AERODYNE RESEARCH, Inc.

CO_2 Isotope Monitor for $\delta^{13}C$, $\delta^{18}O$ and $\Delta^{17}O$

Direct Spectroscopic Measurement of $\Delta^{17}O - CO_2$ with No Chemical Processing.

Features:

- < 0.10 ‰ precision for $\delta^{13}C$ and $\delta^{18}O$ in 1s.
- < 0.15 ‰ precision for $\delta^{17}O$ in 1s.
- Direct measurement of CO_2 isotopes in air without sample processing.
- Repeatability exceeding 0.015 ‰ for $\delta^{13}C$, $\delta^{17}O$ and $\delta^{18}O$ for a 30-minute measurement including balanced working reference measurements.
- Suitable for CO_2 samples derived from carbonate via acid digestion.

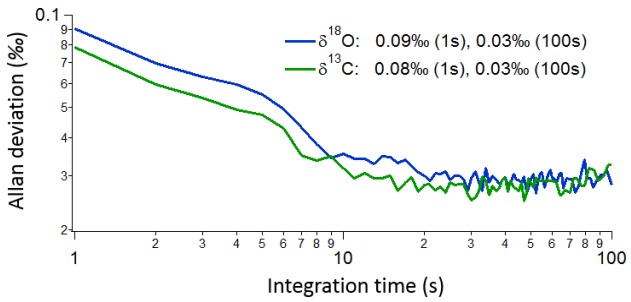
Rugged, field-ready instruments

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 relatively free of measurement interference from other molecular species, enabling extremely specific detection.



APPLICATIONS

- Determination of atmospheric sources, sinks, and transport through CO_2 isotopic ratios.
- Biosphere exchange.
- Analysis of CO_2 samples derived from marine carbonate.
- Laboratory measurements of discrete samples.
- Carbon capture and sequestration monitoring.
- Breath analysis.

AERODYNE CO_2 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.

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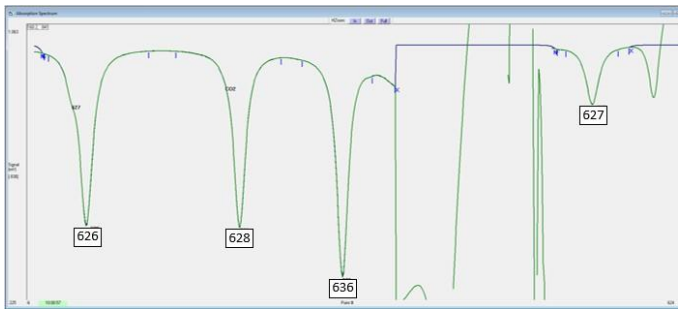
SPECIFICATIONS

Continuous Measurement Specifications – High Speed

	CO_2	$\delta^{13}CO_2$	$\delta CO^{18}O$	$\delta CO^{17}O$
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.

Experimental Spectrum Acquired at 1 Hz



Continuous Measurement Specifications – High Precision

	CO_2	$\delta^{13}CO_2$	$\delta CO^{18}O$	$\delta CO^{17}O$
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	$\delta^{13}CO_2$	$\delta CO^{18}O$	$\delta CO^{17}O$
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 $\delta^{13}C$ and $\delta^{18}O$ of CO_2
Single laser isotope monitor for $\delta^{18}O$ and $\Delta^{17}O$ of CO_2
Dual laser monitor for CO_2 ($\delta^{13}C$, $\delta^{18}O$) and water ($\delta^{18}O$, δD) isotopes

Installation

19” rack mountable or benchtop
Flushing the optics with CO_2-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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