

# $\delta^{13}\text{C}$ in $\text{CH}_4$ and $\text{CO}_2$ Gas Analyzer

PICARRO



- Only field-deployable analyzer for simultaneous high-precision  $\delta^{13}\text{C}$  measurements in  $\text{CH}_4$  and  $\text{CO}_2$
- Less calibration, less maintenance, no consumables
- Excellent precision at a fraction of IRMS operating cost

The **Picarro G2201-*i* Analyzer** combines capabilities of two Picarro carbon isotope instruments for  $\text{CO}_2$  and  $\text{CH}_4$  into a single instrument. Now it's easy and fast to capture the insights that only stable isotope ratios offer. Researchers can follow carbon as it moves from source to sink with a single instrument. The dual-purpose analyzer brings simplicity and speed to research. Its small size and robustness make it easy to transport to the field, where immediate results allow researchers to change course on-the-fly and achieve optimal results from limited-time field campaigns.

The analyzer operates in one of three modes: 1)  $\text{CO}_2$  only, 2)  $\text{CH}_4$  only and 3)  $\text{CO}_2$  and  $\text{CH}_4$  combined. In the combined mode, the measurement of  $\text{CO}_2$  and  $\text{CH}_4$  are interleaved every few seconds to produce a sampling rate that is faster than the gas turn-over time in the cavity. When the analyzer is in  $\text{CO}_2$ -only mode or  $\text{CH}_4$ -only mode, the precision improves, because more time is devoted to one molecule. In all modes, the analyzer precisely measures  $\text{CO}_2$ ,  $\text{H}_2\text{O}$  and  $\text{CH}_4$  concentrations, with fewer calibration events than other spectral absorption-based instruments.

## G2201-*i* Performance Specifications

$\delta^{13}\text{C}$ Precision (1- $\sigma$ , 1-hour window, 5-minute average)	CO <sub>2</sub> Isotope-only mode	CH <sub>4</sub> Isotope-only mode	CO <sub>2</sub> – CH <sub>4</sub> Simultaneous mode
$\delta^{13}\text{C}$ -CO <sub>2</sub>	<0.12‰	NA	<0.16‰
$\delta^{13}\text{C}$ -CH <sub>4</sub>	NA	High Precision mode: <0.8‰ High Dynamic Range mode: <0.4‰	High Precision mode: <1.15‰ High Dynamic Range mode: <0.55‰
$\delta^{13}\text{C}$ Max Drift (peak-to-peak, 1-hour average interval over 24 hours at STP)	CO <sub>2</sub> Isotope-only mode	CH <sub>4</sub> Isotope-only mode	CO <sub>2</sub> –CH <sub>4</sub> Simultaneous mode
$\delta^{13}\text{C}$ -CO <sub>2</sub>	<0.6‰	NA	<0.6‰
$\delta^{13}\text{C}$ -CH <sub>4</sub>	NA	High Precision and High Dynamic Range mode: <1.15‰ at 10 ppm CH <sub>4</sub>	
Concentration Precision (1- $\sigma$ , 30-sec average)	CO <sub>2</sub> Isotope-only mode	CH <sub>4</sub> Isotope-only mode	CO <sub>2</sub> – CH <sub>4</sub> Simultaneous mode
CO <sub>2</sub>	200 ppb + 0.05% of reading ( <sup>12</sup> C) 10 ppb + 0.05% of reading ( <sup>13</sup> C)	1 ppm + 0.25% of reading ( <sup>12</sup> C)	200 ppb + 0.05% of reading ( <sup>12</sup> C) 10 ppb + 0.05% of reading ( <sup>13</sup> C)
CH <sub>4</sub>	50 ppb + 0.05% of reading ( <sup>12</sup> C)	High Precision mode: 5 ppb + 0.05% of reading ( <sup>12</sup> C), 1 ppb + 0.05% of reading ( <sup>13</sup> C) High Dynamic Range mode: 50 ppb + 0.05% of reading ( <sup>12</sup> C), 10 ppb + 0.05% of reading ( <sup>13</sup> C)	
H <sub>2</sub> O	100 ppm		

G2201- <i>i</i> Performance Specifications (continued)				
Dynamic Range	CO <sub>2</sub> Isotope-only mode	CH <sub>4</sub> Isotope-only mode	CO <sub>2</sub> –CH <sub>4</sub> Simultaneous mode	
CO <sub>2</sub> Guaranteed Spec Range	380–2,000 ppm	200–2,000 ppm	380–2,000 ppm	
CO <sub>2</sub> Operational Range	100–4,000 ppm	0–4,000 ppm	100–4,000 ppm	
CH <sub>4</sub> Guaranteed Spec Range	1.8–500 ppm	High Precision mode: 1.8–12 ppm High Dynamic Range mode: 10–1,000 ppm	High Precision mode: 1.8–12 ppm High Dynamic Range mode: 10–500 ppm	
CH <sub>4</sub> Operational Range	0–1,000 ppm	High Precision mode: 1.2–15 ppm High Dynamic Range mode: 1.8–1,500 ppm		
H <sub>2</sub> O Guaranteed Spec Range	0–2.4%			
H <sub>2</sub> O Operational Range	0–5%			
General		CO <sub>2</sub> Isotope-only mode	CH <sub>4</sub> Isotope-only mode	CO <sub>2</sub> –CH <sub>4</sub> Simultaneous mode
Measurement Interval		≈3 sec		≈5 sec
Ambient Temperature Dependence		Guaranteed <±0.06‰/°C, typical <±0.025‰/°C		
Rise/Fall Time (10–90%/90–10%)		Typical ≈30 sec		
Applications Considerations		Interference can occur for concentrations of H <sub>2</sub> O and CO <sub>2</sub> well outside of the defined dynamic range, 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.		
G2201- <i>i</i> System Operating Specifications				
Measurement Technique		Cavity Ring-Down Spectroscopy (CRDS)		
Measurement Cell Temp. and Pressure Control		±0.005°C; ±0.0002 atm		
Shock and Vibration Testing		Meets MIL-STD-810F test method standards 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		
Fittings		¼” Swagelok®		
Installation		Benchtop or 19” rack-mount chassis		
Dimensions (single box system)		17”w x 18”d x 7”h (43 x 46 x 18 cm)		
Weight		56 lbs (25.4 kg), includes external pump		
Power Requirements		100–240 VAC; 47–63 Hz (auto-sensing); <375 W at start-up (total). Steady-state operation: 120 W (analyzer), 150 W (pump)		
Optional Compatible Modes		*S0506 - Enriched <sup>13</sup> C Isotopic CO <sub>2</sub> Calibration (up to 6500permil) *S0507 - High Concentration Isotopic CO <sub>2</sub> (2000–4000ppm) in Air *S0509 - High Concentration Isotopic CO <sub>2</sub> (2000–4000ppm) in N <sub>2</sub> *S0511 - Low Concentration Isotopic CO <sub>2</sub> (200 ppm) *S0512 - Additional N <sub>2</sub> Background Gas Mode for Standard Analyzer Isotopic CO <sub>2</sub> Concentration Range (380–2000ppm) *CO <sub>2</sub> only mode		