

Solar Radiation Meter

MP-100, MP-200



www.apogeeinstruments.com

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MP-100

- Excellent cosine response
- Self-cleaning dome-shaped sensor head does not trap water or debris
- Calibrated silicon-cell photodiode sensor accurate to $\pm 5\%$, under clear sky conditions
- Utilized by leading weather station manufacturers such as Campbell Scientific, Columbia Weather Systems and more
- Four year warranty

Apogee Instruments pyranometers represent the next generation in pyranometer design maximizing accuracy, reliability and durability. Featuring a silicon-cell photodiode with excellent cosine response, our pyranometers measure total solar radiation to within $\pm 5\%$ at a fraction of the price of black-body pyranometers, and at a far lower price-point than most other photodiode pyranometers on the market due to advancements in manufacturing.

The meters include data recording capability and can store up to 99 manually recorded measurements. In automatic mode, measurements are made every 30 seconds and averages are stored every 30 minutes. Daily totals are also calculated for the past 99 days.

To ensure accuracy, each Apogee pyranometer is carefully pre-calibrated in controlled conditions and traceable to ISO class reference standards so your sensor is ready to go right out of the box. Our stock sensors come in several configurations and are readily compatible with most data-loggers. Our custom options can provide maximum flexibility by offering different multipliers, outputs, and cable lengths.



MP-200



AL-100 Leveling plate
AM-110 Mounting Bracket

SPECIFICATIONS

Calibration Uncertainty: $\pm 5 \%$ (see Calibration Traceability below)

Measurement Repeatability: $< 1 \%$

Non-stability (Long-term Drift): $< 2 \%$ per year

Non-linearity: $< 1 \%$ (up to 1750 W m^{-2})

Response Time: $< 1 \text{ ms}$

Field of View: 180°

Spectral Range: 360 to 1120 nm (wavelengths where response is 10 % of maximum; see Spectral Response below)

Directional (Cosine) Response: $\pm 5 \%$ at 75° zenith angle (see Cosine Response below)

Temperature Response: $0.04 \pm 0.04 \%$ per C (see Temperature Response below)

Operating Environment: 0 to 50 C

$< 90 \%$ non-condensing relative humidity up to 30 C

$< 70 \%$ non-condensing relative humidity from 30 to 50 C

Separate sensors can be submerged in water up to depths of 30 m

Meter Dimensions: 12.6 cm length, 7.0 cm width, 2.4 cm height

Sensor Dimensions: MP-200: 2.4 cm diameter and 2.8 cm height

Mass: MP-100: 150 g

MP-200: 180 g

Cable: 2 m of shielded, twisted-pair wire.

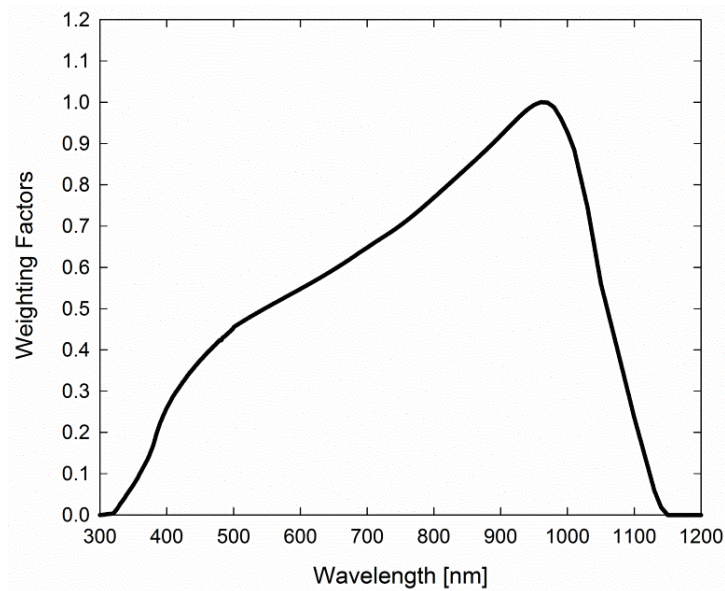
Additional cable available

Santoprene rubber jacket (high water resistance, high UV stability, flexibility in cold conditions)

Calibration Traceability:

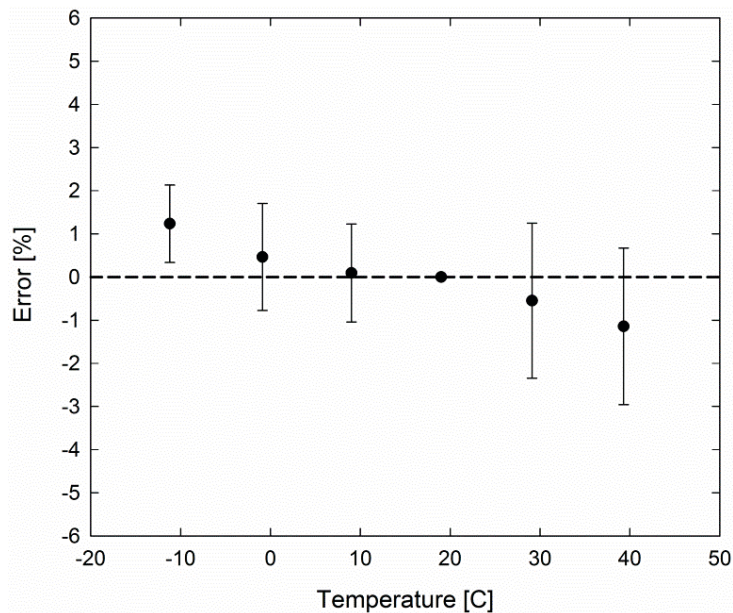
Apogee Instruments MP series solar radiation meters are calibrated through side-by-side comparison to the mean of four Apogee model SP-110 transfer standard pyranometers (shortwave radiation reference) under high intensity discharge metal halide lamps. The transfer standard pyranometers are calibrated 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.

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.

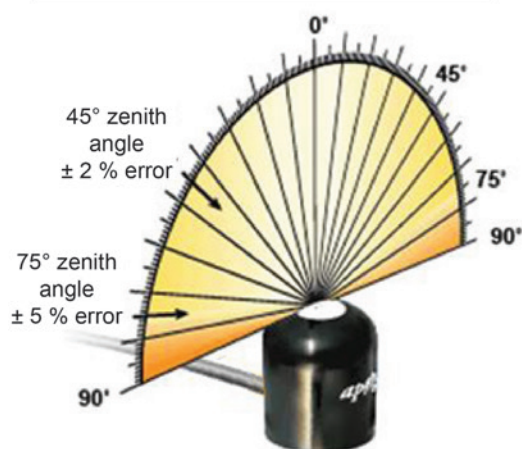
Temperature response:



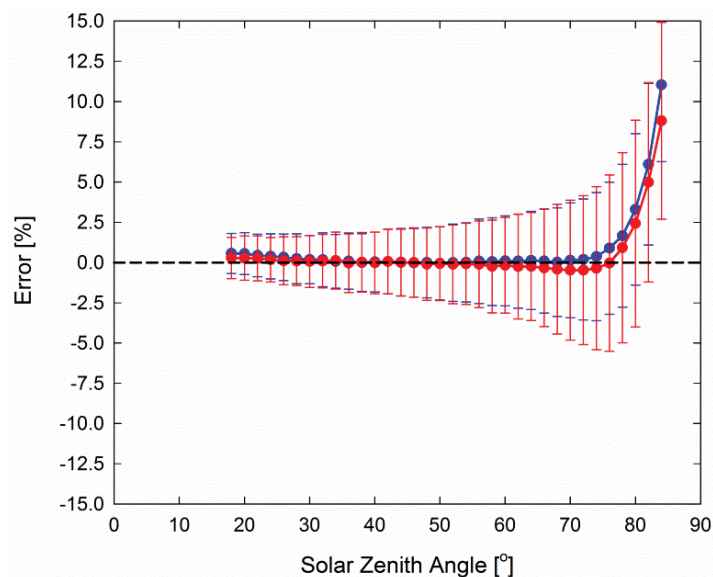
Mean temperature response of ten Apogee silicon-cell pyranometers (***errors bars represent two standard deviations above and below mean***). Temperature response measurements were made at 10 C intervals across a temperature range of approximately -10 to 40 C in a temperature controlled chamber under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

Cosine Response:

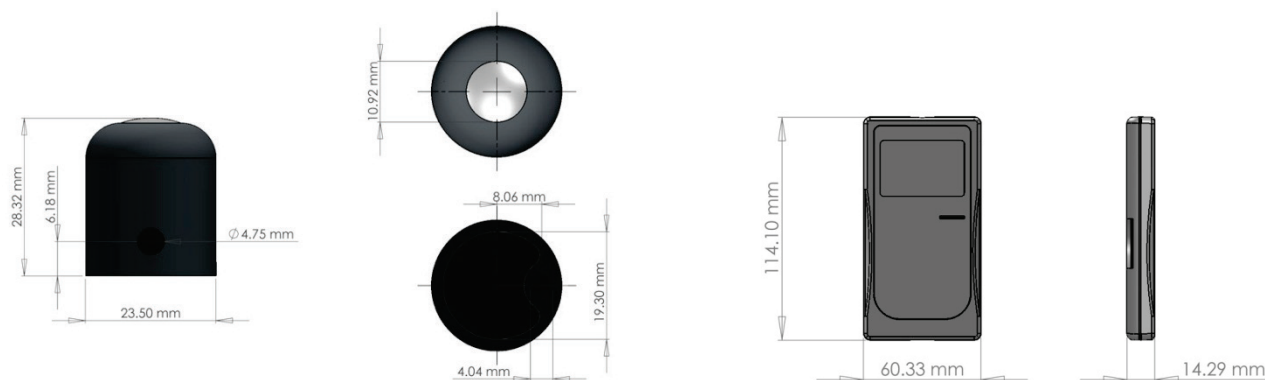
Cosine Response of Apogee SP Series Pyranometers



Directional, or cosine, response is defined as the measurement error at a specific angle of radiation incidence. Error for Apogee silicon-cell pyranometers is approximately $\pm 2\%$ and $\pm 5\%$ at solar zenith angles of 45° and 75° , respectively.



Mean cosine response of eleven Apogee silicon-cell pyranometers (***error bars represent two standard deviations above and below mean***). Cosine response measurements were made by Broadband Outdoor Radiometer Calibrations (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.



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