

Pyranometer

SP-110



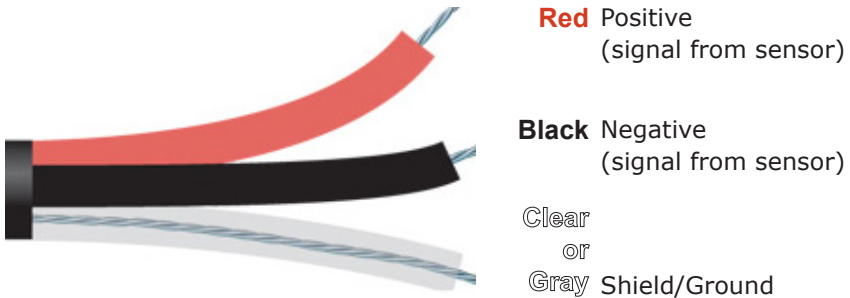
Pyranometer

This sensor is a silicon-cell pyranometer. It is calibrated to measure total shortwave radiation. The evaporation of water from soil and the transpiration of water from plant leaves are partly determined by the intensity of shortwave radiation, which is measured in Joules per meters squared per second or Watts per meters squared.

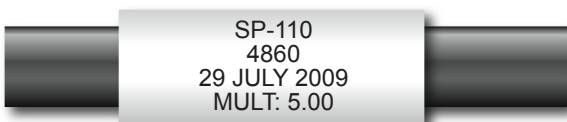
Connection Instructions

Attach the sensor to a meter or datalogger capable of displaying or recording an mV output.

**DO NOT attach the sensor to a power source.
The sensor is self-powered.
Applying voltage to the sensor will damage it.**



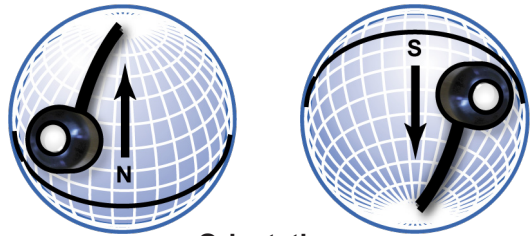
The model, serial number, production date, and calibration factor are located on the sensor cable. Additionally, the sensor cable includes circuitry to provide a calibrated sensor. Removing this portion of the cable will result in erroneous readings.



Mounting the Sensor



Mount the sensor to a solid surface with the nylon mounting screw. The sensor should be mounted level for the most accurate measurements. We recommend using our leveling plate (AL-100). The sensor should be mounted with the cable pointing toward true north in the northern hemisphere or true south in the southern hemisphere to minimize azimuth error. The azimuth error is typically less than 1%.



Proper cable management can improve the performance of all sensors mounted where they are exposed to environmental conditions. To ensure optimum longevity for your sensor we recommend using cable ties to secure the wire, as well as at any junction where the cable has an angle greater than 45 degrees.

Calibration



All Apogee precision pyranometer models have a standard calibration of exactly:

5.00 W m⁻² per mV

Use this conversion factor to convert the mV signal from the sensor to shortwave radiation in Watts m⁻². Multiply the mV output by the conversion factor to get shortwave radiation in W m⁻².

Sensor Output
(220 mV)

$$\begin{aligned}\text{Solar radiation} &= \text{sensor output} \times \text{conversion factor} \\ &= 220 \text{ mV} \times 5.00 \text{ W}^{-2} \text{ per mV} = 1100 \text{ W}^{-2}\end{aligned}$$

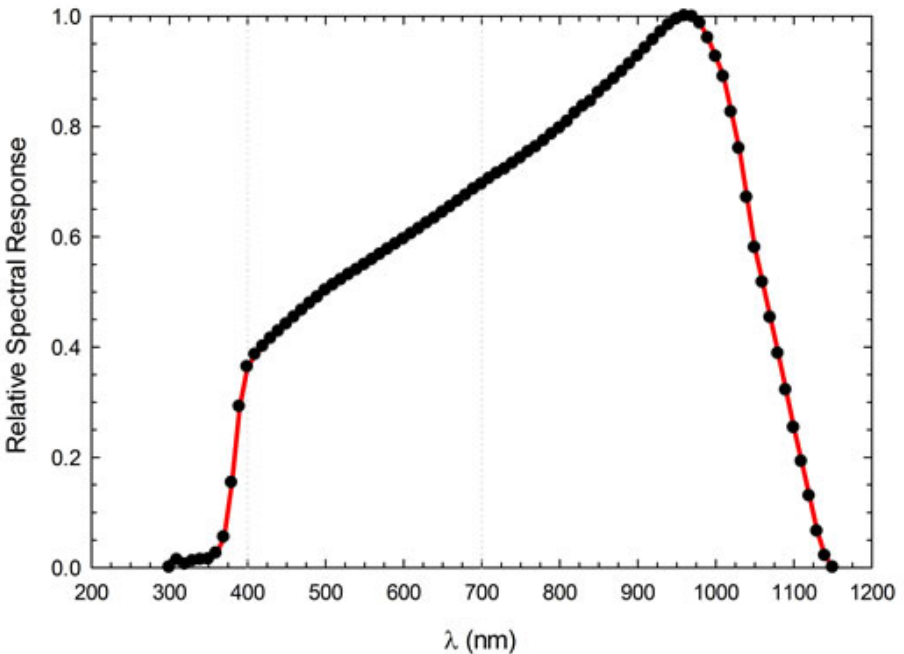
Cleaning

Debris on the pyranometer is a common cause of low readings. Salt deposits can accumulate on a sensor from evaporation of sprinkler irrigation water and dust, which 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.*

Spectral Response and Calibration

An ideal pyranometer measures the entire solar spectrum, 280 to 2800 nm. However, about 90% of sunlight energy is between 300 to 1100 nm. Model SP-110 is calibrated to estimate all of the shortwave energy from sunlight. Apogee pyranometers are calibrated under sunlight over a multiple-day period to a heated and ventilated Kipp & Zonen model CM21 precision reference radiometer.

Spectral Response of the Apogee Pyranometer

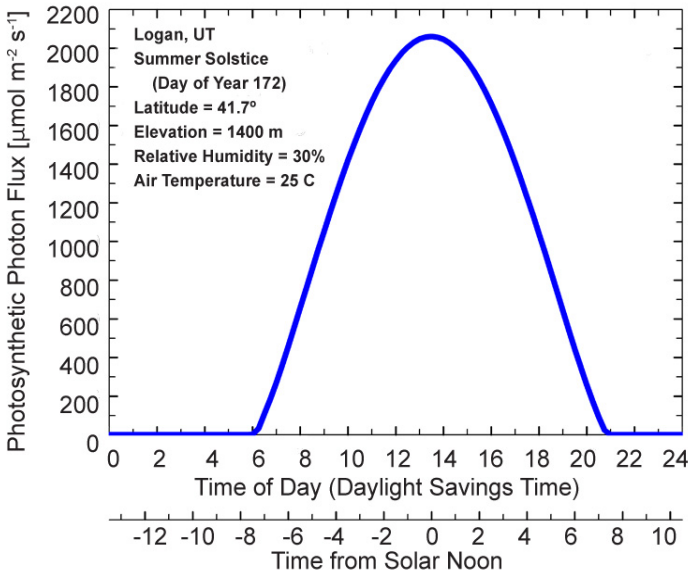




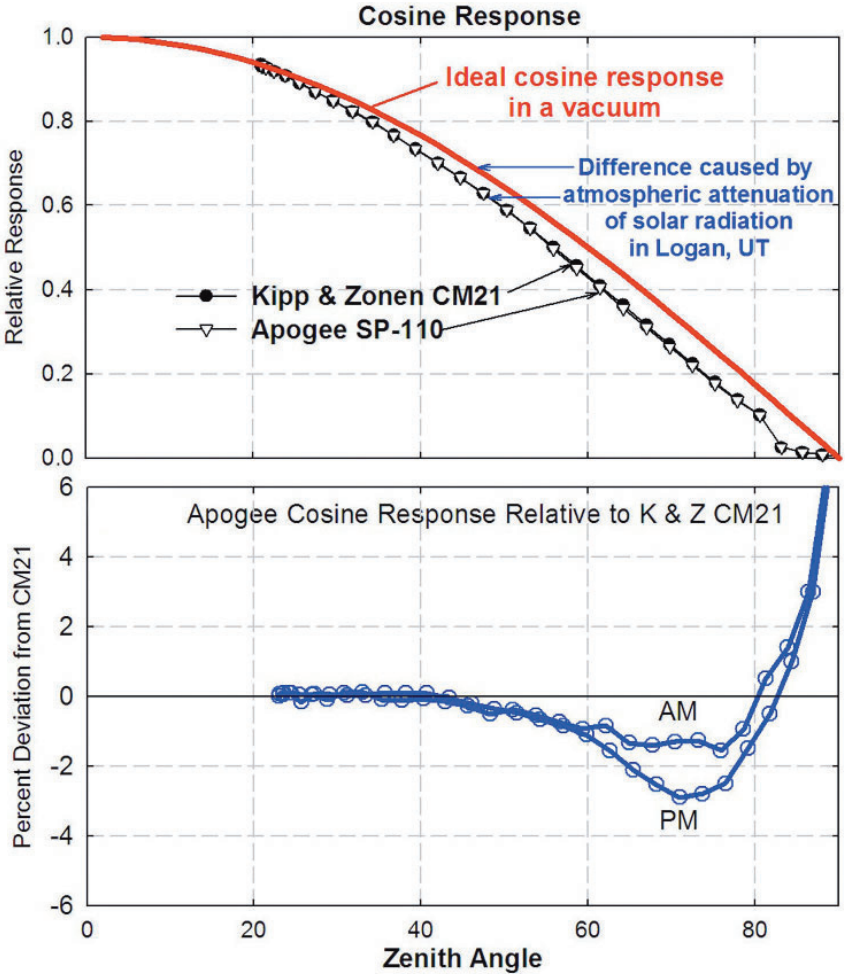
The Clear Sky Calculator is designed to determine the need for radiation sensor recalibration. It determines the intensity of radiation falling on a horizontal surface at any time of the day in any location in the world. It is most accurate when used near solar noon in the summer months.

The calculator is found at www.clearskycalculator.com and is used by typing conditions into the Clear Sky model and comparing measured values with the calculated value for a clear sky. If the output of the sensor over multiple days at solar noon is consistently less than the model value (by more than 8%), the sensor should be cleaned and re-leveled. If the output is still low after a second test, email calibration@apogeeinstruments.com to discuss test results and the possible return of sensors. When used near solar noon over multiple clear, unpolluted days during the spring and summer months, it is estimated that the accuracy of the model can be $\pm 4\%$ in all climates and locations around the world.

Example of Model Output



Cosine Response



Long-Term Stability

Our research indicates that the output increases about 1% per year because of changes in the optical transparency of the diffusion disk. We recommend returning the sensor for recalibration every 2 years.

Specifications

Cosine Response

- 45° zenith angle: $\pm 1\%$
- 75° zenith angle: $\pm 5\%$

Absolute Accuracy

- $\pm 5\%$

Uniformity

- $\pm 3\%$

Repeatability

- $\pm 1\%$

Output

- Responsivity: 0.20 mV per $W m^{-2}$
- In Full Sunlight: 220 mV ($1100 W m^{-2}$)
- Linear Range: 0 - 350 mV (0-1750 $W m^{-2}$); 1.75 * full sun

Sensitivity

- Custom calibrated to exactly 5.00 $W m^{-2}$ per mV

Materials

- Anodized aluminum with cast acrylic lens

Input Power

- None, self-powered

Operating Environment

- -25 to 55 C
- 0 to 100% relative humidity
- Designed for continuous outdoor use
- Can be submerged in water

Cable

- 5 meters of twisted-pair wire
- Foil shield
- Santoprene jacket
- Ending in pigtail leads
- Additional cable is available in multiples of 5 meters

Dimensions

- 2.4 cm diameter by 2.75 cm high

Mass

- 70 g (with 3 m lead wire)

Warranty

- 1 year against defects in materials and workmanship



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