

Patented Design^a

Gas analyzer and sonic anemometer in one sensor

Overview

Campbell Scientific's IRGASON fully integrates the open-path analyzer and sonic anemometer. Designed specifically for eddy-covariance flux measurements, the patented design is easier to install and use than separate sensors and provides increased measurement accuracy.

The IRGASON simultaneously measures absolute carbon dioxide and water vapour, air temperature, barometric pressure, and three-dimensional wind speed and sonic air temperature.

Benefits and Features

- › Combined support structure causes less flow distortion than two separate sensors
- › Co-located analyzer and sonic anemometer avoids flux loss due to sensor separation
- › Synchronized gas analyzer and sonic anemometer avoids the need to correct for time lag
- › Low power consumption; suitable for solar power applications
- › Measurements are temperature compensated without active heat control
- › Low noise
- › Maximum output rate of 50 Hz with 25 Hz bandwidth
- › Angled windows to shed water and are less 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 3 acoustic paths; corrected for crosswind effects
- › Rain: Innovative signal processing and transducer wicks considerably improves performance of the anemometer during precipitation events

IRGASON Outputs

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

^aU.S. Patent No. D680455

General Specifications^b

Operating Temperature: -30° to +50°C

Calibrated Pressure Range: 70 to 106 kPa

Input Voltage Range: 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

Weight:

IRGASON Head and Cables: 2.8 kg (6.1 lb)

EC100 Electronics: 3.2 kg (7 lbs)

Cable Length: 3 m (10 ft) from IRGASON to EC100

Gas Analyzer Specifications^{b,c}

› Path Length: 15.37 cm (6.05 in)

Performance

	CO ₂	H ₂ O
Accuracy^d	1% ^e	2% ^e
Precision RMS (maximum)^f	0.2 mg/m ³ (0.15 μmol/mol)	0.004 g/m ³ (0.006 mmol/mol)
Calibrated Range	0 to 1000 μmol/mol ^g	0 to 72 mmol/mol (37°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^b

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^h

› 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^b

	-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

Ambient Temperature Specifications^b

› Manufacturer: BetaTherm 100K6A11A

› Total Accuracy: ±0.15°C (-30° to +50°C)

^bSubject to change without notice.

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

^dAssumes 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.

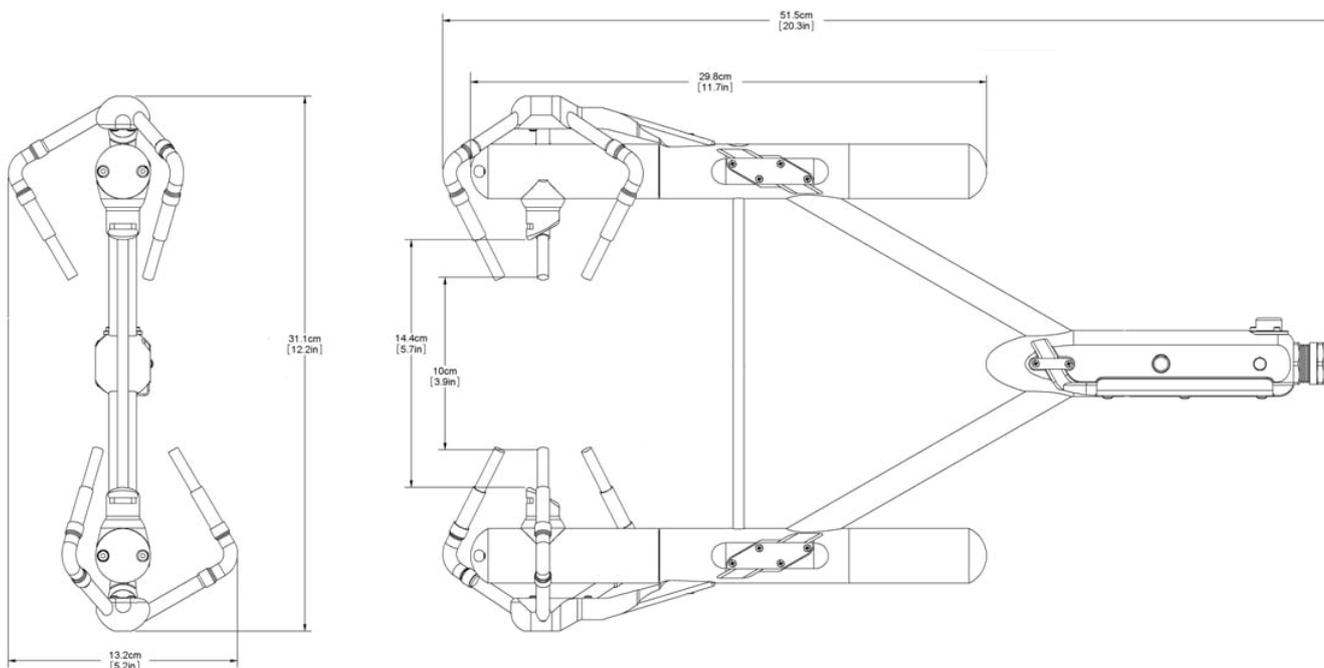
^eStandard deviation of calibration residuals.

^fNominal conditions for precision verification test: 23°C, 86 kPa, 400 μmol/mol CO₂, 12°C dewpoint, and 20 Hz bandwidth.

^g0 to 3,000 μmol/mole available upon request.

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





The dimensions of IRGASON gas analyzer and 3D Sonic anemometer are shown above

Ordering Information

Flux Sensor

IRGASON Integrated CO₂ and H₂O Open-Path Gas Analyzer

Pressure Sensor Options (must choose one)

- BB Basic Barometer
- EB Enhanced Barometer

IRGASON Carrying Case Options

- NC No IRGASON Case
- IC IRGASON Carrying Case

Zero and Span Accessories

- 010828** IRGASON Zero and Span Shroud Kit
- 010829** IRGASON Lab Stand Kit

Cables

For the following cables, specify the length required, in metres. A 10 m cable length is recommended.

- CABLEPCBL** Two-conductor, 16-AWG cable with a Santoprene[®] jacket is used to power the EC100 electronics box.
- CABLE4CBL** Four-conductor, 22-AWG cable with drain wire and Santoprene jacket is used to attach the SDM connector on the EC100 electronics box.
- CABLE3TP** Three-twisted pair, 24-AWG cable with drain wire and Santoprene jacket is recommended for use with the RS-485 output (<150 m length).

Optional wicks to shed water droplets

- 010337** Bottom Wick (IRGA)
- 010337-001** Top Wick (IRGA)
- 010331** Wick Spares Kit (3 top wicks, 3 bottom wicks, adhesive and installation tool) for sonic