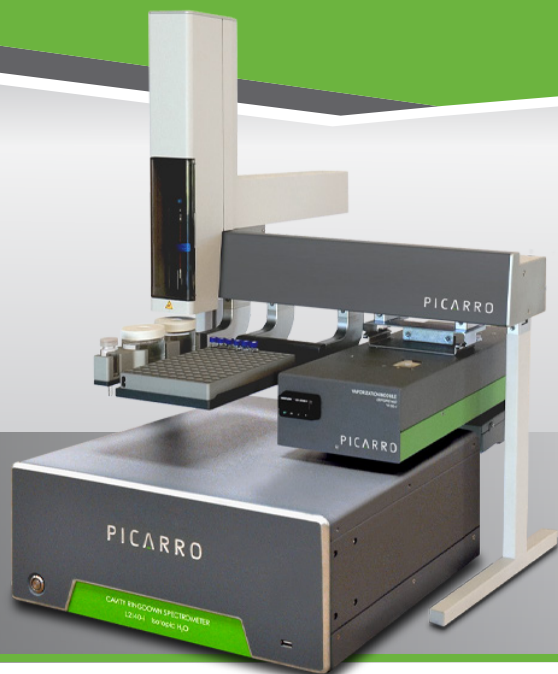


# $\delta^{18}\text{O}$ , $\delta^{17}\text{O}$ , $\delta^2\text{H}$ and $^{17}\text{O}$ -excess Isotopic Water Analyzer

# PICARRO



- Streamlined, simple and simultaneous measurements of  $\delta^{18}\text{O}$ ,  $\delta^{17}\text{O}$ ,  $\delta^2\text{H}$  and  $^{17}\text{O}$ -excess in liquids and vapor
- Average to <15 per meg precision on  $^{17}\text{O}$ -excess for 1 hour vapor measurements
- Repeat measurements demonstrate 15 per meg precision on  $^{17}\text{O}$ -excess for liquids
- Increased sample throughput modes available for  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$

The **Picarro L2140-*i* isotopic water analyzer** enables simultaneous measurements of  $\delta^{18}\text{O}$ ,  $\delta^{17}\text{O}$ , and  $\delta^2\text{H}$ , and determines  $^{17}\text{O}$ -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.

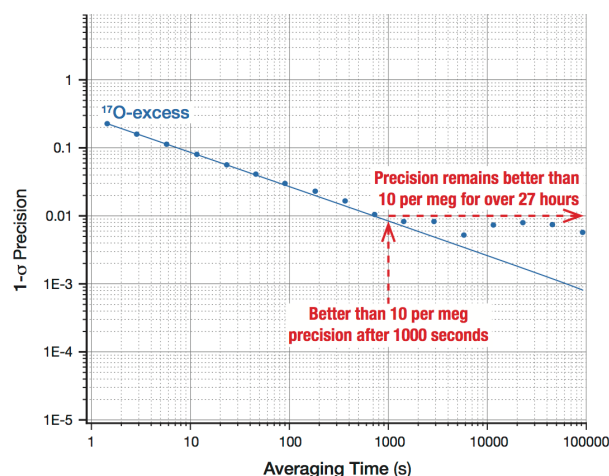
Measurements of  $^{17}\text{O}$ -excess in conjunction with high precision measurements  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$  enable geoscientists to enhance our understanding of present day climate and the interactions between the hydrosphere and biosphere, and to help reconstruct climates of the past. The ability to quantify extremely small deviations in  $\delta^{17}\text{O}$  (i.e.,  $^{17}\text{O}$ -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 ( $^{16}\text{O}$ ,  $^{18}\text{O}$  and  $^{17}\text{O}$ ) 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  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$ , and a high precision mode for  $\delta^{17}\text{O}$ . 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: $^{17}\text{O}$ -Excess Vapor Performance



## L2140-*i* Technical Specifications

| L2140- <i>i</i> Liquid Specifications*<br>(with A0211 and A0340) | Guaranteed Performance                                                                                                                               | Typical Performance**                                                                                                              |                                                                                                                              |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
|                                                                  |                                                                                                                                                      | High Precision/Standard mode                                                                                                       | Express mode***                                                                                                              |
| Precision (1 $\sigma$ )*                                         | $\delta^{18}\text{O}$ – 0.025‰<br>$\delta^2\text{H}$ – 0.1‰<br>$\delta^{17}\text{O}$ – 0.025‰<br>$^{17}\text{O}$ -excess – 0.015‰                    | $\delta^{18}\text{O}$ – 0.010‰<br>$\delta^2\text{H}$ – 0.05‰<br>$\delta^{17}\text{O}$ – 0.012‰<br>$^{17}\text{O}$ -excess – 0.008‰ | $\delta^{18}\text{O}$ – 0.015‰<br>$\delta^2\text{H}$ – 0.05‰<br>$\delta^{17}\text{O}$ – N/A<br>$^{17}\text{O}$ -excess – N/A |
| Maximum 24-hour Drift<br>(vapor & liquid)                        | $\delta^{18}\text{O}$ – 0.2‰<br>$\delta^2\text{H}$ – 0.8‰<br>$\delta^{17}\text{O}$ – 0.2‰<br>$^{17}\text{O}$ -excess – 0.2‰                          | $\delta^{18}\text{O}$ – 0.06‰<br>$\delta^2\text{H}$ – 0.30‰<br>$\delta^{17}\text{O}$ – 0.053‰<br>$^{17}\text{O}$ -excess – 0.039‰  | $\delta^{18}\text{O}$ – 0.100‰<br>$\delta^2\text{H}$ – 0.43‰<br>$\delta^{17}\text{O}$ – N/A<br>$^{17}\text{O}$ -excess – N/A |
| Throughput Per Day                                               | Standard mode - up to 162 injections<br>Express mode - up to 500 injections<br>Survey mode - up to 900 injections                                    | 54 minutes per sample / 27<br>samples per day                                                                                      | 29 minutes per sample / 50<br>samples per day                                                                                |
| Memory                                                           | (after the 3rd injection)<br>$\delta^{18}\text{O}$ – 99%<br>$\delta^2\text{H}$ – 98%<br>$\delta^{17}\text{O}$ – 99%<br>$^{17}\text{O}$ -excess – 99% | (after the 3rd injection)<br>$\delta^{18}\text{O}$ – 99%<br>$\delta^2\text{H}$ – 98%                                               | (after 15 min)<br>$\delta^{18}\text{O}$ – 99%<br>$\delta^2\text{H}$ – 98%                                                    |

\* Precision is based on standard deviation of the mean of groups of 6 injections measured over 8 hrs. 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  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$  mode

| L2140- <i>i</i> Vapor Specifications*                                                              |                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measurement Range                                                                                  | 1,000 to 50,000 ppm                                                                                                                                                                   |
| Guaranteed Precision (1 $\sigma$ ) at<br>12,500 ppm ( $\delta^{18}\text{O}/\delta^2\text{H}$ mode) | 0.12/0.04‰ for $\delta^{18}\text{O}$ at 10/100 sec<br>0.3/0.1‰ for $\delta^2\text{H}$ at 10/100 sec                                                                                   |
| Guaranteed Precision (1 $\sigma$ ) at<br>12,500 ppm ( $^{17}\text{O}$ -excess mode)                | 0.04‰ for $\delta^{18}\text{O}$ at 300 sec<br>0.1‰ for $\delta^2\text{H}$ at 300 sec<br>0.04‰ for $\delta^{17}\text{O}$ at 300 sec<br>0.015‰ for $^{17}\text{O}$ -excess at 3,600 sec |
| Measurement Rate                                                                                   | ~1 Hz                                                                                                                                                                                 |
| L2140- <i>i</i> Analyzer Specifications                                                            |                                                                                                                                                                                       |
| Temperature                                                                                        | -10 to 45°C (vapor sample); 10 to 35°C<br>(liquid sample & system operation); -10 to<br>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                                                                                         | <b>Analyzer:</b> 17" w x 7" h x 17.5" d<br>(43.2 x 17.9 x 44.6 cm), not including 0.5" feet<br><b>External Pump:</b> 6.1" w x 8.7" h x 13.6" d<br>(15.5 x 22 x 34.5 cm)               |
| Weight                                                                                             | 45 lbs (20.4 kg) for analyzer and<br>14.3 lbs (6.5 kg) for external pump                                                                                                              |
| Power                                                                                              | 100–240 VAC; 50/60 Hz (auto-sensing);<br><375 W at start-up (total). Steady-state<br>operation: 120 W (analyzer), 150 W (pump).                                                       |
| Measurement Cell Temperature<br>Control                                                            | ±0.005°C                                                                                                                                                                              |
| Measurement Cell Pressure<br>Control                                                               | ±0.0002 atm                                                                                                                                                                           |
| Data Outputs                                                                                       | RS-232, Ethernet, USB, analog (optional),<br>0–10 V                                                                                                                                   |
| Operating System                                                                                   | Windows 11 LTSC with onboard Picarro<br>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

A0340 – 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 A0340)

### For Solids

A0213 – Induction Module (IM)

(not compatible with  $^{17}\text{O}$  mode)

## Optional Upgrades

S3099 – Express & Survey modes: increase the  
sample throughput. Compatible with required  
peripherals: A0340 Picarro Autosampler,  
A0211 Vaporizer only

## Accessories

C0354 – Salt Liner

A0923 – Zero Air Install Kit

A0921 – N<sub>2</sub> Install Kit (Americas only)

C0211 – Vaporizer Cleaning Kit

C0328 – Water Consumable Kit (500 Pieces)

C0356 – Water Standards

# PICARRO

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