

# Environmental Sensors

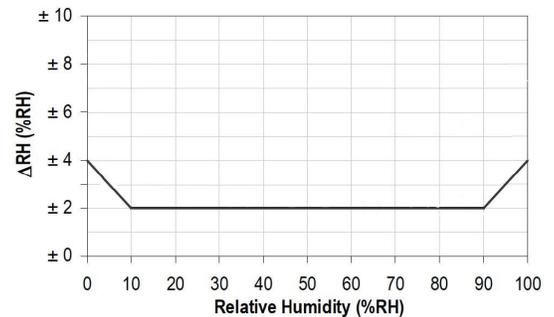
## Environmental Sensing for ENV-Link™ Pro Sensor Nodes

### Digital Relative Humidity and Temperature Sensor

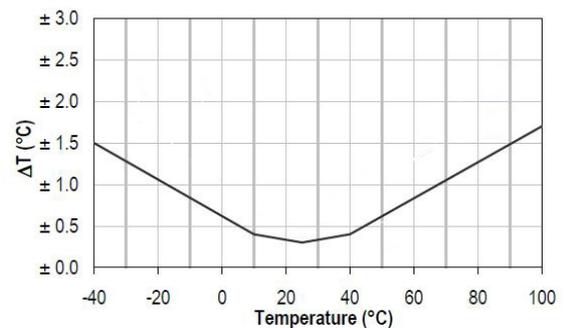
The relative humidity and temperature (RHT) sensor is a highly accurate, surface-mountable device designed exclusively for LORD MicroStrain®'s ENV-Link sensor nodes. A unique capacitive sensor element is used for measuring relative humidity, while temperature is measured by a band-gap sensor. Both sensor elements are coupled to an analog-to-digital converter and a serial interface circuit for seamless data throughput to the node. They are individually calibrated in a precision humidity chamber, and the calibration coefficients saved in the sensor memory so sensors can be swapped without reconfiguration.



Relative Humidity Sensor	
Measurement range	0 to 100 % RH
Accuracy	± 2 % (10 to 90 % RH) ± 4 % (0 to 10% RH and 90 to 100% RH)
Resolution	12 bit
Repeatability	± 0.1 % RH
Hysteresis	± 1 % RH
Non-linearity	<< 1 % RH
Response time	8 s
Long-term drift	< 0.5 % RH/year
Temperature Sensor	
Measurement range	-40 °C to + 123.8 °C
Accuracy	± 0.3 °C
Resolution	14 bit
Repeatability	± 0.1 °C
Long-term drift	< 0.04 °C/year
Operating Parameters	
Power source	2.4 to 5.5 V dc
Power consumption	90 µW (average)
Operating temperature	-40 °C to + 123.8 °C
Physical Specifications	
Dimensions	54 mm x 21 mm x 100 mm
Weight	36 grams
Environmental rating	IP67 when connected
Cable	2 meter cable to bare leads
Integration	
Compatible nodes	ENV-Link™-Pro
Regulatory compliance	ROHS



Maximal RH-tolerance at 25°C per sensor type.



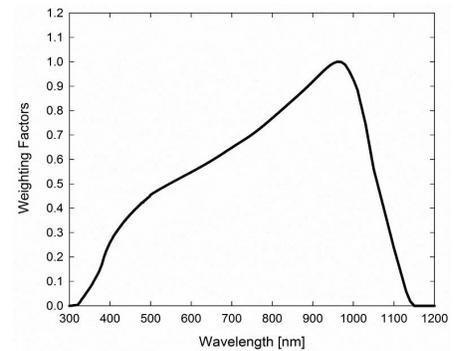
Maximal T-tolerance per sensor type.

## Silicon-Cell Photodiode Pyranometer Sensor

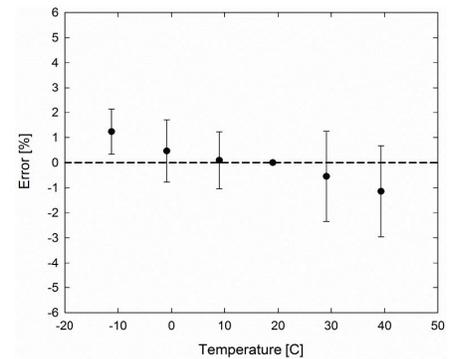
The silicon-cell pyranometer is calibrated to measure total shortwave radiation. It is commonly used in solar site characterization for renewable energy potential and in agricultural applications. The intensity of shortwave radiation is measured in watts per meter squared. This cosine-corrected sensor is designed to maintain its accuracy when radiation comes from low zenith angles.



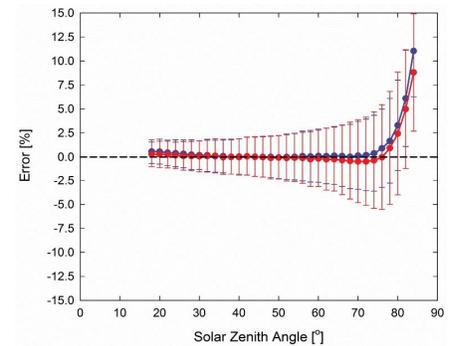
Pyranometer	
Measurement range	0 to 1750 W Watt m <sup>2</sup>
Accuracy	± 5 % (absolute accuracy)
Sensitivity	Calibrated to exactly 0.20 mV per Watt m <sup>2</sup>
Field of view	180 degrees
Directional (cosine) response	45 ° zenith angle: ± 1%, 75 ° zenith angle: ± 5%
Repeatability	< 1 %
Non-linearity	< 1 %
Response time	< 1 ms
Long-term drift	< 2 % per year
Operating Parameters	
Power source	Self-powered
Operating temperature	-40 to 70 °C
Operating wavelength	360 nm to 1120 nm (wavelengths where response is > 10 % of maximum)
Operating humidity	0 to 100%
Physical Specifications	
Dimensions	24 mm x 28 mm
Weight	90 grams
Environmental rating	IP67 when connected, sensor can be submerged
Cable	5 meter cable to bare leads
Integration	
Compatible nodes	ENV-Link™-Pro
Mounting	Leveling/mounting plate available



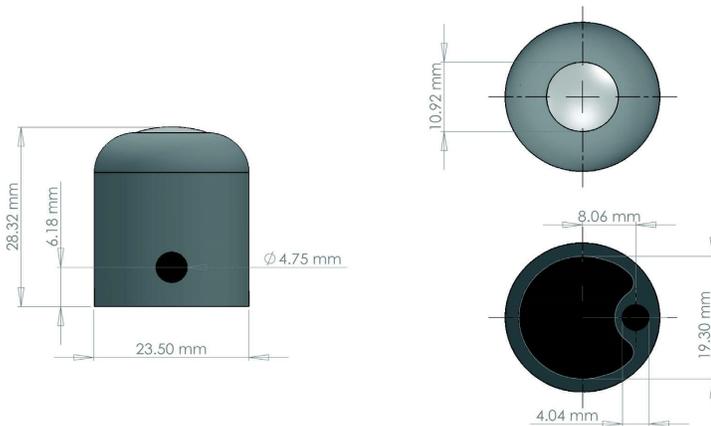
Spectral Response



Temperature Response



Cosine Response

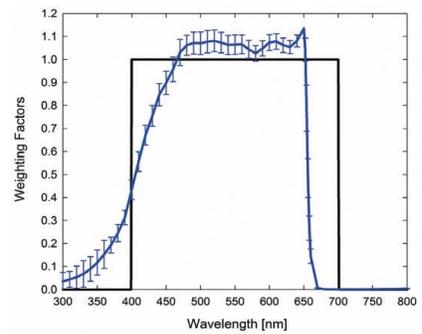
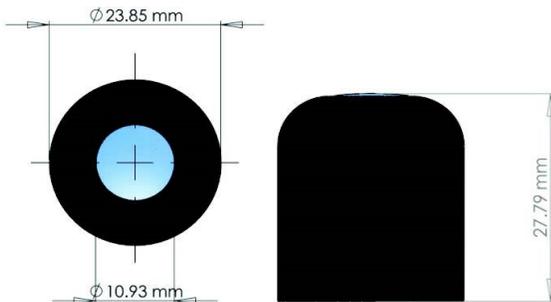


## Photosynthetic Photon Flux Sensor

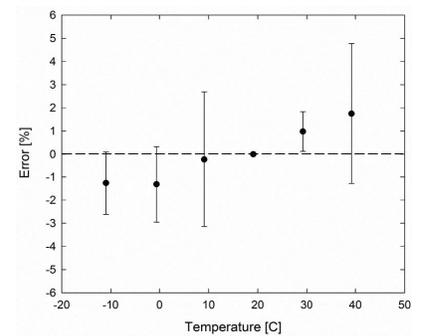
The photosynthetic photon flux sensor is a specialized device used to quantify potential for plant photosynthesis by measuring active radiation in the wavelength ranges strongly correlated with plant growth. The sensor is calibrated for use in sunlight, and an innovative blue lens improves the accuracy of measurements. The pigments in the lens filter the incoming light for an improved spectral response. Photosynthesis is driven by the number of photons between 400 and 700 nanometers (nm). This is called the Photosynthetic Photon Flux (PPF) and is measured in  $\mu\text{mol}/\text{m}^2/\text{s}$  (micro mols of photons per square meter per second). PPF sensors are commonly called quantum sensors because a quantum refers to the amount of energy carried by a photon.



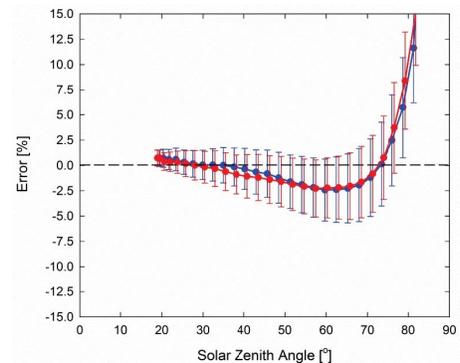
Photosynthetic Photon Flux Sensor	
Measurement range	0 to 4000 $\mu\text{mol}/\text{m}^2/\text{second}$
Accuracy	$\pm 5\%$ (absolute accuracy)
Sensitivity	Calibrated to exactly 0.2 mV per $\mu\text{mol}/\text{m}^2/\text{s}$
Field of view	180 degrees
Directional (cosine) response	45° zenith angle: $\pm 1\%$ , 75° zenith angle: $\pm 5\%$
Repeatability	< 1%
Non-linearity	< 1%
Response time	< 1 ms
Long-term drift	< 2% per year
Operating Parameters	
Power source	Self-powered
Operating temperature	-40 to 70 °C
Operating wavelength	410 nm to 655 nm (wavelengths where response is > 50% of maximum)
Operating humidity	0 to 100%
Physical Specifications	
Dimensions	24 mm x 28 mm
Weight	90 grams
Environmental rating	IP67 when connected, sensor can be submerged
Cable	5 meter cable to bare leads
Integration	
Compatible nodes	ENV-Link™-Pro
Mounting	Leveling/mounting plate available



Spectral Response



Temperature Response



Cosine Response

## Soil Moisture Sensor

The soil moisture probe enables monitoring of volumetric water content (VWC) by measuring the dielectric constant (electrical conductivity) of the soil medium using capacitance and frequency domain technology. Its 70 MHz frequency minimizes salinity and textural effects, making this sensor accurate in almost any soil or soil-less application. Factory calibrations are included for mineral soils, potting soils, rockwool, and perlite. The sensor is easy to install in the field and can also be used in nursery pots. The robust design makes it easy to push directly into undisturbed soil to ensure accuracy. It consumes only 10 mA of power and operates over a wide temperature range. Measurement is in % VWC with accuracy ranges in deciSiemens per meter (dS/m).



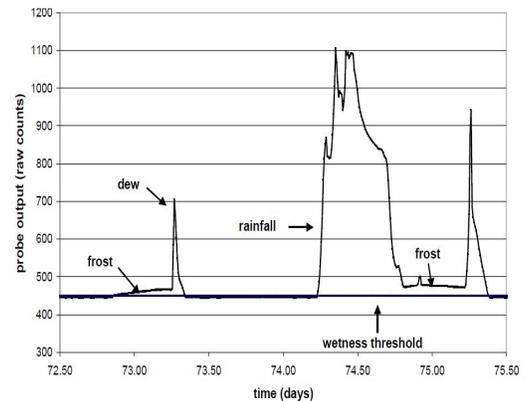
Soil Moisture Sensor	
<b>Sensor type</b>	Frequency domain, dielectric measurement
<b>Measurement range</b>	Up to 0 to 100% VWC (with polynomial equation, calibration dependent)
<b>Accuracy</b>	± 3% VWC, ± 1-2% VWC with soil specific calibration Mineral soil: up to 8 dS/m Rockwool: 0.5 to 8 dS/m Potting Soil: 3 to 14 dS/m
<b>Resolution</b>	Mineral soil: 0.1% VWC Rockwool and potting soil: 0.25% VWC
<b>Output</b>	Voltage: 10 to 40% of excitation voltage (250 to 1,000 mV output with 2.5 V excitation), correlated linearly (soil) or polynomially (growing medium) with VWC
<b>Response time</b>	10 ms
Operating Parameters	
<b>Excitation voltage</b>	2.5 to 3.6 V dc (2 or 3 V dc with ENV-Link)
<b>Power consumption</b>	10 mA
<b>Operating temperature</b>	0 to 50 °C
<b>Operating wavelength</b>	410 nm to 655 nm (wavelengths where response is > 50 % of maximum)
<b>Operating humidity</b>	0 to 100%
Physical Specifications	
<b>Dimensions</b>	93 mm x 18 mm x 7 mm
<b>Weight</b>	132 grams
<b>Environmental rating</b>	IP67 when connected, sensor can be submerged
<b>Cable</b>	5 meter cable to bare leads
Integration	
<b>Compatible nodes</b>	ENV-Link™-Pro

## Leaf Wetness Sensor

The leaf wetness sensor is specially designed to emulate the thermodynamic and radiative properties of real leaves. It is standardized and calibrated to detect the presence and duration of wetness and ice formation. Each sensor is precisely factory-calibrated to detect tiny amounts of water or ice on the leaf surface. The sensor surface coating is not hygroscopic, eliminating false wetness detection. Its thin fiberglass construction closely approximates the heat capacity of a typical leaf, and its overall radiation balance closely matches that of a healthy leaf.



Leaf Wetness Sensor	
<b>Sensor type</b>	Frequency domain, dielectric measurement
<b>Measurement range</b>	Dry to saturated
<b>Output</b>	Voltage; 320-1000 mV @ 3V excitation correlated linearly with digital counts 445 counts (dry) to 1400 counts (saturated)
<b>Accuracy</b>	+/- 10 counts
<b>Repeatability</b>	2 thresholds
<b>Response time</b>	10 ms
Operating Parameters	
<b>Excitation voltage</b>	2.5 to 5 V dc (2 or 3 V dc with ENV-Link)
<b>Power consumption</b>	2 mA @ 2.5 V dc, 7 mA @ 5 V dc
<b>Operating temperature</b>	-10 to 60 °C
<b>Operating humidity</b>	0 to 100%
Physical Specifications	
<b>Dimensions</b>	112 mm x 58 mm x 0.75 mm
<b>Weight</b>	139 grams
<b>Environmental rating</b>	IP67 when connected
<b>Cable</b>	5 meter cable to bare leads
Integration	
<b>Compatible nodes</b>	ENV-Link™-Pro



Sensor Output