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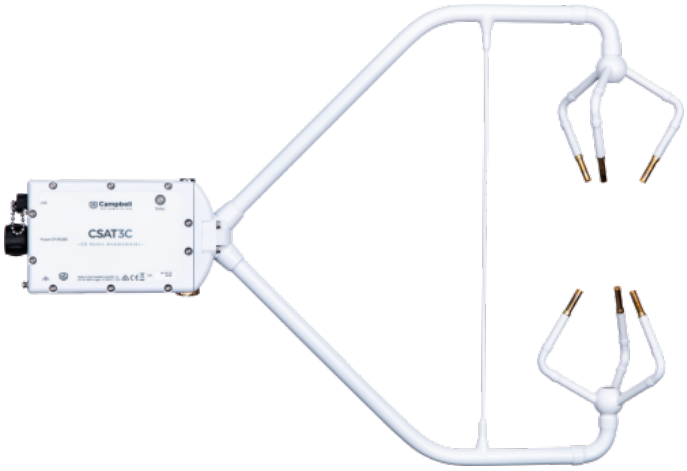
CSAT3C

3-D Sonic Anemometer for Demanding Flux Research



Next-Generation 3-D Sonic Anemometer Based on Three Decades of Flux Research

Overview

Building on more than three decades of field-proven sonic anemometer performance, the CSAT3C delivers reliable 3-D wind flux measurements in even the harshest environments.

First introduced in 1995, the CSAT3 set the standard for measuring turbulent fluxes with its non-orthogonal design optimized for eddy-covariance applications. Each generation has since evolved based on real-world field feedback, including the CSAT3B's integrated electronics.

Now, the CSAT3C advances that legacy with a design hardened for challenging conditions.

While maintaining the same trusted measurement geometry and version 5 algorithm, the CSAT3C introduces meaningful durability and usability improvements, including improved and advanced coatings, dustproof and waterproof sealed connectors, and simplified installation. It provides three-dimensional wind measurements (Ux, Uy, and Uz) and sonic temperature (Ts) at output rates up to 100 Hz. The result is a reliable, long-term solution for accurate 3-D wind speed and direction monitoring, even in precipitation and very high winds.

Benefits and Features

- Reduced flow distortion with a field-proven design
- Ability to capture rapidly changing turbulence conditions with a high-rate output
- Streamlined installation with a single-cable design
- Version 5 algorithm for calculating data outputs, combining the signal sensitivity of version 3 with the rain performance of version 4
- More diagnostics without added sensors
- Improved data accuracy in real time with online crosswind correction
- Refined flux measurements with optional Kaimal corrections
- Open outputs for direct integration into non-Campbell Scientific data loggers and computers without proprietary hardware requirements

Detailed Description

Reduced Flow Distortion

The CSAT3-series non-orthogonal, field-proven aerodynamic design has been cited in more than 100 peer-reviewed

research papers. The CSAT3C retains this design, which is engineered to minimize flow distortion.

Reliable Operation

The CSAT3C has an upgraded transducer coating and sealed connectors.

Measurement of Rapidly Changing Conditions

The CSAT3C delivers up to 100 Hz output with selectable bandwidth filters for accurate flux measurements, making the CSAT3C ideal for turbulence and eddy-covariance studies.

Streamlined Installation

The CPIP cable carries power and communications in one cable. It is being standardized across all future Campbell Scientific micromet sensors to eliminate setup complexity and wiring errors in the field.

Additional Diagnostics

With a built-in inclinometer and internal temperature and relative humidity measurements, the CSAT3C provides additional context for data and system monitoring.

Improved Data Accuracy

The CSAT3C automatically corrects speed of sound and sonic temperature measurements to eliminate the need for additional post-processing.

Refined Flux Measurements

Optional Kaimal corrections account for transducer diameter and sonic path length, reducing flow distortion effects unique to the sensor geometry.

Compatibility

- CPI mode provides synchronization of all sensor measurements across complex topologies.
- RS-485 ASCII mode features 100 Hz unprompted output, selectable bandwidth filters, and high noise immunity on long cable runs, enabling direct integration into third-party data acquisition systems.

Specifications

Sensor	Three-dimensional sonic anemometer
Operating Temperature Range	-40° to +50°C
Measurement Path Length	10.0 cm (3.9 in.) vertical; 5.8 cm (2.3 in.) horizontal
Transducer Angle from Horizontal	60 degrees
Wind Full-Scale Range	± 65 m s^{-1}
Sonic Temperature Resolution	±0.002°C RMS (at 25°C)
Sonic Temperature Reporting Range	-40° to +50°C
Ingress Protection	IP67
Compliance	RCM CE/RoHS2
Transducer Diameter	0.64 cm (0.25 in.)
Transducer Mounting Arm Diameter	0.84 cm (0.33 in.)
Support Arm Diameter	1.59 cm (0.63 in.)
Overall Dimensions	63.1 x 12.3 x 43.3 cm (24.8 x 4.9 x 17.0 in.)
Anemometer Head Weight	1.9 kg (4.2 lb)

Measurement Rates

Data Logger Triggered	1 to 100 Hz
Unprompted Output (to computer)	1, 10, 20, 50, or 100 Hz
Internal Self-Trigger Rate	100 Hz

Measurement Delay

Data Logger Triggered (no filter)	One trigger period (one scan interval)
Unprompted Output (no filter)	10 ms
Filtered Output (data-logger-prompted or unprompted to computer)	395 ms (with 10 Hz bandwidth filter) 795 ms (with 5 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)
Board Temperature Accuracy	±2°C

Power Requirements

Anemometer Voltage Requirement	10.5 to 32 Vdc
Current at 10 Hz Measurement Rate	❱ 65 mA (@ 24 Vdc) ❱ 110 mA (@ 12 Vdc)
Current at 100 Hz Measurement Rate	❱ 80 mA (@ 24 Vdc) ❱ 145 mA (@ 12 Vdc)

Wind Accuracy

-NOTE-	*Accuracy specifications assume the following:* ❱ *-40° to +50°C operating range* ❱ *Wind speeds < 30 m s^{-1}* ❱ *Wind angles between ±170°*
Maximum Offset Error	< ±8.0 cm s^{-1} (u_x, u_y), < ±4.0 cm s^{-1} (u_z)
Maximum Gain Error	❱ < ±3% of reading (wind vector within ±10° of horizontal) ❱ < ±2% of reading (wind vector within ±5° of horizontal) ❱ < ±6% of reading (wind vector within ±20° of horizontal)

Wind Resolution

u_x, u_y	1 mm s^{-1} RMS
u_z	0.5 mm s^{-1} RMS

CPI

-NOTE-	*Used for Campbell Scientific data-logger-based, time-synchronized data acquisition*
Baud Rate	50 kbps to 1 Mbps
Cable Length	❱ 122 m (400 ft) maximum (@ 250 kbps) ❱ 853 m (2800 ft) maximum (@ 50 kbps) ❱ 15 m (50 ft) maximum (@ 1 Mbps)
Address Range	1 to 120
Bus Clocks per Sample	~300

RS-485

-NOTE-	*Used for third-party data acquisition system integration*
Baud Rate	9.6 kbps to 115.2 kbps
Cable Length	❱ 305 m (1,000 ft) maximum (@ 115.2 kbps) ❱ 610 m (2,000 ft) maximum (@ 9.6 kbps)
Bus Clocks per Sample	~500 (ASCII formatted)

USB

-NOTE-	*Used for anemometer configuration*
Connection Speed	USB 2.0 full speed 12 Mbps
Cable Length	5 m (16.4 ft) maximum

For comprehensive details, visit: www.campbellsci.com/csat3c

Campbell Scientific, Inc. | 815 W 1800 N | Logan, UT 84321-1784 | (435) 227-9120 | www.campbellsci.com
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