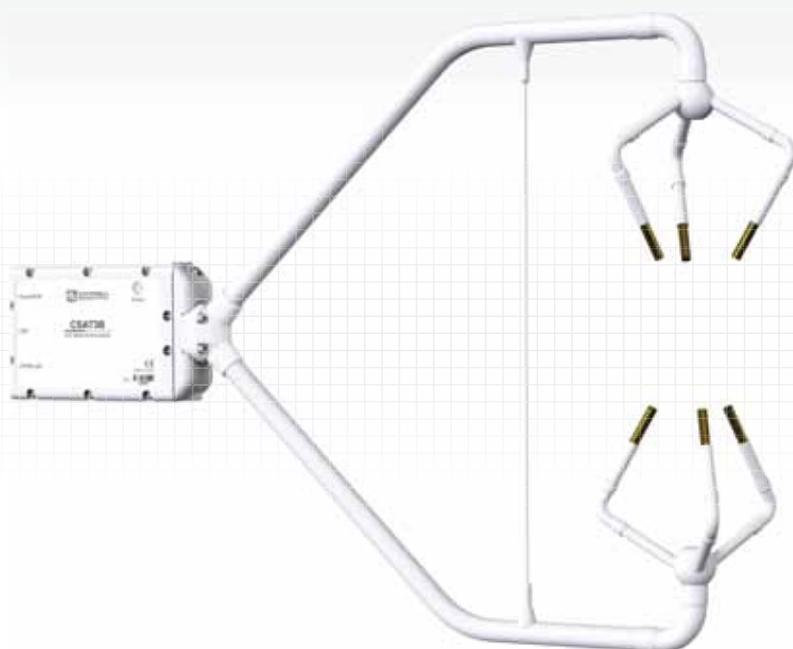




CSAT3B

3D Sonic Anemometer



Precision Measurements

Designed for flux and other turbulence research projects

Overview

Campbell Scientific's CSAT3B 3D Sonic Anemometer is an update and replacement to the original CSAT3, and remains 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 sonic temperature (T_s) are measured and output at a maximum rate of 100 Hz.

The most conspicuous innovation of the new design is the elimination of the electronics box. Instead, the electronics are packaged inside

the mounting block of the CSAT3B head. This design feature makes installation easier and offers greater flexibility in instrument placement.

Measurements can be triggered from three sources:

- › Datalogger SDM command
- › Datalogger CPI command
- › CSAT3B internal clock

The SDM and CPI protocols both support mechanisms for synchronizing multiple CSAT3Bs.

Benefits and Features

- › Integrated electronics that provide easy mounting of a single piece of hardware
- › Integrated inclinometer
- › High-precision measurements ideal for turbulence and eddy covariance studies
- › An improved design with a thin, aerodynamic support strut close to the ends of the sensor arms, creating greater rigidity and improved accuracy of sonic temperature
- › Datalogger sampling supported for any frequency between 1 and 100 Hz
- › New CPI communications for more robust, higher bandwidth measurements
- › Multiple communication options including SDM, CPI, USB, and RS-485
- › Internal temperature and humidity measurements with easily replaced desiccant
- › Version 5 algorithm for calculating data outputs; combines the signal sensitivity of version 3 with the rain performance of version 4
- › Includes options to filter high frequencies for applications requiring analysis of non-aliased spectra

More info: 435.227.9060

campbellsci.com/csats3b



Specifications

Measurements

- Operating temperature range: -30° to +50°C
- 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
- Filter Bandwidths: 5, 10, 20, or 25 Hz

Wind Accuracy^b

- Offset error (maximum): $<\pm 8.0 \text{ cm s}^{-1}$ (u_x , u_y), $<\pm 4.0 \text{ cm s}^{-1}$ (u_z)
- Gain error (maximum)
 - Wind vector within $\pm 5^\circ$ of horizontal: $<\pm 2\%$ of reading
 - Wind vector within $\pm 10^\circ$ of horizontal: $<\pm 3\%$ of reading
 - Wind vector within $\pm 20^\circ$ of horizontal: $<\pm 6\%$ of reading

Measurement Resolution

- u_x , u_y : 1 mm s^{-1} rms
- u_z : 0.5 mm s^{-1} rms
- c : $\pm 0.002 \text{ }^\circ\text{C}$ RMS at 25 °C

Measurement Rates

- Datalogger Triggered: 1 to 100 Hz
- Unprompted Output (to PC): 10, 20, 50, or 100 Hz
- Internal Self-Trigger Rate: 100 Hz

Measurement Delay

- Datalogger-Triggered (no filter): 1 trigger period (1 scan interval)
- Unprompted Output (no filter): 10 ms
- Filtered Output (Datalogger-Prompted or Unprompted to PC):
 - 795 ms with 5 Hz bandwidth filter
 - 395 ms with 10 Hz bandwidth filter
 - 195 ms with 20 Hz bandwidth filter
 - 155 ms with 25 Hz bandwidth filter

Internal Monitor Measurements

- Update Rate: 2 Hz
- Inclinator Accuracy: $\pm 1^\circ$
- Relative Humidity Accuracy:
 - $\pm 3\%$ over 10 to 90% range
 - $\pm 7\%$ over 0 to 10% range
 - $\pm 7\%$ over 90 to 100% range
- Board Temperature Accuracy: $\pm 2^\circ\text{C}$

Communications

SDM (use for datalogger-based data acquisition)

- Bit Period: 10 μs to 1 ms

- Cable Length:
 - 7.6 m (25 ft) max @ 10 μs bit period
 - 76 m (250 ft) max @ 1 ms bit period
- Address Range: 1 to 14
- Bus Clocks per Sample: ~ 200

CPI (Used for datalogger-based data acquisition)

- Baud Rate: 50 kbps to 1 Mbps
- Cable Length: 15 m (50 ft) max @ 1 Mbps
 - 122 m (400 ft) max @ 250 kbps
 - 853 m (2800 ft) max @ 50 kbps
- Address Range: 1 to 120
- Bus Clocks per Sample: ~ 300

RS-485 (used for configuration or PC-based data acquisition)

- Baud rate: 9.6 kbps to 115.2 kbps
- Cable Length: 305 m (1000 ft) max @ 115.2 kbps
 - 610 m (2000 ft) max @ 9.6 kbps
- Bus Clocks per Sample: ~ 500 (ASCII formatted)

USB (used for configuration or PC-based data acquisition)

- Connection Speed: USB 2.0 full speed 12 Mbps
- Cable Length: 5 m maximum

Power Requirements

- Voltage supply: 9.5 to 32 Vdc

Current

- 10 Hz Measurement Rate: 110 mA @ 12 Vdc; 65 mA @ 24 Vdc
- 100 Hz Measurement Rate: 145 mA @ 12 Vdc; 80 mA @ 24 Vdc

Physical Description

- Measurement path length: 10.0 cm (3.9 in) vertical;
 - 5.8 cm (2.3 in) horizontal
- Transducer angle from horizontal: 60 degrees
- Transducer diameter: 0.64 cm (0.25 in)
- Transducer mounting arms diameter: 0.84 cm (0.33 in)
- Support arms diameter: 1.59 cm (0.63 in)
- Anemometer Head Weight: 1.45 kg (3.2 lb)

Anemometer Overall

- Length: 60.64 cm (23.87 in)
- Height: 43.0 cm (16.9 in)
- Width: 12.2 cm (4.8 in)

^aAccuracy specifications assume -30° to +50°C operating range; wind speeds $< 30 \text{ m s}^{-1}$; wind angles between $\pm 170^\circ$.

