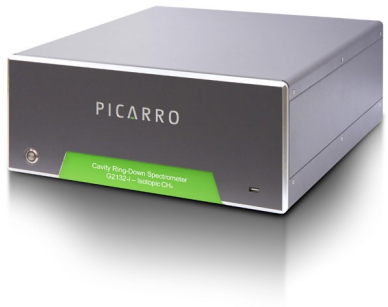
PICARRO

PICARRO G2132-*i* $\delta^{13}C$ High Precision Isotopic CH_4 CRDS Analyzer



High precision, real-time carbon isotope information from methane at ambient concentrations

- Isotopic measurements with superb precision and stability for critical methane source identification
- Direct measurement of CH_4 – no sample drying or preparation required
- Field deployable: < 26 kg, meets shock and vibration tests
- Less hassle – less calibration, less maintenance, no consumables
- Equipped with ChemDetect™ to sense contaminants in the samples

Advantage Note: Methane is both a valuable source of energy and a greenhouse gas many times more powerful than CO_2. Distinguishing between the various sources of methane in our environment can help in a number of ways, such as identifying its origin in groundwater near a hydraulic fracturing well, monitoring fugitive methane emissions from a landfill, or teasing apart the biochemical pathways that produce and consume methane in wetlands. Each source of methane has a characteristic ratio of ^{13}C to ^{12}C. Knowing this ratio helps one link methane to a particular local source. The Picarro G2132-*i* makes precise $^{13}C/^{12}C$ ratio measurements fast and easy. The stability of the analyzer enables these ratios to be determined in the field for immediate source identification.

The core of the G2132-*i* is Picarro's unique Cavity Ring-Down Spectroscopy (CRDS) technique, a time-based measurement that uses a laser to quantify spectral features of gas phase molecules in a small optical cavity, which has an effective laser path length of up to 20 kilometers. The G2132-*i* also includes a patented, high precision wavelength monitor, which maintains absolute spectral position, thereby ensuring accurate peak quantification of the absorption features for $^{12}CH_4$ and $^{13}CH_4$. Like all Picarros, the G2132-*i* maintains consistently high precision and stability due to its unique controls for temperature and pressure which would otherwise dramatically impact spectral measurements.

Excellent measurements of CH_4 are only possible if the influences of other molecules in the sample are quantified. The G2132-*i* makes precise measurements of CO_2 and H_2O concentrations to allow the cross-influence of these species to be quantified and corrected while providing more insight into the sample. The analyzer comes equipped with ChemDetect™, a new layer of analysis that inspects the recorded spectra to find indications of contaminating species.

Portable, Rugged and Easy to Use: The G2132-*i* is compact, weighing less than 26 kg, which makes it easy to take to the field. It can be running within minutes out of the box and will continue to run for months without user interaction. The G2132-i is so rugged that it meets military shock and vibration standards. This analyzer requires no consumables and very little maintenance for low cost-of-ownership. Scientists using Picarro analyzers 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 at regular intervals. The G2132-*i* synchronizes automatically with an atomic clock time service to timestamp the data accurately.

 · 3105 Patrick Henry Drive Santa Clara, CA 95054 · 408.962.3900 · info@picarro.com · www.picarro.com

PICARRO

Performance Specifications	High Precision Mode	High Dynamic Range Mode
Precision, $\delta^{13}C$ in CH_4 (1-σ , 1 hr window)	< 0.8 ‰ guaranteed precision at > 1.8 ppm 5 min. average < 0.5 ‰ guaranteed precision at > 1.8 ppm, 15 minute average	< 0.4 ‰ guaranteed precision at > 10 ppm
Max Drift at STP $\delta^{13}C$ in CH_4 (over 24 hrs, peak-to-peak, 1 hr interval average)	< 1.5 ‰ guaranteed drift at 10ppm < 2 ‰ typical drift at 1.8ppm	< 1.5 ‰ guaranteed drift at 10 ppm
Precision, CH_4 Concentration (30 sec, 1-σ)	5 ppb + 0.05 % of reading (^{12}C) 1 ppb + 0.05 % of reading (^{13}C)	50 ppb + 0.05 % of reading (^{12}C) 10 ppb + 0.05 % of reading (^{13}C)
Precision, CO_2 Concentration (30 sec, 1-σ)	1 ppm + 0.25 % of reading (^{12}C)	
Precision, H_2O Concentration (30 sec, 1-σ)	100 ppm	
CH_4 Dynamic Range	1.8-12 ppm guaranteed range 1.2-15 ppm operational range	10-1000 ppm guaranteed range 1.8-1500 ppm operational range
CO_2 Dynamic Range	200 - 2000 ppm guaranteed range 0.01 - 0.4 % operational range	
H_2O Dynamic Range	0-2.4 % guaranteed range 0-5 % operational range	
Ambient Temperature Dependence	Guaranteed < ± 0.06 ‰/ºC, typical < ± 0.025 ‰/ºC	
Measurement Interval (includes periodic H_2O and CO_2 measurement)	~ 2 secs	~ 2 secs
Rise/Fall time (10-90% / 90-10%)	Typical ~30 secs	
Applications Considerations	Interference can occur for concentrations of H_2O and CO_2 well above normal ambient levels, as well as other organics, ammonia, ethane, ethylene, or sulfur containing compounds. Users should verify with prepared lab samples. Please contact us to discuss the experimental conditions. Pressure drops in the instrument's gas path can draw external air when this system is used in recirculating applications.	

Analyzer Specifications	
Measurement Technique	CRDS
Measurement Cell Temp. Control	+/- 0.005 °C
Measurement Cell Pressure Control	+/- 0.0002 atm
Shock and Vibration Testing	Meets shock and vibration MIL-STD 810F test standard and operates as specified afterward.
Sample Temperature	-10 to 45 °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 °C, no drying required
Ambient Temperature Range	10 to 35 °C (operating) -10 to 50 °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	¼" 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: 5.6" w x 6.4" h x 11.9" d (14.3 x 16.3 x 30.3 cm)
Installation	Benchtop or 19" rack mount chassis
Weight	60.4 lbs (27.4 kg), includes external pump
Power Requirements	100 - 240 VAC, 47 - 63 Hz (auto-sensing), < 260 W start-up (total); 125 W (analyzer), 80 W (pump) at steady state

This product is not optimized for vehicular deployment where there is a requirement for pin-pointing precise methane source locations while driving. As a result, we do not support this product's use for natural gas leak detection or other real-time methane emissions applications while driving. The Picarro Surveyor™ system is the optimal product for such studies.