



Precision Measurements

Best instrument for flux and other high-level turbulence research projects

Overview

The CSAT3 is a three-dimensional sonic anemometer that measures three orthogonal wind components and the speed of sound. In eddy covariance systems, it can measure the turbulent fluctuations of horizontal and vertical wind.

These measurements are then used to calculate momentum flux and friction velocity. This sonic anemometer can also provide average horizontal wind speed and direction measurements. The CSAT3 comes with 25 ft cables.

Benefits and Features

- › Provides precision turbulence measurements with minimal flow distortion
- › FW05 fine wire thermocouple (12.7 μm diameter) is available as an option for fast response temperature measurements
- › Withstands exposure to harsh weather conditions
- › Measurements can be used to calculate momentum flux and friction velocity
- › Compatible with most Campbell Scientific data loggers

Technical Description

The CSAT3 has a 10 cm vertical measurement path and operates in a pulsed acoustic mode. The 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 from the CSAT3's internal clock, the PC-generated RS-232 command, or the datalogger's SDM command. The SDM protocol supports a group trigger for synchronizing multiple CSAT3s.

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Specifications

Measurement Path Length › 10.0 cm (3.94 in.) vertical
› 5.8 cm (2.28 in.) horizontal

Path Angle from Horizontal 60°

Construction Sealed sonic transducers and electronics

Anemometer Head Materials Stainless-steel tubing

Electronics Box Materials	Cast aluminum
Operating Temperature Range	-30° to +50°C
Voltage Supply	10 to 16 Vdc
Current	<ul style="list-style-type: none"> › 200 mA (60 Hz measurement rate) › 100 mA (20 Hz measurement rate)
Digital SDM Output Signal	CSI 33.3 k baud serial interface for data logger/sensor communication. (Data type is 2-byte integer per output plus 2-byte diagnostic.)
Support Arm Diameter	1.59 cm (0.63 in.)
Transducer Diameter	0.64 cm (0.25 in.)
Transducer Mounting Fingers Diameter	0.84 cm (0.33 in.)
Cable Length	7.62 m (25 ft)
Anemometer Head Dimensions	47.3 x 42.4 cm (18.6 x 16.7 in.)
Anemometer Head Weight	1.7 kg (3.7 lb)
Electronics Box Dimensions	26 x 16 x 9 cm (10.24 x 6.3 x 3.54 in.)
Electronics Box Weight	3.8 kg (8.4 lb)

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 Resolution	<ul style="list-style-type: none"> › 0.06° rms (wind direction) › 15 mm/s (0.025°C) rms (c) › 0.5 mm/s rms (u_z) › Resolution values are for instantaneous measurements made on a constant signal; noise is not affected by sample rate. › 1 mm/s rms (u_x, u_y)
Offset Error	<ul style="list-style-type: none"> › < ±8.0 cm/s (u_x, u_y) › Offset error and gain error values assume the -30° to +50°C range, wind speeds of < 30 m/s, and wind angles between ±170°.

	› < ±4.0 cm/s (u_z)
Gain Error	<ul style="list-style-type: none"> › < ±2% of reading (wind vector within ±5° of horizontal) › < ±6% of reading (wind vector within ±20° of horizontal) › < ±3% of reading (wind vector within ±10° of horizontal) › Offset error and gain error values assume the -30° to +50°C range, wind speeds of < 30 m/s, and wind angles between ±170°.
Wind Direction Accuracy	±0.7° at 1 m/s (for horizontal wind)
Rain	Innovative ultrasonic signal processing and user-installable wicks considerably improve the performance of the anemometer under all rain events.

Digital RS-232 Output Signal

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

SDM & RS-232 Digital Outputs Reporting Range

Full-Scale Wind	±65.535 m/s autoranging between four ranges (Least significant bit is 0.25 to 2 mm/s.)
Speed of Sound	300 to 366 m/s (-50° to +60°C) Least significant bit is 1 mm/s (0.002°C).

Analog Outputs Reporting Range

u_x	±30 m s ⁻¹ , ±60 m s ⁻¹
u_y	±30 m s ⁻¹ , ±60 m s ⁻¹
u_z	±8 m s ⁻¹
c	300 to 366 m s ⁻¹ (-50 to +60°C)

Analog Outputs LSB

u_x	15 mm s ⁻¹ , 30 mm s ⁻¹
u_y	15 mm s ⁻¹ , 30 mm s ⁻¹
u_z	±8 m s ⁻¹
c	16 mm s ⁻¹ (0.026°C)

For comprehensive details, visit: www.campbellsci.eu/csats 



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