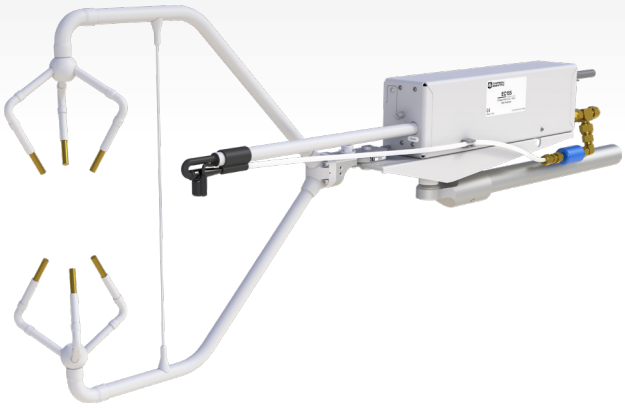
CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

EC155

Closed-Path CO_2 /H_2O Gas Analyzer



Now with Vortex Technology

Use as part of closed-path eddy-covariance system

Overview

Campbell Scientific's EC155 closed-path analyzer now incorporates vortex intake technology for reduced maintenance, more accurate pressure measurements, and improved protection against corrosion. The EC155 can be combined with the CSAT3A sonic anemometer as shown above. The newly revised CSAT3A has a more aerodynamic and rigid design.

The EC155 is ordered as part of the CPEC300-series system, which also includes the sample pump, datalogger, optional valve module, and optional scrub module to provide a zero air source. The EC155 with anemometer simultaneously measures absolute carbon dioxide and water vapor mixing ratio, sample cell temperature and pressure, and three-dimensional wind speed and sonic air temperature.

New Benefits and Features of Updated EC155 and CSAT3A

- Vortex Intake (U.S. Pat. No. 9,217,692) greatly reduces maintenance frequency compared to traditional in-line filters
- Heated inlet increases protection against condensation
- More accurate pressure measurements with the new sample cell absolute pressure sensor
- Fully integrated, detachable intake
- Improved corrosion protection with stainless steel sample cell
- Improved sonic temperature from more rigid CSAT3 geometry
- Stream-lined, aerodynamic CSAT3A mounting

Other Benefits and Features

- Slim aerodynamic shape with minimal wind distortion
- Analyzer, sample cell, and sonic anemometer measurements have matched bandwidths and are synchronized by a common set of electronics
- Low power consumption; suitable for solar power applications
- Low noise
- Small sample cell for excellent frequency response
- Integrated zero/span connection for simplified field zero/span
- 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
- Rain: Innovative signal processing and transducer wicks considerably improve performance of the anemometer during precipitation events

EC155 Outputs

- U_x (m/s)*
- U_y (m/s)*
- U_z (m/s)*
- Sonic Temperature (°C)*
- Sonic Diagnostic*
- CO_2 Mixing Ratio (µmol/mol)
- H_2O Mixing Ratio (mmol/mol)
- Gas Analyzer Diagnostic
- Cell Temperature (°C)
- Cell Pressure (kPa)
- CO_2 Signal Strength
- H_2O Signal Strength
- Differential Pressure (kPa)
- Source Temperature (°C)

**Requires a CSAT3A Sonic Anemometer Head.*

General Specifications[a]

- Operating Temperature: -30° to +50°C
- Operating Pressure: 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 (CO_2 and H_2O only)
- Auxiliary Inputs: air temperature and pressure
- EC100 barometer accuracy
  Basic: ±1.5 kPa (> 0 °C), increasing linearly to ±3.7 kPa at -30°C
  Enhanced: ±0.15 kPa (-30° to 50°C)
- Cable Length: 3 m (10 ft) from EC155/CSAT3A to EC100
- Sample Intake/Sonic Volume Separation: 15.4 cm (6.1 in)
- View EU Declaration of Conformity documentation at:
  www.campbellsci.com/ec155

- Warranty: 3 years or 17,500 hours of operation, whichever comes first
- Weight
  EC155 Head and Cables: 3.9 kg (8.5 lb)
  CSAT3A Head and Cables: 1.7 kg (3.7 lb)
  Mounting Hardware: 0.4 kg (0.9 lb)
  EC100 Electronics: 3.2 kg (7 lb)

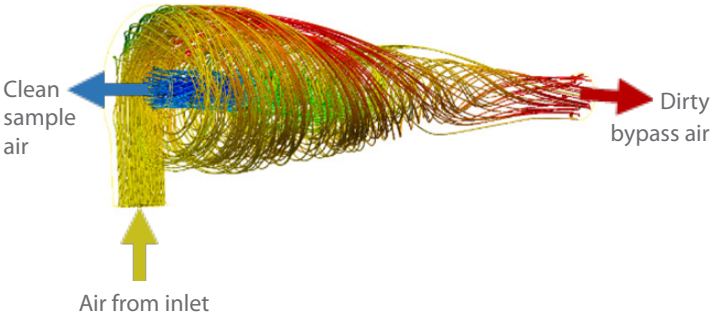


Figure 1. Streamline flows through the vortex. Warmer colors represent higher speeds of dirty air to the right (towards bypass), and cooler colors represent higher speeds of clean air to the left (towards sample cell).

Gas Analyzer Specifications[a]

- Sample Cell Thermistor Accuracy: ± 0.15 °C (-30° to 50°C)
- Sample Cell Pressure Accuracy: ± 1.5 kPa (> 0 °C), increasing linearly to ±3.7 kPa at -30 °C

Performance

	CO_2	H_2O
Accuracy[b]	1%[c]	2%[c]
Precision RMS (maximum)[d]	0.15 µmol/mol	0.006 mmol/mol
Calibrated Range	0 to 1,000 µmol/mol[e]	0 to 72 mmol/mol (38°C dewpoint)
Zero Drift with Temperature (maximum)	±0.3 µmol/mol/°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_2O	±0.1 mol H_2O/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[f]

- 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°

[a]Subject to change without notice.
[b]Assumes 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.
[c]Standard deviation of calibration residuals.
[d]Nominal conditions for precision verification test: 25°C, 86 kPa, 400 µmol/mol CO_2, 12°C dewpoint, and 20 Hz bandwidth.
[e]0 to 3,000 µmol/mol available upon request.
[f]The accuracy specification for the sonic anemometer is for wind speeds <30 m s^{-1} and wind angles between ±170°.