Thermopile Pyranometers

Blackbody accuracy with a cost-effective design

SP-510

Unique Design

The thermopile, blackbody detector produces significant spectral response improvements over silicon-cell pyranometers. The design keeps the price low and optimizes power requirement for the 0.2 W heater to minimize errors from dew, frost, and snow.

Accurate, Stable Measurements

Directional errors are less than 30 W m^{-2} at 80° solar zenith angle. Long-term drift is less than 2 % per year.

Outputs and Options

0 to 90 mV range. A downward sensor is available for measuring shortwave reflectance and can be combined with an upward-looking sensor to measure albedo (see model SP-710-SS, page 14).

Case Study

Apogee **thermopile pyranometers** studied a method of cooling by chilling surfaces and using thermal radiation.


SP-522


Completed Cold Tube

	SP-510-SS (Upward-Looking)	SP-610-SS (Downward-Looking)	SP-522-SS (Upward-Looking)
ISO 9060:2018	Class C (fast response)	N/A	Class C (fast response)
Input Voltage Requirement	–		5.5 to 24 V
Average Max Current Draw	–		RS-232 19 mA; RS-485 72 mA
Sensitivity (variable from sensor to sensor, typical values listed)	0.045 mV per W m^{-2}	0.035 mV per W m^{-2}	–
Calibration Factor (variable from sensor to sensor, typical values listed)	22 W m^{-2} per mV	28.5 W m^{-2} per mV	–
Calibration Uncertainty at 1000 W m^{-2}	Less than 3 %		
Output Type	0 to 90 mV	0 to 70 mV	Modbus
Measurement Range	0 to 2000 W m^{-2} (net shortwave irradiance)		
Measurement Repeatability	Less than 1 %		
Long-term Drift	Less than 2 % per year		
Non-linearity	Less than 1 %		
Detector Response Time	0.5 s		0.5 s (baudrate dependent)
Field of View	180°	150°	180°
Spectral Range (50 % points)	385 to 2105 nm	370 to 2240 nm	385 to 2105 nm
Directional (cosine) Response	Less than 30 W m^{-2} at 80° solar zenith	Less than 20 % for angles between 0 and 60°	Less than 30 W m^{-2} at 80° solar zenith
Temperature Response	Less than 5 % from -15 to 45 C		
Zero Offset A	Less than 2 W m^{-2}; Less than 10 W m^{-2} (heated)	Less than 2 W m^{-2}; Less than 10 W m^{-2} (heated)	Less than 2 W m^{-2}; Less than 10 W m^{-2} (heated)
Zero Offset B	Less than 5 W m^{-2}		
Operating Environment	-50 to 80 C; 0 to 100 % relative humidity		
Heater	780 Ω, 15.4 mA current draw and 185 mW power requirement at 12 V DC		4 mA (heater off); 30 mA (heater on)
Dimensions	23.5 mm diameter, 28.7 mm height	23.5 mm diameter, 27.5 mm height	30.5 mm diameter, 37 mm height
Mass (with 5 m of cable)	90 g	100 g	140 g
Warranty	4 years against defects in materials and workmanship		