



## Innovative Design

Use as part of closed-path eddy-covariance system

### Overview

Campbell Scientific's EC155 is a closed path analyzer specifically designed for eddy-covariance flux measurements. As a stand-alone analyzer, it simultaneously

measures absolute carbon dioxide and water vapour mixing ratio, sample cell temperature and pressure, and three-dimensional wind speed and sonic air temperature.

### Benefits and Features

- › Slim aerodynamic shape with minimal wind distortion
- › Measurements are temperature compensated without active heat control
- › Analyzer and sonic anemometer measurements are temporal synchronized by a common set of electronics
- › Small sample cell for excellent frequency response
- › Fully integrated intake assembly for easy installation and use
- › Integrated zero/span connection for simplified field zero/span
- › Low power consumption; suitable for solar power applications
- › Low noise
- › Maximum output rate of 50 Hz with 25 Hz bandwidth
- › EC155 heated sample intake
- › Field rugged
- › Field serviceable (easy access to chemical bottles and sample cell)
- › Factory calibrated over wide range of CO<sub>2</sub>, H<sub>2</sub>O, pressure and temperature in all combinations encountered in practice
- › Extensive set of diagnostic parameters to warn of questionable data
- › 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 3 acoustic paths, corrected for crosswind effects\*
- › Rain: Innovative signal processing and transducer wicks considerably improves performance of the anemometer during precipitation events\*

### EC155 Outputs

- › U<sub>x</sub> (m/s)\*
- › U<sub>y</sub> (m/s)\*
- › U<sub>z</sub> (m/s)\*
- › Sonic Temperature (°C)\*
- › Sonic Diagnostic\*
- › CO<sub>2</sub> Mixing Ratio (μmol/mol)
- › H<sub>2</sub>O Mixing Ratio (mmol/mol)
- › Gas Analyzer Diagnostic
- › Cell Temperature (°C)
- › Cell Pressure (kPa)
- › CO<sub>2</sub> Signal Strength
- › H<sub>2</sub>O Signal Strength
- › Differential Pressure (kPa)
- › Source Temperature (°C)

\*Requires a CSAT3A Sonic Anemometer Head.

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[www.campbellsci.eu/ec155](http://www.campbellsci.eu/ec155)

## General Specifications<sup>a</sup>

- › 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: 100 Hz
- › Output Rate: 5 to 50 Hz, user programmable
- › Output Bandwidth: 5, 10, 12.5, 20, or 25 Hz user programmable
- › Output Options: SDM, RS-485, USB, analogue
- › Auxiliary Inputs: air temperature and pressure

## Dimensions

- › Analyzer: 13.8 x 7.4 x 10.1 cm (12.8 x 2.9 x 4.0 in)
- › Electronics: 24.1 x 35.6 x 14 cm (9.5 x 14 x 5.5 in)
- › Weight:
  - CSAT3A Head and Cables: 1.7 kg (3.7 lb)
  - EC155 Head and Cables: 3.9 kg (8.5 lb)
  - Mounting Hardware: 0.4 kg (0.9 lbs)
  - EC100 Electronics: 3.2 kg (7 lbs)
- › Cable Length: 3 m (10 ft) from EC155/CSAT3A to EC100
- › Sample Intake/Sonic Volume Separation: 15.6 cm (6.1 in)

## Gas Analyzer Specifications<sup>a</sup>

- › Sample Cell volume: 5.9 cm<sup>3</sup> (0.36 in<sup>3</sup>)

	CO <sub>2</sub>	H <sub>2</sub> O
Accuracy <sup>b</sup>	1% <sup>c</sup>	2% <sup>c</sup>
Precision RMS (maximum) <sup>d</sup>	0.15 µmol/mol	0.006 mmol/mol
Calibrated Range	0 to 1,000 µmol/mol <sup>e</sup>	0 to 72 mmol/mol (37°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 <sup>-4</sup> mol CO <sub>2</sub> /molH <sub>2</sub> O	±0.1 mol H <sub>2</sub> O/mol CO <sub>2</sub>

## Sonic Anemometer Specifications<sup>a\*</sup>

### Measurement Path

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

### Transducer Diameter

- › 0.64 cm (0.25 in.)

### Accuracy<sup>f</sup>

- › Offset Error

$$u_x, u_y: <\pm 8.0 \text{ cm s}^{-1}$$

$$u_z: <\pm 4.0 \text{ cm s}^{-1}$$

- › 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

$$u_x, u_y: 1 \text{ mm s}^{-1}$$

$$u_z: 0.5 \text{ mm s}^{-1}$$

Sonic Temperature: 0.025°C

## Barometer Specifications

	-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°C to 0°C), ±1.5 kPa (0° to 50°C)	±0.15 kPa (-30° to +50°C)
Measurement Rate	10 Hz	1 Hz

<sup>a</sup>Subject to change without notice.

<sup>b</sup>Assumes the gas analyzer was properly zero and spanned using the appropriate standards; CO<sub>2</sub> span concentration was 400 ppm; H<sub>2</sub>O 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.

<sup>c</sup>Standard deviation of calibration residuals.

<sup>d</sup>Nominal conditions for precision verification test: 23°C, 86 kPa, 400 µmol/mol CO<sub>2</sub>, 12°C dewpoint, and 20 Hz bandwidth.

<sup>e</sup>0 to 3,000 µmol/mole available upon request.

<sup>f</sup>The accuracy specification for the sonic anemometer is for wind speeds <30 m s<sup>-1</sup> and wind angles between ±170°.

\*With optional CSAT3A anemometer head.

# Ordering Information

## Flux Sensors

**EC155** CO<sub>2</sub> and H<sub>2</sub>O Closed-Path Gas Analyzer

### Sample Cell Options (must choose one)

- SI Sample Cell with heated Intake tube
- SN Sample Cell with No Intake tube

### Sensing Heads Options (must choose one)

- GH Gas Analyzer Only
- SH CSAT3A and Gas Analyzer

### Pressure Sensor Option (must choose one)

- BB Basic Barometer
- EB Enhanced Barometer

## Carrying Cases

**10823** EC155 Carrying Case without foam insert. It holds both the gas analyzer and sonic anemometer.

**009505-002** CSAT3A Carrying Case without foam insert.

Please ask for details of the CPEC200 - a complete closed path measurement system, based upon the EC155.

## Cables

For the following cables, specify the length required, in metres. A 10 m length is recommended. Connectors can be fitted if required when wired to a datalogger enclosure.

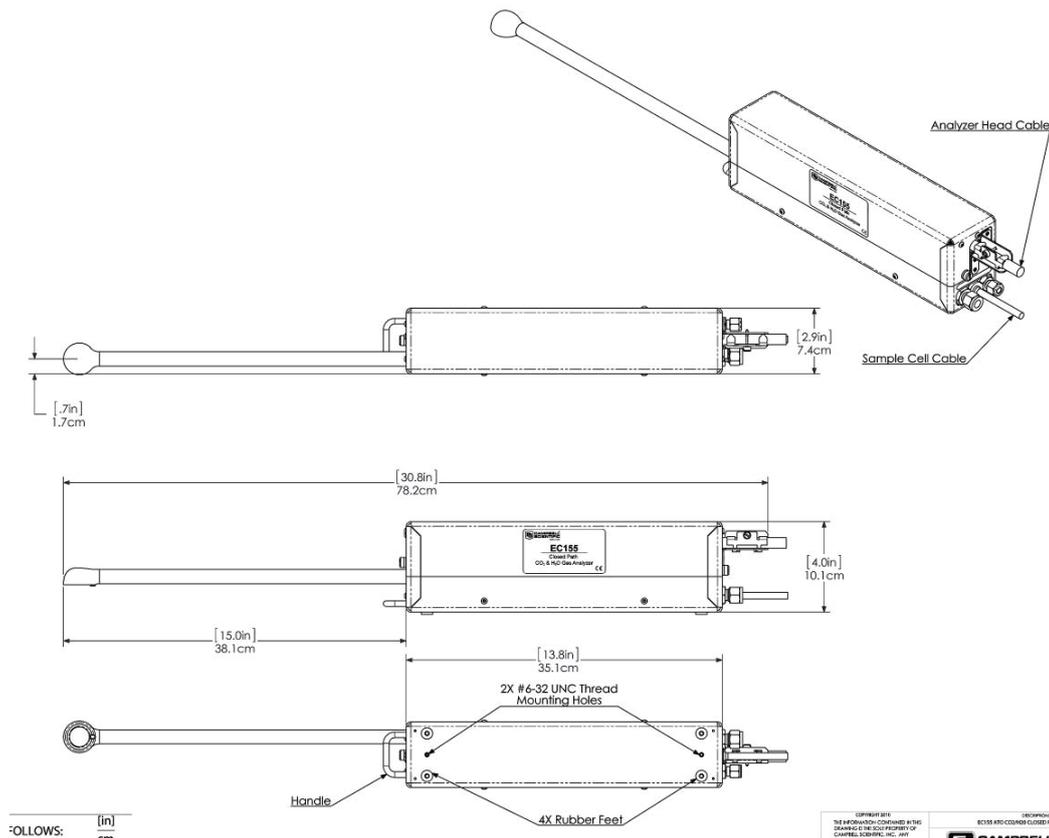
**CABLEPCBL** Two-conductor, 16-AWG cable with a Santoprene® jacket is used to power the EC155.

**CABLE4CBL** Four-conductor, 22-AWG cable with drain wire and Santoprene jacket is used to attach the SDM or Analogue Output connector on the EC155 electronics box.

**CABLE5CBL** Five-conductor, 24-AWG cable with drain wire and Santoprene jacket is recommended for connecting the EC155 with an MD485 multidrop modem.

## Mounting Arms

CM200 series mounting arms are available to allow the sensor to be mounted off the side of a vertical tower. Please request a separate leaflet on those arms.



The dimensions and four views of the EC155 are shown above