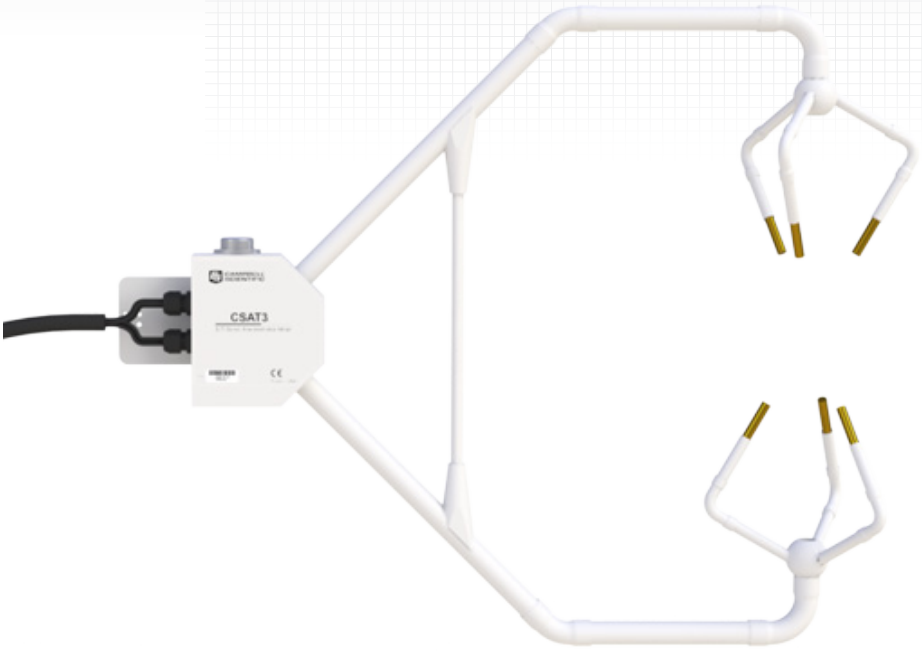
CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

CSAT3

3D Sonic Anemometer



Precision Measurements

Best instrument for flux and other turbulence research projects

Overview

Campbell Scientific's CSAT3 3D Sonic Anemometer is the 3D sonic anemometer of choice for eddy-covariance measurements. It has an aerodynamic design, 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:

- Datalogger's SDM command
- CSAT3's internal clock
- PC-generated RS-232 command

The SDM protocol supports a group trigger for synchronizing multiple CSAT3s.

Benefits and Features

- Innovative design provides precision turbulence measurements with minimal flow distortion
- Can be combined with EC150 or EC155 gas analyzers giving near complete colocation for eddy-covariance measurements
- Compatible with most Campbell Scientific dataloggers
- Measurements can be used to calculate momentum flux and friction velocity
- Campbell Scientific's fine wire thermocouples are an option for fast-response temperature measurements
- Field rugged
- Rain: Innovative signal processing and transducer wicks considerably improves performance of the anemometer duringrain events
- Sealed sonic transducers and electronics

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 three acoustic paths; corrected for crosswind effects
- Measurement Rate: programmable from 1 to 60 Hz, instantaneous measurements; two over-sampled modes are block averaged to either 20 Hz or 10 Hz

Measurement Precision RMS[a]

- u_x, u_y: 1 mm s^{-1} rms
- u_z: 0.5 mm s^{-1} rms
- c: 15 mm s^{-1} (0.025°C) rms
- Wind Direction: 0.06° rms

Accuracy[b]

- Offset error: <±8.0 cm s^{-1} (u_x, u_y), <±4.0 cm s^{-1} (u_z)
- Gain Error
  Wind Vector within ±5° of horizontal: <±2% of reading
  Wind Vector within ±10° of horizontal: <±3% of reading
  Wind Vector within ±20° of horizontal: <±6% of reading
- Wind Direction: ±0.7° at 1 m s^{-1} for horizontal wind

Output Signals

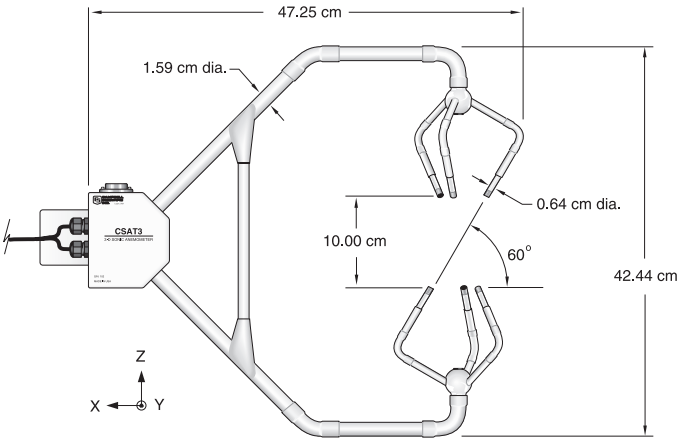
- Digital SDM: CSI 33.3 k bps serial interface for datalogger/sensor communication. Data type is 2 B integer per output plus 2 B diagnostic

Digital RS-232

- Baud rate: 9600, 19200 bps
- Data type: 2 B integer per output plus 2 B diagnostic

Analog

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



Anemometer Head

Reporting Range

- Analog Outputs:

Output	Reporting Range	LSB
u_x, u_y	±30 m s^{-1}, ±60 m s^{-1}	15 mm 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)

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)

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 x 16 x 9 cm

Weight

- Anemometer head: 1.7 kg (3.7 lb)
- Electronics box: 3.8 kg (8.4 lb)

Materials

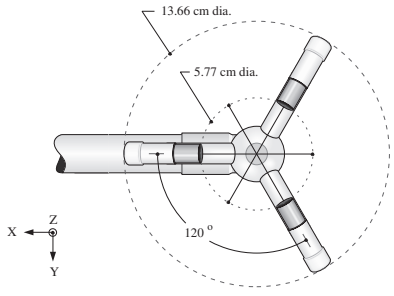
- Anemometer head: stainless steel tubing
- Electronics box: cast aluminum

Environmental

- Operating Temperature: -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

[a]Resolution values are for instantaneous measurements made on a constant signal; noise is not affected by sample rate.

[b]Accuracy specifications assume -30° to +50°C operating range; wind speeds < 30 m s^{-1}; wind angles between ±170°.

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