



FluorPen is a portable, battery-powered fluorometer that enables quick and precise measurement of chlorophyll fluorescence parameters in the laboratory, greenhouse, or in the field. It can be effectively used for studying photosynthetic activity, stress detection, herbicide testing, or mutant screening.

Measured data are sequentially stored in the internal FluorPen memory. Data transfer to a PC is via USB or Bluetooth communication. Comprehensive FluorPen 1.0 software provides data transfer routines and many additional features for data presentation in tables and graphs.

Affordable price and straight-forward two-button operation makes the FluorPen a perfect tool for teaching photosynthesis. Because of its rapid measurement capability and large internal memory, the FluorPen is also an invaluable tool for large plant-screening programs.

FluorPen FP 110 measures:

- **F_T - continuous fluorescence yield in non-actinic light.** F_T is equivalent to F₀ if the leaf sample is dark-adapted.
- **QY - Photosystem II quantum yield.** QY is equivalent to F_v/F_M in dark-adapted samples and to F_v' / F_M' in light-adapted samples. F_v/F_M is the most frequently used chlorophyll fluorescence parameter.
- **OJIP** **Analysis**
Application of chlorophyll fluorescence fast-transient analysis (OJIP) is a simple and non-invasive tool to monitor chloroplast function. Provided OJIP analysis is used as sensitive and reliable fast test for the functionality and vitality of photosynthetic system.
- **NPQ** **Non-Photochemical Quenching**
Provided are two predefined NPQ protocols differing in the duration of light exposure and dark recovery phase as well as in the number of intervals between the pulses. It is typically used for quantification of photochemical and non-photochemical quenching in dark-adapted samples.
- **Light** **Curve**
There are three predefined Light Curve protocols based on pulse modulated fluorometry differing in number and duration of single light phases and light intensities. Light Curve protocols provide successive measurements of the sample photosynthesis under various light intensities of continuous illumination relating the rate of photosynthesis to photon flux density.

Applications Different Sample Holders NPQ Protocol Light Curve Protocol OJIP Parameters
 Explain Software Technical Specification References

- Photosynthesis research
- Photosynthesis education
- Plant & molecular biology
- Agriculture
- Large plant-screening programs

- Biotechnology



- FluorPen in the Field Experiment

- Different leaf-clips for gentle but firm sample holding:
- **Standard leaf-clip:** suitable for experiments where short term dark adaptation is needed



- **Detachable leaf-clips:** suitable for experiments where long term dark adaptation is needed. They also allow simultaneous dark-adaptation of several leaves using several clips *in situ* under light, and then doing the readings one after another by attaching the device unit to each clip.





- **Customized sample holders:** for instance, open leaf-clip suitable for measurements in ambient light (experiments where no dark adaptation is required); or specific clips for mosses, lichens and other experimental material.



- Two predefined NPQ protocols differing in the duration of light exposure and dark recovery phase as well as in the number of intervals between the pulses
 - Typically used for quantification of photochemical and non-photochemical quenching in dark-adapted samples
 - NPQ 1 protocol: light duration 60s, 5 pulses; dark recovery duration 88s, 3 pulses
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• Specifications

- **Measured/Calculated Parameters:** F0, FT, FM, FM, QY, OJIP, NPQ 1,2, and Light Curve 1,2,3, PAR (measured as PPFDF)
 - **Cosine Correction:** Cosine corrected up to 80° angle of incidence
 - **Saturating Pulse Illumination:** Adjustable from 0 to 100 % (up to 3,000 $\mu\text{mol.m}^{-2}.\text{s}^{-1}$)
 - **Actinic Illumination:** Adjustable from 0 to 100 % (up to 1,000 $\mu\text{mol.m}^{-2}.\text{s}^{-1}$)
 - **Measuring Illumination:** Adjustable from 0 to 100 % (up to 0.09 $\mu\text{mol.m}^{-2}.\text{s}^{-1}$) per pulse)
 - **Detector Wavelength Range:** PIN photodiode with 667 to 750 nm bandpass filters
 - **FluorPen 1.1 Software:** Windows 7, or higher
 - **Memory Capacity:** 16 Mbit
 - **Internal Data Logging:** Up to 149,000 data points
 - **Display:** Graphical display
 - **Keypad:** Sealed, 2-key tactile response
 - **Keypad Escape Time:** Turns off after 8 minutes of no use
 - **Power Supply:** Li-ion rechargeable battery
 - **Battery Life:** 48 hours typical with full operation
 - **Low Battery Detection:** Low battery indication displayed
 - **Size:** 134 x65 x 33 mm
 - **Weight:** 188 g
 - **Sample Holder:** Mechanical leaf-clip closed or open or detachable
 - **Operating Conditions:** Temperature: 0 to +55 °C, Relative humidity: 0 to 95 % (non-condensing)
 - **Storage Conditions:** Temperature: -10 to 60 °C, Relative humidity: 0 to 95 % (non-condensing)
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