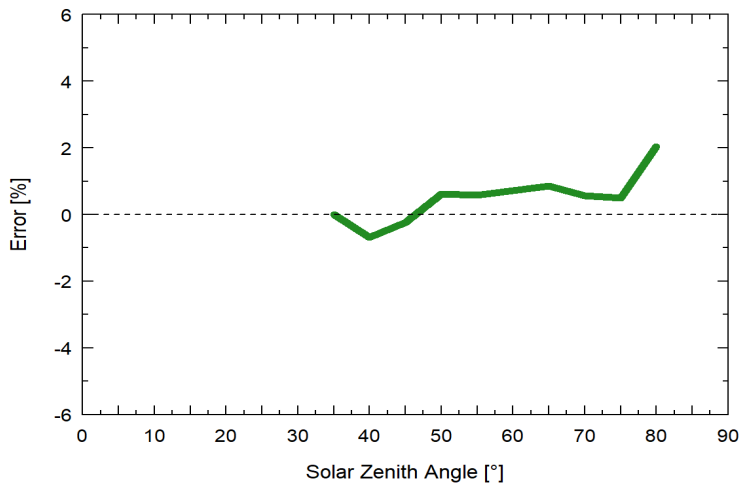


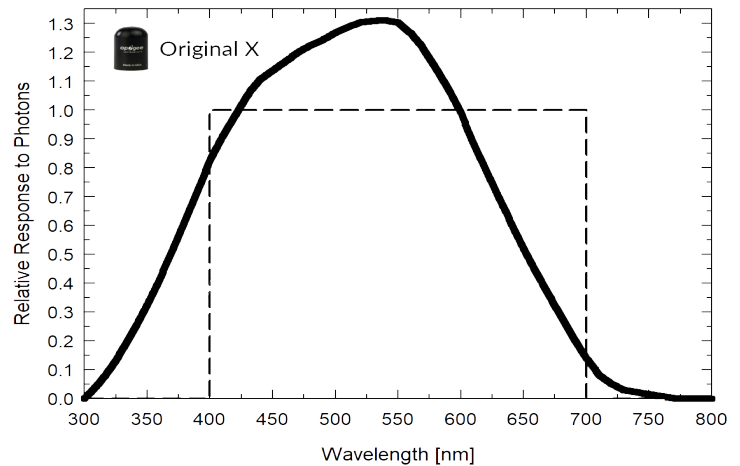
USB quantum sensor can be connected directly to a computer for real time measurements and data logging, or act as a stand-alone datalogger when connected to most standard 5 V DC USB power sources



Response Graphs



Mean cosine response of twenty-three SQ X series quantum sensors.



Mean spectral response of six SQ X series quantum sensors compared to defined PAR 400-700 nm (dotted line).

Product Specifications

SQ-420X	
Power Supply	Uses a 5 V USB power source and has a 61 mA current draw
Resolution	0.1 $\mu\text{mol m}^{-2} \text{s}^{-1}$
Calibration Factor	Custom for each sensor and stored in the firmware
Calibration Uncertainty	$\pm 5 \%$
Measurement Repeatability	Less than 0.5 %
Long-term Drift (non-stability)	Less than 2 % per year
Non-linearity	Less than 1 % (up to 2500 $\mu\text{mol m}^{-2} \text{s}^{-1}$)
Response Time	Software updates every second
Field of View	180°
Spectral Range	370 to 650 nm (wavelengths where response is greater than 50 % of maximum)
Directional (Cosine) Response	$\pm 5 \%$ at 75° zenith angle
Temperature Response	-0.04 % per C
Operating Environment	-10 to 60 C; 0 to 100 % relative humidity; can be submerged in water up to depths of 30 m
Dimensions	24 mm diameter, 33 mm height
Mass	90 g (with 5 m of lead wire)
USB Cable	4.6 m (15 ft)
Warranty	4 years against defects in materials and workmanship

Features

ACCURATE, STABLE MEASUREMENTS

Cosine-corrected with directional errors less than $\pm 5\%$ at a solar zenith angle of 75° . Long-term non-stability less than 2% per year.

SPECTRAL RESPONSE

Original X quantum sensors work well for broadband sources (sun, high pressure sodium, metal halide, cool white fluorescent lamps).

INTERNAL DATA STORAGE

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 most stand-alone 5 V DC USB power sources.

NO DATALOGGER REQUIRED

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

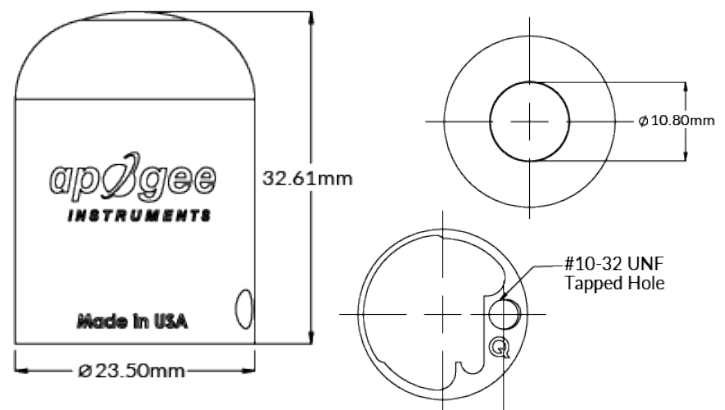
INDEPENDENT CALIBRATION

The SQ-420X is calibrated independently for sunlight and electric light to improve measurement accuracy. The light source calibration can be selected in the settings menu of the Apogee software.

CALIBRATION TRACEABILITY

Apogee SQ X 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).

Dimensions



Software Overview

Software interface for the Apogee Quantum Sensor. The interface displays a real-time output of $81.9 \frac{\mu\text{mol}}{\text{m}^2 \text{ s}}$. A graph shows radiation levels over time. A setup menu allows for calibration type selection (Electric or Sunlight) and logging settings. A data capture table shows timestamped measurements. The file location is `sq-420.csv`.

Timestamp	Value
2015-09-22 13:23:44	78.3
2015-09-22 13:23:45	79.4
2015-09-22 13:23:46	82.2
2015-09-22 13:23:47	82.6
2015-09-22 13:23:48	81.5
2015-09-22 13:23:49	87.1
2015-09-22 13:23:50	90.4
2015-09-22 13:23:51	92.1
2015-09-22 13:23:52	94.4
2015-09-22 13:23:53	96.1
2015-09-22 13:23:54	96.9
2015-09-22 13:23:55	99.3
2015-09-22 13:23:56	99.1
2015-09-22 13:23:57	99.8
2015-09-22 13:23:58	100.8
2015-09-22 13:23:59	103.5
2015-09-22 13:24:00	104.8
2015-09-22 13:24:01	104.3
2015-09-22 13:24:02	105.5
2015-09-22 13:24:03	98.8
2015-09-22 13:24:04	109.6
2015-09-22 13:24:05	104.8
2015-09-22 13:24:06	99.3
2015-09-22 13:24:07	93.6
2015-09-22 13:24:08	73.2