



# MQ-501

## DESCRIPTION

The MQ-501 is designed to be an easy-to-use handheld meter for spot-check measurements. The meter includes the AM-001 meter mounting bracket to mount the sensor on a horizontal plane to the meter and approximately 0.17 m of cable to accommodate the bracket length. The full-spectrum sensor incorporates a blue-enhanced silicon photodiode and custom optical filters with a rugged, self-cleaning sensor housing design, anodized aluminum body with acrylic diffuser. Typical applications include PPFD measurement over plant canopies in outdoor environments, greenhouses, and growth chambers, and reflected or under-canopy (transmitted) PPFD measurements in the same environments.

The meter has a sample and log mode, and will record an integrated daily total in  $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ . Sample mode will record up to 99 manual measurements. Log mode will power the meter on/off to make a measurement every 30 seconds. Every 30 minutes the meter will average the sixty 30 second measurements and record the averaged value to memory. The meter can store up to 99 averages, once full it will start to overwrite the oldest measurement with new ones. An integrated daily total will be recorded from the 48 averaged measurements (making a 24 hr period). Sample and log measurements can be reviewed on the LCD display or by downloading the data to a computer, however, the integrated daily total can only be viewed by downloading the data to a computer. Downloading data to a computer requires the AC-100 communication cable (a standard USB cable will not work) and Apogee AMS software. Comes with a free protective carrying case

## Features:

### Accurate, Stable Measurements

Long-term non-stability determined from multiple replicate quantum sensors in accelerated aging tests and field conditions is less than 2 % per year.

### Unique Design

Measure photosynthetically active radiation with a research grade, full-spectral response sensor. Offers a self-cleaning, cosine-corrected head to minimize errors and is fully-potted for a waterproof design.

### Mounting

The MQ-501 is designed to be an easy-to-use handheld meter for spot-check measurements. The meter includes the AM-001 meter mounting bracket to mount the sensor on a horizontal plane to the meter and shortened cable to accommodate the bracket length.

### Calibration Traceability

Apogee SQ-500 sensors are calibrated through side-by-side comparison to the mean of four transfer standard sensors under a reference lamp. The reference sensors are recalibrated with a quartz halogen lamp that are traceable to the National Institute of Standards and Technology (NIST).



## Spectral Errors

	Apogee SQ-500	Apogee SQ-110 SQ-120	LI-COR LI-190	Kipp & Zonen PQS1
Sun(Clear Sky)	-2.2	0.0	-0.4	-1.0
Sun (Cloudy Sky)	-1.7	1.4	-0.2	-1.3
Sun (Reflected from Deciduous Leaves)	-2.0	4.9	-0.8	1.1
Sun (Transmitted below Wheat Canopy)	-1.1	6.4	-0.1	-0.3
Cool White Fluorescent (T5)	0.0	0.0	0.0	0.0
Metal Halide	0.9	-3.7	0.2	-1.7
Ceramic Metal Halide	-0.3	-6.0	0.4	-0.7
High Pressure Sodium	0.0	0.8	1.3	1.4
Red/Blue LED (16 % 444 nm, 84 % 667 nm peaks)	-3.4	-65.3	3.5	-1.8
Red/White LED				

## DESCRIPTION

### How is the MQ-500 different from previous Apogee quantum sensors?

The MQ-500 is a full spectrum quantum sensor with a spectral range of 389 to 692 nm  $\pm$  5 nm, which can be seen in the graph below. This improved spectral response increases the accuracy of LED measurements.

### Where is the MQ-500 used?

The MQ-500 is used to measure incoming PPFD measurements in outdoor environments, greenhouses, and growth chambers.

Mean **cosine response** of seven Apogee SQ-500 quantum sensors. Cosine response was calculated as the relative difference of SQ-500 quantum sensors from the mean of replicate reference quantum sensors. The red data are AM measurements; the green data are PM measurements.

Mean **spectral response** measurements of six replicate Apogee SQ-100 and SQ-500 series quantum sensors. Spectral response measurements were made at 10 nm increments across a wavelength range of 300 to 800 nm in a monochromator with an attached electric light source. Measured spectral data from each quantum sensor were normalized by the measured spectral response of the monochromator/electric light combination, which was measured with a spectroradiometer.

## MQ-501

	MQ-501
Calibration Uncertainty	$\pm$ 5 %
Measurement Range	0 to 4000 $\mu\text{mol m}^{-2} \text{s}^{-1}$
Measurement Repeatability	Less than 0.5 %
Long-term Drift (Non-stability)	Less than 2 % per year
Non-linearity	Less than 1 % (up to 4000 $\mu\text{mol m}^{-2} \text{s}^{-1}$ )
Response Time	Less than 1 ms
Field of View	180°
Spectral Range	389 to 692 nm $\pm$ 5 nm (wavelengths where response is greater than 50 % of maximum)
Spectral Selectivity	Less than 10 % from 412 to 682 nm $\pm$ 5 nm
Directional (Cosine) Response	$\pm$ 5 % at 75° zenith angle
Azimuth Error	Less than 0.5 %
Tilt Error	Less than 0.5 %
Temperature Response	-0.11 $\pm$ 0.03 % per C
Uncertainty in Daily Total	Less than 5 %
Detector	Blue-enhanced silicon photodiode
Housing	Anodized aluminum body with acrylic diffuser
IP Rating	IP68
Operating Environment	0 to 50 C; less than 90 % non-condensing relative humidity up to 30 C; less than 70 % non-condensing relative humidity from 30 to 50 C; separate sensors can be submerged in water up to depth of 30 m
Cable	2 m of shielded, twisted-pair wire; additional cable available; TPR jacket
Warranty	4 years against defects in materials and workmanship

## Contact info



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