Configurations

An Act2 system can be build up from individual components or purchased as a complete system. The complete systems are more cost-effective. Please note that a FastOcean FRRf is required to run FLCs with the Act2 systems (the Act2 system is not compatible with the Mk I or Mk II FastTracka FRRf).

The Act2 system A includes the Act2 Controller, FLC sample chamber, 2 x white LED units, peristaltic pump unit and FastOcean stand.

Act2 system B is System A plus a second FLC sample chamber and 2 x blue LED units.

An Act2 Oxygraph LED support and extra LED(s) can be added to a System A or B at a later date, to provide a cost effective system for estimating PSII concentration and running oxygen light curves (OLCs). Please note that a Hansatech Oxygraph system is required for these measurements.

Alternatively, Act2 system C comprises System B plus 2 x Oxygraph LED supports and the required extra white and blue LED units.

A solenoid valve unit (with 3 x three-way solenoid valves) can be added to the system through the Act2 Controller. This unit allows for switching between sample sources, sample dilution and/or system cleaning.

Specification

Act2 Controller

Dimensions	198mm (w) x 108mm (d) x 62mm (h) (main unit)
Mass	1.5kg (including power brick and cables)
PC connection	USB (cable supplied)
Environmental rating	IP68 (main unit only)
Power input	28 V (power brick supplied)
Outputs	1 x USB to PC, 1 x FastOcean, 4 x LED units, 2 x peristaltic pumps, 3 x solenoid valves

LED units (white or blue)

Increments (FLCs)	< 4 µmol photons m^{-2} s^{-1}
Maximum output (FLCs / OLCs)	>2,500 µmol photons m^{-2} s^{-1}
Maximum output (Flash O2)	>20,000 µmol photons m^{-2} s^{-1}
Environmental rating	IP68

FLC system with FastOcean

Dimensions	250mm (w) x 180mm (d) x 535mm (h) (excluding Act2 Controller and cables)
Mass	8.2kg (including Act2 Controller, power brick and cables)

Contact us today to see how we can help you

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2271-005-PD-G 03/15

Act2-based laboratory and FerryBox systems

www.chelsea.co.uk

Act2 & the FastOcean FRR fluorometer can be combined to produce a highly automated system for probing oxygenic photosynthesis by phytoplankton

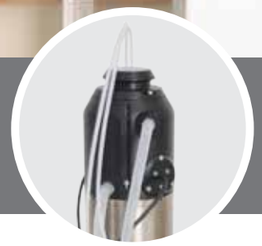
Applications

- Continuous running of fluorescence light curves (FLCs) with automated sampling from one or more phytoplankton cultures
- FerryBox-based, continuous monitoring of primary productivity parameters at relatively high spatial and temporal resolutions
- Replacement of 14C-based photosynthetron systems for generating primary productivity data
- Oxygen light curves (OLCs) and estimation of PSII concentration (when combined with Hansatech Oxygraph system)

Chelsea Technologies Group Ltd

Product Information

What can the Act2 system provide?



How does it work?

Features

- Fully programmable protocol design for fluorescence light curves (FLCs) including sample exchange between successive runs
- Options to duplicate the FLC protocol as oxygen light curves (OLCs) and estimate PSII reaction centre concentration through flash O_2 measurements, when combined with a Hansatech Oxygraph system
- Fine control of photon irradiance (E) during FLCs and OLCs (down to 1 µmol photons m^{-2} s^{-1} at low E values)
- Up to full sunlight intensity during FLCs and OLCs (2500 µmol photons m^{-2} s^{-1})
- Saturating, single turnover flashes of 160 µs duration at 20,000 µmol photons m^{-2} s^{-1} for flash O_2 measurements
- Fully automated changes to FLC protocol design within long-term experiments
- Optional solenoid system allows for programmable switching between sample sources
- High level of automation and operational stability, making it suitable for use in FerryBox systems

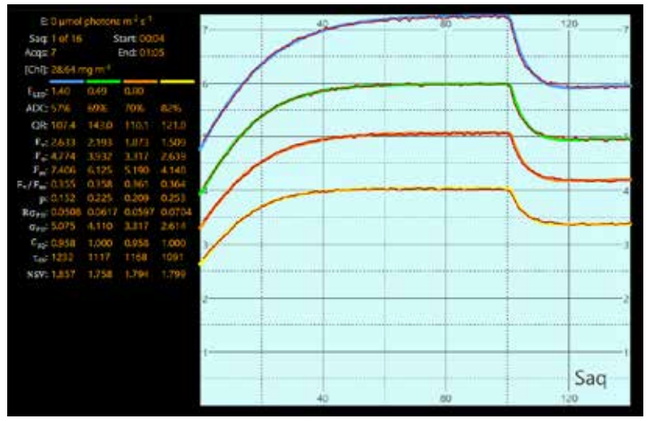
Introduction

The new Act2 builds on our highly successful FastAct system which has been widely used, in combination with our FastOcean Fast Repetition Rate fluorometer (FRRf), to run FLCs and other laboratory-based fluorescence measurements. The Act2 system marks a big step forward in terms of both performance and functionality. For example, the incremental steps available for incident photon irradiance (E) are much smaller and cover a much larger range (up to and above full sunlight). As with the FastAct, the standard Act2 FLC sample chamber provides full spectrum actinic illumination from filtered white LEDs. However, there is also an option to swap in 450 nm LED units. This allows for a spectral match to be made between the FastOcean FRRf and actinic illumination, thereby allowing for direct comparison of FRRf and FLC-derived data. Importantly, this feature also eliminates one of the spectral correction steps required in the estimation of primary productivity.

The Act2 system provides an unparalleled level of automation, including real-time derivation of relative photosynthesis – photon irradiance (rPE) parameters (including alpha and Ek) from FLC data. These data can be used, by the controlling software, to adjust the FLC protocol for the next sample. This feature is likely to be of particular value in FerryBox applications, where it is likely that the system will have to run unattended for several weeks at a time.

An essential part of the automation process is the archiving of FRR data from each FLC to a time stamped file. A simple, but very powerful, function within Act2Run can be used to extract rPE parameters from a user-defined range of files (spanning hours, days or weeks). These data can then be pasted into Excel or other application, through the Windows clipboard. Other clipboard functions allow data from individual files and acquisitions to be extracted in different ways.

The main design criterion for the development of Act2 was to produce a fully automated system for generating FLC / FRRf data that could be used in the estimation of GPP by phytoplankton. Analysis of primary FRRf data is based on the equations provided by Kolber et al. (1998 - Biochim. Biophys. Acta 1367:88-106), while secondary analysis of FRRf and FLC data is based on the absorption method described by Oxborough et al. (2012 - Limnol. Oceanogr.: Methods 10:142-154). All analysis is applied in real-time, which allows for fully automated adjustments to be made by the controlling software.



FRR data generated using four different LED combinations. The solid blue, green, orange and yellow lines through each FFR trace are iterative data fits, which are applied by the controlling software in real time.

Calibration of the Act2 FLC system includes an initial step to balance the output between LED units. This is achieved by making small adjustments to the drive current of each unit.

The required actinic light intensity is then set using pulse width modulation (pwm). This allows for very precise control of light output in very small steps. The LEDs run 'cool' up to full sunlight and beyond, which results in very stable output.

Standard Act2 systems

An **Act2 system** can be built up from component parts. However, the following systems all provide significant savings. All systems are factory calibrated and include a comprehensive spares kit.

System A provides all the requirements for running fully automated FLCs with white actinic illumination, including a full spares kit.

System B adds a second FLC sample chamber with 450 nm LEDs to System A.

System C adds two Oxygraph LED supports plus LEDs to System B. This allows for the running of OLCs and flash O_2 estimation of PSII reaction centre concentration (Hansatech Oxygraph system required).

An add-on solenoid valve unit allows for automated periodic cleaning of the sample chamber and / or switching between sample sources.