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MONITORING-PAM

Fluorometer for Long-term Monitoring of Photosynthesis

High Quality Instrumentation for Plant Sciences

WALZ

Accessories for MONITORING-PAM - STAND-ALONE Configuration of TERRESTRIAL Version

Four-Way Distributor MICRO-HUB

Input port expander when more than 7 MONI-PAM measuring heads are to be connected to a MONI-DA data acquisition system. The maximum number of measuring heads per MONI-DA is 16 corresponding to 12 heads connected via MICRO-HUB and 4 directly connected heads.

WiFi Modem MONI-DA/WIFI and MONI-DA/SWIFI

In the presence of WiFi network coverage, a WiFi modem transfers MONI-DA data via internet and a special Walz server to your computer. When WiFi is not available but cellular network coverage is present, a mobile hotspot can be used to connect the WiFi modem to the Walz server. The WiFi modem MONI-DA/WiFi is designed for the STAND-ALONE Configuration of the TERRESTRIAL Version. The WiFi modem MONI-DA/SWIFI is equipped with underwater connectors and, thus, serves as accessory of the STAND-ALONE Configuration of the AQUATIC Version. For a radio connection, the MONI-DA/SWIFI must be operated above water.

Satellite Modem

When terrestrial wireless communication is unavailable, a satellite modem is available to transfer data via communications satellite and dedicated Walz server to your office.

Specifications for MONITORING-PAM TERRESTRIAL Versions

ONLINE Configuration

Measuring Head MONI-HEAD/485
General Design
Housing: Water-tight aluminum cylinder with one end featuring a ball lens for focusing modulated measuring light, actinic light and saturating light pulses on the sample, and collecting fluorescence. Opposite end of tube: M12 5-pole socket for RS485/power line
Sample clip: Consisting of 2 aluminum frames (3.5 x 2.5 cm), held together by a special O-ring, and mounted at a distance of 2.5 cm from the MONI-HEAD/485 optical window. Angle between optical axis of the MONI-HEAD/485 and sample clip plane: 120°
Cables: Data/power cable, 10 m standard length (between MONI-HEAD/485 and MONI-IB4/LAN, MONI-HEAD/485 and MONI-DA, or MONI-DA and MONI-IB1)
Dimensions: Cylinder with diameter of 3 cm and length of 18 cm
Power consumption: Peak loads during saturating pulses 7 W. During measuring mode 0.1 W
Operating temperature: -15 to +40 °C
Weight: 165 g
Light Emission

Modulated fluorescence excitation: Blue power LED (typical peak wavelength 470 nm, full width at half maximum 22 nm). Photosynthetically active radiation (PAR) of measuring light at level of the sample clip range from 0.15 to 1.5 µmol m^{-2} s^{-1} at low modulation frequencies (5 to 25 Hz), and from 1.5 to 22.5 µmol m^{-2} s^{-1} at high modulation frequency (100 Hz)

Actinic light: Same power LED as for modulated light. At level of sample clip, maximum photosynthetically active radiation of actinic light and saturating flashes of 1500 and more than 8500 µmol m^{-2} s^{-1}

Sensors

Fluorescence: PIN-photodiode protected by longpass filter (50% transmittance at 645 nm). Selective window amplifier to measure pulse amplitude modulated (PAM) fluorescence

Photosynthetically active radiation (PAR): Integrated quantum sensor (photodiode protected by near infrared filters) measuring the radiation reflected by a 1.3 x 0.7 cm area of an optically diffuse Teflon sheet, 1 mm thick, mounted at the edge of the leaf clip

Temperature: Integrated-circuit temperature sensor on circuit board

PC Interface Box MONI-IB4/LAN

Housing: Aluminum case with RS-232, USB-B, Ethernet, power supply sockets, and four M12 5-pole sockets for RS-485 communication

Interfacing: The interface box connects a computer with up to four MONI-HEAD/485 (or one MONI-DA). RS-485 serial data communication is used between interface box and MONI-HEAD/485 or MONI-DA. RS232, USB or Ethernet communication is used between interface box and computer

Recommended maximum cable lengths: To computer via USB and RS-232: 2 m. To computer via Ethernet, 100 m. To MONI-HEAD/485 via RS-485: 10 m. To MONI-DA via RS-485, 100 m

Dimensions: 12 x 9.3 x 3 cm (L x W x H)

Weight: 400 g

Operating temperature: 0 to +40 °C

Power supply: Input: 100 to 240 V AC, 50 to 60 Hz. Output: 19 V DC, 3.7 A. Dimensions: 13.2 x 5.8 x 3 cm (L x W x H). Weight: 310 g

Software

WinControl-3 System Control and Data Acquisition Program (Microsoft Windows 10 and 11) for operation of measuring system via PC, data acquisition and analysis. Not compatible with Windows 10 on ARM. Measured and calculated parameters: F_0, F_M, F_M', F, F_0' (calculated), F_V/F_M (max. Yield), $\Delta F/F_M'$ (Yield), q_P, q_N, q_L, NPQ, Y(NPQ), Y(NO), ETR (i.e. PAR x $\Delta F/F_M'$), PAR and °C. Two different fitting routines for ETR versus light intensity curves

Computer Minimum Requirements

Processor, 1 GHz. RAM, 1 GB. Hard disc space, 1GB. Screen resolution, 800 x 600 pixels. Interface, USB 1.1/2.0/3.0, RS-232, or Ethernet. Operating system: Microsoft Windows 10 and 11

Transport Box

Design: Aluminum box with custom foam packing for MONITORING-PAM

Dimensions: 60 cm x 40 cm x 25 cm (L x W x H); 42 liter

Weight: 4.7 kg

STAND-ALONE Configuration

Measuring Head MONI-HEAD/485

As described for ONLINE configuration of TERRESTRIAL version

Data Acquisition System MONI-DA

Housing: Robust water-proof cylinder consisting of a polyvinyl chloride (PVC) tube and poly-oxymethylene (POM) endplates. One endplate with 2 male M12 5-pole sockets connected in parallel (MONI-IB4/LAN communication, charging voltage), one male M12 5-pole socket for auxiliaries, and 7 female M12 5-pole sockets (MONI-HEAD/485 communication)

Dimensions: Cylinder with diameter of 16 cm and length of 24 cm

Data management: Dual data storage on internal 8 MByte circular flash buffer and an industrial grade 512 MByte removable microSD flash card. Wireless data transfer via WiFi or satellite modem. Online data transfer using RS-485 serial data communication.

Power consumption: 5 mW in standby mode. Operating mode, depends on the number of MONIHEAD/485 connected (see MONI-HEAD/485 power consumption)

Battery: 12 V / 7.5 Ah (96 Wh) LiFePO4 battery.

Operating temperature: -30 to +60 °C

Weight: 5.4 kg

Transport Box

Design: Aluminum box with custom foam packing for MONITORING-PAM including MONI-DA

Dimensions: 80 cm x 40 cm x 34 cm (L x W x H); 60 liter

Weight: 4.9 kg

PC Interface Box MONI-IB1

Housing: Aluminum case with USB-B socket, power supply socket, and M12 5-pole socket for RS-485 communication

Links: The interface box connects a computer with a MONI-DA using RS-485 serial data communication. The same line is used to charge the MONI-DA battery. USB communication is used between interface box and computer

Recommended maximum cable lengths: To computer via USB: 2 m. To MONI-DA via RS-485, 100 m

Dimensions: 9.7 x 6.3 x 3.5 cm (L x W x H)

Weight: 270 g

Operating temperature: 0 to +40 °C

Solar Panel MONI-SP

Design: Polycrystalline silicon panel. Highly resistant to water, abrasion, hail impact and other severe weather conditions. Equipped with a 4 m cable and plug for the AUX or INPUT socket of the Data Acquisition System MONI-DA. Several panels can be connected in parallel to provide sufficient power under conditions of low insolation

Electrical characteristics: Vmax, 15.0 V, Imax, 0.63 A (at 1000 W/m^2 sunlight). VOC, 19.6 V. ISC, 0.80 A
Dimensions: 50 x 35 cm (L x W)
Weight: 1.2 kg (incl. cable and plug)

Fluorometer Software and Computer Minimum Requirements
As described for ONLINE configuration of TERRESTRIAL version

Accessories for STAND-ALONE Configuration

Four-Way Distributor MICRO-HUB
Housing: Aluminum case with one M12 5-pole socket to connect the MONI-DA data acquisition system and four M12 5-pole sockets to connect MONI-HEAD/485 Measuring Heads
Links: The interface box connects up to four MICRO-HEAD/3B Measuring Heads to one single MONI-BUS port of a MONI-DA data acquisition system
Recommended maximum cable lengths: 10 m between MICRO-HEAD/3B and MICRO-HUB, and between MICRO-HUB and MONI-DA
Dimensions: 10 x 6 x 3.5 cm (L x W x H)
Weight: 228 g
Operating temperature: -30 to +40 °C

WiFi Modem MONI-DA/WIFI

Design: Weatherproof cylinder made of POM (Polyoxymethylene) containing a standard WiFi modul. One endplate made of POM, the other endplate made of Plexiglas with 5-pole M12 plug connector. Includes a 10 m cable to connect the modem to the AUX port of the MONI-DA. Data transfer requires connection to a compatible WiFi network or hotspot (2.4 GHz, IEEE 802.11 b/g/n, WPA2-PSK)

Dimensions: 19.5 cm (L) 3.27 cm (Ø)

Weight: 140 g (modem), 320 g (cable)

Satellite Modem

Specification depend on available electronic components at the time of order

Specifications for MONITORING-PAM AQUATIC Version

ONLINE Configuration

Measuring Head MONI-HEAD/S
General Design
Housing: As described for MONI-HEAD/485 but polyoxymethylene (POM) replaces aluminum as housing material and a special underwater 6-pole socket replaces the standard 5-pole RS485 socket. Waterproof down to a depth of 75 m
Sample clip: As described for MONI-HEAD/485 but titanium replaces aluminum
Cables: Special underwater cables for communication and power. Standard length: 10 m (MONI-HEAD/S to MONI-IB4/LANS, MONI-HEAD/S to MONI-DA/S, or MONI-DA/S to MONI-IB1/S)
Dimension, power consumption, and operating temperature: As described for MONI-HEAD/485
Weight: 180 g
Light Emission and Sensors
As described for MONI-HEAD/485

PC Interface Box MONI-IB4/LANS

As described for PC Interface Box MONI-IB4/LAN but four special waterproof 6-pole sockets replace the M12 5-pole sockets. Special underwater cable for communication and power included. Standard length: 10 m

Software, Computer Minimum Requirements

As described for ONLINE configuration of TERRESTRIAL version

Transport Box

As described for ONLINE configuration of TERRESTRIAL version

STAND-ALONE Configuration

Measuring Head MONI-HEAD/S

As described for ONLINE configuration of AQUATIC version

Data Acquisition MONI-DA/S

As described for Data Acquisition MONI-DA but waterproof 6-pole sockets replace M12 5-pole sockets and microSD card non-removable. Waterproof down to a depth of 75 m

Transport Box

As described for Stand-Alone configuration of TERRESTRIAL version

PC Interface Box MONI-IB1/S

As described for PC Interface Box MONI-IB1 but a waterproof 6-pole socket replaces the M12 5-pole socket for RS-485 communication

Fluorometer Software and Computer Minimum Requirements

As described for ONLINE configuration of TERRESTRIAL version