

# Quantum Meter

MQ-100, 200, & 300 Series



## Measuring PPF with Quantum Meter

Photosynthesis is driven by the number of photons between 400 and 700 nanometers (nm). This is called the Photosynthetic Photon Flux (PPF) and is measured in micromoles ( $\mu\text{mol}$ ) per meters squared per second. PPF meters are commonly called quantum meters because a quantum refers to the amount of energy carried by a photon.

## Quantum Meter Models

Quantum meter models available:



**MQ-100 Series:** meter w/ integral sensor



**MQ-200 Series:** meter w/ separate quantum sensor



**MQ-300 Series:** meter w/ separate line quantum sensor

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## Cleaning

Debris on the meter is a common cause of low readings. Salt deposits can accumulate on a sensor from evaporation of sprinkler irrigation water and dust, which can accumulate during periods of low rainfall. Salt deposits should be dissolved and removed with vinegar and a soft cloth or q-tip. Dust and other organic deposits are best removed with water, rubbing alcohol or window cleaner. *Never use an abrasive cleaner on the lens.*

## Application

Line quantum sensors are often used to quantify the variable light in greenhouses and below plant canopies because they provide a spatial average.



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## Using the Meter

1) Press the power button to start. The meter will turn itself off 2 minutes after button is pressed to conserve battery.



2) Choose Calibration: To select between sun and electric calibration push **mode** once and use **up/down** to make choice. Once desired mode is blinking, press **mode** three more times to begin.



3) Choose Mode: To choose between SMPL and LOG modes push **mode** twice and use **up/down** to make choice. Once desired mode is blinking, press **mode** two more times to begin.



**sample** For Automatic Measurements: Use LOG mode. Meter will power on/off to record a measurement every thirty seconds.

**sample** For Manual Measurements: Use SMPL mode. Press **sample** when you want to take a measurement. Store up to 99 manual measurements.

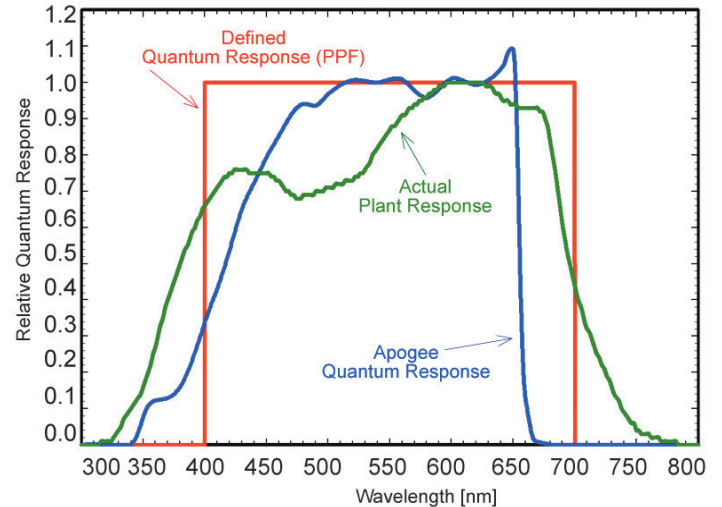
**mode** 4) Reset Meter: From LOG or SMPL mode, press **mode** twice (RUN should be blinking), then while pressing **down**, press **mode** once.

**CAUTION: Resetting will erase ALL measurements.**

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## Spectral Response

As shown in the graph below, quantum response by definition is from 400 to 700 nm and gives equal emphasis to all photons in that range. The spectral response of the Apogee sensor, as well as a typical plant response, are also shown.



5) Review Data: Press **up/down**. To exit and return to present conditions and the capability to take measurements, press **sample**.

6) In LOG mode, every 30 minutes the meter will average the sixty 30-second measurements taken and store the average. Ninety nine 30-minute averaged measurements can be stored. Every 48 measurements (making a 24-hour period), the meter will also store a daily total. In addition, ninety nine daily averages can be stored and are available for download only. These measurements are not viewable on the meter LCD. All measurements taken in LOG mode will continue to be stored eliminating the oldest measurement.

(SMPL) 99 Sample Measurements	(LOG) 99 Log Measurements	(LOG) 99 Daily Total Measurements
Viewable on meter LCD & downloadable	Viewable on meter LCD & downloadable	Downloadable Only

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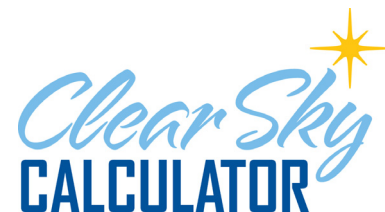
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## Spectral Differences

Apogee quantum sensors are calibrated for both electric light and sunlight. The difference in calibration is close to 10%. A sensor calibrated for fluorescent lamps will read about 10% low in sunlight. A sensor calibrated for sunlight will read about 10% high under fluorescent lamps. The spectral errors are less than 2% for other common electric light sources.

	Electric Calibration	Sunlight Calibration
Cool White Fluorescent	Calibration Reference ↓	10% high
Metal Halide	< 2% low	8% high
High Pressure Sodium	< 2% low	8% high
Sunlight	10% low	↑ Calibration Reference

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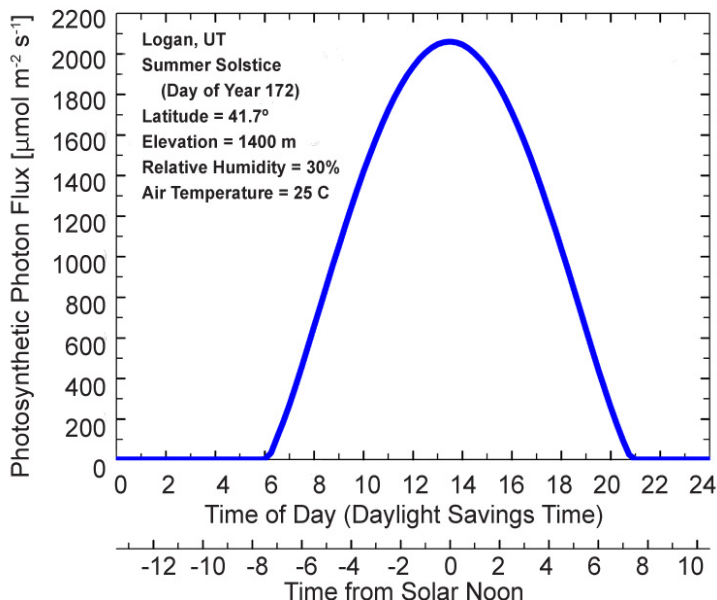


The Clear Sky Calculator is designed to determine the need for radiation sensor recalibration. It determines the intensity of radiation falling on a horizontal surface at any time of the day in any location in the world. It is most accurate when used near solar noon in the summer months.

The calculator is found at [www.clearskycalculator.com](http://www.clearskycalculator.com) and is used by typing conditions into the Clear Sky model and comparing measured values with the calculated value for a clear sky. If the output of the sensor over multiple days at solar noon is consistently less than the model value (by more than 8%), the sensor should be cleaned and re-leveled. If the output is still low after a second test, email [calibration@apogee-inst.com](mailto:calibration@apogee-inst.com) to discuss test results and the possible return of sensors. When used near solar noon over multiple clear, unpolluted days during the spring and summer months, it is estimated that the accuracy of the model can be  $\pm 4\%$  in all climates and locations around the world.

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## Example of Model Output



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## Characteristics

### Cosine Response

Some of the radiation coming into a sensor at low angles is reflected, causing low readings. The convex optical disc found on meters, sensors, and line quantum sensors is designed to capture radiation at low angles and minimize cosine response errors. The cosine error for typical applications is less than 2%.

### Temperature Response

The temperature response is less than 0.1% per degree C. This temperature error is not significant in most applications.

### Long-Term Stability

Our research indicates that the average output increases approximately 1% per year because of changes in the optical transparency of the diffusion disk. We recommend returning the sensor for recalibration every 2 years.

### Error Codes

The most common error code is Error 4. The meter will display this error code on the screen if the battery voltage is too low.

To replace the battery, unscrew the back area on the meter. Then use a pair of tweezers to gently remove the battery and replace it with a new one. Screw the back cover back on the meter, but be careful not to over-tighten as it can affect the LCD screen.



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## Specifications

### Application

- Measuring Photosynthetic Photon Flux (PPF)

### Measurement Range

- 0 to 2999  $\mu\text{mol m}^{-2} \text{s}^{-1}$

### Input Power

- CR2320 3 V coin cell battery

### Operating Environment

- 0 to 50 C
- Less than 90% non-condensing relative humidity up to 30 C
- Less than 70% relative humidity from 30 to 50 C

### Display

- 4.5 cm width by 2.8 cm height

### Cable (MQ-200 & 300 Series)

- 2 meters of twisted-pair wire
- Foil shield
- Santoprene jacket
- Longer cable lengths are available in multiples of 5 meters

### Dimensions

- 12.6 by 7.0 by 2.4 cm

### Mass

- MQ-100: 150 g
- MQ-200: 180 g
- MQ-301: 380 g
- MQ-303, MQ-306: 300 g

### Warranty

- 1 year against defects in materials and workmanship



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