

LabSTAF

Single Turnover Active Fluorometer

The next generation of STAF-based primary productivity instrumentation for deployment on ships and in the lab



LabSTAF *Single Turnover Active Fluorometer*

Single Turnover Active Fluorometry (STAF) is widely accepted for non-invasive primary productivity assessment in the field. LabSTAF is the next generation of STAF-based primary productivity instrumentation which can be used in all environments: from reservoirs and lakes to open oceans.

Chelsea's LabSTAF monitors phytoplankton using the latest in STAF technology. The system combines unparalleled sensitivity with a wide dynamic range, allowing for measurements in extreme oligotrophic waters, open oceans, coastal waters and lakes. The highly automated platform runs continuous Fluorescence Light Curves (FLCs), improving the accuracy of STAF-based PhytoPP assessment for greater precision at low biomass, correction of spectral errors, baseline fluorescence and the package effect.

LabSTAFs compact and robust portable unit is ideal for deployment on research vessels and outdoor locations. A number of features have been specifically incorporated to minimise errors associated with the conversion of STAF data to PhytoPP including: Seven waveband excitation, dual fluorescence waveband measurement and baseline subtraction.

Key Features

- **Monitoring phytoplankton primary productivity** using latest in STAF technology
- **Unparalleled sensitivity** allowing for measurements in extreme oligotrophic water
- **Fully automated acquisition** for continuous measurements
- **Wide dynamic range** providing reliable measurements in open oceans and lakes
- **Advanced corrections** as standard seven waveband excitation, baseline subtraction
- **Compact and robust** portable unit ideal for research vessels and outdoor locations

Applications

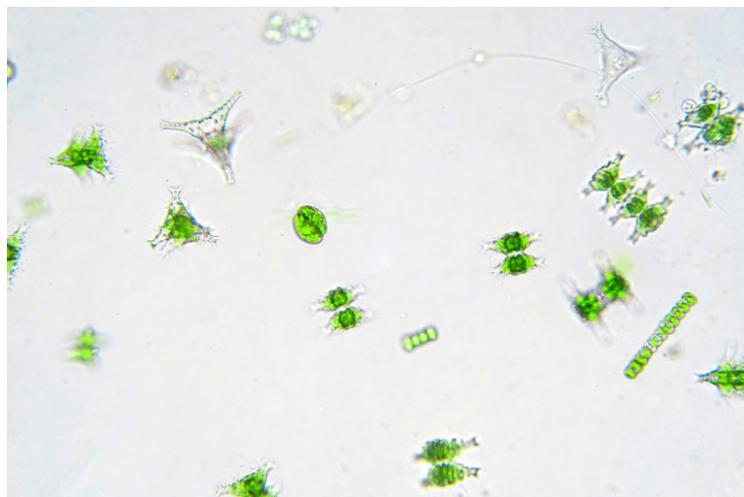
- Measurement of PSII photochemical flux per unit volume (JV_{PII}) to provide an upper limit to PhytoPP at high spatiotemporal scales.
- Quantitative assessment of the fundamental systems driving the global carbon cycle
- Analysis of the biochemistry and ecology of aquatic systems
- Verification of satellite data
- Facilitates measurement at scales from mesoscale eddies to oceanic fronts
- Climate change research and modelling
- Monitoring of algal bloom development and community structure
- Ecological monitoring to manage water catchments
- Identify and mitigate sources affecting water quality in catchments



Why measure Phytoplankton Primary Production?

Phytoplankton Primary Productivity (PhytoPP) forms the base of the marine food chain and represents approximately half of the carbon fixed by photosynthesis on a planetary scale. It is an extremely dynamic process that responds to a range of environmental drivers including light, temperature and nutrients, which vary greatly over multiple scales in the Oceans.

Reliable measurements of phytoplankton productivity across the full relevant range of spatiotemporal variability within marine systems are critical for understanding the global carbon cycle and oceanic ecosystem function.



Why use Single Turnover Active Fluorometry (STAF)?

The application of STAF has revolutionized our general understanding of phytoplankton physiology in oceanic systems over more than twenty years and, with recent technological and theoretical developments, has become recognized as an enabling technology from non-destructive in situ measurements of Phytoplankton Primary Productivity (PhytoPP).

Photochemistry by Photosystem II (PSII) is the ultimate source of energy for PhytoPP. STAF can be used to measure PSII photochemical flux per unit volume (JV_{DII}). This parameter is strongly correlated with oxygen evolution by PSII and provides an upper limit to PhytoPP. LabSTAF can be used on much wider spatiotemporal scales and either ^{14}C fixation or O_2 evolution and at much lower biomass.

Features

- Integration of the absorption method for quantifying photosynthesis (Oxborough et al. 2012)
- Seven measurement wavebands to allow for routine spectral correction based on variable fluorescence (F_v)
- Dual narrow waveband fluorescence measurement, centered at 685 nm and 730 nm, for automated package effect correction (Boatman et al. 2019)
- Dual Single Turnover pulse method for the measurement of relaxation phase kinetics
- Full spectrum blue-enhanced actinic illumination providing up to 2500 $\mu\text{mol photons m}^{-2}\text{s}^{-1}$
- Circulating water jacket for the sample chamber, which avoids intersection with optical paths
- Potential replacement for 14C based photosynthetron measurements
- Three acquisition modes



Specifications

Power supply	140 - 400 mA, 24 V, 3.4 - 9.7 W
Dimensions (mm)	235 (H) x 320 (D) x 420 (W)
Mass (approx.)	8.1 kg
Sample Chamber	20 mL sample volume with fused silica vertical cylinder, BK7 base
Excitation wavebands (wavelength)	452, 472, 505, 417, 534, 594, 622 nm
Actinic light source	Collimated output from 10 - 2400 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$ at 12 bit resolution
Detection limit	Can resolve F_v with an amplitude equivalent to 0.001 mg m^{-3} of chlorophyll <i>a</i>
IP Rating	IP65

**In view of our continual improvements, the designs and specifications of our products may vary from those described.*

Further Reading:

Reference 1:

Boatman, T.G., Geider R.J. and Oxborough, K. (2019) Improving the accuracy of single turnover active fluorometry (STAF) for the estimation of phytoplankton primary productivity (PhytoPP) <https://doi.org/10.1101/583591>

Reference 2:

Oxborough, K., Moore, C.M., Suggett, D.J., Lawson, T., Chan, H.G and Geider, R.J. (2012) Direct estimation of functional PSII reaction centre concentration and PSII electron flux on a volume basis: a new approach to the analysis of Fast Repetition Rate fluorometry (FRRf) data. <https://doi.org/10.4319/lom.2012.10.142>



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Applications

- Automated archiving
- Real time data processing and presentation
- Flexible experimental design
- CSU Compatible data export