



# 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

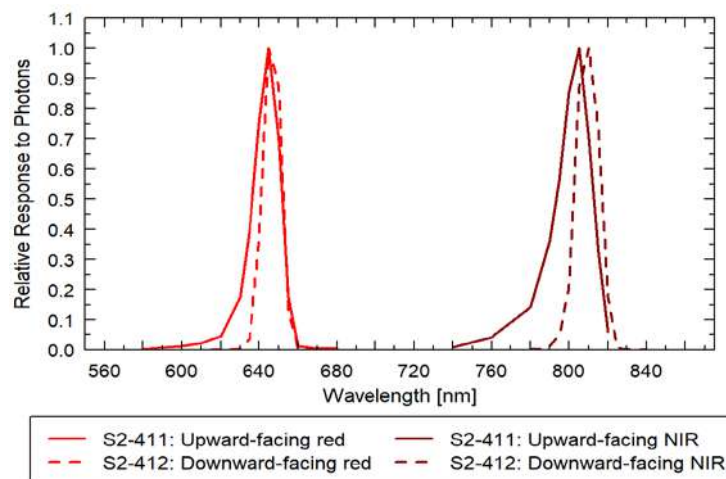
$$NDVI = \frac{\rho_{NIR} - \rho_{Red}}{\rho_{NIR} + \rho_{Red}} \quad PRI = \frac{\rho_{Green} - \rho_{Yellow}}{\rho_{Green} + \rho_{Yellow}}$$

Where  $\rho$  = reflectance (%)

### For Best Measurements

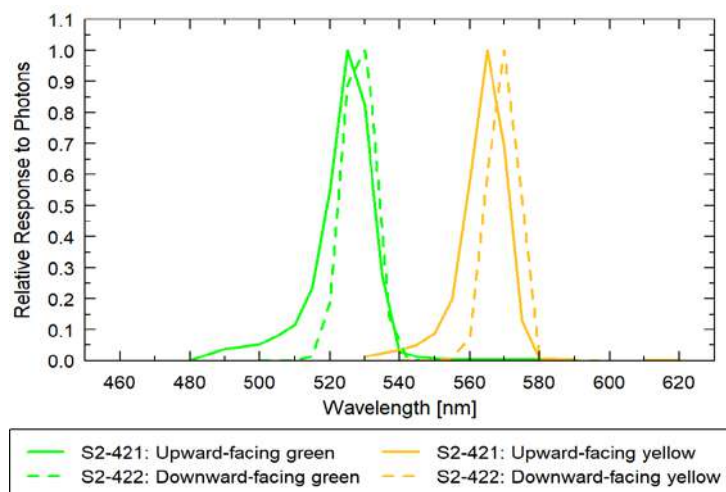
For best results, we recommend pairing upward-looking sensor(s) with downward-looking sensors.

### 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 <sup>-2</sup> (Red) 6.67 mV per W m <sup>-2</sup> (NIR)	10 mV per W m <sup>-2</sup> (Red) 6.67 mV per W m <sup>-2</sup> (NIR)	—	—
Calibration Factor (reciprical of sensitivity)	0.2 W m <sup>-2</sup> (Red) 0.15 W m <sup>-2</sup> (NIR)	0.1 W m <sup>-2</sup> (Red) 0.15 W m <sup>-2</sup> (NIR)	Custom for each sensor and stored in firmware	
Calibration Uncertainty	± 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 Repeat-ability	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	± 2 % at 45°; ± 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				

\*FWHM = full-width half-maximum





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

## Overview

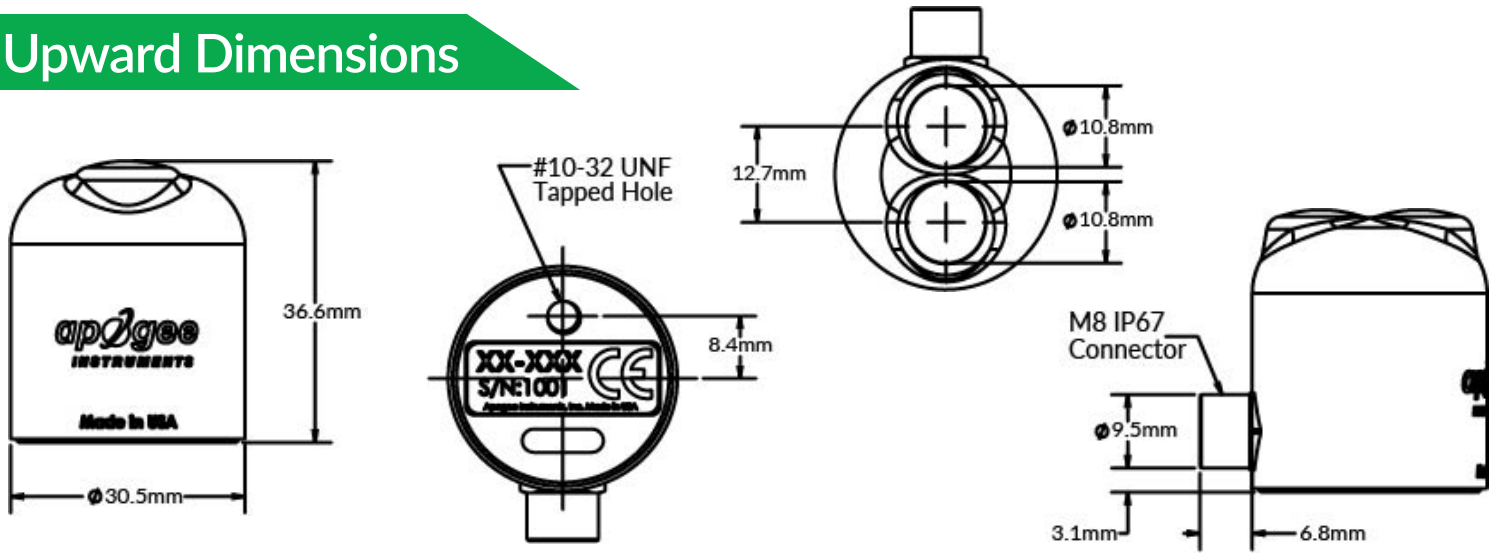
PRI is related to canopy light use efficiency and is often used in studies of canopy light use efficiency and response to stress.

## Specifications

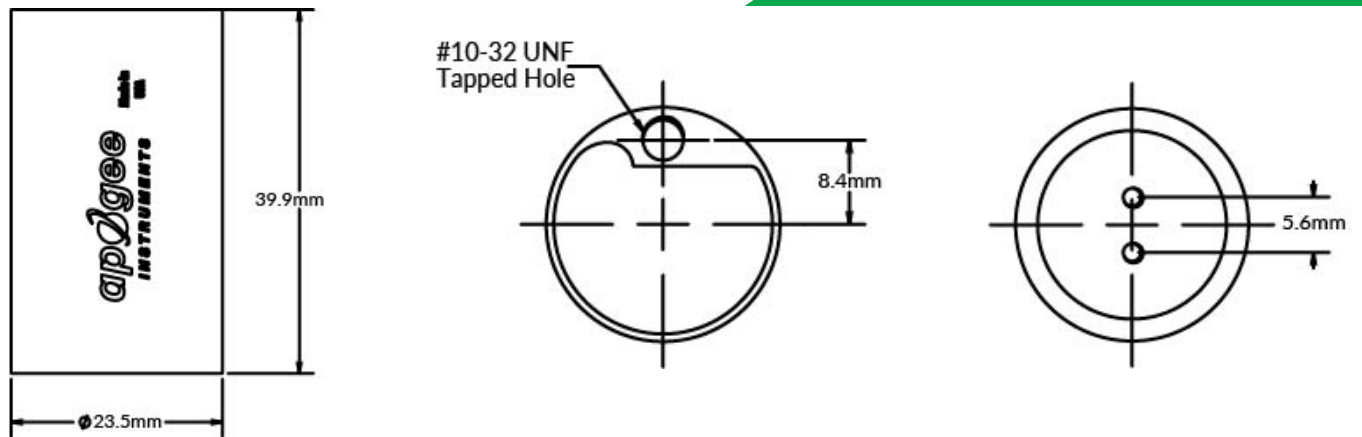
	Analog Output		Digital Output	
	S2-121-SS (Upward-Looking)	S2-122-SS (Downward-Looking)	S2-421-SS (Upward-Looking)	S2-422-SS (Downward-Looking)
Power Supply	Self-powered		5.5 to 24 V DC	
Output (sensitivity)	1.43 mV per W m <sup>-2</sup> (Green) 1.43 mV per W m <sup>-2</sup> (Yellow)	14.3 mV per W m <sup>-2</sup> (Green) 14.3 mV per W m <sup>-2</sup> (Yellow)	—	—
Calibration Factor (recipricol of sensitivity)	0.7 W m <sup>-2</sup> per mV (Green) 0.7 W m <sup>-2</sup> per mV (Yellow)	0.07 W m <sup>-2</sup> per mV (Green) 0.07 W m <sup>-2</sup> per mV (Yellow)	Custom for each sensor and stored in firmware	
Calibration Uncertainty	± 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°	40°
Directional (Cosine) Response	± 2 % at 45°; ± 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
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Warranty	4 years against defects in materials and workmanship			
*FWHM = full-width half-maximum				

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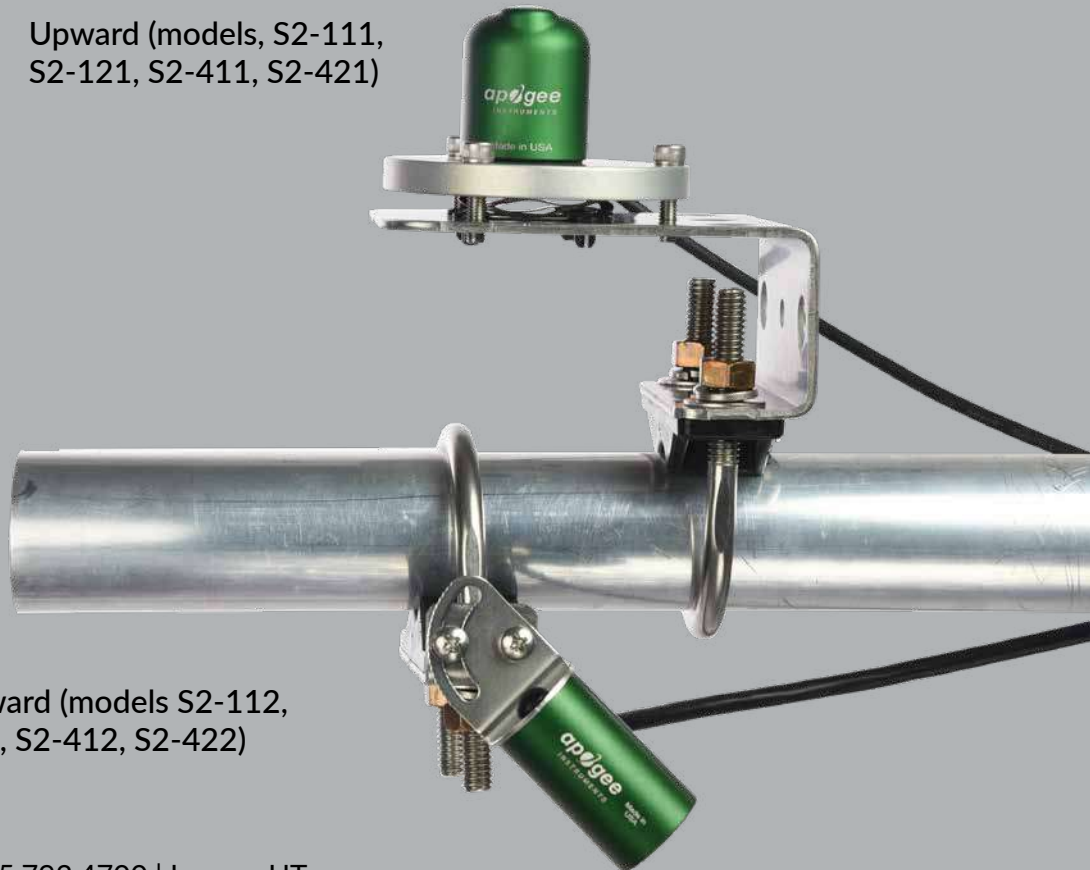
## Upward Dimensions



## Downward Dimensions



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



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