$\delta^{18}O$, $\delta^{17}O$, δD and ^{17}O-excess Isotopic Water Analyzer

PICARRO

- Streamlined, simple and simultaneous measurements of $\delta^{18}O$, $\delta^{17}O$, δD and ^{17}O-excess in liquids and vapor
- Average to <15 per meg precision on ^{17}O-excess for 1 hour vapor measurements
- Repeat measurements demonstrate 15 per meg precision on ^{17}O-excess for liquids
- Increased sample throughput modes available for $\delta^{18}O$ and δD

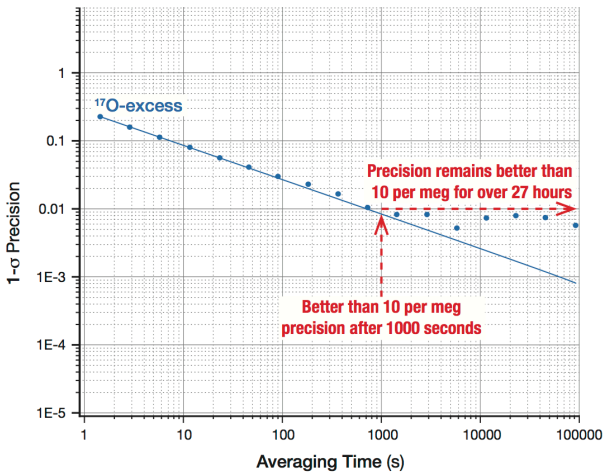
The **Picarro L2140-*i* isotopic water analyzer** enables simultaneous measurements of $\delta^{18}O$, $\delta^{17}O$, and δD, and determines ^{17}O-excess to sub 15 per meg (<0.015‰) precision. Scientists now have a simpler, less expensive option for high-precision measurements of water stable isotopes in liquids and vapor.

Measurements of ^{17}O-excess in conjunction with high precision measurements $\delta^{18}O$ and δD enable geoscientists to enhance our understanding of present day climate and the interactions between the hydrosphere and biosphere, and to help reconstruct climates of the past. The ability to quantify extremely small deviations in $\delta^{17}O$ (i.e., ^{17}O-excess), typically less than 0.1‰ in nature, is essential for paleoclimate, (eco) hydrology, and atmospheric science applications.

High-precision measurements of all three oxygen isotopes (^{16}O, ^{18}O and ^{17}O) was once limited to highly specialized labs with expensive, complex sample preparation systems for analysis by isotope ratio mass spectrometry (IRMS). The L2140-*i* has three measurement modes for $\delta^{18}O$ and δD, and a high precision mode for $\delta^{17}O$. The Standard mode processes 27 samples per day. The Express mode delivers faster high-precision measurements for up to 50 samples per day. The Survey mode makes super-fast approximations of isotopic values for very large sample batches—up to 900 injections per day. This enables more efficient sorting and rearranging of sample clusters to reduce the memory effect, and thereby accelerates the measurement process and increases the accuracy of the results. Combining the Express and Survey modes will further increase throughput by reducing the time it takes to measure 100 samples by up to 68 hours.

Patented Picarro cavity ring-down spectroscopy (CRDS) technology enables an effective measurement path length of up to 20 kilometers in a compact cavity, which results in exceptional precision and sensitivity with a small-footprint analyzer. A meticulously designed small optical cavity incorporates precise temperature and pressure control. As a result, the analyzer delivers a best-in-class combination of precision, accuracy, low drift and ease-of-use.

Allan Deviation Plot: ^{17}O-Excess Vapor Performance



L2140-*i* Technical Specifications

L2140-*i* Liquid Specifications* (with A0211 and A0325)	Guaranteed Performance	Typical Performance**	
		High Precision / Standard mode	Express mode***
Precision (1σ)	$\delta^{18}O$ – 0.025‰ δD – 0.1‰ $\delta^{17}O$ – 0.025‰ ^{17}O-excess – 0.015‰	$\delta^{18}O$ – 0.010‰ δD – 0.05‰ $\delta^{17}O$ – 0.012‰ ^{17}O-excess – 0.008‰	$\delta^{18}O$ – 0.015‰ δD – 0.05‰ $\delta^{17}O$ – N/A ^{17}O-excess – N/A
Maximum 24-hour Drift (vapor & liquid)	$\delta^{18}O$ – 0.2‰ δD – 0.8‰ $\delta^{17}O$ – 0.2‰ ^{17}O-excess – 0.2‰	$\delta^{18}O$ – 0.06‰ δD – 0.30‰ $\delta^{17}O$ – 0.053‰ ^{17}O-excess – 0.039‰	$\delta^{18}O$ – 0.100‰ δD – 0.43‰ $\delta^{17}O$ – N/A ^{17}O-excess – N/A
Throughput Per Day	Standard mode - up to 162 injections Express mode - up to 500 injections Survey mode - up to 900 injections	54 minutes per sample / 27 samples per day	29 minutes per sample / 50 samples per day
Memory	(after the 3rd injection) $\delta^{18}O$ – 99% δD – 98% $\delta^{17}O$ – 99% ^{17}O-excess – 99%	(after the 3rd injection) $\delta^{18}O$ – 99% δD – 98%	(after 15 min) $\delta^{18}O$ – 99% δD – 98%

** Specifications are tested for each unit and based on specific accessories. Please contact Picarro to learn more about the rigorous testing process and application specific accessories.*
*** Typical performance is defined as the median of testing results from a number of sequentially built L2140-i analyzers. Results available upon request.*
**** Only applicable for $\delta^{18}O$ and δD mode*

L2140-*i* Vapor Specifications*	
Measurement Range	1,000 to 50,000 ppm
Guaranteed Precision (1σ) **at 12,500 ppm** ($\delta^{18}O/\delta D$ mode)	0.12/0.04‰ for $\delta^{18}O$ at 10/100 sec 0.3/0.1‰ for δD at 10/100 sec
Guaranteed Precision (1σ) **at 12,500 ppm** ('^{17}O-excess' mode)	0.04‰ for $\delta^{18}O$ at 300 sec 0.1‰ for δD at 300 sec 0.04‰ for $\delta^{17}O$ at 300 sec 0.015‰ for ^{17}O-excess at 3,600 sec
Measurement Rate	~1 Hz
L2140-*i* Analyzer Specifications	
Temperature	-10 to 45°C (vapor sample); 10 to 35°C (liquid sample & system operation); -10 to 50°C (storage)
Sample Pressure	300 to 1000 Torr (40 to 133 kPa)
Sample Flow Rate	~40 sccm at 760 Torr, no filtration required
Installation	Benchtop or 19" rack mount chassis
Dimensions	Analyzer: 17" w x 7" h x 17.5" d (43.2 x 17.9 x 44.6 cm) External Pump: 6.1" w x 8.7" h x 13.6" d (15.5 x 22 x 34.5 cm)
Weight	45 lbs (20.4 kg) for analyzer and 14.3 lbs (6.5 kg) for external pump
Power	100–240 VAC; 47–63 Hz (auto-sensing); <375 W at start-up (total). Steady-state operation: 120 W (analyzer), 150 W (pump).
Measurement Cell Temperature Control	±0.005°C
Measurement Cell Pressure Control	±0.0002 atm
Data Outputs	RS-232, Ethernet, USB, analog (optional), 0–10 V
Operating System	Windows 10 Professional with onboard Picarro Software

Included

ChemCorrect™ post-processing software for flagging contamination and normalizing measurements

A2000 – External Pump

Optional Peripherals

For Discrete Liquid Water
A0211 – High Precision Vaporizer
A0325 – Autosampler
A0214 – Micro-Combustion Module (MCM)

For Continuous Liquid Water
A0217 – Continuous Water Sampler (CWS)

For Water Vapor
A0101 – Standards Delivery Module
A0912 – Dual Mode Kit
(requires A0211 and A0325)

For Solids
A0213 – Induction Module (IM)
(not compatible with ^{17}O mode)

Optional Upgrades

S3099 – Express & Survey modes: increase the sample throughput

Accessories

C0354 – Salt Liner
A0923 – Zero Air Install Kit
A0921 – N_2 Install Kit (Americas only)
C0211 – Vaporizer Cleaning Kit
C0328 – Water Consumable Kit (500 Pieces)
C0356 – Water Standards

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