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

**Full-Spectrum Quantum Sensor | SQ-521-SS & SQ-522-SS**

**Features**

**Accurate, Stable Measurements**
Cosine-corrected with directional errors less than ± 5 % at a solar zenith angle of 75°. Long-term non-stability less than 2 % per year.

**Unique Design**
Measure photosynthetically active radiation with a research grade, full spectral response sensor. The patented, dome-shaped aluminum head is cosine-corrected, self-cleaning, and fully-potted for a waterproof design.

**No Datalogger Required**
Connect sensor to a desktop, laptop, or tablet computer via a USB 2.0 type A plug. The ApogeeConnect software gives the user control of datalogging 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 analysis. Sensor has internal data storage ability to hold up to 10,000 measurements.

**Spectral Errors**

<table>
<thead>
<tr>
<th></th>
<th>Apogee SQ-500</th>
<th>Apogee SQ-110</th>
<th>Li-COR LI-190</th>
<th>Kipp &amp; Zonen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun (Clear Sky)</td>
<td>-2.2</td>
<td>0.0</td>
<td>-0.4</td>
<td>-1.0</td>
</tr>
<tr>
<td>Sun (Cloudy Sky)</td>
<td>-1.7</td>
<td>1.4</td>
<td>-0.2</td>
<td>-1.3</td>
</tr>
<tr>
<td>Sun (Reflected from Deciduous Leaves)</td>
<td>-2.0</td>
<td>4.9</td>
<td>-0.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Sun (Transmitted below Wheat Canopy)</td>
<td>-1.1</td>
<td>6.4</td>
<td>-0.1</td>
<td>-0.3</td>
</tr>
<tr>
<td>Cool White Fluorescent (T5)</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Metal Halide</td>
<td>0.9</td>
<td>-3.7</td>
<td>0.2</td>
<td>-1.7</td>
</tr>
<tr>
<td>Ceramic Metal Halide</td>
<td>-0.3</td>
<td>-6.0</td>
<td>0.4</td>
<td>-0.7</td>
</tr>
<tr>
<td>High Pressure Sodium</td>
<td>0.0</td>
<td>0.8</td>
<td>1.3</td>
<td>1.4</td>
</tr>
<tr>
<td>Red/Blue LED (16 % 444 nm, 84 % 667 nm peaks)</td>
<td>-3.4</td>
<td>-65.3</td>
<td>3.5</td>
<td>-1.8</td>
</tr>
<tr>
<td>Red/White LED (6.5 % 436 nm, 4.5 % 531 nm, 89 % 668 nm peaks)</td>
<td>-3.0</td>
<td>-60.3</td>
<td>2.6</td>
<td>-1.7</td>
</tr>
</tbody>
</table>

**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 (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.
### Power Supply
Uses a 5 V USB power source; 2.1 mA current draw when logging

### Resolution
0.1 μmol m⁻² s⁻¹

### Calibration Factor
Custom for each sensor and stored in the firmware

### Calibration Uncertainty
± 5 %

### Measurement Repeatability
Less than 0.5 %

### Long-term Drift (non-stability)
Less than 2 % per year

### Non-linearity
Less than 1 % (up to 4000 μmol m⁻² s⁻¹)

### Response Time
Software updates every second

### Field of View
180°

### Spectral Range
689 to 692 nm ± 5 nm (wavelengths where response is greater than 50 % of maximum)

### Spectral Selectivity
Less than 10 % from 412 to 682 nm ± 5 nm

### Directional (Cosine) Response
± 5 % at 75° zenith angle

### Azimuth Error
Less than 0.5 %

### Tilt Error
Less than 0.5 %

### Temperature Response
-0.11 ± 0.03 % 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

### Mass
100 g (with 5 m of lead wire)

### USB Cable
4.6 m (15 ft)

### Warranty
4 years against defects in materials and workmanship