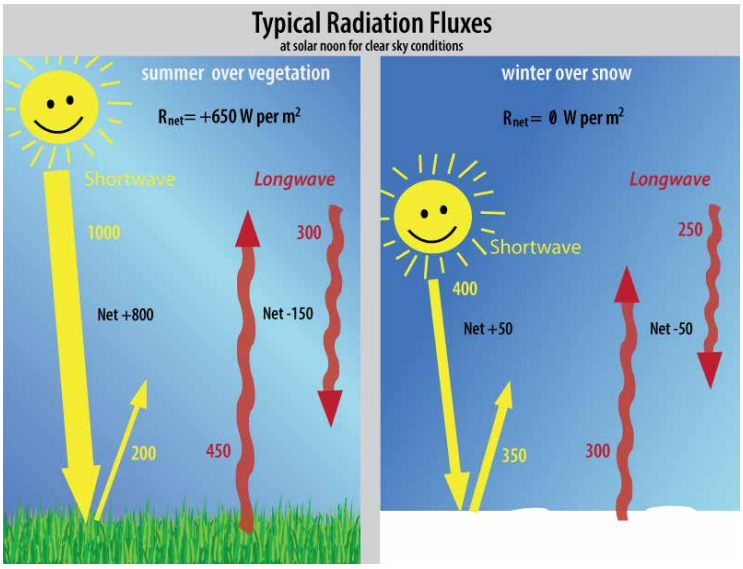
NET RADIOMETER

SN-500

Radiation Fluxes



Net radiation is the sum of the four components shown to the left (incoming shortwave, outgoing shortwave, incoming longwave, outgoing longwave). Incoming shortwave incident on the surface is either reflected or absorbed by the surface material, and longwave radiation is emitted from the surface and emitted from the molecules of air in the atmosphere. Typical clear sky summer fluxes over grass and clear sky winter fluxes over snow are shown. A typical summer flux at solar noon would be +650 W m^{-2}; in winter it would be 0 W m^{-2}.

Features

TYPICAL APPLICATIONS

Net radiation is a key variable in the surface energy balance and influences turbulent fluxes, including evapotranspiration. Applications include measurements on flux towers and weather stations.

DIGITAL OUTPUT

An on-board 24-bit analog to digital converter makes measurements and provides a digital SDI-12 (SN-500) output. This eliminates the need for multiple analog datalogger channels to measure each of the four components of net radiation.

HIGH ACCURACY

Measure all four components of net radiation with a digital output that saves datalogger channels. Comparable accuracy to industry-leading competition in long-term field testing.

Compact and Lightweight

The small lightweight design enables easy mounting to a cross arm using the AM-500 mounting bracket that facilitates precision leveling.

Heated Sensors

Each sensor includes a 0.2 W heater to minimize errors from dew, frost, rain, and snow that can block the radiation path.

Product Specifications

SN-500-SS		
Input Voltage Range	5.5 to 24 V DC (heaters are optimized to run at 12 V DC)	
Output Type	SDI-12	
Current Draw (12 V DC Supply Voltage)	Heaters on, communication enabled: 63 mA; Heaters off, communication enabled: 1.5 mA; Heaters off, communication disabled: 0.6 mA	
Response Time	1 s (SDI-12 data transfer rate; detector response times are 0.5 sec)	
Heaters (sensors individually heated)	62 mA current draw and 740 mW power requirement at 12 V DC	
Operating Environment	-50 to 80 C; 0 to 100 % relative humidity	
Dimensions	116 mm length, 45 mm width, 66 mm height	
Mass	320 g (with mounting rod and 5 m of lead wire)	
Cable	M8 connector (IP68 rating) to interface to sensor housing; 5 m of four conductor, shielded, twisted-pair wire in a TPR jacket with pigtail lead wires	
Warranty	4 years against defects in materials and workmanship	

SPECIFICATIONS

Pyranometer (Shortwave Radiation) SP-510 and SP-610

	SP-510-SS (Upward-looking)	SP-610-SS (Downward-looking)
Sensitivity (variable from sensor to sensor, typical values listed)	0.057 mV per W m^{-2}	0.15 mV per W m^{-2}
Calibration Factor (Reciprocal of Sensitivity)	17.5 W m^{-2} per mV	6.7 W m^{-2} per mV
Calibration Uncertainty	± 5 % (see Calibration Traceability below)	
Output Range (Variable from sensor to sensor)	0 to 114 mV	0 to 300 mV
Measurement Range	0 to 2000 W m^{-2} (shortwave irradiance)	
Measurement Repeatability	Less than 1 %	
Long-term Drift (Non-stability)	Less than 2 % per year	
Non-linearity	Less than 1 %	
Detector Response Time	0.5 seconds	
Field of View	180°	150°
Spectral Range (wavelengths where response is 50% of maximum)	385 to 2105 nm	295 to 2685 nm
Directional (Cosine) Response	Less than 30 W m^{-2} at 80° solar zenith	Less than 20% for angles between 0 and 60°
Temperature Response	Less than 5 % from -15 to 45 C	
Zero Offset A	Less than 5 W m^{-2}; Less than 10 W m^{-2} (heated)	
Zero Offset B	Less than 5 W m^{-2}	
Uncertainty in Daily Total	Less than 5 %	

Calibration Traceability

Apogee Instruments SP-510 and SP-610 pyranometers are calibrated through side-by-side comparison to the mean of four Apogee model SP-510 transfer standard pyranometers (shortwave radiation reference for upward-looking pyranometer on net radiometer) or to the mean of four Apogee model SP-610 transfer standard pyranometers (shortwave radiation reference for downward-looking pyranometer on net radiometer) 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).

Pyrgeometers (Longwave Radiation) SL-510 and SL-610

	SL-510-SS (upward-looking) SL-610-SS (downward-looking)
Sensitivity	0.12 mV per W m^{-2} (variable from sensor to sensor, typical value listed)
Calibration Factor (Reciprocal of Sensitivity)	8.5 W m^{-2} per mV (variable from sensor to sensor, typical value listed)
Calibration Uncertainty	± 5 %
Measurement Range	-200 to 200 W m^{-2} (net longwave irradiance)
Measurement Repeatability	Less than 1 %
Long-term Drift (Non-stability)	Less than 2 % change in sensitivity per year
Non-linearity	Less than 1 %
Detector Response Time	Less than 0.5 seconds
Field of View	150°
Spectral Range	5 to 30 µm
Temperature Response	Less than 5% from -15 to 45 C
Window Heating Offset	Less than 10 W m^{-2}
Zero Offset B	Less than 5 W m^{-2}
Tilt Error	Less than 0.5 %
Uncertainty in Daily Total	± 5 %
Temperature Sensor	30 kΩ thermistor, ± 1 C tolerance at 25 C
Output from Thermistor	0 to 2500 mV (typical, other voltages can be used)
Input Voltage Requirement for Thermistor	2500 mV excitation (typical, other voltages can be used)

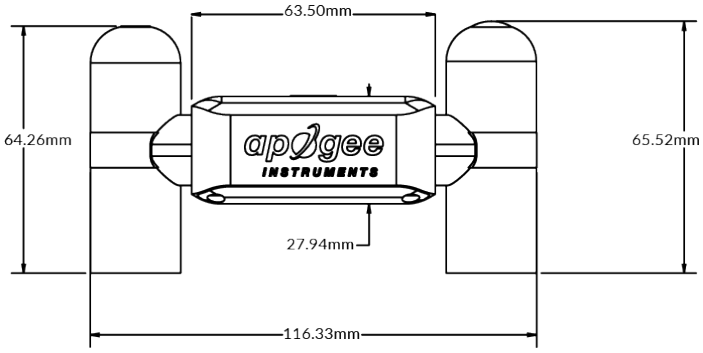
Calibration Traceability

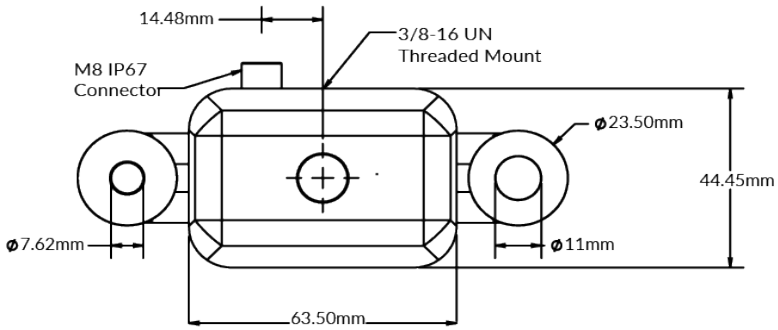
Apogee SL-510 and SL-610 pyrgeometers are calibrated against the mean of at least two Apogee model SL-510 transfer standard pyrgeometers inside a custom blackbody cone held at multiple fixed temperatures over a range of radiometer (detector and sensor body) temperatures. The temperature of the blackbody cone is measured with replicate precision thermistors thermally bonded to the cone surface. The transfer standard pyrgeometers are calibrated against the mean of least two reference upward-looking pyrgeometers under all sky conditions in Logan, Utah. Each of the two reference pyrgeometers are recalibrated on an alternating year schedule (one instrument per year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Infrared Standard Group (WISG) in Davos, Switzerland.

Net Radiometer

	SN-500-SS
Input voltage Range	5.5 to 24 V DC (heaters are optimized to run at 12 V DC)
Current Draw (12 V DC Supply Voltage)	Heaters on, communication enabled: 63 mA; Heaters off, communication enabled: 1.5 mA; Heaters off; communication disabled: 0.6 mA
Response Time (using SDI-12 Protocol)	1 s (SDI-12 data transfer rate; detector response times are 0.5 seconds)
Heaters (4 sensors individually heated)	62 mA current draw and 740 mW power requirement at 12 V DC
Operating Environment	-50 to 80 C; 0 to 100 % relative humidity
Dimensions	116 mm length, 45 mm width, 66 mm height
Mass	320 g (with mounting rod and 5 m of lead wire)
Cable	M8 connector (IP68 rating) to interface to sensor housing, 5 m of four conductor, shielded, twisted-pair wire, additional cable available in multiples of 5 m, TPR jacket (high water resistance, high UV stability, flexibility in cold conditions), pigtail lead wires

Dimensions


63.50mm
64.26mm
65.52mm
apogee
INSTRUMENTS
27.94mm
116.33mm


14.48mm
3/8-16 UN
Threaded Mount
M8 IP67
Connector
⌀23.50mm
44.45mm
⌀7.62mm
⌀11mm
63.50mm