PICARRO

MCM™

User's Manual

PICARRO

User's Manual

Thank you for purchasing a Picarro product. Your Picarro Induction Module is a quality product that has been designed and manufactured to provide reliable performance.

This manual is an important part of your purchase as it will help familiarize you with the module and explain its features. Please read this manual thoroughly before using your Picarro Induction Module.

Please contact Picarro or your authorized Picarro distributor should you have questions regarding specific applications or if you require additional information.

Contact Technical Support:
Email: support@picarro.com
Phone: 408.962.3991
(See "Need help from Picarro?" chapter for more information.)

Contact Customer Service:
Email: orders@picarro.com
Phone: 408.962.3992

Picarro, Inc. reserves the right to change or update the contents of this manual and to change the specifications of its products at any time without prior notification. Every effort has been made to keep the information in this document current and accurate as of the date of publication or revision. However, no guarantee is given or implied that this document is error free or that it is accurate with regard to any specification.

Picarro, Inc. has prepared this manual for use by its customers as a guide for the proper installation, operation and/or maintenance of the Picarro Analyzer.

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INTRODUCTION

The Micro-Combustion Module™ (MCM) includes Picarro's unique Micro-Combustion Technology for catalytic oxidation. This in-line process oxidizes organic compounds in samples, eliminating spectral interferences and enhancing analyzer performance.

SAFETY

The Picarro analyzer complies with the following safety standards:

CE	**IEC EN61010-1:2001 (Safety) and EN61326-1:2006 (EMC)** requirements for electrical equipment for measurement, control and laboratory use.
FDA/CDRH	**21 CFR Parts 1040.10-11**

	WARNING: DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE! DO NOT OPERATE IN THE PRESENCE OF FLAMMABLE GASSES OR FUMES.
	WARNING: THE INSTRUMENT IS NOT WATER PROOF, AND IT SHOULD BE KEPT PROTECTED FROM EXPOSURE TO ALL LIQUID WATER.
	CAUTION: The Picarro analyzer contains no user serviceable components except the particulate filter and the vacuum pump. Do not attempt repairs; instead, report all problems to Picarro Customer Service or your local distributor. Please contact Picarro if you have any questions regarding the safe operation of this equipment.
	CAUTION: The inlet gas connector on the back panel of the analyzer, and its immediate vicinity, runs hot during operation of the analyzer. Take care when connecting gas lines or working at the rear of the instrument to wear protective gloves or avoid contact with these surfaces.
	CAUTION: The analyzer contains HOT SURFACES and utilizes HIGH VOLTAGES inside the instrument. There are no user serviceable components except the filter within the analyzer and you should not open the analyzer except to replace the filter. Do not open any enclosures within the analyzer.
	CAUTION: The analyzer is heavy. To avoid injury, please use proper lifting procedures when moving or installing the equipment.

Laser Safety

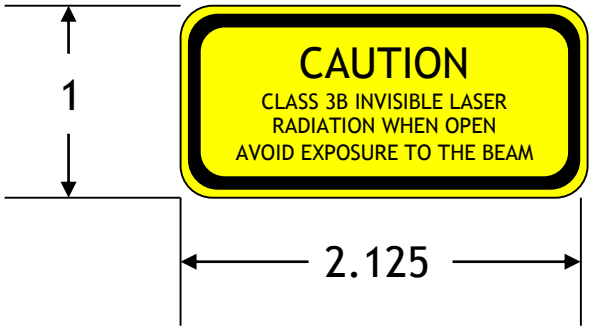
The outside of the Picarro analyzer is classified as a Class 1 Embedded Laser Product, while the inside of the Picarro analyzer is classified as a Class 3B Embedded Laser Product.

	CAUTION: CLASS 3B INVISIBLE LASER RADIATION WHEN OPEN. AVOID EXPOSURE TO THE BEAM.

The lasers inside of the analyzer emit a maximum of 100 mW of Continuous Wave (CW) light in the near-infrared. There are no user serviceable components within the analyzer enclosures and so you should not open any of these enclosures within the analyzer. FAILURE TO FOLLOW THIS INSTRUCTION COULD RESULT IN EXPOSURE TO CLASS IIIB LASER RADIATION, which can permanently damage eyes and skin.

Safety Label

The following label is affixed to the inside of the analyzer.



MCM INSTALLATION

OVERVIEW

The MCM is shipped already connected to the Picarro High Precision Vaporizer. The MCM-Vaporizer module can either be installed to the CRDS analyzer with an Autosampler for an automatic multiple sample analysis or on its own for manual sample analysis. If you want to install the MCM-Vaporizer module with an Autosampler, please see the **Autosampler Installation & Operation Manual** and the **Basic Water Analyzer Setup** section of your analyzer's **Installation User's Manual** before proceeding with the MCM Installation. If you want to set up for a manual sample analysis, please refer to just the latter document.

MATERIALS

7/16th wrench.

9/16th wrench.

11/16th wrench.

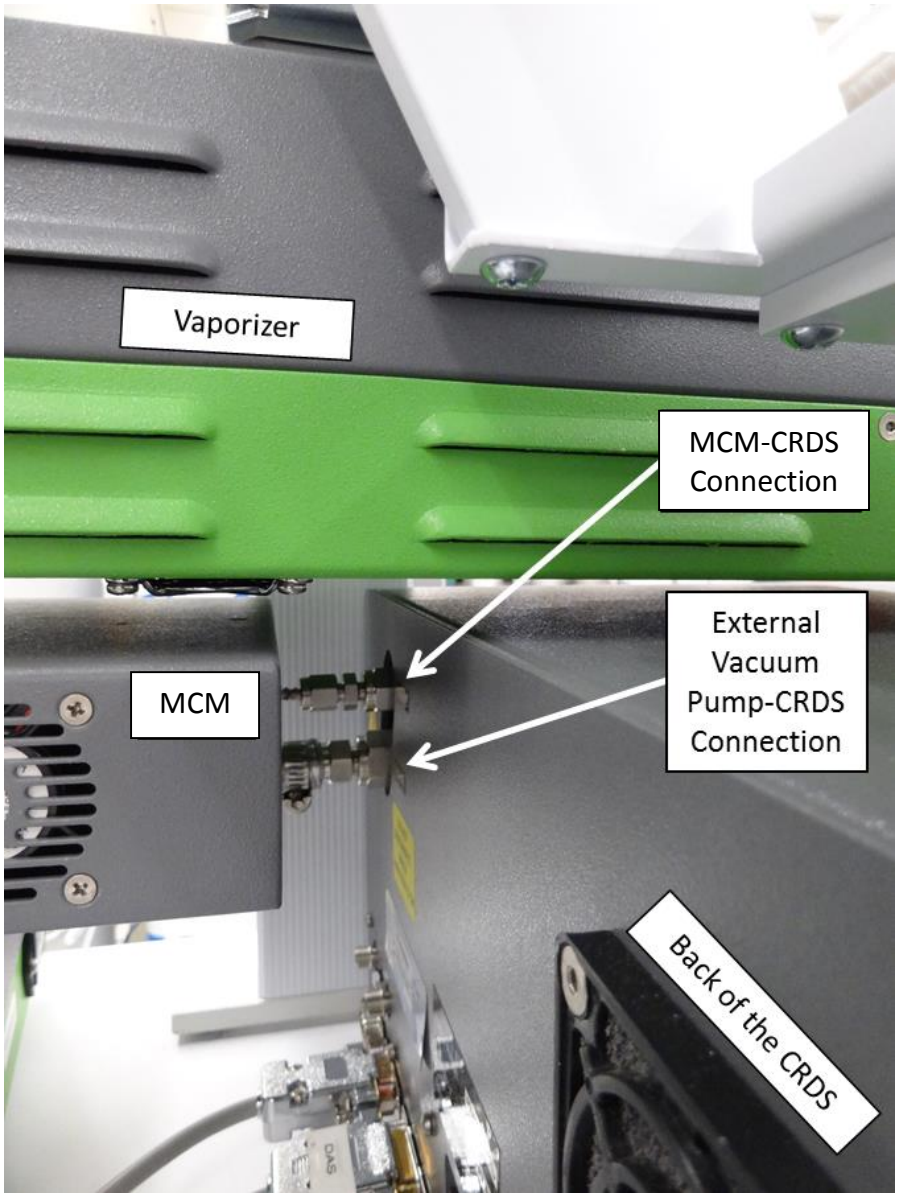
Phillips P1 screwdriver.

INSTALLATION

1. Please make the following power and USB connections for the MCM.

Back of the Vaporizer-MCM Module: Make the two MCM connections shown above: Power and USB.

2. Please make the MCM-CRDS gas connection shown. Finger-tighten first and then tighten with a 9/16th wrench.



Please make the MCM gas connection shown above.

MCM OPERATION

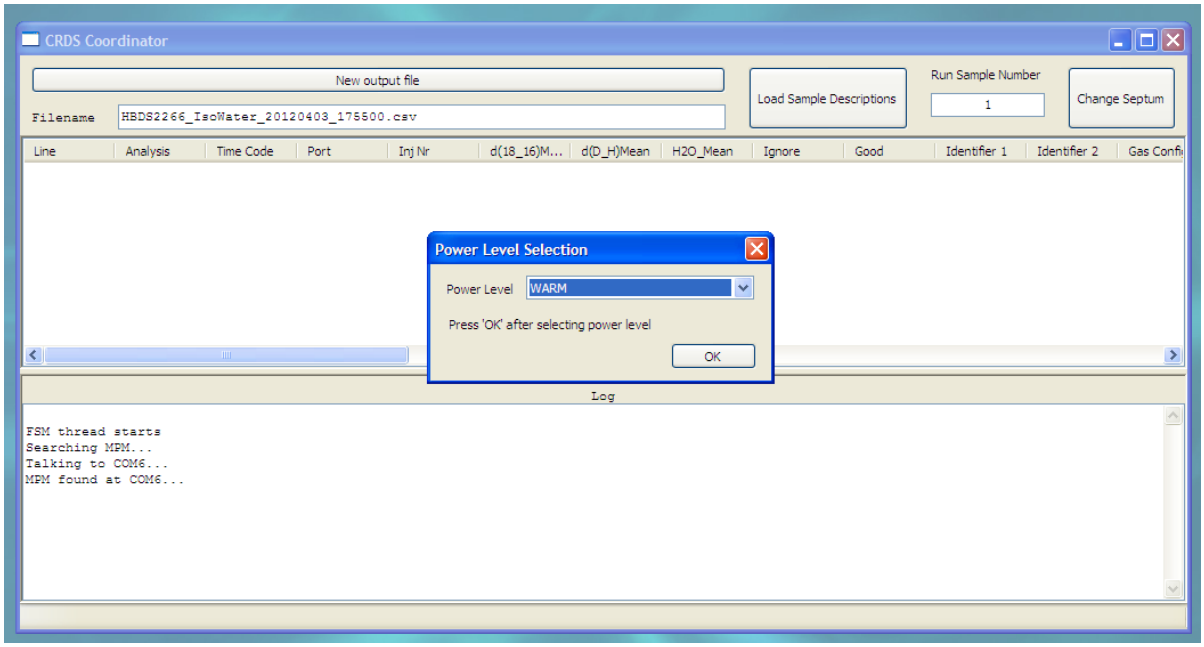
The steps below describe how to start operating in MCM mode.

1. Click on the “Coordinator” icon in your desktop.
2. Select the “MCM High Precision” coordinator choice, and then click “OK.”
3. You will be prompted to select an operation mode. Choose the appropriate mode, and click “OK” to continue. See below for descriptions of various operation modes.
    - **OFF** means the active cartridge element is completely off with power level set to 0.
    - **ON** means the active cartridge element is turned on with power level set to 63% and achieves a temperature of 400 C. This is normal operational mode. Expected lifetime in this mode is a 4 months when analyzing plant water extract.
    - **WARM** means the active cartridge element is turned on with power level set to 20%. This does not break down organics but does minimize memory

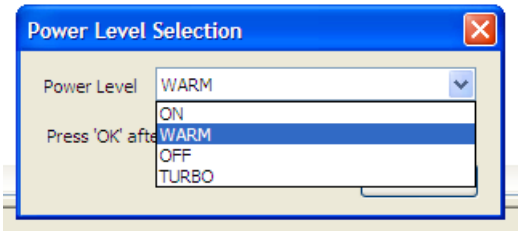
	The firmware has a soft ramp up of the temperature—it increments the heat setting once per second until it reaches the set power value. Everything (including transfer lines) should be fully warmed up within 10 minutes.
	With the MCM installed, we recommended running the MCM in the “ON” mode, even if you do not suspect your samples contain contaminants. If the MCM-Vaporizer is run in “OFF” mode the MCM component of the system runs cold and water vapor may condense onto the wall of the stainless steel tubing within the MCM. This will result in enhanced memory effects and possibly a degradation in precision and accuracy.
	Be careful when touching the cartridge. DO NOT look inside the cartridge, because this may result in breakage and this is **not covered under warranty.**

See the following screenshots for more information.

Choose the "MCM High Precision" coordinator mode.



The window above will pop up.



Choose the appropriate operation mode for your sample analysis.

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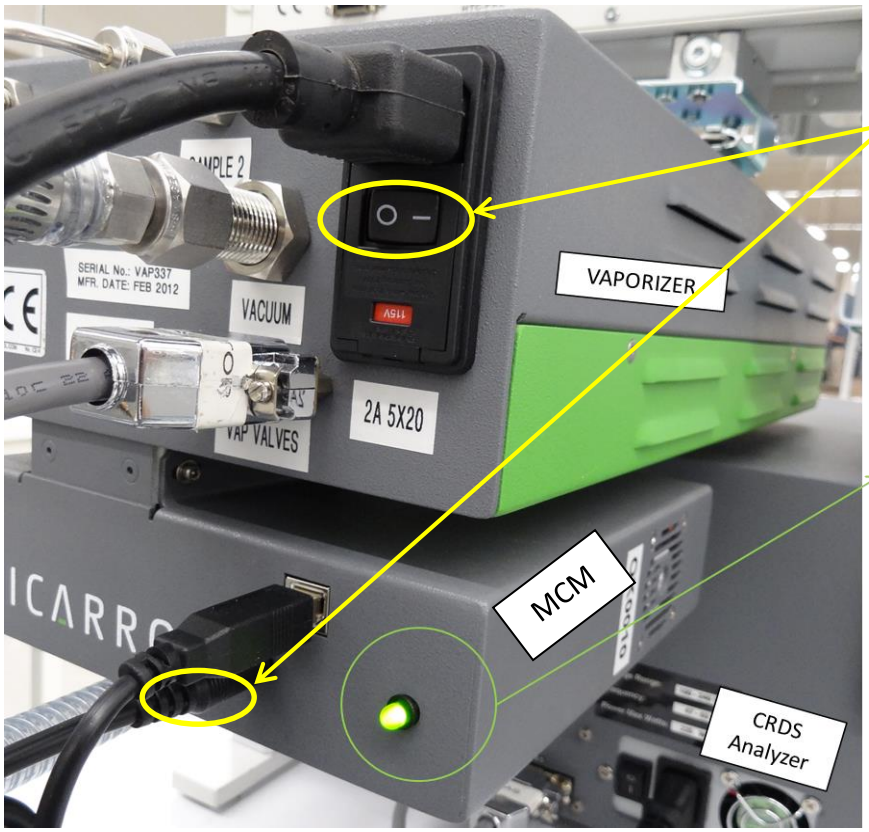
MCM CARTRIDGE REPLACEMENT

OVERVIEW

When the MCM's green light starts blinking, the micro-combustion cartridge needs to be replaced.



Before replacing the cartridge, turn off the power.

MCM CARTRIDGE LIFETIME

The MCM cartridge must be replaced when the green light on the rear of the MCM starts blinking. In addition, we recommend testing the efficiency of organics removal by periodically running a simulated plant water solution dilution test. Picarro recommends the following procedure:

1. Prepare a simulated plant water solution with the following volume percent components:
    a. 1.13 vol % ethanol

b. 0.2 vol % methanol
c. 0.02 vol % n-hexanol
d. 0.02 vol % prenol
e. 0.01 vol % cis-3-hexen-1 ol

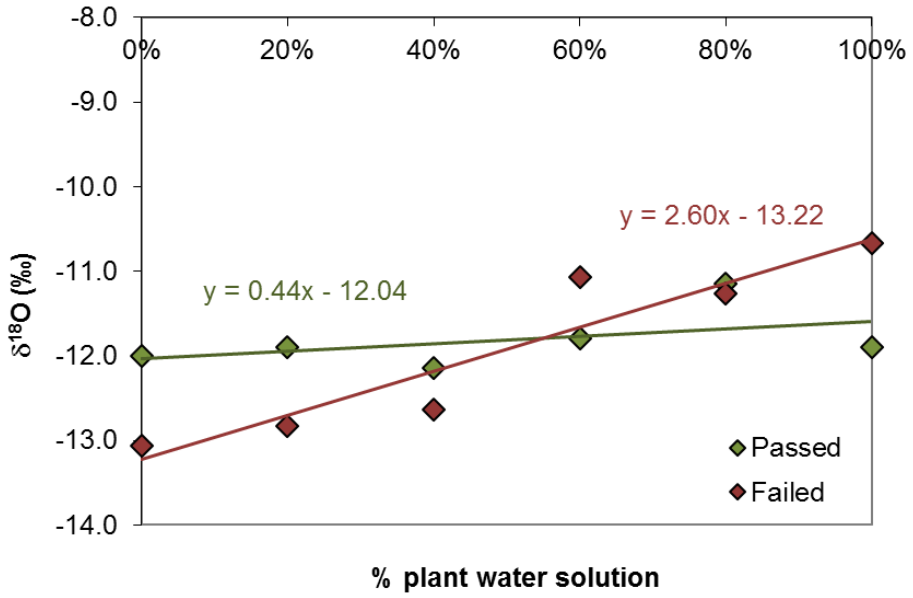
The balance of the solution should be made up of di-ionized water (DI).

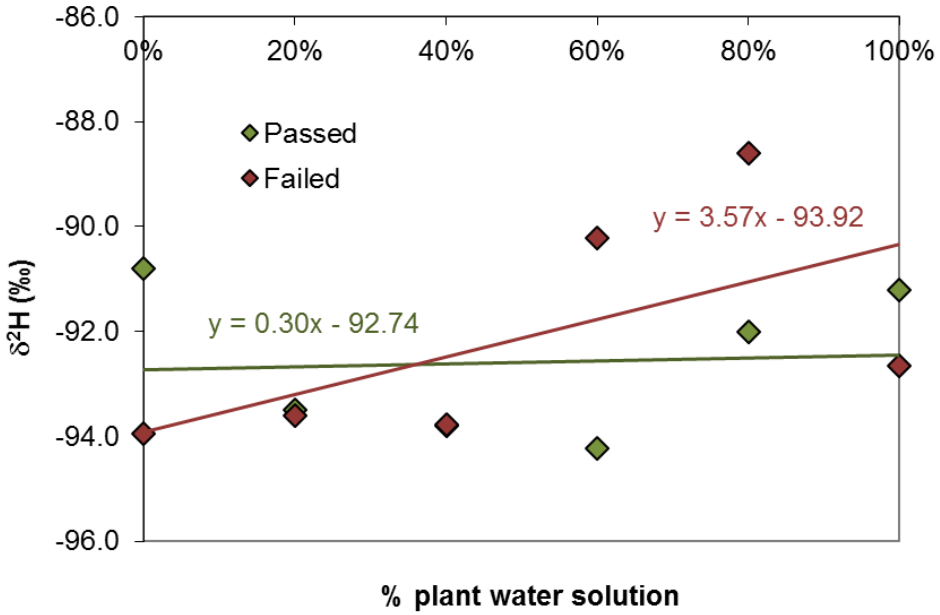
2. Prepare 6 solutions ranging from 100% DI to 100% simulated plant water solution.
   a. 0:5 (pure DI)
   b. 1:4 (1 part plant water solution, 4 parts DI)
   c. 2:3 (2 parts plant water solution, 3 parts DI)
   d. 3:2 (3 parts plant water solution, 2 parts DI)
   e. 4:1 (4 parts plant water solution, 1 parts DI)
   f. 5:0 (pure plant water solution)

   We recommend preparing approximately 20 mL of each solution for long-term storage in a refrigerator. Then when a new sub-sample is needed for testing, an individual 2 mL autosampler vial can be prepared.
3. Prepare an autosampler run with one vial of each solution. Run 6 injections per vial. Average the last three injections per vial and compile a table similar to the example given below.

% plant water solution	Sample Name	$\delta^{18}O$ (‰)	$\delta^{2}H$ (‰)
0%	0:5	-12.0	-90.8
20%	1:4	-11.9	-93.5
40%	2:3	-12.1	-93.8
60%	3:2	-11.8	-94.2
80%	4:1	-11.2	-92.0
100%	5:0	-11.9	-91.2
0%	0:5	-11.1	-89.6

4. Plot the data and determine the slope of a best fit line. For example, the following figures for $\delta^{18}O$ and $\delta^{2}H$ show a passing and failing cartridge. Picarro sets the tolerance for efficient destruction of organics during our manufacturing testing as a slope of between 0.5 and -1 ‰ and 0.5 and -3 ‰ for $\delta^{18}O$ and $\delta^{2}H$, respectively. Accept or reject a cartridge based on these thresholds, or determine your own thresholds. If a cartridge fails, consider replacing it with a new cartridge and repeating the test.





MATERIALS

Before getting started, please prepare the following items. See the following image for more information.

1. O-ring 2-006 silicone **(four)**: p/n 16987
2. Retainer plate **(two):** p/n 16217
3. Base burner assy **(one):** p/n 16550
4. Ball point hex l-keys (2mm with length 3 3/16") **(one):** p/n 5503A37
5. Allen Wrench (2mm).
6. Screw M3X6 button head

Burner Cartridge Assembly	

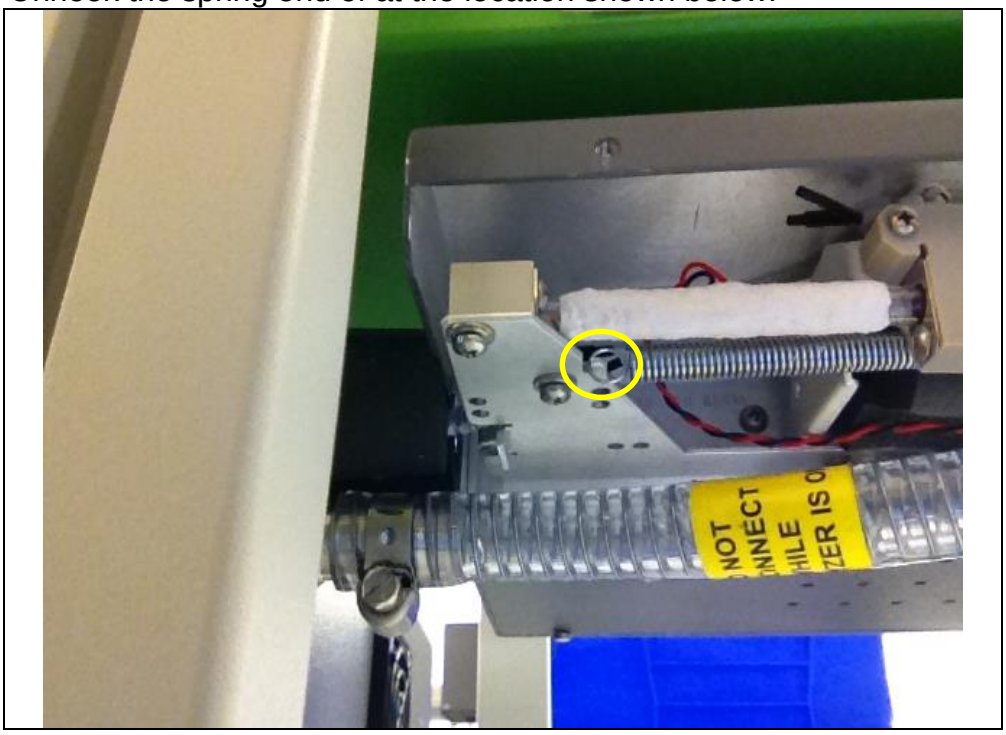
PROCEDURE

Follow the steps below to replace the MCM cartridge.

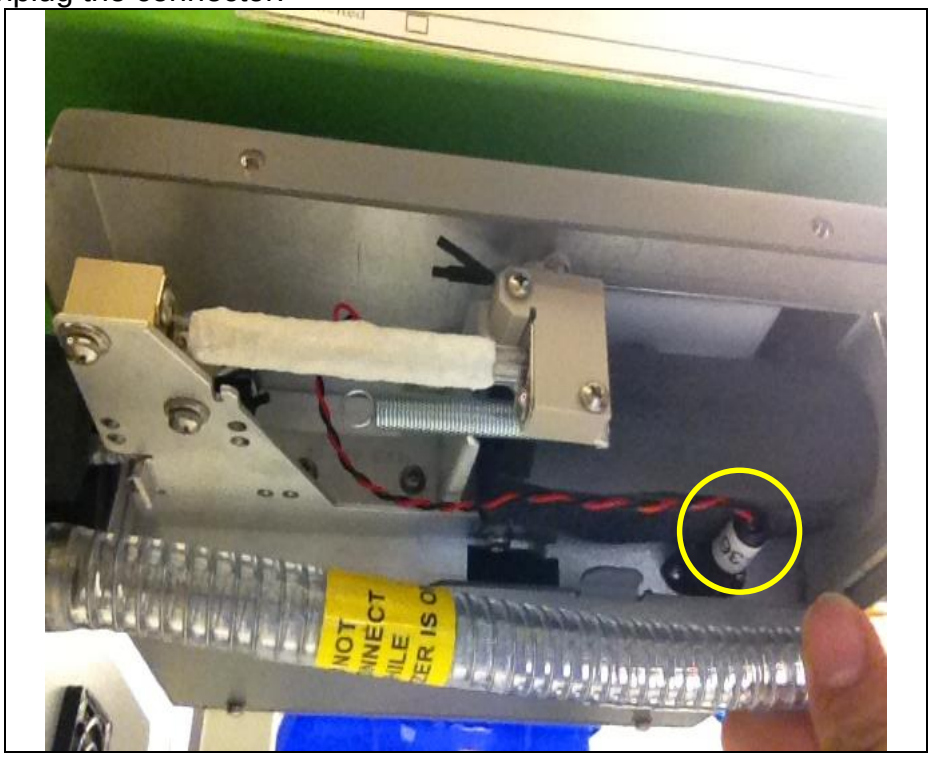
	**CAUTION:** If the MCM has been running (“ON” or “WARM” mode), the cartridge will be hot. Turn off the MCM and let it cools down in about 30 minutes before changing.

STEP 1: Take off the access cover by removing the two screws circled below.

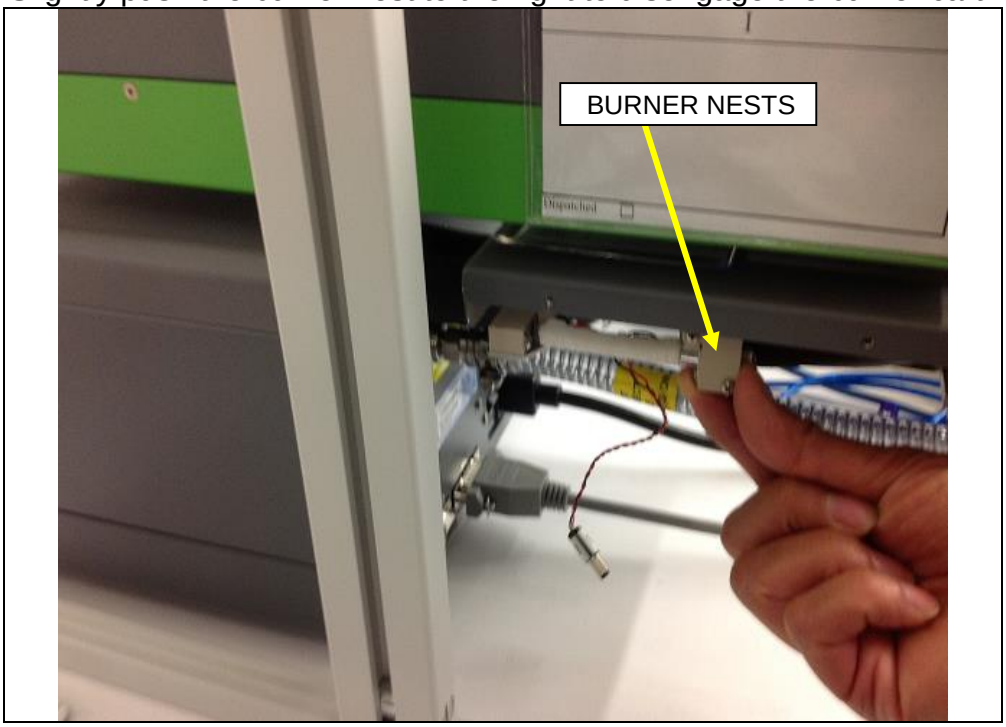
STEP 2: Unhook the spring end of at the location shown below.



STEP 3: Unplug the connector.



STEP 4: Slightly push the burner nest to the right to disengage the burner cartridge.



STEP 5: Twist the burner cartridge lightly while pulling it out to the right. Removing the retainers and O-rings is optional.

STEP 6: Place the new Organics Oxidation Cartridge between the burner nests. Start by aligning the cartridge on the left side, and then align it to the right of the burner nest.

STEP 7: Twist the cartridge gently to make sure it fits snuggly.

STEP 8: Plug the connector back into position.

STEP 9: While placing your thumb against the burner nest, re-hook the spring back into position. Placing your thumb against the burner next, will help prevent cartridge from sliding out.

STEP 10: Screw the cover back onto the MCM.

STEP 11: Turn on the power to the back of the vaporizer, and plug in the power cord to the back of the MCM.

SAMPLE PREPARATION AND APPLICATION NOTES

CARRIER GAS

The MCM removes organics through the process of oxidation, thus the **carrier gas must be dry air or zero air with an oxygen content of 21%**. If nitrogen is used as a carrier gas then no oxidation will occur and organics will interfere with accurate measurements.

LIQUID SAMPLE PREPARATION

The MCM is designed and tested to work with plant water extract samples which contain a mixture of alcohols (ethanol, various hexanols, methanol) at a total concentration of < 0.5% by weight. Although the MCM can remove higher concentrations of alcohols oxidation may be incomplete, and if so, spectral interferences can occur. Similarly, because the process is oxidative, alcohols in the samples will be converted to H_2O. This effect is negligible at low concentrations (< 0.5 % by weight), but may introduce sufficient exogenous water at higher concentrations to skew the results. Investigations at higher alcohol concentrations (up to ~ 5%) are possible but not a supported feature of the MCM.

Plant water extracts contain a wide variety of compounds besides alcohols. The non-alcohol compounds can easily be separated from water without incurring isotopic fractionation. This is done by the use of a sorbent media such as activated carbon. It is important to remove these other compounds (such as terpenes, chlorophyll, etc) prior to filling the autosampler vials. These other compounds will build up in the syringe and vaporizer and result in various mechanical failure modes. Furthermore the MCM has not been tested with these non-alcohol compounds.

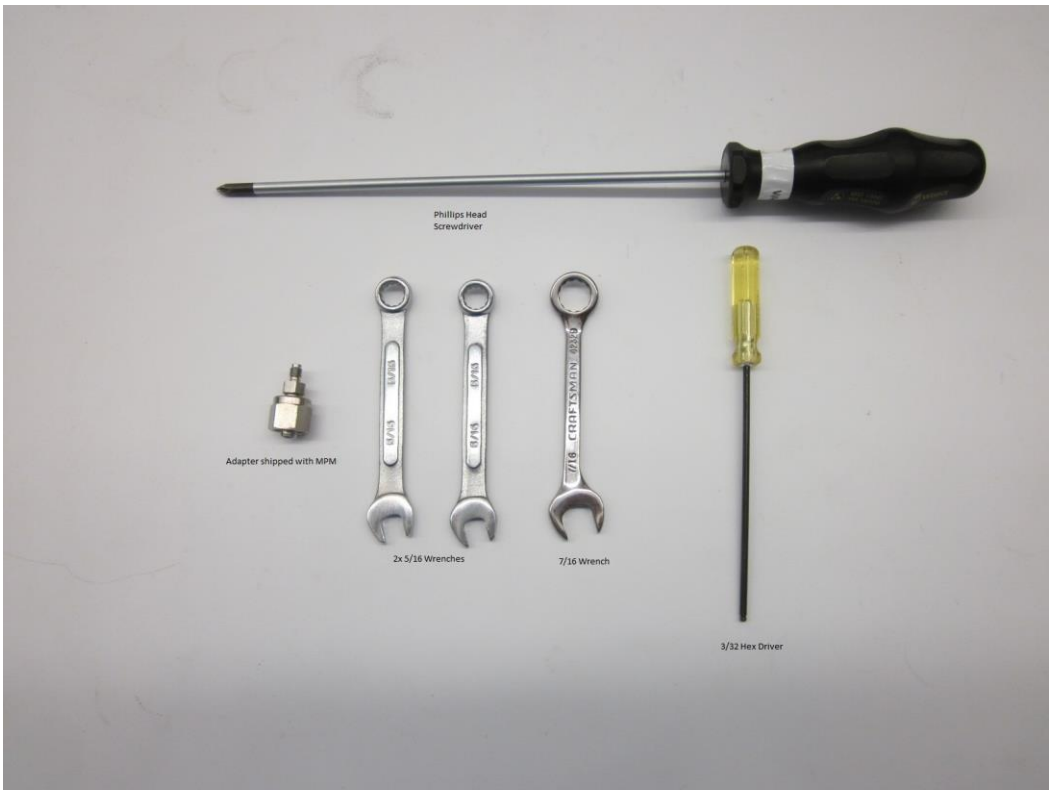
REMOVING THE MCM FROM THE VAPORIZER

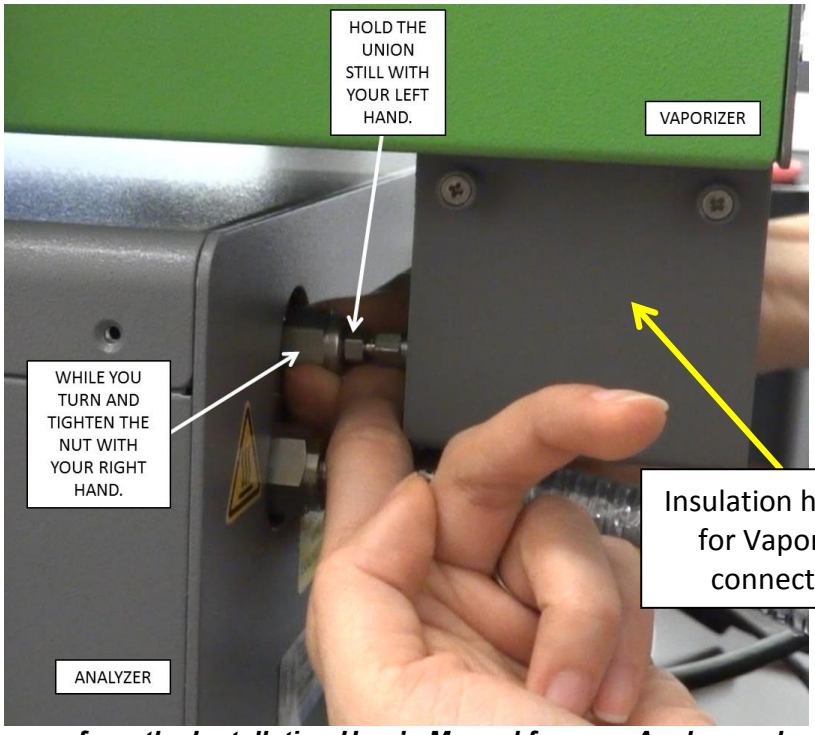
The MCM can be disconnected from the MCM-Vaporizer combination for:

1. Vaporizer cleaning
2. If you wish to run the Vaporizer without the MCM

The following tools are required:

- Phillips Head Screwdriver
- Swagelok adaptor shipped with the MCM
- Two 5/16” wrenches
- 7/16” wrench
- 3/32” hex driver
- Insulation housing for the Vaporizer connection (only if you wish to run the Vaporizer without the MCM)





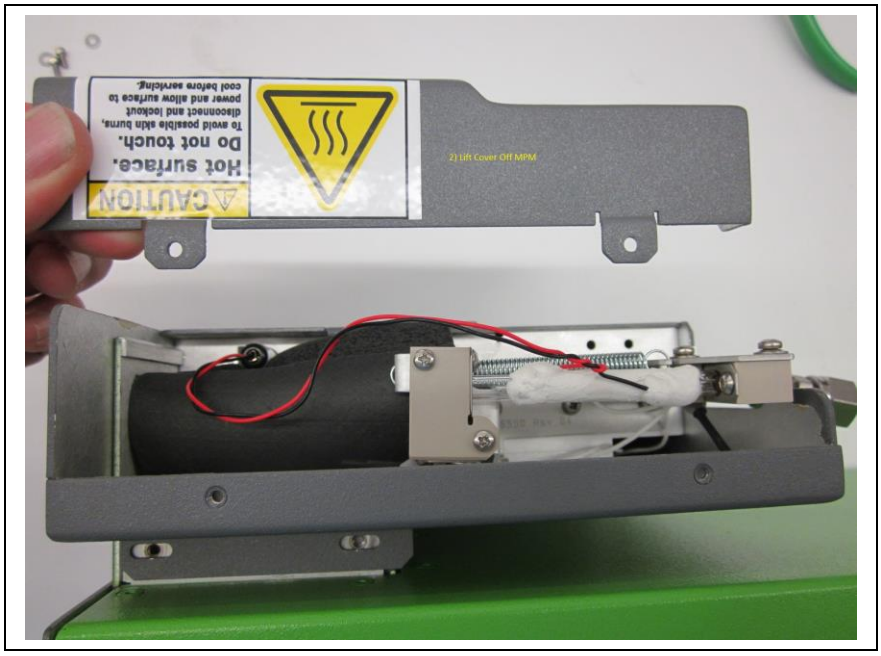
This image, from the Installation User's Manual for your Analyzer, shows the insulation housing for the Vaporizer connection.

	**CAUTION:** If the MCM has been running (“ON” or “WARM” mode), the cartridge will be hot. Turn off the MCM and let it cools down in about 30 minutes before changing.

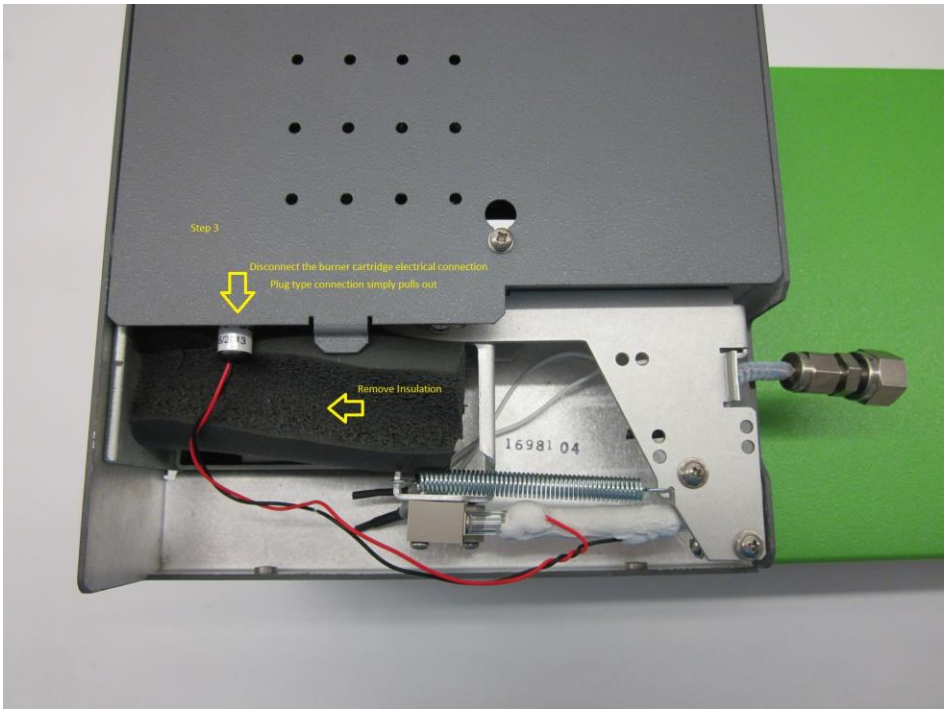
Step 1: Remove the MCM-Vaporizer combination from the analyzer and autosampler mount.

Step 2: Remove the indicated screws from the front and back of the block that connects the MCM to the Vaporizer (two of the screws are not visible in the image below).

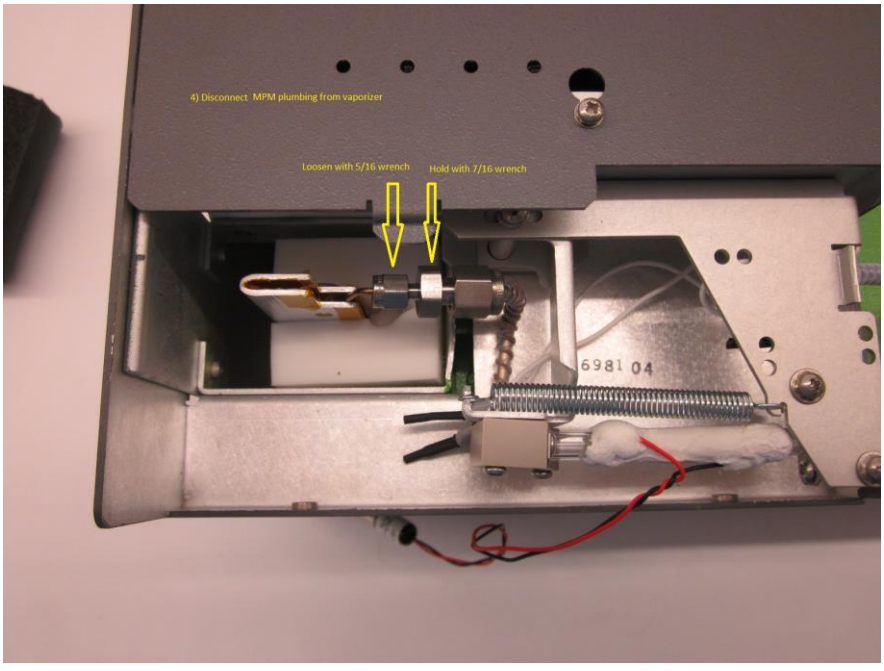
Step 3: Lift the cover off the MCM.



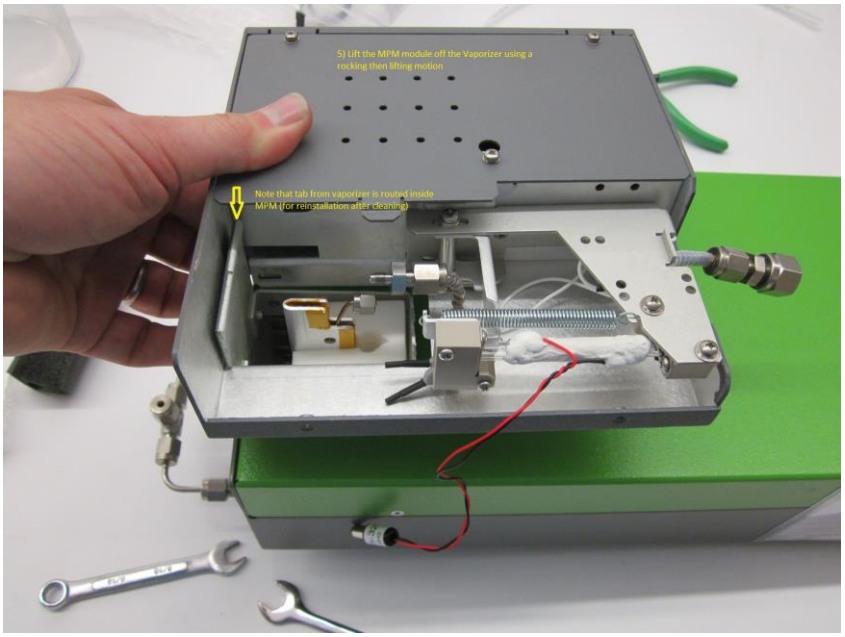
Step 4: Disconnect the cartridge electronical connection by pulling it out. Then remove the insulation.



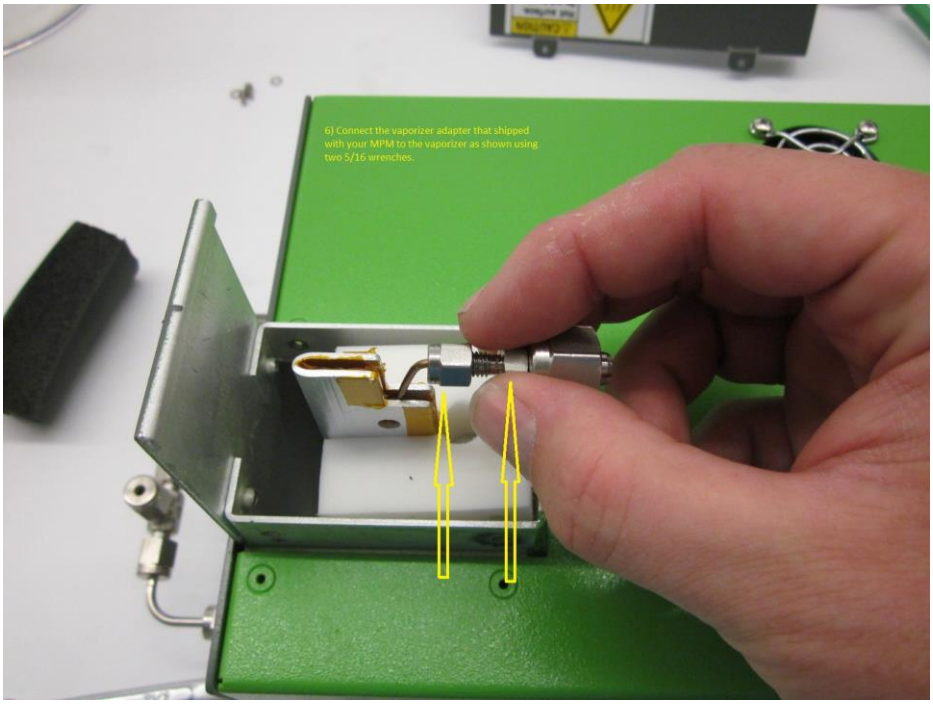
Step 5: Disconnect the MCM plumbing from the Vaporizer.



Step 6: Lift the MCM module off the Vaporizer.



Step 7: Connect the Vaporizer adapter that was shipped with the MCM using two 5/16" wrenches.



The Vaporizer is now ready to be cleaned using the standard method. Or, if you wish to install the Vaporizer directly onto the analyzer without the MCM, please refer to the High Precision Vaporizer Setup section of L2140-*i*, L2130-*i* and L2120-*i* Installation User's Manual. You will need also to screw on the the insulation housing which covers the connection between the Vaporizer and the analyzer.

Step 8: If you wish to re-install the MCM, follow steps 1 through 7 in reverse order.

COORDINATOR SOFTWARE

In order to measure discrete samples or to control external peripherals and accessories a separate software tool (Coordinator) is used to control the sample source and match the corresponding real time read out with the sample source. **The Coordinator programs that are accessible to a user, are dependent on the system configuration.**

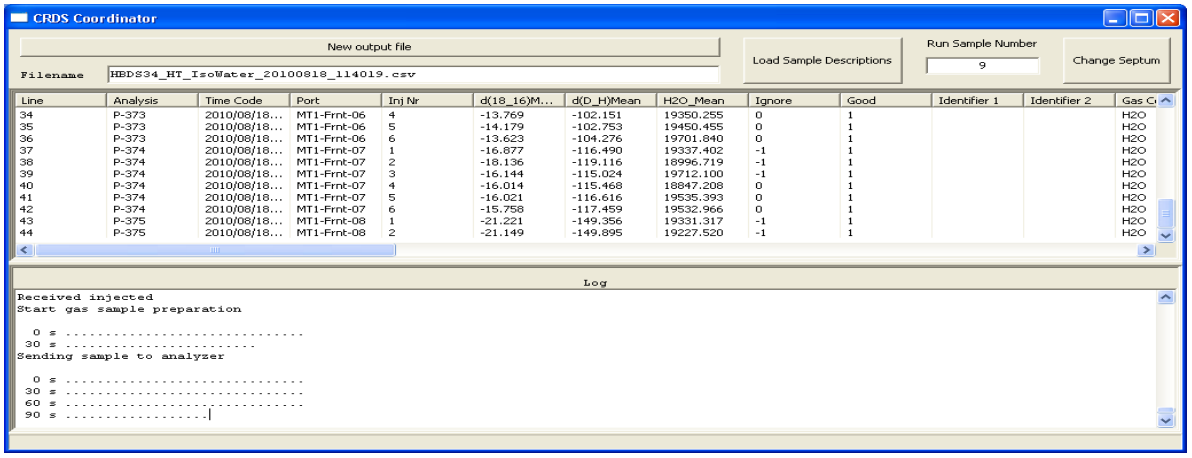
This section only provides an overview of the MCM Coordinator. For other water system coordinators, please refer to the **OPERATION, MAINTENANCE and TROUBLESHOOTING L2140-*i*, L2130-*i* or L2120-*i* Analyzer and Peripherals** User's Manual.

HOW TO RUN THE COORDINATOR SOFTWARE:

First, make the required hardware connections for your system of interest. Afterwards, turn on the analyzer and wait for the CRDS Data Viewer of the analyzer's software to open up automatically on your desktop screen. Next, launch the coordinator software by double clicking on the 'Coordinator Launcher' icon on your desktop.

After double clicking on the 'Coordinator Launcher' icon, a window will appear. Choose the appropriate coordinator from the drop down menu, and then click on the 'Launch' button. Make sure that the chosen coordinator is supported by your hardware connections and that samples are ready to be analyzed.

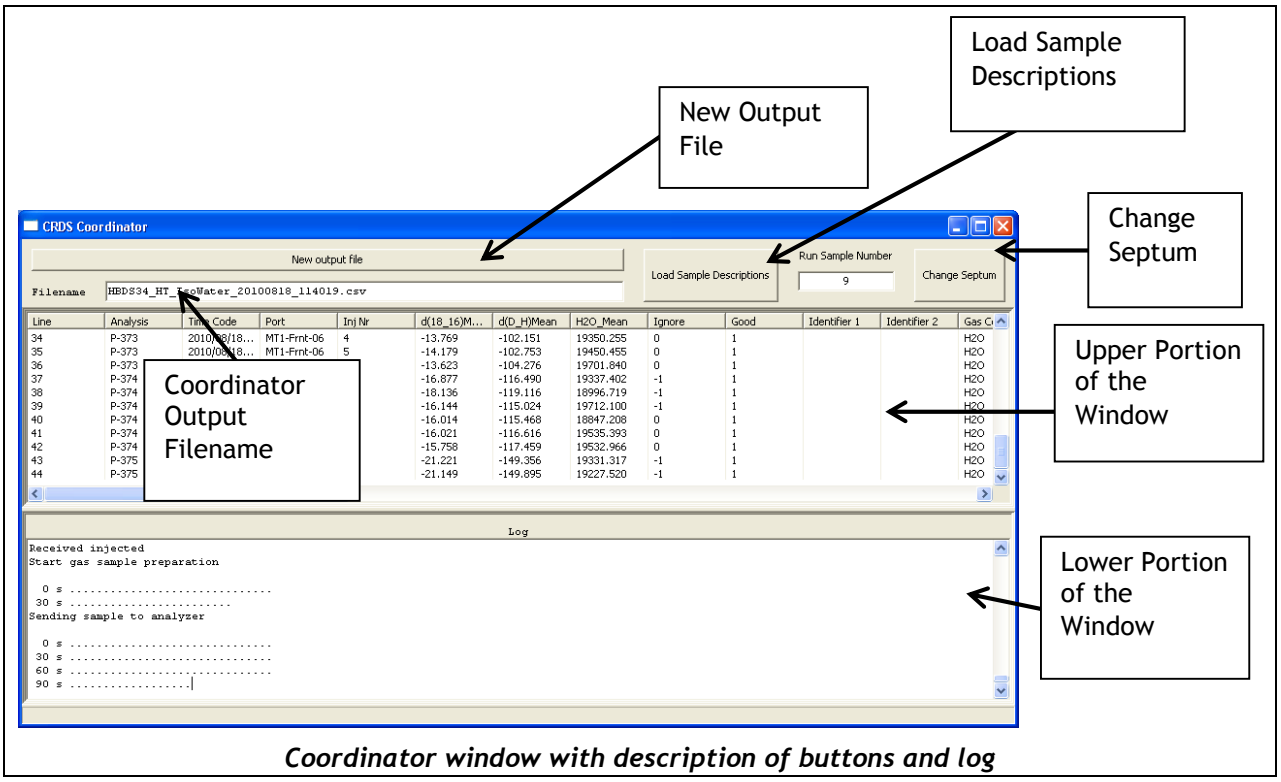
Coordinator Launcher



Coordinator window. The look of the window may vary depending on the configuration of your analyzer.

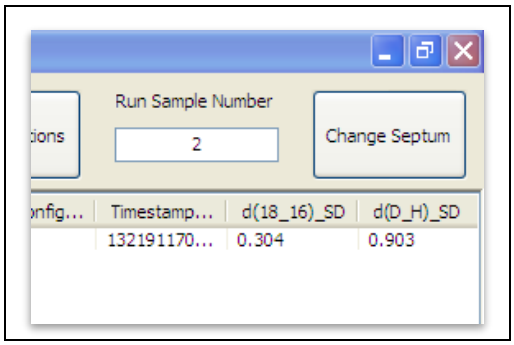
After clicking on the "Launch" button, the coordinator window will pop up (depending on the coordinator mode chosen, you may or may not be asked to set parameters for your analysis). From the Coordinator window, you will be able see results from sample analysis, see the current status of your analyzer, and load sample descriptions.

COORDINATOR WINDOW DESCRIPTION:



Coordinator window with description of buttons and log

a. CHANGE SEPTUM BUTTON: Used to pause the Autosampler and the vaporizer in the middle of an analysis to physically change the septum on the vaporizer.



b. LOAD SAMPLE DESCRIPTIONS BUTTON: Located around the upper right corner of the Coordinator Window. The button allows the user to include a description for each vial in the data file output on the coordinator window.

In order to load the sample description file, press the button labeled ‘Load Sample Descriptions’. If you are using the CTC PAL Autosampler, two file dialog boxes will appear in sequence, the first for the front tray and the second for the rear tray. For the Picarro Autosampler, only one dialog box will appear. Select the sample description file, and then click to ‘Open’. If a certain tray (front or rear) is not being used, use the ‘Cancel’ button to dismiss the dialog.

c. NEW OUTPUT FILE BUTTON: Clicking on this button will save the data that you see on the coordinator window into a file, and then clear the data from the Coordinator Window.

d. UPPER PORTION OF THE WINDOW: Each row represents the analysis results from a single injection. The types of columns are pre-selected by Picarro to include the most useful values for isotopic water analysis and for diagnostic indications.

   The values for the columns, unless otherwise noted, are the average value for time period of the injection, which was marked in red on the CRDS Data Viewer. Values of the form *_SD are standard deviations for that same time period. The time period is selected by trigger thresholds based on the water vapor concentration. The analyzer is characterized and specified based on the factory default trigger thresholds—changing these values is not recommended, please contact Picarro if you feel this is necessary.

e. LOWER PORTION OF THE WINDOW (labelled Log): This window displays the action that is currently taking place. For those actions that take some time to complete, a period is displayed each second and a new line is started every thirty seconds to show progress.

f. COORDINATOR OUTPUT FILENAME: Can be seen in the upper left of the Coordinator window. It follows an automated convention of –

   model, serial number, mode, year, month, date, and time. For example

   HBDS34_HT_IsoWater_20100818_114019.csv

   This means the coordinator file output was taken using analyzer HBDS34 in high throughput isotopic water analysis starting on 18 August 2010 at 11:40:19 am.

HOW TO MAKE THE SAMPLE DESCRIPTION FILE:

The sample description file should be in CSV (comma separated value) format. Use the supplied NotePad++ software. Write the sample descriptions in the format as shown below.

Tray,Vial,Identifier 1,Identifier 2

1,1,Picarro 00,standard

1,2,Picarro 11, standard

1,3,Picarro 22, standard

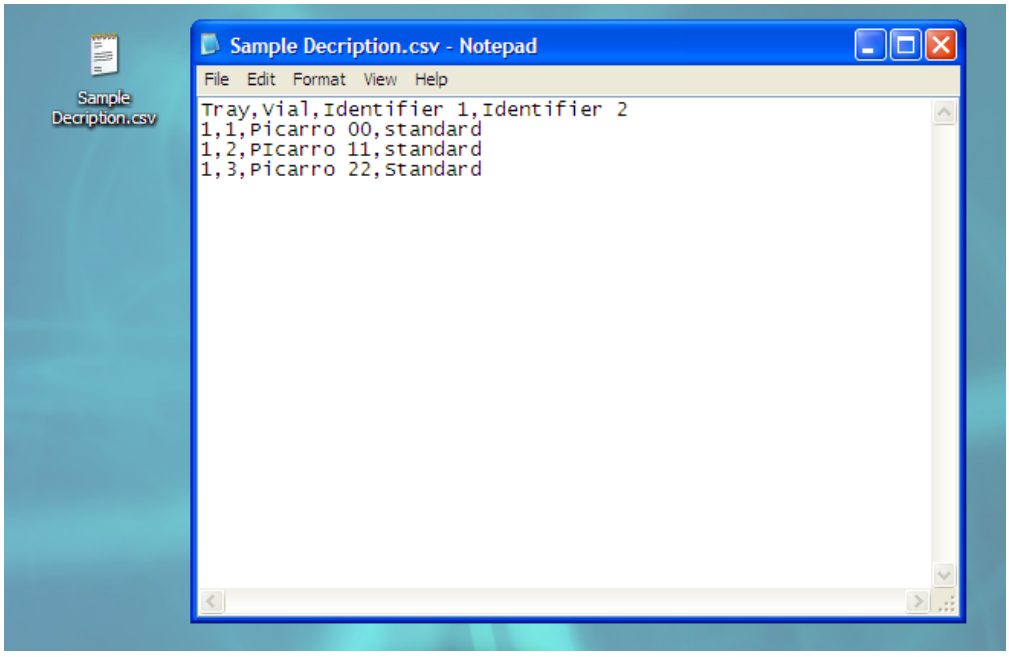
1,4,WA 1,first sample from Washington

1,5,WA 2,second sample from Washington

1,6,CA 1, first sample from California

1,7,CA 2, second sample from California

1,8,Picarro 00, standard



An example of a Sample Description CSV files.

After the first line (which should contain the column heading), each line should represent a sample description for the analysis results from a single injection. The lines in the file may be arranged in any order. The capitalization and spacing of the first line must exactly match the provided example. MS Excel can be used if the file is saved in CSV format. It is recommended to generate the file using Windows operating systems (as on the analyzer) as there are differences in CSV format between different operating systems. It is permissible to load the sample description files at any time during the data collection. The output file is rewritten to use the new sample descriptions, so that the most recently loaded descriptions are always used.

COORDINATOR MODES AVAILABLE ON A PICARRO WATER ISOTOPE ANALYZER:

The CRDS analyzer needs to be equipped with the appropriate hardware to support a coordinator mode.

Hardware	**Associated Coordinator(s)**
High Precision Vaporizer (A0211) CRDS Analyzer (L21x0-i)	Manual Injection
High Precision Vaporizer (A0211) Autosampler (A0325) CRDS Analyzer (L21x0-i)	High Precision High Throughput High Precision 17O (if L2140-*i*)
High Precision Vaporizer (A0211) Autosampler (A0325) CRDS Analyzer (L21x0-i) Vaporizer Switching Valve (A0912)	Dual Mode Dual Mode 17O (if L2140-*i*)
High Precision Vaporizer (A0211) Standards Delivery Module (A0101) CRDS Analzyer (L21x0-i)	Standards Delivery Module (SDM)
High Precision Vaporizer (A0211) Micro Combustion Module (A0214) Autosampler (A0325) CRDS Analyzer (L21x0-i)	MCM High Precision MCM High Throughput MCM Manual Mode
Induction Module (A0213) CRDS Analyzer (L21x0-i)	Induction Module
Continuous Water Sampler CRDS Analyzer (L2130-*i* or L2140-*i*)	Continuous Water Sampler

Short description of different Coordinator modes:

1. **High Precision:** Used to measure liquid water samples with maximum precision. Automatically injects and measures liquid samples. Each injection cycle takes 9 minutes. High Precision & High Throughput Coordinator Modes operate in the exact same fashion except that the steps of sample preparation and analysis are faster in the high throughput coordinator.

2. **High Throughput:** Used for faster measurement of liquid water samples with good precision. Automatically injects and measures liquid samples. Each injection cycle takes 4 minutes. High Precision & High Throughput Coordinator Modes operate in the exact same fashion except that the steps of sample preparation and analysis are faster in the high throughput coordinator.
3. **Manual Inject:** Used for semi-automated measurement of liquid water samples with maximum precision. Requires A0211 High Precision Vaporizer and A0322 Syringe Guide. User manually injects samples after prompt. The vaporizer control and the analysis of liquid samples are automated. Each injection cycle takes 9 minutes.
4. **Dual Liquid/Vapor:** Used for measurement of ambient vapor coupled with automated injection of liquid calibration standards. Requires A0211 high precision vaporizer, A0912 Dual Mode Configuration hardware and software for vapor calibration and Autosampler. Alternates between analyzing ambient vapor and liquid standards based on user defined sequence. Uses high precision method for liquid calibration. Each injection cycle takes 9 minutes.
5. **Standards Delivery Module (SDM):** Used for measurement of ambient vapor coupled with automated injection of liquid calibration standards. Requires A0211 High Precision Vaporizer and A0101 standards delivery module. Alternates between analyzing ambient vapor from multiple points and a continuous stream of vaporized standard. The alternation is based on user defined sequence. A calibration measurement takes approximately 20 minutes per concentration/standard. Before operating in SDM mode, set the vaporizer temperature to 140°C**.**
6. **IM CRDS (Induction Module)**: Requires the IM. Used for isotopic analysis of extracted water from samples such as soil, plants, or tissues and allows the isotopic analysis of the extracted water. This requires the Induction Module.
7. **Micro Combustion Module (MCM)**: Used to measure liquid water samples while destructively removing potential contaminants with maximum precision. Requires A0211 High Precision Vaporizer, A0214 Micro Combustion Module and Autosampler. Automatically injects and measures liquid samples. Each injection cycle takes 9 minutes. In addition to controlling the valve sequence for injection liquid water samples, the MCM coordinator also control the heating of the MCM to ensure removal of interfering organics.
8. **Continuous Water Sampler (CWS):** Used for continuous, real-time measurements of water. Requires A0217 Continuous Water Sampler. No discrete sampling is required. Automatically switches between calibration standards and samples using four inlet ports.

IMPORTANT NOTE: The L2140-*i* can operate in four instrument modes (iH2O N2, iH2O Air, iH2O N2 O-17 and iH2O air O-17). Due to the high precision demands of 17O-excesss science, only the 'High Precision', 'Dual Mode' and 'Manual Inject' coordinator modes will work for the two O-17 instrument modes.

DESCRIPTION OF COLUMN HEADERS USED IN COORDINATORS:

The following table provides information regarding the column headers presented in the Coordinator output files available on a Picarro water isotope analyzer. The following table includes the header for the following coordinators:

- MCM High Precision Mode
- MCM High Throughput Mode
- MCM Manual Mode

The table covers all variations of the coordinators. Coordinators vary by analyzer product number therefore not all columns will be visible on an individual analyzer.

Line	Line counter. Each line represents a single injection or data point (for vapor measurements in the dual mode).
Analysis	Sequential number of the sample run over the history of the analyzer.
Time Code	Time the line was recorded in “Year/Month/Day Hours:Minutes:Seconds”. This time stamp is linked the local time of your computer’s clock.
Port	Reports the vial position on the tray where the autosampler is sampling from.
Inj Nr	Sequential injection number from the port (vial).
d(18_16)Mean	The average $\delta^{18}O$ value, in per mil (‰), measured for that injection (Line). The typical raw data acquisition rate on a L21x0-*i* is ~ 1 Hz, therefore this represents the average of 1 Hz data points across the water pulse. The averaging window is shown in red on the CRDS Data Viewer. The reported delta values are not calibrated. Post-processing is required for calibration.
d(D_H)Mean	The average $\delta^{2}H$ value, in per mil (‰), measured for that injection (Line). The typical raw data acquisition rate on a L21x0-*i* is ~ 1 Hz, therefore this represents the average of 1 Hz data points across the water pulse. The averaging window is shown in red on the CRDS Data Viewer. The reported delta values are not calibrated. Post-processing is required for calibration.
H2O_Mean	The average water concentration, in ppm, measured for that injection (Line). The typical raw data acquisition rate on a L21x0-*i* is ~ 1 Hz, therefore this represents the average of 1 Hz data points across the water pulse. The averaging window is shown in red on the CRDS Data Viewer. The reported delta values are not calibrated.
Ignore	-1 or 0: -1 indicates the measurement should be ignored and is based on the first three injections from each sample vial being ignored due to sample-to-sample isotopic memory.
Good	0 or 1: 1 indicates that the mean H_2O concentration is within the required range. 0 indicates that the mean H_2O concentration is outside the required range.

Identifier 1	First identifier of the sample. Only populated if a sample description file is loaded when the coordinator is open.
Identifier 2	Second identifier of the sample. Only populated if a sample description file is loaded when the coordinator is open.
Gas Configuration	Indicates the type of gas being measured. Water isotope analyzers measure water vapor sample.
Timestamp Mean	Unix timestamp.
d(18_16)_SD	Standard deviation of the measured $\delta^{18}O$ across an injection's averaging window. The averaging window is show in red on the CRDS Data Viewer.
d(D_H)_SD	Standard deviation of the measured $\delta^{2}H$ across an injection's averaging window. The averaging window is show in red on the CRDS Data Viewer.
H2O_SD	Standard deviation of the measured H_2O concentration across an injection's averaging window. The averaging window is show in red on the CRDS Data Viewer.
d(18_16)_Sl	Slope of the measured $\delta^{18}O$ across an injection's averaging window. The averaging window is show in red on the CRDS Data Viewer.
d(D_H)_Sl	Slope of the measured $\delta^{2}H$ across an injection's averaging window. The averaging window is show in red on the CRDS Data Viewer.
H2O_Sl	Slope of the measured H_2O concentration across an injection's averaging window. The averaging window is show in red on the CRDS Data Viewer.
ORGANIC_BASE	Absorption underlying the baseline spectroscopic signal, including organics. L2120-*i* only.
ORGANIC_MEOH_AMPL	Absorption of the MeOH peak. L2120-*i* only.
ORGANIC_SLOPE	Change in linear term of fitted organic baseline. L2120-*i* only.
ORGANIC_CH4CONC	CH_4 (methane) mole fraction with no calibration. L2120-*i* only.
ORGANIC_CM_SHIFT	Change in constant term of fitted organic baseline. L2120-*i* only.
ORGANIC_STDEV	Root mean squared residuals of the least squares fit to spectra, including organics. L2120-*i* only.

ORGANIC_Y	Collisional line broadening scale correction on organics. L2120-*i* only.
ORGANIC_77	Absorption of Peak 1 ($^{1}H^{18}O^{1}H$ peak), including organics. L2120-*i* only.
ORGANIC_82	Absorption of Peak 2 ($^{1}H^{16}O^{2}H$ peak), including organics. L2120-*i* only.
ORGANIC_SPLINEMAX	Absorption of Peak 3 ($^{1}H^{16}O^{1}H$ peak), including organics. L2120-*i* only.
ORGANIC_SQUISH	Frequency scale correction on organics. L2120-*i* only.
STANDARD_BASE	Absorption underlying baseline spectroscopic signal (water only). L2120-*i* only.
STANDARD_STDEV	Root mean squared residuals of least squares fit to spectra (water only). L2120-*i* only.
baseline_shift	The average value for baseline shift, in ppb/cm, measured for that injection (Line). Baseline_shift is a spectral term that is measured on the L2130-*i* and L2140-*i*. It is the change in the constant term of the fitted baseline, relative to an empty cavity baseline which is measured at the Picarro factory. This column can be used to track potential spectral interference and data integrity. See **ChemCorrect** section.
slope_shift	The average value for slope shift, in ppb/cm, measured for that injection (Line). Slope_shift is a spectral term that is measured on the L2130-*i* and L2140-*i*. It is the change in the linear term of the fitted baseline, relative to an empty cavity baseline which is measured at the Picarro factory. This column can be used to track potential spectral interference and data integrity. See **ChemCorrect** section.
residuals	The average value for residuals, in ppb/cm, measured for that injection (Line). Residuals is a spectral term that is measured on the L2130-*i* and L2140-*i*. This term represents the root mean squared residual of the least-squares fit of the measured spectra versus the expected spectra. This column can be used to track potential spectral interference and data integrity. See **ChemCorrect** section.

baseline_curvature	The average value for baseline curvature, in ppm*cm, measured for that injection (Line). Baseline_curvature is a spectral term that is measured on the L2130-*i* and L2140-*i*. This term represents the quadratic term in the fitted baseline. This column can be used to track potential spectral interference and data integrity. See **ChemCorrect** section.
interval	Average of the elapsed time between each fitted spectrum for an injection's averaging window.
ch4_ppm	The average methane concentration, in ppm, measured for that injection (Line). This column can be used to track potential spectral interference and data integrity. Methane concentration is not calibrated, and should not be used directly to determine the methane concentration in the water source.
h16od_adjust	This term represents an adjustment applied to WLMh16od_offset, a filtered and scaled frequency error derived from least-squares fit. h16od_adjust is only reported on the L2130-*i* and L2140-*i*. This column may be used to the Picarro Technical Support team in diagnosing wavelength locking.
h16od_shift	This term represents an adjustment applied to WLMh16od_offset, a frequency error derived from least-squares fit. h16od_shift is only reported on the L2130-*i* and L2140-*i*. This column may be used to the Picarro Technical Support team in diagnosing wavelength locking.
n2_flag	Flag for reported the measurement mode at the time of measurement. n2_flag will equal 1 for operation in the N_2 mode, and equal to 0 for operation in the Zero Air mode.
Resistance	The MCM is equipped with an automatic sensor to check the resistance heating element of the cartridge, and is reported as the average value fo each injection (Line). Resistance of injections should be in the range of 17 ot 18 Ohms. It is normal for the first few injections to differ in value from subsequent injections as they are often measured before the systems reaches equilibrium temperature and resistance.
DAS Temp	Temperature measured at the DAS board in the Picarro Analyzer.

Tray	Tray number. Relevant for CTC Autosampler (Picarro Part Number A0321).
Sample	Vial sample number.
Job	Line in the autosampler job queue.
Method	Autosampler method that is associated with the autosampler sequence.
Error Code	Error code associated with Autosampler operation.

TROUBLESHOOTING

CARTRIDGE RESISTANCE ERROR MESSAGE / BLINKING LIGHT

The MCM is equipped with an automatic sensor to check the resistance heating element of the cartridge. When the MCM is first turned on it is normal for the LED light on the back panel (see picture on page 11) to blink for a few minutes as the system performs a self-diagnostic test. The LED should turn steady green within 5 minutes of being plugged in. In addition the resistance of the cartridge is measured with each sample injection and reported in the coordinator. The resistance of the first injection will differ in value from subsequent injections as it is measured before the systems reaches equilibrium temperature and resistance. The resistance associated with subsequent injections should be in the range of 17 to 18 Ohms. If the coordinator reports an error with cartridge resistance it indicates the heating element has burned out and the entire cartridge should be replaced. At room temperature a normal cartridge resistance is 23 – 25 Ohms.

ODD PULSE SHAPE / LEAKS

If the water concentration signal measured at the CRDS does not resemble a series of square waves (concentration goes up and down from 0 to ~20,000ppm quickly) then this indicates there may be a leak in the connections. Please see the Picarro Community Pulse Dictionary for examples:

http://www.picarro.com/community/picarro_community/liquid_water_isotope_analyzer_pulse_shape_dictionary_diagnosing_problems

ENHANCED MEMORY / COLD CONNECTIONS

The MCM-Vaporizer combination has slightly higher inherently memory than the vaporizer alone due to the additional surface area introduced by the MCM. If the memory behavior changes this may be due to several different causes. The build- up of solid residue within the vaporizer can result in mineral compounds (especially sulfates) which form hydrates and thus increase vaporizer memory over time. Another potential cause of memory would be failure of the transfer line heating in the MCM. This can be verified by measuring the temperature of the connection between MCM and CRDS. This connection is shown on page 8, and the temperature should be approximately 80°C. The connection should be warm to the touch. To further investigate the temperature of the connection, we recommend the use of a thermocouple.

WARRANTY CLAIMS

In order to track incidents, and enable our customers to follow progress using the online Picarro Support Community, Picarro has adopted a case number structure for service requests. If you need help from Picarro, please contact us in accordance with these instructions.

1. Contact Technical Support to be assigned a case number.

   Please call: +1 408 962 3991

   Or email: support@picarro.com

   To help us assist you, please provide the following information:
   - Analyzer Serial Number
   - Your Institution
   - A description of the symptom, including error codes when relevant. This will, for example, help us understand whether the problem is related to hardware, software or sample handling.
   - Screen captures, data and photos can also help us
   - We have a number of tools to help customer online and an internet connection will be extremely useful.

2. In some cases, Picarro is unable to resolve the situation remotely and a return is necessary. We will do our best to make this as painless as possible. The first step in the process is to secure a Return Material Authorization number. Your Technical Support representative will email a link to complete and submit our RMA form online. Upon completion of the form, the RMA number will be sent, automatically, as well as additional information regarding the return process, such as appropriate packing, insurance. Units returned without a valid RMA number will not be worked on until the RMA process is complete.

PICARRO

NEED HELP FROM PICARRO?

We are committed to helping our customers! Following the steps below will help us get to your problem faster!

STEP 1: Visit our popular Community forum! It offers a wealth of information with answers to thousands of questions from our customers as well as useful links and updates to operate your analyzer optimally. www.picarro.com/community

If this is your first time visiting this forum, you will be asked to login using your username and password, which can be created easily with a special email invitation from Picarro. These invitations are automatically emailed to current customers upon purchase and to interested individuals. Please contact us to request an invitation to community (support@picarro.com).

STEP 2: If you can't find the answer your question in the Community, **please activate the Logmein software before emailing us (see directions in your Analyzer's User Manual).** This activation allows our technical engineers to get access to your analyzer's desktop remotely, allowing us to find and solve your problem quickly. This access can be turned off easily by the user.

STEP 3: Email us! (support@picarro.com) Please feel free to attach data and/or screen shots to your email that you feel might help us diagnose your problem. They always do! We will get back to you right away! You can also call us at 408.392.3991.