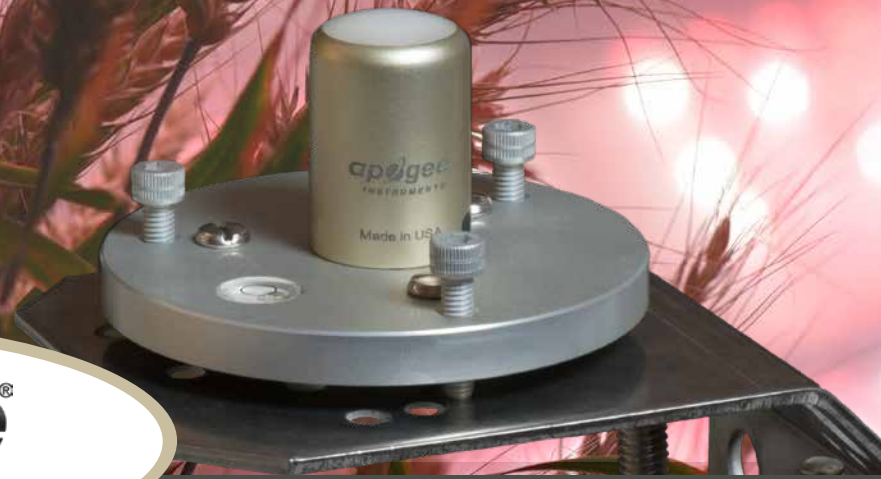


Provides research-grade measurements under all light sources, including LEDs



FULL-SPECTRUM QUANTUM SENSOR | SQ-500 Series

Features

Seven Output Options

- 0 to 40 mV
- 0 to 5 V
- USB
- 0 to 2.5 V
- 4 to 20 mA
- SDI-12



• or hand-held meter

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 (PAR) 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.

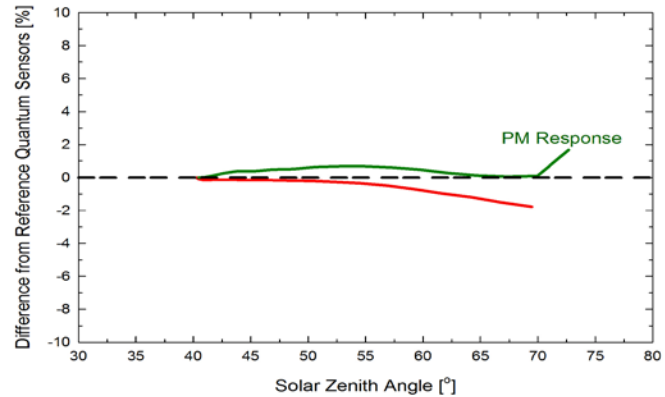
Typical PPFD Measurement Applications

- Incoming and reflected PPFD over and under plant canopies in greenhouses, in fields, and in growth chambers
- Aquatic environments including salt water aquariums and freshwater lakes and streams

Spectral Errors

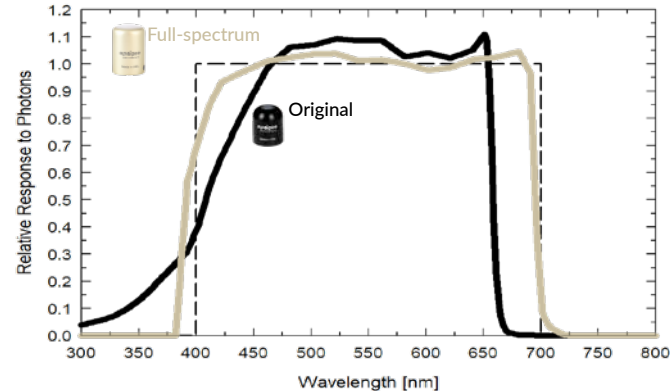
	Apogee SQ-500	Apogee SQ-110 SQ-120	LI-COR LI-190	Kipp & Zonen PQS 1
Sun (Clear Sky)	-2.2	0.0	-0.4	-1.0
Sun (Cloudy Sky)	-1.7	1.4	-0.2	-1.3
Sun (Reflected from Deciduous Leaves)	-2.0	4.9	-0.8	1.1
Sun (Transmitted below Wheat Canopy)	-1.1	6.4	-0.1	-0.3
Cool White Fluorescent (T5)	0.0	0.0	0.0	0.0
Metal 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

Cosine Response



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.

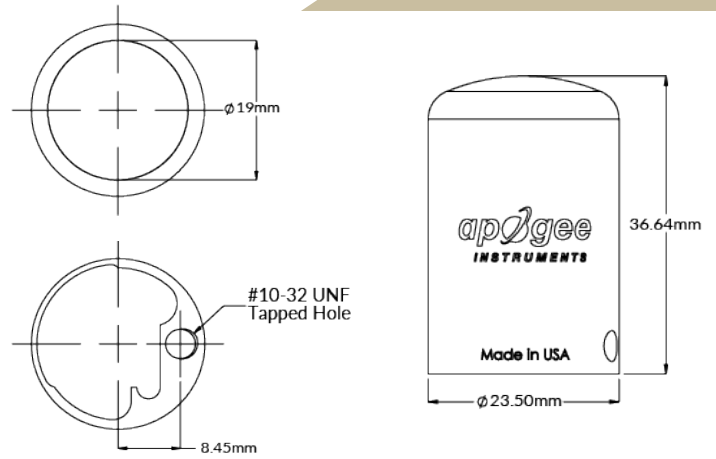
Spectral Response



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.

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 traceable to the National Institute of Standards and Technology (NIST).



Product Specifications

	SQ-500-SS	SQ-512-SS	SQ-515-SS	SQ-514-SS	SQ-520 (USB)	SQ-521 (SDI-12)
Power Supply	Self-powered	5.5 to 24 V DC, current draw at 12 V is 57 μ A		12 to 24 V DC	5 V USB power source; 2.1 mA current draw when logging	4.5 to 24 V DC
Output (sensitivity)	0.01 mV per μ mol $m^{-2} s^{-1}$	0.625 mV per μ mol $m^{-2} s^{-1}$	1.25 μ mol $m^{-2} s^{-1}$	0.004 μ mol $m^{-2} s^{-1}$ per mA	—	
Calibration Factor	100 μ mol $m^{-2} s^{-1}$ per mV	1.6 μ mol $m^{-2} s^{-1}$ per mV	0.8 μ mol $m^{-2} s^{-1}$ per mV	250 μ mol $m^{-2} s^{-1}$ per mA	—	
Calibration Uncertainty	± 5 %					
Calibrated Output Range	0 to 40 mV	0 to 2.5 V	0 to 5 V	4 to 20 mA	—	
Measurement Repeatability	Less than 0.5 %					Less than 1 %
Long-term Drift	Typically less than 1 % per year with a 2 % maximum					
Non-linearity	Less than 1 % (up to 4000 μ mol $m^{-2} s^{-1}$)					
Response Time	Less than 1 ms					Fastest data transmission rate for SDI-12 circuitry is 1 s
Field of View	180°					
Spectral Range	389 to 692 ± 5 nm			391 nm to 695 nm	389 to 692 ± 5 nm	
Spectral Selectivity	Less than 10 % from 412 to 682 nm ± 5 nm					
Directional (Cosine) Response	± 5 % at 75° zenith angle			± 2 % at 45°, ± 5 % at 75°	± 5 % at 75° zenith angle	± 2 % at 45°, ± 5 % at 75°
Azimuth and Tilt Errors	Less than 0.5 %					
Temperature Response	-0.11 ± 0.04 % per C			-0.1 % per C	-0.11 ± 0.04 % 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	-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					23.5 mm diameter, 45 mm height
Mass	100 g (with 5 m of lead wire)					117 g (with 5 m cable)
Cable	5 m of shielded, twisted-pair wire; TPR jacket (high water resistance, high UV stability, flexibility in cold conditions), pigtail lead wires; stainless steel (316), M8 connector located 25 cm from sensor head					
Warranty	4 years against defects in materials and workmanship					