



# LI-7200

## Enclosed CO<sub>2</sub>/H<sub>2</sub>O Gas Analyzer

Combining the Best of Open  
and Closed Path Analyzers

High Speed, High Precision,  
Low Power Consumption

# The LI-7200 Enclosed CO<sub>2</sub>/H<sub>2</sub>O Gas Analyzer

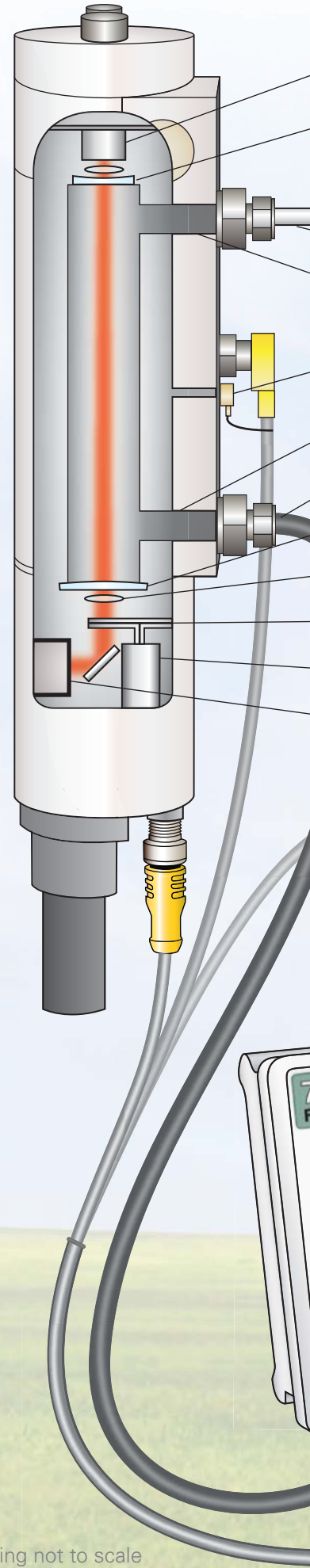
- Based on the proven LI-7500 platform
- Low power requirements (12 W)
- High precision and accuracy
- Continuous measurements through rain, snow, and fog
- High frequency, in-cell temperature and pressure measurements

The LI-7200 Enclosed CO<sub>2</sub>/H<sub>2</sub>O Analyzer is a high speed, high precision, non-dispersive infrared gas analyzer designed for applications that require fast and accurate CO<sub>2</sub>/H<sub>2</sub>O measurements. For eddy covariance applications, it mounts atop a flux tower or measurement platform and uses a short inlet tube co-located with the sample volume of the sonic anemometer.

The LI-7200 maximizes the strengths of traditional open path and closed path instruments. Open path analyzers feature excellent frequency response, low power requirements, tool-free optical cell cleaning, and are light weight. Closed path analyzers also provide many benefits, including low susceptibility to rain, fog or snow, and the potential for automated calibration. These features are brought together in the LI-7200, making it the first gas analyzer with the consistency of closed path instruments and the practicality and low power requirements of open path instruments.

## Proven Technology

The LI-7200 is based upon the proven technology of the LI-7500, which is the world leader in open path CO<sub>2</sub>/H<sub>2</sub>O analyzers for eddy covariance research. The LI-7200 makes precise, accurate, and fast CO<sub>2</sub>/H<sub>2</sub>O measurements using non-dispersive infrared (NDIR) detection. NDIR has consistently proven to be the best technology for measuring CO<sub>2</sub> and H<sub>2</sub>O at high precision and high speeds. In the 23 years since LI-COR Biosciences introduced our first high-precision NDIR CO<sub>2</sub> sensor, we have continuously worked to improve the measurement technology. The results of this ongoing effort are apparent in the LI-7200.



Drawing not to scale



# Simplifying Eddy Covariance Data Collection

- Integrates CO<sub>2</sub>/H<sub>2</sub>O measurements with U, V, W, and T from a sonic anemometer with 4 analog inputs
- Logs merged eddy covariance datasets to an internal, removable USB storage device
- Point and click set-up for data logging and auxiliary inputs

The LI-7200 simplifies the process of collecting eddy covariance data sets - by simplifying setup and logging eddy covariance data in a text format that easily imports into spreadsheets. Data logging software and an interface utility that converts text files into a format that is suitable for EdiRe<sup>1</sup> are included with the instrument at no additional cost.

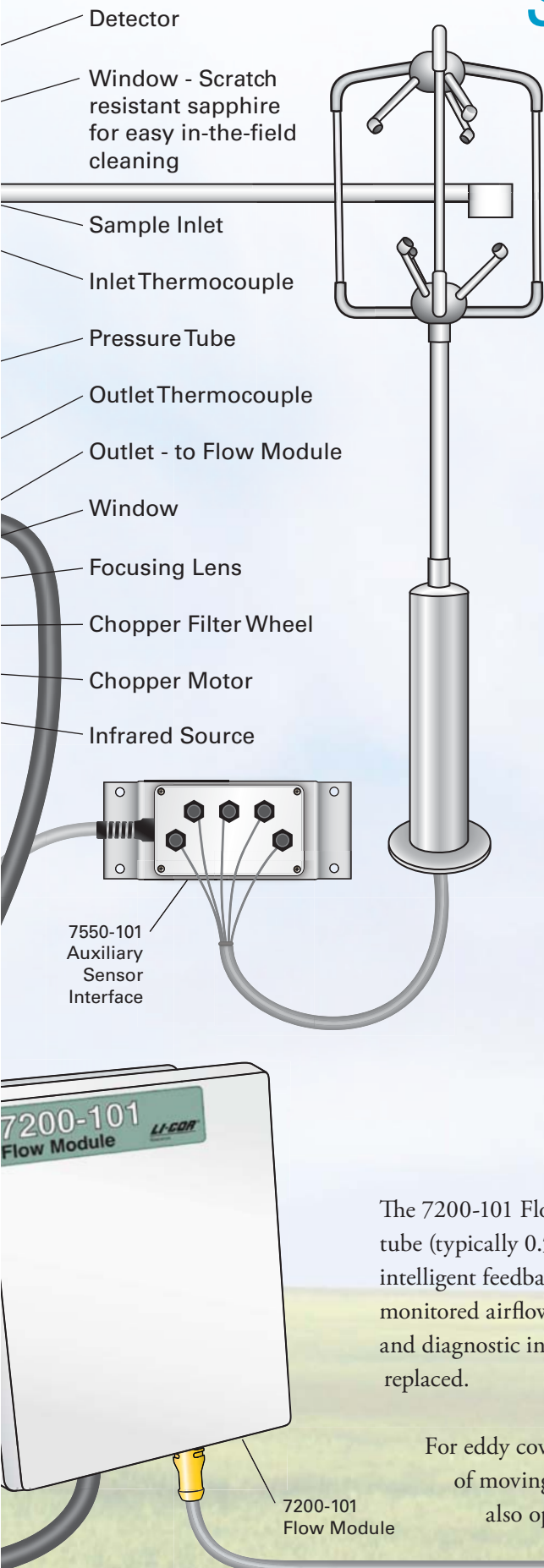
The 7550-101 Auxiliary Sensor Interface (optional) is a weatherproof terminal strip for connecting external sensors. It provides four general  $\pm 5$  V inputs for analog data from sonic anemometers, (including Campbell Scientific<sup>2</sup>, Gill Instruments<sup>3</sup>, Metek<sup>4</sup>, Applied Technologies<sup>5</sup>, Kaijo<sup>6</sup>, RM Young<sup>7</sup>, or others).

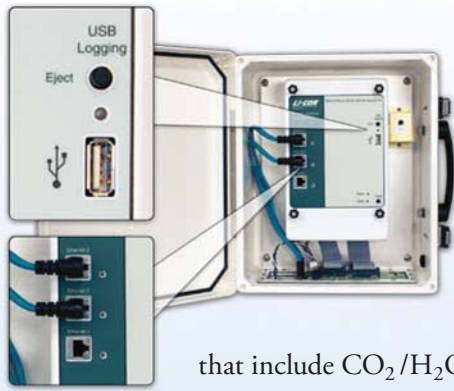
## Integrated System Solutions

- 7200-101 Flow Module (optional) maintains a precisely controlled flow
- Outputs diagnostic data with the data record
- Requires 15 W of power to maintain a flow of 15 LPM nominally

The 7200-101 Flow Module (optional) draws the sample volume through an insulated intake tube (typically 0.5 to 1 m) and the LI-7200 optical cell. With precision pressure sensors and intelligent feedback controls, the flow module actively regulates flow to ensure a stable, carefully monitored airflow rate. The 7200-101 Flow Module outputs flow rate, motor drive percentage, and diagnostic information with the data record to indicate when filters need to be cleaned or replaced.

For eddy covariance applications, the 7200-101 provides a practical solution to the challenge of moving the sample volume from the sampling point to the analyzer. The LI-7200 can also operate with a user-supplied pump.





# Versatile Data Output Options

- Ethernet for world-wide connectivity and data transfer
- Removable USB Data Storage
- RS-232, SDM, high-speed DACs

The new LI-7550 Analyzer Interface Unit (included) houses the high speed Digital Signal Processing electronics. The LI-7550 enables the collection of complete data sets that include CO<sub>2</sub>/H<sub>2</sub>O, pressure, temperature, sonic anemometer measurements, and diagnostic data. With the included 4 GB industrial grade USB storage device, the LI-7550 can store 34 channels of 10 Hz data for about 15 days. Data also can be output via Ethernet to a computer or network. The instrument uses industry standard TCP/IP networking protocols to facilitate two-way communication with networked computers anywhere in the world. In addition, high speed digital-to-analog converters, SDM (Synchronous Devices for Measurement for CSI<sup>2</sup> Dataloggers), and RS-232 outputs enable integration with a variety of storage devices.

## Built for the Field



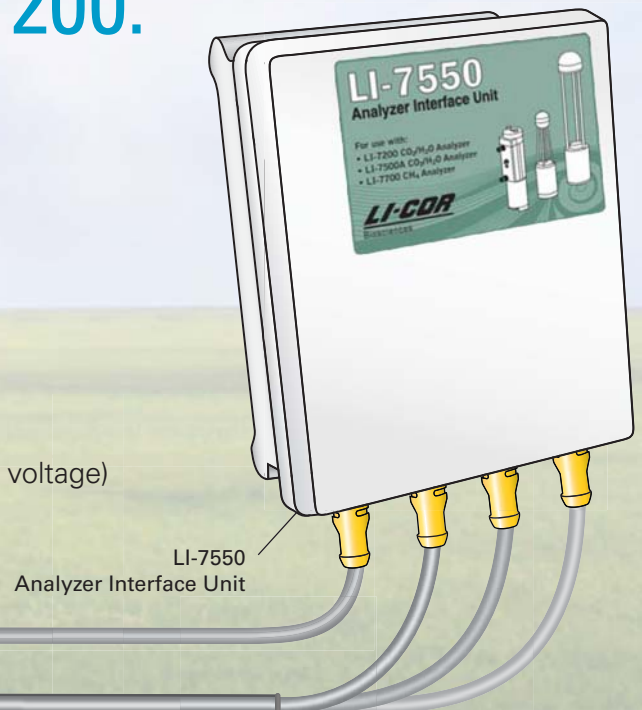
LI-7200 optical path slides out for cleaning

- Easy-to-clean, field serviceable optics
- No delicate optical alignment
- Factory recalibration unnecessary after cleaning
- No tools required to clean the optics

The LI-7200 features a simple, user-cleanable optical bench. It can be cleaned on site without any special tools and without removing the instrument from the platform. To open the optics for cleaning, simply loosen the two knurled screws on the top of the analyzer, lift the analyzer cap, and slide out the optical path. There is no need for factory recalibration after cleaning the optical components, and there are no delicate optical components to re-align. The optical path thermocouples and pressure transducer are protected in the optical path to minimize the risk of damage during cleaning.

## Variables Logged by the LI-7200:

- CO<sub>2</sub> (mmol/m<sup>3</sup>, absorptance, μmol/mol)
- H<sub>2</sub>O (mmol/m<sup>3</sup>, absorptance, mmol/mol)
- Date/Time
- Dew Point (°C)
- Cell Temperature (°C)
- Temperature In (°C)
- Temperature Out (°C)
- Block Temperature (°C)
- Total Pressure (kPa)
- Box Pressure (kPa)
- Cooler Voltage (V)
- Diagnostic Value
- Auxiliary Input 1 (e.g. U sonic voltage)
- Auxiliary Input 2 (e.g. V sonic voltage)
- Auxiliary Input 3 (e.g. W sonic voltage)
- Auxiliary Input 4 (e.g. sonic temperature voltage)
- Flow Rate (lpm)



LI-7550 Analyzer Interface Unit



# The Innovation Continues...

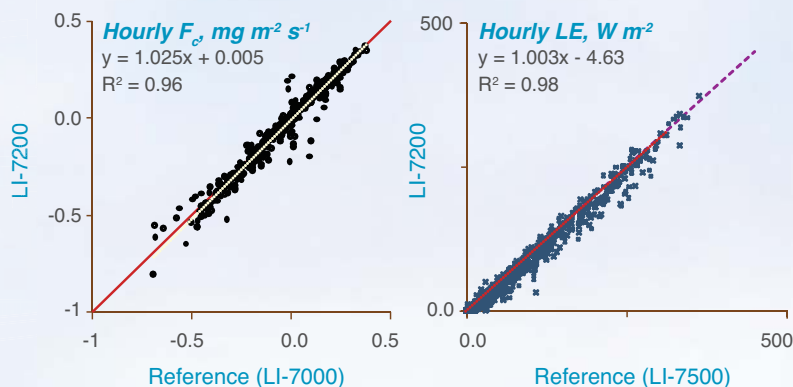
The LI-7200 sensor head has a 16 cm<sup>3</sup> enclosed optical cell, with single pass optics and a large 8 mm diameter optical beam. Optical filters centered at 3.95 μm and 4.26 μm provide reference and absorption signals for CO<sub>2</sub>, while filters centered at 2.35 μm and 2.59 μm provide reference and absorption signals for water vapor. Sensitivity to dust is minimized by keeping the wavelengths of reference and absorption signals relatively close for respective species. This ensures that computations of CO<sub>2</sub> and H<sub>2</sub>O density are very insensitive to dust, which may accumulate during normal operation.

The figure to the left shows a cutaway representation of the LI-7200 sensor head. The **Infrared Source** emits radiation, which is directed through a **Chopper Filter Wheel**, **Focusing Lens**, and then through the measurement path to a temperature-controlled lead selenide **Detector**. A brushless **Chopper Motor** rotates the **Chopper Filter Wheel** at 9,000 rpm. Lifetimes of the source, detector, and chopper motor are extremely long – in a ten-year period, over 96% of instruments have never had these repairs done. **Thermocouples** located at the inlet and outlet of the sample cell measure the sample temperature at high speeds, and a pressure transducer provides high-speed in-cell pressure measurements. The **Windows** at both ends of the optical path are made of scratch resistant sapphire, allowing for worry-free cleaning in the field. The LI-7200 operates over a temperature range of -25 to 50 °C (-40 °C verification test available).

The LI-7550 Analyzer Control Unit houses the digital signal processing electronics, encloses the USB data storage device, and has weatherproof connections for the cables used for data output, power, and auxiliary inputs.

## Reliable Long-Term Data Collection

The figures to the left show hourly CO<sub>2</sub> and H<sub>2</sub>O fluxes measured with the LI-7200 Enclosed CO<sub>2</sub>/H<sub>2</sub>O Analyzer compared to fluxes measured with the LI-7000 and LI-7500 analyzers, which were used as standards. Fluxes measured with the LI-7200 were within 2.5% of the standards for all field experiments. These data were collected in 3 deployments that took place over four seasons. Data were collected over a ryegrass field and saw grass wetland.



## Ordering Information

### LI-7200 Enclosed CO<sub>2</sub>/H<sub>2</sub>O Analyzer

Includes the LI-7200 Enclosed CO<sub>2</sub>/H<sub>2</sub>O Analyzer, LI-7550 Analyzer Interface Unit, 4 GB industrial grade USB storage device, 1 meter insulated intake tube with insect screen, IRGA cable (5 meters), 5 meter data cables (RS-232, Ethernet, SDM interface, Analog input/output cables), Windows® software, mounting hardware, and instruction manual.

### LI-7200FM CO<sub>2</sub>/H<sub>2</sub>O Analyzer Package

LI-7200 Enclosed CO<sub>2</sub>/H<sub>2</sub>O Analyzer  
LI-7200-101 Flow Module

### LI-7200DP CO<sub>2</sub>/H<sub>2</sub>O Analyzer Package

LI-7200 Enclosed CO<sub>2</sub>/H<sub>2</sub>O Analyzer  
LI-610 Portable Dew Point Generator

### GHG-2 Greenhouse Gas Analyzer Package

LI-7200 Enclosed CO<sub>2</sub>/H<sub>2</sub>O Analyzer  
LI-7700 Open Path CH<sub>4</sub> Analyzer  
7550-101 Auxiliary Sensor Interface

### 7550-101 Auxiliary Sensor Interface

The 7550-101 is a weather resistant terminal strip for connecting external sensors. It provides four general purpose ±5 V inputs for a sonic anemometer. Includes mounting bracket, hardware, and a 0.8 meter cable.

High-speed sonic anemometers are available with gas analyzer purchases. Contact LI-COR Biosciences for more information.

# Specifications:

	CO <sub>2</sub>	H <sub>2</sub> O
Calibration range	0-3000 ppm	0 - 60 ppt
Accuracy	Within 1%	Within 2%
Zero drift (per °C)	±0.1 ppm typical ±0.3 ppm max.	±0.03 ppt typical ±0.05 ppt max.
RMS noise: 5 Hz (typical @ 370 ppm CO <sub>2</sub> , 10 Hz and 10 mmol mol <sup>-1</sup> H <sub>2</sub> O) 20 Hz	0.08 ppm 0.11 ppm 0.16 ppm	0.0034 ppt 0.0047 ppt 0.0067 ppt
Gain drift (% of reading per °C)	±0.02% typical ±0.1% max. @ 370 ppm	±0.15% typical ±0.30% max. @ 20 ppt
Direct sensitivity to H <sub>2</sub> O (mol CO <sub>2</sub> /mol H <sub>2</sub> O)	±2.00E-05 typical ±4.00E-05 max.	--- ---
Direct sensitivity to CO <sub>2</sub> (mol H <sub>2</sub> O/mol CO <sub>2</sub> )	---	±0.02 typical ±0.05 max

**Data Storage:** Removable industrial grade USB flash storage device (4 GB provided, addressable capacity >16 GB).

**Data Communication:** Ethernet, Synchronous Devices for Measurement (SDM; >50 Hz), RS-232 (115,200 baud; 20 Samples per Second max), 6 DACs (0-5 V; 300 Hz).

**Inputs:** Ethernet, 4 analog input channels.

**Operating Temperature Range:** -25 to 50° C  
(-40 °C characterization available).

**Power Requirements:** 10.5 to 30 VDC.

**Power Consumption:** 12 W nominal  
(up to 30 W during start up)

**Type:** Absolute, non-dispersive infrared gas analyzer.

**Detector:** Thermoelectrically cooled lead selenide.

## LI-COR®

Biosciences

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The LI-7200 gas analyzer is covered by patents pending.  
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**Optical Cell Volume:** 16 cm<sup>3</sup>.

**Bandwidth:** 5, 10, or 20 Hz, user-selectable.

**User Interface:** Windows® based.

### LI-7550 Analyzer Interface Unit Dimensions:

**Size:** 35 cm x 30 cm x 15 cm (13.8" x 12" x 6")  
external dimensions.

**Weight:** 4.4 kg (10 lbs).

### LI-7200 CO<sub>2</sub>/H<sub>2</sub>O Analyzer Dimensions:

**Size:** 7.5 cm (3") diameter, 31 cm (12.2") length.

**Weight:** 1.8 kg (3.95 lbs)

**Cable and Tubing Length:** 5 m (16.4 ft).

### 7200-101 Flow Module (optional):

**Operating Temperature Range:** -25 to 50° C.

**Power Requirements:** 10.5 to 30 VDC.

**Power Consumption:** 15 W nominal @ 15 LPM.

**Flow Rate:** 15 LPM (10 to 18 LPM, user settable).

**Dimensions:** 35 cm x 30 cm x 15 cm (13.8" x 12" x 6").

**Weight:** 6.15 kg (13.55 lbs).

### 7550-101 Auxiliary Sensor Interface:

**Inputs:** 4 general purpose ±5 V.

**Size:** 11.5 cm x 6.5 cm x 4.2 cm (4.5" x 2.6" x 1.7").

**Weight:** 0.39 kg (0.85 lbs) including mounting bracket.

\*Specifications subject to change without notice.

<sup>1</sup>School of Geosciences, University of Edinburgh, UK; <sup>2</sup>Campbell Scientific, Inc., Logan, UT; <sup>3</sup>Gill Instruments Ltd., Lymington Hampshire, UK; <sup>4</sup>Metek GmbH, Germany; <sup>5</sup>Applied Technologies, Inc., Longmont, CO; <sup>6</sup>Kaijo Sonic Corporation, Japan; <sup>7</sup>RM Young Company, Traverse City, MI

The LI-COR board of directors would like to take this opportunity to return thanks to God for His merciful providence in allowing LI-COR to develop and commercialize products, through the collective effort of dedicated employees, that enable the examination of the wonders of His works.

“Trust in the LORD with all your heart and do not lean on your own understanding. In all your ways acknowledge Him, and He will make your paths straight.”

—Proverbs 3:5,6