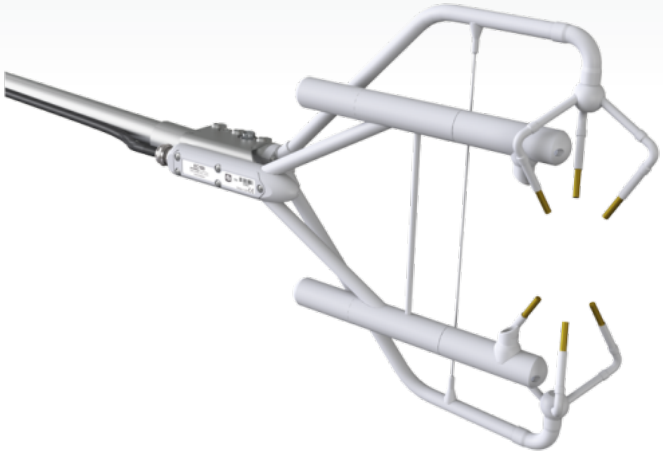
CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

EC150

CO2/H2O Open-Path Gas Analyzer



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 analyzer specifically designed for eddy-covariance carbon and water flux measurements. As a stand-alone analyzer, it simultaneously measures absolute carbon-dioxide and water-vapor densities, air temperature, and barometric pressure. With the optional CSAT3A sonic anemometer head, three-dimensional wind speed and sonic air temperature are measured.

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 CO_2, H_2O, 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

Detailed 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:

- CO_2 Density (mg/m^3)
- H_2O Density (g/m^3)
- Gas Analyzer Diagnostic
- Ambient Temperature (°C)
- Atmospheric Pressure (kPa)
- CO_2 Signal Strength
- H_2O 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_2O 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	1.7 kg (3.7 lb) for CSAT3A head and cables 2.0 kg (4.4 lb) for EC150 head and cables 3.2 kg (7.1 lb) for EC100 electronics

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.

Gas Analyzer - CO_2 Performance

-NOTE-	*A temperature of 20°C and pressure of 101.325 kPa was used to convert mass density to concentration.*
Accuracy	1% (standard deviation of calibration residuals) Assumes the following: the gas analyzer was properly zero and spanned using the appropriate standards; CO_2 span concentration was 400 ppm; H_2O 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.
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.)
Zero Drift with Temperature (maximum)	±0.55 mg/m^3/°C (±0.3 µmol/mol/°C)

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

Gain Drift with Temperature (maximum)	±0.1% of reading/°C
Cross Sensitivity (maximum)	±1.1 x 10^{-4} mol CO_2 /mol H_2O

Gas Analyzer - H_2O Performance

-NOTE-	*A temperature of 20°C and pressure of 101.325 kPa was used to convert mass density to concentration.*
Accuracy	❱ Assumes the following: the gas analyzer was properly zero and spanned using the appropriate standards; CO_2 span concentration was 400 ppm; H_2O 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_2O/mol CO_2

Sonic Anemometer - Accuracy

Offset Error	❱ ±0.7° while horizontal wind at 1 m s^{-1} (for wind direction) ❱ < ±4.0 cm s^{-1} (for u_z) ❱ < ±8.0 cm s^{-1} (for u_x, u_y)
Gain Error	❱ < ±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	❱ 0.025°C (for sonic temperature) ❱ 1 mm s^{-1} (for u_x, u_y) ❱ 0.5 mm s^{-1} (for u_z) ❱ 0.6° (for wind direction)
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 100K6A1IA
Total Accuracy	±0.15°C (-30°C to +50°C)