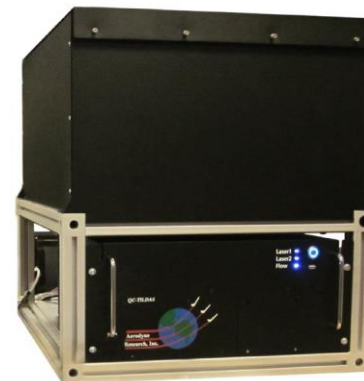




Clumped Isotope Analyzer for CO₂ Derived from Carbonate

Direct Spectroscopic Measurement of ¹³C¹⁸O¹⁶O with No Isobaric Interference



- Direct measurement of ¹⁶O¹³C¹⁸O (⁶³⁸Δ) rather than mass 47 (⁴⁷Δ)
- Precision for ⁶³⁸Δ better than 0.02 ‰ for 4 minute measurement with less than 0.4 mg calcite
- Precision for ⁶³⁸Δ better than 0.01 ‰ for 16 minute measurement with less than 1.6 mg calcite
- Low operating costs
- Suitable for CO₂ samples derived from carbonate via acid digestion

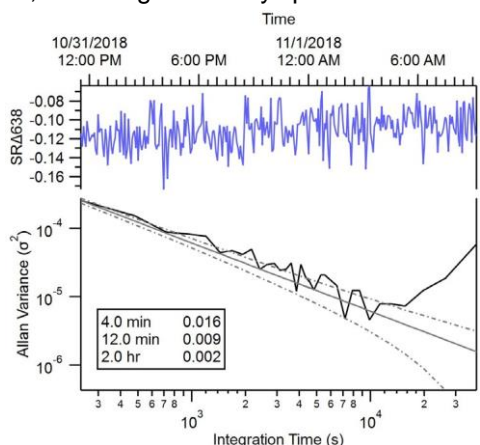
Rugged, field-ready instruments

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



Applications

- Paleothermometry
- Geologic Altimetry
- Burial, Diagenesis and Metamorphism
- Analysis of diverse concentrated CO₂ samples. Analysis of CO₂ samples derived from marine carbonate.
- Analysis of diverse concentrated CO₂ samples

Aerodyne Clumped CO₂ Isotope Advantages

- Measurement precision comparable to much larger and more expensive IRMS instruments.
- 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:

Discrete Sample Specifications for CO₂ Clumped Isotope Monitor

	CO ₂	$\Delta^{13}\text{C}^{18}\text{O O}$
One sample: <5 μ -moles CO ₂ 4 min measurement	0.02 ppm	0.035‰
10 Samples: <50 μ -moles CO ₂ 40 min measurement	0.01 ppm	0.01‰

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, pressure and matrix composition similar to the sample.

Related Instruments

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

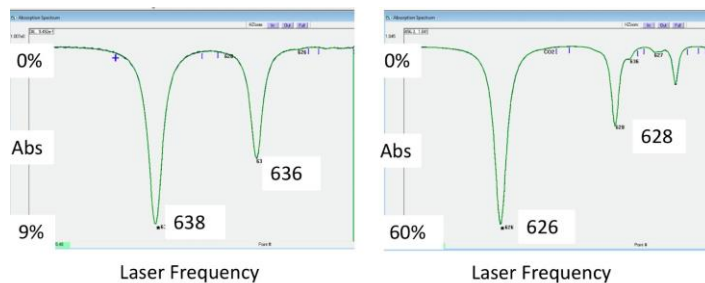
Data Outputs

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)

Infrared Spectroscopy for Clumped Isotope Determination



Laser #1 measures 638 and 636.

Laser #2 measures 626 and 628.

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)

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

RELATED REFERENCES:

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Wehr, R., Munger, J.W., McManus, J.B., Nelson, D.D., Zahniser, M.S., Davidson, E.A., Wofsy, S.C. and Saleska, S.R., 2016. Seasonality of Temperate Forest Photosynthesis and Daytime Respiration. *Nature*, 534(7609), pp.680-683.

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