

PICARRO G2131-*i*

$\delta^{13}\text{C}$ High-Precision Isotopic CO_2 , CH_4 concentration CRDS Analyzer

From ships in the Gulf of Mexico to bat caves in the Scandinavian tundra – high precision where you need it.



- < 0.1 ‰ precision, < 0.5 ‰ drift for $\delta^{13}\text{C}$ in CO_2
- Measures CH_4 concentration to capture more carbon cycle dynamics
- Field deployable: < 26 kg, meets shock and vibration tests
- Less hassle – Less calibration, less maintenance, no consumables
- Endures harsh environments – mountains, oceans, forests, and tundra

Picarro's G2131-*i* analyzer for measurement of $\delta^{13}\text{C}$ in CO_2 is the world's best combination of precision, ruggedness, and ease-of-use. With guaranteed precision < 0.1 ‰ and long-term drift < 0.5 ‰, the G2131-*i* has a performance comparable to that commonly achieved with continuous flow IRMS. This measurement stability, along with Picarro's renowned ease-of-use, make field studies more productive. You will get immediate, continuous results that will allow you to redirect an experiment to get the most valuable data in a limited amount of time.

The G2131-*i* also makes precise measurements of CO_2 , H_2O , and CH_4 concentration to gain further insight into carbon cycle dynamics. This also allows cross-influence of these species to be quantified and corrected. The water measurement correction eliminates need for gas drying. The concentration dependence of $\delta^{13}\text{C}$ is calibrated up to 2000 ppm of CO_2 , while response to CO_2 concentration transients is nearly undetectable.

Picarro's Patented CRDS Technology: The heart of the Picarro analyzer is a sophisticated time-based measurement that uses a laser to quantify spectral features of gas phase molecules in an optical cavity. Picarro's patented CRDS technology enables an effective measurement path length of up to 20 kilometers in a compact cavity, which results in exceptional precision and sensitivity with a small footprint. The CRDS analyzer uses robust, proven telecommunications hardware and manufacturing techniques, so the analyzer requires no optical adjustments or maintenance.

To ensure measurement fidelity over long periods of time, even in the harshest environments, Picarro uses a patented, high-precision wavelength monitor to maintain absolute spectral position and the most accurate peak quantification of any instrument and reduces measurement drift.

The CRDS optical cavity also incorporates precise temperature and pressure control along with careful material selection and meticulous mechanical design to minimize the influence of ambient temperature and pressure variations and produce exceptionally stable measurements.

Portable, Rugged & Easy to Use: The Picarro's small size and < 26 kg weight make it easy to get to the field, where it can be running within minutes out of the box and can operate for months without user interaction. The analyzer is so rugged that it meets military shock and vibration standards. The analyzer requires no consumables and very little maintenance for low cost-of-ownership. Scientists using these systems have reported the highest quality data, day in and day out, with fewer calibrations than other spectral absorption-based instruments.

Remote operation: An internet or dial-up modem connection can open up a world of possibilities for researchers. Users can connect remotely with the analyzer's internal Windows-based PC to control the instrument. The analyzer can automatically send data via email over the Internet at regular intervals. The analyzer can also synchronize automatically with an atomic clock time service to timestamp the data accurately.

Performance Specifications	
Precision, $\delta^{13}\text{C}$ in CO_2 (1- σ , 1 Hr window, 5 min)	< 0.1 ‰ guaranteed precision at > 380 ppm CO_2 , < 0.25 ‰ typical precision at 200 ppm CO_2 , < 0.05 ‰ typical precision at > 1000 ppm CO_2
Max Drift at STP $\delta^{13}\text{C}$ in CO_2 (over 24 hrs, peak-to-peak, 1 hr interval average)	< 0.5 ‰
Precision, CO_2 Concentration (30 sec, 1- σ)	200 ppb (^{12}C) / 10 ppb (^{13}C)
Precision, CH_4 Concentration (30 sec, 1- σ)	50 ppb + 0.05 % of reading (^{12}C)
Precision, H_2O Concentration (30 sec, 1- σ)	100 ppm
CO_2 Dynamic Range	380 - 2000 ppm guaranteed specification range, 0.01 - 0.4 % operational range Up to 100% pure CO_2 samples can be analyzed with the A0314 Small Sample Isotope Module 2 (SSIM2) peripheral, which includes dilution. Minimum sample volume per replicate with the SSIM2 is 10 μl of pure CO_2 (0.45 μmoles or 20 μg of CO_2) or the equivalent volume of CO_2 in air.
CH_4 Dynamic Range	0 - 500 ppm guaranteed specification range, 0 - 1000 ppm operational range
H_2O Dynamic Range	0 - 2.4 % guaranteed specification range, 0 - 5 % operational range
Transient Response	Typical behavior < 0.1 ‰ for a rate of 300 ppm CO_2 /min
Ambient Temperature Dependence	Guaranteed < ± 0.06 ‰/ $^\circ\text{C}$, typical < ± 0.025 ‰/ $^\circ\text{C}$
Measurement Interval	~ 2 secs (includes periodic H_2O and CH_4 measurements)
Rise/Fall time (10-90% / 90-10%)	Typical ~30s
Applications Considerations	Interference can occur for concentrations of H_2O , CO_2 , and CH_4 well above normal ambient levels, as well as other organics, ammonia, ethane, ethylene, or sulfur containing compounds. Large changes in the isotopic ratio of H_2O can affect the results. Users should verify with prepared lab samples. Please contact us to discuss the experimental conditions.

Analyzer Specifications	
Measurement Technique	CRDS
Measurement Cell Temp. Control	+/- 0.005 $^\circ\text{C}$
Measurement Cell Pressure Control	+/- 0.0002 atm
Shock and Vibration Testing	Meets shock and vibration military MIL-STD 810F test standard.
Sample Temperature	-10 to 45 $^\circ\text{C}$
Sample Pressure	300 to 1000 Torr (40 to 133 kPa)
Sample Flow Rate	< 50 sccm (typical ~25 sccm) at 760 Torr, no filtration required
Sample Humidity	< 99 % RH non-condensing @ 40 $^\circ\text{C}$, no drying required
Ambient Temperature Range	10 to 35 $^\circ\text{C}$ (operating) -10 to 50 $^\circ\text{C}$ (storage)
Ambient Humidity	< 99 % RH non-condensing
Accessories	Pump (external), keyboard, mouse, LCD monitor (optional)
Data Outputs	RS-232, Ethernet, USB, analog (optional) 0 – 10 V
Fittings	1/4" Swagelok ®
Dimensions	Analyzer: 17" w x 7" h x 17.55" d (43.18 x 17.78 x 44.57 cm) not incl. 0.5" feet External Pump: 7.5" w x 4" h x 11" d (19 x 10.2 x 28 cm)
Installation	Benchtop or 19" rack mount chassis
Weight	56 lbs (25.4 kg), includes external pump
Power Requirements	100 - 240 VAC, 47 - 63 Hz (auto-sensing), < 260 W start-up (total); 125 W (analyzer), 35 W (pump) at steady state