# Small Sample Introduction Module 2

## For high-precision isotopic and concentration measurements of small, discrete gas samples

**PICARRO**

- Analyze discrete gas samples as small as 20 mL
- Introduce samples via syringe or gas-bag
- Single sample or automatic processing of up to 8 samples using Picarro's 16-Port Manifold
- Built-in dilution system enables optimal concentration targeting for isotopic analysis
- Automatically measure isotopic reference gases between samples
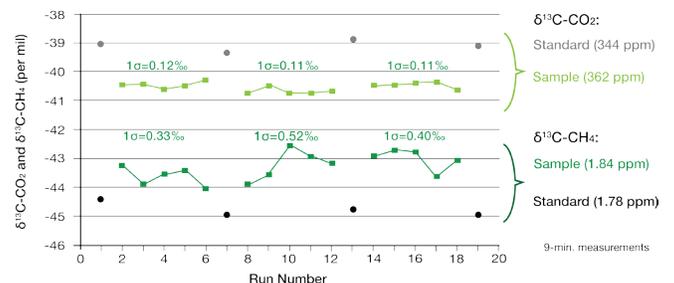- Software flexibility provides automated work-flows and data reporting

The **Picarro A0314 Small Sample Introduction Module 2 (SSIM2)** is Picarro's front-end that transforms our continuously-sampling analyzers into instruments capable of measuring small, discrete gas samples. The SSIM2 is an excellent solution for soil, headspace, plant, and other studies that provide gas samples in limited volumes. This front-end may be used with Picarro's isotopic and concentration-only analyzers.

Connecting to the SSIM2 is straightforward. The sample input is a standard 1/8" Swagelok® fitting, so users can easily introduce samples from bags or flasks, or attach a septum holder for syringe injection. When used for isotopic measurements, the SSIM2 may be paired with the Picarro 16-Port Distribution Manifold to enable automatic analysis of up to eight sample containers.

The unique design of the SSIM2 allows for efficient purge cycles, leading to minimal sample carry over, reducing memory effects and improving precision. 20-mL gas samples travel from the SSIM2 chamber into the CRDS analyzer at reduced flow rates, enabling sampling times of 4 or 9 minutes. The steady plateau is then analyzed and averaged automatically by the SSIM2 software package—data review and feedback are instant. The following graph shows an example of a stable concentration plateau of ~2 ppm $CH_4$ on the SSIM2 and G2508 concentration analyzer. The plateau has a 1σ standard deviation of ~0.0005 ppm.



SSIM Injection
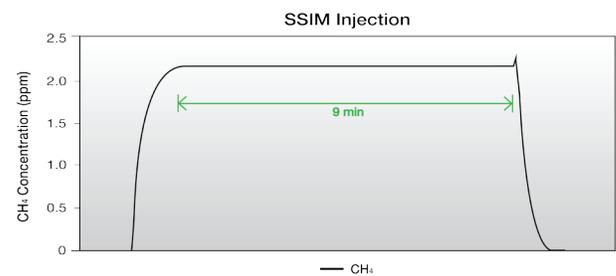
Such stability leads to excellent performance on a sample-to-sample basis. The graph below depicts typical precision of five replicates on a G2201-*i* isotopic analyzer, capable of measuring $\delta^{13}C\text{-}CO_2$ and $\delta^{13}C\text{-}CH_4$.



$\delta^{13}C\text{-}CO_2$:
Standard (344 ppm)
Sample (362 ppm)

$\delta^{13}C\text{-}CH_4$:
Sample (1.84 ppm)
Standard (1.78 ppm)

9-min. measurements

The mechanical design and software features complement each other, allowing for a suite of additional measurement options. The SSIM2 can be configured to introduce reference gases for sample bracketing, the number of sample replicates can be adjusted, and the built-in dilution feature can be used to dilute high-concentration isotopic samples and/or standards.

| A0314 SSIM2 Isotopic Performance | | | |
|---|---|---|---|
| Specification | Isotopologue | Value | Analyzer |
| Guaranteed Precision* | $\delta^{13}C$ in $CO_2$ | <0.5‰ @ 500 ppm<br><0.2‰ @ 1,500 ppm<br><0.1‰ @ 3,000 ppm | G2201-*i*, G2131-*i* |
| | $\delta^{13}C$ in $CH_4$ | <1.5‰ @ 1.8 ppm<br><0.3‰ @ 10 ppm | G2201-*i*, G2132-*i* |
| | $\delta^{15}N$ in $N_2O$ | <3‰ | G5131-*i* |
| | $\delta^{18}O$ in $N_2O$ | <3‰ | G5131-*i* |

| A0314 SSIM2 Concentration Performance | | | |
|---|---|---|---|
| Specification | Concentration | Value | Analyzer |
| Guaranteed Precision* | $CO_2$ | <1 ppm @ 400 ppm | G2201-*i*, G2131-*i*, G2508, G2308 |
| | $CO_4$ | <3 ppb @ 2 ppm | G2201-*i*, G2132-*i*, G2508, G2308 |
| | $N_2O$ | <1.5 ppb @ 330 ppb | G5131-*i*, G2508, G2308 |
| Sample Dilution** | $CO_2$ | Bag: ~4% / Syringe: 0.6% | G2201-*i*, G2131-*i*, G2508, G2308 |
| | $CH_4$ | Bag: ~7% / Syringe: 0.6% | G2201-*i*, G2132-*i*, G2508, G2308 |
| | $N_2O$ | Bag: ~8% / Syringe: 2% | G5131-*i*, G2508, G2308 |

* 1-σ of five replicates (using 9-minute measurement time)

** The dead-volume effect, after a purge cycle, leads to a small degree of dilution with zero-air. This influences the accuracy of concentration readings but has no effect on the concentration or isotopic precision. The method of sample delivery (bag/syringe) determines the extent of this dilution effect. See App Note AN038 for details on how to minimize sample dilution.

NOTE: This dead-volume effect is not to be mistaken with the built-in dilution function of the SSIM, designed to handle a larger range of dilutions.

| A0314 SSIM2 System Specifications | |
|---|---|
| Minimum Sample Volume Per Measurement | 20 mL directly into the SSIM2<br>23 mL through the 16-Port Manifold |
| Injection Time | 10 or 15 minutes (Corresponds to 4- or 9-minute measurement time) |
| Connections | 1/8" Swagelok® |
| Dimensions | SSIM2: 8.5" w x 4" h x 9" d (21.6 x 10.2 x 22.9 cm)<br>Pump: 7.5" w x 4" h x 11" d (19 x 10.2 x 28 cm) |
| Weight | SSIM2: 12 lbs (5.4 kg)<br>Pump: 8 lbs (3.62 kg) |
| Power Requirements | SSIM2 powered through the USB 2.0 port of the analyzer.<br><3 watts additional power draw through analyzer.<br>Pump: 35 watts steady state |
| Gas Requirements | Zero air as carrier gas<br>Standards in zero air at appropriate concentrations |