DIVING-PAM-II Underwater Fluorometer with Miniature Spectrometer

DESCRIPTION

The DIVING-PAM-II is the successor of the DIVING-PAM which has been proven as reliable and robust chlorophyll fluorometer for studying photosynthesis in and under water. To date, about 500 scientific papers containing measurements with DIVING-PAM have been published.

The DIVING-PAM-II continues the manifold tested design of its predeccessor, but it possesses significantly advanced data aquisition and instrument control by employing state-of-the-art optical and electronic components.

The DIVING-PAM-II fluorometer permits examinations of photosynthesis down to 50 m water depth. All functions of the instrument can be controlled by 10 infrared reflection switches situated inside a transparent, cylinder-shaped housing. A new feature is the energy-saving B/W screen which displays instrument status and measured data. The transflective screen is readable even under sunlight.

DIVING-PAM-II

General Features

The innovative Miniature Spectrometer MINI-SPEC, being part of the basic DIVING-PAM-II system, adds a new level of information to studies of photosynthesis. The MINI-SPEC measures spectra of PAR, which are known to vary significantly with water depth. The device also permits spectral analyses of reflectance and fluorescence emission of a sample. Also new is an internal PAR sensor which continuously records the intensity of the internal light source of the DIVING-PAM-II.

- Miniature spectrometer for PAR measurement, spectral information on PAR and reflectance
- Wireless LAN for convenient data download at experimental site
- Graphical and alphanumerical display by low-power consuming transflective B/W screen
- High power LED for actinic light and saturation pulses. Far red LED for PS I excitation.
- Advanced pressure and temperature sensor
- High capacity battery for more than 1,300 PS II yield measurements. Flash memory for more than 27,000 saturation pulse analyses
- Continuous monitoring of internal light intensity by built-in PAR sensor
- Automatic calculation of all relevant parameters of saturation pulse analysis
- Accessories included in the basic system:
- 1.5 m flexible fiber optics, miniature spectrometer, distance clip, dark leaf clips, surface holder, PC Interface Box, battery charger, USB cable, 5 m underwater cable, WinControl-3 software packed in a rugged outdoor transport case
- In dry environment, accessories of the MINI-PAM-II fluorometer can be operated in conjunction with the DIVING-PAM-II.

DIVING-PAM-II

ACCESSORIES

- **Universal Sample Holder DIVING-II-USH**
- **Surface Holder DIVING-SH**
- **Magnet Sample Holder DIVING-MLC**
- **Underwater Oxygen Sensor, DIVING-PAM-II/O2**
- **Adapters for DIVING-II-USH**
- **Underwater Cables DIVING-II/K25 -K50**

BLUE & RED Version
DIVING-PAM-II/B and DIVING-PAM-II/R

- The color of light emitted by the primary LED distinguishes the BLUE from the RED version of the DIVING-PAM-II fluorometer. The BLUE version (DIVING-PAM-II/B) possesses a blue LED emitting maximally around 475 nm which is replaced by a red LED emitting maximally around 655 nm in the RED version (DIVING-PAM-II/R). Both versions have a second LED providing far red light for specific excitation of photosystem I.
- The second difference between the two versions is the spectral window for fluorescence detection. The BLUE version detects fluorescence at wavelengths > 630 nm but the RED version detects fluorescence at wavelengths > 700 nm

BLUE or RED Version?

- Its extended range for fluorescence detection makes the BLUE version more sensitive than the RED version. In samples with high chlorophyll contents, a large part of the short wavelength fluorescence, which potentially can be detected by the BLUE version, is reabsorbed by chlorophyll. Hence, in such samples the sensitivity of the BLUE version is only slightly better than that of the RED one.
- The MINI-PAM-II can be used to investigate cyanobacteria. Cyanobacteria often absorb poorly in the blue. Therefore, in studies of cyanobacteria the RED version is normally preferred over the BLUE version which shows low signal to noise ratios with cyanobacteria.
- The blue actinic light source of the MINI-PAM-II/B excites the broad short wavelength band of the major light-harvesting complex of photosystem II in higher plants and green algae (LHC II). Red light of the MINI-PAM-II/R excites the comparably minor long-wavelength band of the LHC II. Hence, if LHC II excitation is important, the BLUE version might be advantageous.
  Blue is absorbed by blue light photoreceptors which can stimulate responses like chloroplast relocation in higher plants. Chloroplast relocation can affect the fluorescence signal by changing the efficiency of light absorption. This effect is difficult to distinguish from other fluorescence quenching mechanisms. Choosing the RED version excludes such blue light effects.

Application

- The Miniature Spectrometer MINI-SPEC is a compact and robust outdoor instrument for gathering spectral information of the light environment and the sample.
- Absorption of light by water affects the spectral properties of radiation available for aquatic photosynthesizers.
- The spectral properties of radiation available for individual plants can be influenced by neighboring plants.
- Reflectance spectra contain information on light absorbed by a sample
- The shape of fluorescence emission spectra is affected by the chlorophyll content of a leaf

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