

# **Universal Sample Holder DIVING-USH**

**for the DIVING-PAM  
Chlorophyll Fluorometer**

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# 1 Component Description

The **Universal Sample Holder** DIVING-USH was specially developed for use in conjunction with the DIVING-PAM Chlorophyll Fluorometer. Its construction takes account of the specific requirements of underwater field work on samples like sea grass, macroalgae, corals, algal mats and periphyton. It features the particular advantage, that for measurements only one hand is required. A measurement is started using a trigger-button in the carrying grip, similarly as triggering a gun. This device is the result of three years of development going along with practical use of the DIVING-PAM in a broad range of applications. It covers measurements using ambient light as well as light derived from the internal halogen lamp.

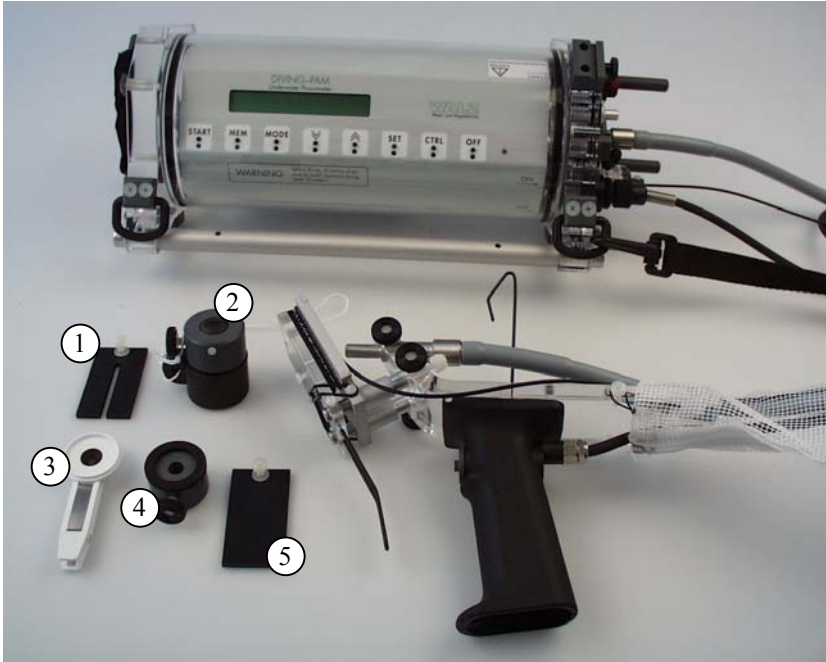


Fig. 1: DIVING-PAM with Universal Sample Holder and various accessories:

- (1) Adapter Plate for Fiber Quantum Sensor
- (2) Magnet Sample Holder DIVING-MLC (optional accessory)
- (3) Dark Leaf Clip DIVING-LC (optional accessory)
- (4) Darkening Adapter
- (5) Darkening Plate to shield off light from the bottom

The Universal Sample Holder connects to the DIVING-PAM via the Fiberoptics and a special Underwater Cable, both of which are loosely held together by a nylon-mesh-cover featuring a zipper. The Underwater Cable, which is very robust, can be attached to the diver's BCD-jacket. In this way, harmful bending and stretching of the fiberoptics can be largely avoided. When not in use, the whole device can be hooked to the diver's jacket. The various parts and accessories of the device are displayed in figure 1. The various

modes of application are illustrated in the following sections. Figure 2 shows how the cable and the fiberoptics are connected to the DIVING-PAM.



Fig. 2: Various connectors at the right hand side of the DIVING-PAM housing:

- (1) Cable of Universal Sample Holder
- (2) Fiber Quantum Sensor
- (3) Fiberoptics
- (4) Underwater connector for RS 232 Interface Cable

The Universal Sample Holder requires an upgraded version of the DIVING-PAM (issued in September 1999) which features two underwater connectors (for Universal Sample Holder and RS 232 Interface Cable). Older versions can be upgraded at the factory. The cable of the Universal Sample Holder has to be plugged into the left

connector, marked with "AUX" on the housing. Please consult the DIVING-PAM manual for information on the other connectors.

## **2 Application on leaves and leaf-like samples, as macroalgae**

With leaves or leaf-like objects, as macroalgae, the Universal Sample Holder can be used in conjunction with a clip, which can be connected to the holder with the help of two screws. The “jaws” of the clip can be opened by a handle with a single finger of the same hand which holds the grip of the device. Two rubber o-rings constitute the elastic part of the clip, holding the two parts of the jaw together. The o-rings are held by two nylon screws, one at the back side of the upper jaw and another one at the bottom of the lower jaw. Two of the latter are provided at different distances to the former, such that depending on the type of sample more or less pressure can be exerted. Different pressures can be also obtained with o-rings of various thicknesses. Furthermore, it is possible to adjust the distance between upper and lower jaw with the help of the two vertical nylon screws. In this way, the clip can be adapted for samples of various strength and thickness. The stripe-like contact area is covered with neoprene rubber foam (bottom) and a plastic “pin-cushion” (top), which assure a good grip even with slippery objects like kelp and other seaweeds.

The Fiberoptics metal endpiece can be mounted at angles of either  $60^\circ$  or  $90^\circ$  with respect to the sample plane. Changing the angle just takes a couple of seconds. Figures 3 and 4 show the clip featuring the two different measuring geometries. At an angle of  $60^\circ$  ambient light can unhindered reach the site at which fluorescence is measured. The quantum flux density of this light can be readily measured with the help of the special Fiber Quantum Sensor provided with the instrument. This can be mounted at the left side of the upper jaw with the help of two screws. Knowledge of quantum

flux density is important for estimation of relative electron transport rate (ETR) and for evaluation of measured effective quantum yields.

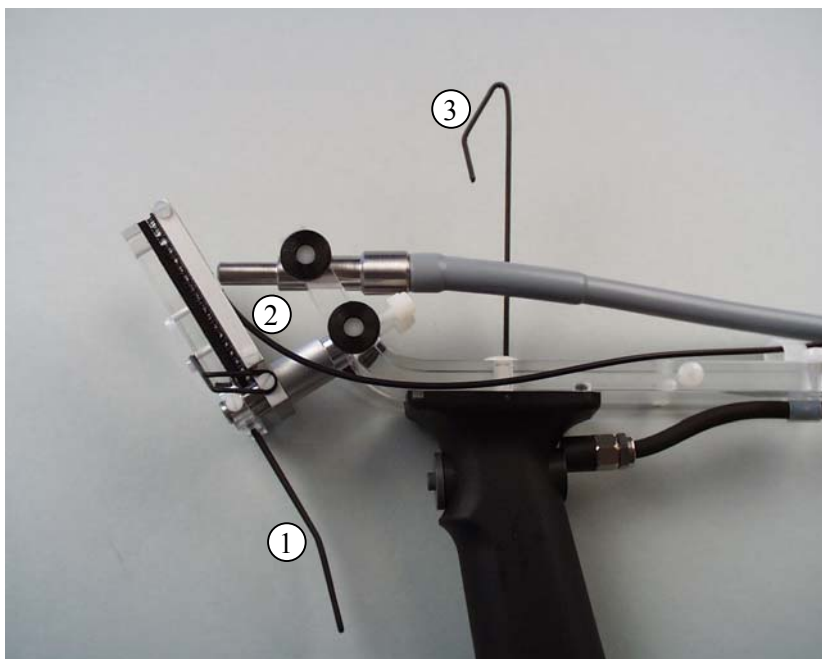


Fig. 3: 60° measuring geometry of clip

- (1) Handle to open the Clip
- (2) Fiber Quantum Sensor mounted close to Fiberoptics endpiece
- (3) Hook to attach the device to diver's BCD-jacket



Fig. 4: 90° measuring geometry recommended for recordings of Light- and Induction-Curves

At an angle of 90°, ambient light cannot reach unhindered the site of fluorescence measurement and the internal halogen lamp source is used for illumination. Well-defined Light Response Curves and Induction Curves can be measured when the external light is fully excluded. For this purpose a special Darkening Adapter is provided which slips over the Fiberoptics metal endpiece (see figure 5 and figure 1, part 4). One side of this adapter is covered with neoprene rubber, making provision for a light-tight, gentle contact with the sample. In order to prevent access of light from the bottom side, a Darkening Plate can be fixed in the lower jaw (see figure 1, part 5). With 90° measuring geometry, the external Fiber Quantum Sensor does not provide relevant readings of quantum flux density. In this case, the Internal PAR-list will become valid, as soon as in the

instrument (Mode-menu point 7) the Ext.Light-Sensor is disabled (see DIVING-PAM manual).



Fig. 5: 90° measuring geometry featuring Darkening Adapter and Darkening Plate installed in the lower "jaw"

### 3 Application on surface samples

For measurements on surface samples (e.g. corals, sea anemones, periphyton and microphytobenthos), the bottom part of the clip can be easily removed. For this purpose, first the two open rubber o-rings are pulled off. Then the lower “jaw” can be pulled out of its bearings. The holder can be placed with either 60° (see figure 6) or 90° measuring geometry on the surface of the investigated sample. In the latter case, depending on the type of object, it may be better to also remove the upper part of the holder and to use the Darkening Adapter only (see figure 7).



Fig. 6: 60° geometry with lower jaw being removed



Fig. 7: Darkening Adapter in 90° geometry

## 4 Sample holders for dark adaptation ( $F_v/F_m$ measurements)

For assessment of the maximal quantum yield ( $F_v/F_m$ ) a sample must be dark adapted over an extended time (at least several minutes). For this purpose two different types of dark sample holders are optionally available, the Magnet Sample Holder DIVING-MLC and the Dark Leaf Clip DIVING-LC (see DIVING-PAM manual). The former is suited for the study of relatively large and robust samples, whereas the latter is better suited for more fragile leaf-like samples. The two types of sample holders for dark adaptation are depicted in figures 8 and 9, respectively.



Fig. 8: Magnet Sample Holder DIVING-MLC (optional accessory) connected to the Fiberoptics



Fig. 9: Dark Leaf Clip DIVING-LC (optional accessory) connected via the back side of the Darkening Adapter to the Fiberoptics

## 5 Assessment of absorption of a leaf-like sample

Instead of the Darkening Plate a special Adapter Plate can be mounted in the lower jaw of the clip. This plate features a slot in which the Fiber Quantum Sensor can be fitted. With the diffusing disk of this sensor being positioned underneath the outlet of the Fiberoptics of the DIVING-PAM, the absorption of a leaf-like sample can be readily assessed. The same type of incident light as for measurement of effective quantum yield ( $\Delta F/F_m'$ ) is used, i.e. either the ambient light (60° measuring geometry) or the internal halogen light (90° measuring geometry). In this way an estimate of the relevant quantum flux density of the absorbed (not incident) light may be obtained, which may be used for estimation of apparent electron transport rates (ETR) (see DIVING-PAM manual). While most green leaves display an absorption of photosynthetically active radiation close to an average value of 84 % (so-called ETR-factor being 0.84), absorption may be considerably lower in sea grasses and sea weeds.

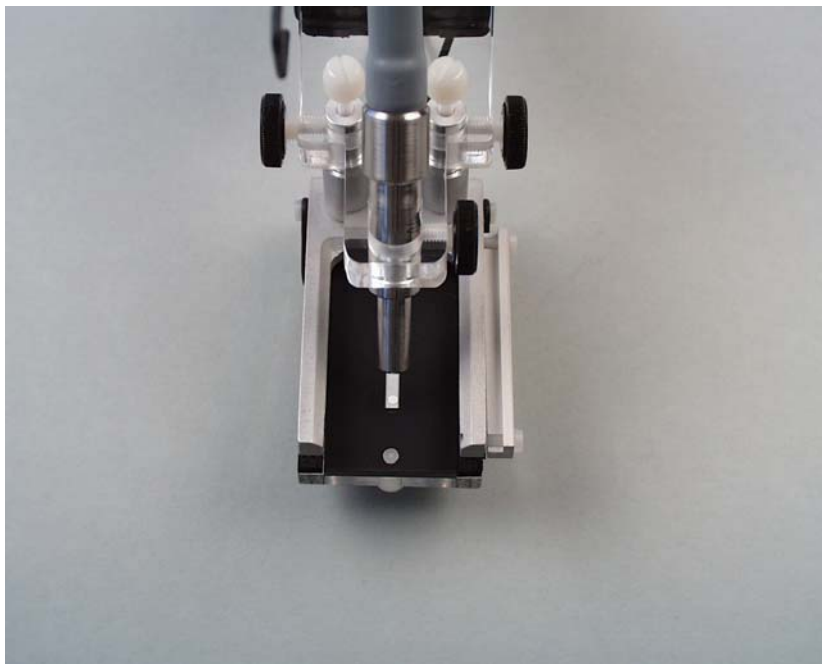


Fig. 10: Adapter Plate with Fiber Quantum Sensor

6 List of spare parts

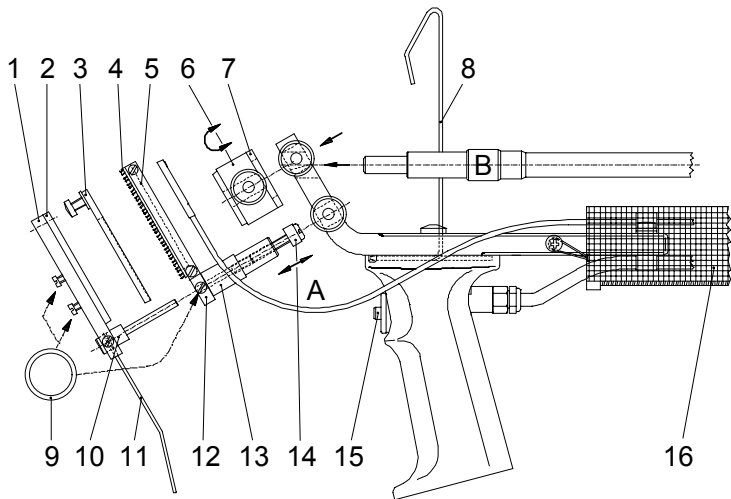


Fig. 11: Parts DIVING-USH

Parts DIVING-USH

Pos.-No.	Quantity	Part-No.	Description
1	1	000241808214	Lower jaw
2	2	000241809214	Self-adhesive rubber foam
3	1	000241808614	Darkening Plate
3	1	000241808714	Adapter Plate
4	2	000241809314	Self-adhesive pin-cushion
5	1	000241808014	Fiber Quantum sensor holder
6	1	000241804614	Darkening Adapter
7	1	000241809414	Self-adhesive rubber foam
8	1	000241809014	Hook
9	2	000150702202	O-ring 20x2
10	2	000241808514	Joint shaft
11	1	000241808914	Handle
12	1	000241808314	Upper jaw
13	2	000241807914	Distance rod
14	2	000150110607	Screw M4x20

Pos.-No.	Quantity	Part-No.	Description
15	1	241807714	Trigger button
16	1	241809514	Nylon-mesh-cover
A		DIVING-F	Fiberoptics
B		DIVING-LI	Fiber Quantum Sensor

## 7 Warranty conditions

All products supplied by the Heinz Walz GmbH, Germany, are warranted by Heinz Walz GmbH, Germany to be free from defects in material and workmanship for one (1) year from the shipping date (date on invoice).

**The warranty is subject to the following conditions:**

1. This warranty applies if the defects are called to the attention of Heinz Walz GmbH, Germany, in writing within one year (1) of the shipping date of the product.
2. This warranty shall not apply to any defects or damage directly or indirectly caused by or resulting from the use of unauthorized replacement parts and/or service performed by unauthorized personnel.
3. This warranty shall not apply to any product supplied by the Heinz Walz GmbH, Germany which has been subjected to misuse, abuse, abnormal use, negligence, alteration or accident.
4. This warranty does not apply to damage caused from improper packaging during shipment or any natural acts of God.
5. This warranty does not apply to underwater cables, batteries, fiberoptic cables, lamps, gas filters, thermocouples, fuses or calibrations.

**To obtain warranty service, please follow the instructions below:**

1. The Warranty Registration form must be completed and returned to Heinz Walz GmbH, Germany.
2. The product must be returned to Heinz Walz GmbH, Germany, within 30 days after Heinz Walz GmbH, Germany has received written notice of the defect. Postage, insurance, custom duties,

and/or shipping costs incurred in returning equipment for warranty service are at customer expense.

3. All products being returned for warranty service must be carefully packed and sent freight prepaid.
4. Heinz Walz GmbH, Germany is not responsible or liable, for missing components or damage to the unit caused by handling during shipping. All claims or damage should be directed to the shipping carrier.