

4 isotopologues, 3 isotope ratios, 2 modes
1 instrument

Only LGR



Carbon Dioxide Isotope Analyzer

Features and Benefits

- New model measures all stable isotopologues of carbon dioxide
- New model reports at up to 5 Hz
- 0.1 per mil accuracy
- Extremely fast response
- High-resolution absorption spectra are viewable for real-time diagnostics
- Continuous flow and batch operation
- Insensitive to hydrocarbons
- Enhanced Performance package provides unprecedented stability, precision and low drift
- (optional) Dynamic Dilution System allows measurements of elevated CO₂
- (optional) Multiport Inlet Unit allows measurements at several locations and automatic calibration

LGR's newest Carbon Dioxide Isotope Analyzer (model CCIA-46) employs a mid-infrared quantum cascade laser to record high-resolution absorption lineshapes of all the stable isotopologues of carbon dioxide in a single scan. As a result, the instrument reports the mole fractions of ¹²CO₂, ¹³CO₂, CO¹⁷O and CO¹⁸O and thus the isotopic ratios δ¹³C, δ¹⁷O, δ¹⁸O in real time. Measurements may be recorded in continuously flowing air samples (at up to 5 Hz) and in batch samples via syringe injection. Of course, the instrument is thermally stabilized (milliKelvin stability) to ensure minimal drift and allow operation in the field. No longer do you need to an IRMS lab to obtain measurements in ambient air with better than 0.1 per mil accuracy.

Key advantages include:

- Enhanced Performance package provides ultra-high precision and lowest drift
- Ability to measure δ¹³C, δ¹⁷O, δ¹⁸O in CO₂
- Allows eddy covariance flux measurements
- Fully resolved absorption spectra reported in real time provides traceability

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, (2) high precision, (3) ability to report reliable values even if mixing ratios are rapidly changing, (4) portability, (5) user-friendly interface, (6) low drift, (7) insensitivity to methane and other hydrocarbons.

LGR's Carbon Dioxide Isotope Analyzers meet all of these requirements. In addition, the availability of many value-added options extends the abilities of these units to include discrete samples (collected in bags or vials) and to automatically handle multiple inlet sources.

The analyzers use 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, and not requiring expensive auxiliary components. As a result, LGR analyzers provide unsurpassed performance, durability, reliability and simplicity.

Carbon Dioxide Isotope Analyzers

Performance Specifications

Precision - Model CCIA-36d (1 σ , 60 sec / 5 minutes):

$\delta^{13}\text{C}$: 0.2‰ / 0.1‰
 $\delta^{18}\text{O}$: 2‰ / 1‰
[$^{12}\text{CO}_2$]: 100 ppb / 50 ppb
[$^{13}\text{CO}_2$]: 5 ppb / 3 ppb
[H_2O]: 100 ppm / 50 ppm

Precision - Model CCIA-46r (1 σ , 1 sec / 2 minutes):

$\delta^{13}\text{C}$: 0.7‰ / 0.08‰
 $\delta^{17}\text{O}$: 1.8‰ / 0.18‰
 $\delta^{18}\text{O}$: 0.7‰ / 0.08‰
[$^{12}\text{CO}_2$]: 200 ppb / 20 ppb
[$^{13}\text{CO}_2$]: 2 ppb / 0.2 ppb
[CO^{17}O]: 0.3 ppb / 0.03 ppb
[CO^{18}O]: 0.4 ppb / 0.04 ppb

Measurement Rates:

CCIA-36d-EP: up to 1 Hz
CCIA-46r-EP: up to 5 Hz

Measurement Range (meets all specs):

Model CCIA-36d
 CO_2 : 300 – 25000 ppm
 H_2O : 4000 – 60000 ppm
Model CCIA-46r
 CO_2 : 150 – 800 ppm

Operational Range - Model CCIA-36d:

CO_2 : 0 – 50000 ppm
 H_2O : 0 – 70000 ppm (non-condensing)

Operational Range - Model CCIA-46r:

CO_2 : 0 – 2000 ppm

Response time to register 95% of a step change:

Model CCIA-36d-EP: 1 second
Model CCIA-46d-EP: 0.1 seconds
(Flow response < 6 sec requires optional external pump)

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

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

Sampling Conditions:

Sample Temperature: -20 – 50 °C
Operating Temperature: 0 – 45 °C
Ambient Humidity: non-condensing (0 – 100% RH)

Outputs:

digital (RS232), Ethernet, USB

Power Requirements (steady state):

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

Dimensions:

11" x 38" x 22" (CCIA-36d-EP)
14" x 45" x 17" (CCIA-46r-EP)

Weight:

50 kg

Ordering Information

Model CCIA-36d-EP (Part Number 912-0003):
 $^{12}\text{CO}_2$, $^{13}\text{CO}_2$, CO^{18}O_2 , H_2O

Model CCIA-46r-EP (Part Number 913-0033):
 $^{12}\text{CO}_2$, $^{13}\text{CO}_2$, CO^{17}O , CO^{18}O

Accessories

908-0003-9001: Multiport Inlet Unit – 16-inlet port multiplexer

908-0003-9002: Multiport Inlet Unit – 8-inlet port multiplexer

908-0001-9011: N940 pump – enables flow-through time (1 sec)

907-0005-9002: Dynamic Dilution System –
Extends upper range by 100x through automated dilution

908-0005-9002: Syringe Injection –
Allows measurements of discrete samples via manual injection

904-0002: Data Logging System – multi-channel data logging
system records and synchronizes serial (RS-232) outputs
from multiple LGR analyzers and other devices (e.g., GPS,
anemometers)



Instrument complies with 21 CFR 1040.10 and 1040.11