



# SP-420

## DESCRIPTION

The new SP-420 smart pyranometer can be connected directly to a computer for taking spot measurements or graphing and datalogging real-time shortwave radiation using the included software. The sensor can also act as a stand-alone shortwave radiation datalogger by simply connecting it to most standard 5 V DC USB power sources. Internal memory within the sensor head is capable of storing 10,000 user-specified periodic measurements that can be downloaded as a csv file to a computer for analysis.

### Internal Data Storage

The 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 stand-alone 5 V DC power supply such as a USB wall adapter.

### No Datalogger Required

The sensor can be connected to a desktop or laptop computer via USB 2.0 type A plug, to be used with the ApogeeConnect software (Windows compatible, XP and later; Mac compatible, 10.10 and later). The included Apogee software gives the user control of data logging and calibration settings, provides a real time output display and graph of shortwave radiation measurements and allows the data set to be saved as a csv file.



### Features:

#### Output Options

- SDI-12
- Modbus
- USB

#### Stable Measurements

Long-term non-stability determined from multiple replicate pyranometers in accelerated aging tests and field conditions is less than 2 % per year.

#### Unique Design

An accurate, cosine-corrected patented design sheds water and dirt for a self-cleaning performance. Sensors are housed in a rugged anodized aluminum body and electronics are fully potted.

#### Typical Measurement Applications

- Solar panel arrays
- Agricultural, ecological, and hydrological weather networks

#### Calibration Traceability

Apogee SP sensors are calibrated through side-by-side comparison to the mean of four Apogee SP-110 transfer standard sensors under high intensity discharge metal halide lamps. The transfer standard sensors are calibrated through side-by-side comparison to the mean of at least two ISO-classified reference pyranometers under sunlight in Logan, UT. Each of two ISO-classified reference sensor are recalibrated on an alternating year schedule at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

# SP-400 Digital Output Series

## 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.

## 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.

|  | SP-421-SS (SDI-12)  | SP-422-SS (Modbus) | SP-420 (USB)                  |
|--|---|--------------------|-------------------------------|
| <b>Input Voltage Requirement</b>                 | 5.5 to 24 V DC  |                    | 5 V USB power source          |
| <b>Current Draw</b>                              | 0.6 mA (quiescent),<br>1.3 mA (active)  | 20 mA (active)     | 2.1 mA current draw (active)  |
| <b>Output Range</b>                              | 0 to 2000 W m <sup>-2</sup>   |                    |                               |
| <b>Calibration Uncertainty</b>                   | ± 5 %   |                    |                               |
| <b>Calibration Factor (reciprocal of output)</b> | Custom for each sensor and stored in firmware   |                    |                               |
| <b>Measurement Repeatability</b>                 | Less than 1 %   |                    |                               |
| <b>Long-term Drift (non-stability)</b>           | Less than 2 % per year  |                    |                               |
| <b>Non-linearity</b>                             | Less than 1 % (up to 2000 W m <sup>-2</sup> )   |                    |                               |
| <b>Response Time</b>                             | 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             | Software updates every second |
| <b>Field of View</b>                             | 180°  |                    |                               |
| <b>Spectral Range</b>                            | 360 to 1120 nm  |                    |                               |
| <b>Directional (Cosine) Response</b>             | ± 5 % at 75° zenith angle   |                    |                               |
| <b>Temperature Response</b>                      | 0.04 ± 0.04 % per C   |                    |                               |
| <b>Operating Environment</b>                     | -40 to 70 C; 0 to 100 % relative humidity; can be submerged in water up to depths of 30 m   |                    |                               |
| <b>Dimensions</b>                                | 44 mm height, 24 mm diameter  |                    | 33 mm height, 24 mm diameter  |
| <b>Mass</b>                                      | 117 g (with 5 m of lead wire)   |                    | 90 g                          |
| <b>Cable</b>                                     | 5 m of shielded, twisted-pair wire with TPR jacket (high water resistance, high UV stability, flexibility in cold conditions); pigtail lead wires |                    | 4.6 m (15 ft)                 |
| <b>Warranty</b>                                  | 4 years against defects in materials and workmanship  |                    |                               |

## Contact info



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### Other Models:

#### SP-420 USB

Sensor connects to computers and tablets via USB using ApogeeConnect software for Windows and Mac for data logging, graphs, calibration, real-time PPFd readings, and storing downloadable CSV files for further analysis. Sensor can also store 10,000 measurements internally while connected to a standalone 5 V DC USB “always-on” power source.

#### SP-421

Uses the SDI-12 communication protocol, which is low-power and has the ability to connect multiple sensors to one long bus cable making them ideal for remote locations. Cables only have 3 conductors including a serial data line, a ground, and a 12-volt line. Complex self-calibration algorithms are done in an internal microprocessor making the sensors compatible with a wide variety of data recorders.

#### SP-422

The SP-422 outputs a digital signal using Modbus RTU digital signal over RS-232 or RS-485, based on wiring configuration. Modbus is open protocol and used by many manufacturers in many industries.

#### Apogee Modbus Sensor Communication

Defaults: Modbus RTU , Slave address: 0x1 , Baudrate: 115200 , Data bits: 8 , Stop bits: 1 , Parity: None , Byte order: Big Endian (most significant Byte sent first)

\*User configurable values include the baudrate and slave address

This Instrument is manufactured by our principle company

**Apogee Instruments - USA**