

# Radiation Frost Detector | SF-110 and SF-421

Effective prediction of leaf and bud temperatures for orchards.

## Monitor Radiation Frost Events

On calm, clear nights surface temperature, including leaf and bud temperatures, can drop well below air temperature due to a net loss of longwave radiation to the clear sky. A radiation frost occurs when frost forms at the surface before the air temperature reaches freezing (0 C). Under cloudy and/or windy conditions, radiation frost events do not occur. The Apogee radiation frost detector is a combination of two high accuracy thermistors mounted in a single housing. One sensor is designed to mimic a leaf and one sensor is designed to mimic a bud, providing estimates of leaf and bud temperatures and a direct means of monitoring radiation frost events.

## Wide Range, Accurate Measurements

Thermistor accuracy is  $\pm 0.1$  C across a range of 0 to 70 C, providing accurate measurements at temperatures near zero where frost damage is likely to occur.

## Output Options

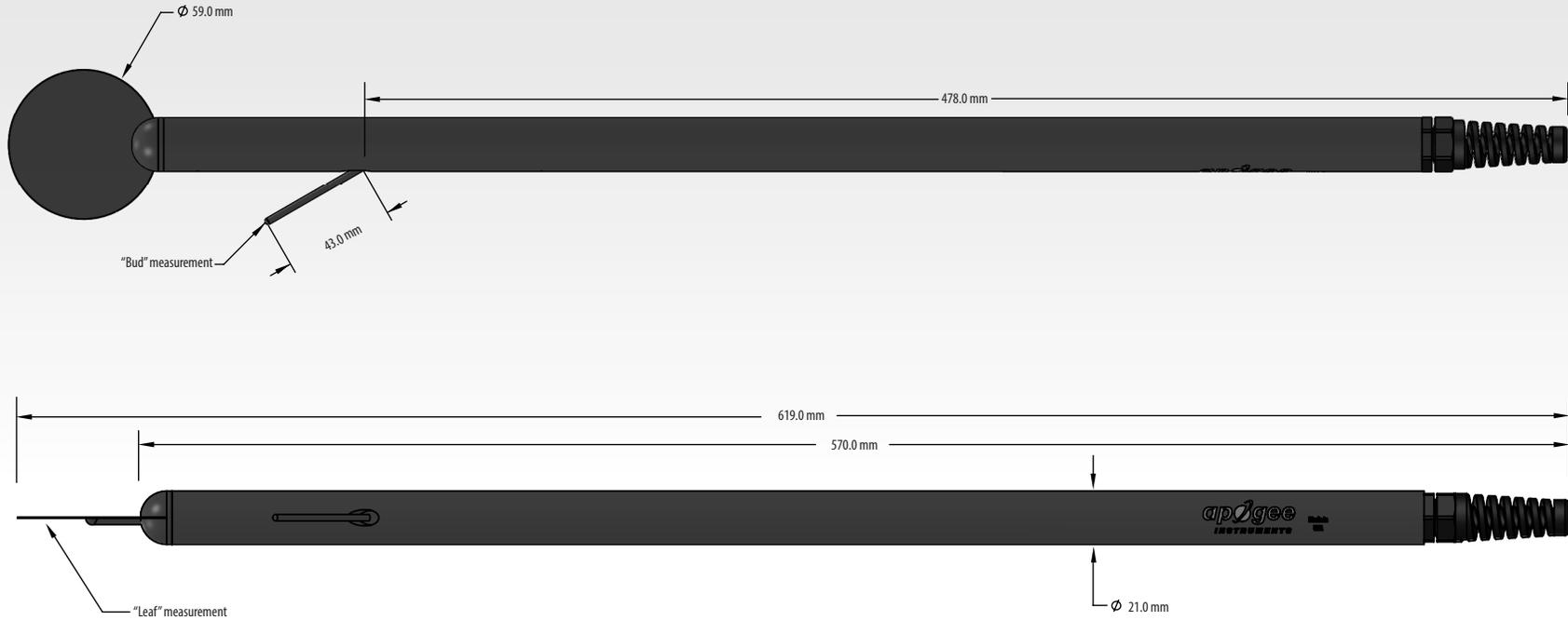
Analog and digital output options are available. Analog version is an un-amplified voltage output. Digital version is SDI-12 communication protocol.

## Typical Applications

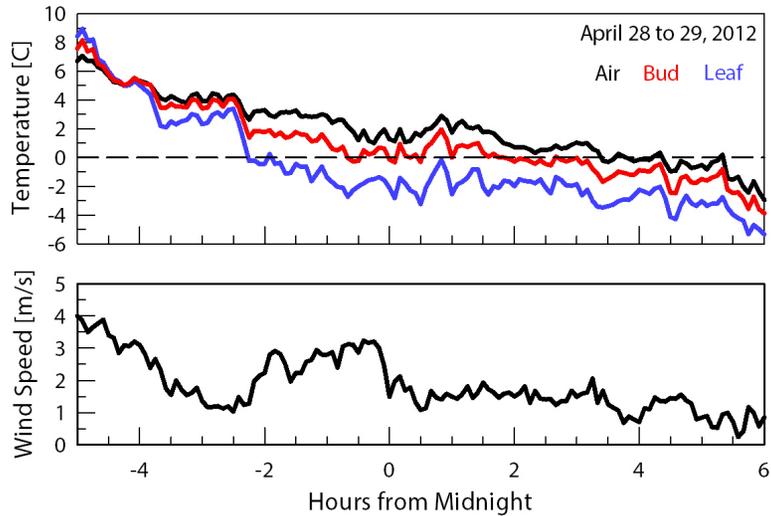
Applications include leaf and bud temperature estimates in cropped fields, orchards, and vineyards. Leaf and bud temperatures returned by the detector can then be used to alert growers to the potential of frost damage to crops.



## Dimensions



## Temperature Response



Leaf and bud temperature approximations measured with an Apogee SF-110 compared to air temperature (top panel) and wind speed (bottom panel) on the evening of April 28, 2012. Leaf and bud temperatures were both below air temperature after 8 P.M. and reached freezing 6 (leaf) and 4 (bud) hours before the air temperature.

	SF-110	SF-421
Measurement Range	-50 to 70 C	
Measurement Uncertainty	0.1 C (from 0 to 70 C); 0.2 C (from -25 to 0 C); 0.4 (from -50 to -25 C)	
Measurement Repeatability	Less than 0.05 C	
Long-term Drift (Non-stability)	Less than 0.02 C per year (when used in non-condensing environments where the annual average temperature is less than 30 C; continuously high temperatures or continuously humid environments increase drift rate)	
Equilibration Time	10 s	
Self-heating	Less than 0.01 C (typical, assuming pulsed excitation of 2.5 V DC), 0.08 C at 5 C (maximum, assuming continuous input excitation of 2.5 V DC)	Less than 0.01 C
Operating Environment	-50 to 70 C; 0 to 100 % relative humidity	
Input Voltage Requirement	2.5 V DC excitation	4.5 to 24 V DC
Output Voltage Range	0 to 2.5 V DC (assuming input excitation of 2.5 V DC)	-
Current Drain	0.1 mA DC (per thermistor) at 70 C (maximum, assuming continuous input excitation of 2.5 V DC)	0.6 mA (quiescent); 1.3 mA (active)
Dimensions	570 mm length, 21 mm pipe diameter, 70 mm disk diameter	
Mass	400 g	
Cable	5 m of shielded, twisted-pair wire; additional cable available in multiples of 5 m; santoprene rubber jacket (high water resistance, high UV stability, flexibility in cold conditions); pigtail lead wires	
Warranty	4 years against defects in materials and workmanship	