Trace Gas Analyzers

# High performance $CO_2$, $CO_2$ Isotope, $NH_3$, $CH_4$, and $N_2O$ gas analyzers for the field, the lab, and mobile applications.

## Go wherever your research takes you.

**LI-7810** $CH_4/CO_2/H_2O$ Trace Gas Analyzer
**LI-7815** $CO_2/H_2O$ Trace Gas Analyzer
**LI-7820** $N_2O/H_2O$ Trace Gas Analyzer
**LI-7825** $CO_2$ Isotope/$NH_3$ Trace Gas Analyzer

LI-COR®

# Precision, stability, and portability

For over 35 years, LI-COR infrared gas analyzers have been used and trusted by researchers and networks around the world.

LI-COR Trace Gas Analyzers provide the same exceptional performance in the lab, in the field, or on the move for $CO_2$, $CO_2$ Isotopologue, $NH_3$, $CH_4$, and $N_2O$ measurements. With low power and low maintenance requirements, LI-COR Trace Gas Analyzers are rugged and reliable enough for the most extreme and remote locations, even at high altitudes.

## Patented design

LI-COR Trace Gas Analyzers use Optical Feedback-Cavity Enhanced Absorption Spectroscopy (OF-CEAS) complemented by several patented technologies[1] and innovations. Our unique approach to OF-CEAS enhances precision and stability. The high-finesse optical cavity allows the laser to be reflected through the cavity multiple times, enhancing the signal several fold.

The technology and sophisticated signal processing result in a cost-effective analyzer that consistently delivers high performance and requires minimal maintenance. LI-COR Trace Gas Analyzers merge the precision of a bench analyzer with portability and flexibility for a range of research applications.

1. U.S. patents 8659758, 8665442, 8885167, 9116047, 9194742, 9304080, 9581492, 9678003, 9759654, 9759655, 9989729, and 10060942. Additional patents pending in the U.S. and other countries.

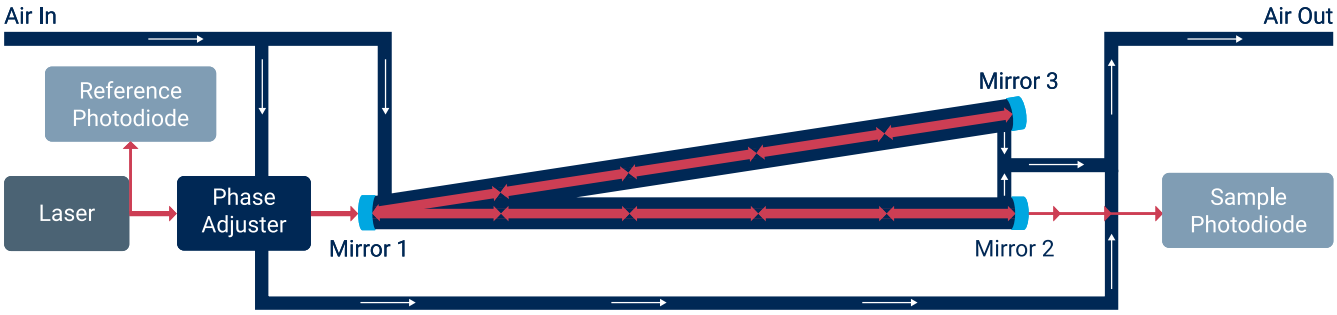



**Figure 1. Simplified schematic of the Trace Gas Analyzer flow path through the optical bench.** The phase adjuster is a volume in the path between the laser and optical bench that is tied to a pressure control mechanism. Changing the pressure of that volume alters the refractive index which subsequently modifies the phase of the laser.

## Versatile for many applications

With a durable, weather-resistant case and wide operating temperature range, LI-COR Trace Gas Analyzers can be deployed under a simple shelter in ambient temperature in many areas. Multiple analyzers can be plumbed in parallel for combined $CO_2$, $CO_2$ Isotopologue, $NH_3$, $CH_4$, and $N_2O$ measurements from a single source.


* Wi-Fi connectivity limited in some countries

## Web-enabled for convenience

- Wi-Fi and a built-in web server with software make connecting to a computer, smart phone, or tablet effortless.
- Software is designed for quick access to measurement data, status information, and configuration options.
- Built-in storage holds two months of data.
- Support for direct connection to a PC or Ethernet-compatible datalogger expands data storage options.

**LI-COR Trace Gas Analyzers are now supported by GCWerks software to simplify your remote data acquisition, instrument calibration, and system monitoring.**

Go to **www.licor.com/tracegas** for more information, case studies, and research.

# LI-7810 $CH_4/CO_2/H_2O$ Trace Gas Analyzer

The LI-7810 delivers exceptionally stable and precise $CH_4$ measurements. The instrument is ideal for atmospheric $CH_4$ monitoring, combined $CH_4/CO_2$ soil gas flux measurements, and high-precision methane measurement applications.

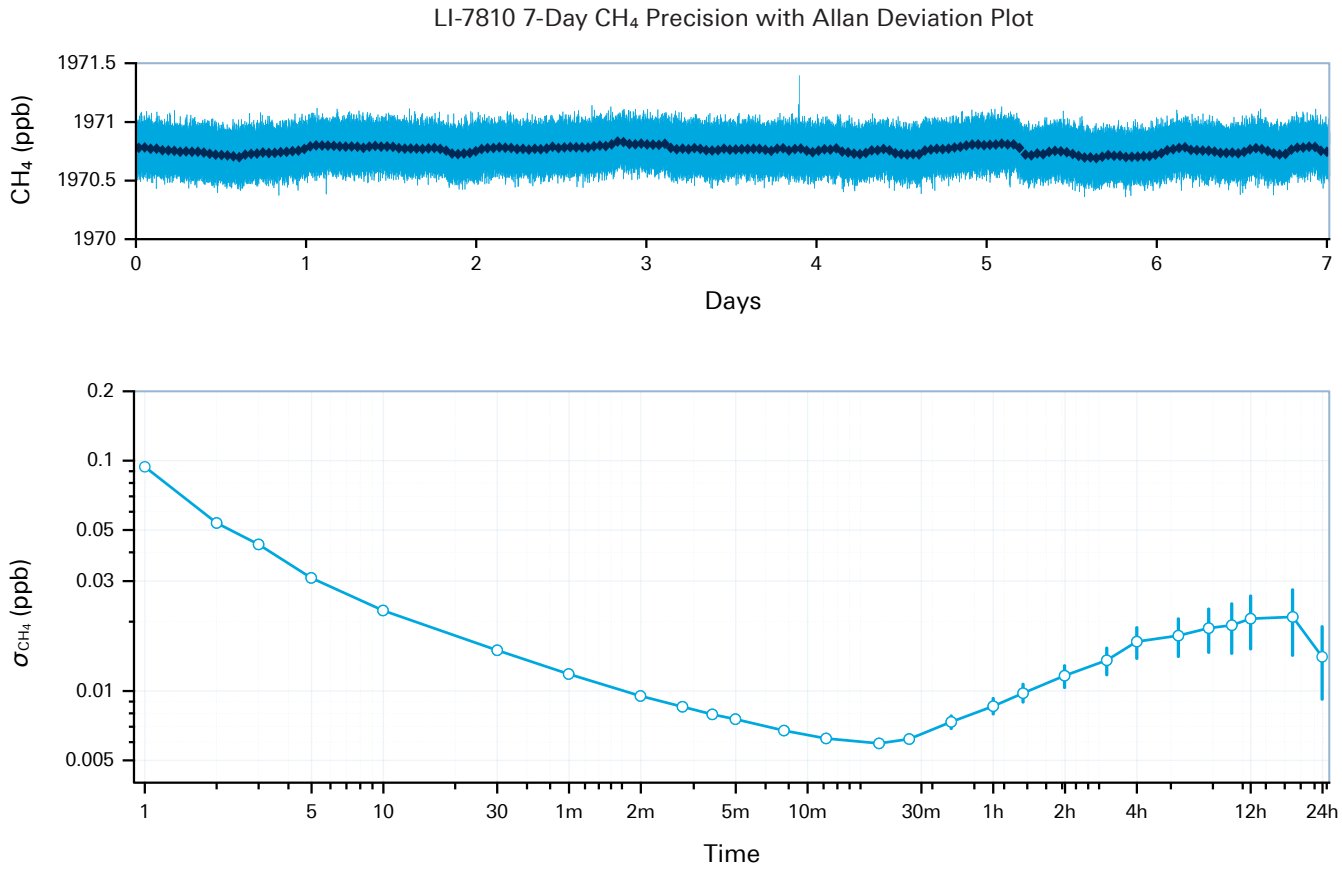



**Figure 2. $CH_4$ stability data from an LI-7810 as it measured continuously flowing tank gas (1970.7 ppb $CH_4$ and 387.5 ppm $CO_2$) over a 7-day period.** The light blue line (top) is the 1-second $CH_4$ output; the dark blue line is the 50-minute block average. The Allan deviation plot (bottom) is $CH_4$ precision with 1-second averaging. Precision improves as averaging time increases. Error bars represent 68% (±1σ) confidence intervals based on number of averaged time series available at each τ.

## Applications

The LI-7810 is ideal for a range of applications—from atmospheric $CH_4$ monitoring to mobile monitoring, to soil $CH_4$ and $CO_2$ flux measurements. It easily connects to the Smart Chamber or LI-8250 Multiplexer for survey or long-term soil $CH_4$/$CO_2$ gas flux measurements.

- Atmospheric monitoring
- Soil gas flux measurements
- Mobile measurement systems
- Wetland and lake emissions
- Small volume injections
- Sampling from flasks
- Urban emissions monitoring
- $pCH_4$ measurement systems
- Sensor networks
- Large area emissions monitoring
- Fugitive emissions detection
- High altitude sites

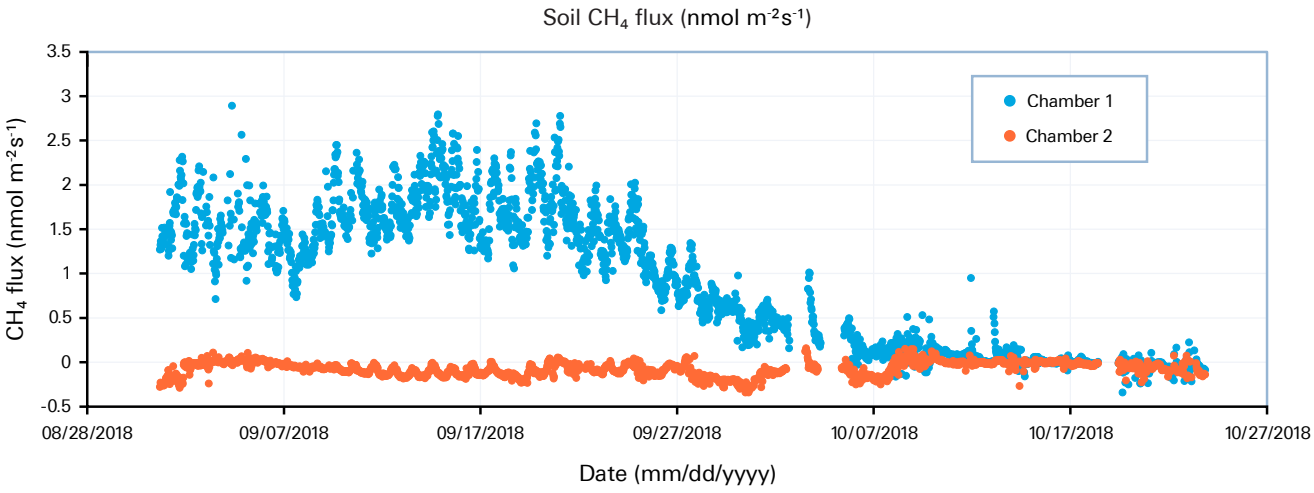



**Figure 3. Seasonal soil $CH_4$ flux variations observed using the LI-7810 $CH_4$/$CO_2$/$H_2O$ Trace Gas Analyzer and the LI-8150 Multiplexer with 8100-104 Long-Term Chambers.** Chamber 1 site was a source of emissions up to 2.8 nmol $m^{-2}s^{-1}$—which was unexpected for grassland. By October, the site had become a sink. Chamber 2 site was typically a sink with rates ~-0.2 nmol $m^{-2}s^{-1}$. This was expected and consistent with published rates.

## Specifications

### $CH_4$ Measurements

**Response Time ($T_{10}$-$T_{90}$):** all from 0 to 2 ppm
≤ 2 seconds in *Standard Configuration*
≤ 3 seconds in *High Altitude Configuration*
**Range:** 0 to 100 ppm
**Precision (1σ):**
0.60 ppb at 2 ppm with 1 second averaging
0.25 ppb at 2 ppm with 5 second averaging
**Maximum Drift:** < 1 ppb per 24-hour period

### $CO_2$ Measurements

**Range:** 0 to 10,000 ppm
**Precision (1σ):**
3.5 ppm at 400 ppm with 1 second averaging
1.5 ppm at 400 ppm with 5 second averaging

### $H_2O$ Measurements

**Range:** 0 to 60,000 ppm
**Precision (1σ):**
45 ppm at 10,000 ppm with 1 second averaging
20 ppm at 10,000 ppm with 5 second averaging

*Specifications subject to change without notice*

# LI-7815 $CO_2/H_2O$ Trace Gas Analyzer

The LI-7815 is designed for long-term atmospheric $CO_2$ measurements, and is ideal for mobile monitoring systems, emissions monitoring applications, and $pCO_2$ analysis systems.

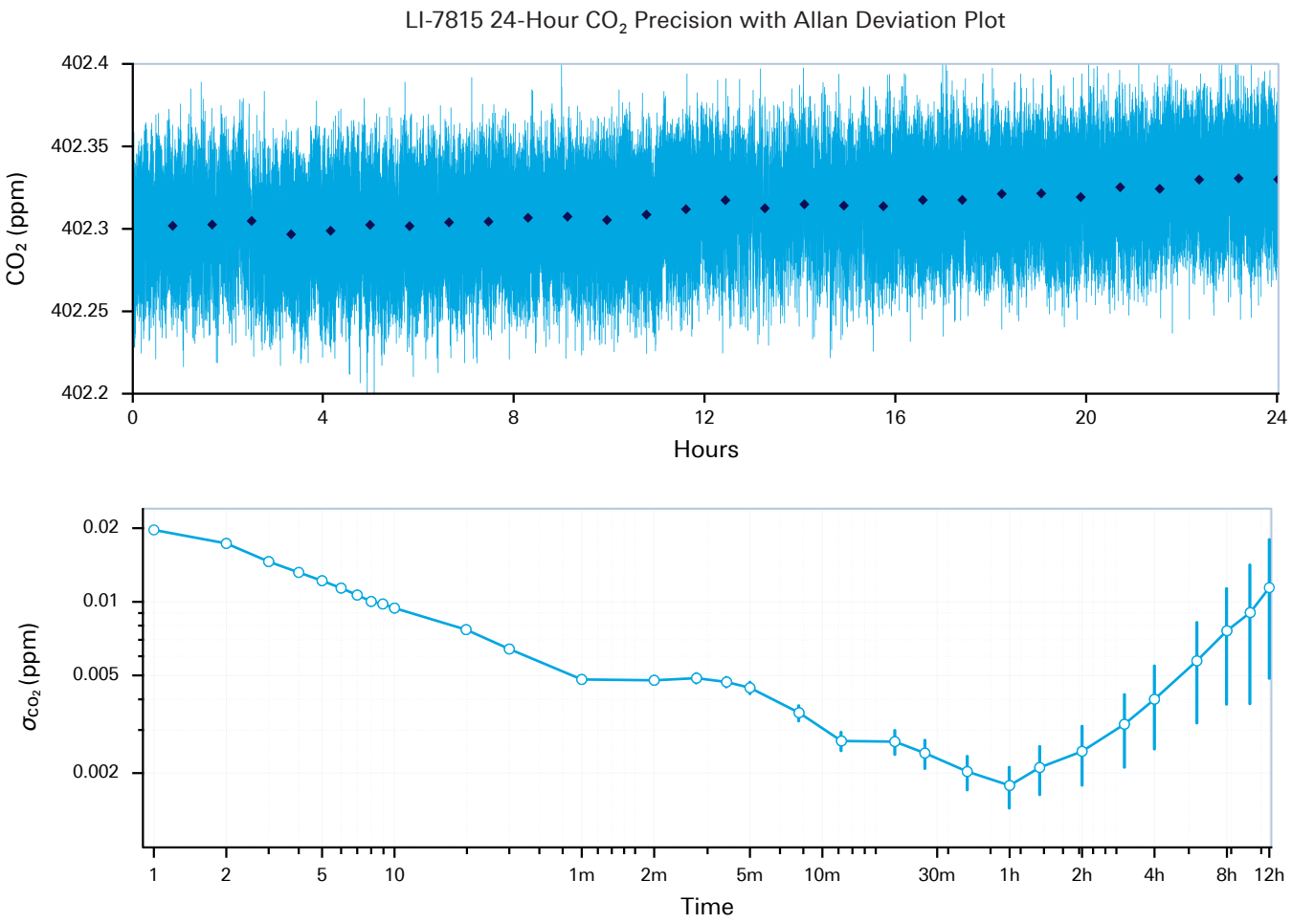



**Figure 4. $CO_2$ stability data from an LI-7815 as it measured continuously flowing tank gas (402.3 ppm $CO_2$) for a 24-hour period.** The blue line (top) shows 1-second measurements; the diamond line shows a 50-minute block average. The Allan deviation plot (bottom) of $CO_2$ precision with 1-second signal averaging. Precision improves as averaging time increases. Error bars represent 68% (±1σ) confidence intervals based on number of averaged time series available at each τ.

## Applications

The LI-7815 provides the high precision, accuracy, and stability required by leading atmospheric monitoring organizations.

- Atmospheric $CO_2$ monitoring
- Sensor networks
- Urban emissions monitoring
- Mobile emissions monitoring
- $pCO_2$ measurement systems
- Large area emissions monitoring
- Fugitive emissions
- High altitude sites

## Specifications

### $CO_2$ Measurements

**Response Time ($T_{10}$-$T_{90}$):** all from 0 to 400 ppm
≤ 2 seconds in *Standard Configuration*
≤ 3 seconds in *High Altitude Configuration*
**Range:** 0 to 10,000 ppm
**Precision (1σ):**
0.10 ppm at 400 ppm with 1 second averaging
0.04 ppm at 400 ppm with 5 second averaging
**Maximum Drift:** < 0.2 ppm per 24-hour period

### $H_2O$ Measurements

**Range:** 0 to 60,000 ppm
**Precision (1σ):**
45 ppm at 10,000 ppm with 1 second averaging
20 ppm at 10,000 ppm with 5 second averaging

*Specifications subject to change without notice*

## LI-7820 $N_2O/H_2O$ Trace Gas Analyzer

The LI-7820 provides precise $N_2O$ measurements that are ideal for chamber-based soil gas flux research and more. When coupled with LI-COR soil gas flux systems, it can measure short-term natural variations of $N_2O$ and large emission events. Capable of measuring flux rates as low as 0.05 nmol $m^{-2}$ $s^{-1}$ in a 2-minute measurement, the LI-7820 measures flux from soils in a fraction of the time required by traditional analyzers.

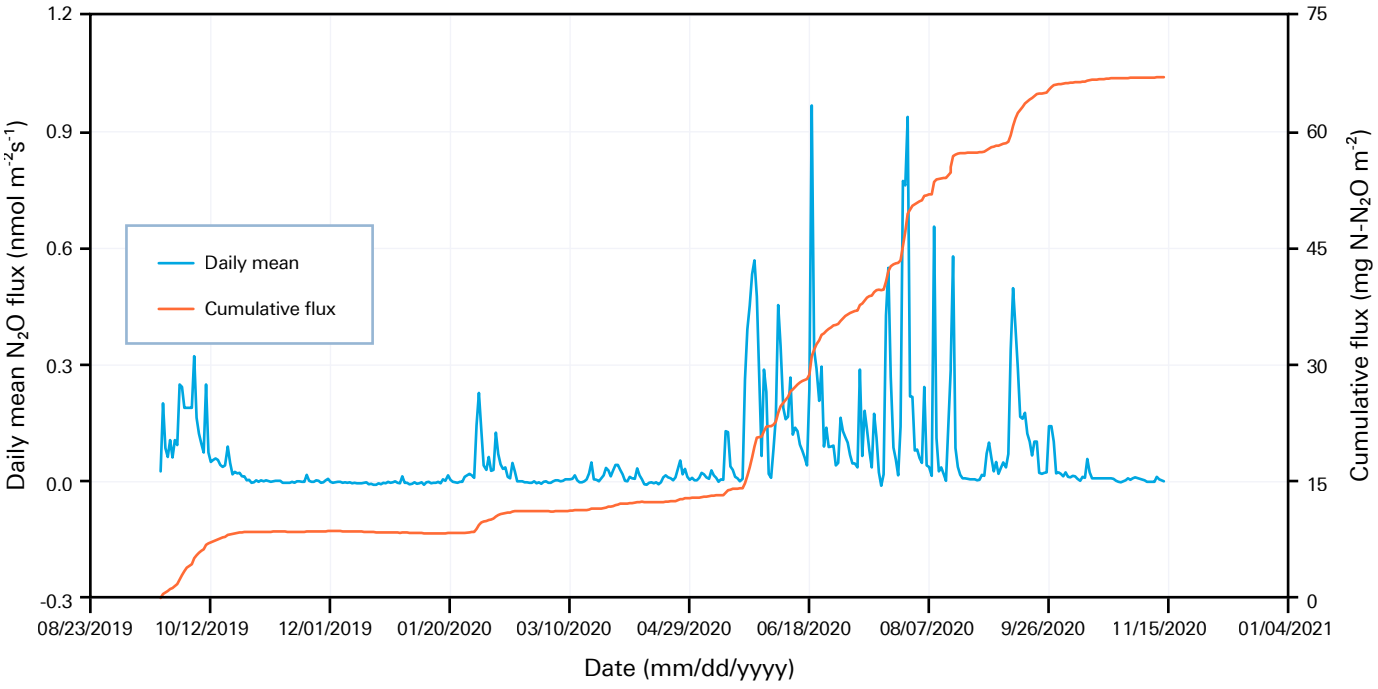


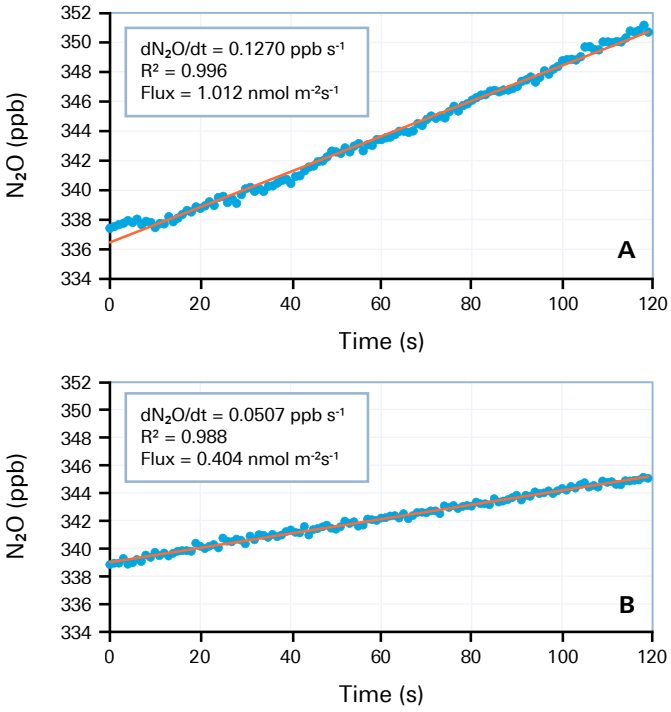

**Figure 5. Measurements of $N_2O$ flux from soils over a 14-month time period.** Measured by the LI-7820 $N_2O/H_2O$ Trace Gas Analyzer and an LI-8100A Automated Soil $CO_2$ Flux System. Measurements were conducted over an urban lawn in Lincoln, NE, USA, and shows natural variations of $N_2O$ fluxes detected by the LI-7820. Results from Xu, et al., 2020.[2]

2. Xu., Liukang, Minish, K., Trutna, D. (2020). How do soil temperature and moisture regulate $N_2O$ flux from an urban lawn? Exhibited at AGU Annual Meeting 2020, December 1 - December 17, 2020.

## Applications

The LI-7820 is ideal for soil gas exchange measurements and general-purpose monitoring. It easily connects to the Smart Chamber or LI-8250 Multiplexer for survey or long-term soil $N_2O$ flux measurements.

- Soil gas flux measurements
- Atmospheric monitoring
- Large area emissions monitoring
- Animal agriculture $N_2O$ flux measurements
- Urban emissions monitoring
- Mobile emissions monitoring
- $N_2O$ measurements in sensor networks
- High altitude sites



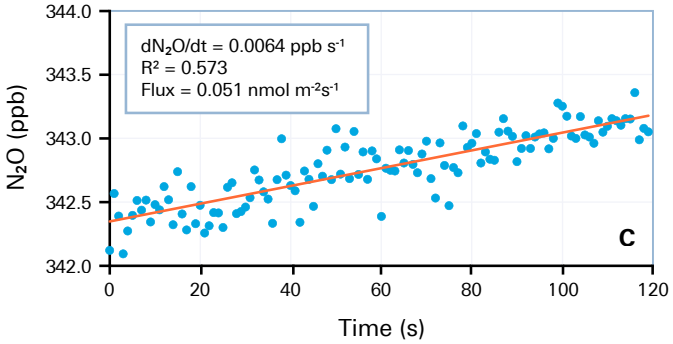




**Figure 6. Soil $N_2O$ flux measurements with the LI-7820.** The LI-7820 precision allows fluxes to be resolved within 2 minutes, for both high fluxes (linear regression coefficients higher than 0.9 when $N_2O$ flux was higher than 0.1 nmol $m^{-2}s^{-1}$, figures A and B), as well as when fluxes from natural emissions occur that can be extremely low. The LI-7820 is capable of measuring flux rates as low as 0.05 nmol $m^{-2}s^{-1}$ in 2 minutes under these conditions (C).

Learn more about using the LI-7820 with the Smart Chamber or LI-8250 Multiplexer at **www.licor.com/soil**

## Specifications

### $N_2O$ Measurements

**Response Time ($T_{10}$-$T_{90}$):** all from 0 to 330 ppb
≤ 2 seconds in *Standard Configuration*
≤ 3 seconds in *High Altitude Configuration*
**Range:** 0 to 100 ppm
**Precision (1σ):**
0.40 ppb at 330 ppb with 1 second averaging
0.20 ppb at 330 ppb with 5 second averaging
**Maximum Drift:** < 1 ppb per 24-hour period

### $H_2O$ Measurements

**Range:** 0 to 60,000 ppm
**Precision (1σ):**
45 ppm at 10,000 ppm with 1 second averaging
20 ppm at 10,000 ppm with 5 second averaging

*Specifications subject to change without notice*


# LI-7825 $CO_2$ Isotope/$NH_3$ Trace Gas Analyzer

The LI-7825 $CO_2$ Isotope/$NH_3$ Trace Gas Analyzer measures the four most abundant $CO_2$ gas isotopologues in air and reports $\delta^{13}C$, $\delta^{17}O$, and $\delta^{18}O$ with high precision and accuracy. By measuring $CO_2$ isotopologues and calculating isotope ratios, researchers can:

- Identify the sources and sinks of atmospheric carbon
- Partition net ecosystem carbon exchange
- Gain insight into biological processes
- Evaluate carbon sequestration efforts

## Measuring atmospheric $CO_2$ isotopologues

The LI-7825 meets or exceeds requirements for long-term atmospheric background measurements and offers a versatile platform for a range of applications for a better understanding of $CO_2$ emissions from anthropogenic and natural sources.

## Measuring $NH_3$

The LI-7825 measures higher concentrations of $NH_3$, and is suitable for detecting ammonia in livestock barns, feedlots, barnyards, fertilizer applications, fence line monitoring, ammonia leaks, and other applications where $NH_3$ concentration is elevated above natural abundance.

## Applications

- Atmospheric monitoring
- Urban emissions monitoring
- Mobile emissions monitoring
- Large area emissions monitoring
- Sensor networks
- Mud gas logging

LI-7825 10-Day Precision with Allan Deviation Plots

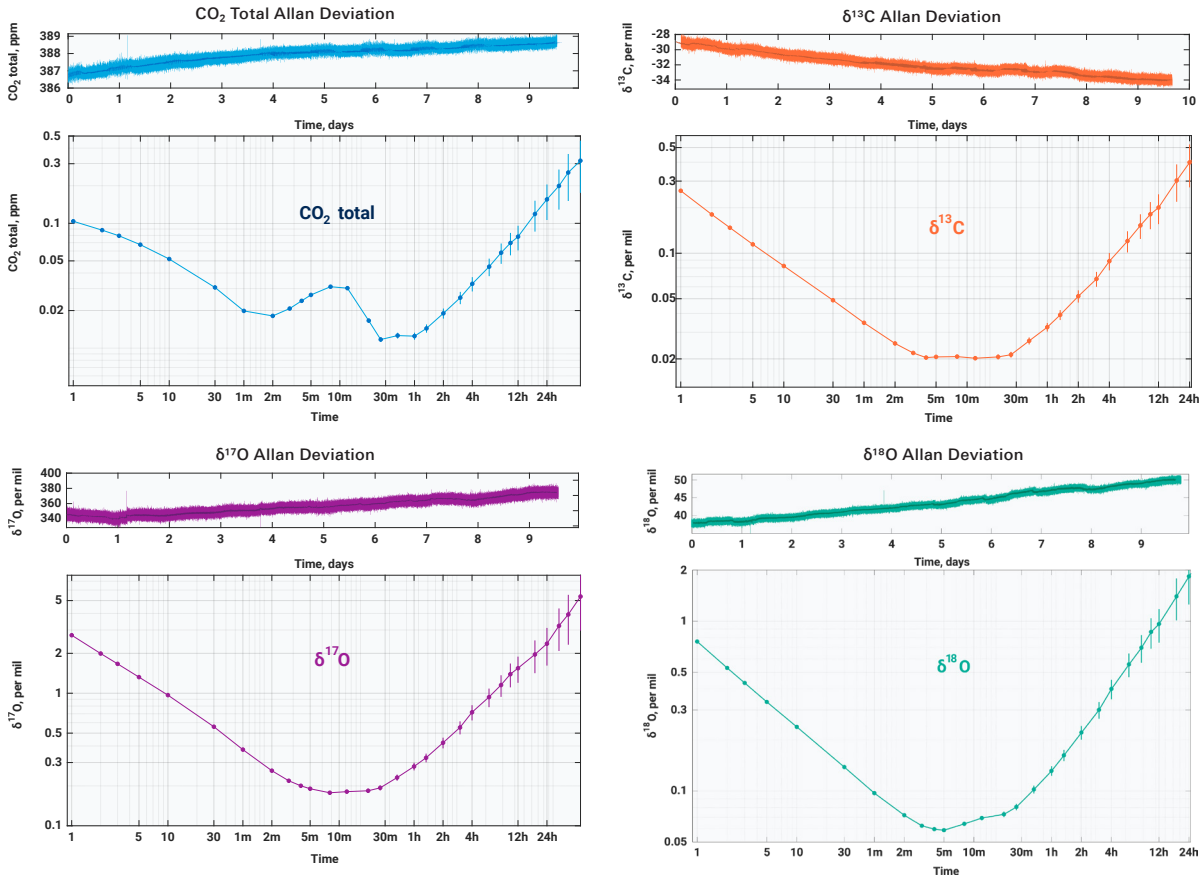



**Figure 7. Ten-day $CO_2$ Isotope stability data from an LI-7825 $CO_2$ Isotope/$NH_3$ Trace Gas Analyzer.** Data for the Allan Deviation plots were collected over a 10-day period, where, prior to the measurement of test gas, the LI-7825 was powered on to sample ambient air for 24 hours. For the study, it was connected to a 400 ppm $CO_2$ tank with stainless steel tubing.

## Specifications

### $CO_2$ Measurements

**Response Time ($T_{10}$-$T_{90}$):** ≤ 2 seconds from 0-400 ppm
**Range:** 50 to 2,000 ppm
**Precision (1σ):**
0.05 ppm at 400 ppm with 5-minute averaging
**Maximum Drift:** < 0.5 ppm per 24-hour period

### δ¹³C Measurements

**Precision (1σ):**
<0.5 ‰ at 400 ppm $CO_2$ with 1 second averaging
0.04 ‰ at 400 ppm $CO_2$ with 5-minute averaging
**Maximum Drift:** <1 ‰ per 24-hr period

### δ¹⁸O Measurements

**Precision (1σ):**
0.1 ‰ at 400 ppm $CO_2$ with 5-minute averaging
**Maximum Drift:** <4 ‰ per 24-hr period

### δ¹⁷O Measurements

**Precision (1σ):**
0.4 ‰ at 400 ppm $CO_2$ with 5-minute averaging
**Maximum Drift:** <12 ‰ per 24-hr period

### $NH_3$ Measurements

**Range:** 0-30,000 ppb
**Precision (1σ):**
2 ppb at 300 ppb with 1 second averaging
**Response Time ($T_{10}$-$T_{90}$):** ~5 minutes. *

### $H_2O$ Measurements

**Range:** 0 to 60,000 ppm
**Precision (1σ):**
45 ppm at 10,000 ppm with 1 second averaging
20 ppm at 10,000 ppm with 5 second averaging

*$NH_3$ measurement response time is dependent upon gas composition and inlet pneumatic configuration including tubing/fitting materials, flow rates, and upstream volumes.

*Specifications subject to change without notice*

# General Specifications

These general specifications apply to all analyzers.
See individual analyzers for measurement specifications.

**Measurement Technique:** OF-CEAS (Optical Feedback-Cavity Enhanced Absorption Spectroscopy)
**Measurement Rate:** 1 sample per second (1 Hz)
**Optical Cavity Volume:** 6.41 $cm^3$
**Flow Rate:** 250 sccm nominally; 70 sccm with reduced flow rate kit
**Total Weight:** 10.5 kg (including batteries)
**Case Dimensions:** 51 cm x 33 cm x 18 cm (L x W x H)
**Operating Temperature Range:** -25 °C to 45 °C (without solar load, under normal operating conditions)
**Operating Humidity Range:** 0 to 85% RH (non-condensing, without solar load, under normal operating conditions)
**Sample Line Humidity Range:** 0 to 99.9% non-condensing
**Operating Pressure Range:** 70 to 110 kPa
**Connectivity:** Ethernet, Wi-Fi (not available in some countries)
**Wi-Fi Compatibility:** 2.4 GHz, 802.11 a/b/g/n/ac
**Power Consumption:**
- **Steady State Operation:** 22 W at 25 °C without batteries charging
- **Warm up:** Up to 65 W without batteries charging; up to 100 W with batteries charging
- **Off:** Up to 2.3 W when powered from pins 3 and 4 without batteries charging; up to 0.2 W when powered from pins 1 and 5 without batteries charging

**Power Supply Requirements**
- **Pins 1 and 5 (24 VDC Input):** Minimum 6 A at 24 V
- **Pins 3 and 4 (10.5 to 33 VDC Input):** Minimum 14 A at 10.5 VDC; 6 A at 24 VDC
- **Power Supply:** Universal Power Adapter (Input: 100 to 240 VAC, 50-60 Hz; Output: 24 VDC)

**Battery Life:** 8 hours typical with 2 batteries
**Pollution Degree:** 2
**Over-voltage Category:** II
**Class 1 Laser Product**

*Specifications subject to change without notice*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980-20584 REV.2 08/23