



EC150 and CSAT3A

Open-Path CO₂/H₂O Gas Analyzer and Sonic Anemometer



Innovative Design

Use as part of open-path eddy-covariance system

Overview

Campbell Scientific's EC150 is an open-path analyzer specifically designed for eddy covariance flux measurements. Combined with the CSAT3A sonic anemometer as shown above, these two components

of an open-path eddy-covariance system simultaneously measure carbon dioxide, water vapor, air temperature, barometric pressure, and three-dimensional wind speed and sonic air temperature.

Benefits and Features

- › Unique optical configuration gives a slim aerodynamic shape with minimal wind distortion
- › Analyzer and sonic anemometer measurements are synchronized by a common set of electronics
- › Maximum output rate of 60 Hz with 20 Hz bandwidth
- › Low power consumption; suitable for solar power applications
- › Low noise
- › Measurements are temperature compensated without active heat control
- › Angled windows to shed water and are tolerant to window contamination
- › Field rugged
- › Field serviceable
- › Factory calibrated over wide range of CO₂, H₂O, pressure, and temperature in all combinations encountered in practice
- › Extensive set of diagnostic parameters
- › Fully compatible with Campbell Scientific dataloggers; field setup, configuration, and field zero and span can be accomplished directly from the datalogger
- › Speed of Sound: Determined from three acoustic paths; corrected for crosswind effects
- › Rain: Innovative signal processing and transducer wicks considerably improve performance of the anemometer during precipitation events

Outputs

CSAT3A

- › U_x (m/s)
- › U_y (m/s)
- › U_z (m/s)
- › Sonic Temperature (°C)
- › Sonic Diagnostic

EC150

- › CO₂ Density (mg/m³)
- › H₂O Density (g/m³)
- › Gas Analyzer Diagnostic
- › Ambient Temperature (°C)

- › Atmospheric Pressure (kPa)
- › CO₂ Signal Strength
- › H₂O Signal Strength
- › Source Temperature (°C)

More info: 780.454.2505

www.campbellsci.ca/ec150



General Specifications^a

- › Operating Temperature Range: -30° to +50°C
- › Calibrated Pressure Range: 70 to 106 kPa
- › Input Voltage: 10 to 16 Vdc
- › Power @ 25°C: 5 W (steady state and power up)
- › Measurement Rate: 60 Hz
- › Output Bandwidth: 5, 10, 12.5, or 20 Hz; user programmable
- › Output Options: SDM, RS-485, USB, analog (CO₂ and H₂O only)
- › Auxiliary Inputs: air temperature and pressure
- › EC150 Head and Cables Weight: 2.0 kg (4.4 lb)
- › CSAT3A Head and Cables Weight: 1.7 kg (3.7 lb)
- › EC100 Electronics Weight: 3.2 kg (7.1 lb)
- › Cable Length: 3 m (10 ft) from EC150 and CSAT3A to EC100
- › Gas Analyzer/Sonic Volume Separation: 5.0 cm (2.0 in)
- › Warranty: 3 years or 17,500 hours of operation, whichever comes first

Gas Analyzer Specifications^{a,b}

- › Path Length: 15.37 cm (6.05 in)

Performance

	CO ₂	H ₂ O
Accuracy^c	1% ^d	2% ^d
Precision RMS (maximum)^e	0.2 mg/m ³ (0.15 μmol/mol)	0.004 g/m ³ (0.006 mmol/mol)
Calibrated Range	0 to 1,000 μmol/mol ^f	0 to 72 mmol/mol (38°C dewpoint)
Zero Drift with Temperature (maximum)	±0.55 mg/m ³ /°C (±0.3 μmol/mol/°C)	±0.037 g/m ³ /°C (±0.05 mmol/mol/°C)
Gain Drift with Temperature (maximum)	±0.1% of reading/°C	±0.3% of reading/°C
Cross Sensitivity (maximum)	±1.1 x 10 ⁻⁴ mol CO ₂ /mol H ₂ O	±0.1 mol H ₂ O/mol CO ₂

Sonic Anemometer Specifications^a

Measurement Path

- › Vertical: 10.0 cm (3.9 in)
- › Horizontal: 5.8 cm (2.3 in)

Transducer Diameter

- › 0.64 cm (0.25 in)

Range

- › u_x: ±30 m s⁻¹
- › u_y: ±60 m s⁻¹
- › u_z: ±8 m s⁻¹
- › T_s: -50° to +60°C
- › Wind Direction: ±170°

Accuracy^g

- › Offset Error
 - u_x, u_y: <±8.0 cm s⁻¹
 - u_z: <±4.0 cm s⁻¹
 - Wind Direction: ±0.7° while horizontal wind at 1 m s⁻¹
- › 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
- › Measurement Precision RMS
 - u_x, u_y: 1 mm s⁻¹
 - u_z: 0.5 mm s⁻¹
 - Sonic Temperature: 0.025°C
 - Wind Direction: 0.6°

Barometer Specifications^a

	-BB Basic Barometer	-EB Enhanced Barometer (Vaisala PTB110)
Total Accuracy	±3.7 kPa at -30°C, falling linearly to ±1.5 kPa at 0°C (-30° to 0°C), ±1.5 kPa (0° to 50°C)	±0.15 kPa (-30° to +50°C)
Measurement Rate	10 Hz	1 Hz

Ambient Temperature Specifications^a

- › Manufacturer: BetaTherm 100K6A11A
- › Total Accuracy: ±0.15°C (-30° to +50°C)

^aSubject to change without notice.

^bA temperature of 20°C and pressure of 101.325 kPa was used to convert mass density to concentration.

^cAssumes the gas analyzer was properly zero and spanned using the appropriate standards; CO₂ span concentration was 400 ppm; H₂O span dewpoint was at 12°C (16.7 ppt); zero/span temperature was 25°C; zero/span pressure was 84 kPa; subsequent measurements made at or near the span concentration; temperature is not more than ±6°C from the zero/span temperature; and ambient temperature is within the gas analyzer operating temperature range.

^dStandard deviation of calibration residuals.

^eNominal conditions for precision verification test: 25°C, 86 kPa, 400 μmol/mol CO₂, 12°C dewpoint, and 20 Hz bandwidth.

^f0 to 3,000 μmol/mol available upon request.

^gThe accuracy specification for the sonic anemometer is for wind speeds <30 m s⁻¹ and wind angles between ±170°.

