

# USB Smart Silicon-cell Pyranometer | SP-420

USB pyranometer can be connected directly to a computer for real-time measurements and data logging, or can act as a stand-alone datalogger when connected to most standard 5 V DC USB power sources.

## 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  $\pm 5\%$  at a solar zenith angle of  $75^\circ$ . 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.

## Internal Data Storage

Sensor has internal data storage capability with the ability to hold up to 10,000 measurements. This allows the sensor to collect data while connected to a most stand-alone 5 V DC USB power sources.

## No Datalogger Required

Sensor can be connected to a desktop, laptop, or tablet computer via a USB 2.0 type A plug, to be used with the ApogeeConnect software. The software gives the user control of data logging settings, provides real time output display and graph measurements, and allows the data set to be saved as a csv file for further analysis.

## Typical Applications

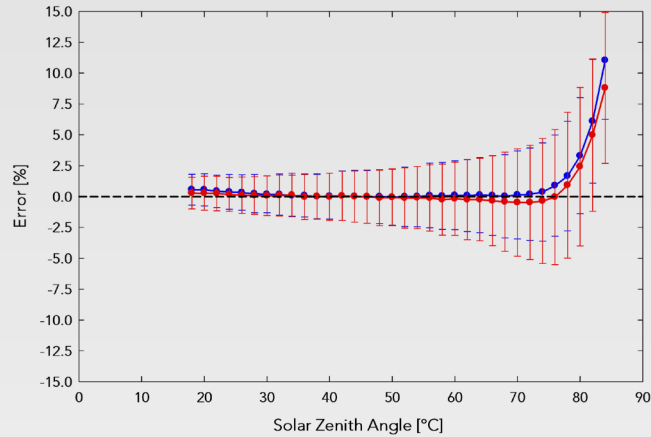
Applications include shortwave radiation measurement in agricultural, ecological, and hydrological weather networks and solar panel arrays.



[www.apogeeinstruments.com](http://www.apogeeinstruments.com) | 435.792.4700

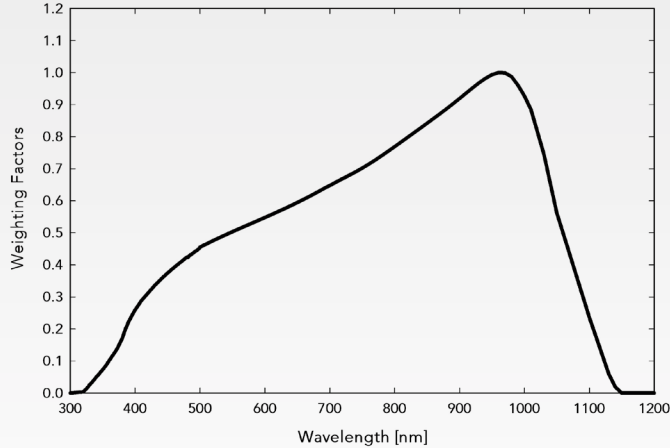
**apogee**<sup>®</sup>  
INSTRUMENTS  
Logan, UT

## Cosine Response



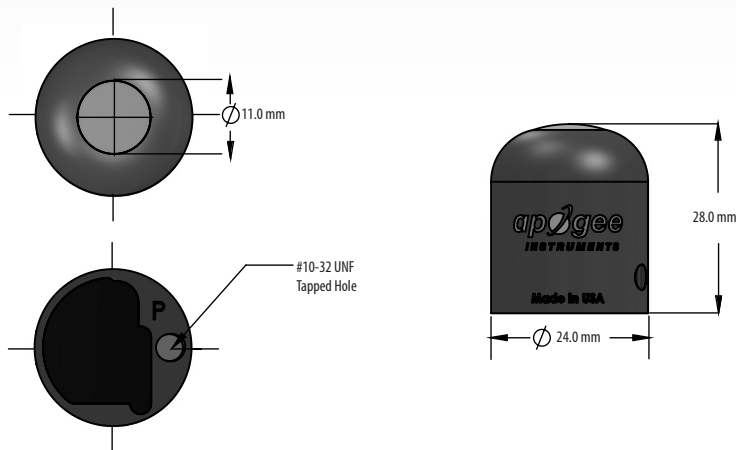
Mean cosine response of eleven Apogee silicon-cell pyranometers (error bars represent two standard deviations above and below mean). Cosine response measurements were made during broadband outdoor radiometer calibration (BORCAL) performed during two different years at the National Renewable Energy Laboratory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

## Dimensions



## 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 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.

## Software Overview

The screenshot shows the Apogee Connect software interface. The main display shows an instantaneous output of 0.6 Watts/m². Below this is a graph of radiation levels over time. A data logging table is visible on the right, showing timestamp and value data. The interface includes buttons for Settings, Data Logging, and Start/Setup.

Timestamp	Value
2016-08-22, 12:25:59	8.2
2016-08-22, 12:26:00	8.2
2016-08-22, 12:26:01	8.2
2016-08-22, 12:26:02	8.2
2016-08-22, 12:26:03	7.4
2016-08-22, 12:26:04	4.6
2016-08-22, 12:26:05	4.1
2016-08-22, 12:26:06	4.2
2016-08-22, 12:26:07	4.6
2016-08-22, 12:26:08	4.6
2016-08-22, 12:26:09	4.6
2016-08-22, 12:26:10	4.7
2016-08-22, 12:26:11	4.9
2016-08-22, 12:26:12	5.1
2016-08-22, 12:26:13	5.3

## SP-420

Resolution	0.1 W m <sup>-2</sup>
Calibration Factor	Custom for each sensor and stored in firmware
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 <sup>-2</sup>
Response Time	Software updates every second
Field of View	180°
Spectral Range	360 to 1120 nm (wavelengths where response is 10 % of maximum)
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)	Sensor head weighs 90 g
USB Cable	4.6 m (15 ft)
Current Draw	61 mA
Warranty	4 years against defects in materials and workmanship