

# USB Smart Quantum Sensor | SQ-520

Apogee Instruments is proud to announce our new USB quantum sensor with an improved spectral response providing accurate PAR/PPFD measurements under all light sources, including LEDs.



## Refined Spectral Response

The improved spectral response of the SQ-520 increases the accuracy of LED measurements making it ideal for use with both natural and electric light sources.

## Internal Data Storage

The sensor has internal data storage capability with the ability to hold up to 10,000 measurements. This allows the sensor to collect data while connected to a stand-alone 5 V DC power supply such as a USB wall adapter.

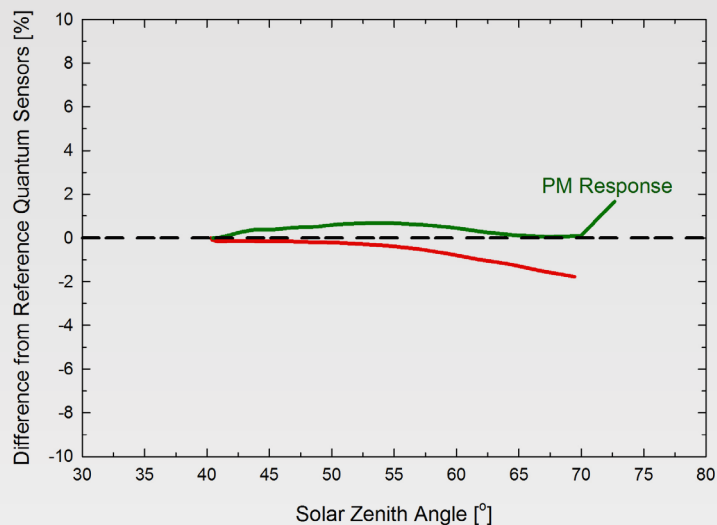
## No Datalogger Required

The sensor can be connected to a desktop, laptop, or tablet computer via a USB 2.0 type A plug to be used with the Apogee software. The included Apogee software gives the user control of data logging and calibration settings, provides a real time output display and graph of PPFD measurements, and allows the data set to be saved as a csv file.

**apogee**  
INSTRUMENTS

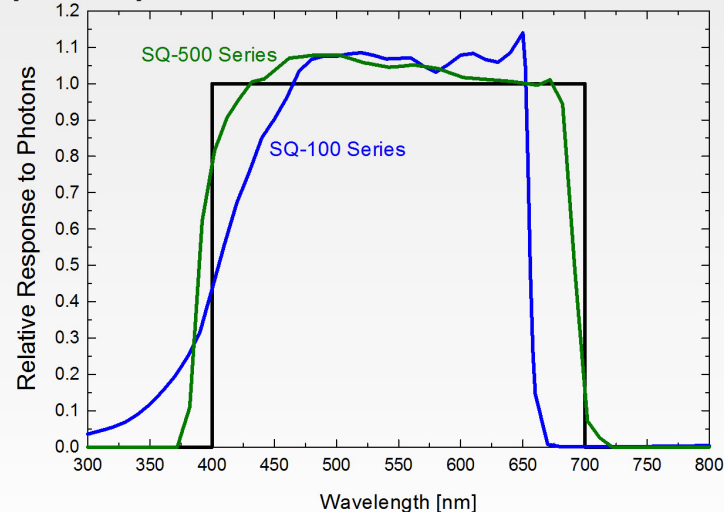
www.apogeeinstruments.com | 435.792.4700

## Cosine Response



Mean cosine response of seven Apogee SQ-500 quantum sensors. Cosine response measurements were made on the rooftop of the Apogee building in Logan, UT. Cosine response was calculated as the relative difference of SQ-500 quantum sensors from the mean of replicate reference quantum sensors (LI-COR models LI-190 and LI-190R, Kipp & Zonen model PQS 1). The red data are AM measurements; the green data are PM measurements.

## Spectral Response



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.

## Spectral Errors of Commercial Quantum Sensors

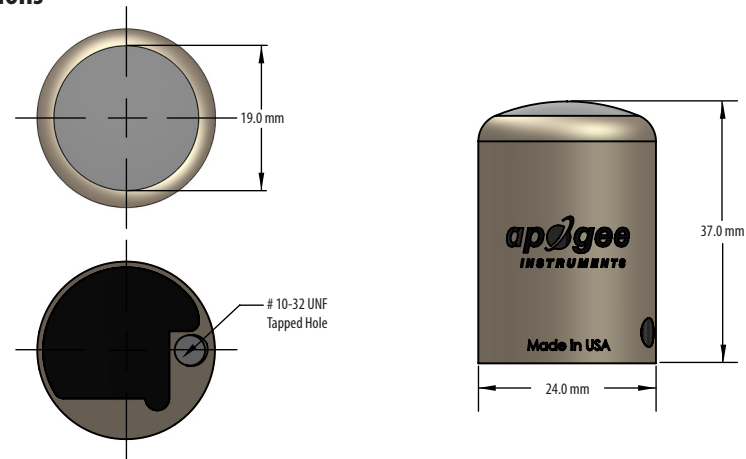
Radiation Source	Apogee SQ-500	Apogee SQ-110 SQ-120	LI-COR LI-190	Kipp & Zonen PQS 1
Sun (Clear Sky)	-2.2	0.0	-0.4	-1.0
Sun (Cloudy Sky)	-1.7	1.4	-0.2	-1.3
Sun (Reflected from Deciduous Leaves)	-2.0	4.9	-0.8	1.1
Sun (Transmitted below Wheat Canopy)	-1.1	6.4	-0.1	-0.3
Cool White Fluorescent (T5)	0.0	0.0	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 (6.5 % 436 nm, 4.5 % 531 nm, 89 % 668 nm peaks)	-3.0	-60.3	2.6	-1.7

Spectral errors are theoretical errors calculated from sensor spectral responses (Apogee SQ-100 and SQ-500 series shown in graph above) and spectral output of radiation sources (measured with a spectroradiometer). Only spectral errors are listed in the table. Calibration, cosine, and temperature error can also contribute to measurement error.

## Calibration Traceability

Apogee Instruments SQ-500 series quantum sensors are calibrated through side-by-side comparison to the mean of four Apogee model SQ-500 transfer standard quantum sensors under high output T5 cool white fluorescent lamps. The transfer standard quantum sensors are calibrated through side-by-side comparison to the mean of at least three LI-COR model LI-190 reference quantum sensors under high output T5 cool white fluorescent lamps. The reference quantum sensors are recalibrated on a biannual schedule with a LI-COR model 1800-02 and quartz halogen lamp that are traceable to the National Institute of Standards and Technology (NIST).

## Dimensions



Resolution	0.1 $\mu\text{mol m}^{-2} \text{s}^{-1}$
Calibration Factor	custom for each sensor and stored in the firmware
Calibration Uncertainty	$\pm 5\%$ (see Calibration Traceability above)
Measurement Repeatability	less than 1% (up to 4000 $\mu\text{mol m}^{-2} \text{s}^{-1}$ )
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	software updates every second
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 (see Spectral Response; left)
Directional (Cosine) Response	$\pm 5\%$ at 75° zenith angle
Azimuth Error	less than 0.5%
Tilt Error	less than 0.5%
Temperature Response	$-0.11 \pm 0.03\% \text{ C}^{-1}$
Uncertainty in Daily Total	less than 5%
Detector	blue-enhanced silicon photodiode
Housing	anodized aluminum body with acrylic diffuser
IP Rating	IP68
Operating Environment	-40 to 70 C; 0 to 100% relative humidity; can be submerged in water up to depths of 30 m
Dimensions	24 mm diameter; 37 mm height
Mass	100 g (with 5 m of lead wire)
USB Cable	4.6 m (15 ft)
Current Draw (when Logging)	5.1 mA
Warranty	4 years against defects in materials and workmanship