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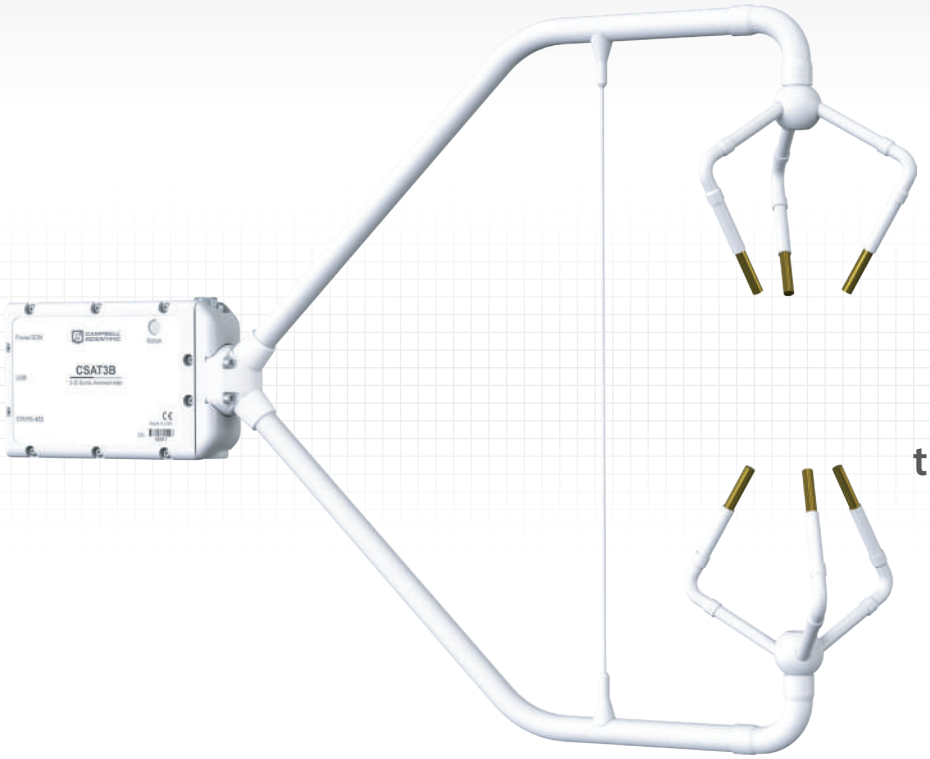
WHEN MEASUREMENTS MATTER

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

Specifications

Measurements

- Operation temperature range: -30 to +50 °C, equivalent to 312 to 368 m s^{-1} in speed of sound
- Outputs: u_x, u_y, u_z, T_s (u_x, u_y, u_z are wind components referenced to the anemometer axes; T_s is sonic temperature in degrees Celsius)
- Speed of sound: Determined from three acoustic paths; corrected for crosswind effects
- Wind direction range: 2.5 to 357.5° in CSAT3B coordinate system; 0 to 360° customized
- Filter Bandwidths: 5, 10, 20, or 25 Hz

Wind Accuracy[b]

- Offset error (maximum): <±8.0 cm s^{-1} (u_x, u_y), <±4.0 cm s^{-1} (u_z)
- Gain error (maximum)
  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

Measurement Resolution

- u_x, u_y: 1 mm s^{-1} rms
- u_z: 0.5 mm s^{-1} rms
- T_s: ± 0.002 °C RMS at 25 °C
- Wind direction: < 0.058° ($u_x = u_y \leq 1$ m s^{-1})

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
- Inclinometer Accuracy: ± 1°
- Relative Humidity Accuracy:
  ± 3 % over 10 to 90% range
  ± 7 % over 0 to 10% range
  ± 7 % over 90 to 100 % range
- Board Temperature Accuracy: ± 2°C

Compliance Information

- View the EU Declaration of Conformity for the CSAT3B cables at: www.campbellsci.com/csat3bcbl1-l

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)

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