Silicon-cell Pyranometers | SP-400-SS Series - Digital Outputs

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.

Mounting

The AM-110 mounting bracket facilitates mounting the AL-100 leveling plate to a mast or pipe. The bubble level in the plate makes leveling simple and accurate.

Output Options

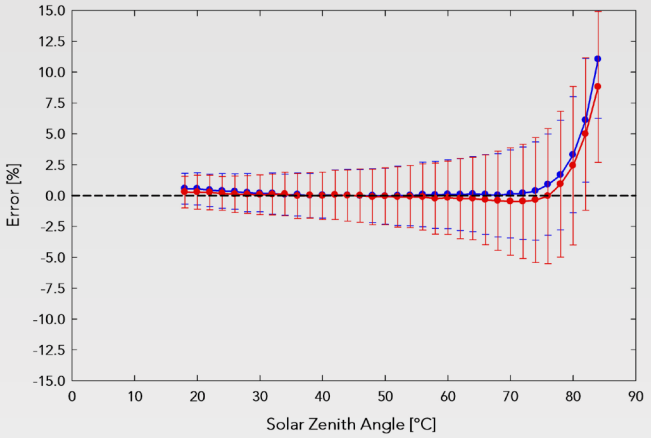
Digital output options include SDI-12 or ModBus communication protocol. Sensor is also available in multiple analog output options, attached to a hand-held meter with digital readout, and as a 'digital' smart sensor that uses USB communication and custom software to interface directly to a computer.

Typical Applications

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

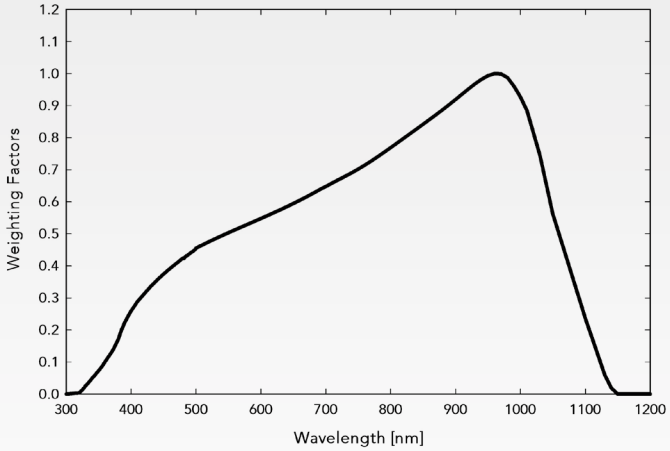
apogee® INSTRUMENTS
www.apogeeinstruments.com | 435.792.4700 Logan, UT

Cosine Response



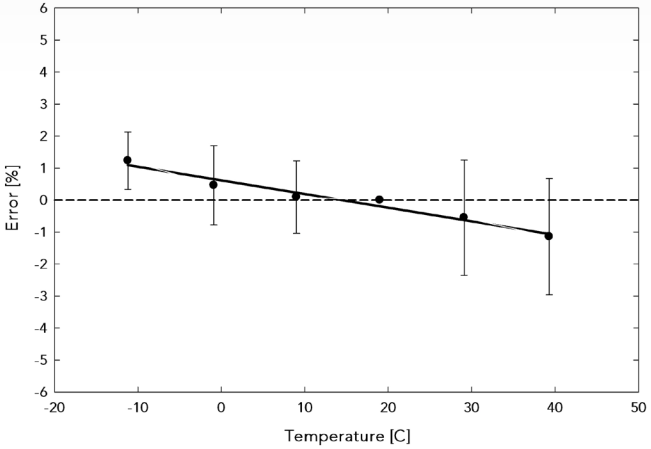
Mean cosine response of eleven Apogee silicon-cell pyranometers **(error bars represent two standard deviations above and below mean).** Cosine response measurements were made during broadband outdoor radiometer calibration (BORCAL) performed during two different years at the National Renewable Energy 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

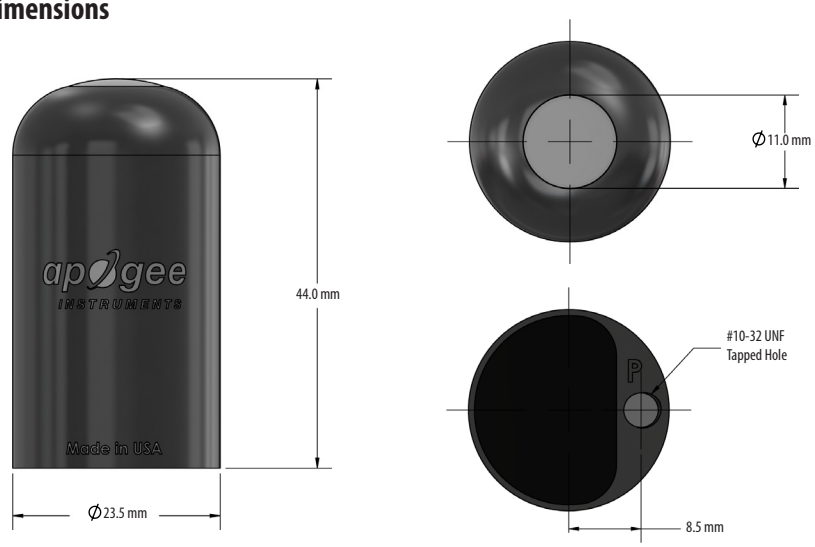


Mean temperature response of ten Apogee silicon-cell pyranometers **(errors bars represent two standard deviations above and below mean).** Temperature response measurements were made at 10 C intervals across a temperature range of approximately -10 to 40 C in a temperature controlled chamber under a 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

Apogee Instruments SP series pyranometers are calibrated through side-by-side comparison to the mean of four Apogee SP-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 pyanometers 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



	SP-421-SS	SP-422-SS
Input Voltage Requirement	4.5 to 24 V DC	4.5 to 24 V DC
Current Drain	0.6 mA (quiescent), 1.3 mA (active)	12.6 mA (quiescent), 13.5 mA (active)
Calibration Uncertainty	± 5 %	
Measurement Repeatability	Less than 1 %	
Long-term Drift	Less than 2 % per year	
Non-linearity	Less than 1 % up to 1750 W m^{-2}	
Response Time	0.6 s, time for detector signal to reach 95 % following a step change; fastest data transmission rate for SDI-12 circuitry is 1 s	320 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, 44 mm height	
Mass (with 5 m of cable)	117 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	