

# CO<sub>2</sub>, CH<sub>4</sub> and H<sub>2</sub>O Dual Mode Greenhouse Gas Analyzer

# PICARRO

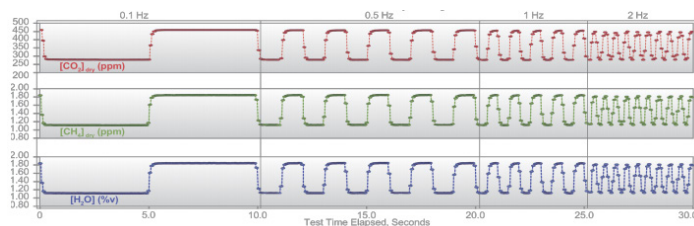


- Highest precision CO<sub>2</sub>, CH<sub>4</sub> and H<sub>2</sub>O measurements at 10 Hz and 0.2 Hz
- Automatic synchronization with 10 Hz anemometer data in real time
- Lowest Drift: No unnecessary calibrations and reference gas measurements
- Dry mol fractions reported automatically. No drying. No post-correcting.
- Switch easily between flux and low-flow mode operation

**The Picarro Advantage:** Our patented Cavity Ring-Down Spectroscopy (CRDS) technology is capable of measuring CO<sub>2</sub>, CH<sub>4</sub> and water vapor down to parts-per-billion (ppb) sensitivity in both high-precision and 10 Hz flux mode. In flux mode, the analyzer measures and reports the concentration of all three species at 10 Hz with a guaranteed gas turnover of 5 Hz for true response measurements.

**Unparalleled Long Term Stability:** In order to ensure measurement fidelity over long periods of time, even in the harshest environments, Picarro incorporates amazingly precise temperature and pressure control, along with careful material selection and meticulous mechanical design. Because lasers drift in all instruments, Picarro also uses a patented, high-precision wavelength monitor to maintain absolute spectral position. The truly unique aspect is that the G2311-f is capable of long-term stability during not only low flow precision mode operation, but during flux (fast flow) operation as well.

## Gas Pulse Frequency

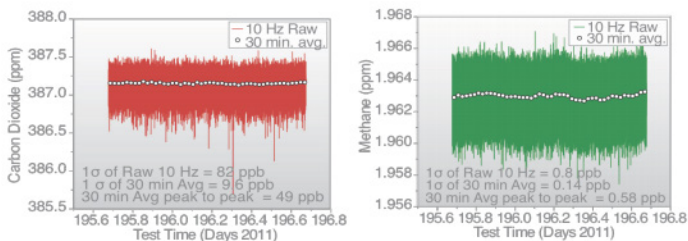


**Figure 1.** Typical raw, unsynchronized data. The analyzer also outputs sync data on a 10 Hz grid. Figure 1 shows a portion of the gas response testing performed on every Picarro flux analyzer. During the test, small nitrogen pulses are introduced into the inlet gas stream via a fast switching valve. During testing, pulses up to 8 Hz or higher are introduced to characterize the response capability of the analyzer. The concentrations shown are dry mixing ratios, automatically calculated and reported.

**Drift Matters:** Frequent reference gas measurements waste expensive calibration standards, and steal valuable data measurement time. Just five minutes of cylinder measurement an hour adds up to over 30 days a year of lost data. Having to make frequent data corrections for instrument and temperature drift is time consuming, introduces error, and increases the chance for mistakes. That's why Picarro puts so much effort into ensuring every instrument meets our guaranteed low-drift standards.

**Flux Mode:** Simplify your instrument set up and your data analysis by plugging your anemometer directly into the Picarro via RS232. Then let our analyzer auto sync and integrate the data into one file in real time. Up to four additional columns of data can be included so other sensors such as relative humidity can be integrated via the anemometer. Also included on the standard analyzer is a higher precision CO<sub>2</sub> flux mode for the most demanding research.

**Precision Mode:** Do you need to make well mixed atmosphere, storage or cylinder measurements, or move to long term monitoring to accommodate changing research goals? The Picarro can easily switch to high-precision, lowflow mode to meet all these needs.



**Figure 2.** (Left) Dry bottle drift test showing incredibly low CO<sub>2</sub> drift. Data taken over 24 hrs at 10 Hz.

**Figure 3.** (Right) Dry bottle drift test showing incredibly low CH<sub>4</sub> drift. Data taken over 24 hrs at 10 Hz.

G2311-f Performance Specifications		CO <sub>2</sub>	CH <sub>4</sub>	H <sub>2</sub> O
<b>Flux Modes</b>				
3-Species Precision (10Hz, 1-σ)	≤200 ppb	≤3 ppb	≤6 ppm + 0.3% of reading	
Max Drift at STP over 24 Hours/1 Month <i>*Max - Min of 50 minute average</i>	≤250/500 ppb	≤2.5/3 ppb	≤10 ppm + 0.3% of reading	
2-Species Precision (10 Hz, 1-σ)	≤110 ppb	N/A	≤6 ppm + 0.3% of reading	
Measurement Rate	≥10 Hz	≥10 Hz	≥10 Hz	
Gas Response in Cell	≥5 Hz	≥5 Hz	≥5 Hz	
<b>Precision Mode</b>				
Precision (1-σ of Raw, 5 sec/5 min averaged data)	≤150/50 ppb	≤1/0.7 ppb	≤6 ppm + 0.3% of reading	
Max Drift at STP over 24 Hours/1 Month <i>*Max - Min of 50 minute average</i>	≤150/500 ppb	≤1/3 ppb	≤10 ppm + 0.3% of reading	
Measurement Rate	≥0.2 Hz	≥0.2 Hz	0–3% (non-condensing)	
Gas Response in Cell	≥0.33 Hz	≥0.33 Hz	≥0.33 Hz	
<b>All Modes</b>				
Guaranteed Specifications Range	300–500 ppm	1–3 ppm	0–3 %v H <sub>2</sub> O 25°C dew pt (non-condensing)	
Operating Range	0–1000 ppm	0–20 ppm	0–7 %v H <sub>2</sub> O 39°C dew pt (non-condensing)	
<b>G2311-f System Specifications</b>				
Measurement Cell Temperature Control	+/-0.005°C			
Measurement Cell Pressure Control	+/-0.0002 atm			
Sample Temperature	-10 to 45°C			
Sample Pressure	550 to 1000 Torr (74 to 134 kPa) in flux mode; 300 to 1000 Torr (40 to 134 kPa) in high precision and low flow mode			
Sample Flow Rate	Flux Mode: ≥5 slm at 760 Torr inlet pressure, no filtration required Precision Mode: ≥0.4 slm at 760 Torr, external flow restrictor included			
Sample Humidity	<99% R.H. non-condensing @40°C			
Ambient Temperature Range	5°C to 40°C operating, -10°C to 50°C storage			
Ambient Humidity	<99% R.H non-condensing			
Accessories (included)	Pump (external), vacuum line with fittings, keyboard, mouse, 256 GB SSD, LCD monitor (optional)			
Dimensions	Analyzer: 17" w x 7" h x 17.55" d (43.18 x 17.78 x 44.57 cm) External Pump: 7.5" w x 4" h x 11" d (19 x 10.2 x 28 cm)			
Weight	83.1 lbs (37.7 kg) including pump			
Installation	Benchtop (standard) or 19" rack mount chassis (optional)			
Power Requirements	90–120 VAC, 50/60 Hz, 220 VAC, 50 Hz, Start up: <600 W, total (including pump) Steady State: 110 W (analyzer) + 250 W (pump) = 360 W			
Data Outputs	RS-232, Ethernet, USB, analog (optional) 0–10 V			
Optional Accessories	16-Port Rotary Valve for multi-inlet sampling. Fully controlled by analyzer software, including valve switching. Available for high precision and low flow modes only.			