

DIVING-PAM-II

Underwater Fluorometer with Miniature Spectrometer

Particularly distinguished by the ability to analyze photosystem II *in situ* at diving depths down to 50 m.

New features are WiFi for data download and a transfective LCD display.

Including a miniature spectrometer to record spectra of PAR, reflectance and fluorescence.

High capacity battery for more than 2,000 PS II yield measurements. Flash memory for more than 27,000 saturation pulse analyses.

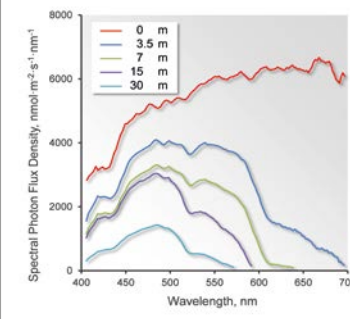
Automatic calculation of all relevant parameters of saturation pulse analysis.

Optional sample holder for macro algae and leaves.



Versions with blue or red high power LED available. Both versions equipped with far-red LED for PS I excitation.

Under dry conditions, the DIVING-PAM-II can operate MINI-PAM-II accessories.



Underwater light spectra

DIVING-PAM-II



PHYTO-PAM-II

Multiple Excitation Wavelength Phytoplankton & Photosynthesis Analyzer

Live deconvolution of up to four different algal groups in a mixed sample; e.g. green algae, cyanobacteria, diatoms/dinoflagellates, and phycoerythrin-containing algae.

The COMPACT version is highly portable due to integration of light sources, fluorescence detection, and signal processing in the same housing.

The MODULAR version provides two extra optical ports, and the options of changing detector filters, software-triggered stirring and temperature control.

For the COMPACT version, the Flow-Through Cuvette PHYTO-II/FT is available as new accessory.



Both PHYTO-PAM-II versions provide five measuring light wavelengths, six actinic light colors, the full range of saturation pulse analysis, assessment of chlorophyll a content, fast kinetics, determination of the functional antenna size of PS II, automated recording, and script file operation.



MODULAR Version

The photomultiplier detector provides the high sensitivity required to analyze even extremely dilute cell suspensions such as natural water samples.

Flow-Through Cuvette



Reference spectra of algae can be transferred between different PHYTO-PAM-II units.

An exchange data base of reference spectra is available on the Walz website.

MICRO-PAM

Small PAM Sensor for MONITORING-PAM Systems & Photosynthesis Analyzer

Small and lightweight measuring head for field use. External dimensions 13.5 x 4.0 x 3.5 cm, weight 100 g.

Long-term monitoring of PS II photochemical yield (Φ_{II}), PAR, leaf temperature, air humidity.

Fiber optics principle employed for measurement of PAM fluorescence.

Blue measuring light and saturation pulses.

Weather-proof design for unattended operation in the field.

Optional data transfer via telephone or satellite modem when connected to the MONI-DA data acquisition system.



Measuring head

MICRO-PAM measuring heads can be operated by the WinControl-3 software running on Windows OS. A special interface connects up to four measuring heads.

At remote sites, the data acquisition system MONI-DA can operate the MICRO-PAM heads. Up to 16 MICRO-PAM heads can be connected to one MONI-DA.

Data Acquisition System



MINI-PAM-II

Photosynthesis Yield Analyzer

Ultra-mobile, compact and reliable PAM fluorometer for field use.

Easy operation via touchscreen interface.

Versions with blue or red light available.

Strong far-red light source for photosystem I excitation.

Leaf clip with improved sensor for photosynthetically active radiation (PAR).

Unique expandability of experimental options by additions like high-power RGBW lamp, compact spectrometer (for light, fluorescence and reflectance spectra), or oxygen package for suspensions.



The MINI-PAM-II fluorometer combines the advantages of its predecessor with most recent LED and computer technology. A transfective touchscreen, energy efficient LED sources and easy replaceable off-the-shelf batteries make the MINI-PAM-II the ideal PAM fluorometer for field research. All common fluorescence parameters are automatically calculated.

Leaf-Clip Holder



External LED Light Source

Photosynthetic electron transport (ETR) under field conditions can be derived from PAR measurements by the leaf clip and PAM fluorescence. When photosynthesis is driven by the MINI-PAM-II internal light source, PAR data for ETR calculations are measured by an internal light sensor. The MINI-PAM-II can be operated by Windows computers using WinControl-3 software.

RGBW-L084

LED-Panel RGBW

A densely packed array of high-efficiency color LEDs provides bright and homogeneous illumination. Low heat production even at high output.

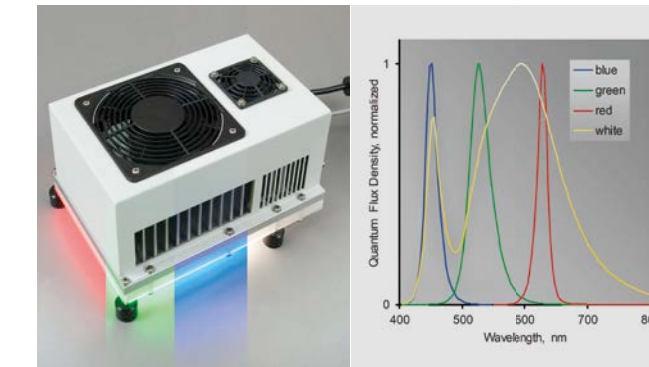
Ideal light source to study relationships between light color and photosynthesis. Well suited to investigate blue light effects.

With socket for PAR sensor.

Light colors can be adjusted independently. Maximum PAR of 2000 $\mu\text{mol m}^{-2} \text{s}^{-2}$ or better.

Fits perfectly on Gas-Exchange Chamber 3010-GWK1.

Operation as independent unit or as an integral part of the GFS-3000 system.



LED spectra



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PRODUCT HIGHLIGHTS

NEW:
DUAL-KLAS-NIR
MICRO-PAM



Precision Analysis of Photosynthesis

WALZ

IMAG-3D

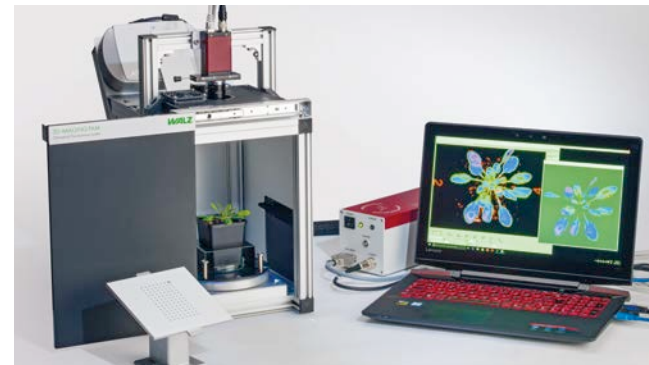
Chlorophyll Fluorescence System

Compact PS II / 3D system based on MAXI version of the IMAGING-PAM *M-Series*.

In the new version of IMAG-3D, the 3D scanning process and PS II measurements are fully automated and controlled via software.

The digitized plant structural information enables constructing three-dimensional models of chlorophyll fluorescence data.

As additional feature, important morphological parameters, used in plant phenotyping, can be obtained.



3D models are quickly calculated by algorithms developed in collaboration with the Fraunhofer Institute for Integrated Circuits, IIS.

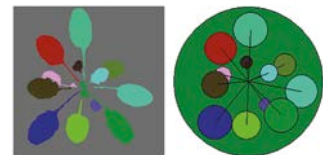


3D image of q_m parameter

The same camera is used for 3D scanning and for PS II measurements. Convenient data acquisition through motorized switching of camera filters and plant position.

The instrument is shipped together with a software package (that includes all future updates) and calibration targets for chlorophyll fluorescence as well as for 3D scanner calibration.

Evaluation of leaf morphology



Optionally, also a high-performance Imaging-PC is available with ImagingWin3D software preinstalled.

DUAL-PAM-100

P700 & Chlorophyll Fluorescence System

Well-established and proven system for monitoring simultaneously photosystems I and II (PS I and II).

PAM chlorophyll fluorescence evaluates PS II, a two wavelength method probes near infrared absorption by PS I. In both cases, saturation pulse analysis is applied.

MODULAR and FIBER versions available. Both versions have blue, red, and far red actinic light. Sine-wave illumination by all actinic lights possible.

MODULAR version with blue or red probing light for fluorescence, FIBER version always with red measuring light.



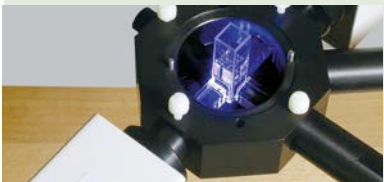
An optional photodiode or photomultiplier enhances sensitivity of fluorescence detection by the MODULAR version. This version is also upgradable to measure ΔA_{515} , ΔA_{535} , NADPH, and the pH-sensitive dyes acridine orange, acridine yellow, and 9-aminoacridine. MODULAR version and GFS-3000 can be combined into one single measuring system.



Leaf holder

Software includes routines for induction and light response curves, as well as for polyphasic rise kinetics. Sophisticated script file programming permits automatic performance of experiments.

Measuring setup for suspensions



Additional features are a macro recorder and continuous evaluation of PS I contribution to total fluorescence.

PAM-2500

Portable Chlorophyll Fluorometer

Very high time resolution down to 10 μ s.

Powerful LEDs providing single-turnover flashes for one complete PS II excitation and multiple-turnover flashes for standard saturation pulse method.

Red, blue, and far-red actinic light.



The PAM-2500 fluorometer succeeds the renowned PAM-2000/2100 instruments which were introduced in the 1990s as the first portable PAM fluorometers.



Laboratory setup

The fluorometer is fully computer controlled.

The range of optional accessories includes an ultra-mobile PC for touch screen operation and a special optical cuvette for studies of microalgae and cyanobacteria.

Leaf Clip



High sensitivity for high quality measurements also on samples with low Chl content.

2030-B Leaf-Clip Holder with precise sensors for PAR and leaf temperature measurements.

For use in basic and applied research.

MULTI-COLOR-PAM

Multiple Excitation Wavelength Chlorophyll Fluorometer

6 colors of pulse-modulated measuring light, 5 colors of actinic light plus white, and far-red light.

Highly sensitive analysis of very dilute suspensions, allowing light gradient-free measurements.

Accessory for leaf studies available.



The MULTI-COLOR-PAM provides six colors of pulse-modulated measuring light (365 or 400, 440, 480, 540, 590 and 625 nm) and five colors of actinic light (440, 480, 540, 590, 625) plus white (420-640 nm) and far-red light (730 nm).



Optical unit for suspensions

sample and to study wavelength-dependent aspects of photosynthesis.

Spherical and flat cosine-corrected sensors are available for accurate PAR-measurements in suspension or at leaf surface, respectively. A special routine is provided for measuring PAR-lists of all colors.

Optical unit for leaf measurements



GFS-3000

Portable Gas Exchange & Fluorescence System

High precision gas exchange and chlorophyll fluorescence measuring system.

Full control of CO_2 and H_2O concentrations, cuvette or leaf temperature, ventilation and illumination.

Control range for CO_2 : 0 to 2000 ppm, for H_2O : 0 to nearly 100% rh.



Extensive options for data acquisition by combination with other Walz systems (IMAGING-PAM, DUAL-PAM-100, or the new DUAL-KLAS-NIR).

Many cuvette configurations including Gas-Exchange Chamber 3010-GWK1 for medium sized samples.

DUAL-PAM-100 and GFS-3000



Simultaneous saturation pulse analysis of photosystem II. Integrated computer with color touch screen. Easy-to-handle software. Simple programming of automated experiments.

New power solution: high performance, low weight eSMART batteries.



3041-L and 3056-FL

The LED-Array 3041-L provides homogeneous warm white illumination from 1 to ca. 3000 μ mol $m^{-2} s^{-1}$ PAR on up to 10 cm^2 sample area.

The LED-Array/PAM-Fluorometer 3056-FL combines outstandingly homogeneous illumination by blue and red LEDs with chlorophyll fluorescence measurements.

DUAL-KLAS-NIR

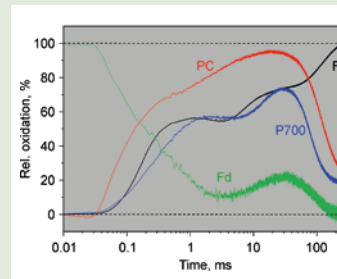
Measuring System for P700, Plastocyanin, Ferredoxin & Chlorophyll Fluorescence

Simultaneous determination of the redox states of plastocyanin (PC), PS I reaction center (P700) and ferredoxin (Fd) with four pairs of measuring beams at near infrared wavelengths.

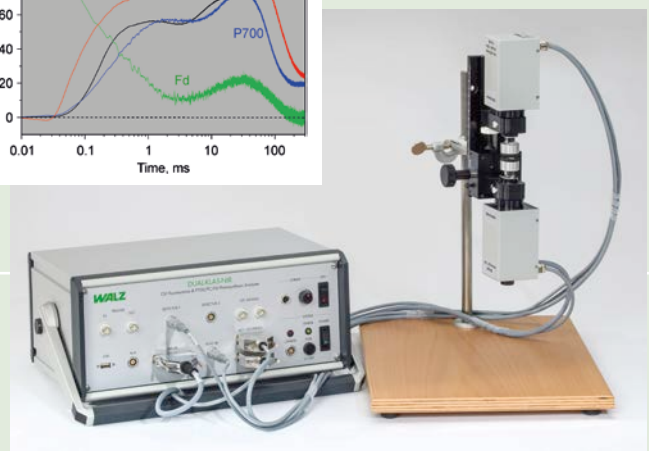
Blue- and green-excited chlorophyll fluorescence can be measured concurrently.

Assessment of quantum yields and effective antenna sizes of PS I and PS II, control of linear electron transport by lumen pH, as well as ratios of PC:P700 and P700:Fd.

Ideal for studying function, stoichiometry and regulation of the photosynthetic electron transport chain.



Polyphasic fluorescence rise and redox changes of Fd, P700, and PC



System overview

On-board blue, red and far-red actinic light. Red multiple turnover pulses and red single turnover flashes.

Configurations for both leaves and suspensions available. Includes positioning system for emitter and detector units.

Software structure similar to DUAL-PAM-100 software; streamlined to operate the six-channel DUAL-KLAS-NIR as easy as the two-channel device DUAL-PAM-100.

Including many standard measuring protocols. With templates for automated experiments. Signal deconvolution based on pioneering approach of Differential Model Plots (DMPs).