and reliable photosynthesis data. The iFL is the **first** plant physiology system to measure leaf absorptance, leaf transmittance and chamber leakage (Flexas protocol) and thus removing any errors that these variable factors could introduce.

Leaf temperature is measured by a new miniaturised IR sensor positioned inside the leaf chamber.

One PAR sensor is positioned inside the leaf chamber to monitor the constant actinic light source during routines. A second PAR sensor positioned on top of the fluorometer allows ambient light to be measured and automatically matched inside the chamber if required.

## Colour touch screen display



A large, colour, touch screen display makes the iFL both interactive and simple to use. Set up is easy whether loading or editing an existing protocol, or building a new protocol. Real time data, calculations and graphs are clearly presented on screen. Sub screens can be blown up to full screen size for even easier viewing.

Gas exchange measurements can be presented in either ppm/mbar or  $\mu\text{mol mol}^{-1}/\text{mmol mol}^{-1}$ .

Data, protocols and graphs can be stored on the internal 2Gb flash memory or on SD cards. Downloading is either directly from the SD cards or via USB. For class or group presentations the iFL features a video HDMI output.

## Versatile and truly portable for field research

Weighing only 4.5kg the iFL is a truly portable and versatile instrument for field plant physiology research.

The iFL can be used as a combined system or an independent advanced gas exchange system or as an independent powerful chlorophyll fluorometer.

This allows researchers to also conduct standard gas exchange experiments under ambient or controlled conditions.

A variety of highly accurate fluorescence plant stress tests can be performed including: Fv/Fm, Yield (Y) II with Multiflash-Fm' correction, rapid light curves and a selection of quenching protocols such as Hendrickson model, Kramer lake model and Puddle model.

## iFL provisional specification

### Gas exchange provisional specification

#### Measurement range, technique and control:

**CO<sub>2</sub>**: 0-3000ppm, 1ppm resolution Infrared gas analyser. Differential, open system with auto zero. Programmed control 0-2000ppm

**H<sub>2</sub>O**: 0-75mbar, 0.1mbar resolution dual laser trimmed, fast response sensors. Programmed control above and below ambient dependent on ambient conditions

**PAR**: External 0-3000 $\mu\text{mols m}^{-2} \text{s}^{-1}$  Silicon photocell. Programmed control 0-7500 $\mu\text{mols m}^{-2} \text{s}^{-1}$   
Internal leaf chamber PAR sensor 0-7500 $\mu\text{mols m}^{-2} \text{s}^{-1}$

#### Temperature:

**Leaf**: -5°C to 50°C IR sensor.

**Chamber**: -5°C to 50°C precision thermistor.

Programmed control typically +/- 14°C from ambient

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

**Warm up**: 5 minutes@20°C

### Fluorometer provisional specification

#### Excitation sources:

##### Saturation

**pulse**: White LED with 690nm filter.  
0-7,500  $\mu\text{mols m}^{-2} \text{s}^{-1}$

##### Modulating

**light**: 660nm LED with 690nm short pass filter

**Actinic light**: White LED 0-2,000 $\mu\text{mols m}^{-2} \text{s}^{-1}$ .

**Far red**: 740nm LED

#### Blue/red/green absorptance sensors

**Detection method**: Pulse modulation

**Automated setting of modulated light intensity**: Adjustable On/Off

**Automated Multi-Flash Fm' correction for all light adapted protocols**: Adjustable On/Off

**Detector**: PIN photodiode with 700-750nm filter

**Sampling rate**: 10 to 10,000 points per second, dependent on phase of test

**Test duration**: Adjustable 20 seconds - 4,000 hours

### System provisional specification

**Data storage**: 2Gb internal memory for thousands of data sets and traces. Removable SD cards

**Digital output**: SD cards, USB and HDMI

**User interface**: Large, colour, menu driven, graphic touch screen display (14.5cm x 8.5cm)

**Battery**: 7.0Ah 12 V lead acid battery. Up to 8 hours of battery life as iFL system

**Total console dimensions**: 31cm x 11cm x 17cm

**Total leaf chamber dimensions**: 30cm x 8cm x 8cm

**Total console weight**: 4.5kg



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