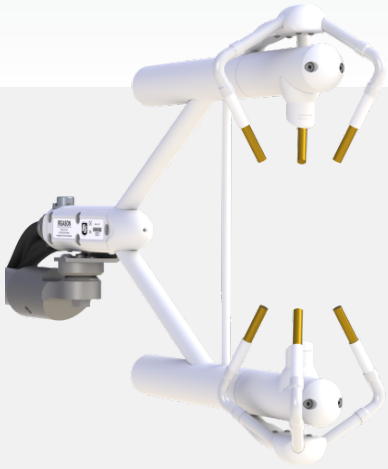
CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

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 colocated 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 colocated 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 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
- 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
- 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)

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_2O 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	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.

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/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 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	❱ 2% (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)	0.004 g/m^3 (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

-NOTE-	*The accuracy specification for the sonic anemometer is for wind speeds < 30 m s^{-1} and wind angles between ±170°.*
Offset Error	❱ < ±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	❱ < ±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	❱ 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	❱ ±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 100K6A1IA
Total Accuracy	±0.15°C (-30° to +50°C)