



FMS 1

Laboratory Based Pulse Modulated Chlorophyll Fluorescence Monitoring System

- ✓ Integral amber (594nm) modulating LED (optional 470nm blue LED), 735nm far-red LED & dual purpose tungsten-halogen light source
- ✓ External device control interface
- ✓ Programmable by Hansatech Scripting Language (HSL)
- ✓ Optional leaf-clip with integral PAR/temperature sensor
- ✓ Fibre-optic cable suitable for incorporation into O₂ electrode chambers & legacy IRGA systems
- ✓ Windows® data acquisition & data analysis software



Hansatech Instruments

Hansatech Instruments is a small, British, scientific instrument company located in the heart of rural Norfolk. For over 40 years, our efforts have been concentrated towards the design & manufacture of high quality instrumentation for teaching and research in the fields of cellular respiration and photosynthesis. Our instruments are now in use in a wide range of programs in more than 100 countries throughout the world and have gained an enviable reputation for quality, reliability and excellent price/performance.

Overview

The FMS 1 modulated chlorophyll fluorimeter 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 2 different modes. Connection via RS232 serial communications 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, 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 fluorimeter can be operated as a stand-alone system inside the laboratory or outside (via connection to an optional external battery). All measurement data and calculated parameters are saved to integral protected memory sufficient to 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 chlorophyll 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 $\mu\text{mol m}^{-2} \text{s}^{-1}$ in 50 steps) and saturating pulse (0 – 20,000 $\mu\text{mol m}^{-2} \text{s}^{-1}$ in 100 steps)
- 735 nm far-red LED source for preferential PSI excitation allowing accurate determination of the F_0' parameter

A leafclip system has been developed for situations where ambient light is to be excluded from the sample during measurement using the FMS chlorophyll fluorimeter. This is suitable 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 sample rests on a foam pad whilst in the clip in order to minimise damage to the structure of the sample. 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.

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.

A further application is also included with the FMS chlorophyll fluorimeter. 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 $\mu\text{mol m}^{-2} \text{s}^{-1}$, saturating up to 20,000 $\mu\text{mol m}^{-2} \text{s}^{-1}$. 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/temp clip with cosine corrected PAR sensor (0 to 20,000 $\mu\text{mol m}^{-2} \text{s}^{-1}$) & thermocouple (-10 to 90 °C). Remote trigger button and tripod mount.