Hansatech Instruments
http://www.hansatech-instruments.com
info@hansatech-instruments.com

FMS 1

Fluorescence Monitoring System

- Pulse-modulated system.
- Integral LED & tungsten-halogen light sources.
- External device control interface.
- Programmable by Hansatech Scripting Language (HSL).
- Optional leaf-clip with Integral PAR/Temperature Sensor.
- Fibre-optic for incorporation into oxygen electrode chambers & IRGA.
- Windows® data acquisition & data analysis software.

Overview

The FMS 1 chlorophyll fluorescence measurement system is a versatile pulse modulated fluorimeter, designed to measure chlorophyll fluorescence emission from a wide range of different sample types engaged in photosynthesis under ambient light conditions.

The FMS 1 chlorophyll fluorometer consists of a control unit housing all of the electronics, optics and light sources necessary to derive most common chlorophyll fluorescence parameters. These are optically linked to the sample by a statistically randomised fibre optic cable that is suitable for insertion into a range of sample containers such as oxygen electrodes, gas analysis chambers, petri dishes and microtitre plates.

The system may be operated in several different modes: serial connection to a Windows® PC enables real-time instrument control and data presentation.

Captured data is simultaneously presented as a real-time chart recorder emulation and parameters-only format for easy identification of key experimental events. This PC mode of operation is suitable for development of complex protocols which may be programmed into the instrument using the simple drag and drop editor to generate user-defined scripts. These scripts automate the execution of experiments in the field, allowing complex protocols involving many control events to be operated with the same ease as single control event measurement such as Fv/Fm.

Once programmed, the FMS 1 chlorophyll fluorometer can be operated as a stand-alone fluorimeter inside the laboratory or outside (via connection to an optional external battery). All measurement data and calculated parameters are saved to integral protected memory. The unit can store up to six experimental protocols, any one of which may be accessed and executed using the built-in menu system. When data collection is complete the results can be downloaded to the Windows® software for full analysis.

All of the light sources required for modulated measurement of common fluorescence parameters are self-contained within the instrument.

- 594 nm amber modulating beam with 4 step frequency control (optional 470 nm blue LED).
- Dual-purpose halogen light source providing actinic light (0 - 3000 µmol m-2 s-1 in 50 steps) and saturating pulse (0 - 20,000 µmol m-2 s-1 in 100 steps).
- 735 nm far-red LED source for preferential PSI excitation allowing accurate determination of the Fo' parameter.

Dark Adaptation Leafclip System

A leafclip system has been developed for situations where ambient light is to be excluded from the sample during measurement. This is necessary for experiments requiring dark-adapted measurements e.g. screening applications measuring Fv/Fm or situations which require adaptation of tissue to standardised doses of actinic light.

The system consists of small, lightweight leafclips and 2 different types of fibre optic cable adapter. The leafclip itself has a small shutter plate which should be closed over the leaf when the clip is attached so that light is excluded and dark adaptation takes place. The body of the clips are constructed from white plastic to minimise the effects of heat build-up on the leaf during the period when the clip is in place. The locating ring section of the clip which interfaces with the fibre optic adapter is also constructed from white plastic.

During dark adaptation, all the reaction centres are fully oxidised and available for photochemistry and any chlorophyll fluorescence yield is quenched. This process takes a variable amount of time and depends upon plant species, light history prior to the dark transition and whether or not the plant is stressed. Typically, 15 - 20 minutes may be required to dark adapt effectively. In order to reduce waiting time before measurement, a number of leaves may be dark adapted simultaneously using several leafclips.

The fibre optic cable is inserted into either one of the adapters which in turn, fits over the locating ring of the leafclip. The closed fibre optic adapter is suitable for applications where ambient light must be excluded whilst the open adapter is suitable for studies under ambient conditions.

Optional FMS/PTL Leafclip with PAR & Temperature Sensors

The PAR / temperature leafclip facilitates measurements made under ambient light conditions.

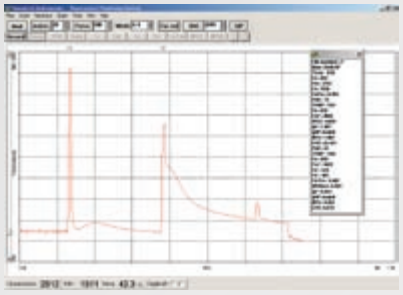
The FMS/PTL consists of a sprung upper section which gently grips the sample in a gentle clamping action. A grooved neck mounted at 60° to the plane of the sample accommodates the fibre optic cable which is slid into position.

Marked graduations on the neck can be aligned with graduations on the fibre optic cable termination to reference its position for future work, a retaining screw locks it into position throughout the experiment. A fully cosine corrected PAR sensor and 0 - 90°C thermocouple are also fitted to the FMS/PTL.

An electrical connection to the leafclip socket on the front panel of the FMS 1 enables use of the remote trigger switch to activate / abort measurements in Local mode and connect the leafclip thermocouple and light sensor to the control unit. The leafclip may be held in the hand if multiple samples are being studied or mounted on a standard tripod mount via a thread in the lower clip section for fixed-position work.

The PAR sensor has been designed for both recording of ambient light intensities during fluorescence analysis and measurement of FMS actinic and saturating light sources during instrument setup.

FMS I Software Applications



PC-control from Modfluor32 Windows® software allows real-time trace plotting as a chart-recorder emulation with calculated parameters written to a text parameters window. Instrument features and parameter measurement routines are selected from a toolbar with drop down menus to control file handling and instrument configuration.

Complex experimental protocols may be automated to reduce repetitive work by developing Scripts with Hansatech Scripting Language (HSL). An iconised Script Editor allows a sequence of control functions and measurements to be developed into a protocol. Once created scripts may be executed directly from the Modfluor32 program and data viewed while the instrument automatically completes a user-defined experiment. A maximum of six scripts can be downloaded to the instrument's internal memory for operation without a computer.

Connection of an optional external battery enables portable operation with data stored to instrument memory for subsequent upload and full graphical presentation on the computer.

A further application is also included with the FMS 1. Parview32 is a stand-alone utility designed to allow easy upload and transfer of multiple parameter files to a spreadsheet type program.

Technical Specifications

Dimensions	260mm (L) x 235mm (D) x 83mm (H). Weight: 2.8 kg
Light Sources	**Modulation beam:** Temperature compensated 594nm amber LED with 4 step frequency control (Optional 470nm blue LED) **Halogen source:** Actinic up to 3000 µmol m^{-2} s^{-1}, saturating up to 20,000 µmol m^{-2} s^{-1}. **Far red:** 735nm LED
Detector	PIN photodiode with >700 nm filter
Detection Method	Rapid peak pulse tracking
Sampling Rate	Variable 10 Hz to 20 kHz depending upon instrument mode
Electronics	16 bit 165 microprocessor, 8 A/D channels 12 bit resolution, 4 external digital I/O lines, Single 12 bit buffered DAC (0 to 4095 mV)
Storage Capacity	256 Kb backed up RAM storing up to 2,430 full trace or 12,850 parameter only Fv/Fm data sets
User Interface	20 x 4 LCD display, 4 button keypad
Display	8 line x 20 character LCD display
Power Supply	95 to 260 V universal input mains supply
Leafclips	10 x dark adaptation clips with fibre-optic adapters. Optional PAR / temperature clip with cosine corrected PAR sensor (0 to 20,000 µmol m-2 s-1) and thermocouple (-10 to 90 °C). Remote trigger button and tripod mount.

Hansatech Instruments

Hansatech Instruments ltd
Narborough Road, Pentney, King's Lynn, Norfolk, UK PE32 1JL
Tel: +44 (0)1760 338877 Fax: +44 (0)1760 337303
http//:www.hansatech-instruments.com info@hansatech-instruments.com