



Innovative Design

Use as part of open-path eddy-covariance systems or as a stand-alone IRGA

Overview

Campbell Scientific's EC150 is an open-path analyser specifically designed for eddy-covariance flux measurements. As a stand-alone analyser, it simultaneously measures absolute carbon-dioxide and water-vapour

densities, air temperature, and barometric pressure. With the optional CSAT3A sonic anemometer head, the EC150 also measures three-dimensional wind speed and sonic air temperature.

Benefits and Features

- ▶ New conformal coating helps protect sonic transducers in corrosive environments
- ▶ 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
- ▶ Innovative signal processing and transducer wicks considerably improve performance of the anemometer during precipitation events

Technical Description

The CSAT3A has the following outputs:

- ▶ U_x (m/s)*
- ▶ U_y (m/s)*
- ▶ U_z (m/s)*

- ▶ Sonic Temperature (°C)*
- ▶ Sonic Diagnostic*

The EC150 has the following outputs:

- ▶ 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)

*The first five outputs require the CSAT3A Sonic Anemometer Head.

Specifications

Operating Temperature Range	-30° to +50°C
Calibrated Pressure Range	70 to 106 kPa
Input Voltage Range	10 to 16 Vdc
Power	5 W (steady state and power up) at 25°C
Measurement Rate	60 Hz
Output Bandwidth	5, 10, 12.5, or 20 Hz (user-programmable)
Output Options	SDM, RS-485, USB, analog (CO ₂ and H ₂ O only)
Auxiliary Inputs	Air temperature and pressure
Gas Analyzer/Sonic Volume Separation	5.0 cm (2.0 in.)
Warranty	3 years or 17,500 hours of operation (whichever comes first)
Cable Length	3 m (10 ft) from EC150 and CSAT3A to EC100
Weight	<ul style="list-style-type: none"> › 2.0 kg (4.4 lb) for EC150 head and cables › 3.2 kg (7.1 lb) for EC100 electronics › 1.7 kg (3.7 lb) for CSAT3A head and cables

Gas Analyzer

Path Length	15.37 cm (6.05 in.) A temperature of 20°C and pressure of 101.325 kPa was used to convert mass density to concentration.
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Gas Analyzer - CO₂ Performance

-NOTE-	A temperature of 20°C and pressure of 101.325 kPa was used to convert mass density to concentration.
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Accuracy	<ul style="list-style-type: none"> › Assumes the following: 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. › 1% (standard deviation of calibration residuals)
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Precision RMS (maximum)	0.2 mg/m ³ (0.15 µmol/mol)
	Nominal conditions for precision verification test: 25°C, 86 kPa, 400 µmol/mol CO ₂ , 12°C dewpoint, and 20 Hz bandwidth.

Calibrated Range	0 to 1,000 µmol/mol (0 to 3,000 µmol/mole available upon request.)
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Zero Drift with Temperature (maximum)	±0.55 mg/m ³ /°C (±0.3 µmol/mol/°C)
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Gain Drift with Temperature (maximum)	±0.1% of reading/°C
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Cross Sensitivity (maximum)	±1.1 x 10 ⁻⁴ mol CO ₂ /mol H ₂ O
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Gas Analyzer - H₂O Performance

-NOTE-	A temperature of 20°C and pressure of 101.325 kPa was used to convert mass density to concentration.
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Accuracy

- › Assumes the following: 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.
- › 2% (standard deviation of calibration residuals)

Precision RMS (maximum)	0.004 g/m ³ mmol/mol (0.006 mmol/mol)
	Nominal conditions for precision verification test: 25°C, 86 kPa, 400 µmol/mol CO ₂ , 12°C dewpoint, and 20 Hz bandwidth.
Calibrated Range	0 to 72 mmol/mol (38°C dewpoint)
Zero Drift with Temperature (maximum)	±0.037 g/m ³ /°C (±0.05 mmol/mol/°C)
Gain Drift with Temperature (maximum)	±0.3% of reading/°C
Cross Sensitivity (maximum)	±0.1 mol H ₂ O/mol CO ₂

Sonic Anemometer - Accuracy

Offset Error	<ul style="list-style-type: none"> › < ±4.0 cm s⁻¹ (for u_z) › < ±8.0 cm s⁻¹ (for u_x, u_y) › ±0.7° while horizontal wind at 1 m s⁻¹ (for wind direction)
Gain Error	<ul style="list-style-type: none"> › < ±2% of reading (for wind vector within ±5° of horizontal) › < ±3% of reading (for wind vector within ±10° of horizontal) › < ±6% of reading (for wind vector within ±20° of horizontal)
Measurement Precision RMS	<ul style="list-style-type: none"> › 0.6° (for wind direction) › 0.5 mm s⁻¹ (for u_z) › 0.025°C (for sonic temperature) › 1 mm s⁻¹ (for u_x, u_y)
Speed of Sound	Determined from 3 acoustic paths (corrected for crosswind effects)
Rain	Innovative ultrasonic signal processing and user-installable wicks considerably improve the performance of the anemometer under all rain events.

Ambient Temperature

Manufacturer	BetaTherm 100K6A11A
Total Accuracy	±0.15°C (-30°C to +50°C)
EC100 ingress protection	IP65

For comprehensive details, visit: www.campbellsci.eu/ec150 



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