Amplified Quantum Sensor

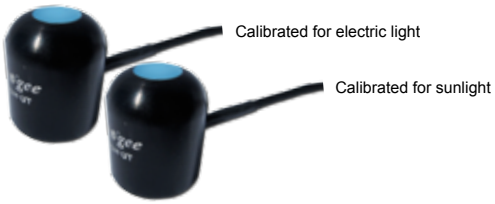
JSQ-200 Series

Measuring PPF with a Quantum Sensor

Photosynthesis is driven by the number of photons between 400 and 700 nanometers (nm). This is called the Photosynthetic Photon Flux (PPF) and is measured in μmol m^{-2} s^{-1}. PPF sensors are commonly called quantum sensors because a quantum refers to the amount of energy carried by a photon.

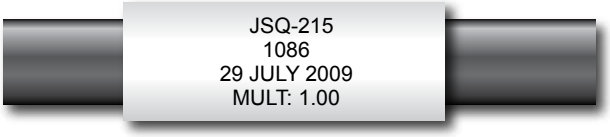
Quantum Sensors

US Patent No. D519,860



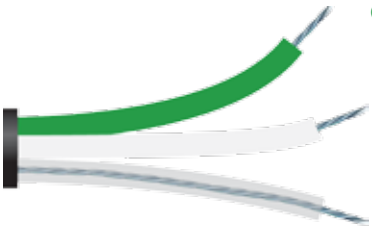
Labels

The model, serial number, production date, and calibration factor are located on the sensor cable.



Connection Instructions

Do not exceed 5.5 Volts in power supply.
Do not connect green wire to power supply.



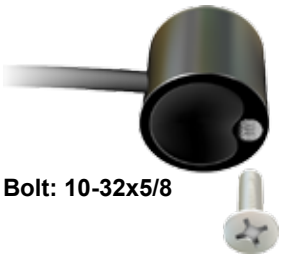
Green Positive (signal from sensor)

White Input power

Clear Ground (for sensor signal and input power)

	2.5 Option	5.0 Option
Power Supply	2.5 to 5.5 V	5.0 to 5.5 V
Conversion Factor	1.0 μmol m^{-2} s^{-1} per mV	0.5 μmol m^{-2} s^{-1} per mV
Output (Volts)	0.0 to 2.5 V	0.0 to 5.0 V
Full Sunlight	2.0 V (2000 μmol m^{-2} s^{-1})	4.0 V (2000 μmol m^{-2} s^{-1})

Mounting the Sensor

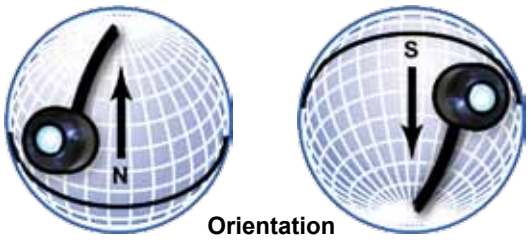


Bolt: 10-32x5/8

Mount the sensor to a solid surface with the stainless steel mounting bolt.

Photon Flux is most accurately measured when the sensor is mounted level. We recommend using our leveling plate (AL-100) for the most accurate measurements. The sensor should be mounted with the cable pointing toward the nearest magnetic pole to minimize azimuth error.

Model AL-100



Orientation

Cleaning

Debris on the sensor head is a common cause of low readings. The sensor has a domed head for improved self-cleaning from rainfall, but salt deposits can accumulate from evaporation of sprinkler irrigation water and dust can accumulate during periods of low rainfall. Salt deposits should be dissolved and removed with vinegar and a soft cloth or q-tip. Dust and other organic deposits are best removed with water, rubbing alcohol or window cleaner. *Never use an abrasive cleaner on the lens.*

Application

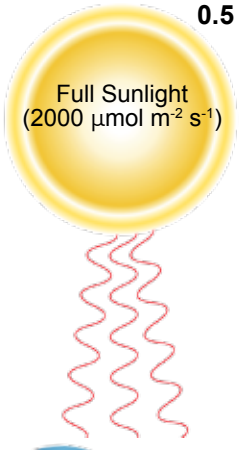
Quantum sensors are designed for use with dataloggers. They are often used to quantify the light available in greenhouse settings.

An innovative blue lens improves the accuracy of these sensors and meters. The pigments in the lens filter incoming light for an improved spectral response. The sensor has a domed diffusion disk and head for improved self-cleaning characteristics and long-term stability.

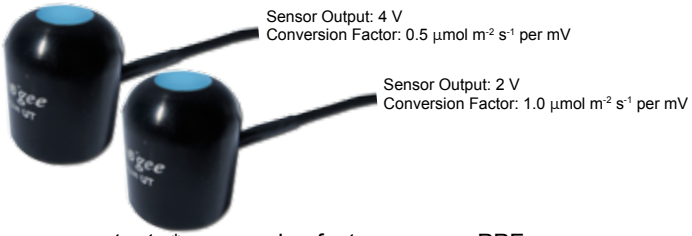
Calibration

All Apogee quantum sensor models have a standard calibration of exactly:

0.5 or 0.25 W m^{-2} per mV



Use this conversion factor to convert the mV signal from the sensor to photosynthetic photon flux. Multiply the mV output by the conversion factor to get photosynthetic photon flux in µmol m^{-2} s^{-1}.



sensor output * conversion factor = PPF
4000 mV * 0.5 µmol m^{-2} s^{-1} per mV = 2,000 µmol m^{-2} s^{-1}

Spectral Differences

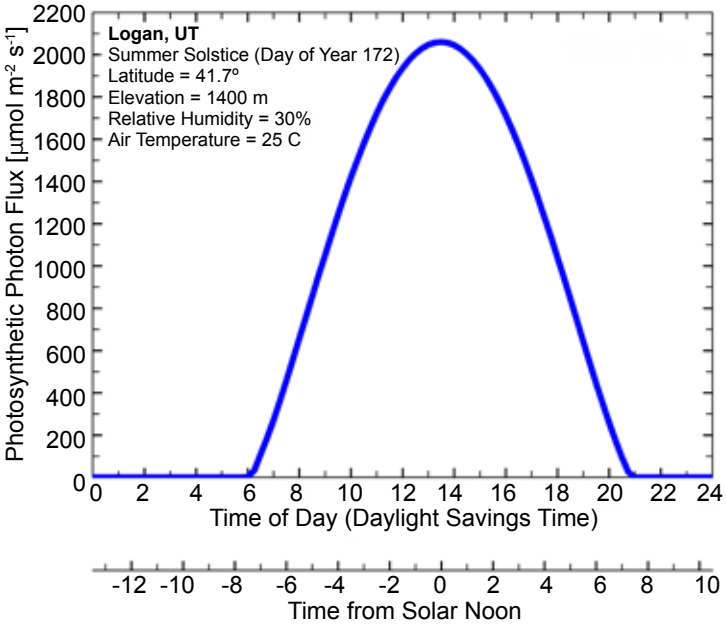
Apogee quantum sensors are calibrated for either electric light or sunlight. The difference in calibration is close to 11%. A sensor calibrated for fluorescent lamps will read about 11% high in sunlight. A sensor calibrated for sunlight will read about 11% low under fluorescent lamps. The spectral errors are less than 2% for other common electric light sources.

	Electric Calibration	Sunlight Calibration
 Cool White Fluorescent	Calibration Reference ↓	11% high
 Metal Halide	< 2% low	9% high
 High Pressure Sodium	< 2% low	9% high
 Sunlight	11% low	↑ Calibration Reference

Clear Sky CALCULATOR

The Clear Sky Calculator is designed to determine the need for radiation sensor recalibration. It determines the intensity of radiation falling on a horizontal surface at any time of the day in any location in the world. It is most accurate when used near solar noon in the summer months.

Example of Model Output

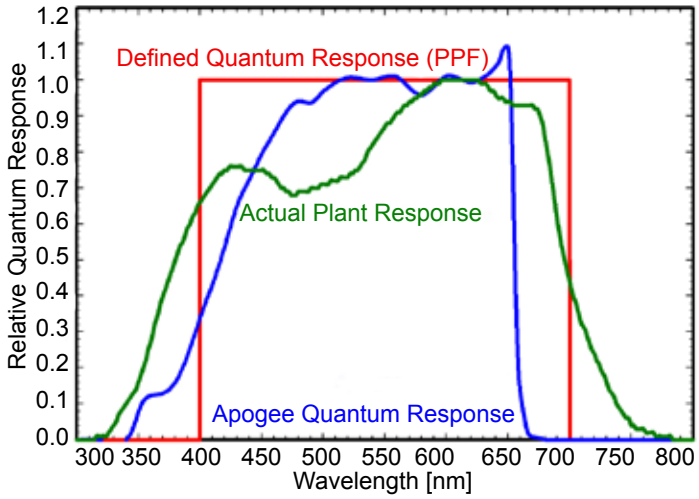


Characteristics

Cosine Response: The convex disc is designed to capture radiation at low angles and minimize cosine errors. The cosine error for integrated daily total measurements is less than 2%.

Temperature Response: Temperature response is less than 0.1% per degree Celsius. This temperature error is not significant in most applications.

Spectral Response: Quantum response is from 400 to 700 nm and gives equal emphasis to all photons. A blue lens filters the light and improves the spectral response. The spectral response of the Apogee sensor and a typical plant response are shown below.



Specifications

Sunlight Calibration (SQ-212 & 215)
- Absolute Accuracy: ± 5%
- Uniformity: ± 3%
- Repeatability ± 1%

Electric Lamps Calibration (11% Difference) (SQ-222 & 225)
- Absolute Accuracy: ±5%
- Uniformity: ±3%
- Repeatability: ±1%

2.5 V Option
- Output: 0 to 2.5 V (2.0 V = full sunlight 2000 µmol m^{-2} s^{-1})
- Input Power: 2.5 to 5.5 VDC
- Sensitivity: Custom calibrated to exactly 1.0 µmol m^{-2} s^{-1}

5.0 V Option
- Output: 0 to 5 V (4.0 V = full sunlight 2000 µmol m^{-2} s^{-1})
- Input Power: 5 to 5.5 VDC
- Sensitivity: Custom calibrated to exactly 0.5 µmol m^{-2} s^{-1}

Current Draw
- 285 µA

Long-Term Drift
- Less than 3% per year

Operating Environment
- -40 to 55° C
- 0 to 100% relative humidity
- Designed for continuous outdoor use
- Can be submerged underwater with or without mounting screw

Materials
- Anodized aluminum with acrylic lens

Cable
- 5 meters of twisted-pair wire
- Shielded w Santoprene casing
- Ending in pigtail leads
- Additional cable is available in multiples of 5 meters

Dimensions
- 2.4 cm diameter by 2.75 cm height

Mass
- 70 g (with 3 m lead wire)

Warranty
- 1 year against defects in materials and workmanship