



CCM-300



## Chlorophyll Content Meter for very small leaves

A lightweight hand-held device for the accurate and easy determination of chlorophyll content in very small leaves and difficult to measure intact samples.



- ◆ Non-destructive
- ◆ Accurate and reliable
- ◆ Relative chlorophyll content ( $\text{mg m}^{-2}$ )
- ◆ Data averaging
- ◆ Touch screen, colour graphic display
- ◆ Hand-held, battery portable
- ◆ Large 2Gb internal memory

### Chlorophyll content determinations

The new CCM-300 is the world's first cost effective solution for the non-destructive measurement of chlorophyll content in very small leaves and other difficult to measure intact samples.

The OSI CCM-200*plus* has established an outstanding reputation for the accurate and reliable determination of chlorophyll in broad leaves. However the absorption technique employed requires that the measuring area is fully covered by the sample, so restricting its use on many plant species.

### New fluorescence technology

The CCM-300 uses a well established chlorophyll fluorescence technique, where light is absorbed at one wavelength and is re-emitted at a longer wavelength. This technique does not require the measuring aperture to be fully filled, allowing very small leaves, curved leaves and very thick samples to be measured quickly and non-destructively.

Recent advances in technology developed for the CCM-300, has significantly reduced the cost of this traditionally expensive technique.

### Chlorophyll content of:

- ◆ Conifers and needles
- ◆ Grasses
- ◆ Arabidopsis and other small leaves
- ◆ Algae, moss and Lichens
- ◆ Fruit
- ◆ Cactus



## Proven scientific principles

The design of the CCM-300 is based on the work of Gitelson\* (1999) using the ratio of fluorescence at 735nm/700nm to determine chlorophyll content. Each measurement takes only 5 seconds to perform and is presented as Chlorophyll Fluorescence Ratio (CFR) or as a relative chlorophyll content in  $\text{mg m}^{-2}$ . There has proven to be a high degree of correlation to traditional chemical assays using this technique.

## Battery portable and easy to use

Weighing only 275gms the CCM-300 is a lightweight, hand-held field portable instrument.

Powered by two AA rechargeable batteries, the power efficient CCM-300 will operate for up to 8 hours between charging.

Programming and operation is via a colour, touch screen display.



## Data averaging, storage and download

Data may be made as:

- Single measurements.
- 2-30 measurements averaged (with applied sigma 2 standard deviation to exclude rogue data points).

The integral 2Gb data storage allows many thousands of experimental results to be saved, before downloading via the USB port. Stored data can be reviewed in the field.



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## Technical Specifications

**Measured parameters:** Chlorophyll Fluorescence Ratio (CFR) at 735nm/700nm, or relative chlorophyll content in  $\text{mg m}^{-2}$

**Measurement area:** Fiber optic probe with inner 3mm diameter circle. Samples smaller than 3mm can be measured accurately

**Resolution:** Ratio 0.01 or  $1\text{mg m}^{-2}$

**Repeatability:** Typical ratio 0.03. Averaging of multiple samples recommended

**Sample measuring time:** 5 seconds

**Noise:**  $< \pm 2\%$

**Source:** One LED 460nm blue diode, half bandwidth 15nm

**Detectors:** Two solid state, high sensitivity detectors with band limiting filter sets. Simultaneous detection at 700nm to 710nm and 730nm to 740nm

**Detection:** Modulated light digitally controlled to minimise background detection. Temperature compensation for source and detector

**Data modes:** Single point and selectable 2-30 point average that disregards data beyond a 2 sigma standard deviation

**Storage capacity:** 2Gb non-volatile flash memory

**User Interface:** 240 x 320 pixel colour touch screen

**Output:** USB 1.1

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

**Batteries:** 2 x Rechargeable AA batteries

**Auto off interval:** Programmable 0-20 minutes (with no key press or download)

**Dimensions:** 12 x 9 x 3 cm

**Weight:** 275g

**Linear correlation to chemical assay:**

*41  $\text{mg m}^{-2}$  to 675  $\text{mg m}^{-2}$  with determination coefficient of  $r^2 = 0.95$  or better*

### \* Reference:

Gitelson A. A., Buschmann C., Lichtenthaler H.K.(1999). The Chlorophyll Fluorescence Ratio F735/F700 as an accurate measure of chlorophyll content in plants. Remote sense. environ. 69:296-302.