



apogee
INSTRUMENTS

APOGEE NDVI & PRI SENSORS | S2-100 Series & S2-400 Series

Two-band radiometers inform environment and plant health

Features

Overview

Apogee two-band radiometers combine two photodetectors that measure specific wavelength ranges. They are designed to continuously measure reflectance for calculation of the normalized difference vegetation index (NDVI) or photochemical reflectance index (PRI) of plant canopies.

Key Features

Digital SDI-12 output is standard with analog options available by request. Domed diffuser promotes self-cleaning to minimize errors from dust and debris.

Wavelength Ranges

NDVI (S2-411, S2-412)

- Red detector = 650 nm with 10 nm FWHM*
- NIR detector = 810 nm with 10 nm FWHM

PRI (S2-421, S2-422)

- Green detector = 532 nm with 10 nm FWHM
- Yellow detector = 570 nm with 10 nm FWHM

*FWHM = full-width half-max

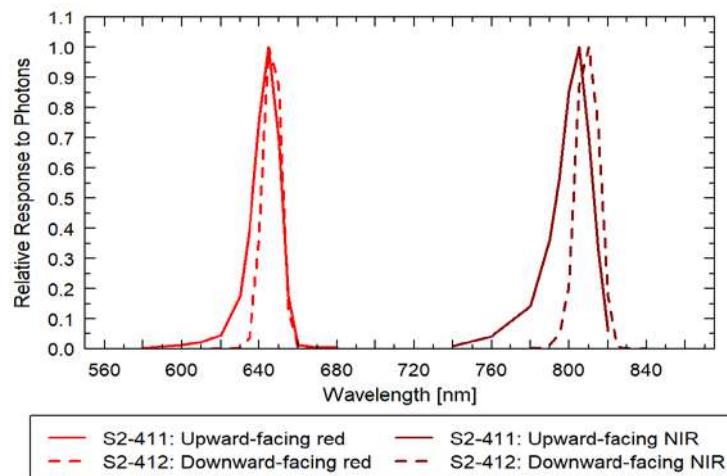
$$\text{NDVI} = \frac{\rho_{\text{NIR}} - \rho_{\text{Red}}}{\rho_{\text{NIR}} + \rho_{\text{Red}}} \quad \text{PRI} = \frac{\rho_{\text{Green}} - \rho_{\text{Yellow}}}{\rho_{\text{Green}} + \rho_{\text{Yellow}}}$$

Where ρ = reflectance (%)

For Best Measurements

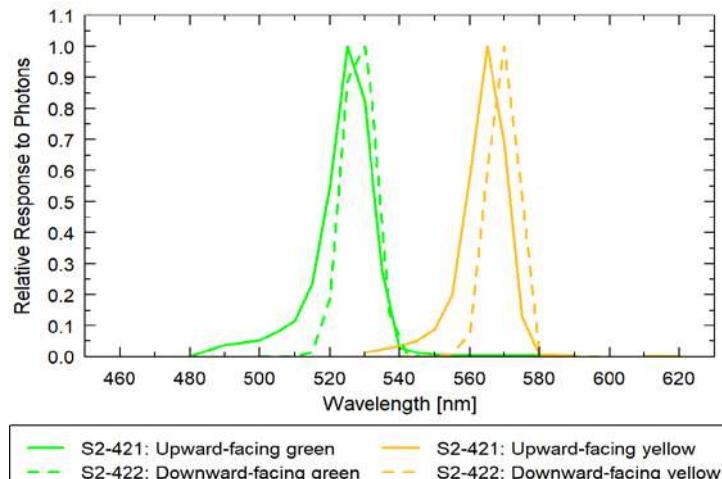
For best results, we recommend pairing upward-looking sensor(s) with downward-looking sensors.

NDVI Spectral Response



Above: The NDVI sensors have the spectral ranges of 650 nm with 10 nm full-width half-maximum (Red) and 810 nm with 10 nm full-width half-maximum (NIR). The spectral responses can be seen in the graph to the left.

PRI Spectral Response



Above: The PRI sensors have the spectral ranges of 532 nm with 10 nm full-width half-maximum (Green) and 570 nm with 10 nm full-width half-maximum (Yellow). The spectral responses can be seen in the graph to the left.



APOGEE NDVI SERIES | S2-111, S2-112, S2-411, and S2-412

Overview

NDVI provides a measure of canopy chlorophyll content and leaf area and is often used to monitor green-up in the spring and senescence in the fall.

Specifications

	Analog Output		Digital Output			
	S2-111-SS (Upward-Looking)	S2-112-SS (Downward-Looking)	S2-411-SS (Upward-Looking)	S2-412-SS (Downward-Looking)		
Power Supply	Self-powered		5.5 to 24 V DC			
Output (sensitivity)	5 mV per W m^{-2} (Red) 6.67 mV per W m^{-2} (NIR)	10 mV per W m^{-2} (Red) 6.67 mV per W m^{-2} (NIR)	—	—		
Calibration Factor (reciprocal of sensitivity)	0.2 W m^{-2} (Red) 0.15 W m^{-2} (NIR)	0.1 W m^{-2} (Red) 0.15 W m^{-2} (NIR)	Custom for each sensor and stored in firmware			
Calibration Uncertainty	$\pm 5\%$					
Output Range	18.5 mV (Red) 26 mV (NIR)	20 mV (Red) 20 mV (NIR)	SDI-12			
Wavelength Ranges	Red detector = 650 nm with 10 nm FWHM* NIR detector = 810 nm with 10 nm FWHM*					
Measurement Range	2x full sunlight					
Measurement Repeatability	Less than 1 %					
Long-term Drift	Less than 2 % per year					
Response Time	Less than 1 ms		Less than 0.6 s			
Field of View	180°	40°	180°	40°		
Directional (Cosine) Response	$\pm 2\%$ at 45°; $\pm 5\%$ at 75° zenith angle					
Temperature Response	Less than 0.1 % per C					
Housing	Anodized aluminum body with acrylic diffuser					
IP Rating	IP68					
Operating Environment	-40 to 70 C; 0 to 100 % relative humidity					
Dimensions	30.5 mm diameter, 36.6 mm height	23.5 mm diameter, 40 mm height	30.5 mm diameter, 36.6 mm height	23.5 mm diameter, 40 mm height		
Mass	51 g	110 g (with 5 m of cable)	51 g	110 g (with 5 m of cable)		
Warranty	4 years against defects in materials and workmanship					

*FWHM = full-width half-maximum



APOGEE PRI SERIES | S2-121, S2-122, S2-421, and S2-422

Overview

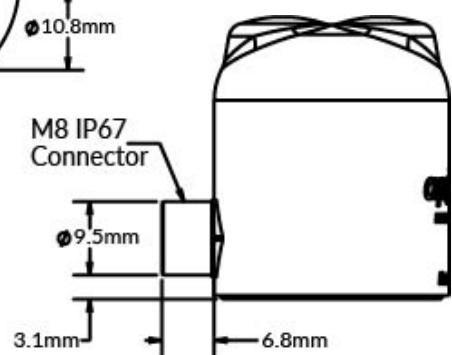
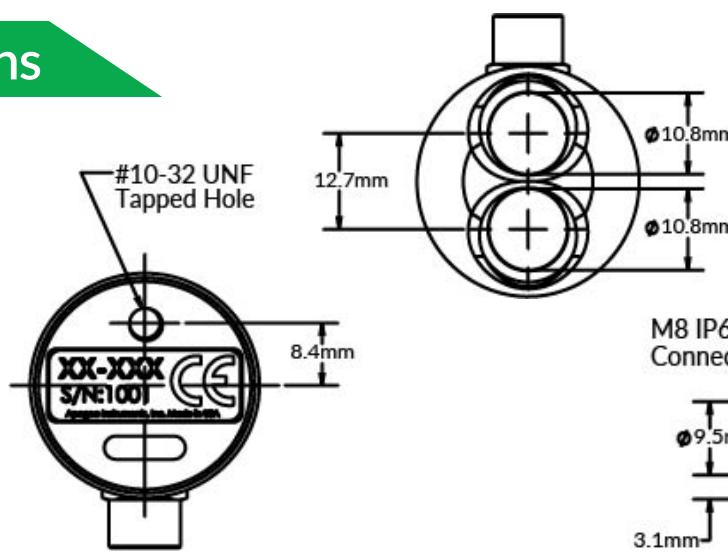
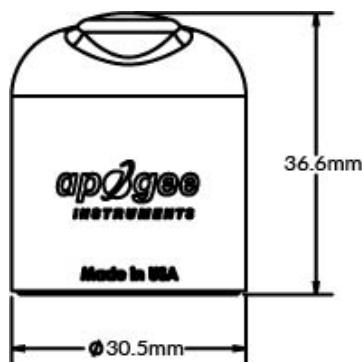
PRI is related to canopy light use efficiency and is often used in studies of canopy light use efficiency and response to stress.

Specifications

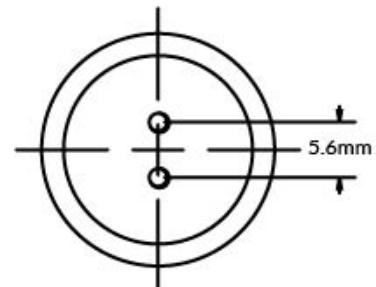
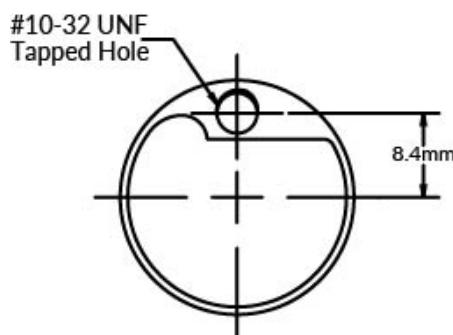
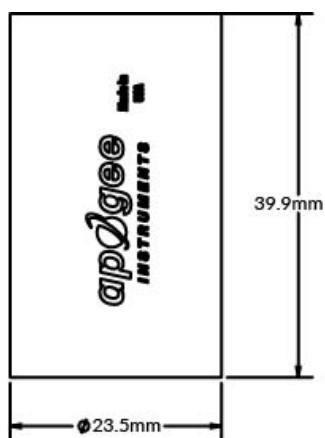
Analog Output		Digital Output	
	S2-121-SS (Upward-Looking)	S2-122-SS (Downward-Looking)	S2-421-SS (Upward-Looking)
Power Supply	Self-powered		5.5 to 24 V DC
Output (sensitivity)	1.43 mV per W m^{-2} (Green) 1.43 mV per W m^{-2} (Yellow)	14.3 mV per W m^{-2} (Green) 14.3 mV per W m^{-2} (Yellow)	—
Calibration Factor (reciprocal of sensitivity)	0.7 W m^{-2} per mV (Green) 0.7 W m^{-2} per mV (Yellow)	0.07 W m^{-2} per mV (Green) 0.07 W m^{-2} per mV (Yellow)	Custom for each sensor and stored in firmware
Calibration Uncertainty	$\pm 5\%$		
Output Range	5 mV (Green) 5 mV (Yellow)	10 mV (Green) 10 mV (Yellow)	SDI-12
Wavelength Ranges	Green detector = 532 nm with 10 nm FWHM* Yellow detector = 570 nm with 10 nm FWHM*		
Measurement Range	2x full sunlight		
Measurement Repeatability	Less than 1 %		
Long-term Drift	Less than 2 % per year		
Response Time	Less than 1 ms		Less than 0.6 s
Field of View	180°	40°	180°
Directional (Cosine) Response	$\pm 2\%$ at 45°; $\pm 5\%$ at 75° zenith angle		
Temperature Response	Less than 0.1 % per C		
Housing	Anodized aluminum body with acrylic diffuser		
IP Rating	IP68		
Operating Environment	-40 to 70 C; 0 to 100 % relative humidity		
Dimensions	30.5 mm diameter, 36.6 mm height	23.5 mm diameter, 40 mm height	30.5 mm diameter, 36.6 mm height
Mass	51 g	110 g (with 5 m of cable)	51 g
Warranty	4 years against defects in materials and workmanship		

*FWHM = full-width half-maximum

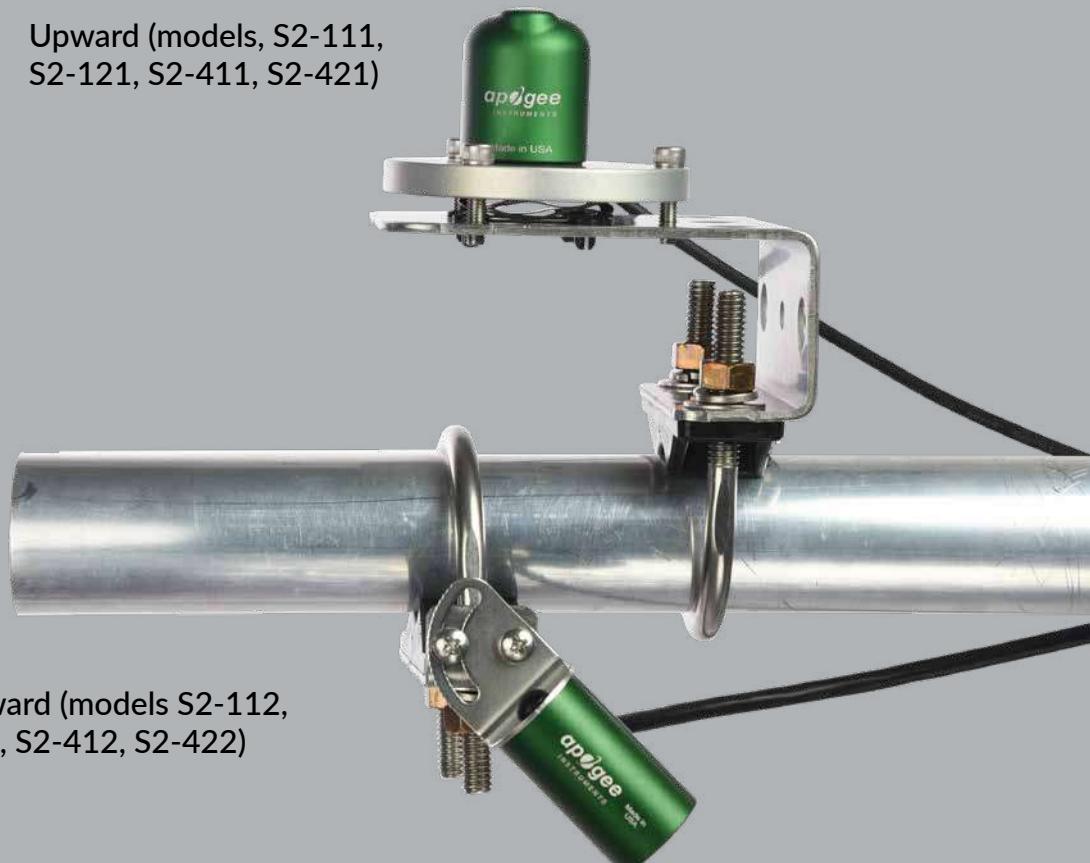
Upward Dimensions



Downward Dimensions



Upward (models, S2-111,
S2-121, S2-411, S2-421)



Downward (models S2-112,
S2-122, S2-412, S2-422)