Fastest, Most Precise Water Isotope Analysis Systems

Accurately measure $\delta^{18}O$, $\delta^{17}O$, $\delta^{2}H$, and ^{17}O-excess in water quickly, simply, and without sample conversion



PICARRO

ADVANCING HOW WE MEASURE AND INTERPRET PROPERTIES OF WATER, VAPOR, AND ICE

Water is life. By studying how it moves and carries other elements through Earth's ecosystems, and by measuring its properties in various forms (fresh or salt water as liquid, vapor, or ice), scientists unlock a variety of insights about the planet's past, present, and future. Gaining these insights requires a better understanding of the hydrological cycle and catchment hydrology. The ability to quickly and accurately analyze the isotopic signatures in water is key to identifying the many factors affecting atmospheric convection, the water cycle, climate change, and more.

Picarro analyzers provide the high-quality, real-time continuous measurements of stable isotopes in water that are critical for scientists studying hydrology, oceanic and atmospheric processes, and paleoclimatology. The Picarro Water Isotope Analysis Systems accurately measure $\delta^{18}O$, $\delta^{17}O$, $\delta^{2}H$, and ^{17}O-excess in water quickly, simply, and without sample conversion. Their small, light, robust design makes them ideal for lab and field work. And with a comprehensive selection of compatible peripherals, the Picarro analyzers can process just about any type of water sample.

HIGHLIGHTS

- Patented CRDS technology delivers highest precision and lowest drift measurements
- Unparalleled speed allows processing of up to 900 injections per day
- Multi-species, real-time analysis
- Straightforward and infrequent calibrations
- Carefully selected sample handling materials and coatings for fast response
- Form factor suitable for mobile and stationary deployments
- Fast start-up and easy-to-use interface

L2130-*i* Analyzer

- Precisely measures $\delta^{18}O$ and $\delta^{2}H$
- Features three throughput modes:
  - Standard - 162 injections per day (27 samples)
  - Express - 500 injections per day (50 samples)
  - Survey - up to 900 injections per day (150 samples)

L2140-*i* Analyzer

- Precisely measures $\delta^{18}O$, $\delta^{17}O$, $\delta^{2}H$ and ^{17}O-excess
- Features two throughput modes:
  - Standard - 162 injections per day (27 samples)
  - Express* - 500 injections per day (50 samples)
  - Survey* - up to 900 injections per day (150 samples)

COMPREHENSIVE SOLUTIONS FOR WIDE RANGE OF APPLICATIONS

Picarro's flagship isotopic water analysis systems are the gold standard measurement technology in hydrology, ocean science, and paleoclimatology. They've been deployed for applications ranging from identifying the influence of sea ice on ocean water vapor isotopes to reconstructing paleotemperatures through a triple isotope study on precipitation, drip water and speleothem fluid to mapping nutrient dynamics and residence time of river water, and more. With a powerful combination of analyzers and peripherals, Picarro has isotopic water analysis systems to meet the needs of most applications. Using ChemCorrect processing software, researchers can easily flag contamination and normalize measurements for more accurate results.

** Only applicable for $\delta^{18}O$ and $\delta^{2}H$ mode*

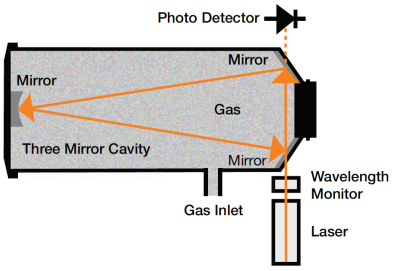
HIGH PERFORMANCE WATER ISOTOPE ANALYZERS



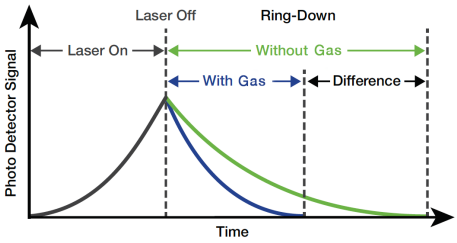
PATENTED CRDS TECHNOLOGY ENSURES HIGH PRECISION AND LOW DRIFT

All Picarro analyzers are built on proven cavity ring-down spectroscopy (CRDS) technology. This sophisticated time-based measurement uses a laser to quantify spectral features of gas phase molecules in an optical cavity. A beam from a single-frequency laser diode enters a three-mirror cavity to create a continuous traveling light wave, as illustrated in the figure below. The laser is locked to the patented wavelength monitor to ensure spectral precision. When the laser is on, the cavity fills with circulating laser light. A fast photo detector senses a small amount of light leaking through one of the mirrors to produce a signal that is directly proportional to the intensity in the cavity.

CRDS Schematic



CRDS Operation



Picarro's CRDS technology offers several advantages over Off-Axis Integrated Cavity Output Spectroscopy (OA-ICOS). Picarro's unique CRDS technology relies on time-based measurements providing the highest precision and lowest drift. CRDS also allows for low flow and fast response which are required to achieve real-time, quality measurements. In addition, Picarro's patented wavelength monitor maintains the wavelength of the laser frequency and sequential sensitivity, providing uncompromised precision and accuracy over time and ambient conditions.

NEW HIGH-THROUGHPUT MODES INCLUDED IN L2130-*i* and L2140-*i*

The L2130-*i* and L2140-*i* has two high-throughput modes in addition to the original Standard mode. The Express mode delivers faster high-precision measurements for up to 500 injections per day. The Survey mode makes super-fast approximations of isotopic values for very large sample batches—up to 900 injections per day. With these approximations researchers can more efficiently sort and rearrange sample clusters to reduce memory effects, accelerating the measurement process and increasing the accuracy of the results.

SPECIALIZED WATER ANALYSIS PERIPHERALS



High Precision Vaporizer and Autosampler

The Picarro A0340 Autosampler and A0211 Vaporizer offer exceptional precision with minimal maintenance. These peripherals fully integrate with the L2130-*i* and L2140-*i* water isotope analyzers, including onboard software control.

- Complete solution for automated analysis
- Choice of operating modes: high precision or high throughput
- Onboard software controls both Autosampler and Vaporizer
- Sample analysis conducted automatically with data reported per injection

Compatibility:
- L2130-*i*
- L2140-*i*

Related Applications:
- Hydrology
- Ocean Science
- Paleoclimatology



Micro-Combustion Module (MCM)

The Picarro A0214 Micro-Combustion Module effectively removes spectral interference for commonly occurring alcohols and plant products, including multicomponent mixtures of alcohols, terpenes, and green leaf volatiles.

- Treat samples inline to decompose interfering organics
- Improve data quality for water isotope analysis
- Easily deploy in a laboratory or in the field

Compatibility:
- L2130-*i*
- L2140-*i*
- A0211

Related Applications:
- Hydrology
- Ocean Science

SPECIFICATIONS

General Specifications	L2130-*i*	L2140-*i*
Measurements	$\delta^{18}O$ and $\delta^{2}H$	$\delta^{18}O$, $\delta^{17}O$, $\delta^{2}H$ and ^{17}O-excess
Throughput Per Day	Standard - 162 injections (27 samples) Express - 500 injections (50 samples) Survey - up to 900 injections (150 samples)	Standard - 162 injections (27 samples) Express* - 500 injections (50 samples) Survey* - up to 900 injections (150 samples)

Liquids Specifications**	L2130-*i*		L2140-*i*	
Guaranteed Precision (1σ)	$\delta^{18}O$ – 0.025‰ $\delta^{2}H$ – 0.1‰		$\delta^{18}O$ – 0.025‰ $\delta^{2}H$ – 0.1‰ $\delta^{17}O$ – 0.025‰ ^{17}O-excess – 0.015‰	
Typical Precision (1σ)	Standard - $\delta^{18}O$ – 0.010‰ $\delta^{2}H$ – 0.05‰	Express - $\delta^{18}O$ – 0.015‰ $\delta^{2}H$ – 0.05‰	Standard - $\delta^{18}O$ – 0.010‰ $\delta^{2}H$ – 0.05‰ $\delta^{17}O$ – 0.012‰ ^{17}O-excess – 0.008‰	Express - $\delta^{18}O$ – 0.015‰ $\delta^{2}H$ – 0.05‰ $\delta^{17}O$ – N/A ^{17}O-excess – N/A
Zero Drift (24 hour)	$\delta^{18}O$ – 0.2‰ $\delta^{2}H$ – 0.8‰		$\delta^{18}O$ – 0.2‰ $\delta^{17}O$ – 0.2‰ $\delta^{2}H$ – 0.8‰ ^{17}O-excess – 0.2‰	
Memory Removal ($\delta^{18}O$ 99%, $\delta^{2}H$ 98%, ^{17}O 99%, in X minutes)	Standard – 27 minutes (3 injections) Express – 5 minutes (cavity flushing) Survey – N/A		Standard – 27 minutes (3 injections) Express* – 5 minutes (cavity flushing) Survey* – N/A	

Vapor Specifications	L2130-*i*	L2140-*i*
Measurement Range	1,000 to 50,000 ppm	1,000 to 50,000 ppm
Guaranteed Precision (1σ) **at 12,500 ppm** ('Normal' mode)	0.120/0.040‰ for $\delta^{18}O$ at 10/100 sec 0.300/0.100‰ for $\delta^{2}H$ at 10/100 sec	0.120/0.040‰ for $\delta^{18}O$ at 10/100 sec 0.300/0.100‰ for $\delta^{2}H$ at 10/100 sec
Measurement Rate	~ 1 Hz	~1 Hz

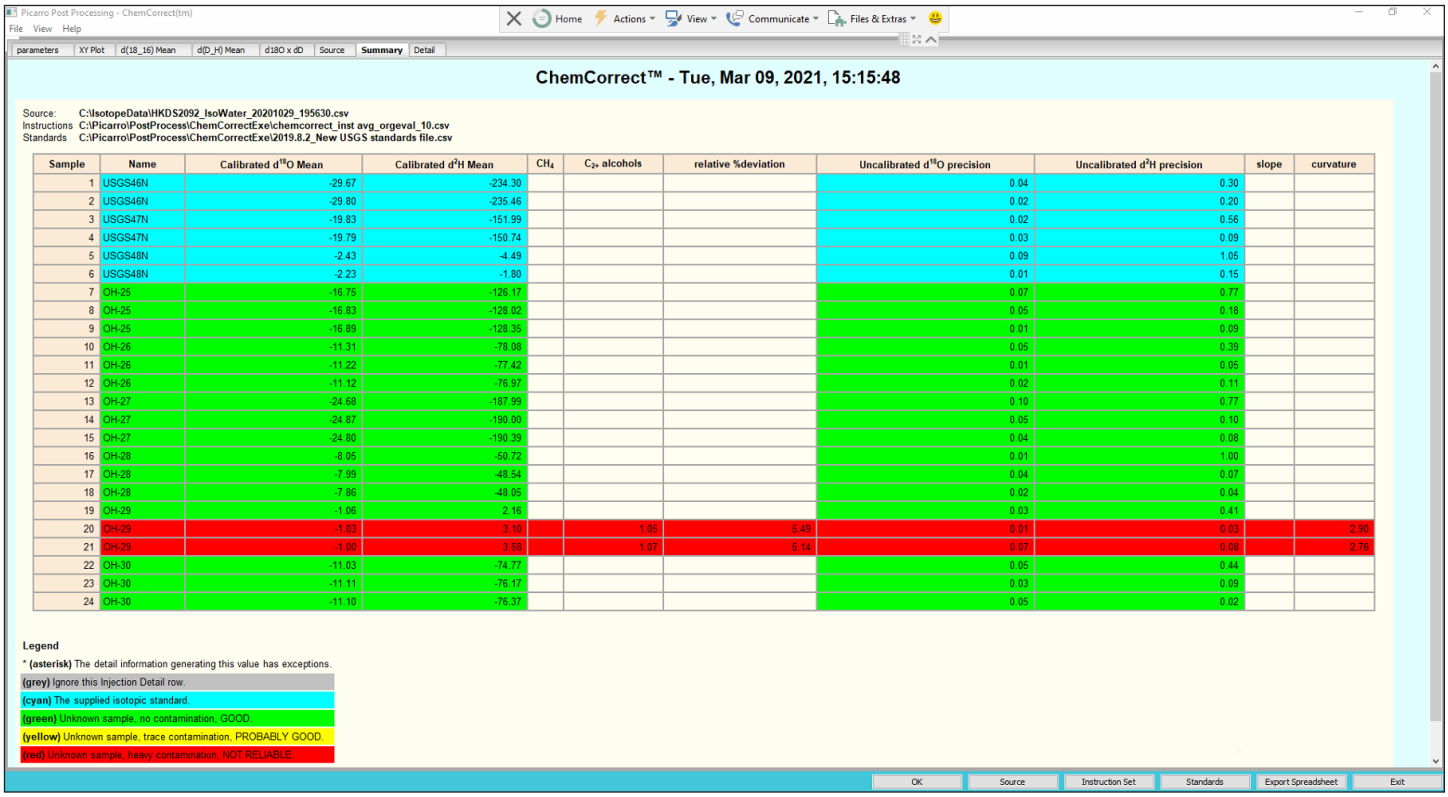
* *Only applicable for $\delta^{18}O$ and $\delta^{2}H$ mode*

** *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.*

SOFTWARE

ChemCorrect™ Software

As water research expands, so do the types of water analyzed. In some cases, researchers are finding that they encounter interferences from organic molecules that compromise the isotopic measurements. Picarro's ChemCorrect post-processing software helps address this challenge. ChemCorrect analyzes the spectral features of each water sample and uses data extracted from that information to determine whether the analysis is compromised by trace hydrocarbons. This is extremely useful information in deciding whether further methods have to be applied to a sample. ChemCorrect produces a color-coded output summary. Cyan indicates that the sample is a standard as specified by the user, green indicates that the sample analysis is valid and does not present any signs of organics contamination, yellow indicates that the sample contains trace amounts of organics and isotope values are slightly shifted, and red indicates that the sample analysis is highly compromised by organic contamination.



About Picarro

Picarro is a leading provider of solutions to measure greenhouse gas (GHG) concentrations, trace gases and stable isotopes across many scientific and industrial applications. Our portfolio of gas analyzers and systems enables scientists around the world to measure GHGs, trace gases and stable isotopes found in the air we breathe, water we drink and land we harvest. Picarro's industrial solutions range from advanced natural gas leak detection and emissions quantification technology for utilities companies, to trace gas analysis for semiconductor AMC monitoring, and isolator applications for pharmaceutical manufacturing. Our patented Cavity Ring-Down Spectroscopy (CRDS) is at the heart of all Picarro instruments, enabling the detection of target molecules at parts per billion or better resolution.

Visit
WWW.PICARRO.COM
to learn more about products, peripherals and customer testimonials.

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