



CO₂ Isotope Monitor for $\delta^{13}\text{C}$, $\delta^{18}\text{O}$ and $\Delta^{17}\text{O}$

Direct Spectroscopic Measurement of $\Delta^{17}\text{O}$ – CO₂ with No Chemical Processing.



Features:

- < 0.10 ‰ precision for $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ in 1 s
- < 0.15 ‰ precision for $\delta^{17}\text{O}$ in 1s
- Direct measurement of CO₂ isotopes in air without sample processing
- Repeatability exceeding 0.015 ‰ for $\delta^{13}\text{C}$, $\delta^{17}\text{O}$ and $\delta^{18}\text{O}$ for a 30 minute measurement including balanced working reference measurements
- Suitable for CO₂ samples derived from carbonate via acid digestion

Rugged, field-ready instruments

Direct absorption spectroscopy allows for highly specific and accurate gas detection

Mid-IR detection enables maximum measurement sensitivity

TILDAS Technology

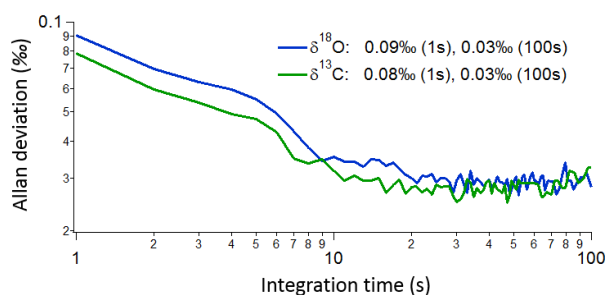
Aerodyne instruments use tunable infrared laser direct absorption spectroscopy (TILDAS) at mid-IR wavelengths to probe molecules at their strongest “finger-print” transition frequencies. We further enhance sensitivity by employing a patented multi-pass broad-band absorption cell that provides optical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

Applications

- Determination of atmospheric sources, sinks, and transport through CO₂ isotopic ratios.
- Biosphere exchange.
- Analysis of CO₂ samples derived from marine carbonate.
- Laboratory measurements of discrete samples.
- Carbon capture and sequestration monitoring.
- Breath analysis.

Aerodyne CO₂ Isotope Advantages

- Measurement precision comparable to much larger and more expensive IRMS instruments.
- Time response up to 10 Hz enables eddy covariance studies.
- Powerful TDLWintel software provides flexible instrument control, and real-time data analysis.
- Valve control capable of complex scheduling and automatic background and calibrations.
- Optional automated sample handling systems.
- Turn-key design allows unattended operation.



Performance Specifications:

Continuous Measurement Specifications – High Speed

	CO ₂	δ ¹³ CO ₂	δCO ¹⁸ O	δCO ¹⁷ O
0.1 second	0.15 ppm	0.3‰	0.3‰	0.5‰
1 second	0.05 ppm	0.1‰	0.1‰	0.15‰
60 second	0.015ppm	0.03‰	0.03‰	0.05‰

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

Continuous Measurement Specifications – High Precision

	CO ₂	δ ¹³ CO ₂	δCO ¹⁸ O	δCO ¹⁷ O
2 min measurement	0.02 ppm	0.03‰	0.03‰	0.05‰
20 min measurement	0.01 ppm	0.01‰	0.01‰	0.015‰

Note: These measurements are normalized to a working reference and the time to do so is included in the quoted measurement time. The working reference has a mixing ratio similar to the sample. The flow rate is 0.6 slpm.

Discrete Sample Specifications – High Precision

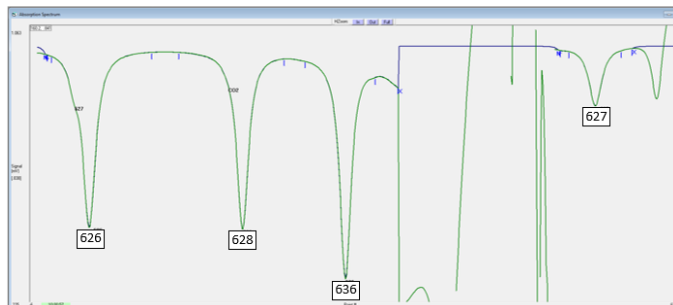
	CO ₂	δ ¹³ CO ₂	δCO ¹⁸ O	δCO ¹⁷ O
One air sample (~15 ml of air or 0.25 μmoles CO ₂) 3 min measurement	0.02 ppm	0.03‰	0.03‰	0.05‰
10 Air samples (~150 ml of air or 2.5 μmoles CO ₂) 30 min measurement	0.01 ppm	0.01‰	0.01‰	0.015‰

Note: These measurements are normalized to a working reference and the time to do so is included in the quoted measurement time. The working reference has a mixing ratio similar to the sample.

Related Instruments

Single laser isotope monitor for δ¹³C and δ¹⁸O of CO₂
 Single laser isotope monitor for δ¹⁸O and Δ¹⁷O of CO₂
 Dual laser monitor for CO₂ (δ¹³C, δ¹⁸O) and water (δ¹⁸O, δ D) isotopes

Experimental Spectrum Acquired at 1 Hz



Installation

19" rack mountable or benchtop
 Flushing the optics with CO₂-free gas is recommended

Instrument Operations

Operating temperature: 10 to 35 °C
 Sample flow rate: 0 to 20 slpm

Instrument Components

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

Data Outputs

RS-232, USB drive, ethernet

Size, Weight, Power

Dimensions: 560 mm x 770 mm x 640 mm (W x D x H)
 Weight: 75 kg
 Electrical Power: 250-500 W, 120/240 V, 50/60 Hz (without pump)

Aerodyne specializes in collaboration and custom design. Please contact us if you would like to discuss additional measurement options and applications.

REFERENCES:

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