

LI-7000 CO₂/H₂O Analyzer

High Speed, High Precision
Differential Analyzer



LI-COR®



The LI-7000 CO₂/H₂O Analyzer

The LI-7000 is a high performance, dual cell, differential gas analyzer. It uses a dichroic beam splitter and two separate detectors to measure infrared absorption by CO₂ and H₂O in the same gas stream. At the heart of the LI-7000 is an innovative optical bench that can be dismantled and cleaned by the user without the need for factory recalibration.

The LI-7000 also features:

- **Large diameter air inlet and outlet ports** that virtually eliminate back pressure, even at flow rates of 10 l/min
- **Direct connection of air fittings** to the optical bench eliminates diffusive leaks
- **Durable sapphire optical bench windows** which are extremely hard and scratch resistant
- **Built-in pressure sensor** with 0.1% accuracy, for automatic compensation for pressure changes in the sample cell
- **Built-in auxiliary pump** can be used for either sample or reference cell
- **Intelligent diagnostic indicators** warn of potential problems before data are compromised
- **Real-time charting**

The LI-7000 is ideal for a variety of high speed, high precision differential projects.

Applications

Flexibility

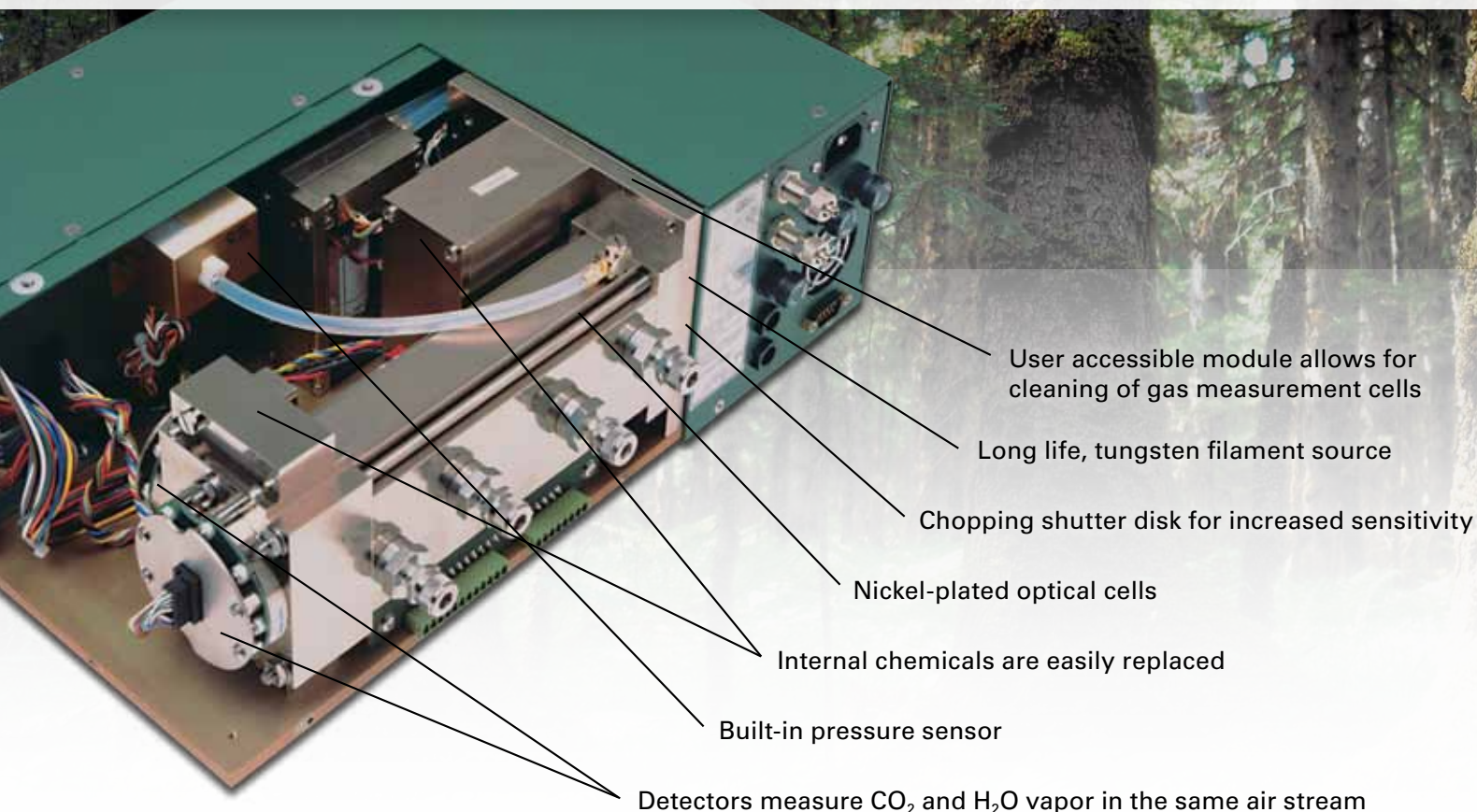
The LI-7000 is ideally suited for applications that demand high speed, high precision measurements in absolute and/or differential modes, including plant gas exchange using chamber-based methods, atmospheric-surface flux eddy covariance and Bowen ratio techniques, vertical profiling, and general atmospheric monitoring. The cleanable optics and software functions such as integration and peak detection operations are important features for applications such as the measurement of dissolved CO₂ (pCO₂), and Total Organic Carbon (TOC) in aqueous samples.

The LI-7000's inherent stability and wide operating temperature range make it well suited for the rigorous demands of cross-sectional measurements of plumes from point sources such as volcanoes, geothermal degassing locations, or industrial sites.

- Atmospheric Monitoring
- Animal Respiration
- Industrial Monitoring
- Greenhouse Applications
- Insect Respiration
- Soil CO₂ Flux Measurements
- Growth Chamber Applications
- Photosynthesis and Transpiration Studies
- Plant Physiology
- Oceanographic Studies (pCO₂ and TOC)

For Eddy Covariance Analyzers, visit www.licor.com/ec-analyzers





Technology

Design features that contribute to the LI-7000 performance are:

- A long life (>5 years), vacuum sealed tungsten filament source. This source has low power consumption, and is highly stable.
- Nickel-plated optical cells to minimize water sorption. The optical cells can be removed and cleaned with compressed air or water, and reassembled without requiring factory recalibration.
- CO₂ and H₂O detectors simultaneously measure CO₂ and H₂O vapor in the same air stream.
- Digital Signal Processing immediately digitizes the signal from the detectors. All further signal processing is in the digital domain to avoid analog component drifts.



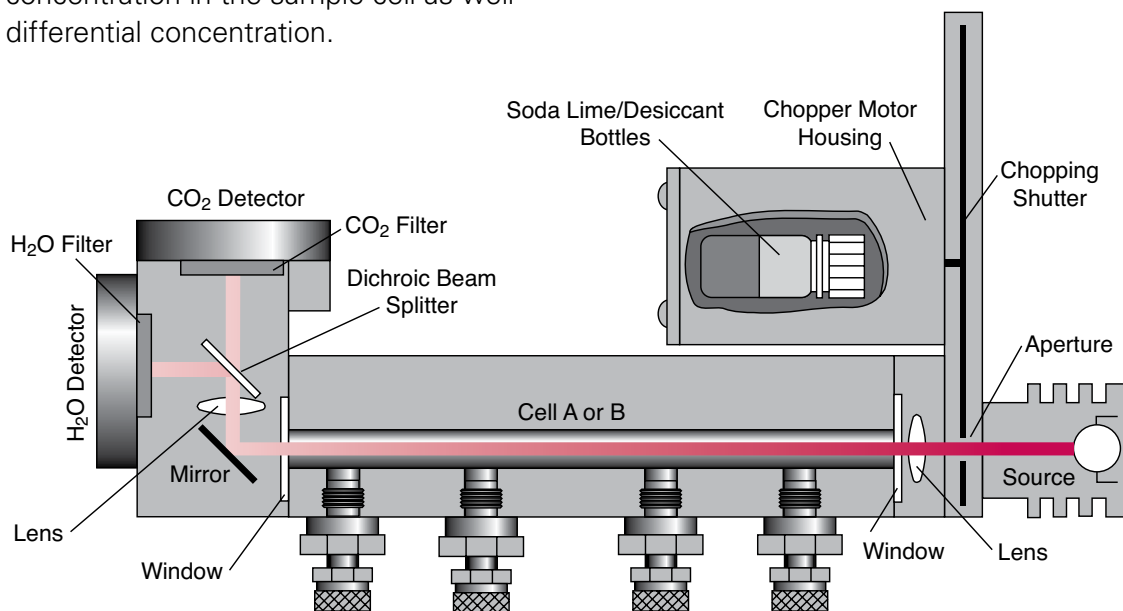
- A spinning chopper shutter disk allows for radiation to alternately pass through each gas sampling cell. The rotation of the disk is precisely controlled at a high chopping frequency, which reduces sensitivity of the detector to low frequency vibrations. This results in lower analyzer noise, fast response, and increased sensitivity.
- Modular components in user accessible areas of the analyzer provide a simple method of cleaning the gas sampling cells and changing internal chemicals to minimize the need for factory service.
- Two auxiliary input channels (10 Hz bandwidth) which can be used to input an analog signal from an external sensor. CO₂ and H₂O references may be input through these channels.
- Four fully configurable digital-to-analog converters (DACs) which are updated at 600 Hz provide output signals that are directly proportional to gas concentration or other meaningful units. Both USB and RS-232 interfaces are provided for data output at rates of up to 50 Hz.



Operational Overview

The LI-7000 is a differential analyzer, in which a gas of known concentration (which can be zero) is put in the reference cell (A), and an unknown gas is put in the sample cell (B). The instrument software provides continuous output of the absolute concentration in the sample cell as well as the differential concentration.

The infrared source provides radiation through both optical paths, which is directed to CO₂ and H₂O detectors. Internal chemicals keep the detector and chopper housings free of CO₂ and H₂O vapor.

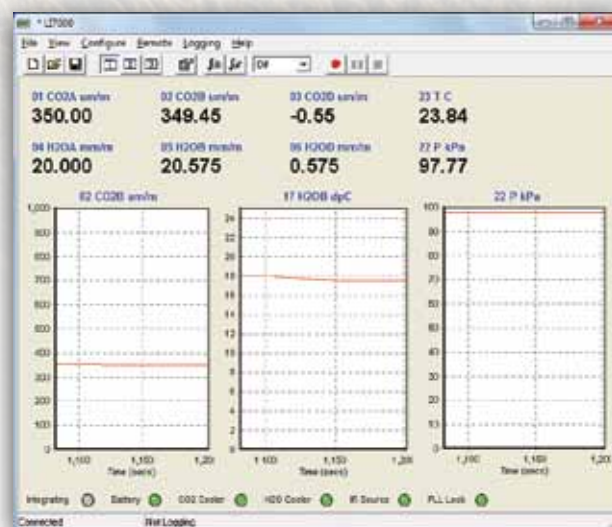


Software

Windows Interface

Simple PC-compatible software for Windows® provides easy access to all instrument functions, including calibration, data output options, and the display of output variables. The main window allows for viewing real-time data in text or graphical form.

Any software communications program capable of sending command strings and receiving ASCII data can be used to communicate with the LI-7000. All instrument functions can also be accessed at the LI-7000 front panel. Custom displays with up to 8 variables, updated in real time, are available on the LCD.

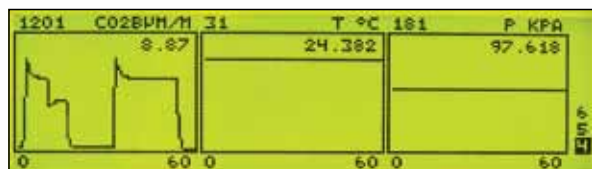


Output variables are presented in real-time text or graphical forms with a simple Windows® interface.

Screen Display

The LI-7000 has a 40 character x 8 line backlit LCD that displays real-time measured values. The variables to be displayed are chosen from a list, and as many as 8 can be viewed on a single display screen. Different screens can be programmed and accessed quickly by pressing a single numeric key on the keypad. More than 50 different measured and diagnostic variables, including CO₂ and H₂O measurements as mole fraction, partial pressure, dew point (H₂O), or raw absorbance values are available for display.

Measured variables can be automatically integrated using built-in integration functions.



The display can be quickly toggled between text and graphics modes, where measured or computed variables can be viewed in real time. Up to 3 sets of plots can be defined and stored, with as many as 3 plots per graph set.



The LCD display has adjustable backlighting and contrast settings.

Ordering Information



LI-7000 CO₂/H₂O Gas Analyzer

Includes external battery leads, scrubber tube, AC power cord, RS-232 serial cable, USB cable, Windows® Interface Software and factory calibration.



LI-7000DP

Special pricing package, includes the LI-7000 CO₂/H₂O Gas Analyzer and the LI-610 Dew Point Generator, which can be used to calibrate the water channel of the LI-7000.



LI-610 Portable Dew Point Generator

Includes 610-01 AC Module and 610-04 BNC to mV Recorder Leads.

Eddy Covariance Analyzers

LI-COR offers additional high speed, high precision analyzers which are ideal for measuring ecosystem gas exchange. For more information on these analyzers, visit: www.licor.com/ec-analyzers

LI-7500A Open Path CO₂/H₂O Analyzer

The LI-7500A is an open path, high speed, high precision, non-dispersive infrared gas analyzer that accurately measures densities of carbon dioxide and water vapor *in situ*. With the eddy covariance technique, these data are used in conjunction with sonic anemometer wind speed to determine the fluxes of CO₂ and H₂O into and out of ecosystems.

The LI-7500A and LI-7200 (below) accept analog data from a sonic anemometer and log complete data sets to a removable USB storage device.

LI-7200 Enclosed CO₂/H₂O Analyzer

The LI-7200 is a compact, enclosed CO₂/H₂O analyzer that combines the benefits of open and closed path gas analyzers. It is an integrated system designed to provide continuous measurements in harsh weather conditions and environments, with very low power consumption.

LI-7700 Open Path CH₄ Analyzer:

The open path design of the LI-7700 provides solutions to many of the challenges of measuring atmospheric CH₄ flux over various ecosystems, while providing excellent co-spectra. No external pumps or tubing are required, and low power requirements for the entire system enable the LI-7700 to be powered with solar panels in remote locations (~ 8W during normal operation). Self-cleaning optics provide low maintenance requirements and more robust data.



LI-7000 Specifications

Type: Differential, non-dispersive infrared gas analyzer.

Detectors: Two solid state detectors; one each for CO₂ and H₂O, filtered with center wavelengths at 4.255 and 2.595 microns, respectively.

Chopping Frequency: 600 Hz.

Source: Single source, lifetime > 5 years.

Optical Bench: One optical bench. Sample cell size: 9.53 mm Dia. × 152.4 mm L (3/8" × 6"). Volume: 10.86 cm³.

Warm-up Time: Approximately 2 minutes to operation.

Gas Pressure: Maximum allowable pressure is 115 kPa (17 psi) with pressure sensor connected. 200 kPa (29 psi) max. w/o pressure sensor connected.

Maximum Flow through Analyzer: >50 liters/min.

Internal Pump Max Flow Rate: Approximately 1 liter/minute.

Display: 40 character × 8 line backlit LCD.

Back Panel Connections:

Analog: 4 user-scalable DAC's, 600 Hz update frequency (±5V maximum, 14-bit).

RS-232: 9600 to 115,200 baud.

USB: Data output rate up to 50 Hz. USB 2.0 compliant.

Auxiliary Input Channels: 2, -2.5 to +2.5V. Common mode input voltage range ±2.5V.

Power Requirements: 100-240 VAC, 50-60 Hz, or 10.5-16 VDC, 4 amp max.

Power Consumption: 15-40 Watts DC (dependent on temperature and pump usage).

Temperature Range: 0-50 °C ambient, 0-55 °C bench.

Size: 5" H × 9.875" D × 14.5" L (12.7 × 25 × 36.8 cm).

Weight: 19.4 lbs. (8.8 kg).

CO₂ Analyzer Specifications

Range: 0-3000 µmol/mol.

Accuracy: 1% nominal.

Zero Drift (with temperature): <0.1 µmol/mol/°C.

Span Drift: <0.2% of reading/°C.

Water Sensitivity: <0.1 µmol/mol CO₂/mmol/mol H₂O (Software algorithm corrects for band broadening effects).

Calibration: Factory linearization over 0-3000 µmol/mol range using NIST-traceable standard gases.

Pressure Range: 0 to 115 kPa absolute.

Display Resolution: .01 µmol/mol.

Signal Noise: See table below.

H₂O Analyzer Specifications

Range: 0-60 mmol/mol. Optical bench and interconnecting hoses must be maintained above the dewpoint temperature by the user.

Accuracy: 1%.

Zero Drift: <0.1 mmol/mol/°C.

Span Drift: <0.4% of reading/°C.

Signal Noise: See table below.

Calibration: LI-610 Dew Point Generator

Noise Specifications (Typical)

Average Time (s)	Bandwidth (Hz)	CO ₂ (370 µmol/mol)		H ₂ O (10 mmol/mol)	
		RMS Noise (ppb)	Peak-to-Peak (ppb)	RMS Noise (ppm)	Peak-to-Peak (ppm)
20	0.025	6	39	0.4	3
1	0.5	25	173	2	12
0.5	1	35	245	2	17
0	20	157	1096	11	75

LI-COR®

LI-COR Biosciences

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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