

APOGEE QUANTUM SENSORS | Original & Full-Spectrum Series

The photosynthetically active radiation measurement tool of choice for lighting researchers

Features

Apogee Instruments Quantum Sensors are the tool of choice for researchers and agricultural professionals measuring photosynthetically active radiation (PAR) all over the world. Apogee offers two types of quantum sensors: a Full-spectrum Quantum (previously gold) and Original Quantum Sensor. Consult our spectral response graph to decide which model is right for your application.

Accurate, Stable Measurements

Cost-effective, original quantum sensors work well for broadband radiation sources (sun, high-pressure sodium, metal halide, cool white fluorescent lamps), while full-spectrum sensors are good for all light sources, including LEDs. Offers a self-cleaning, cosine-corrected head that 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

Calibration Traceability

Apogee SQ series quantum 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).

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



Above: Spectral response of **original quantum sensor (black)** and **fullspectrum quantum sensor (blue)** compared to defined response of plants to radiation (dashed). Provides research-grade measurements under all light sources, including LEDs



FULL-SPECTRUM QUANTUM SENSORS | SQ-500 Series

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Made in US/

Output Options

- 0 to 40 mV
- 0 to 5 V
- USB
- Modbus
- 0 to 2.5 V
 4 to 20 mA
- 4 to 20 • SDI-12
- or hand-held meter



SQ-500

All other models

& SQ-520

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Specifications

	SQ-500-SS	SQ-512-SS	SQ-514-SS	SQ-515-SS	SQ-520	SQ-521-SS	SQ-522-SS	
Power Supply	Self-powered	3.3 to 24 V DC	12 to 24 V DC	5.5 to 24 V DC	5 V USB power source	VDC		
Current Draw	-	At 12 V is 57 μA	maximum of 20 mA	At 12 V is 57 μA	61 mA when logging	1.4 mA (quiescent), 1.8 mA (active)	20 mA maximum	
Output (sensitivity)	0.01 mV per µmol m ⁻² s ⁻¹	0.625 mV per µmol m⁻² s⁻¹	0.004 mA per µmol m ⁻² s ⁻¹	1.25 mV per μmol m⁻² s⁻¹				
Resolution	-	-	-	-	0.1 µmol m⁻² s⁻¹	0.1 μmol m ⁻² s ⁻¹ –		
Calibration Factor (reciprocal of output)	100 μmol m ⁻² s ⁻¹ per mV	1.6 μmol m ⁻² s ⁻¹ per mV	250 μmol m⁻² s⁻¹ per mA	0.8 µmol m⁻² s⁻¹ per mV	Custom for each sensor and stored in the firmware			
Calibration Uncertainty	± 5 %							
Output Range	0 to 40 mV	0 to 2.5 V	4 to 20 mA	0 to 5 V	USB	SDI-12	Modbus	
Measurement Repeatability	Less than 0.5 %	Less than 1 %	Less than 0.5 %	Less than 1 %	Less than 0.5 %	ess than 0.5 % Less than 1 %		
Long-term Drift	Less than 2 % per year							
Non-linearity	Less than 1 % (up to 4000 μ mol m ⁻² s ⁻¹)							
Response Time	Less than 1 ms				Software updates every second	Less than 0.6 s	320 ms	
Field of View	180°							
Spectral Range	389 to 692 nm ± 5 nm (wavelengths where response is greater than 50 %)							
Spectral Selectivity	Less than 10 % from 412 to 682 nm ± 5 nm							
Directional (cosine) Response	± 2 % at 45°, ± 5 % at 75° zenith angle							
Temperature Response	-0.11 ± 0.04 % per C							
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	30.5 mm diameter, 37 mm height			24 mm diameter, 37 mm height	24 mm diameter, 30.5 mm diameter, 37 mm height 37 mm height		
Mass (5 m of cable)	100 g	140 g			100 g 140 g			
Warranty	4 years against defects in materials and workmanship							



ORIGINAL QUANTUM SENSORS | SQ-100, SQ-200, & SQ-300 Series

Output Options

- 0 to 800 mV
- 0 to 5 V
- USB
- Modbus
- 0 to 2.5 V • 4 to 20 mA
- SDI-12
 - or hand-held meter

Sensors come calibrated for either sun or electric broadband light sources.



Line Quantum Sensor Options

Sensors are available with multiple detectors mounted along the length of a rugged anodized aluminum bar, which provides spatially averaged PPFD



Specifications

	SQ-110/120-SS	SQ-212/222-SS	SQ-214/224-SS	SQ-215/225-SS	SQ-300 Series	SQ-420	SQ-421-SS	SQ-422-SS	
Power Supply	Self-powered	3.3 to 24 V DC	7 to 24 V DC	5.5 to 24 V DC	Self-powered	5 V USB 5.5 to 24 V DC power source			
Current Draw	-	10 µA	22 mA maximum; 2 mA quiescent	10 µA	-	61 mA when logging	1.4 mA (quiescent), 1.8 mA (active)	20 mA maximum	
Output (sensitivity)	0.2 mV per µmol m⁻² s⁻¹	0.625 mV per µmol m ⁻² s ⁻¹	0.004 mA per µmol m⁻² s⁻¹	1.25 mV per μmol m⁻² s⁻¹	0.2 mV per µmol m⁻² s⁻¹	-	-	-	
Calibration Factor (reciprocal of output)	5 μmol m⁻² s⁻¹ per mV	1.6 μmol m ⁻² s ⁻¹ per mV	250 μmol m⁻² s⁻¹ per mA	0.8 µmol m⁻² s⁻¹ per mV	5 μmol m⁻² s⁻¹ per mV	Custom for each sensor and stored in the firmware			
Calibration for Uncertainty	±5%								
Output Range	0 to 800 mV	0 to 2.5 V	4 to 20 mA	0 to 5 V	0 to 800 mV	USB	SDI-12	Modbus	
Measurement Repeatability	Less than 0.5 %						Less than 1 %		
Long-term Drift	Less than 2 % per year								
Non-linearity	Less than 1 % (up to 4000 μ mol m ⁻² s ⁻¹)								
Response Time	Less than 1 ms				Software updates every second	Less than 0.6 s	320 ms		
Field of View	180°								
Spectral Range	410 to 655 nm (wavelengths where response is greater than 50 % maximum)								
Spectral Selectivity	Less than 10 % from 469 to 655 nm								
Directional (cosine) Response	± 5 % at 75° zenith angle								
Temperature Response	0.06 ± 0.06 % per C								
Operating Environment	-40 to 70 C; 0 to 100 % relative humidity; can be submerged in water up to 30 m								
Dimensions	24 mm diameter, 33 mm height 30.5 mm diameter, 37 mm height			height	500 x 15 x 15 mm; SQ-311/321: 700 x 15 x 15 mm	24 mm diameter, 33 mm height	30.5 mm diameter, 37 mm height		
Mass (5 m of cable)	90 g		140 g		275 g; SQ-311/321: 375 g	90 g	140 g		
Warranty	4 years against defects in materials and workmanship								

Dimensions



