

Closed System Measurement Package

PICARRO



- Real-time, non-destructive concentration and isotope studies
- Set-up in minutes; fast and easy to use
- Have confidence in your results; minimal efflux and influx
- Ideal for small sample work; perfectly matched to our small cavity technology
- Rugged, robust analyzers for use in the field or in the lab

The **Picarro A0701 and A0702 Closed System Measurement (CSM)** package enables closed-loop system applications. Combined with an appropriate Picarro analyzer, our rugged, high-precision systems offer unparalleled performance for a wide-range of closed system applications—from studying gas evolution from soils or vegetation to incorporating stable labels into living organisms. Our small-cavity analyzers have long been the optimal choice for sample-limited studies. Now, we have a series of turn-key systems with minimal efflux and influx to avoid contamination and interference in closed-loop operation.

A Picarro CSM package (**Figure 1**) consists of an analyzer and diaphragm pump module specially adapted for low-leak operation. All tubing and fittings are provided to attach directly to your chamber. The

complete gas path has been optimized to provide a total volume of only ≈ 100 mls for the analyzer, pump and tubing up to the chamber. Picarro's rugged, robust instruments are proven for lab or field work. Picarro analyzers have accurately acquired data while installed in some of the earth's most severe and challenging environments, including Arctic and Antarctic glaciers, African deserts and Amazonian jungles.

Data in **Figure 2** (CO_2) and **Figure 3** (CH_4), on the opposite page, show how well this system operates when attached to a chamber charged with an air-like matrix containing $\approx 3,000$ ppm of CO_2 and zero CH_4 , respectively. In this experiment, the rate of change in $[\text{CH}_4]$ is less than 70 ppb/minute and the rate of change in $[\text{CH}_4]$ is better than 0.1 ppb/minute.

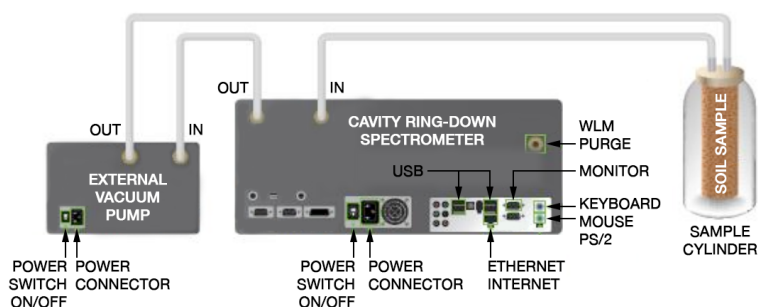


Figure 1. A Picarro CRDS analyzer and A0702 external low-leak pump configured for closed-loop measurement of a soil sample.

Figure 2. A closed-cycle chamber system was charged with an air-like matrix containing 3,028 ppm CO₂. When running, the chamber gas is continuously circulated through the analyzer. Data acquired for 2 hours (left) and 24 hours (right) shows that mixing of the chamber air with ambient air (≈390 ppm CO₂) outside the chamber is minimal.

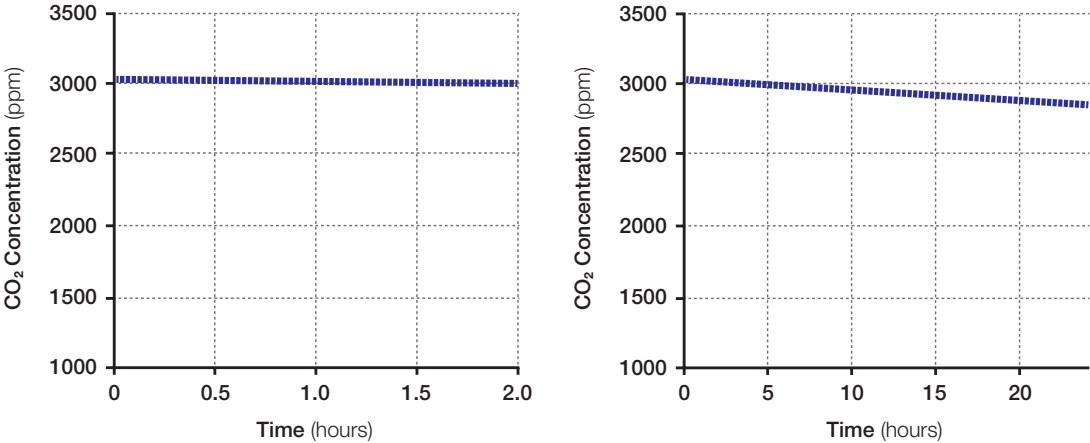
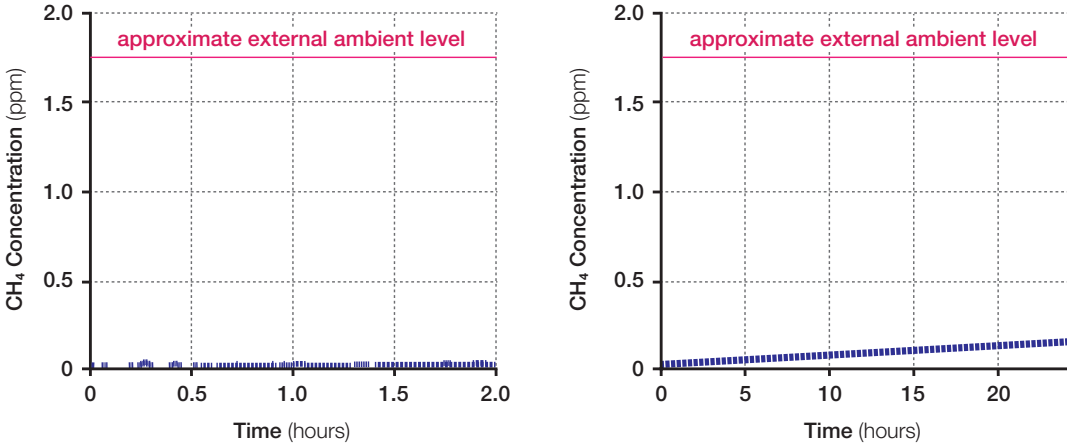


Figure 3. A closed-cycle chamber system was charged with an air-like matrix containing no CH₄. When running, the chamber gas is continuously circulated through the analyzer. Data acquired for 2 hours (left) and 24 hours (right) shows that mixing of the chamber air with ambient air outside the chamber is minimal.



Specifications	
Picarro Analyzer Compatibility	G2201- <i>i</i> δ ¹³ C for methane (CH ₄) and carbon dioxide (CO ₂) G2131- <i>i</i> δ ¹³ C for carbon dioxide (CO ₂) G2508 Nitrous oxide (N ₂ O), methane (CH ₄), carbon dioxide (CO ₂), ammonia (NH ₃), and water (H ₂ O) G2401 Carbon monoxide (CO), carbon dioxide (CO ₂), methane (CH ₄), and water (H ₂ O)
Gas Concentration and Isotope Performance	See relevant Picarro analyzer data sheet
Leak Rate ¹	<0.05 sccm over 12 hours ²
Fittings	Picarro provides two fittings types for chamber connection: 1/8 inch NPT and 1/4" Swagelok® ferrule
Ordering Information	<p>G2201-<i>i</i> and G2508: Both instruments include A0701 low-leak modifications as standard equipment; order instruments with A0702 low-leak diaphragm pump for CSM.</p> <p>G2131-<i>i</i> and G2401: Both instruments require A0701 low-leak internal modifications; order either with A0701 modification and A0702 low-leak diaphragm pump for CSM.</p>

¹ Requires a gas tight chamber, including lids and seal. Use only Picarro supplied bellows tubing and fittings. Using other tubing and fittings may degrade performance.

² Using the supplied bellows tubing, connect the pump outlet to the analyzer inlet and the pump vacuum inlet to the analyzer outlet to create a minimum volume loop. Measure the pressure change between the analyzer inlet and pump outlet over 12 hours and convert to leak rate. Smaller chambers have more rapid pressure change than larger chambers. Pressure increase for the minimum volume loop is ≈220 Torr (4.3 psi) over 12 hours and is negligible for a 1 L chamber over 24 hours. Leak rate specification is unchanged with different samples volumes/chambers.