

$\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ in CO_2 with *minimal drift*

Precisely.



Carbon Dioxide Isotope Analyzer

Features and Benefits

- Measures $\delta^{13}\text{C}$, $\delta^{18}\text{O}$, $^{12}\text{C}^{16}\text{O}_2$, $^{13}\text{C}^{16}\text{O}_2$, $^{12}\text{C}^{18}\text{O}^{16}\text{O}$, H_2O at 1 Hz
- $^{12}\text{CO}_2$ and $^{13}\text{CO}_2$ from 300 ppm to 25000 ppm CO_2 in air
- Simultaneous measurements of all gases provides maximum accuracy even when CO_2 levels vary rapidly
- Values reported on dry mol basis (without drying or post processing)
- High-resolution absorption spectra are viewable for real-time diagnostics
- Low power: ideal for field apps
- Insensitive to methane or other hydrocarbons at typical atmospheric levels
- Enhanced Performance package provides unprecedented stability, precision and low drift.
- (Option) Manual injection of discrete gas samples
- (Option) Dynamic Dilution System (allows measurements to 100% CO_2)

LGR's improved Carbon Dioxide Isotope Analyzer provides many features that researchers need when measuring isotopic carbon dioxide. Key improvements include:

- New Enhanced Performance package provides ultra-low drift and high precision
- Ability to measure $\delta^{18}\text{O}$ in CO_2
- Ability to measure water vapor in air
- $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ measurements for CO_2 ranging from 300 to 25000 ppm
- Automatic determination of $\delta^{13}\text{C}$, $\delta^{18}\text{O}$ and CO_2 on dry mol basis - spectroscopic analysis corrects for water vapor dilution and line broadening effects

Isotopic measurements of carbon dioxide allow determination of transport, uptake, residence time, sequestration, and depletion modes of carbon dioxide throughout the atmosphere and biosphere. Carbon dioxide is a particularly useful gas for this type of analysis because of its presence in the metabolic processes of living organisms as well as being a by-product of combustion processes. When making isotopic carbon dioxide measurements, scientists require: (1) accurate measurements over a wide range of mole fractions (concentrations), (2) high precision, (3) ability to report reliable values even if concentrations are rapidly changing, (4) portability (low power), (5) user-friendly interface, (6) low drift, (7) insensitivity to hydrocarbons at typical atmospheric levels.

LGR's Carbon Dioxide Isotope Analyzer meets all of these requirements. The CCIA-36d provides measurements of $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ as well as concentrations of $^{13}\text{CO}_2$, $^{12}\text{CO}_2$, and $^{12}\text{C}^{18}\text{O}^{16}\text{O}$ in gas samples with high precision in measurement times of less than one second contained in an easy-to-use, field portable unit. Due to its inherently fast time response, the instrument provides $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ measurements over a wide range even when CO_2 values change rapidly as often happens during field studies.

In addition, the availability of many value-added options extends the abilities of the unit to include discrete samples (collected in bags or vials, for example) and to automatically handle multiple inlet sources.

The Analyzer uses LGR's patented Off-axis ICOS technology, a fourth-generation cavity enhanced absorption technique. Off-axis ICOS has many advantages over conventional Cavity Ringdown Spectroscopy (CRDS) techniques such as being more robust mechanically and thermally, having a much shorter measurement time, much easier to service, and not requiring expensive and power consuming auxiliary components. As a result, LGR instruments provide unsurpassed performance, durability and ease of use.

Carbon Dioxide Isotope Analyzer (CCIA-36d)

Performance Specifications

Precision (1 σ , 60 sec / 5 min):

$\delta^{13}\text{C}$: 0.2‰ / 0.1‰
 $\delta^{18}\text{O}$: 2‰ / 1‰ (300-1000 ppm)
 $\delta^{18}\text{O}$: precision improves with greater CO_2 levels
[$^{12}\text{C}^{16}\text{O}_2$]: 100 ppb / 50 ppb
[$^{13}\text{C}^{16}\text{O}_2$]: 5 ppb / 3 ppb
[$^{12}\text{C}^{18}\text{O}$]: 1 ppb / 0.5 ppb
[H_2O]: 100 ppm / 50 ppm

Measurement Rates:

All parameters measured simultaneously at rates up to 1 Hz

Measurement Range (meets all specs):

CO_2 : 360 – 25000 ppm
 H_2O : 4000 – 25000 ppm

Operational Range

CO_2 : 0 – 50000 ppm
 H_2O : 0 – 70000 ppm (noncondensing)

Response time (time to register 95% of a step change):

$\delta^{13}\text{C}$, $\delta^{18}\text{O}$: 1 second
[$^{12}\text{C}^{16}\text{O}_2$], [$^{13}\text{C}^{16}\text{O}_2$], [$^{12}\text{C}^{18}\text{O}$]: 1 second
Note: requires 4-head diaphragm vacuum pump (accessory)

Transient Performance (response to steps of 200 ppm CO_2):

Max transient $\delta^{13}\text{C}$ change: 1‰
Max transient $\delta^{18}\text{O}$ change: 1‰

Max Drift at STP (peak-to-peak, 1 hr average over 24 hours):

$\delta^{13}\text{C}$: < 2‰ (Standard package)
 $\delta^{13}\text{C}$: < 0.5‰ (Enhanced Performance package)

Accuracy:

CO_2 : uncertainty <1% of reading (without calibration);
(much higher accuracy may be obtained with calibration)

Sampling Conditions:

Sample Temperature: -20 – 50 °C
Operating Temperature: 0 – 45 °C (Enhanced Performance package)
Operating Temperature: 10 – 35 °C (Standard package)
Ambient Humidity: non-condensing (0-100% RH)

Outputs:

digital (RS232), Ethernet, USB

Power Requirements:

115/230 VAC, 50/60 Hz
140 W (standard package), 350 W (Enhanced Performance package)

Dimensions:

10" x 38" x 14" (Standard package)
11" x 38" x 22" (Enhanced Performance package)

Weight:

30 kg (standard package)
50 kg (Enhanced Performance package)

Ordering Information

Part Number 912-0003 (Enhanced Performance package)

Accessories

908-0003-9001: Multiport Inlet Unit – automated 16-inlet port multiplexer
908-0003-9002: Multiport Inlet Unit – automated 8-inlet port multiplexer
908-0001-9011: N940 Vacuum Pump – for fast flow-through time (1 sec)
907-0005-9002: Dynamic Dilution System –
Extends upper range by 100x through automated dilution with zero air
908-0005-9002: Syringe Injection –
Allows measurements of discrete samples via manual injection



Instrument complies with 21 CFR 1040.10 and 1040.11