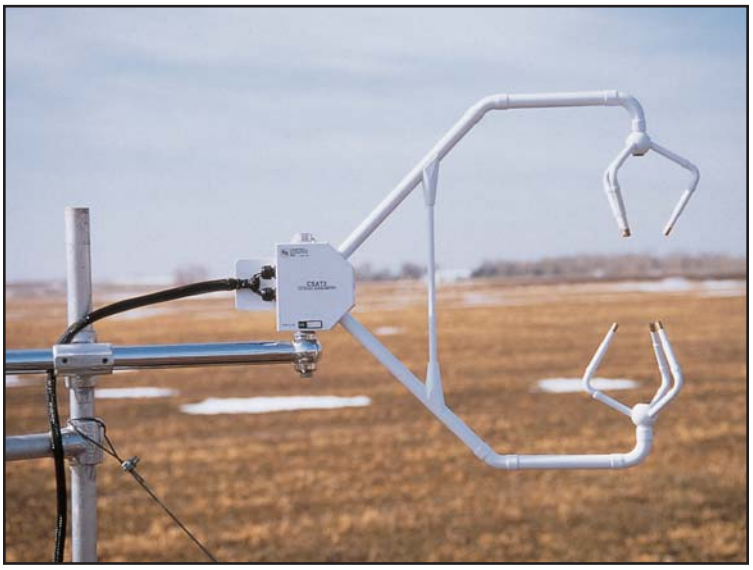
3-D Sonic Anemometer

Model CSAT3

Campbell Scientific, Inc.'s model CSAT3 3-D Sonic Anemometer has a 10 cm vertical measurement path, operates in a pulsed acoustic mode, and withstands exposure to harsh weather conditions. Three orthogonal wind components (u_x, u_y, u_z) and the speed of sound (c) are measured and output at a maximum rate of 60 Hz. Analog outputs and two types of digital outputs are provided. Measurements can be triggered from three sources: the CSAT3's internal clock, a PC-generated RS-232 command, or our datalogger's SDM command. The SDM protocol supports a group trigger for synchronizing multiple CSAT3s. The model FW05 fine wire thermocouple (12.7 µm diameter) is available as an option for fast response temperature measurements.



The CSAT3, shown making measurements over a fallow field in Minnesota, provides precision turbulence measurements with minimal flow distortion.

Specifications*

Measurements:

Outputs: u_x, u_y, u_z, c (u_x, u_y, u_z are wind components referenced to the anemometer axes; c is speed of sound)

Speed of Sound: determined from 3 acoustic paths; corrected for crosswind effects

Measurement Rate: programmable from 1 to 60 Hz, instantaneous measurements; two oversampled modes are block averaged to either 20 Hz or 10 Hz

Measurement Resolution: u_x, u_y is 1 mm s^{-1} rms; u_z is 0.5 mm s^{-1} rms; c is 15 mm s^{-1} (0.025°C) rms; values are for instantaneous measurements made on a constant signal; noise is not affected by sample rate

Accuracy: (-30° to +50°C operating range; wind speeds < 30 m s^{-1}; wind angles between ±170°):

Offset error:

u_x, u_y:	<±4.0 cm s^{-1}
u_z:	<±2.0 cm s^{-1}

Gain error:

Wind vector within ±5° of horizontal	<±2 percent of reading
Wind vector within ±10° of horizontal	<±3 percent of reading
Wind vector within ±20° of horizontal	<±6 percent of reading

Rain: Innovative ultrasonic signal processing and user installable wicks considerably improve the performance of the anemometer under all rain events

Output Signals:

Digital SDM: CSI 33.3 k baud serial interface for datalogger/sensor communication
Data type: 2-byte integer per output plus 2-byte diagnostic

Digital RS-232: Baud rate: 9600, 19200 bps
Data type: 2-byte integer per output plus 2-byte diagnostic

Analog: Number of outputs: 4
Voltage range: ±5 V
Number of bits: 12

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Specifications (cont.)

Reporting Range

SDM and RS-232 Digital Outputs:

Full scale wind: ±65.535 m s^{-1} autoranging between four ranges; least significant bit is 0.25 to 2 mm s^{-1}

Speed of sound: 300 to 366 m s^{-1} (-50° to +60°C); least significant bit is 1 mm s^{-1} (0.002°C)

Analog Outputs:

Output	Range	LSB
u_x, u_y	±30 m s^{-1}	15 mm s^{-1}
	±60 m s^{-1}	30 mm s^{-1}
u_z	±8 m s^{-1}	4 mm s^{-1}
c	300 to 366 m s^{-1} (-50° to +60°C)	16 mm s^{-1} (0.026°C)

Physical Description

Measurement Path Length: 10.0 cm vertical; 5.8 cm horizontal

Path Angle from Horizontal: 60 degrees

Transducer: 0.64 cm diameter

Transducer Mounting Arms: 0.84 cm diameter

Support Arms: 1.59 cm diameter

Dimensions:

Anemometer head:
47.3 cm (l) x 42.4 cm (h)

Electronics box:
26 cm x 16 cm x 9 cm

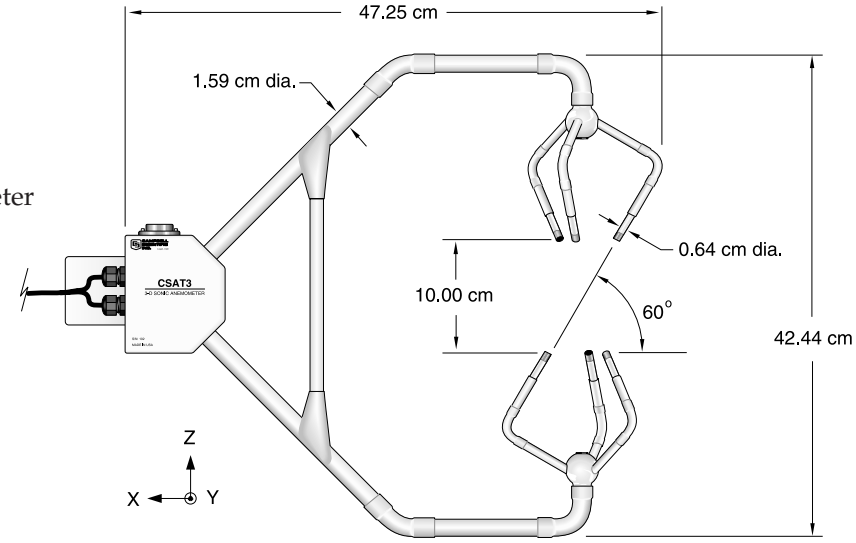
Weight:

Anemometer head: 1.7 kg (3.7 lb)

Electronics box: 3.8 kg (8.4 lb)

Materials:

Sealed sonic transducers and electronics:
Anemometer head: stainless steel tubing
Electronics box: cast aluminum



Anemometer Head

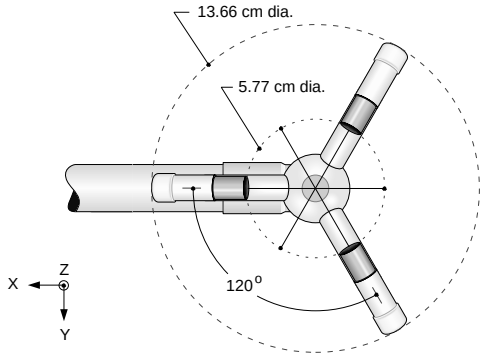
Environmental

Operating Temperature Range: -30° to +50°C

Power Requirements

Voltage Supply: 10 to 16 Vdc

Current: 200 mA @ 60 Hz measurement rate;
100 mA @ 20 Hz measurement rate



Lower Transducer Assembly
Top View

* Specifications are subject to change

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