

# Y(II) Meter



## A compact and affordable light adapted Y(II) & ETR meter

Quantum Yield of PSII or Y(II) is a test that allows the measurement of the efficiency of Photosystem II under actual light adapted environmental and physiological conditions.



- Y(II) and ETR corrected for absorbance
- Leaf absorbance using RGB sensors
- PAR and leaf temperature measured
- Fm' correction according to Loriaux 2013
- Long-term fluorescence monitoring mode
- 2Gb of on-board memory
- USB output

### Compact, yet accurate

Weighing less than 0.5kg, the Y(II) meter is the most advanced light-weight, compact and portable; modulated fluorometer available.

The Y(II) meter follows established and proven scientific principles to provide the user with accurate plant stress measurements.

Yield(II) is measured from the top of the leaf along with photosynthetically active radiation, while the leaf temperature is measured, over a large area, from the bottom of the chamber. This gives a more representative and accurate leaf temperature reading than a spot, thermistor measurement.

### Leaf absorbance

New sensors now allow for the accurate estimation of leaf absorbance changes under different field conditions. Leaf absorbance can vary from 0.7 to 0.9 in healthy leaves. These values can vary by plant type, by exposure to high light levels and the presence of some plant stresses. By measuring leaf absorbance the Y(II) meter can provide reliable ETR, or 'J' values (electron transport rate).

### Innovative design

The Y(II) meter PAR clip was designed to improve on previous industry standards. The bottom opening design prevents the clip from opening when mounted on a tripod or when being held in an elevated position.

The cosine corrected PAR sensor is located close to the leaf and at the same angle, ensuring that a reading is made which is representative of the PAR at the leaf surface.

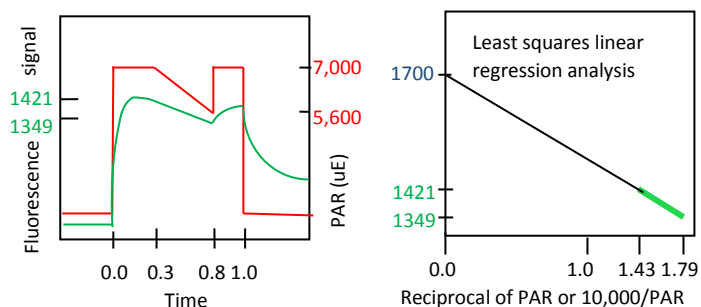
### Fm' correction

Modulated fluorometers use saturating pulses of light to close all PSII reaction centres.

The maximum fluorescence intensity value resulting from the saturating flash, Fm' is used in most measurements including, quantum yield of PSII (also called Y(II) or  $\Delta F/Fm'$ ), ETR (or J) and all quenching protocol parameters.

It has been found that under high light conditions the closure of all reaction centres is not possible. It is thought that the fast turnover of the plastiquinone pools prevent the complete reduction of Q<sub>A</sub>.

The Y(II) meter follows protocols determined by Loriaux (2006) to determine the maximum, theoretical level of Fm' with an infinitely intense saturating pulse. An automated, default protocol on the Y(II) meter has been optimised for most applications.



The saturating pulse (in red) has three phases: 7,000μmols for 0.3s to saturate PSII, a downward ramp of 25% for 0.5s and a final phase of 7,000μmols to check for saturation pulse NPQ.

The graph on the right shows the plot of the fluorescence data along with the linear regression analysis to the y intercept which represents machine fluorescence with an infinite saturation pulse.



## Automated modulated light adjustment

The Y(II) meter provides an automated method of setting the intensity of the modulated light.

It starts low and adjusts the output until the fluorescence signal is high enough for accurate detection but not high enough to produce  $Q_A$ . While it is still possible to make manual adjustments to the modulated intensity, this automated method saves time and can prevent errors.

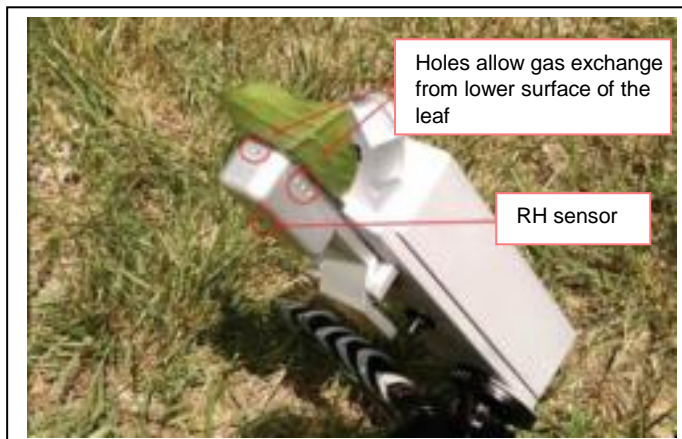
## USB

A mini USB port is provided on the back of the Y(II) meter. When connected to a PC the Y(II) meter becomes a hard drive, allowing the transfer of data measuring files and software upgrades. No special software is required. Data files can simply be opened in Excel, or any other software that can receive comma delineated files.

## Long-term monitoring

Holes in the lower jaw of the leaf clip allow gas exchange to take place on the lower surface of the leaf.  $CO_2$ ,  $O_2$  and  $H_2O$  can enter and leave the leaf so there is the possibility of doing longer monitoring type measurements, without inhibiting the gas exchange of the leaf.

The lower jaw also houses a humidity sensor which allows RH measurements to be related to other measured parameters.



## Parameters measured

Y(II): Quantum Photosynthetic Yield of PS(II)

ETR: Electron transport rate

PAR: Photosynthetically active radiation

T: Leaf temperature

$F_{MS}$  (or  $F_M'$ ): Maximum fluorescence at steady state

$F_S$  (or  $F$ ): Fluorescence under steady state

Loriaux 2013 correction of ETR and  $F_M'$

$\alpha$ : Leaf absorptance & transmittance

RH: Relative humidity 5% to 95% (+/-2% over the range)

Monitor mode:  $F_v/F_m$ , Y(II), ETR, absorptance, PAR, T, RH and ETR

## Specification

**Light Sources:**

**Saturation pulse:** 7,000umols white LED

**Modulated light:** Red: 660 nm LED with 690 nm short pass filter

**Actinic light source:** Ambient light only

**Detection method:** Pulse modulation method

**Detector & Filters:** A PIN photodiode with a 700 ~750 nm bandpass filter

**Sampling Rate:** Auto-switching from 1 to 10,000 points per sec, depending on test & on phase of test

**Automated routine to optimally set the modulated light intensity.** The modulated light may also be set manually

**Multi-Flash FM' correction for all light adapted protocols & quenching:** May be turned off

**Test Duration:** About 3 seconds for fast tests and may be run for months in monitor mode

**Storage Capacity:** 2 Gigabyte of non-volatile flash memory, supporting almost unlimited data sets

**Special Algorithms:** 8 point rolling 25 ms average to determine  $F_m$  and  $F_m'$  eliminating saturation pulse NPQ as an issue

**Automated modulation light intensity set up:** (manual may also be used)

**Output:** USB comma delineated files may be opened in Excel

**User Interface:** Menu driven with arrows

**Display:** Graphic black and white display 132 x 32 pixels

**Power Supply:** 8 hour USB lithium ion battery is standard, but any USB battery can be used. Mains current may also be used. Mains plug is also supplied. Charger included

**Dimensions:** 23cm long with a USB cable that is 160cm long

The case is 36 x 28 x 15mm - included

**Weight:**

Y(II) meter w/battery & USB cable- 0.45 kg

Complete w/case & accessories- 1.5 kg

**Operating temperature range:** 0°C to 50°C

**Absorptance measuring standard:** 2 included

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