

TILDAS Compact Single Laser CO₂ Isotope Analyzer for $\Delta^{17}\text{O} - \text{CO}_2$

Direct Spectroscopic Measurement of $\Delta^{17}\text{O} - \text{CO}_2$ for Geochemistry and Atmospheric Chemistry

Features

- Direct measurement of CO₂ isotopes in air with no chemical processing or separation
- Repeatability < 0.01 ‰ for $\Delta^{17}\text{O}$ for a 30-minute measurement including balanced working reference measurements
- Small sample size (~0.25 μmol CO₂ or 15 mL of air) for discrete sample model
- Suitable for samples derived from carbonate via acid digestion
- Automated valve control capable of custom sample scheduling, backgrounds, and calibrations
- 10 Hz time response and 1-sec precisions < 0.2 ‰ in $\delta^{18}\text{O}$ and $\delta^{17}\text{O}$ enable eddy covariance studies for continuous flow model

Applications

- Analysis of CO₂ samples derived from carbonate
- Determination of atmospheric sources, sinks, and transport through CO₂ isotopic ratios
- Biosphere- or stratosphere-troposphere exchange

Advantages over IRMS

- Direct measurement of ¹⁷O-CO₂, which is not possible by IRMS
- High precision (< 0.01 ‰ in $\Delta^{17}\text{O}$)
- Lower cost
- Faster measurements (e.g. 30 min)

Related Instruments

- Single laser isotope monitor for $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ of CO₂
- Dual laser isotope monitor for $\delta^{13}\text{C}$, $\delta^{18}\text{O}$ and $\Delta^{17}\text{O}$ of CO₂
- Dual laser monitor for CO₂ ($\delta^{13}\text{C}$, $\delta^{18}\text{O}$) and water ($\delta^{18}\text{O}$, δD) isotopes



Rugged, field-ready instruments

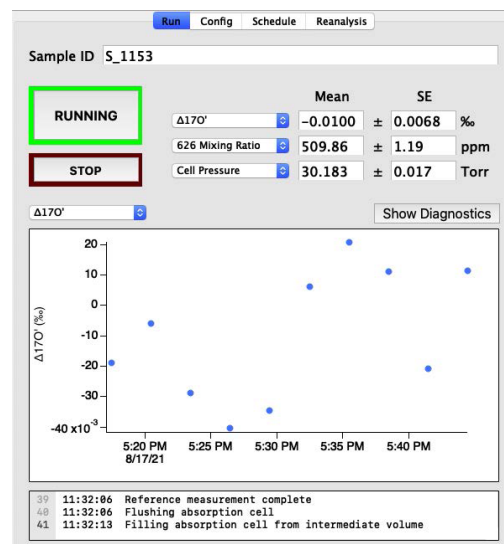
Direct absorption spectroscopy allows for highly specific and accurate gas detection

Mid-IR detection enables maximum measurement sensitivity

TILDAS TECHNOLOGY

Aerodyne instruments use **tunable infrared laser direct absorption spectroscopy (TILDAS)** at mid-IR wavelengths to probe molecules at their strongest “fingerprint” transition frequencies. We further enhance sensitivity by employing a patented multi-pass broad-band absorption cell that provides optical path lengths up to 400 meters. Direct absorption spectroscopy allows for fast (<1 sec) absolute trace gas concentrations without need for elaborate calibration procedures. Moreover, TILDAS instruments are relatively free of measurement interference from other molecular species, enabling extremely specific detection.

Powerful software provides easy, flexible instrument control, and real-time results.



CO₂ Isotope Analyzer for $\Delta^{17}\text{O} - \text{CO}_2$

Specifications

Discrete Samples – High Precision

	CO ₂	$\delta\text{CO}^{18}\text{O}$	$\delta\text{CO}^{17}\text{O}$	$\Delta^{17}\text{O}$
1 Sample (0.25 $\mu\text{mol CO}_2$, 3 min)	0.03 ppm	0.03 ‰	0.03 ‰	0.03 ‰
10 Samples (2.5 $\mu\text{mol CO}_2$, 30 min)	0.01 ppm	0.01 ‰	0.01 ‰	0.01 ‰

Note: These measurements alternate the sample gas with a working reference with a similar mixing ratio, and the time to do so is included in the quoted measurement time.

Continuous Air Measurement – High Precision

	CO ₂	$\delta\text{CO}^{18}\text{O}$	$\delta\text{CO}^{17}\text{O}$
2 min	0.03 ppm	0.03 ‰	0.03 ‰
20 min	0.01 ppm	0.01 ‰	0.01 ‰

Note: These measurements are normalized to a working reference with a mixing ratio similar to the sample. The flow rate is 0.6 slpm.

Continuous Air Measurement – High Speed

	CO ₂	$\delta\text{CO}^{18}\text{O}$	$\delta\text{CO}^{17}\text{O}$
0.1 second	0.15 ppm	0.6 ‰	0.6 ‰
1 second	0.05 ppm	0.2 ‰	0.2 ‰
60 seconds	0.015 ppm	0.04 ‰	0.04 ‰

Note: These measurements are not referenced to a working reference. This configuration supports 10 Hz eddy covariance measurements with a modest pump (120 lpm) and a flow rate of 6 slpm.

REFERENCES

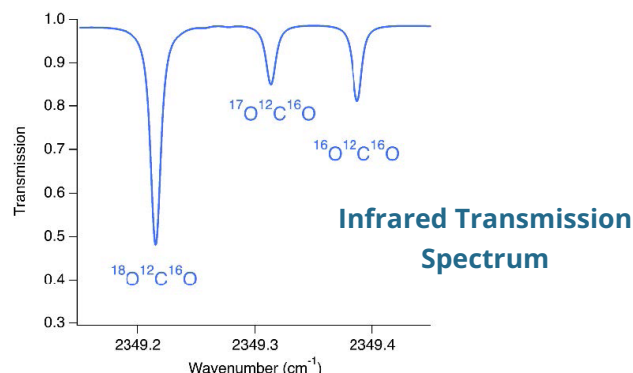
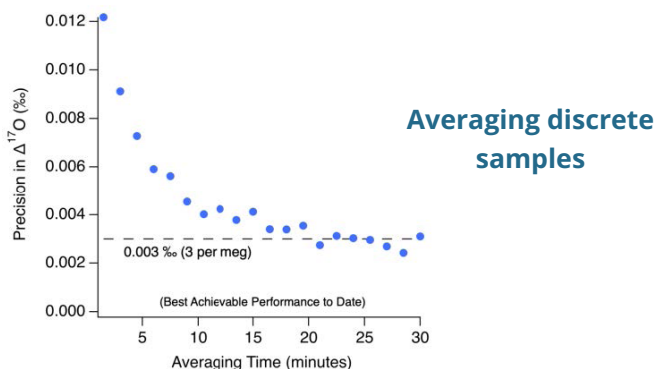
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Installation

19" rack mountable or benchtop

Flushing the optics with CO₂- free gas is recommended

Instrument Components

Core instrument • Thermoelectric chiller • Keyboard, mouse, and monitor • Vacuum pump (customer specified) • Inlet sampling system (customizable)

Instrument Operations

Operating temperature: -20 to +40 °C

Sample flow rate: 0 to 20 slpm

Dynamic Range

0 – 1000 ppm CO₂

Data Outputs

RS-232, USB drive, ethernet

Size, Weight, Power

Dimensions: 440 mm W x 660 mm D x 6U (267mm) H

Weight: 35 kg (core instrument) + 15 kg (chiller) + pump weight

Electrical Power: 250 W, 120/240 V, 50/60 Hz (without pump)



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CO₂ for $\Delta^{17}\text{O}$