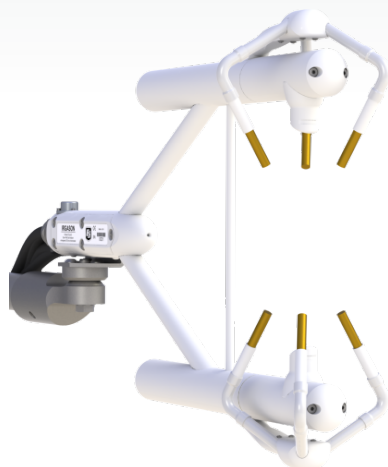




IRGASON

Integrated CO₂ and H₂O Open-Path Gas Analyzer and 3-D Sonic Anemometer



Patented Design

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 carbon and water 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 vapor, air temperature, barometric pressure, three-

dimensional wind speed, and sonic air temperature. *U.S. patent D680455*

For more information about the benefits of having a collocated measurement, refer to the poster "[Improved eddy flux measurements by open-path gas analyzer and sonic anemometer co-location.](#)"

Benefits and Features

- ▶ New conformal coating helps protect sonic transducers in corrosive environments
- ▶ Combined support structure causes less flow distortion than two separate sensors
- ▶ Truly collocated gas analyzer and sonic anemometer measurements avoid flux loss due to sensor separation
- ▶ Synchronized gas analyzer and sonic anemometer measurements avoid 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 60 Hz with 20 Hz bandwidth
- ▶ Angled windows 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
- ▶ Sonic temperature 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 IRGASON® has the following 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)

Specifications

Patent	U.S. Patent No. D680455
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
Warranty	3 years or 17,500 hours of operation (whichever comes first)
Cable Length	3 m (10 ft) from IRGASON® to EC100
Weight	<ul style="list-style-type: none"> › 2.8 kg (6.1 lb) for IRGASON® 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.
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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.

Accuracy	<ul style="list-style-type: none"> › 1% (standard deviation of calibration residuals) › 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.
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/mol available upon request.)
Zero Drift with Temperature (maximum)	±0.55 mg/m ³ /°C (±0.3 µmol/mol/°C)
Gain Drift with Temperature (maximum)	±0.1% of reading/°C
Cross Sensitivity (maximum)	±1.1 × 10 ⁻⁴ mol CO ₂ /mol H ₂ O

Gas Analyzer - H₂O Performance

-NOTE-

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

Accuracy	<ul style="list-style-type: none"> › 2% (standard deviation of calibration residuals) › 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.
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Precision RMS (maximum) 0.004 g/m³ (0.006 mmol/mol)

Nominal conditions for precision verification test: 25°C, 86 kPa, 400 µmol/mol CO₂, 12°C dewpoint, and 20 Hz bandwidth.

Calibrated Range 0 to 72 mmol/mol (38°C dewpoint)

Zero Drift with Temperature ±0.037 g/m³/°C (±0.05 mmol/mol/°C) (maximum)

Gain Drift with Temperature ±0.3% of reading/°C (maximum)

Cross Sensitivity (maximum) ±0.1 mol H₂O/mol CO₂

Sonic Anemometer - Accuracy

-NOTE-

The accuracy specification for the sonic anemometer is for wind

speeds < 30 m s⁻¹ and wind angles between ±170°.

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

Basic Barometer (option -BB)

Total Accuracy	<ul style="list-style-type: none"> › ±3.7 kPa at -30°C, falling linearly to ±1.5 kPa at 0°C (-30° to 0°C) › ±1.5 kPa (0° to 50°C)
Measurement Rate	10 Hz

Enhanced Barometer (option -EB)

Manufacturer	Vaisala PTB110
Total Accuracy	±0.15 kPa (-30° to +50°C)
Measurement Rate	1 Hz

Ambient Temperature

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

