Silicon-cell Pyranometers | JSP-100-SS and JSP-200-SS Series

Accurate and stable global shortwave radiation measurement

Accurate, Stable Measurements

Calibration in controlled laboratory conditions is traceable to the World Radiometric Reference in Davos, Switzerland. Pyranometers are cosine-corrected with directional errors less than ± 5 % at a solar zenith angle of 75°. Long-term non-stability determined from multiple replicate pyranometers in accelerated aging tests and field conditions is less than 2 % per year.

Rugged, Self-cleaning Head

Patented domed shaped sensor head (diffuser and body) facilitate runoff of dew and rain to keep the diffuser clean and minimize errors caused by dust blocking the radiation path. Sensors are housed in a rugged anodized aluminum body and electronics are fully potted.

Heated Option

A heated pyranometer (JSP-230 All-season) is available with a 0.2 W heater to keep water (liquid and frozen) off the sensor and minimize errors caused by dew, frost, rain, or snow blocking the optical path.

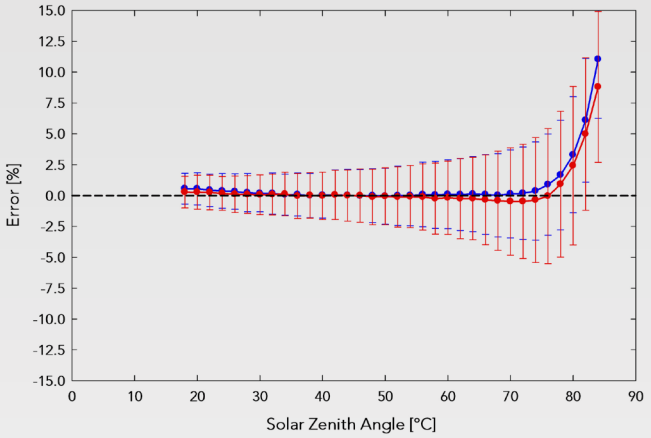
Output Options

Multiple analog output options are available including: 0 to 400 mV, 0 to 2.5 V, 0 to 5.0 V, and 4 to 20 mA ranges. The silicon-cell pyranometer is also available attached to a hand-held meter with digital readout.

Typical Applications

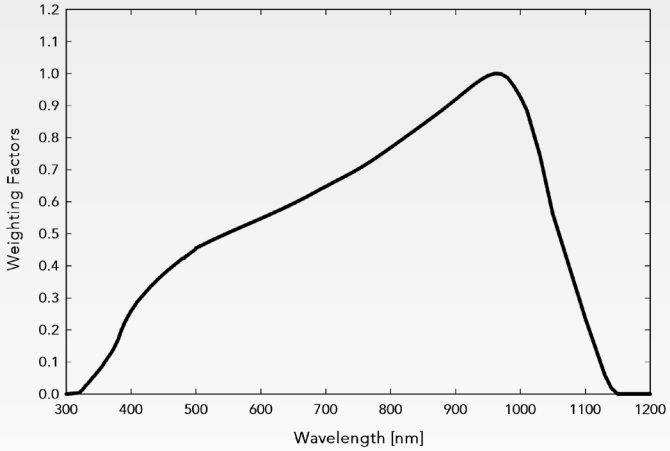
Applications include shortwave radiation measurement in agricultural, ecological, and hydrological weather networks and solar panel arrays.

Cosine Response



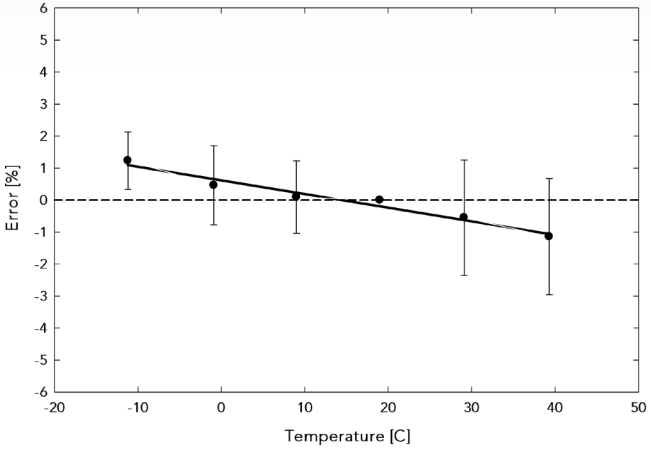
Mean cosine response of eleven Apogee silicon-cell pyranometers **(error bars represent two standard deviations above and below mean).** Cosine response measurements were made during broadband outdoor radiometer calibration (BORCAL) performed during two different years at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. Cosine response was calculated as the relative difference of pyranometer sensitivity at each solar zenith angle to sensitivity at 45° solar zenith angle. The blue symbols are AM measurements, the red symbols are PM measurements.

Spectral Response



Spectral response estimate of Apogee silicon-cell pyranometers. Spectral response was estimated by multiplying the spectral response of the photodiode, diffuser, and adhesive. Spectral response measurements of diffuser and adhesive were made with a spectrometer, and spectral response data for the photodiode were obtained from the manufacturer.

Temperature Response

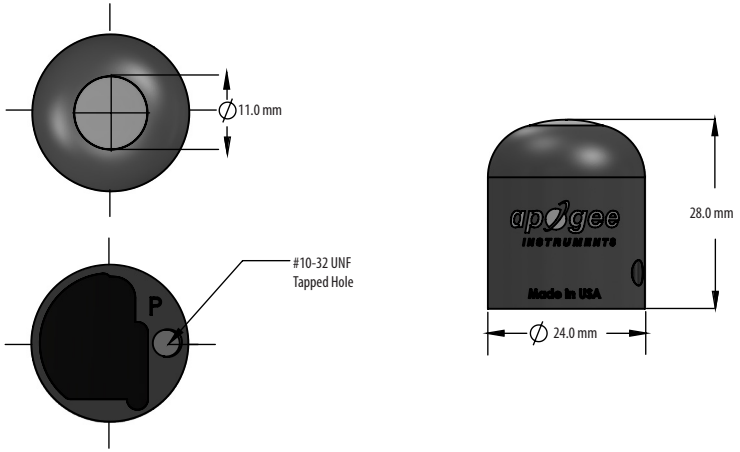


Mean temperature response of ten Apogee silicon-cell pyranometers **(errors bars represent two standard deviations above and below mean).** Temperature response measurements were made at 10 C intervals across a temperature range of approximately -10 to 40 C in a temperature controlled chamber under a fixed, broad spectrum, electric lamp. At each temperature set point, a spectroradiometer was used to measure light intensity from the lamp and all pyranometers were compared to the spectroradiometer. The spectroradiometer was mounted external to the temperature control chamber and remained at room temperature during the experiment.

Calibration Traceability

JSP series pyranometers are calibrated through side-by-side comparison to the mean of four JSP-110 transfer standard pyranometers (shortwave radiation reference) under high intensity discharge metal halide lamps. The transfer standard pyranometers are calibrated through side-by-side comparison to the mean of at least two ISO-classified reference pyranometers under sunlight (clear sky conditions) in Logan,Utah. Each of four ISO-classified reference pyranometers are recalibrated on an alternating year schedule (two instruments each year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

Dimensions



	JSP-110-SS	JSP-212-SS	JSP-214-SS	JSP-215-SS	JSP-230-SS
Power Supply	Self-powered	5 to 24 V DC with a nominal current draw of 300 µA	5 to 36 V DC with a maximum current drain of 22 mA (2 mA quiescent current drain)	5.5 to 24 V DC with a nominal current draw of 300 µA	12 V DC for heater with a current draw of 15 mA
Output (sensitivity)	0.2 mV per W m^{-2}	2.0 mV per W m^{-2}	0.013 mA per W m^{-2}	4.0 mV per W m^{-2}	0.2 mV per W m^{-2}
Calibration Factor (reciprocal of output)	5.0 W m^{-2} per mV	0.5 W m^{-2} per mV	78 W m^{-2} per mA, 4.0 mA offset	0.25 W m^{-2} per mV	5.0 W m^{-2} per mV
Calibration Uncertainty	± 5 %				
Measurement Repeatability	Less than 1 %				
Long-term Drift	Less than 2 % per year				
Non-linearity	Less than 1 % up to 2000 W m^{-2}	Less than 1 % up to 1250 W m^{-2}			Less than 1 % up to 2000 W m^{-2}
Response Time	Less than 1 ms				
Field of View	180°				
Spectral Range	360 to 1120 nm				
Directional (Cosine) Response	± 5 % at 75° zenith angle				
Temperature Response	0.04 ± 0.04 % per C				
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, 28 mm height				
Mass (with 5 m of cable)	90 g		140 g	90 g	
Cable	5 m of shielded, twisted-pair wire; additional cable available in multiples of 5 m; santoprene rubber jacket (high water resistance, high UV stability, flexibility in cold conditions); pigtail lead wires				
Warranty	4 years against defects in materials and workmanship				