

Silicon-cell Pyranometers and Meters

Accurate and stable global shortwave radiation measurement



Proven Design

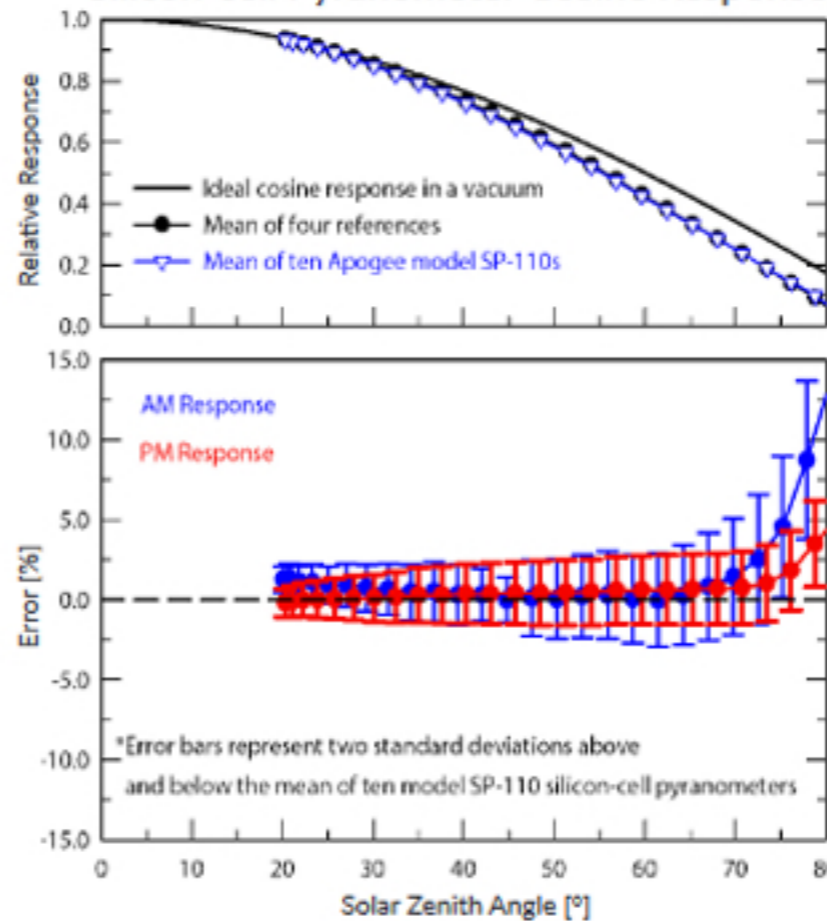
An accurate, cosine-corrected patented design sheds water and dirt for a self-cleaning performance. A heated option (SP-230) is available with a 0.2 W heater to minimize errors caused by dew, frost, or snow.

Case Study

The Institute of Agroalimentary Research and Technology in Catalonia, Spain uses Apogee Silicon-cell Pyranometers mounted on a model train to collect measurements in orchards. This allows them to study the irrigation and nutrient needs of the fruit trees.



Silicon-cell Pyranometer Cosine Response



Top: Mean relative response of ten Apogee model SP-110 pyranometers and mean relative response of four reference pyranometers (Kipp & Zonen models CM11, CMP11, CM21; Hukseflux model SR20) compared to ideal angular (cosine) response in a vacuum. Differences from the ideal response are caused by atmospheric attenuation of solar radiation, which increases as solar zenith angle increases.

Bottom: Mean angular response (error as function of solar zenith angle) of ten Apogee model SP-110 pyranometers, where the mean of the four reference pyranometers was used as the reference.

Heated vs Unheated
Apogee offers the SP-230 sensors with an internal 0.2 W heater. This helps melt frost or snow to ensure your sensor continues to take accurate measurements, even in extreme conditions.



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Sensor Models

SP-110	0 to 400 mV	Self-powered
SP-212	0 to 2.5 V	Amplified
SP-214	4 to 20 mA	Amplified
SP-215	0 to 5 V	Amplified
SP-230	0 to 400 mV	All-season Heated
SP-420	USB	Digital
SP-421	SDI-12	Digital
SP-422	Modbus	Digital

Meter Models

MP-100	Integrated Sensor
MP-200	Separate Sensor



	SP-110-SS	SP-212-SS	SP-214-SS	SP-215-SS	SP-230-SS	SP-420	SP-421-SS	SP-422-SS
ISO 9060:2018	Class C (fast response)							
Power Supply	Self-powered	5 to 24 V DC	7 to 24 V DC	5.5 to 24 V DC	12 V DC for heater	5 V USBS	5.5 to 24 V DC	
Current Draw	—	300 μ A	22 mA maximum; 2 mA quiescent	300 μ A	15.4 mA	61 mA when logging	1.5 mA (quiescent); 1.9 mA (active)	RS-232 37 mA; RS-485 quiescent 37 mA, active 42 mA
Output (sensitivity)	0.2 mV per $W m^{-2}$	1.25 mV per $W m^{-2}$	0.008 mA per $W m^{-2}$	2.5 mV per $W m^{-2}$	0.2 mV per $W m^{-2}$	USB	SDI-12	Modbus
Output Type	0 to 400 mV	0 to 2.5 V	4 to 20 mA	0 to 5 V	0 to 400 mV	USB	SDI-12	Modbus
Calibration Factor (reciprocal of output)	5 $W m^{-2}$ per mV	0.8 $W m^{-2}$ per mV	125 $W m^{-2}$ per mA, 4 mA offset	0.4 $W m^{-2}$ per mV	5 $W m^{-2}$ per mV	Custom for each sensor and stored in firmware		
Calibration Uncertainty at 1000 $W m^{-2}$	Less than 3 %							
Measurement Repeatability	Less than 1 %							
Long-term Drift	Less than 2 % per year							
Non-linearity	Less than 1 % up to 2000 $W m^{-2}$							
Response Time	Less than 1 ms					Software updates every second	Less than 0.6 s	Less than 200 ms
Field of View	180°							
Spectral Range	360 to 1120 nm							
Directional (cosine) Response	\pm 5 % at 75° zenith angle							
Temperature Response	0.04 \pm 0.04 % per C							
Operating Environment	-40 to 70 C; 0 to 100 % relative humidity; can be submerged in water up to 30 m							
Dimensions	24 mm diameter, 33 mm height	30.5 mm diameter, 37 mm height			24 mm diameter, 33 mm height		30.5 mm diameter, 37 mm height	
Mass (with 5 m of cable)	90 g	140 g			90 g		140 g	
Warranty	4 years against defects in materials and workmanship							