

MODEL LI-190SA/SZ QUANTUM SENSOR

MEASURE PHOTOSYNTHETICALLY ACTIVE RADIATION

During photosynthesis, plants use energy in the region of the electromagnetic spectrum from 400-700 nm (1,2). The radiation in this range, referred to as Photosynthetically Active Radiation (PAR), can be measured in energy units (watts m⁻²) or as Photosynthetic Photon Flux Density (PPFD), which has units of quanta (pho-tons) per unit time per unit surface area. The units most commonly used are micro-moles of quanta per second per square-meter (µmol s⁻¹m⁻²). Plant scientists, horticulturists, ecologists, and other environmental scientists use the LI-190SA Quantum Sensor to accurately measure this variable.

Accurate measurements are obtained under all natural and artificial lighting conditions because of the computer tailored spectral response of the LI-190SA. Colored glass filters are used to tailor the silicon photodiode response to the desired quantum response (Figure 1). An interference filter provides a sharp cutoff at 700nm, which is critical for measurements under vegetation where the ratio of infrared to visible light may be high. A small response in the infrared region can cause an appreciable measurement error. This sensor, developed from earlier work (3), was pioneered by LI-COR and has become the standard for PPFD measurement in most photosynthesis related studies. The LI-190SA is also used in oceanography, limnology, and marine science as a reference sensor for comparison to underwater PAR measured by the LI-192SA Underwater Quantum Sensor.

*Units currently used are moles, einsteins, photons and quanta (2,4,5).
1 µmol s⁻¹m⁻² = 1 µE s⁻¹m⁻² = 6.02 x 10¹⁷ photons s⁻¹m⁻² = 6.02 x 10¹⁷ quanta s⁻¹m⁻².

SPECIFICATIONS:

Absolute Calibration: ±5% traceable to the National Institute of Standards and Technology (NIST).

Sensitivity: Typical 5µA per 1000µmol s⁻¹m⁻².

Linearity: Maximum deviation of 1% up to 10,000 µmol s⁻¹m⁻².

Stability: Typically < ±2% change over a 1 year period.

Response Time: 10 µs.

Temperature Dependence: 0.15% per °C maximum.

Cosine Correction: Cosine corrected up to 80° angle of incidence.

Azimuth: < ±1% error over 360° at 45° elevation.

Tilt: No error induced from orientation.

Operating Temperature: -40 to 65°C.

Relative Humidity: 0 to 100%.

Detector: High stability silicon photovoltaic detector (blue enhanced).

Sensor Housing: Weatherproof anodized aluminum case with acrylic diffuser and stainless steel hardware.

QUANTUM SENSORS

LI-COR Quantum Sensors are used to measure PPFD of photosynthetically active radiation (PAR). A simple integral relationship exists between the number of molecules photochemically changed and the number of photons absorbed within a particular waveband regardless of photon energy (6). The ideal quantum sensor should have an equal response to all photons within the 400-700 nm waveband. A typical response curve of a LI-COR quantum sensor plotted against the ideal quantum response is shown in Figure 1.

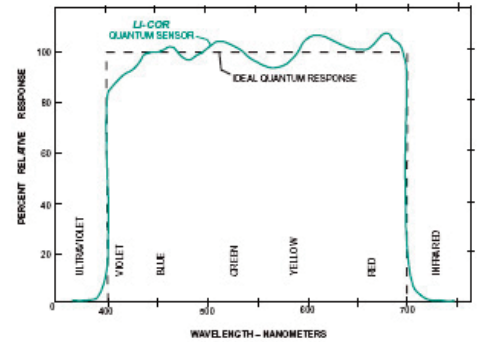


Figure 1. Typical spectral response of LI-COR Quantum Sensors vs. Wavelength and the Ideal Quantum Response (equal response to all photons in the 400-700 nm waveband).

ORDERING INFORMATION

The **LI-190SA** Quantum Sensor cable terminates with a BNC connector that connects directly to the LI-250 Light Meter or LI-1400 DataLogger. The 2290 Millivolt Adapter should be ordered if the LI-190SA will be used with a strip chart recorder or datalogger that measures millivolts. The 2290 uses a 6040 hm precision resistor to convert the LI-190SA output from microamps to milli-volts. The Quantum Sensor can also be ordered with bare leads (without the connector) and is designated LI-190SZ. Both are available with 50 foot cables, LI-190SA-50 or LI-190SZ-50. The 2003S Mounting and Leveling Fixture is recommended for each sensor unless other provisions for mounting are made.

LI-190SA Quantum Sensor

LI-190SZ Quantum Sensor

LI-190SA-50 Quantum Sensor

LI-190SZ-50 Quantum Sensor

2290 Millivolt Adapter

2003S Mounting and Leveling Fixture

2222SB-50 Extension Cable

2222SB-100 Extension Cable



LI-190SA Quantum Sensor