



# LI-7500A

## Open Path CO<sub>2</sub>/H<sub>2</sub>O Gas Analyzer

High Speed, High Precision,  
Low Power Consumption

Designed for Eddy Covariance and  
Atmospheric Measurements

**LI-COR®**  
Biosciences

# The LI-7500A Open Path 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
  - 0.11 ppm CO<sub>2</sub> RMS @ 10 Hz
  - 0.0047 ppt H<sub>2</sub>O RMS @ 10 Hz
- High speed *in-situ* CO<sub>2</sub>/H<sub>2</sub>O measurements
- Ideal for eddy covariance applications

The LI-7500A Open Path CO<sub>2</sub>/H<sub>2</sub>O Analyzer is a high speed, high precision, non-dispersive infrared gas analyzer that accurately measures densities of carbon dioxide and water vapor in turbulent air structures. With the eddy covariance technique, these data are used in conjunction with sonic anemometer air turbulence data to determine the fluxes of CO<sub>2</sub> and H<sub>2</sub>O.

The LI-7500A is based upon the proven technology of the LI-7500, which is the leading open path CO<sub>2</sub>/H<sub>2</sub>O analyzer for eddy covariance research. It relies upon the innovative optical arrangement and system design that have made the LI-7500 reliable year after year. It has full backward compatibility with data management applications written for the LI-7500.

## The LI-7500A improves upon the LI-7500 by providing:

- High speed analog input channels for auxiliary sensors, such as a sonic anemometer (up to 20 Hz bandwidth)
- Logs eddy covariance data sets to an internal removable storage device at up to 20 Hz
- Ethernet for two-way communication/data transfer using standard networking protocols
- Versatile outputs, including Ethernet, SDM (Synchronous Devices for Measurement), RS-232, and high speed digital-to-analog converters
- Reduced energy use in cold climates with a low temperature setting for the chopper housing

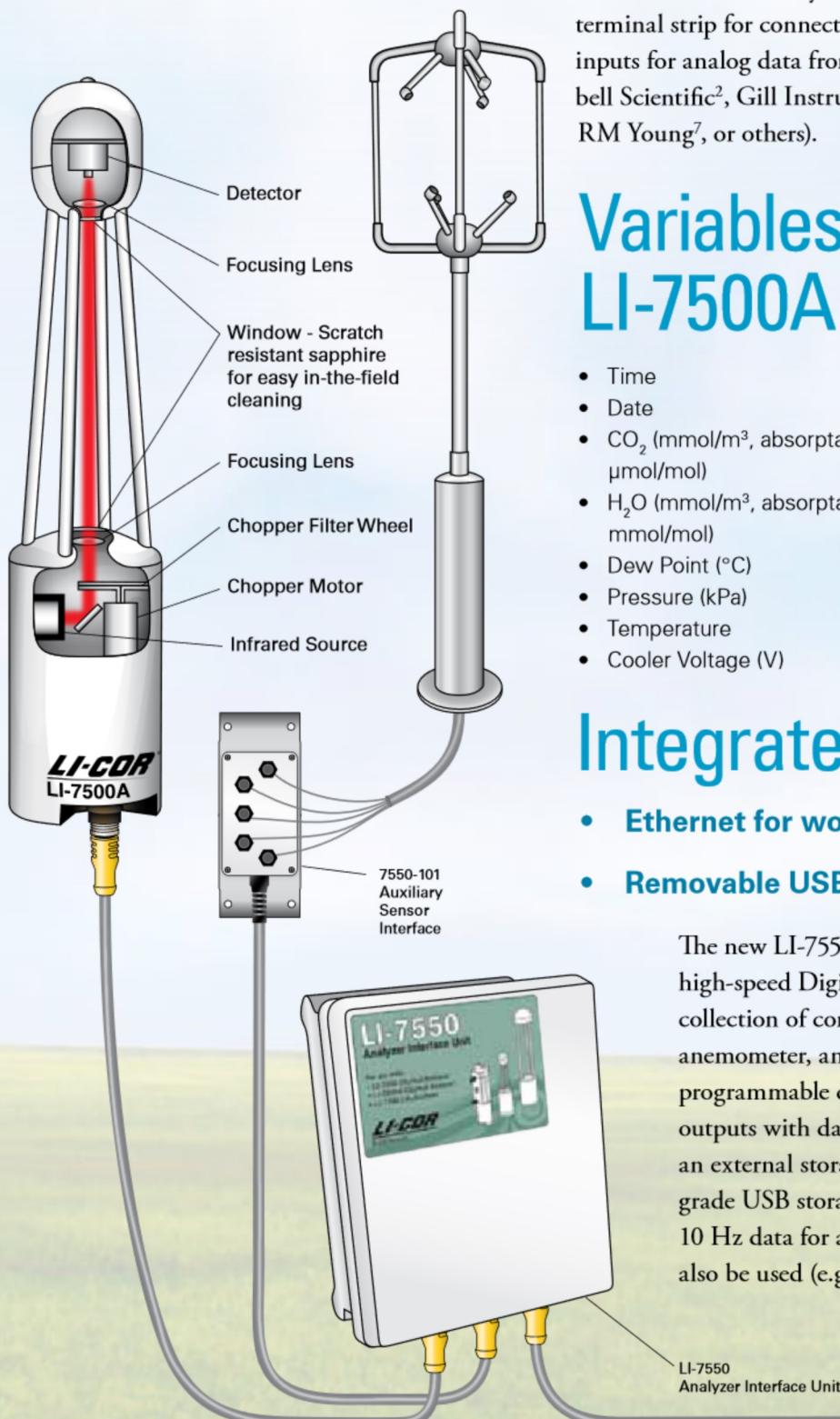
## Proven Technology

The LI-7500A 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 LI-7500A is a result of that ongoing effort.

# 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

The LI-7500A 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) provides a weatherproof terminal strip for connecting external sensors. It provides four general  $\pm 5$  V inputs for analog data from any fast sonic anemometer, (including Campbell Scientific<sup>2</sup>, Gill Instruments<sup>3</sup>, Metek<sup>4</sup>, Applied Technologies<sup>5</sup>, Kajio<sup>6</sup>, RM Young<sup>7</sup>, or others).

## Variables Logged by the LI-7500A:

- Time
- Date
- CO<sub>2</sub> (mmol/m<sup>3</sup>, absorptance, or  $\mu\text{mol/mol}$ )
- H<sub>2</sub>O (mmol/m<sup>3</sup>, absorptance, or mmol/mol)
- Dew Point (°C)
- Pressure (kPa)
- Temperature
- 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)

## Integrated Data Storage

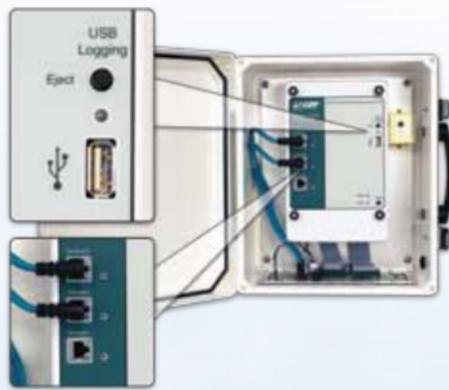
- Ethernet for world-wide connectivity and data transfer
- Removable USB Data Storage

The new LI-7550 Analyzer Interface Unit (included) houses the high-speed Digital Signal Processing electronics. It enables the collection of complete data sets that include CO<sub>2</sub>/H<sub>2</sub>O, sonic anemometer, and diagnostic data. The LI-7500A has a user-programmable delay time to allow synchronization of LI-7500A outputs with data from additional instruments when logging to an external storage device. With the included 4 GB industrial grade USB storage device, the LI-7550 can store 24 channels of 10 Hz data for about 20 days. Larger USB storage devices can also be used (e.g.  $\geq 16$  GB).

# Versatile Data Output Options

The LI-7500A supports four data output options, including Ethernet, linearized digital-to-analog converters (DACs), RS-232 serial data, and SDM output for Campbell Scientific, Inc.<sup>2</sup> dataloggers. Selectable output bandwidths of 5, 10, or 20 Hz are available (response times of 0.1, 0.05, and 0.025 seconds respectively).

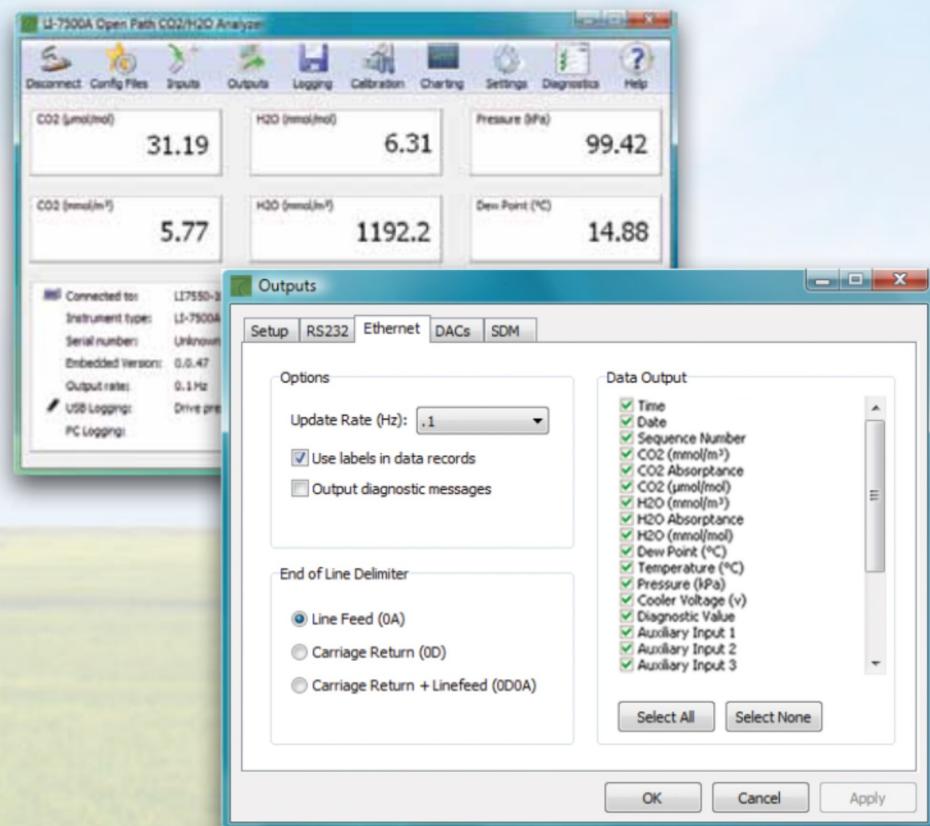
- Ethernet - The instrument uses industry standard TCP/IP networking protocols to facilitate communication with networked computers.
- RS-232 - Serial data output is available at up to 20 records per second at a connection speed of 115,200 baud. A software command or serial hardware control line is also available to query the LI-7500A for individual data records.
- Digital-to-Analog Output - Six user-configurable linear DACs are updated at 300 times per second by Digital Signal Processing electronics.
- SDM - Serial data can also be output at rates of up to 50 Hz using the SDM output.

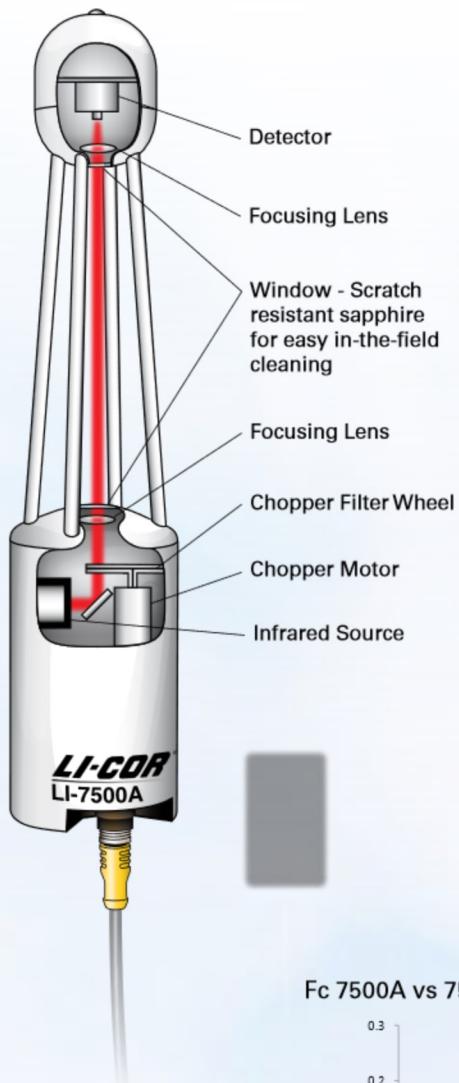


## Intuitive Software

Intuitive Windows® software provides versatile, yet simple instrument setup. Configuring the instrument is accomplished with a personal computer connected with either the RS-232 or Ethernet connection. The graphical controls window provides easy access to instrument options, including auxiliary sensor inputs, live data

charting, and data logging settings. There is no need to learn a complex programming language to setup your eddy covariance data collection. Just configure the parameters through the graphical interface and let the instrument do the rest.





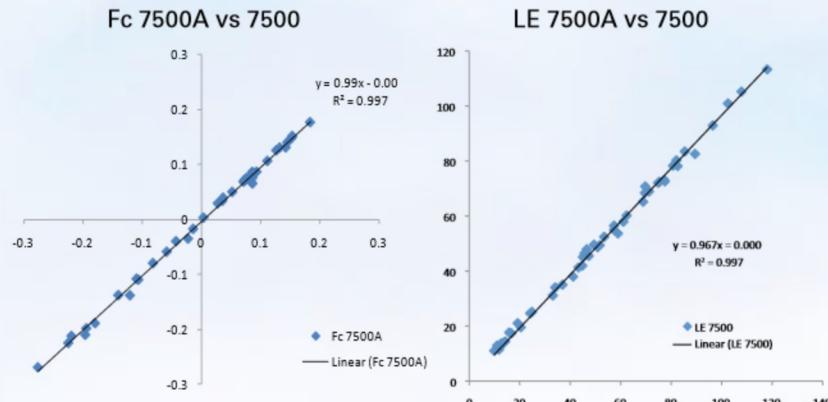
# A Tradition of Excellence...

The LI-7500A sensor head has a 12.5 cm open optical path, with single pass optics and a large 8 mm diameter optical beam. Optical filters centered at 3.95  $\mu\text{m}$  provide a reference signal for CO<sub>2</sub> and water vapor. Absorption at wavelengths centered at 4.26  $\mu\text{m}$  and 2.59  $\mu\text{m}$  provide for measurements of CO<sub>2</sub> and water vapor, respectively. This design minimizes sensitivity to dirt and dust, which can accumulate during normal operation.

The figure to the left shows a cutaway representation of the LI-7500A sensor head. The Infrared Source emits radiation that 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. The Windows at both ends of the optical path are made of scratch resistant sapphire, allowing for worry-free and easy cleaning in the field. The LI-7500 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.

## Proven Performance



The LI-7500A uses the proven technology of the LI-7500, providing specifications identical to those of the LI-7500. The figures to the left show CO<sub>2</sub> and latent heat (LE) fluxes computed from data collected with an LI-7500A and an LI-7500 standard. Both figures show strong agreement between the two instruments.

## Ordering Information:

### LI-7500A Open Path CO<sub>2</sub>/H<sub>2</sub>O Analyzer

Includes the LI-7500A Open Path CO<sub>2</sub>/H<sub>2</sub>O Analyzer, LI-7550 Analyzer Interface Unit, 4 GB industrial grade USB storage device, 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-7500ADP CO<sub>2</sub>/H<sub>2</sub>O Analyzer Package

LI-7500A Open Path CO<sub>2</sub>/H<sub>2</sub>O Analyzer  
LI-610 Portable Dew Point Generator

### GHG-1 Greenhouse Gas Analyzer Package

LI-7500A Open Path CO<sub>2</sub>/H<sub>2</sub>O Analyzer  
LI-7700 Open Path CH<sub>4</sub> Analyzer

### 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 for a sonic anemometer. Includes mounting bracket, hardware, and a 0.8 meter cable.

### LI-7500 Upgrade Kit

Includes hardware upgrade to convert an LI-7500 to an LI-7500A, the LI-7550 Analyzer Interface Unit, IRGA Cable, (5 meter), data cables (5 meter), Windows® software, and instruction manual.

**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% of reading	Within 2% of reading
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 records 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 verification test 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.

**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-7500A Open Path CO<sub>2</sub>/H<sub>2</sub>O Analyzer Dimensions:

**Size:** 6.5 cm (2.6" diameter, 30 cm (12") length.

**Weight:** 0.75 kg (1.65 lbs.).

**Cable length:** 5 meters (data and IRGA cables).

## 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



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The LI-7500A gas analyzer is covered by U.S. Patent 6,317,212, and foreign equivalents.  
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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