

SPECIFICATIONS

Display: 3½ digit LCD, 1.2 cm height

Operating environment: 0 to 50 C;

Less than 80% relative humidity up to 30 C;

Less than 70 % RH from 30 to 50 C

Power: Standard 9 volt battery. Battery life is typically 100 hours with the carbon-zinc battery (included) and 200 hours with an alkaline battery. The letters "BAT" appear in the display when the battery needs to be replaced. To replace the battery, remove the 2 screws in the back of the case and carefully lift off the back. Observe polarity of the battery contacts.

Dimensions: 126 mm long, 70 mm wide, 24 mm thick

Mass: 140 g

Range: 0 to 2000 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (full sunlight)

0 to 10,000 fc (full sunlight)

Warranty: 1 year parts and labor



435-792-4700

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✉ techsupport@apogee-inst.com

Each Quantum Meter is calibrated for either electric light or sunlight.

The average spectral errors associated with electric light and sunlight calibration are shown below.

<u>Lamp Type</u>	<u>Error</u>
Sunlight	0%
Cool White Fluorescent	10% high
Metal Halide	8% high
High Pressure Sodium	12% high

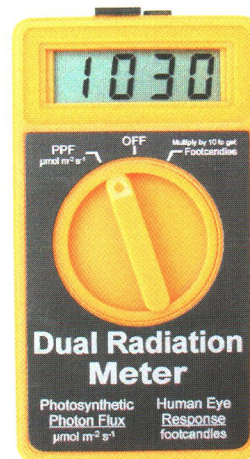


Owners Manual

DUAL RADIATION METER

PPF sensor and Foot-candle Sensor

Model: MQ-400

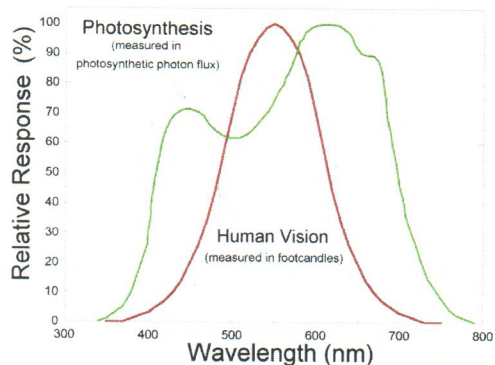


USING THE INSTRUMENT

1. Depending on what you would like to measure, turn the dial to the left to measure Photosynthetic Photon Flux (PPF) or turn the dial to the right to measure Foot-candles.
2. Hold the meter vertically so that the sensor surface on the top is horizontal.
3. Hold the meter at eye level to avoid shading the sensors with your head.
4. If measuring PPF, the number in the display is the in the units of $\mu\text{mol m}^{-2} \text{s}^{-1}$. If measuring foot-candles, multiply the number in the display by 10 to get actual value.
5. Turn the meter off after use to conserve battery power.

The Photosynthetic Photon Flux (PPF) side of this meter approximates the radiation between 400 and 700 nm, which are the most important wavelengths for plant growth. PPF is measured in $\mu\text{mol m}^{-2} \text{s}^{-1}$ (micromoles of photons per square meter second).

Foot-candles measure the light that the human eye sees. Until recently, foot-candles have been used by growers to approximate light. This meter is useful to those unfamiliar with PPF units and would like a comparison to foot-candles to begin the switch to photosynthetic radiation units. The graph illustrates the difference between the two methods of measuring light.



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The sensor on the top of the meter must be exactly horizontal for the most accurate measurement. The biggest error is often caused by small changes in the position of the meter.



The correct position for making a measurement.

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Cosine response. Some of the radiation coming into a sensor at low angles is reflected, which causes the reading to be less than it should be. The sensor on the quantum meter is cosine corrected by surrounding it with a dense foam gasket that blocks the radiation at very low angles. A small gap between the edge of the sensor and the gasket allows the correct amount of low angle radiation to be captured by the sensor. The cosine error for typical applications is less than 2%.

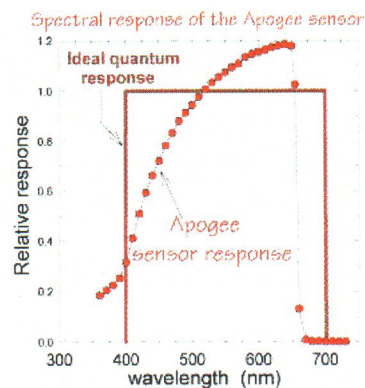
Temperature response. The temperature response is about 0.1 % per degree celsius. This temperature error is insignificant for most applications.

Long-term stability. The output of all radiation sensors tends to decrease over time as the detector ages. Our measurements indicate that the average decrease of the sensor is about 1 % per year. We recommend returning the sensor for recalibration every 3 years.

Recalibration. Contact Apogee to have your meter recalibrated.

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Spectral response. An ideal quantum sensor would give equal emphasis to all photons between 400 and 700 nm and would exclude photons above and below these wavelengths. The response of such a sensor is shown in the graph below. The most accurate way to measure this radiation is with a spectroradiometer, which can be purchased from Apogee Instruments



The spectral response of the Apogee sensor is shown above. It underestimates the 400 to 500 nm wavelengths, overestimates the 550 - 650 nm wavelengths (yellow and orange light), and has little sensitivity above 650 nm (red light). Fortunately common light sources are mixtures of colors and many spectral errors offset each other.

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