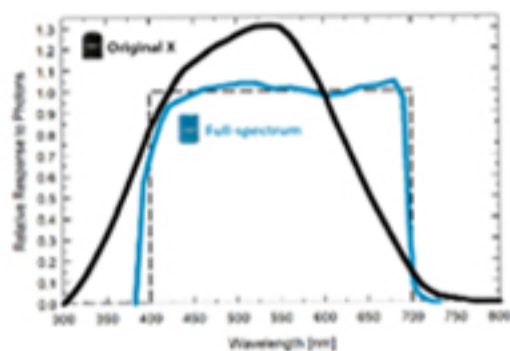


Quantum Sensors and Meters

The photosynthetically active radiation measurement tool of choice for lighting researchers

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 to measure the traditional 400-700 nm PAR range: our high accuracy Full-spectrum Quantum and our less accurate, but more economical, Original X Quantum. Our Apogee ePar Sensor is used to measure the extended PAR range of 400-750 nm (see page 8). Consult our spectral response graph and table with photosynthetic photon flux density (PPFD) errors to decide which model is right for your application.



Above: Spectral response of original X quantum sensor (black) and full-spectrum quantum sensor (blue) compared to defined response of plants to radiation (dashed).



Radiation Source	Original (SQ-100X Series) PPFD Error [%]	Full-Spectrum (SQ-500 Series) PPFD Error [%]
Sun (clear sky)	0.0	0.0
Sun (cloudy sky)	0.2	0.1
Reflected from Grass Canopy	5.0	-0.3
Transmitted below Wheat Canopy	7.0	0.1
Cool White Fluorescent (T5)	7.2	0.1
Metal Halide	6.9	0.9
Ceramic Metal Halide	-8.8	0.3
High Pressure Sodium	3.3	0.1
Blue LED (448 nm peak, 20 nm full-width half-max)	14.5	-0.7
Green LED (524 nm peak, 30 nm full-width half-max)	29.6	3.2
Red LED (635 nm peak, 20 nm full-width half-max)	-30.9	0.8
Red LED (667 nm peak, 20 nm full-width half-max)	-56.7	2.8
Red, Blue LED Mixture (84 % Red, 16 % Blue)	-21.2	-3.9
Red, White LED Mixture	-29.7	-2.0
Cool White LED	7.3	0.5
Warm White LED	-7.8	0.2

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Accurate, Stable Measurements

Cost-effective, original X quantum sensors work well for broadband radiation sources (sun, high-pressure sodium, metal halide, cool white fluorescent lamps). Full-spectrum sensors are good for all light sources, including LEDs. Both sensors offer a self-cleaning, cosine-corrected head that is fully-potted for a waterproof design.

Output Options

Sensors are available in multiple analog options: attached to a hand-held meter with a digital output; as a "smart" sensor that uses USB communication and custom software; SDI-12 or Modbus protocols; or with Apogee's new μ Cache device.

Full-spectrum Models

- SQ-500 Self-powered 0 to 40 mV
- SQ-512 0 to 2.5 V
- SQ-514 4 to 20 mA
- SQ-515 0 to 5 V
- SQ-520 USB
- SQ-521 SDI-12
- SQ-522 Modbus
- MQ-500 Meter, separate sensor
- MQ-501 Meter, attached sensor
- MQ-510 Meter, underwater calibration

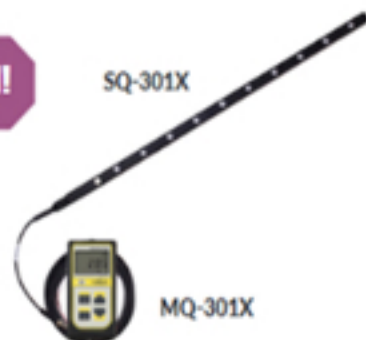
Original X Models

- SQ-100X Self-powered 0 to 400 mV
- SQ-202X Amplified 0 to 2.5 V
- SQ-204X Amplified 4 to 20 mA
- SQ-205X Amplified 0 to 5.0 V
- SQ-420X USB
- SQ-421X SDI-12
- SQ-422X Modbus
- MQ-100X Meter, attached sensor
- MQ-200X Meter, separate sensor
- MQ-210X Meter, underwater calibration

Line Quantum Models (0 to 250 mV)

- SQ-301X 10 Sensors Sun Calibration
- MQ-301X Meter, 10 Sensors Sun Calibration

NEW DESIGN!



Case Study

The Kuwait Institute for Scientific Research models algal species in the Kuwait Bay. The study helps advance our understanding of the frequent algal bloom and fish kill incidents particularly occurring during the summer season. They used an Apogee MQ-510 underwater full-spectrum quantum sensor for continuous PAR field measurements.

