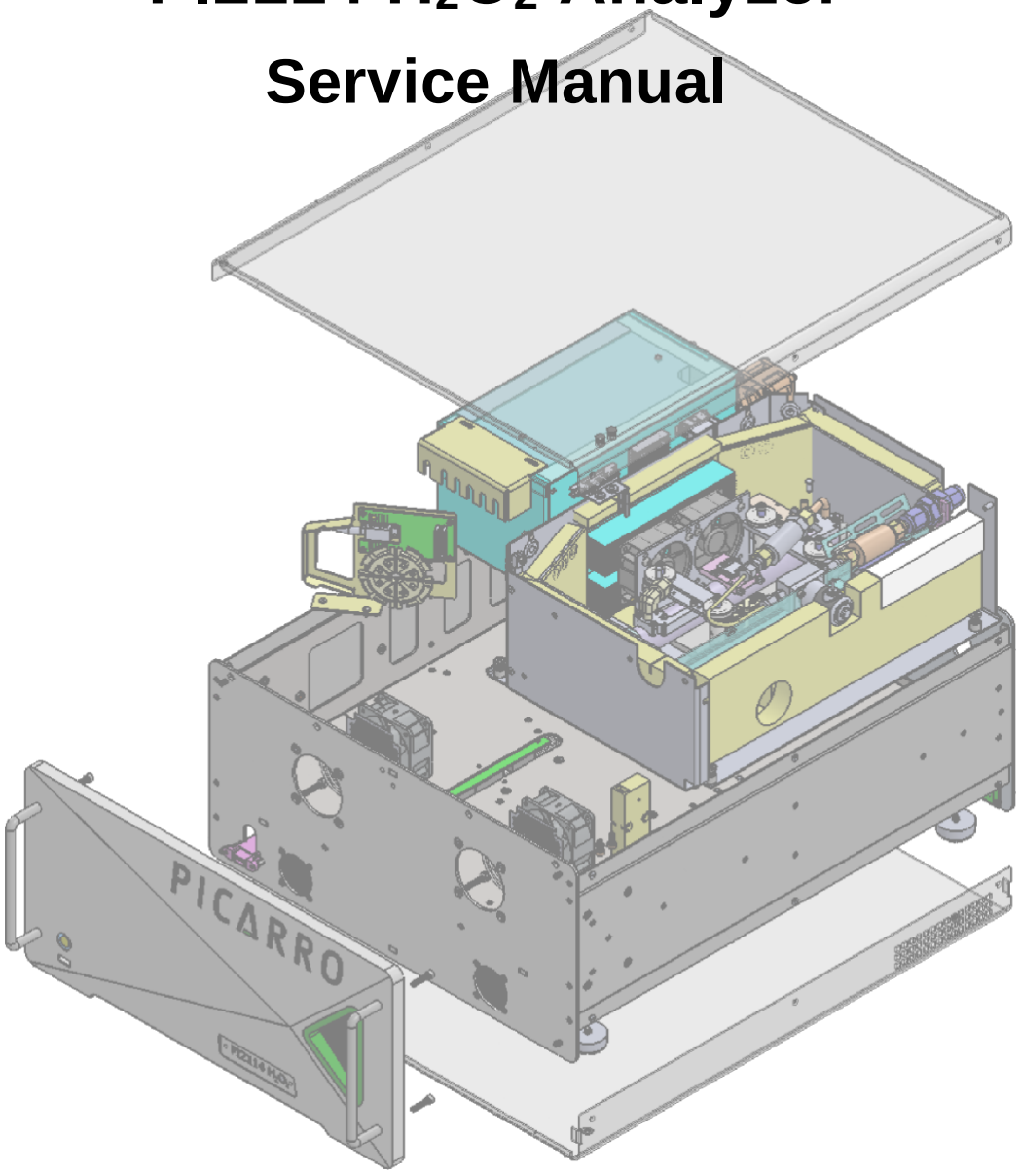
PICARRO

PI2114 H_2O_2 Analyzer

Service Manual



Picarro, Inc
3105 Patrick Henry Drive
Santa Clara, CA 95054, USA
Tel: 408.962.3944
www.picarro.com

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PICARRO

This document covers the Picarro, Inc. PI2114 Hydrogen Peroxide Analyzer.

The tool, hardware, and software are periodically enhanced and modified; therefore, information in this document is subject to change without notice. Although we update technical manuals where appropriate to reflect hardware and software changes to the instrument, Picarro Inc. makes no guarantee that the information in this manual is current for all PI2000 Series Gas Analyzers.

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Table of Contents

1. User Safety

1.1 Warning Symbols Used in This Manual

The following icons are used throughout this manual to emphasize important information in the text. These icons indicate dangers to either the operator or to the analyzer, and other important information.

	Consult the user's manual for important information (When you see this symbol placed at hazard points on equipment, consult the user manual).
	**NOTE** is important information that you should be aware of before proceeding.
 **WARNING**	**LASER WARNING** alerts you of a laser danger.
 **CAUTION**	**CAUTION** alerts you of a potential danger to equipment or to the user.
 **WARNING**	**WARNING** indicates an imminent danger to the user.

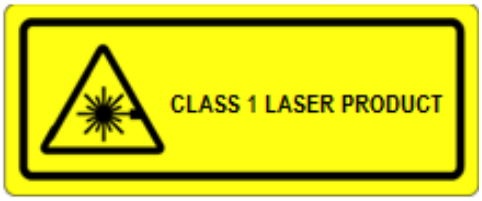
1.2 Laser Safety

WARNING

This equipment is classified as a Class 1 laser product with an embedded 3B laser in accordance with EN 60825-1:2014.

WARNING

The laser is a Class IIIb when exposed.
Only trained service personnel are authorized to open the housing or service the laser in an approved laser safe service area using appropriate laser safety glasses.



1.3 General Safety

WARNING

Using this analyzer in a manner not specified by Picarro may result in damage to the analyzer, and render it unsafe to operate.

WARNING

Only authorized persons may open the analyzer cover or perform internal maintenance. Contact Picarro for maintenance instructions and maintenance kits. Unplug the analyzer before working with the internal components. Failure to do so may result in electric shock and can damage the analyzer.

WARNING

When using compressed gases, follow all appropriate safety conventions, including use of eye protection, physical restraint of cylinders, etc.

WARNING

This analyzer weighs 48 lbs. Use the technique described below when lifting the analyzer.

a. Before lifting, inspect the unit for slippery substances or sharp edges.
b. Lift with two people, one on each side of the analyzer.
c. Crouch down and stay close to the unit. Always keep your back as straight as possible.
d. Position your feet for sturdy balance. Lift with your legs, not your back.
e. Do not twist the back while carrying the unit. Rotate direction with hip joints.
f. Lower the unit by bending at the knees.

1.4 Personal Protective Equipment

Laser safety glasses or goggles are recommended when servicing the tool's optics where direct or reflective laser scatter can occur. The recommended laser safety glasses or goggles should have an optical density (OD) of 2 or greater.

The use of gloves is recommended when working with the external filter, or any other heated surfaces or plumbing.

All personal protective equipment (PPE) shall be used in accordance with the instructions provided by the PPE supplier.

1.5 Tool Certifications

The PI2114 H_2O_2 Analyzer meets two types of tool certifications. They are the CDRH issued by the FDA and CE by the European Union.

CDRH Certification

The PI2114 Hydrogen Peroxide Analyzer complies with 21 CFR Chapter 1, sub-chapter J. The PI2114 Hydrogen Peroxide Analyzer classified as a Class 1 laser system when all panels and covers are on.

CE Certification

The PI2114 Hydrogen Peroxide Analyzer complies with the European standards thus the instrument is affixed with a CE label. This CE label is located on the rear of the instrument.

1.6 Label Locations

The warning labels are located in the following positions.

Figure 1: Warning-labels on top of the analyzer

Figure 2: Warning labels on the rear panel of the analyzer

Figure 3: Warning labels inside the analyzer (top)

The inside of the analyzer should not be accessed under normal operation. Only remove the top cover when replacing the filter (see page 58).

2. Hazards

2.1 Overview

The hazards identified and explained in this section might be encountered during maintenance or service tasks.

2.2 Hazardous Voltage

WARNING

ELECTRICAL HAZARD: There are two locations that the voltage potentials operate above 30 Volts RMS. The first location is in the rear of the instrument on power entry adapter in which the power cord plug plugs into. The second source is the power entry adapter in which the power cord plugs into the external pump. Refer to Manual Number 999085 included in the box for the Vacuubrand MD1 External Pump.

2.3 Safety Provisions

Enclosure, Overcurrent, Over Voltage, and Short Circuit Protection

Enclosures protect the operators of the tool from contact with hazardous voltages during normal operation of the system. If a short circuit, overcurrent condition, or over voltage occurs, the power supply will automatically shut down. The power supply shall return to normal operation after the faulty event is rectified.

Lockout/Tagout

Prior to performing service on the Analyzer, perform Lockout/Tagout on the power cord connected to the instrument by disconnecting it at the wall and at the instrument and placing it within your lockable toolbox.

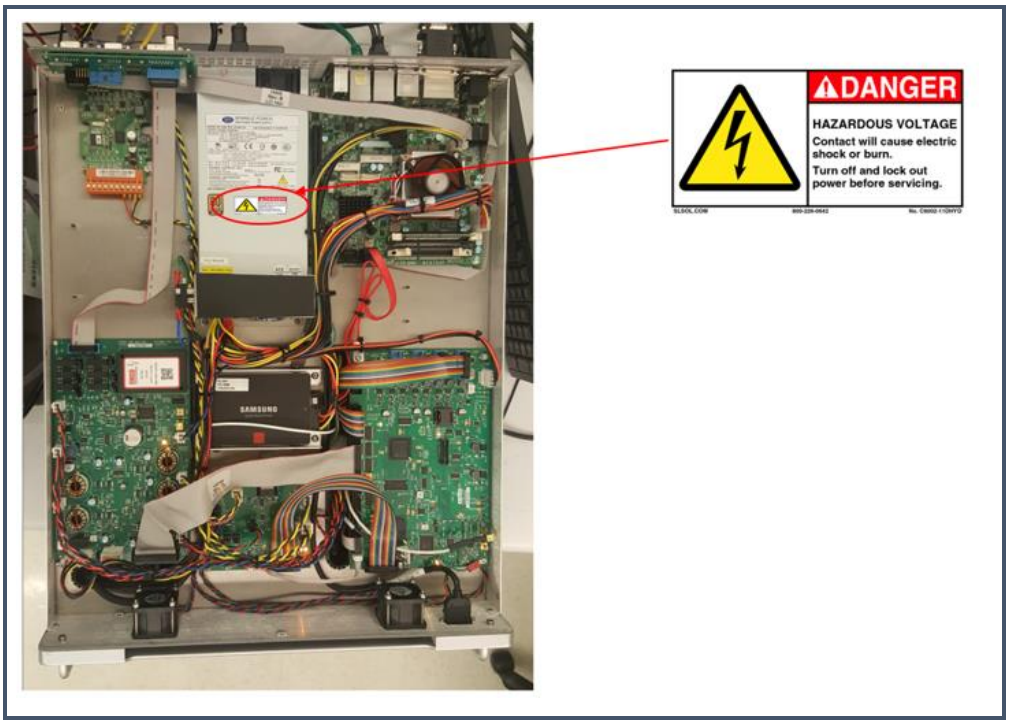


Figure 4: Hazardous Voltage Warning Label

Location of Hazardous Voltages

Hazardous voltage warning labels are located at the power entry module on the DC Power Supply (see Figure 4).

2.4 Laser Hazards

WARNING

LASER HAZARD: Under normal operating conditions, the PI2114 H_2O_2 Analyzer is classified as a Class 1 Laser product, in accordance with Title 21 Code of Federal Regulations, Chapter 1, sub-chapter J.

WARNING

LASER BEAM: The Hot and Warm Box with the PI2114 H_2O_2 Analyzer contains the output fiber end of the fiber laser used. The fiber laser is Class 3B with an operating wavelength between 1200–2000 nm. The maximum output power is 80mW. The beam of this laser is, by definition, a safety hazard. Personnel are normally protected from exposure by the covers on the system. When these covers are removed for service tasks and the laser interlocks are bypassed, there is a potential for exposure. Figure 5 displays the

location of the Hot and Warm Box and the location of the laser warning labels.

Take precautions during service tasks to prevent accidental exposure to both direct and reflected beams. Diffuse as well as specular beam reflections can cause severe eye or skin damage.

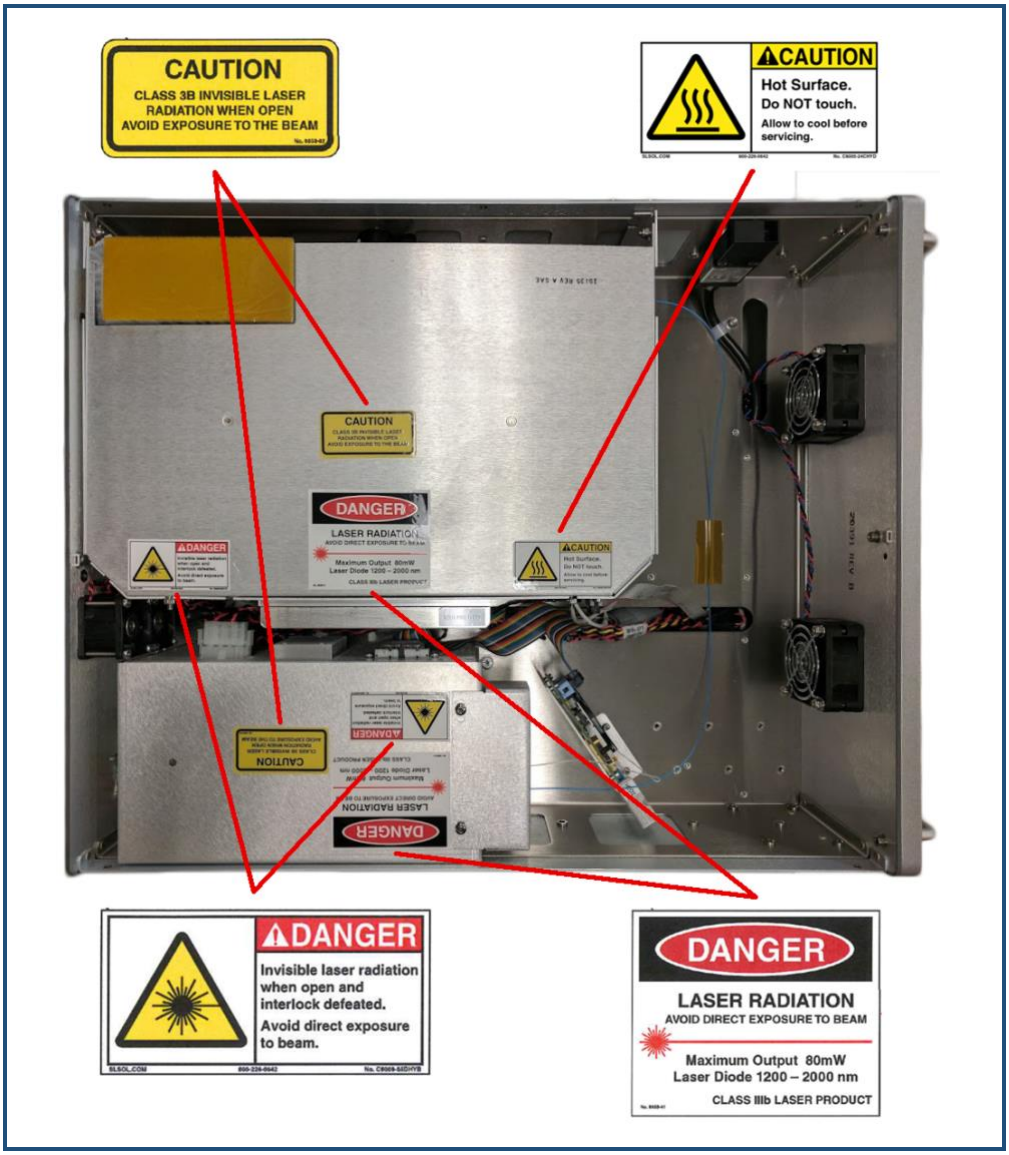
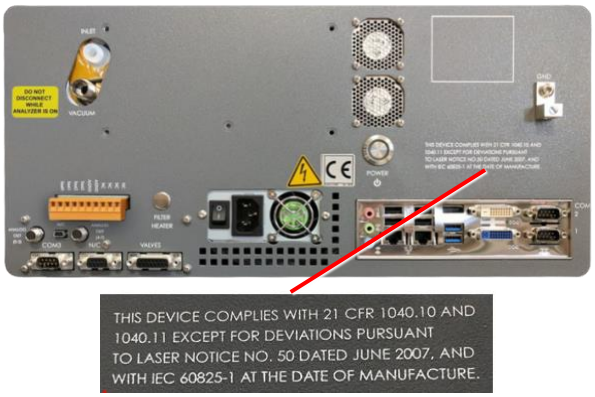


Figure 5: Laser Hazard Labels inside Analyzer

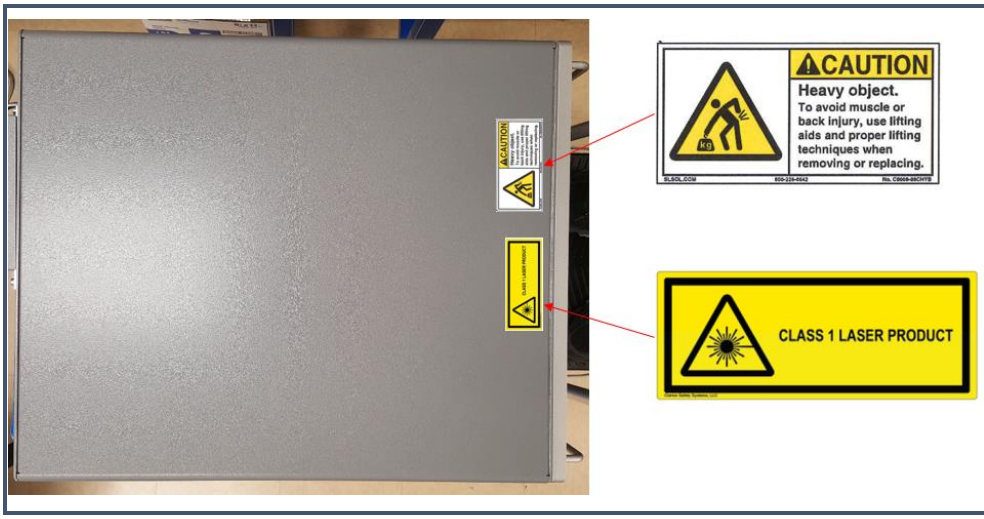
Figure 6: CDRH Label Classification



CDRH Certification

PI2114 H_2O_2 Analyzer complies with 21 CFR chapter 1, sub-chapter J. This is stated on the silkscreen label on the rear panel of the Gas Analyzer.

Figure 7: Class 1 Laser Product Label



The PI2114 H_2O_2 Analyzer is classified as a Class 1 laser product when all panels and covers are on. A Class 1 laser product label is attached to the top panel of the instrument.

2.5 Laser Characteristics

Electrical/Optical Characteristics (T_{sub}=25deg.)

Parameter	Condition	Min.	Typ.	Max.	Units
Forward voltage	I_f=30mA		1.2	1.6	V
Threshold current	CW		10	20	mA

Fiber output power	CW, I_f=130mA	20			mW
Peak wavelength	CW, $Ø_e$20mW	-1	ITU-T	+1	nm
Spectral linewidth	CW, $Ø_e$20mW		2		MHz
Side mode suppression ratio	CW, $Ø_e$20mW	35			dB
Monitoring Current (PD)	CW, $Ø_e$20mW	0.1			mA
Dark current (PD)	CW, V_{DR}=5V			100	nA
Tracking error	$I_{R(E)}$=constant	-0.5		+0.5	dB

2.6 Hot Surface Hazards

CAUTION

HOT SURFACE: Under normal operating conditions, the user is protected from the hot surfaces within the Analyzer. The Hot Box can reach temperatures up to 80˚C. For access into the Hot Box of the Analyzer, power down the instrument and allow the instrument time to cool down before disassembly.

The Hot Surface Hazard label is affixed to the top surface of the Hot Box as shown in Figure 5.

2.7 Lifting Hazard

WARNING

LIFTING HAZARD: Lifting hazards will be encountered when moving the PI2114 H_2O_2 Analyzer. Never lift more weight than is recommended in any procedure. Heavy objects are defined to be over 30 lbs. The Analyzer's weight is 48 lbs. Failure to employ two-person lift utilizing proper lifting techniques may cause injury to persons or damage to equipment.

Safety Provisions

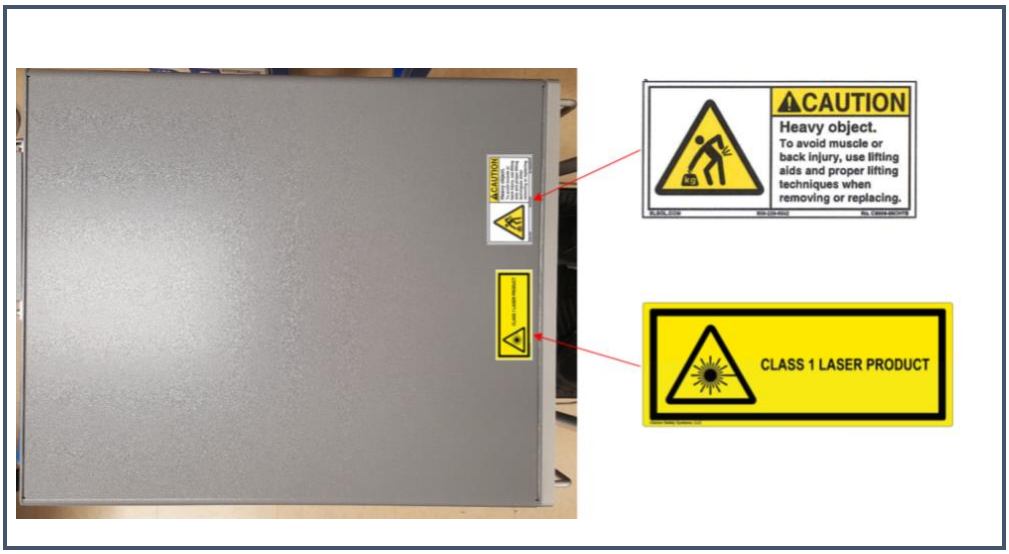
Heavy replaceable components bear the Lifting Hazard alert labels. Pictorial hazard alerts call attention to the hazard in procedures requiring removal of heavy components. This will be the case should PI2114 Hydrogen Peroxide Analyzer needs to be removed for relocation or return to the factory for repair.

Do the following when lifting heavy objects:

- Use two people to lift any object weighing over 30 pounds.
- Use proper lifting technique: when lifting, do not lift with your legs straight or from a forward bent position. Bend your knees and hips, using your legs muscles for lifting and make sure you are as close to the load as possible.
- Test the load to make sure you are able to lift it safely.
- Avoid sudden movements and make sure you never twist. A bending and twisting motion can cause a rupture of the discs in your spine. If you must do a sideways motion, make sure you move your feet to where you are facing the area where you can set the load down safely.
- If load is not safe, make sure you get help to lift the load. When two or more persons are performing the lift, make sure you synchronize the actions. It is necessary to communicate to each other to avoid injury and it is best for one person to call the signals so you can lift together.
- Avoid lifting heavy objects with one hand. Try to always balance the loads in both hands or get a cart.

The PI2114 Hydrogen Peroxide Analyzer's weight is 48 lbs. There is a heavy object label affixed to the top cover/enclosure of the Analyzer.

Figure 8: Lifting Hazard Label



2.8 Hazardous Material Content

The European Union has identified certain substances that are considered environmentally hazardous according to the WEEE (Waste for Electrical and Electronic Equipment) and RoHS Directives. At the end of life of the instrument, the PI2114 Hydrogen Peroxide Analyzer shall be dismantled, and the hazardous materials shall be identified, sort, and collected.

The WEEE directive sets minimum standards for recycling of electrical and electronic waste. Those standards must be met. Local practice may exceed the minimum standards.

The crossed-out wheeled bin symbol represents that hazardous content is included in the equipment. The equipment and parts with hazardous content shall not be disposed of with unsorted municipal waste. It is required that electrical and electronic equipment be disposed of under separate collection.

Figure 9: Do Not Dispose Label

Hazardous Material in Electronic Equipment

- Lead is typically found in solder connections including PCBA terminations.
- Mercury can be found in electronic components such as switches, and relays.
- Lead, mercury and cadmium may be found in insulation of electrical cables.
- Hexavalent Chromium may be used as a coating on frames, screw and fasteners.

All parts with hazardous material shall be separated and disposed of to comply with applicable local laws and regulations including with European WEEE Directive.

3. Safety Interlock

3.1 Overview

The PI2114 Hydrogen Peroxide Analyzer is equipped with the Safety Interlock Switch. There is only one safety interlock switch on the Analyzer. This safety interlock switch when triggered will remove power from the power supply feeding to all the electronics within. Even with the safety interlock tripped, there will still be power on the power entry module (the AC that plugs into the instrument) and portions of the power supply electronics, if the instrument is still plugged into the AC wall outlet. Figure 10 shows the location of the safety interlock in the Analyzer. Figure 11 is the schematic of the safety interlock switch showing how it is wired to the instrument system power supply.

Figure 10: Safety Interlock Switch

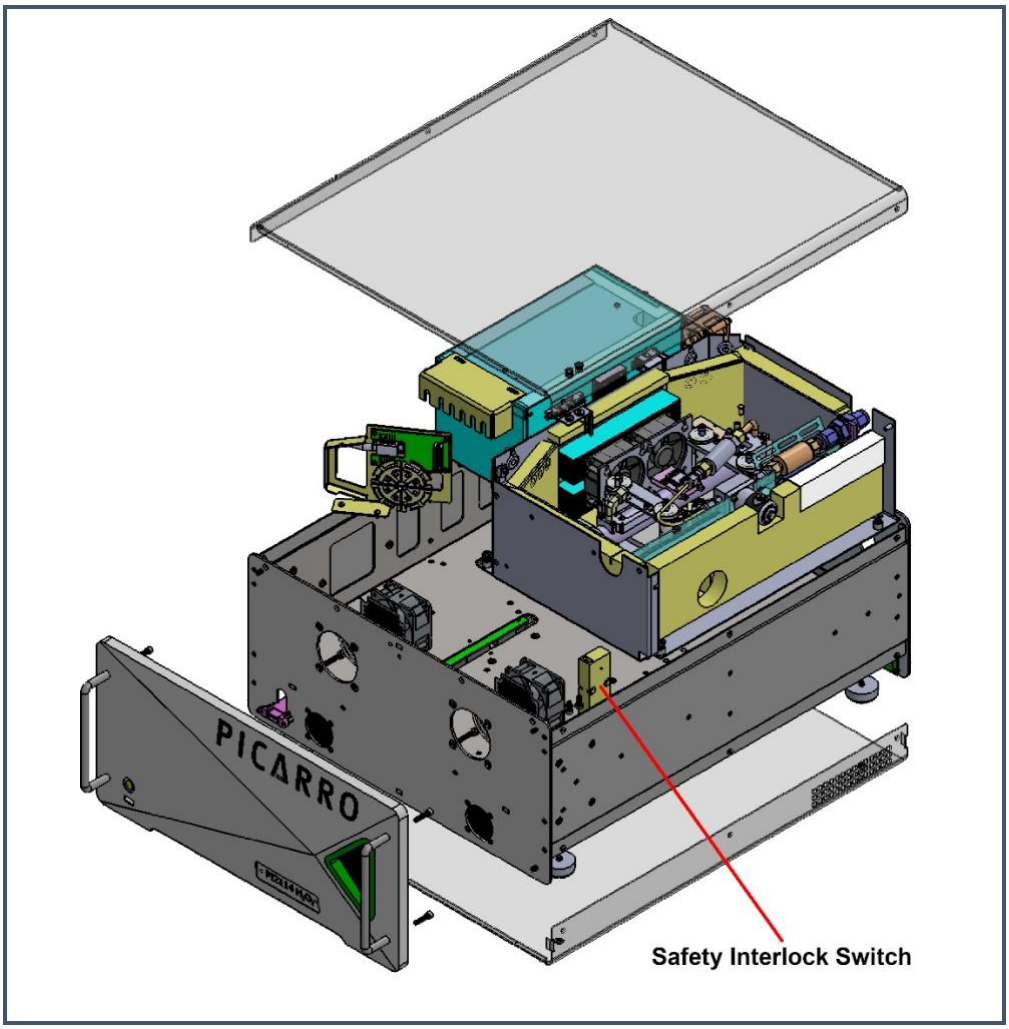
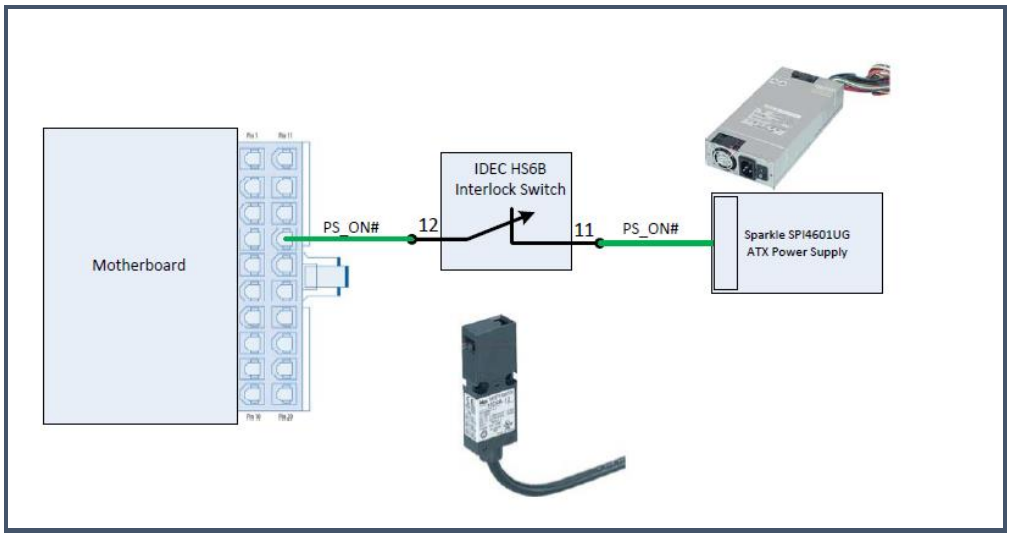


Figure 11: Safety Interlock Wiring



The PI2114 system power supply DC output is enabled with a PS_ON# active-low signal from the motherboard to the power supply. When PS-ON is pulled to TTL low, the DC output are enabled; when PS-ON is pulled to TTL high or open-circuited (interlock switch open) the DC outputs are disabled.

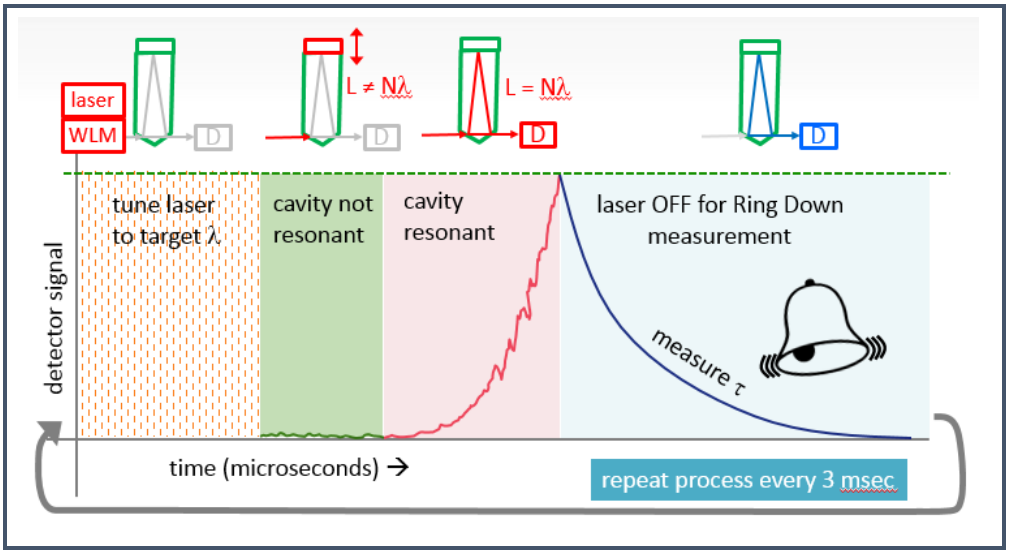
4. Theory of Operation

4.1 Overview

The PI2114Hydrogen Peroxide Analyzer is a laser based, cavity based gas analyzer. The Analyzer uses the Beer-Lambert law for optical absorption of a specific gas molecules, and applies the principle of operation based on the measurement of a decay rate (ring down time). Each type of gas molecule has a unique optical absorption. Optical absorption is achieved when the specific wavelength of light matches that of the resonant frequency (the spectral line) of the gas molecule. Concentration is determined from the size of the spectral line at that resonant frequency. For the measurement, the process is as follow:

1. Inject the laser light at the same wavelength as the resonant frequency of the gas species concentration you want to determine into a fixed length and volume cavity filled with the gas to be measured.
2. Turn off the laser and measured the time the laser light level decrease (ring down time) to zero. The ring down time is dependent upon the concentration amount of the gas absorption of the laser light. The shorter the ring-down time, the higher the concentration of that specific gas. The longer the ring-down time is, the lower the concentration of that specific gas.
3. Repeat for a continuous measurement over time.

Figure 12: Cavity Ring Down System Measurement Sequence



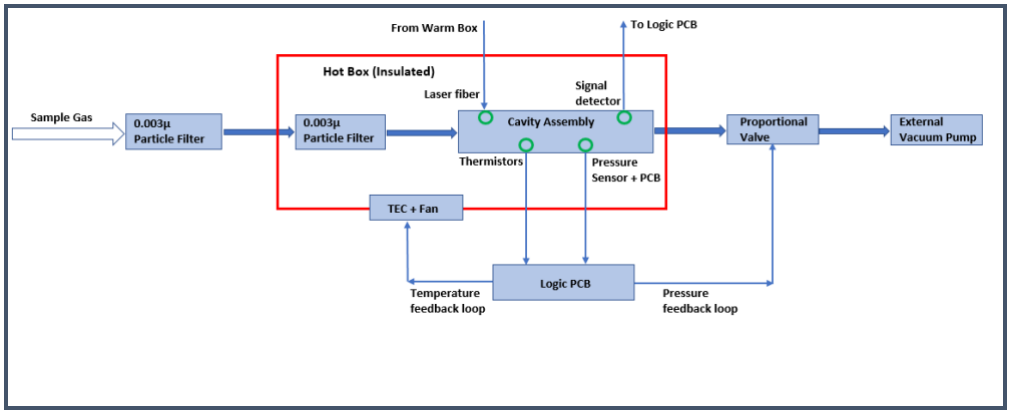
CAUTION

Proper use of the PI2114 Hydrogen Peroxide Analyzer does not include personnel protection or monitoring of the occupied space. The PI2114 Analyzer is not a safety device.

4.2 Dependencies

The Gas Analyzer Cavity module resides in the “Hot Box,” which provides thermal stability. The pressure within the cavity module is controlled by a Proportional Valve to contract or expand its orifice to maintain a constant measurement pressure. Any swings from either the temperature or pressure can change the optical absorption through resonance of the gas molecule by moving its spectral line away from the laser wavelength. Both the cavity temperature and pressure are constantly monitored at all time during measurement and controlled through the Logic board, providing a closed loop system. Figure 13 is a simple block diagram of the measurement module.

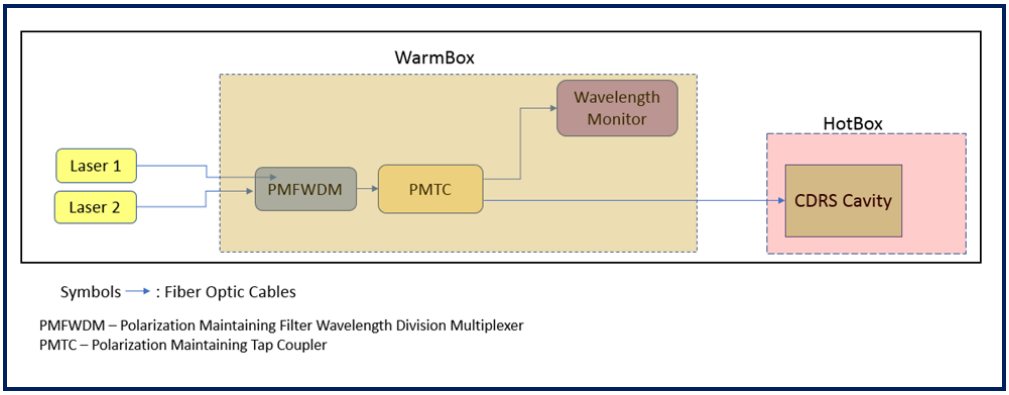
Figure 13: Gas Analyzer Block Diagram



4.3 Laser Path

During operation, the path of the light leaving the laser travels through the coupled fiber, enters the Warm Box, through the PMFDM, then to the PMTC. From the PMTC, the path splits to the Wavelength Monitor and ends. The remaining light travels out of the Warm Box, through another laser fiber entering the Hot Box, and finally into the optical cavity.

Figure 14: Laser Path through the Warm Box and Hot Box



5. Analyzer Overview

5.1 Intended Use

The Picarro PI2114 Hydrogen Peroxide Analyzer is designed for the accurate measurement of residual vaporized hydrogen peroxide, H_2O_2, in units of parts per billion (ppb). The unit uses cavity ring-down spectroscopy and wavelength monitoring to facilitate precise and continuous monitoring of vaporized hydrogen peroxide.

5.2 Analyzer Front-Panel

Figure 15: Front Panel

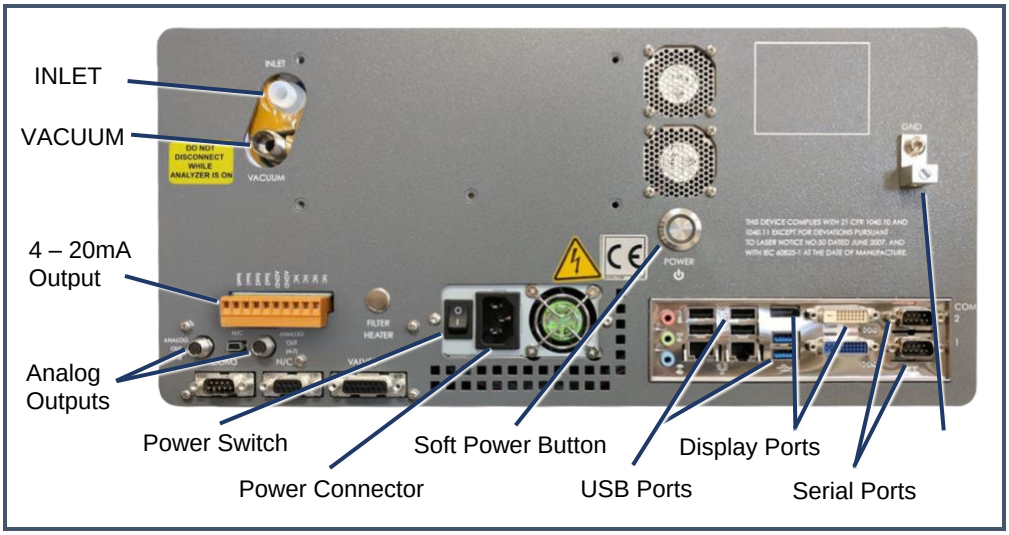
Feature	Description
Status Indicator LED	There are five states of the status indicator: Off: System is off or has no power. Yellow (flashing): Warming up. Green: Operating correctly. Yellow (steady): not operating correctly. Red: Not measuring.
USB Port	For transferring files to a flash drive.

CAUTION

Only use the USB ports to connect to flash drives, mice, or keyboards. Do not connect hubs or other types of devices.

5.3 Analyzer Back Panel

Figure 16: Back Panel



Feature	Description
INLET	1/4" PFA Swagelok Compression Fitting Connect to gases to be sampled.
VACUUM	3/8" NPT Swagelok Compression Fitting Connect to external vacuum pump.
4–20 mA Output	Output terminal for monitoring the analyzer's 4–20mA signal output.
Power Switch	Control power to the analyzer.
Power Connector	Connect to AC power.
Soft Power Button	On/off button (Main Power Switch must be on).
USB Ports	Connect the mouse and keyboard USB flash-memory drive (optional).
Display Ports	Connect your video monitor (not included) to one of these three display ports. Three different types of connector are available: DVI-I, DVI-D, and DisplayPort.
Ground	Ground lug (if needed).
Serial Port	Connect for digital data streaming. *See page 36 for configuration instructions.*

Analog Outputs	Hirose HR25-7TP-8P(72) Connectors Connect for analog signal streaming. *See page 40 for configuration instructions.*

NOTE

The analyzer's universal power supply automatically adjusts to power sources ranging from 100-240 VAC, 50/60 Hz, 250 W max.

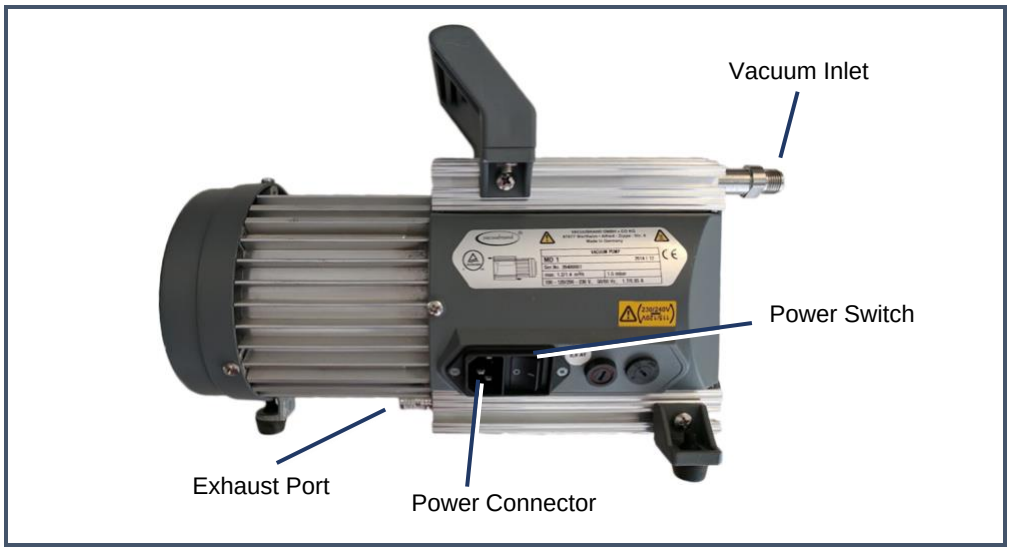
CAUTION

Only use the USB ports to connect to flash drives, mice, or keyboards. Do not connect hubs or other types of devices.

5.4 External Vacuum Pump

The external vacuum pump is used to maintain cavity pressure inside the analyzer. The pump should be connected and running whenever the analyzer is in use.

Figure 17: External vacuum pump



Feature	Description
Vacuum Inlet	3/8" Swagelok Fitting. Connect to the vacuum port on the analyzer with the provided vacuum hose assembly.
Exhaust Port	Pump output (see pump manual).
Power Switch	On/Off switch for the pump.
Power Connector	Connect to AC power.

5.5 Analyzer Specifications

Weight	48 lbs (Use two people to lift)
Dimensions	Length: 24.38" Width: 17.5" (17.75" with rails) Height: 7.88" (8.38" with feet)
Temperature Range	Storage: 0°–70°C Operation: 0°–35°C
Ambient Humidity Range	<99% R.H. non-condensing
Maximum Altitude	10,000 ft (operation)
Clearance	Front: 6" Rear: 6"
Power Requirements	100–240 ±10%VAC, 50/60 Hz, 250 W max
Minimum Rated Circuit Amperage	10A @115VAC 5A @230VAC
Liquid Ingress Protection	None

WARNING

This analyzer is designed to be used in an indoor environment. Do not operate or store the unit outside or exposed to the elements.

WARNING

If the equipment is used in a manner not specified by Picarro, the protection provided by the equipment may be impaired.

6. Hardware Setup

6.1 Overview

Items/Tools Required:

- 5/8" open end wrench
- 11/16" open end wrench
- Pump
- Power Cord

CAUTION

If you rack-mount the analyzer, be sure to support it with a shelf or additional rails, the analyzer cannot support itself on the front rackmounts alone.

CAUTION

The instrument is intended to measure concentrations of H_2O_2 up to 100 ppm. Operating at concentrations above the intended ranges may render the instrument unsafe to operate, maintain, service or dispose.

CAUTION

Sample or CDA lines connected to the ¼" Swagelok connectors must not exceed 3 psig.

CAUTION

Any light emitted from the Status Indicator, regardless of color or state, indicates one or more lasers are on.

Figure 18: Status Indicator on Front Panel

6.2 Install the Analyzer and Vacuum Pump

1. Place the analyzer on a sturdy, level, cart or table. (A 19" rack-mounting kit is available separately if preferred.)

WARNING

This analyzer weighs 48 lbs. Use the technique outlined in the General Safety section on page 6 when lifting or moving it.

NOTE

Placing the analyzer where it may be exposed to RF radiation in the 80MHz–1GHz range at field strengths over 10V/m per IEC 61326-1-2013 may degrade performance.

2. Place the external vacuum pump near the analyzer on a cart or table.
3. Remove the caps from the analyzer's INLET and VACUUM connection ports. Save the caps; you should reinstall them when the analyzer is stored, moved or shipped.
4. Remove the cap from vacuum pump's inlet. Save the cap for later use. Reinstall the caps when the pump is stored, moved or shipped.
5. Connect one end of the vacuum hose to the pump: hand tighten the nut and then use an 11/16" wrench (not included) to make an additional turn of one flat (about 60 degrees).
6. Connect the other end of the vacuum hose to the VACUUM connector on the back of the analyzer: hand tighten the nut and then use the 11/16" wrench to make an additional turn of one flat (about 60 degrees).
7. Connect the analyzer to a power source using one of the supplied AC power cables.
8. Connect the external vacuum pump to a power source using the remaining AC power cable.

CAUTION

Use only the AC power cables supplied with the analyzer or a similarly rated cable. Check with Picarro technical support if you have questions about power cable replacement.

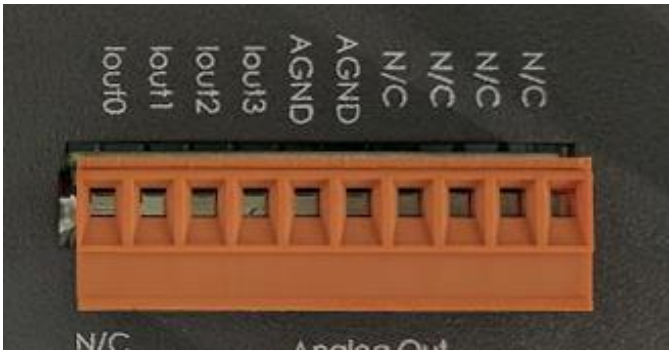
CAUTION

When working with hazardous gases, make sure to provide proper ventilation or direct the exhaust with a hose to a safe place for venting. Consult the pump's manual for details.

6.3 Connect the 4–20mA Signal Output

Four channels of output are available on the back of the analyzer.

Figure 19: 4–20mA output with terminal connector in place



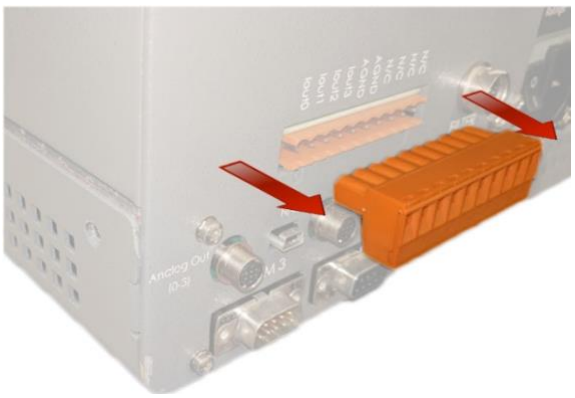
By default, the settings for the four channels are as follows:

	Iout0	Iout1	Iout2	Iout3
Monitoring	H_2O_2	Cavity Temperature	DAS Temperature	Cavity Pressure
Units	ppb	Degrees C	Degrees C	Torr
Min	0.0	0.0	0.0	0.0
Max	1000.0	100.0	100.0	1000.0

To connect to the output:

1. Using your fingers, pull the 4–20 mA terminal connector straight back away from the analyzer.

Figure 20: Removing the terminal connector



2. Use a small slotted screwdriver to loosen the retaining screw for the desired terminal.

Figure 21: Retaining screws at the bottom of the terminal connector

3. Insert the stripped end of the wire into the terminal.
4. Tighten the retaining screw.
5. Repeat for each desired terminal.
6. Slide the terminal connector back onto the analyzer with the retaining screws facing down; there should be a soft click when the connector is set into its proper position.

NOTE

If shielding is desired, connect the drain wire of the shielded cable to the ground lug on the back panel. *Do not* connect the shield to the ground pins of the 4–20 mA connector. Connect only one end of your shielded cable to the ground lug to avoid ground loops.

6.4 Connecting to the Analyzer Inlet

Connect to the inlet of the analyzer using ¼" OD PTFE or PFA tubing using the supplied plastic ¼" PFA inlet nut and ferrules.

WARNING

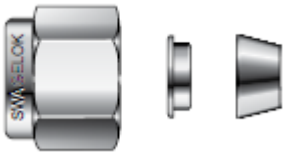
When using compressed gases, follow all appropriate safety conventions, including use of eye protection, physical restraint of cylinders, etc.

Making a new connection:

When using new tubing, follow these steps.

1. Place the two ferrules inside the nut as shown.

Figure 22: Orientation of ferrules and nut



2. Loosely connect the nut to the INLET on the back panel of the analyzer about a full turn, being careful not to let the ferrules fall out.
3. Insert the tubing into the back of the nut, feeding it in as far as possible without deforming the tubing.
4. Hand tighten the nut.
5. Using a 5/8" wrench (not included), tighten the nut approximately seven flats (420 degrees).

Replacing a connection

When reattaching tubing that already has a nut connected:

1. Inspect ferrules. If you see any damage, replace the ferrules and follow the directions above for making a new connection.
2. If there is no damage, hand tighten the connector to the analyzer's INLET.
3. Using a 5/8" wrench (not included), tighten the nut approximately one flat (60 degrees).

6.5 Setting Up a Monitor, Keyboard and Mouse

A video monitor (not included), keyboard, and mouse are required for monitoring device operations, viewing or changing settings (including setting user permissions), or validating device performance.

NOTE

This device will operate under its default settings without any direct control of the internal software.

1. Connect a keyboard to one of the available USB ports.
2. Connect a mouse to one of the available USB ports.
3. Connect a monitor to one of the monitor ports. The analyzer will detect the connection and adjust the resolution to match the monitor.
4. Connect the monitor to a power source.
5. Turn on power to the monitor.

7. Operate the Analyzer

7.1 Power Up the System

This section describes the steps to power on the system. These steps are sufficient for operating the instrument at the default values.

1. Switch on the external vacuum pump.

CAUTION

Always turn on the external pump before turning on the analyzer. This ensures a rapid start-up sequence.

2. Switch on the main power to the analyzer.
3. Press the soft power button.
4. Wait approximately 45 minutes for the system to power up, initialize, and stabilize.

   The status indicator on the front panel will flash yellow during initialization. Once the cavity pressure and operating temperature are at their proper values and stable, the indicator will turn to green.
5. To assign user roles, manage password requirements, or perform other administrative tasks, refer to *"User Management"* on page 83.
6. To run the validation procedure to check the operation of the instrument, refer to *"Validation Procedure"* on page 75.

7.2 Using the Software

Operating the system through the software requires a monitor, keyboard and mouse (see page 30).

When the device is first powered on, the analyzer first displays the Home Screen. The Home Screen will be available for 30 seconds before the device initializes and begins normal operation. While on the home screen, choose another action or click anywhere to stop the timer.

Figure 23: Home Screen

Use the buttons on the Home Screen to select a task:

Button	Function
H_2O_2	Begin normal operation (see Operation Manual).
Files	Copy validation reports or user history to a USB drive (see Operation Manual).
Config	Perform configuration tasks.
Service	Perform service tasks (for trained personnel only).
Power Off	Shutdown and power off the analyzer (user name and password required).

7.3 Shutdown Procedure

To shut down the analyzer using the GUI:

1. From the **Users** menu, choose User Login.
2. Enter your Username and password and click **OK**.

   All roles—operator, technician, and administrator—are authorized to shut down the analyzer.
3. Click **Quit** in the lower-left corner of the Data Viewer. The analyzer will display the Analyzer Shut Down dialog.

Figure 24:
Quit measuring

4. Click **Yes** to end measuring. The analyzer will step through the following sequence of events and may take a few minutes:
   a. Fill cavity with gas from the inlet until it reaches near-atmospheric pressure.
   b. Close proportional valves.
   c. Display the Home Screen.
5. In the lower-right corner of the Home Screen, click **Power Off**. This will prompt for a user name and password.
6. Enter the user name and password and click **OK**.
7. Turn off the pump.

CAUTION

Do not turn off the pump while the analyzer is operating. This could damage the instrument.

To shut down the analyzer without the GUI:

1. Hold down the soft power button on the back of the analyzer.
2. Wait until the status indicator on the front of the analyzer turns off, then release the soft power button.
3. Turn off the pump.

CAUTION

Do not turn off the pump while the analyzer is operating. This could damage the instrument.

7.4 Recovery From Power Outages

When the power returns after an unplanned outage, the analyzer will restart automatically.

If short power outages will be a routine operating environment, Picarro recommends using power conditioning or an uninterrupted power supply to help prevent damage to the operating system or other software corruption that may occur with repeated crashes.

8. System Configuration

8.1 Configuration Menu

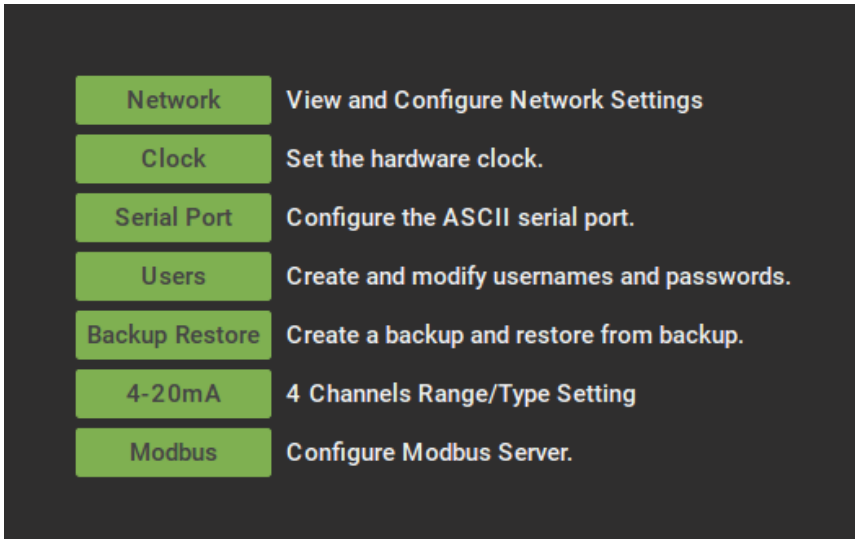
The Configuration Menu can be accessed from the Home Screen upon starting up the analyzer. If the analyzer is operating it must first be shut down to access the Home Screen. After clicking the **Config** button, you will be prompted to log in – you must sign in as an administrator to access the Configuration Menu. Please see User Management on page 37 for more information on user roles.

Figure 25: Locate the Configuration Menu from the Home Screen

After logging in, the Configuration Menu options displayed are:

- **Network**
- **Clock**
- **Serial Port**
- **Users**
- **Backup Restore**
- **4-20mA**
- **Modbus**

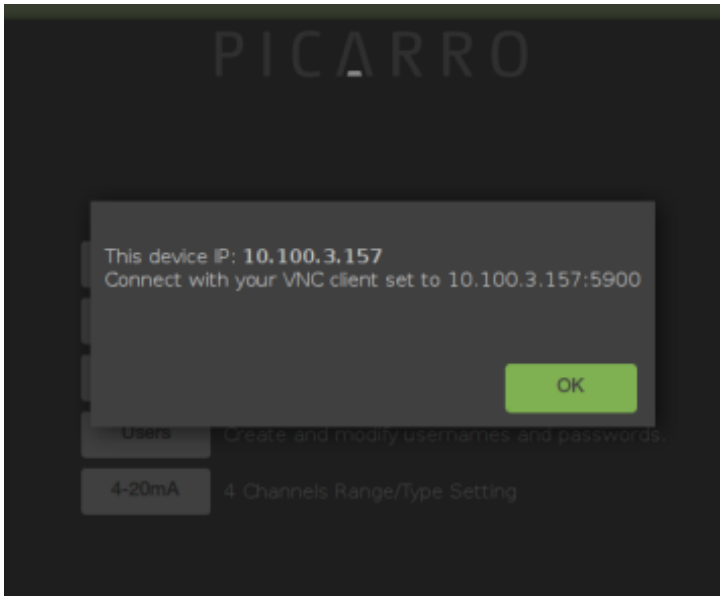
Figure 26: Config Menu Options



8.2 Network

The Network option will display TCP/IP network information.

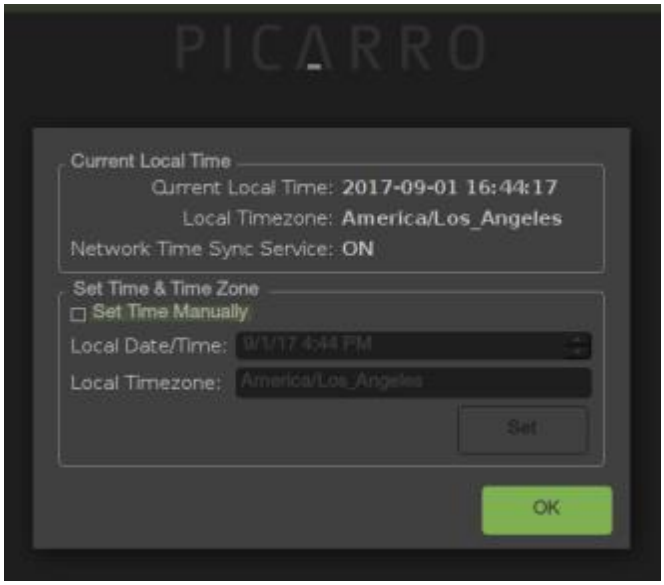
Figure 27: Network Display



8.3 Clock

The Clock Menu will display the current local time and time zone if the analyzer is connected to a network. The time and time zone can also be set manually by checking off the **Set Time Manually** option. Any modifications of the date, time, and time zone are logged in the User History with the credentials of the logged in user.

Figure 28: Clock Configuration



8.4 Serial Port

The Serial Port Menu displays the configurations of COM1 (used for Command Interface) and COM2 (used for Data Out). The COM1 port is preconfigured and its settings cannot be changed. The COM2 port can be enabled or disabled and the following settings can be configured:

- **Baud rate**: number of bit transfers per second
- **Data Bits**: number of data bits in a communication packet, or a single byte transfer
- **Stop Bits**: number of bits used to signal the end of a communication packet
- **Parity**: sets the parity bit to Even, Odd, Mark, Space, or None

After making any changes, select **Save** to apply the changes or **Undo** to revert to the previous configuration.

Figure 29: Serial Port Configuration

8.5 User Management

User management is available from the Configuration Menu or, if you are already signed in as an administrator, from the **Tools** menu on the Data Viewer.

User management includes:

- Managing user accounts, such as adding users and changing passwords.
- Setting user policies, such as password requirements and session duration.
- Viewing and saving user histories.

There are three user roles defined in the system: operator, technician, and administrator. The permissions are as follows:

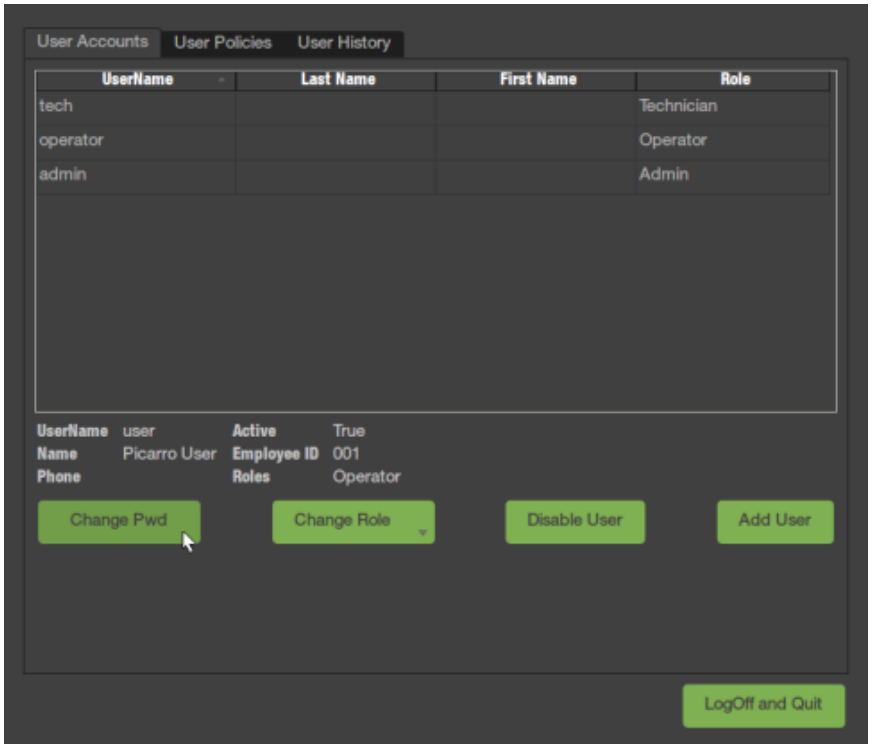
Function	Not Signed In	Operator	Technician	Administrator
View Data Viewer	•	•	•	•
Set Alarms	•	•	•	•
Configure Data Viewer (partial)		•	•	•
Quit Measuring		•	•	•

Shut Down (software shutdown)		•	•	•
H_2O_2 Validation			•	•
Configure Data Viewer (full access)				•
User Management				•

To view the User Management Window from the Home Screen:

1. From the **Config**.menu, click **Users**.
2. Log in as an admin (default user name is *admin*; default password is *admin*.)

Figure 30: User Management Window



The User Management window has three tabbed states: User Accounts, User Policies, and User History. User management settings are also available from the **Tools** menu in the Data Viewer.

See **User Management** on page 84 for settings and options.

8.6 4–20 mA Output Configuration

A current output proportional to a signal can be more immune to electrical noise in an industrial setting. The data must be scaled appropriately so that the available span is filled without saturating the output. For each Channel (#0-3) you can select from the following signal options:

- **H_2O_2:** displays the H_2O_2 concentration reading in parts per billion (ppb)
- **CavityTemp:** displays cavity temperature in degrees Celsius
- **DasTemp:** displays the internal logic board temperature in degrees Celsius
- **CavityPressure:** displays the cavity pressure in Torr

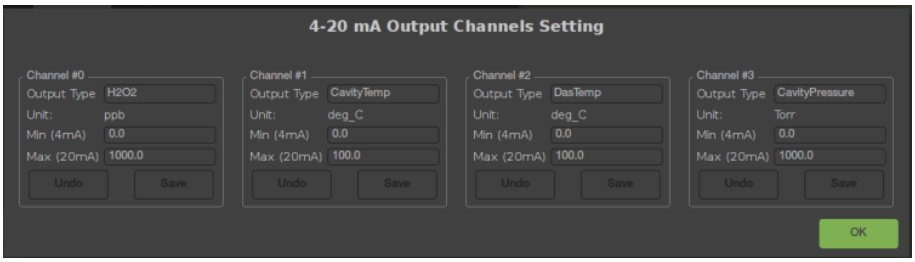
Default Channel configurations and max values:

	Channel #0	Channel #1	Channel #2	Channel #3
Monitoring	H_2O_2	Cavity Temperature	DAS Temperature	Cavity Pressure
Unit	ppb	Degrees C	Degrees C	Torr
Min	0.0	0.0	0.0	0.0
Max	1000.0	100.0	100.0	1000.0

To change values:

1. From the **Config**.menu, click **4-20mA** to open the 4-20 settings.

Figure 31: 4-20mA Output Channel Settings



2. Log in as an admin (default user name is *admin*; default password is *admin*.)
3. Select the output type for a channel.
4. For **Min**, enter the minimum value of interest. Any measurement at or below this value will correspond to a 4mA output on this channel.
5. For **Max**, enter the maximum value of interest. Any measurement at or above this value will correspond to a 20mA output on this channel.

6. Click **Save**.
7. Repeat for each channel.
8. Click **OK**.

After making any modifications on a Channel save or undo the changes as necessary.

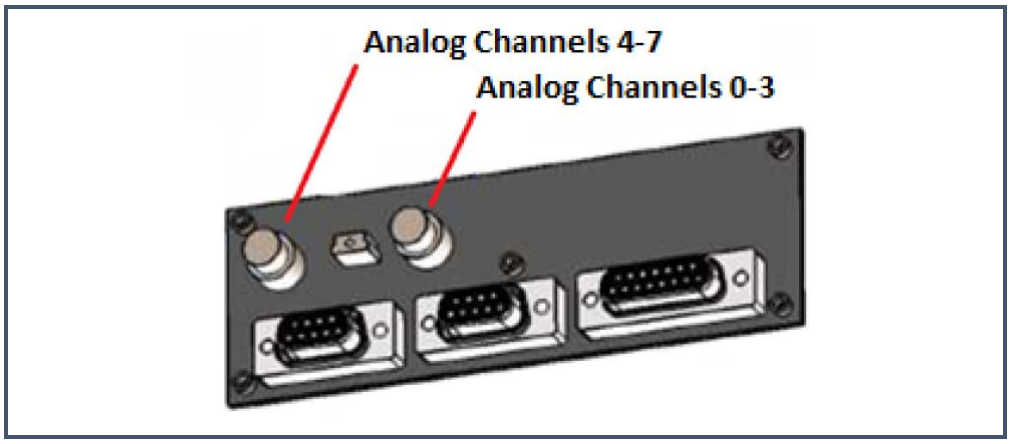
NOTE

Selecting the same output type over multiple channels enables different ranges of measurement (i.e., 0-100ppb H_2O_2 on Channel 0 and 0-1000ppb H_2O_2 on Channel 1).

8.7 Analog Signal Output

The PI2114 Analyzer is configured with an optional Electrical Interface Card (EIC) that provides 4 analog signals for monitoring various measurement results and analyzer parameters. Two circular connectors, on the back panel of the analyzer are available for analog output.

Figure 32: Analog Channel Connectors



Two external cables (for the analog channel connectors) are provided with the analyzer. The mating connector is part number HR25-7TP-8P(72)

Analog Signal Pin Mapping

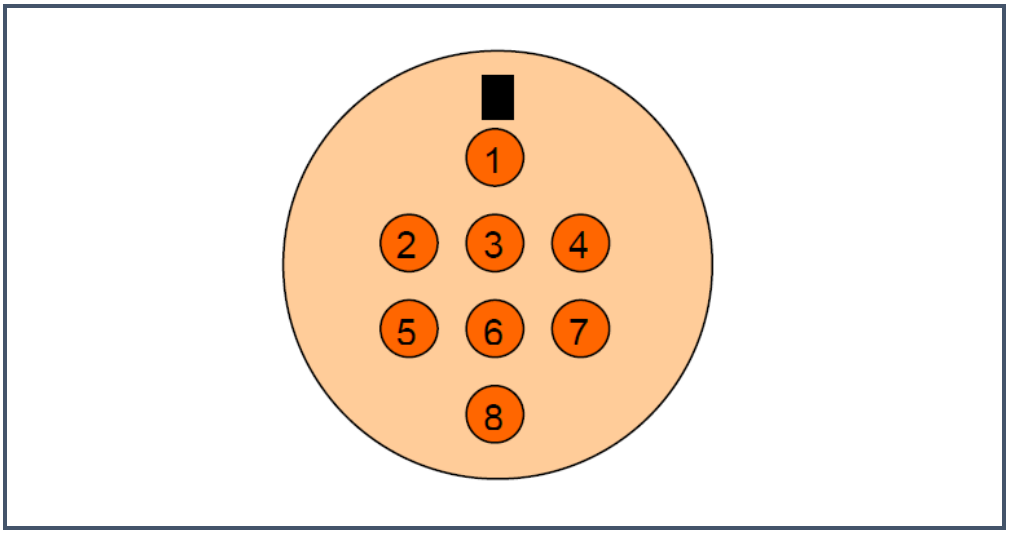
Analog Channels 0–3	
Pin	Function
1	GND 0
2	Channel 0

Analog Channels 4–7	
Pin	Function
1	GND 4
2	Channel 4

3	GND 1
4	Channel 1
5	GND 2
6	Channel 2
7	GND 3
8	Channel 3

3	GND 5
4	Channel 5
5	GND 6
6	Channel 6
7	GND 7
8	Channel 7

Figure 33: Analog Connector Pin Map



Default Parameter Configuration

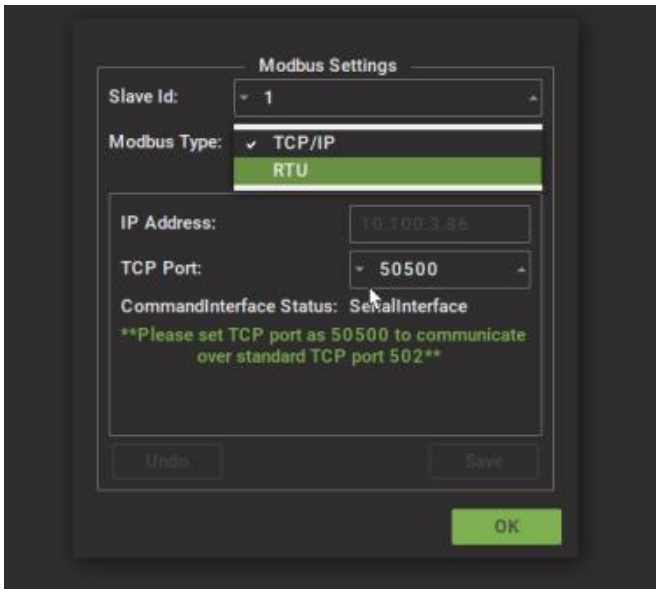
Channel	Parameter	Scale	Range
0	H_2O_2 Concentration	0–10V	0–10 ppm
1	H_2O_2 Concentration	0–10V	0–100 ppm
2	H_2O Concentration	0–10V	0–4%
3	DAS Temperature	0–10V	0–50C
4	None	N/A	N/A
5	None	N/A	N/A
6	None	N/A	N/A
7	None	N/A	N/A

8.8 Modbus Settings

From the Config Menu window, select Modbus. If Modbus is not an available option then please contact Picarro to have it enabled.

This will open the Modbus Settings window shown in Figure 34.

Figure 34: Modbus Settings Window



From this window, you can configure:

- The analyzer's Slave ID
- Modbus Communication Protocol: TCP/IP or RTU (See Appendix F: MODBUS Communication)
- TCP Port designation (if TCP/IP is selected)

Additionally, the window will display the CommandInterface Status. However, if Modus Type is set to "RTU", then the CommandInterface on COM 1 will be disabled

8.9 Modbus Communications

MODBUS Data Registers Overview

This section describes the basic types of MODBUS data registers and setup information.

MODBUS Register Types

Name	Size	Access
Input Register	16 bits	Read-only
Holding Register	16 bits	Read-write
Discrete Input	1 bit	Read-only
Coils	1 bit	Read-write

Setup Notes for MODBUS TCP

- MODBUS is configured for TCP/IP on port 50500.
- When MODBUS is configured on port 50500, communication is also possible via port 502.
- If MODBUS is configured as TCP/IP and the IP address of analyzer is changed, the user needs to restart the Host application to run MODBUS with the updated IP address.
- MODBUS over TCP/IP will not support privileged ports (0 to 1023), except for port 502.

Setup Notes for MODBUS RTU

- MODBUS RTU uses the analyzer's COM1 port
- To establish connection between Master and Slave over MODBUS RTU, user needs to establish connection using "Straight Through Cable".
- When MODBUS is configured for RTU, CommandInterface on COM1 will be disabled.

MODBUS Register Maps Overview

- Data returned is in big endian format if it utilizes more than one Modbus register.
- If input register functionality is not available for a given analyzer type, the instrument will return value as "NaN" for float values and "False" for 1-bit registers.
- Memory map is continuous memory. If a user tries to read a register address for which functionality is not available, it will return "0". For example, reading address 0 for coil registers will return "0" since the address does not exist.

- If a user tries to read a register address outside of maximum register memory map, the request will return an exception. For example, reading address 156 for coil register will return exception code “0x02” (Illegal address).
- System time is in "milliseconds Since 0001-01-01 AD"

Input Register Map

Most of the readings in Picarro analyzer are the float type and need 32-bit data. Each parameter utilizes 2 registers, out of which the first one will be storing MSB and the second one will be storing the LSB of the float number.

NOTE

All entries are floats unless otherwise noted.

Input Registers

Address	Description	Units	Type	Comments
0-5	Time stamp		String	Long value return as 12byte string. Date will be in format YYMMDDHHMMSS
6-7	H_2O_2 Concentration	ppb	float	
8-9	H_2O_2_ID	unitless	float	Gas ID code 14 identifies gas at register 7 as H_2O_2
10-11	H_2O_2, 30sec trailing average	ppb	float	
12-13	H_2O_2, 2min trailing average	ppb	float	
14-15	H_2O_2, 5min trailing average	ppb	float	
16-17	H_2O_2, max (full scale range)	ppb	float	Value is 100,000 ppb or 100 ppm
18-19	H_2O_2, min	ppb	float	Value set to 0
20-21	Concentration of H_2O	%	float	Water is measured in absolute %, not to be confused with relative humidity
22-23	H_2O_ID	unitless	float	Gas ID code 00 identifies gas at register 20 as H_2O

Address	Description	Units	Type	Comments
24-25	H_2O, 30sec trailing average	ppm	float	
26-27	H_2O, 2min trailing average	ppm	float	
28-29	H_2O, 5min trailing average	%	float	
30-31	H_2O, max (full scale range)	ppm	float	Value is 50,000 (5%)
32-33	H_2O, min	ppm	float	Value is set to 0
34-35	Concentration of CH_4	ppb	float	
36-37	CH_4_ID	unitless	float	Gas ID code 04 identifies has at register 34 as CH_4
38-39	CH_4, 30sec trailing average	ppb	float	
40-41	CH_4, 2min trailing average	ppb	float	
42-43	CH_4, 5min trailing average	ppb	float	
44-45	CH_4, max (full scale range)	ppm	float	Value is set at 200 ppm
46-47	CH_4, min	ppm	float	Value is set at 0
48-49	Reserved			
50-51	Reserved			
52-53	Reserved			
54-55	Reserved			
56-57	Reserved			
58-59	Reserved			
60-61	Reserved			
62-63	Reserved			
64-65	Reserved			
66-67	Reserved			
68-69	Reserved			
70-71	Reserved			
72-73	Reserved			

Address	Description	Units	Type	Comments
74-75	Reserved			
76-77	Reserved			
78-79	Reserved			
80-81	Reserved			
82-83	Reserved			
84-85	Reserved			
86-87	Reserved			
88-89	Reserved			
90-91	Reserved			
92-93	Reserved			
94-95	Reserved			
96-97	Reserved			
98-99	Reserved			
100-101	Reserved			
102-103	Reserved			
104-105	Reserved			
106-107	Reserved			
108-109	Reserved			
110-111	Reserved			
112-113	Reserved			
114-115	Reserved			
116-117	Reserved			
200-201	Cavity Pressure	Torr	float	
202-203	Cavity Temperature	deg C	float	
204-205	DAS Temperature	deg C	float	
206-207	Etalon Temperature	deg C	float	
208-209	Warm Box Temperature	deg C	float	
210-211	Outlet Valve	dig counts	float	

Address	Description	Units	Type	Comments
212-213	Instrument cal slope, H_2O_2		float	
214-215	Instrument cal offset, H_2O_2		float	
216-217	User cal slope, H_2O_2		float	
218-219	User cal offset, H_2O_2		float	
220-221	Instrument cal slope, H_2O		float	
222-223	Instrument cal offset, H_2O		float	
224-225	User cal slope, H_2O		float	
226-227	User cal offset, H_2O		float	
228-229	Instrument cal slope, CH_4		float	
230-231	Instrument cal offset, CH_4		float	
232-233	User cal slope, CH_4		float	
234-235	User cal offset, CH_4		float	
236-237	Reserved			
238-239	Reserved			
240-241	Reserved			
242-243	Reserved			
244-245	Reserved			
246-247	Reserved			
248-249	Reserved			
250-251	Reserved			
252-253	Reserved			
254-255	Reserved			
256-257	Reserved			
258-259	Reserved			

Address	Description	Units	Type	Comments
260-261	Reserved			
262-263	Reserved			
264-265	Reserved			
266-267	Reserved			
268-269	Reserved			
270-271	Reserved			
272-273	Reserved			
274-275	Reserved			

Address	Description	Type	Comments
386	Error code	int	Error for each control command of COIL • NO_ERROR = 0 • ERROR_HANDLER_ERROR = 1 • ERROR = 2 • NO_SUDO_USER_PRIVILEGE = 3 • NO_USER_EXIST = 7 • USERNAME_PASSWORD_INCORRECT = 9 • USER_DISABLED = 10 • ADMIN_RIGHT_REQUIRES = 11 • PASSWORD_LENGTH_ERROR = 12 • PASSWORD_FORMATE_ERROR = 13 • PASSWORD_REUSE_ERROR = 14
387	Measurement status	int	ledState = 0 red, system error, gas conc. measurements invalid ledState = 1 solid yellow, need service, gas conc. measurements might be ok ledState = 2 blinking yellow, not in reporting mode by system ok, like during warmup ledState = 3 green, system ok, gas conc. measurements accurate

Discrete Input Register Map

NOTE

All entries are floats unless otherwise noted.

Discrete Input Registers

Address	Description
5	Pressure locked
6	Cavity temperature locked
7	Warm box temperature locked
72	Reserved
73	Reserved
74	Reserved
75	Reserved
76	Reserved
77	Reserved
78	Reserved
79	Reserved
80	Reserved
81	Reserved
82	Reserved
83	Reserved
84	Reserved
85	Reserved
86	Reserved
87	Reserved
88	Reserved
89	Reserved
90	Reserved
91	Reserved
92	Reserved
93	Reserved
94	Reserved
95	Reserved

Holding Register Map

Holding Register

Address	Description	Units	Type	Comments
0-3	System time		int	Integer representing milliseconds from 1AD January 1st to now
4-7	User Name		String	
8-11	Password		String	
200-201	User data 1		Float	
202-203	User data 2		Float	
204-205	User data 3		Float	
206-207	User data 4		Float	
208-209	User data 5		Float	
210-211	User data 6		Float	
212-213	User data 7		Float	
214-215	User data 8		Float	
216-217	User data 9		Float	
218-219	User data 10		Float	
220-221	User data 11		Float	
222-223	User data 12		Float	
224-225	User data 13		Float	
226-227	User data 14		Float	
228-229	User data 15		Float	
230-231	User data 16		Float	
232-233	User data 17		Float	
234-235	User data 18		Float	
236-237	User data 19		Float	
238-239	User data 20		Float	

Coil Register Map

Coil Registers

Address	Description	Units	Comments
115	Quit host application		
116	Shutdown Instrument		It will take approximately 2 min to shutdown
150	Get system time		After this please read Sync Time holding register
153	User login (Coming in near future)		Before executing this command, user need to set user name and user password holding register
154	Update user password (Coming in near future)		Before executing this command follow below steps: 1) Login as admin using User Login functionality if not logged in already 2) Set user name and password holding register
155	User logout (Coming in near future)		
200	Get User data 1		
201	Set User data 1		
202	Get User data 2		
203	Set User data 2		
204	Get User data 3		
205	Set User data 3		
206	Get User data 4		
207	Set User data 4		
208	Get User data 5		
209	Set User data 5		
210	Get User data 6		
211	Set User data 6		
212	Get User data 7		
213	Set User data 7		
214	Get User data 8		

Address	Description	Units	Comments
215	Set User data 8		
216	Get User data 9		
217	Set User data 9		
218	Get User data 10		
219	Set User data 10		
220	Get User data 11		
221	Set User data 11		
222	Get User data 12		
223	Set User data 12		
224	Get User data 13		
225	Set User data 13		
226	Get User data 14		
227	Set User data 14		
228	Get User data 15		
229	Set User data 15		
230	Get User data 16		
231	Set User data 16		
232	Get User data 17		
233	Set User data 17		
234	Get User data 18		
235	Set User data 18		
236	Get User data 19		
237	Set User data 19		
238	Get User data 20		
239	Set User data 20		

Note:

- Data is in big-endian format if it utilizes more than one Modbus register
- If input register functionality is not available for analyzer type, analyzer will return value as NaN for float values
- Registers in Red are coming in near future

- Memory map is continuous memory, so if user try to read address for which functionality is not available it will return 0 (for example reading address 0 for coil register)
- If user tries to read address outside of maximum register memory map, request will be exception (for example reading address 156 for coil register)

Gas ID Map

The Gas ID input registers return a two-digit code to identify the gas species being measured.

Gas ID Map

Address	Species	Description
00	H_2O	Water
01	NH_3	Ammonia
02	H_2S	Hydrogen sulfide
03	CO_2	Carbon dioxide
04	CH_4	Methane
05	CO	Carbon monoxide
06	C_2H_2	Acetylene
07	C_2H_4	Ethylene
08	N_2O	Nitrous oxide
09	CH_2O	Formaldehyde
10	HF	Hydrogen fluoride
11	O_2	Oxygen
12	HCl	Hydrogen chloride
13	C_2H_6	Ethane
14	H_2O_2	Hydrogen peroxide

9. Maintenance

9.1 Consumables and Replacement Parts

The following parts can be ordered directly from Picarro as needed over the lifetime of the analyzer. For contact information please see page 97.

Part Number	Description	Expected Servicing Frequency
S1020	Particulate filter kit for input sample line	After 12 months
S2009	Rebuild kit for A2000 Pump	After 15,000 hours
S2175	Complete fan replacement kit	After 2-3 years
A2000	External vacuum pump	After 40,000 hours

9.2 Case Fan Assembly Replacement

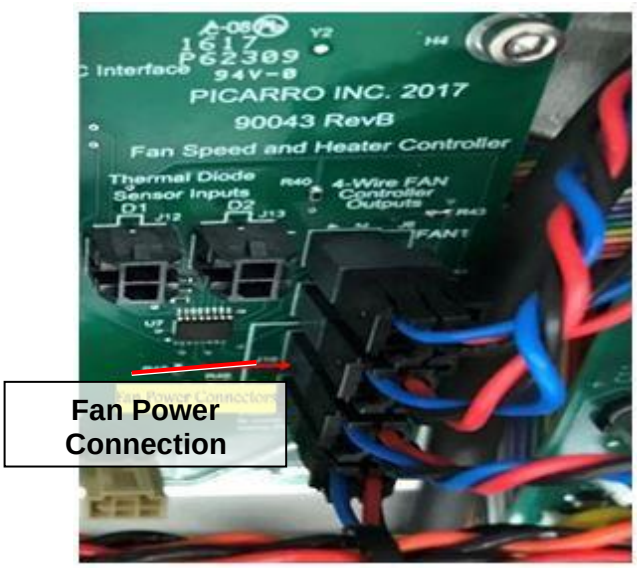
Items/Tools Required:

- 2 mm Hex driver
- ¼" open end wrench

Procedure:

1. Completely power down the instrument
2. There are total of four case top fan Assembly 60 mm and 40 mm respectively on the top and bottom of the instrument.

Figure 34: Case Fan Power Connection



3. Flip the analyzer so that it rests upside Down & the bottom layer is accessible open the bottom cover using 2 mm hex drive.
4. Locate the PCBA. Safely remove the power connectors out from the PCBA.
5. Locate the 40 mm fan assembly. Use 1/4" wrench to remove all the four screws and replace with the new fan.

Figure 35: Case Fan Assembly

6. Same procedure should be followed to replace the top side fan assembly. After disconnecting the power connectors on the back panel PCBA, flip it over to remove the front cover.
7. Locate the 60 mm fan assembly and replace with the new fan assembly.

9.3 Hard Drive Replacement

Items/Tools Required:

- 2.5 mm Hex drive
- 2 mm Hex driver
- Phillips Screwdriver
- Static wrist-strap
- Static wrist-strap

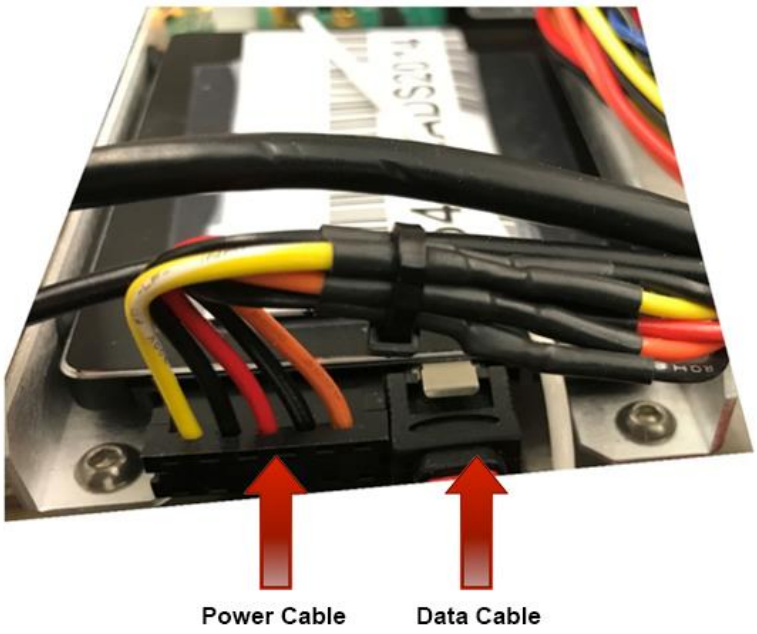
CAUTION

The analyzer must be powered off. Line power must be unplugged and Static wrist-strap needs to be worn for grounding yourself to protect the instrument electronics.

Procedure:

1. Completely power down the instrument
2. Flip the analyzer so that it rests upside down & the bottom cover is accessible
3. Open the bottom cover, using 2 mm hex drive
4. Locate the Hard drive. Safely remove the data and power connectors out from the drive.

Figure 36: Hard Drive Power Cable and Data Cable Location



5. Using 2.5 mm hex key unscrew all four corner screws and lift the Hard drive assembly out. Using Phillips Screwdriver unscrew all the four side screws holding the hard drive assembly and replace with the new hard drive.

9.4 CPU Fan Replacement

Items/Tools Required:

- 2.5 mm Hex driver
- Phillips Screwdriver

Procedure:

1. Completely shut down the instrument
2. Flip the analyzer so that it rests upside-down & the bottom layer is accessible
3. Open the bottom cover.
4. Locate the Mother Board. Locate the CPU fan, unscrew all four corner screws and Replace with the new fan.

Figure 37: CPU Fan

9.5 Filter Replacement

Overview

Picarro analyzers require minimal service or maintenance. Except for changing a particulate filter, the analyzer is not user serviceable.

Gasses are filtered by two in-line, sub-micron particulate filters before reaching the measurement cavity. Only one of these filters, the outer filter, is user-serviceable. Contact Picarro to obtain a replacement filter.

CAUTION

The inner filter is inside the analyzer's internal hot box and is NOT user replaceable. Do NOT open the hot box. If you suspect the inner filter is clogged, contact Picarro for replacement by a Picarro-certified technician. USER REPLACEMENT OF THE INNER FILTER OR BREAKING THE ANTI-TAMPER TAPE ON THE INNER FILTER VOIDS THE WARRANTY.

Symptoms of a Clogged Filter

Filters can become clogged with continual use.

If liquid is sucked into the inlet line, it may clog the filter and impede the flow (usually for a few days) until it evaporates.

Some symptoms of a clogged filter are:

- The analyzer pressure is low.
- Unusual measurements.
- Response time is slower than usual.

If You Suspect a Wet Filter

Do NOT turn off the analyzer when a filter is wet. Liquid in the filter can cause condensation on the optics if the analyzer is allowed to cool.

- Dry the filter by running Clean Dry Air (CDA) through the analyzer. If the analyzer functions normally after drying, a filter replacement is not necessary.
- If drying the filter does not fix the problem, replace the filter.

Required Tools

Make sure you have these tools before starting the filter replacement:

- $^{7}/_{8}$" open-end wrench
- $^{9}/_{16}$" open-end wrench
- Needle-nosed pliers

- 2 mm hex wrench

Safety Requirements

Follow the safety precautions as described in Section 1, “User Safety.”

Remove the Old Particulate Filter

1. Shut down the analyzer (see page 32).
2. Wait for the indicator on the front panel to turn off.
3. Turn off the vacuum pump.
4. Disconnect the pump and any input gases.
5. Disconnect the AC power cable from the back of the instrument.
6. Disconnect any monitor, keyboard, or mouse that may be connected.
7. If necessary, move the analyzer to a clean work environment.

WARNING

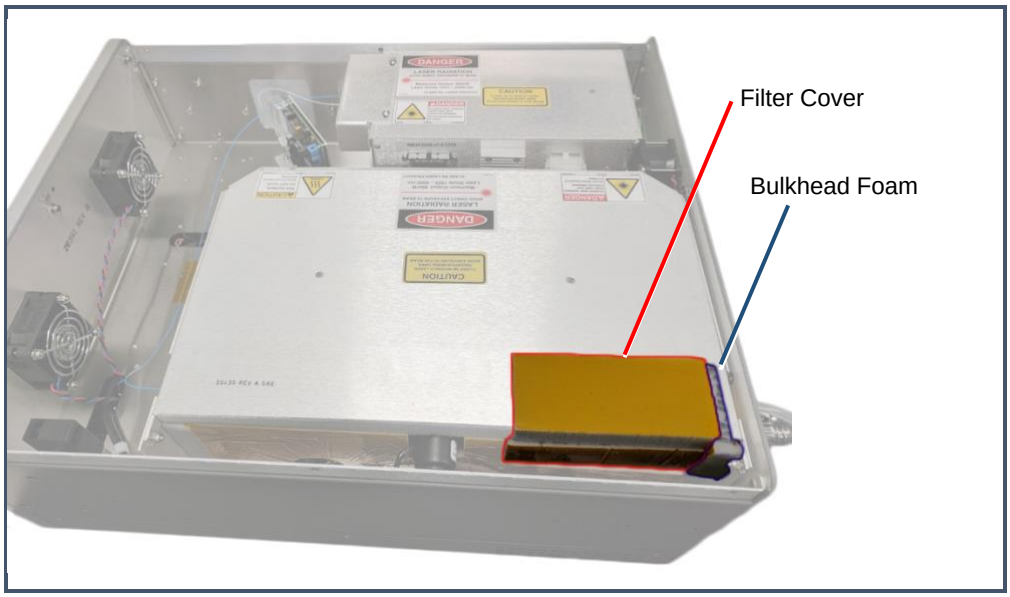
This analyzer weighs 48 lbs. Lifting it is a two-person job. Use the technique outlined in the General Safety section on page 7 when lifting or moving the analyzer.

8. Use a 2 mm hex wrench to remove the top lid’s six M3 x 6 mm socket flathead screws (three screws per side).

Figure 38: Lid Screws (right side)

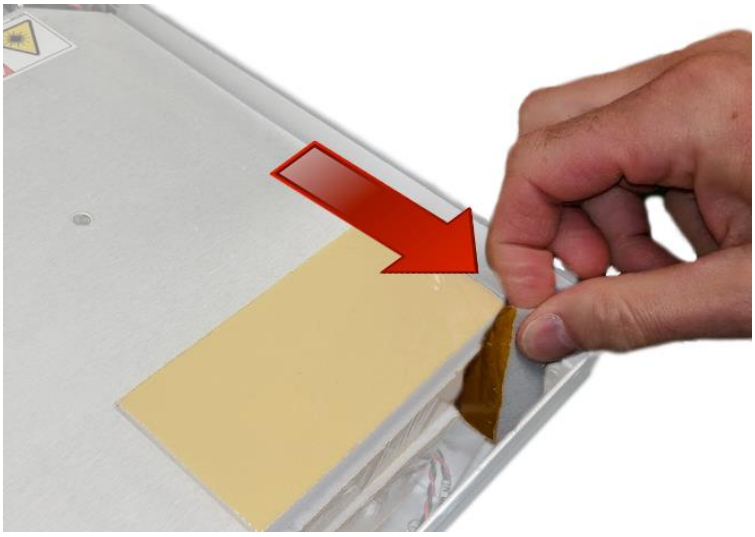
9. Lift the top cover off the analyzer. This will reveal the bulkhead foam and filter cover.

Figure 39: Filter Cover and Bulkhead Foam



10. Carefully slide the bulkhead foam to the side of the analyzer, and then lift it up and out. This will reveal the *Jam Nut*.

Figure 40: Removing the Bulkhead Foam

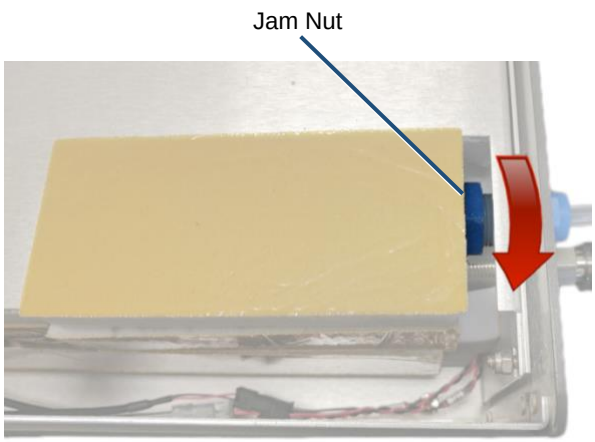


CAUTION

Be careful not to tear the foam when sliding it to the side and lifting it out of the analyzer.

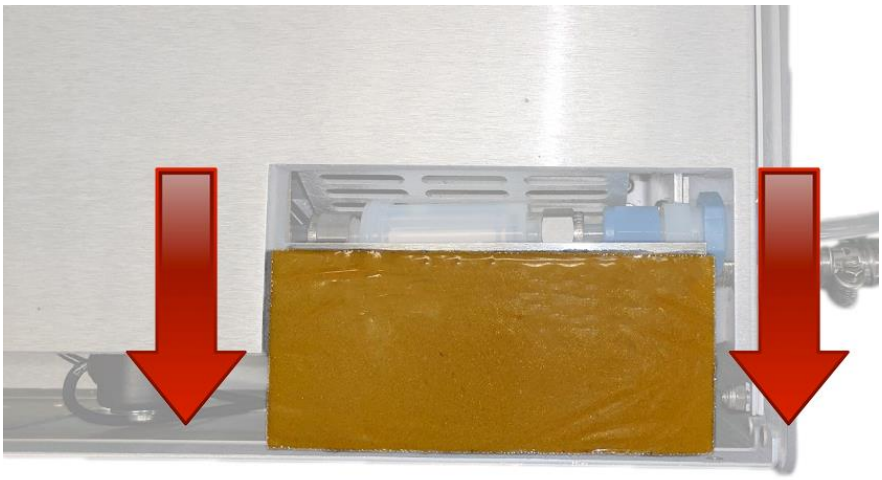
11. Use the $^{7}/_{8}$" wrench to loosen the jam nut enough that the filter cover can slide free (about 1 full turn should be enough).

Figure 41: Loosening the Jam Nut



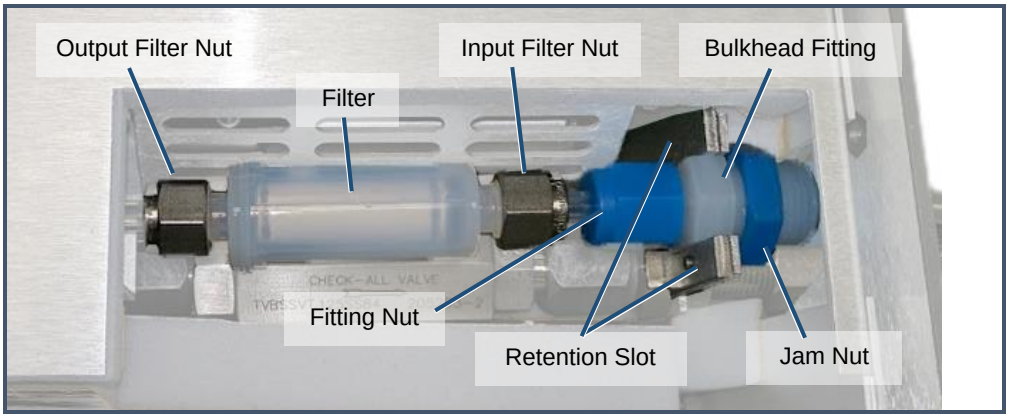
12. With the jam nut loose, slide the filter cover towards the side of the analyzer and then lift up to remove it.

Figure 42: Removing the filter cover



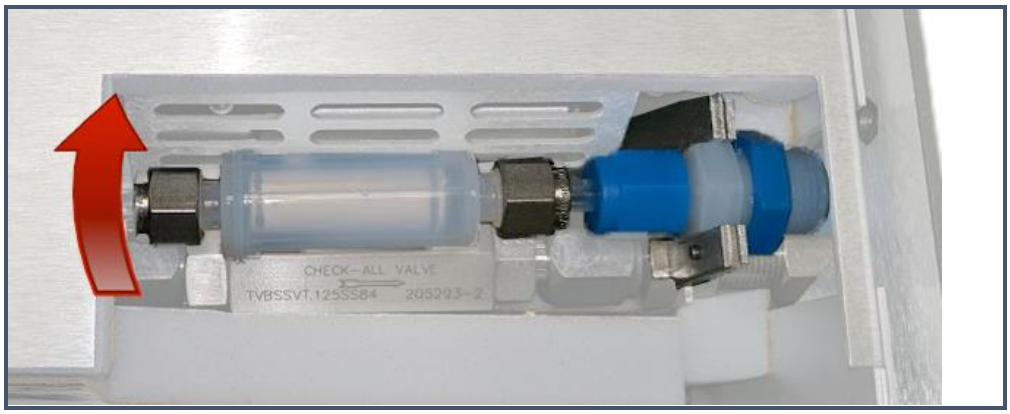
Removing the filter cover will reveal the filter assembly:

Figure 43: Filter assembly



13. Use the needle nose pliers to hold the filter while using the $^{9}/_{16}$" wrench to unscrew the Output Filter Nut. (Once loosened with the wrench, it may be easier to unscrew the nut by hand.)

Figure 44: Loosen the Output Filter Nut



14. Use the needle nose pliers to hold the filter while using the $^{9}/_{16}$" wrench to unscrew the Input Filter Nut. (Once loosened with the wrench, it may be easier to unscrew the nut by hand.)

Figure 45: Loosen the Input Filter Nut

15. Shift the filter assembly towards the back of the analyzer until there is enough room to pull the filter out. (The Fitting Nut will fit through the Retention Slot, although it may require a little twist to get it oriented correctly.)
16. Pull the filter out and dispose of it appropriately.
17. Inspect the ferrules in both the input and output nuts. If they show signs of wear, they should be replaced before installing the new filter.

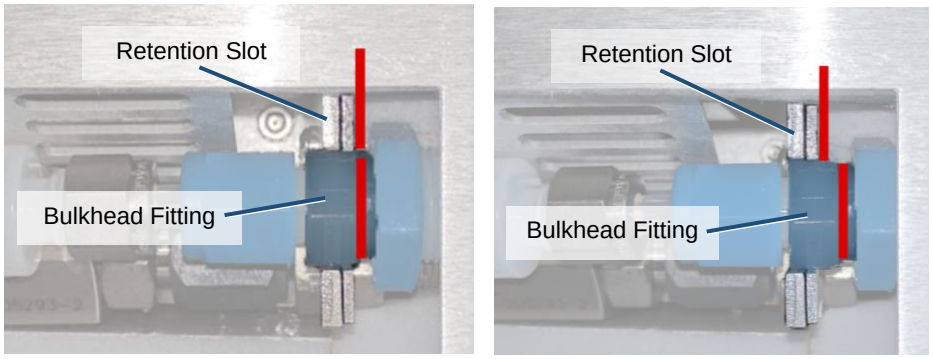
Install the New Filter

1. Remove the new filter from its packaging.
2. Thread the output end of the new filter (the end with the wide flange) into the Output Filter Nut until finger tight. Be careful to avoid cross-threading.

Figure 46: Filter orientation

3. Shift the Bulkhead fitting towards the filter and thread the Input Filter Nut onto the input end of the filter until finger tight. Be careful to avoid cross-threading.
4. Use the needle nose pliers to hold the filter while using the $^{9}/_{16}$" wrench to tighten the Input Filter Nut about one flat (60 degrees).
5. Use the needle nose pliers to hold the filter while using the $^{9}/_{16}$" wrench to tighten the Output Filter Nut about one flat (60 degrees).
6. Shift the filter assembly so that the Bulkhead Fitting is approximately flush with the back of the Retention Slot:

Figure 47: Aligning the filter assembly



7. Reposition the filter cover over the filter assembly.
8. Use the $^{7}/_{8}$" wrench to retighten the Jam Nut.
9. Reposition the Bulkhead Foam around the Bulkhead Fitting.
10. Replace the lid on top of the analyzer.
11. Use the 2 mm hex driver to fasten the lid to the analyzer with the six lid screws (three on each side).

9.6 Replacing Vacuum Diaphragms and Valves

CAUTION

Never operate the pump if covers or other parts of the pump are disassembled. Never operate a defective or damaged pump. Check every motor capacitor regularly by measuring its capacity and estimating its service life. See A2000 Pump Manual for more information and servicing instructions.

Overview

The valves and diaphragms as well as the motor capacitors are wear parts. If the rated ultimate vacuum is no long achieved or in case of increased noise level, the pump interior, the diaphragms and the valves mist be cleaned and checked for cracks or other damage.

All bearings are encapsulated and are filled with long-life lubricant. Under normal operating conditions, the drive system is maintenance free. In demanding circumstances, it may be efficient to check and clean the pump heads on a regular basis. In normal use, the lifetime of the diaphragms and valves is typically 15,000 operating hours.

CAUTION

Prevent internal condensation, transfer of liquids or dust. The diaphragms and valves will be damaged if liquid is pumped in significant amount. Carry out maintenance frequently if the pump is exposed to corrosive media or in case of deposits.

CAUTION

Service only one side of the pump at a time to avoid the mixing of parts.

Required Tools

A Pump Rebuild Kit (part number S2009) can be ordered directly from Picarro and includes 4 diaphragms, 8 valves, a 46 mm diaphragm key, and a silicone rubber tube for the pump's silencer.

In addition to the above, you will also need the following tools:

- 15 mm open-end wrench
- 4 mm Allen key
- Phillips screwdriver size 2

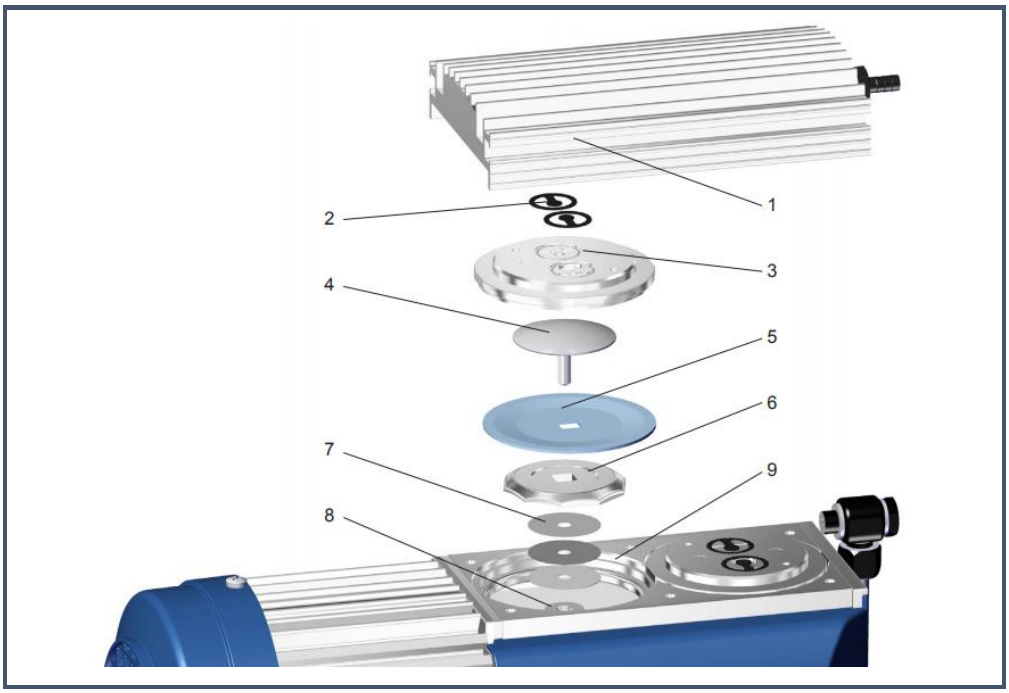
Safety Requirements

Follow the safety precautions as described in Section 1, “User Safety.”

Checking Diaphragms and Valves

Before starting the procedure, familiarize yourself with the different parts involved as outlined below:

Figure 48: Diagram of the diaphragms and valves in A2000



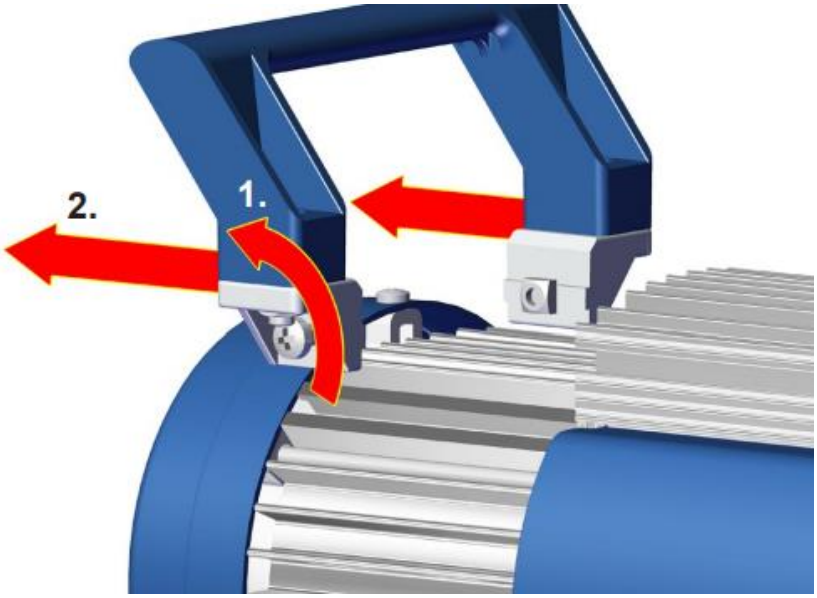
Position	Component
1	Housing cover
2	Valves
3	Head cover
4	Diaphragm clamping disc with square head screw
5	Diaphragm
6	Diaphragm support disc
7	Washers
8	Connecting rod
9	Housing

1. Use the 15 mm open end wrench to loosen the nut holding on the housing cover.

Figure 49: Loosen the nut securing the housing cover

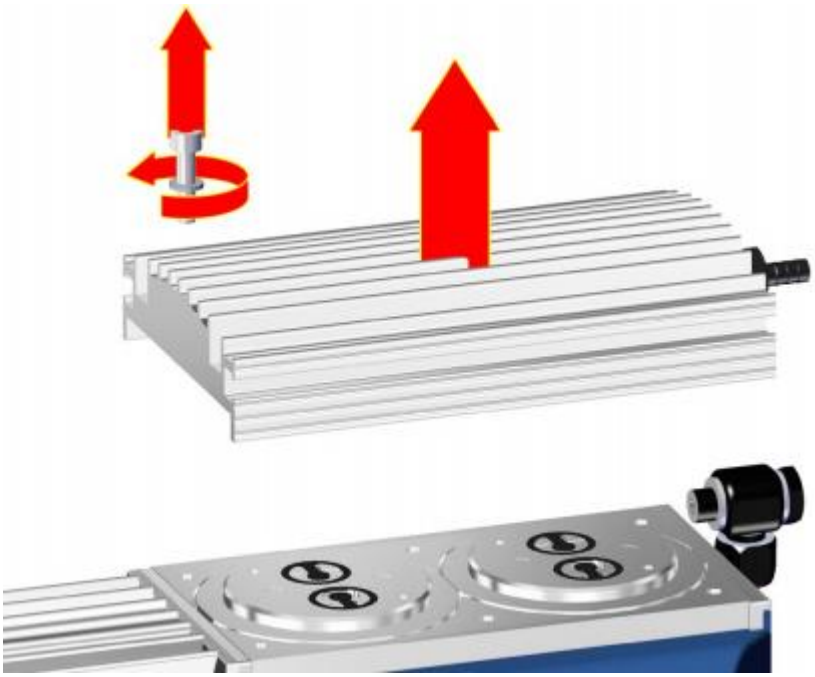
2. With the Phillips screwdriver, remove the two screws at the base of the pump handle and then carefully dislodge and remove the handle.

Figure 50: Removing the handle



3. Using the 4 mm Allen key, loosen and remove the 6 screws in the housing cover.
4. Remove the housing cover and set aside.

Figure 51: Remove the housing screws and then the housing cover



5. Remove the head cover and valves you would like to inspect. It is recommended to only service one side at a time.

Figure 52: Visually inspect the valves

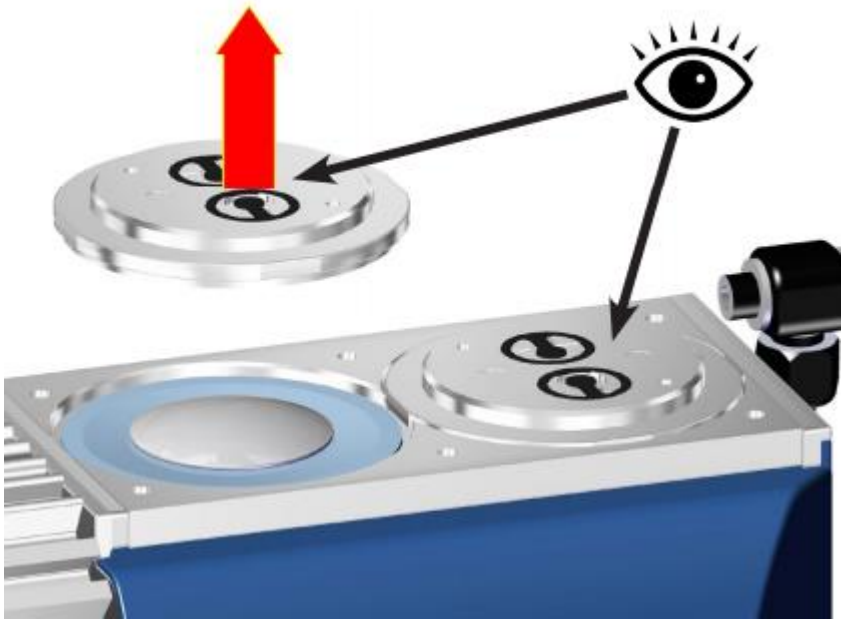
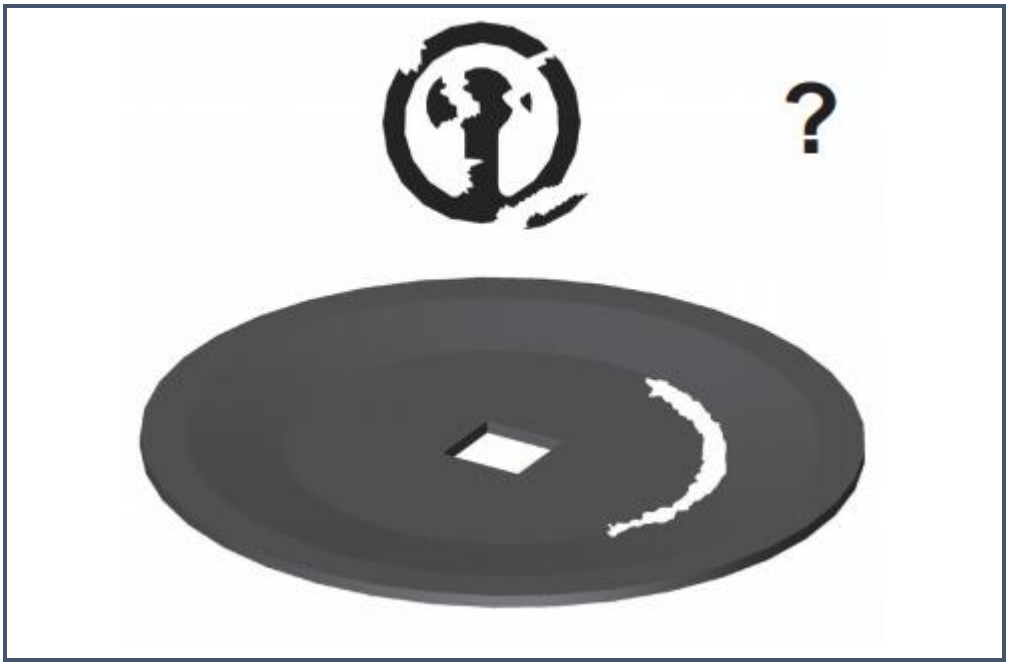


Figure 53: Removing the valves from the head cover

6. Carefully remove the valves and clean if necessary. Do not use sharp instruments to remove the valves. If the valves appear worn or show damage, replace with new valves provided in the S2009 Pump Rebuild Kit.

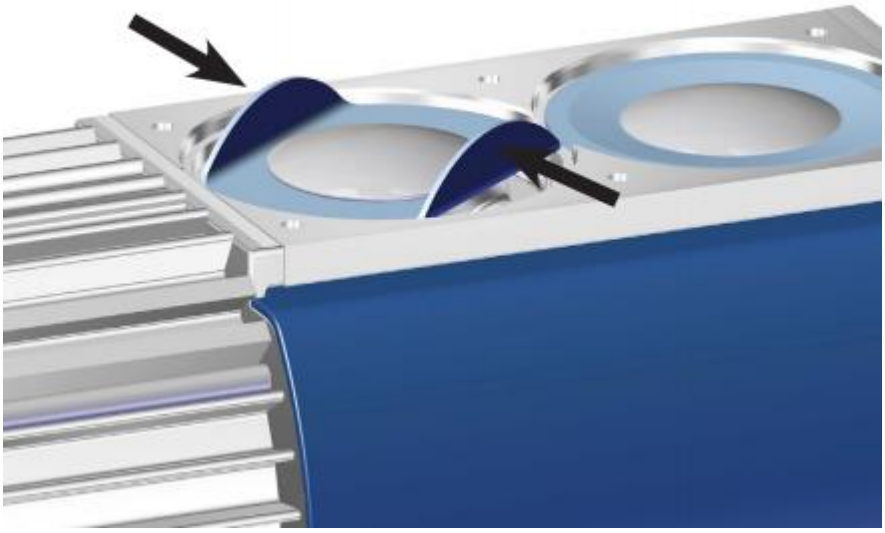
Figure 54: Signs of damage to the valves and diaphragm



Replacing the Diaphragm

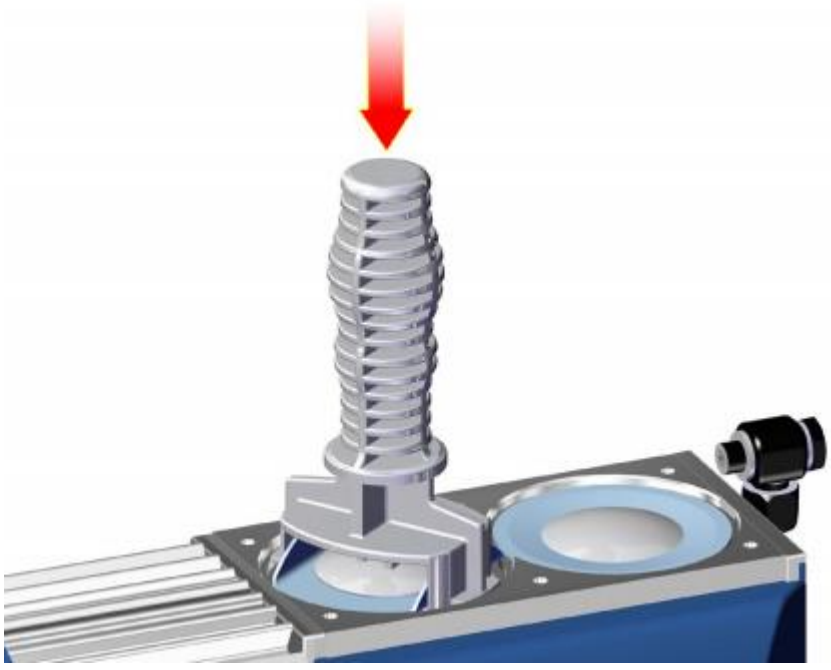
1. Carefully fold in the edges of the diaphragm to reveal the diaphragm support disc below. Do not use any sharp tools as this can damage the diaphragm.

Figure 55: Lift the edges of the diaphragm



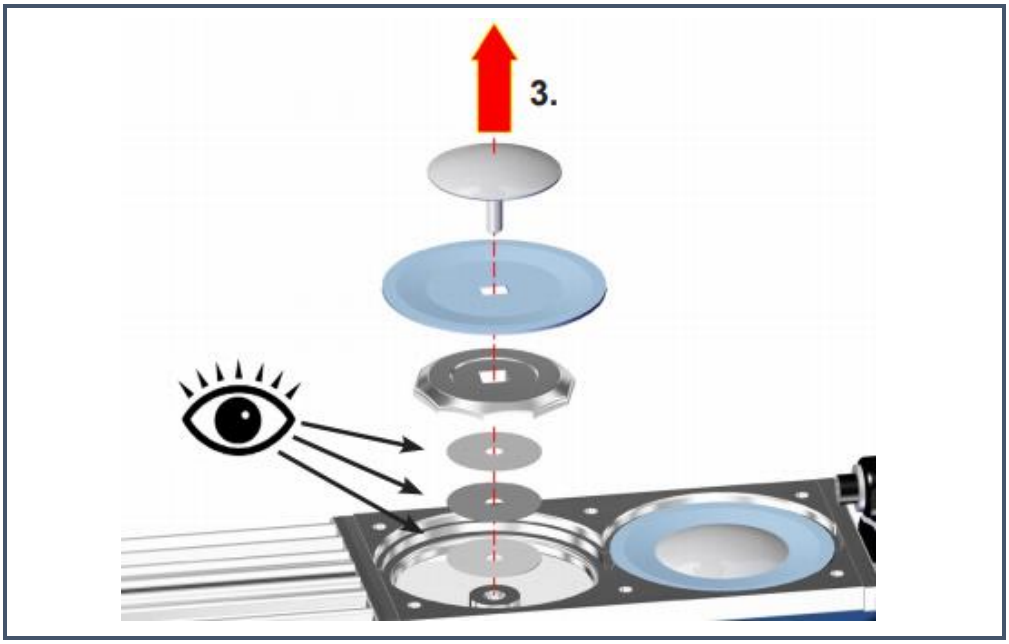
2. Align the 46 mm diaphragm key with the edges of the diaphragm support disc.

Figure 56: Align the diaphragm key



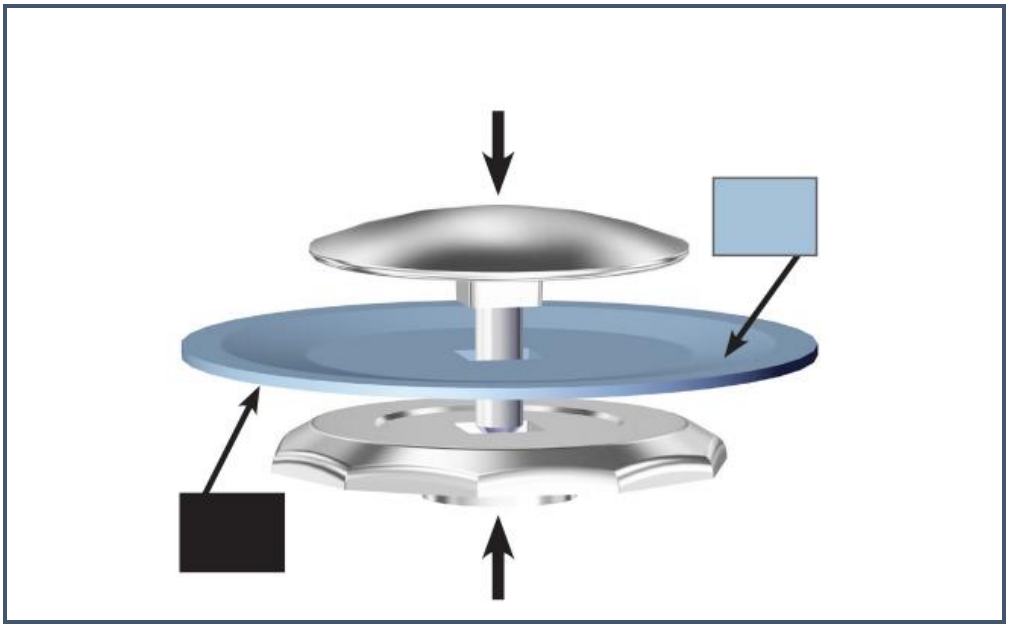
3. Apply pressure on the diaphragm key and turn counter clockwise to release the diaphragm clamping disc. As you remove the components be sure to note the order they are removed in and the number of washers.

Figure 57: Order of components beneath the diaphragm clamping disc



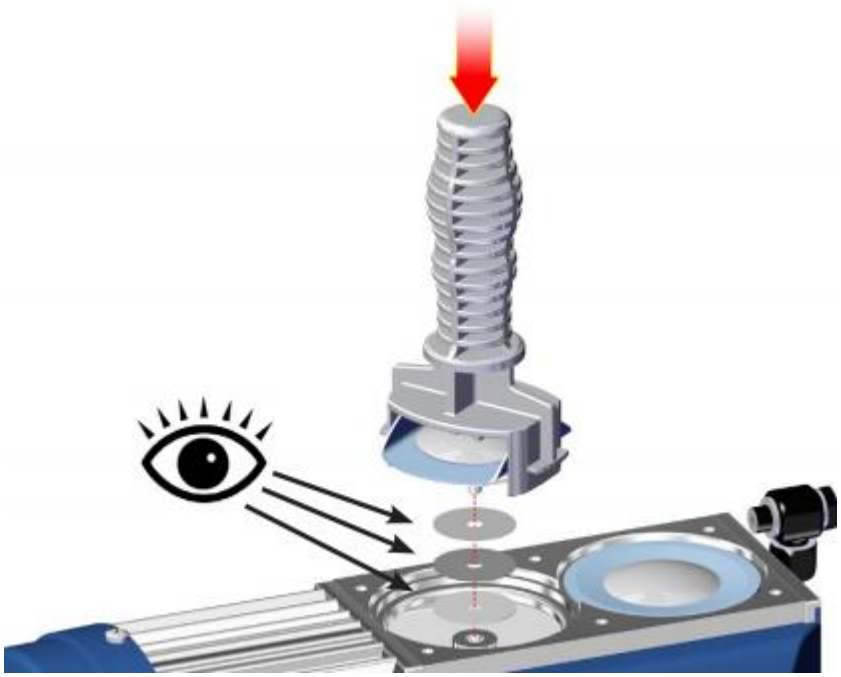
4. Replace the old diaphragm making sure to place it with the blue side of the diaphragm facing the diaphragm clamping disc.

Figure 58: Correct diaphragm orientation



5. Align the square head of the diaphragm clamping disc with the opening on the diaphragm support disc and make sure it is properly seated.
6. Replace any washers as necessary.
7. Using the diaphragm key, locate the connecting rod and reseat the diaphragm clamping disc, diaphragm, and diaphragm support disc.

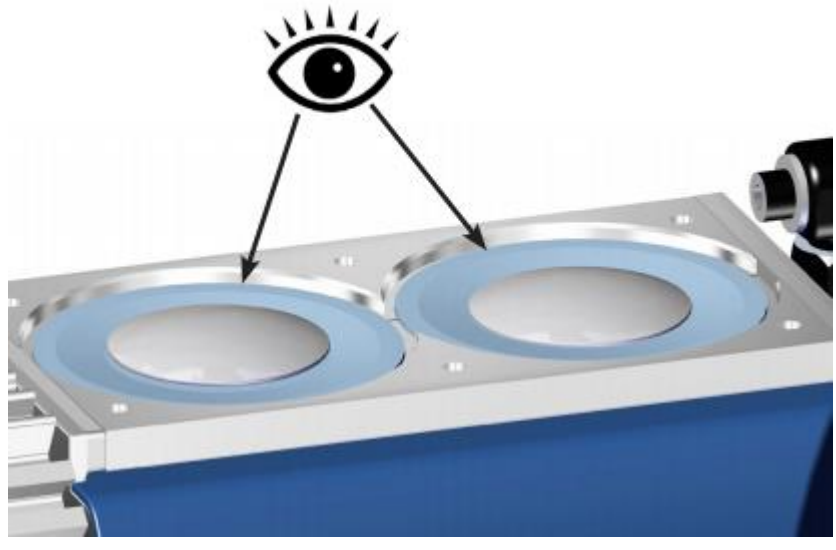
Figure 59: Confirm the number of washers



8. Apply pressure and turn the diaphragm key clockwise to secure the components.

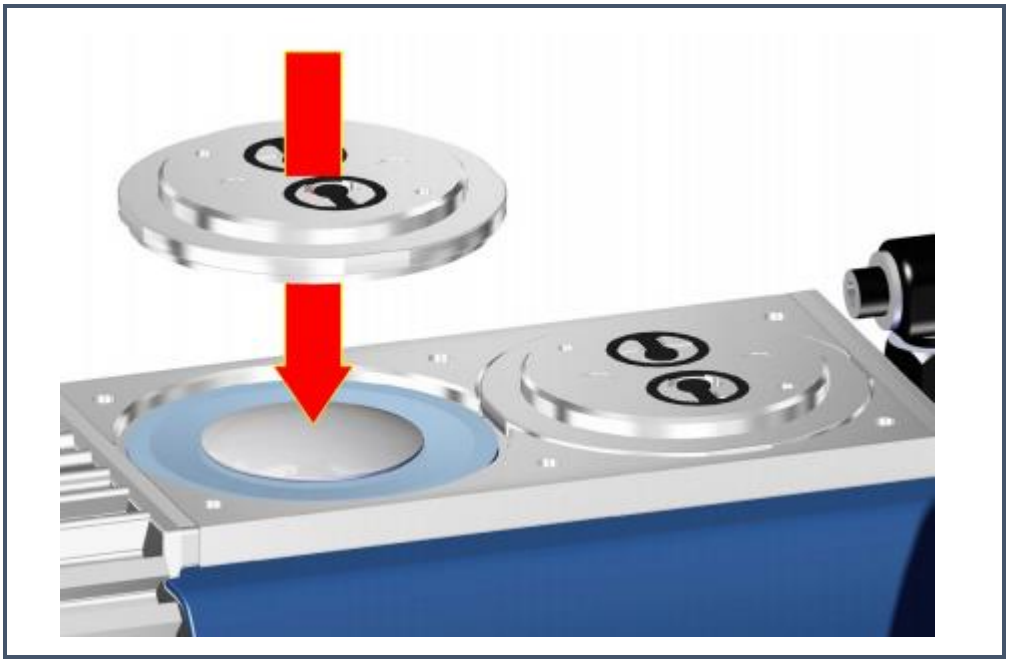
Replacing the Valves and Assembling Pump Heads

Figure 60: Visually inspect diaphragms



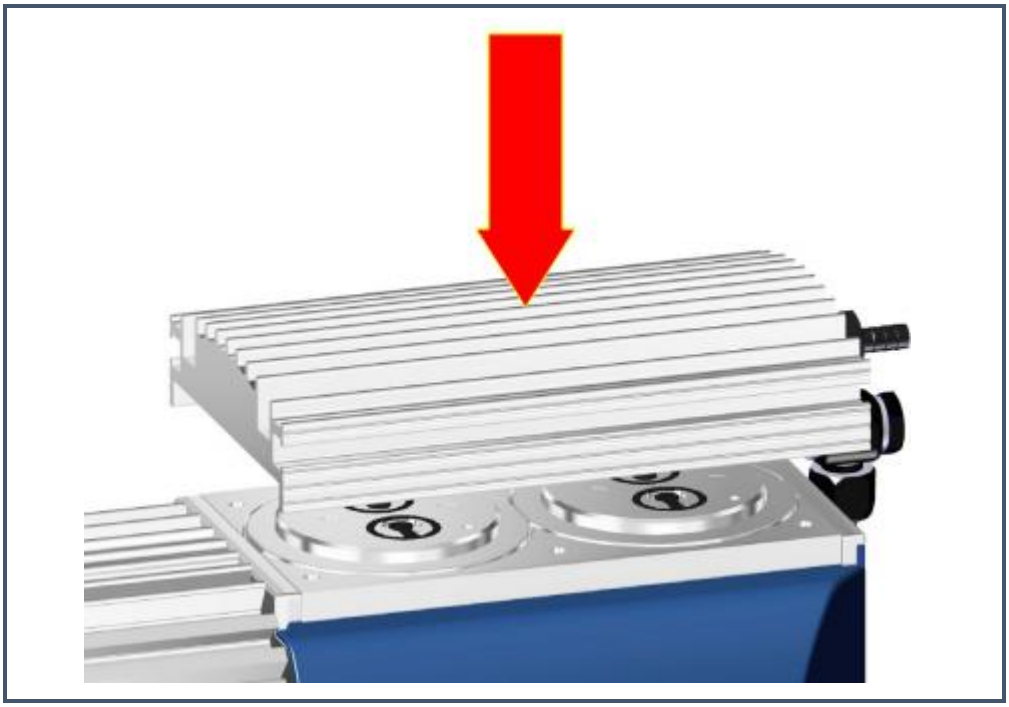
1. Visually inspect both diaphragms, they should be properly seated and locked in prior to replacing the head covers.

Figure 61: Replace head covers above diaphragms



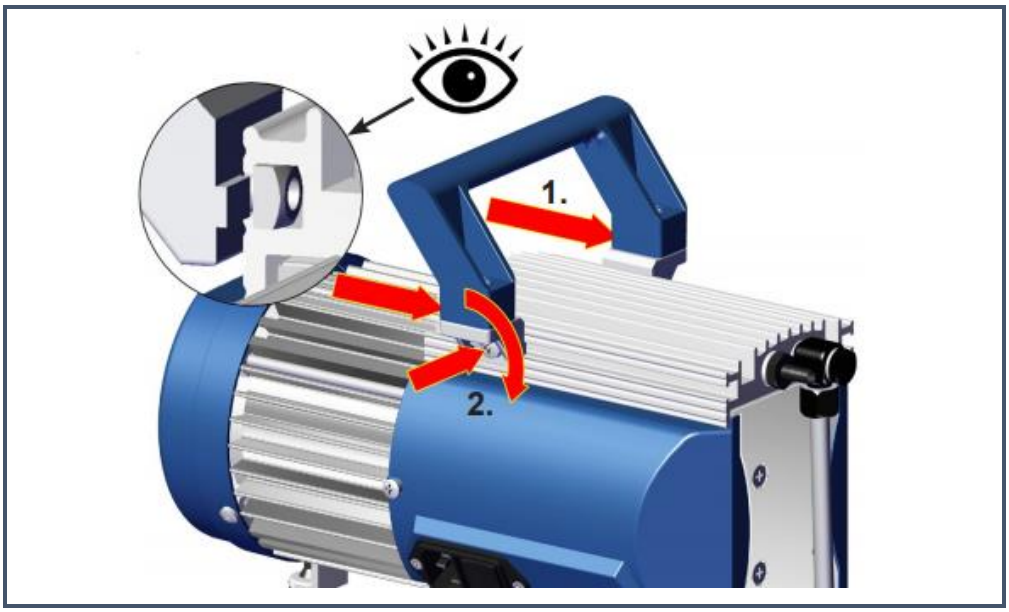
2. Replace the head covers and valves over the diaphragm clamping discs.

Figure 62: Replace housing cover



3. Replace the housing cover.
4. Align the housing cover with the screw holes in the housing.
5. Replace all six screws. Screw in manually at first and then use the 4 mm Allen key to tighten.
6. Use the 15 mm open end wrench to tighten the nut connecting the housing and housing cover.

Figure 63: Replace handle and align screws



7. Reseat the handle on top of the housing cover and align the screw holes.
8. Use the size 2 Phillips screwdriver to screw and tighten both screws at the base of the handle.
9. Make sure that the edge of the handle does not hang over the edge of the housing cover as you tighten the screws.

Checking the Ultimate Vacuum

After any intervention at the equipment (e.g., repair or maintenance) the ultimate vacuum of the pump has to be checked. Only if the pump achieves its specified ultimate vacuum, the pump's leak rate is low enough to ensure that no explosive atmospheres will occur in the interior of the equipment.

If the pump does not achieve the ultimate vacuum:

- Whenever the diaphragms and valves have been replaced, a break-in period of several hours is required before the pump achieves its ultimate vacuum.
- In case of an unusual noise, switch off pump immediately and check camping disc positions.
- If the ultimate vacuum is not achieved after break-in period, check hose connectors at pump heads for leaks.
- If necessary, recheck valve seats and pump chambers.

10. Surrogate Gas Validation Procedure

10.1 Validation Overview

The Surrogate Gas Validation Procedure is a method to validate the existing calibration of the instrument without having to use the actual gas the instrument is tuned to measure. The surrogate gas operates close to the same spectral line of the targeted gas the gas analyzer is tuned to measure. Users must obtain the MSDS for sample gasses from their respective suppliers.

CAUTION

The procedure shall be performed in a location with adequate ventilation and air exchanges.

When required, the validation procedure can test that the instrument is operating as expected.

Validation is performed using low-concentration methane (CH_4) in place of hydrogen peroxide. Methane has the following advantageous characteristics:

- Available as a certified, NIST-traceable standard
- Non-hazardous at relevant concentrations.
- Stable indefinitely.
- Gaseous across the operational range of the instrument.
- Has an absorption feature immediately adjacent to H_2O_2.

The validation procedure is based on sequentially introducing zero air and three methane standards. The H_2O_2 signal in zero air is measured to evaluate the zero offset for the H_2O_2 spectroscopic model.

Separately, the methane concentrations in zero air and in each standard cylinder are measured, and a linear regression is calculated to demonstrate the linearity and zero-accuracy of the analyzer. As any system performance problems that would affect the accuracy of the H_2O_2 slope (span) will likewise affect the slope for methane, this procedure provides a means of rapidly validating system performance using certified standards.

It will take approximately 60 minutes for data acquisition and analysis.

10.2 Required Supplies

Instrument validation requires the following:

- **Four cylinders of input gases:**
  - **One cylinder of zero air** (dry synthetic hydrocarbon-free air).
  - **Three methane standard cylinders**. Three cylinders of methane, each with a different concentration, certified within +/- 2% composition uncertainty. We recommend concentrations of 2, 10, and 100ppm.
- **Four regulators** (one for each cylinder being used). Each regulator should be capable of accurately delivering 2–3 psi (0.1–0.2 bar) of line pressure.
- **Sufficient tubing to connect the regulator(s) to the instrument.** We recommend using ¼" OD PTFE or PFA tubing when working with hydrogen peroxide. While not required for work with methane, we recommend using the same material in this procedure to avoid inadvertent use of inappropriate tubing in later work with hydrogen peroxide.
- Suitable adjustable or fixed wrenches for making gas-line connections.

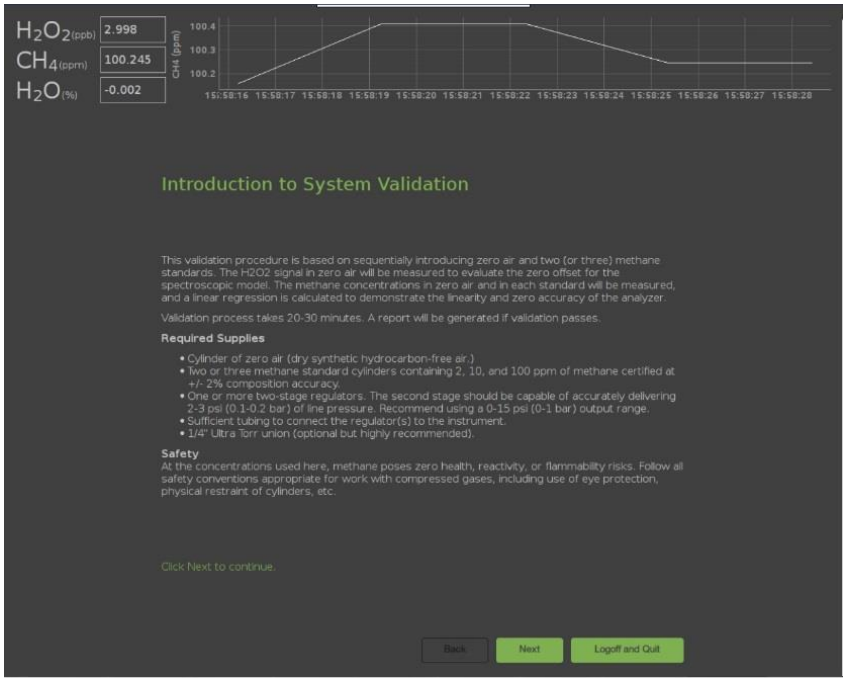
10.3 Safety

At the concentrations used here, methane poses zero health, reactivity, or flammability risks. Follow all safety conventions appropriate for work with compressed gases, including use of eye protection, physical restraint of cylinders, etc.

10.4 Validation Procedure

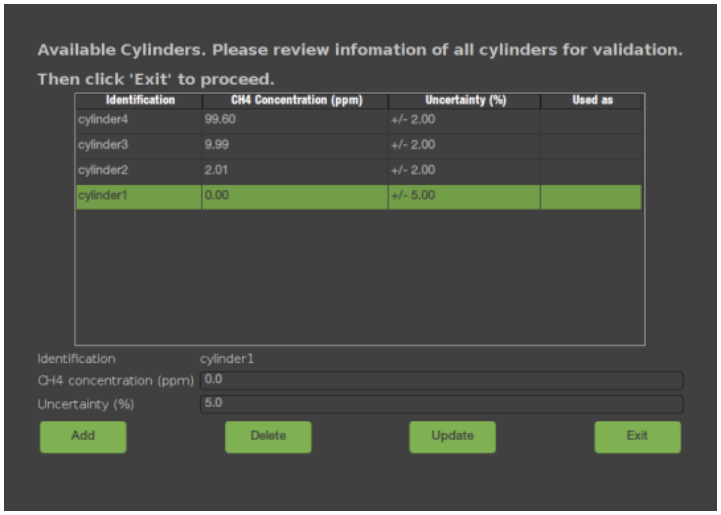
1. Allow the system to reach operating temperature and pressure settings. (See “Power Up the System” on page 31).
2. Attach regulators to the gas sources and adjust their output line pressures so they are within the range of 2–3 psi (0.1–0.2 bar).
3. From the **Users** menu, select **User Login** and sign in (requires technician or administrator privileges).
4. From the **Tools** menu, select **H2O2 Validation** to open the first step, Introduction to System Validation window.

Figure 64: Beginning System Validation



5. Click **Next**. The first time validation is run, this will display the Edit Cylinders page. Use this page to specify the concentrations and uncertainties of the cylinders being used in this procedure. On subsequent uses, the system will remember the saved values and skip directly to the Zero-Air Measurement step.

Figure 65: Edit Cylinders



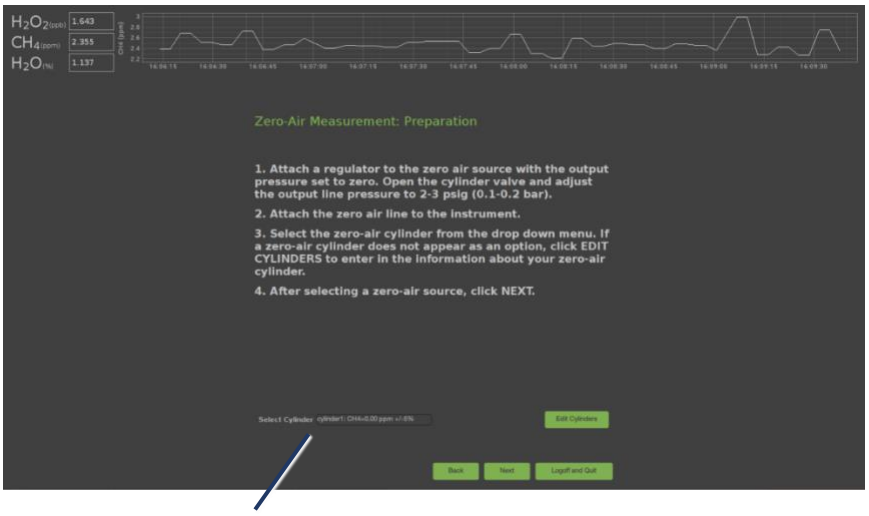
6. If this is the first time performing system validation, enter the information for each of the cylinders you're going to use. Note that the uncertainty value is typically provided by the supplier for each cylinder.

   If validation has been run before, use this window to verify that the concentrations match the cylinders to be used and make any necessary updates.

Button	Function
Add	Add a new cylinder to the list.
Delete	Remove the highlighted cylinder from the list. (Click to highlight.)
Update	Click on a cylinder, make changes to the values shown at the bottom of the table, and click **Update** to save the updated values.
Exit	Exit the cylinder setup and return to validation.

7. Once the cylinders are set up, click **Exit** to continue to Zero-Air Measurement Preparation.

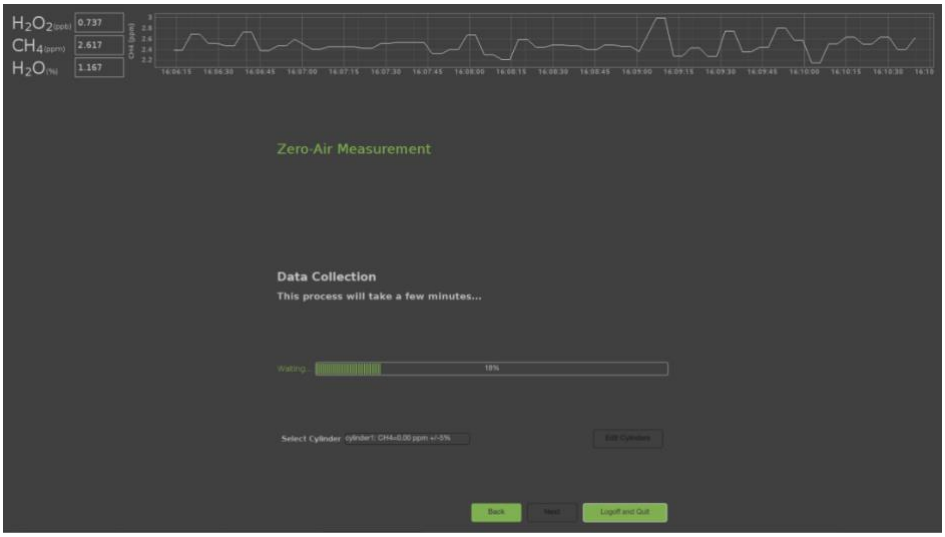
Figure 66: Zero Air Measurement Preparation



Select Cylinder

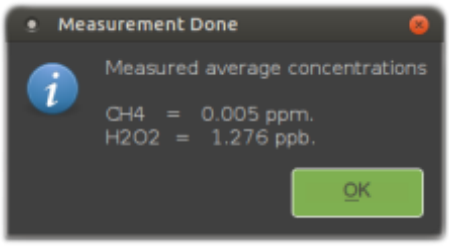
8. If this is not the first time running validation on this system, click **Edit Cylinder** and verify the settings for the cylinders being used in this procedure (see steps 5–7).
9. Select the zero-air cylinder from the **Select Cylinder** list.
10. Open the valve on the zero-air cylinder.
11. Connect the zero-air cylinder to **INLET** on the back of the analyzer. (See “Connecting to the Analyzer Inlet” on page 29).
12. Click **Next** to begin measurement. This will take several minutes. Once it has finished with measuring the cylinder, it will show a confirmation dialog that measurement is complete.

Figure 67: Zero-Air Measurement6



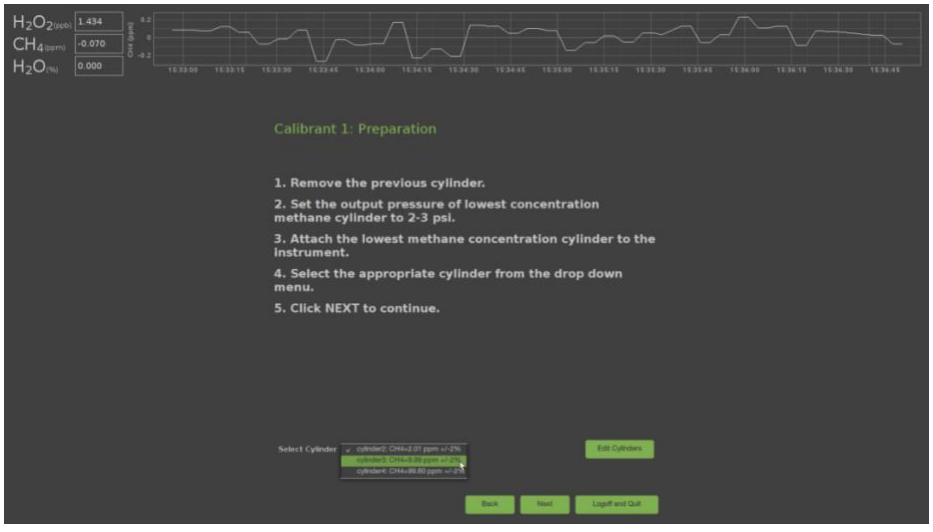
When the measurement is complete, the system will prompt you:

Figure 68: Measurement Done dialog



13. Click **OK** to proceed to the next step, Calibrant 1 Preparation.

Figure 69: Calibrant 1 Preparation

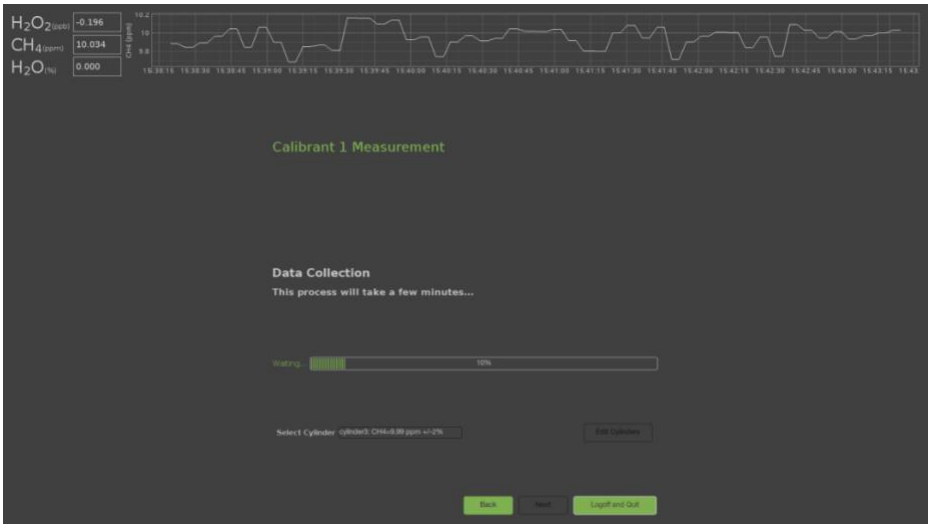


14. Disconnect the zero-air cylinder from the analyzer INLET.

15. Close the valve on the zero-air cylinder.

16. Open the valve on the first methane cylinder (the regulator should already be set to 2–3 psi).
17. Connect the cylinder to the analyzer INLET.
18. Select the cylinder from the **Select Cylinder** list.
19. Click **Next** to begin measuring the first cylinder.

Figure 70: Calibrant 1 Measurement



20. Follow the prompts to finish measuring the first methane cylinder and to prepare and measure the next two methane cylinders.

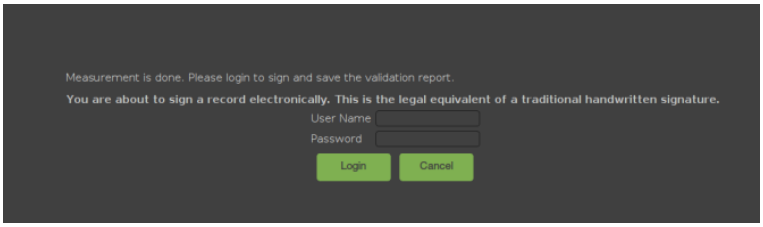
CAUTION

When switching cylinders, follow these steps to avoid damaging the instrument:

- Do not turn off the gas valve before disconnecting the cylinder from the analyzer.
- Before connecting the next cylinder, make sure its regulator is set to 2–3 psi (0.1–0.2 bar) and open the regulator valve before connecting it to the analyzer INLET.
- Refer to page 29 for information on connecting to the INLET.

After the last cylinder has been measured, the system will prompt you to sign in again as a digital signature.

Figure 71: Digital signature is required after all cylinders have been measured

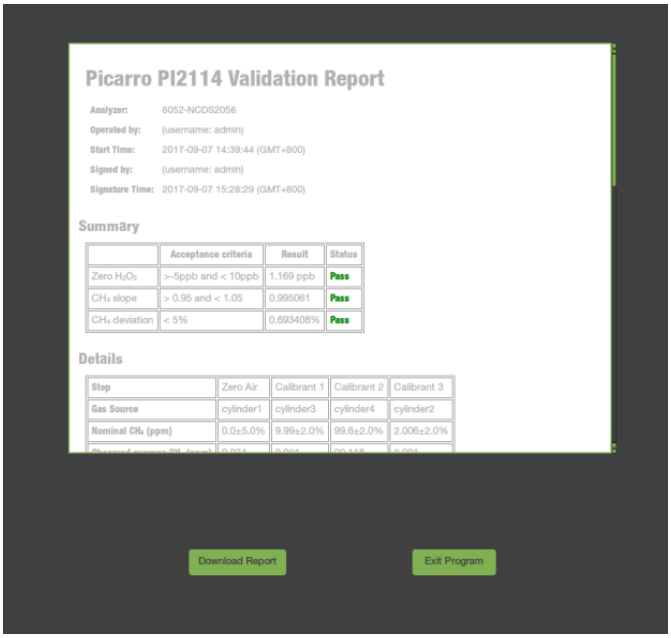


21. Enter your user name and password (must have technician or administrator privileges) and click **Login** to display the validation results.

Figure 72: Validation Results

22. Click **OK** to clear the dialog and view a preview of the Validation Report.

Figure 73: Validation Report



23. To copy the Validation Report to a USB flash-memory drive, click **Download Report**.

Downloading the report will prompt you to sign in to the File Manager, which you can use to copy the report to a USB drive. See *PI2114 Operation Manual* for more information on the File Manager.

24. To return to the Data Viewer, click **Exit Program**.

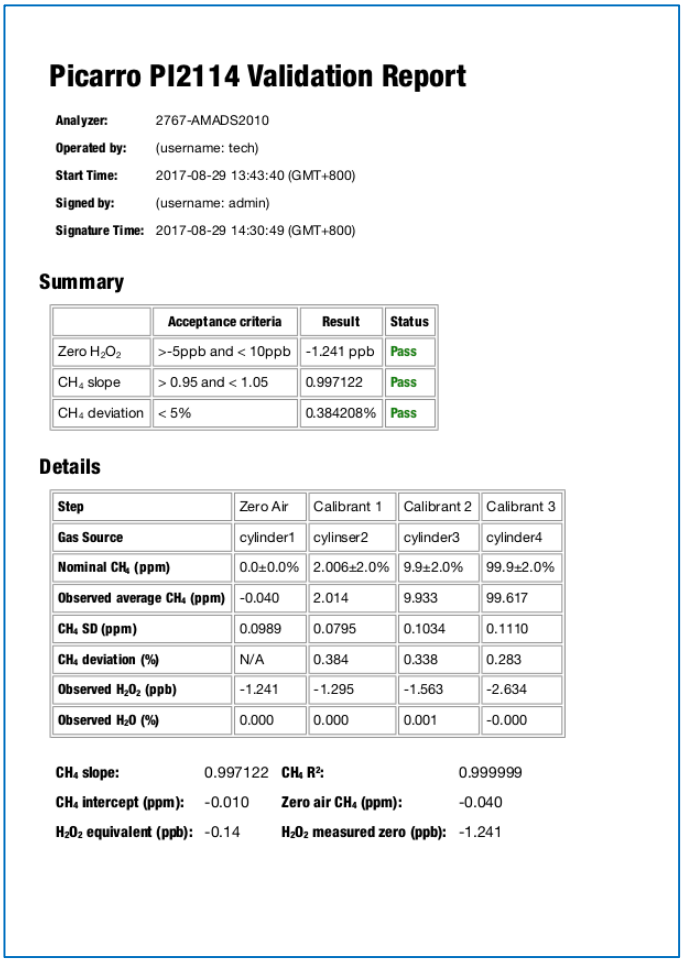
25. Disconnect the last methane cylinder, making sure to disconnect it before closing the cylinder's valve.

10.5 Example of Results from Validation

In the example below, we collected data using four cylinders with nominal methane concentrations of 0, 2.058, 10.0, and 100.2 ppm.

Approximately five minutes of data were acquired for each concentration. Scaling for the relative sensitivity difference between methane and H_2O_2 (methane produces spectra 70-fold weaker) these standards are comparable to 0, 30, 145.7, and 1427 ppb of H_2O_2 in terms of their utility in evaluating the fundamental performance characteristics of the instrument.

Figure 74: Validation Report, page 1



Picarro PI2114 Validation Report

Analyzer: 2767-AMADS2010
Operated by: (username: tech)
Start Time: 2017-08-29 13:43:40 (GMT+800)
Signed by: (username: admin)
Signature Time: 2017-08-29 14:30:49 (GMT+800)

Summary

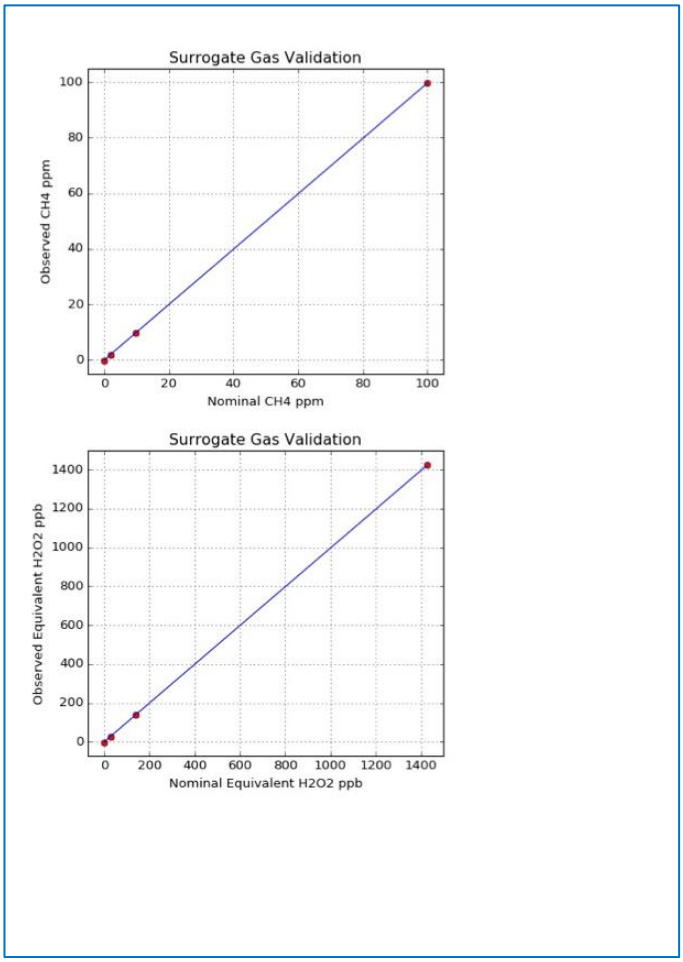
	Acceptance criteria	Result	Status
Zero H_2O_2	>-5ppb and < 10ppb	-1.241 ppb	Pass
CH_4 slope	> 0.95 and < 1.05	0.997122	Pass
CH_4 deviation	< 5%	0.384208%	Pass

Details

Step	Zero Air	Calibrant 1	Calibrant 2	Calibrant 3
Gas Source	cylinder1	cylinser2	cylinder3	cylinder4
Nominal CH_4 (ppm)	0.0±0.0%	2.006±2.0%	9.9±2.0%	99.9±2.0%
Observed average CH_4 (ppm)	-0.040	2.014	9.933	99.617
CH_4 SD (ppm)	0.0989	0.0795	0.1034	0.1110
CH_4 deviation (%)	N/A	0.384	0.338	0.283
Observed H_2O_2 (ppb)	-1.241	-1.295	-1.563	-2.634
Observed H_2O (%)	0.000	0.000	0.001	-0.000

CH_4 slope: 0.997122 **CH_4 R^2:** 0.999999
CH_4 intercept (ppm): -0.010 **Zero air CH_4 (ppm):** -0.040
H_2O_2 equivalent (ppb): -0.14 **H_2O_2 measured zero (ppb):** -1.241

Figure 75: Validation Report, page 2



10.6 If the Analyzer Does Not Pass

If the analyzer fails the validation test, check the nominal CH_4 on page one of the report against the actual CH_4 concentration and uncertainty for your reference cylinders.

If there is a discrepancy, run the test again, correcting the discrepancies on the “Edit Cylinder” step.

If the analyzer did not pass and there is no discrepancy between the nominal values of the calibrants in the report and the values of the cylinders used during validation, contact Picarro.

11. User Management

11.1 Overview

User management includes:

- Managing user accounts, such as adding users and changing passwords.
- Setting user policies, such as password requirements and session duration.
- Viewing and saving user histories.

There are three user roles defined in the system: operator, technician, and administrator. The permissions are as follows:

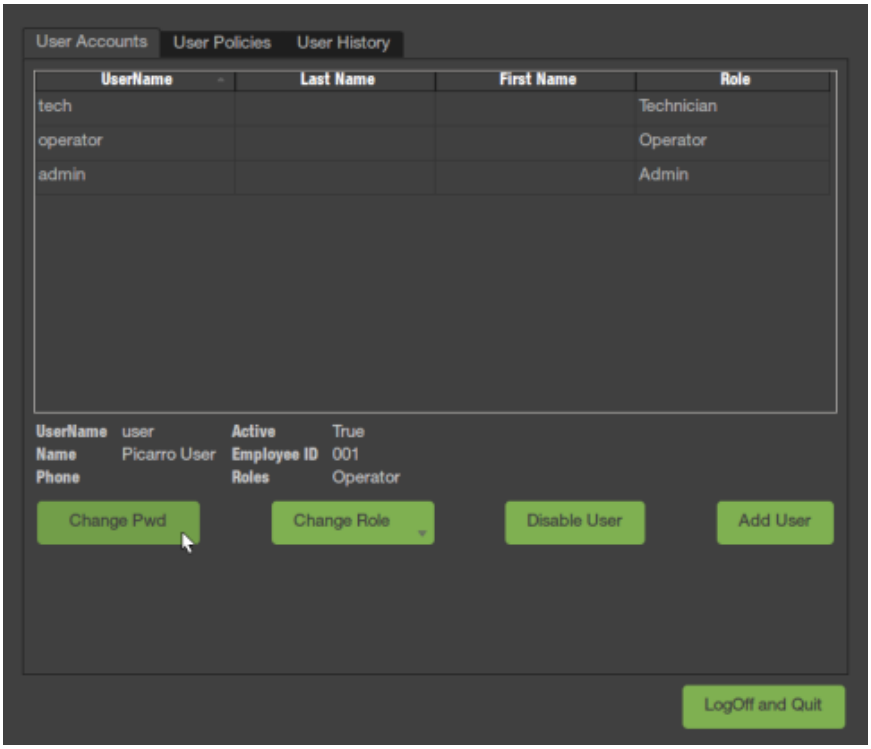
Function	Not Signed In	Operator	Technician	Administrator
View Data Viewer	•	•	•	•
Set Alarms	•	•	•	•
Configure Data Viewer (partial)		•	•	•
Quit Measuring		•	•	•
Shut Down (software shutdown)		•	•	•
H2O2 Validation			•	•
Configure Data Viewer (full access)				•
User Management				•

User management settings are available from the **Tools** menu in the Data Viewer:

1. In the Data Viewer, from the **Users** menu, select **User Login**.
2. Log in as an administrator (default user name is *admin*; default password is *admin*).

3. From the **Tools** menu, select **User Administration** to view the User Management window.

Figure 76: User Management Window



The User Management window has three tabbed states: User Accounts, User Policies, and User History.

4. Make any desired changes and click **LogOff and Quit** to return to the Data Viewer.

11.2 Manage User Accounts

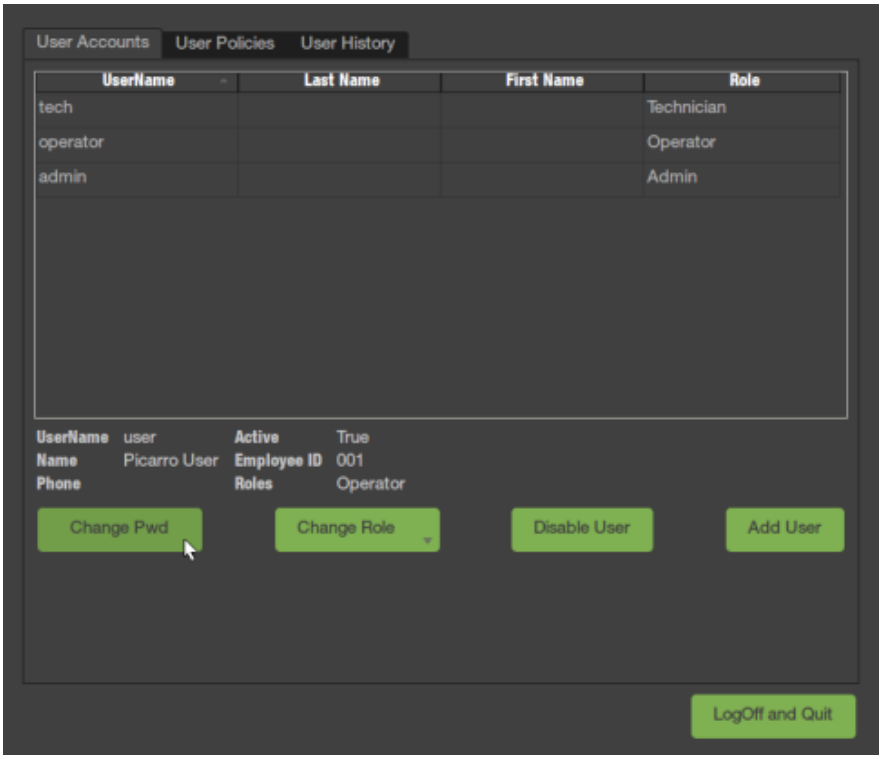
From the User Accounts tab, perform any of the following tasks:

- Add new users
- Disable users
- Change user passwords
- Change user roles

NOTE

The default user names that are shipped with the analyzer are *tech*, *operator* and *admin*. The default passwords are *tech*, *operator*, and *admin*, respectively. User names *and* passwords are both case sensitive.

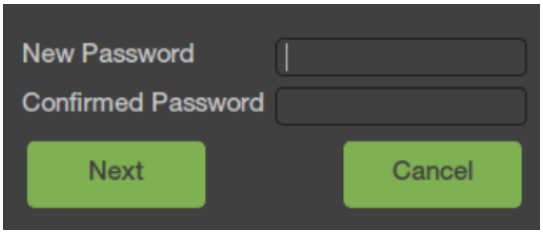
Figure 77: User Accounts Tab



To change a password:

1. In the User Management window, click the **User Accounts** tab.
2. From the list of users, click the user you want to change.
3. Click **Change Pwd** to prompt for a new password.

Figure 78: Change Password



4. In the **New Password** field, enter the new password.

   Passwords are case sensitive. Additional rules for passwords can be set in the User Policies tab (see page 87).
5. In the **Confirm Password** field, re-enter the password.
6. Click **Next** to save the password.

To Change a User's Role:

1. In the User Management window, click the **User Accounts** tab.
2. From the list of users, click the user you want to change.
3. Click **Change Role** to see a menu of available roles.

Figure 79: Change Roles

4. Click the new role; this will prompt you to confirm the change.
5. In the Confirm Action dialog, click **OK** to confirm the changed role.

To Disable a User Account:

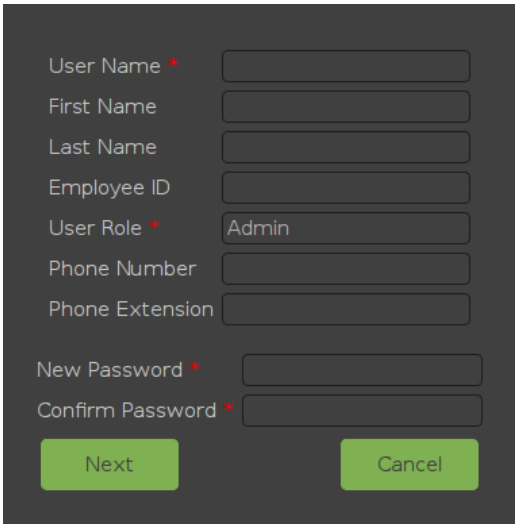
Users cannot be deleted from the system, but they can be disabled so they won't have access to the software.

1. In the User Management window, click the **User Accounts** tab.
2. From the list of users, click a user name.
3. Click **Disable User**; this will prompt you to confirm your choice.
4. Click **OK** to confirm the action.

To Add a User:

1. In the User Management window, click the **User Accounts** tab.
2. Click **Add User**; this will display the Add User screen.

Figure 80: Add User

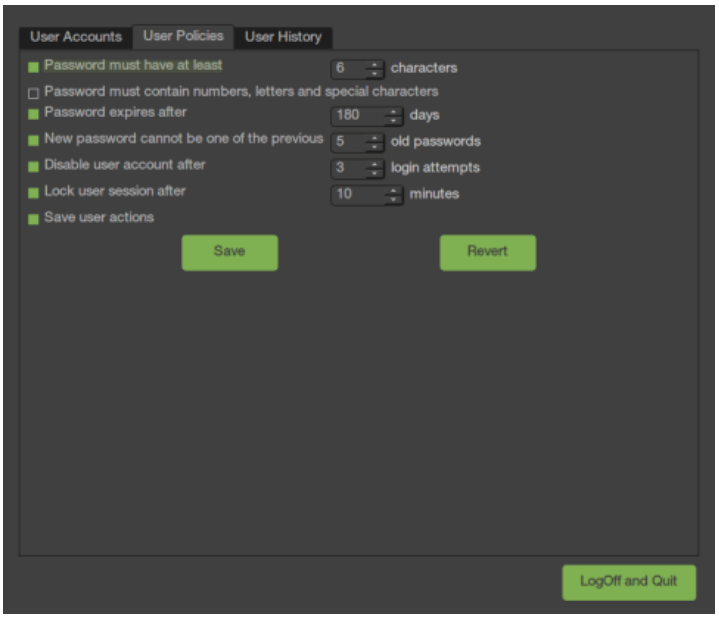


3. Fill in the fields in the Add User window.
4. Click **Next** to open the New User Account dialog.
5. Review the user information and click **OK** to accept or **Cancel** to go back and edit the information.

11.3 Set User Policies

1. In the User Management window, click the **User Accounts** tab.

Figure 81: User Policies Tab



2. Make the changes you want:

Policy	Description
Password length	Specify that the length of passwords (6–15 characters) or turn off the length requirement.
Password complexity	When selected, all *new* passwords must have at least one number, one letter, and one special character. This will not impact existing passwords.
Password expiration	When selected, any passwords that reach the selected maturity will expire. Any user signing in with an expired password will be required to create a new password.

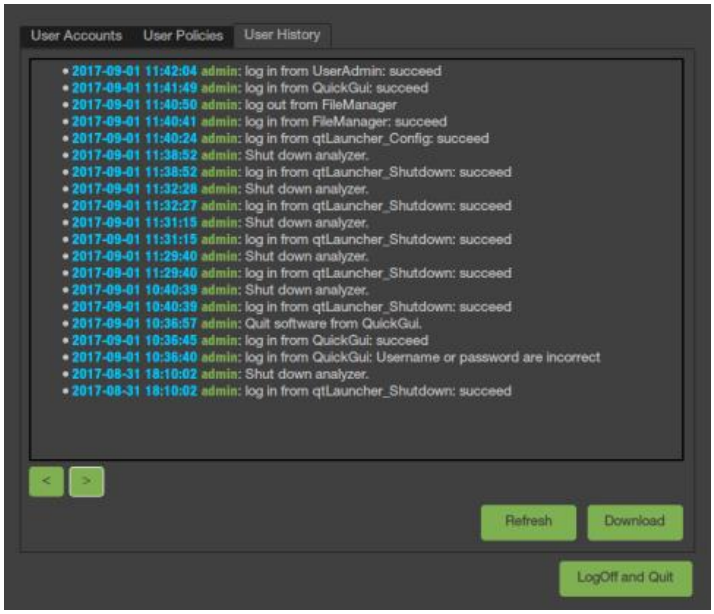
Policy	Description
Previous passwords	When set, prevents a user from reusing a recent password. The system can remember up to 10 old passwords.
Limit login attempts	Tell the system to disable a user account after a set number of failed password attempts. The failed attempts are counted until the user successfully logs in. Once disabled, an admin will have to enable the account.
Lock session	When set, the system will automatically logoff any user after a set period of inactivity, requiring the user to sign in again.
Save user actions	When enabled, user actions (such as logging in) will be saved in the User History.

3. Click **Save**. If you typed in a bad value and want to undo any changes and revert back to the last saved configuration, click **Revert**.

11.4 View User History

1. In the User Management window, click the **User History** tab to see a list of all the logged events.

Figure 82: User History Tab



2. Click the **<** and **>** buttons to navigate through the history (if the button is grayed out, then there are no additional pages).
3. To make sure the content is up to date, click **Refresh**.
4. To copy the user history onto a USB drive, click **Download**. This will direct you to the File Manager, which will prompt you to log in again. See *PI2114 Operation Manual* for details on copying files from the analyzer.

12. Transportation & Storage

12.1 Packing the Analyzer

1. Shut down the instrument using the **Quit** button in the Data Viewer. Clean dry gas should be attached to the instrument prior to shutting down. This prevents condensation inside the system during storage or shipment.
2. Disconnect the all tubing and electrical connections from the analyzer.
3. To prevent contamination and possible damage to the connector threads, place caps on all gas connections.
4. Place the analyzer in a plastic bag with a package of desiccant. Seal the bags with tape.
5. Pack the analyzer in the original shipping container ensuring that all of the foam pieces are in place to protect the analyzer during shipping.

CAUTION

When shipping or relocating the analyzer, it is important to protect it from mechanical shocks. Failure to do so can compromise its performance. When shipping the analyzer, use its original packing only.

13. Troubleshooting

13.1 Overview

This section lists problems that may occur during installation and operation of the analyzer, and step-by-step procedures that will provide resolution in most cases. If these instructions do not solve the problem, contact Picarro Technical Support.

13.2 Analyzer Won't Turn On

The Status Indicator on the front panel of the analyzer should be lit whenever the analyzer is on.

Figure 83: Status Indicator on Front Panel

If pressing the soft power button on the back of the analyzer does not switch the analyzer on, perform following steps.

1. Check that the AC power cord is attached to the instrument and plugged into a working outlet.
2. Check that the rear ON-OFF switch near the AC power cord on the rear panel is in the ON position.
3. Press and hold the soft-power button on the rear panel for 5 seconds (the analyzer may not respond to a quick press).

13.3 Cavity Pressure Unlocked

The cavity pressure should automatically adjust to the correct value during normal operation. The “Pressure Locked” message in the Measurement Status panel of the Data Viewer indicates that the cavity pressure is within operating parameters.

If the cavity pressure is out of operating specification, the Measurement Status in the Data Viewer will display a “Pressure Unlocked” message.

The first step in troubleshooting will be determining if the cavity pressure is too high or too low:

1. From the **Users** menu, click **User Login**.
2. Log in to the analyzer and click **OK**.
3. From the **Source 1** dropdown, select **Sensors**.
4. From the **Data Key 1** dropdown, select **CavityPressure**.
5. Look at the top data plot:
    - If the pressure is less than 100 Torr, the pressure is too low.
    - If the pressure is greater than 100 Torr, the pressure is too high.

Troubleshooting Low Pressure

If there is insufficient flow through the cavity:

- Ensure the inlet plumbing to the analyzer is not clogged.
- Ensure that the pump is turned on and operating correctly.
- Ensure that the plumbing between the analyzer VACUUM port and the pump is clear.
- When connected to a gas cylinder or bottle, ensure the regulator pressure is set between 2–3 psi (0.1–0.2 bar) and the valve is open.
- If the pressure continues to be low, the filter may be clogged and need replacement. See page 58.

Troubleshooting High Pressure

If gas cannot exhaust from the analyzer at a sufficient rate:

- Check for leaks in the vacuum line between the analyzer and the pump.
- Check the vacuum pump. Make sure it is functioning correctly.
- When measuring flow from a gas cylinder or bottle, ensure the regulator is set to the proper pressure (2–3 psi).

13.4 GUI Does Not Update Graphs During Operation

In the event the GUI becomes unresponsive during operation, it may be necessary to restart the instrument.

NOTE

The device may still be sending data even if the GUI is unresponsive. You may wish to finish your measurements before restarting.

If the computer responds to the mouse:

1. Follow the shutdown procedure on page 32.
2. Wait until the analyzer is completely shut down.
3. After a few seconds, restart the analyzer by pressing the soft power button on the back panel.

If the computer does not respond to the mouse:

1. Hold down the soft-power button on the rear panel for a few seconds until the instrument turns off.
2. After another few seconds, restart the analyzer using the soft power button.

13.5 Liquid in the Inlet

If liquid is sucked into the inlet line, it may clog the filter and impede the flow (usually for a few days) until it evaporates.

Some symptoms of a clogged filter are:

- The analyzer pressure is low.
- Low flow into the analyzer, causing unusual measurements.
- Response time is slower than usual.

If you observed or suspect liquid in the inlet:

1. Do NOT turn off the analyzer or try to replace a wet filter. Liquid in the filter can cause condensation on the optics if the analyzer is allowed to cool when the filter is still wet.
2. Dry the filter by running Clean Dry Air (CDA) through the analyzer.

If the analyzer functions normally after drying, a filter replacement is not necessary. If drying the filter does not fix the problem, replace the filter. See “Filter Replacement” on page 58.

13.6 Unusual Measurements or Slow Response Time

Filters can become clogged with continual use. Some symptoms of a clogged filter are:

- The analyzer pressure is low.
- Low flow into the analyzer, causing unusual measurements.
- Response time is slower than usual.

CAUTION

If you suspect liquid may have been sucked into the inlet line, do NOT turn off the analyzer. Follow the steps above to try and let the water evaporate.

If you suspect a clogged filter is to blame, and you don't think there is liquid in the inlet, then you may need to replace the filter. See "Filter Replacement" on page 58.

13.7 Long Measurement Intervals or Excessive Noise

Exposure to RF radiation between the frequencies of 80MHz to 1GHz with field strength above 10V/m (per IEC 61326-1-2013) may degrade the performance of the analyzer below its normal operating specifications.

If possible, relocate the instrument or take measurements when the interfering equipment is not in use.

13.8 Measurement Status Messages

Message	Description
Aborting…	
Disabling Data Manager	Exiting measuring state.
Leaving Measuring	
Measuring	This is the normal mode of operation. The analyzer will scan and report concentration measurements until it is shutdown.
Parking	Entering parking state
Parking Sample	Entering parking state
Preparing Sample Manager	
Preparing to Measure	Spectral scanning has started. Concentration measurements will be available in approximately 30 seconds.
Pressure = %d Torr	Dynamic reporting of pressure as instrument is shut down.
Pressure stabilizing	The valve control system is allowing flow through the analyzer and is stabilizing the pressure inside the cavity.
Pressure Locked	The valve control system has stabilized the pressure inside the cavity.
Pressure Unlocked	
Purge Complete	
Putting Data Manager in warming mode	Exiting measuring state.
Reset	
Restart Measuring	This is the normal mode of operation. The analyzer will scan and report concentration measurements until it is shutdown.
Sample prepare complete	
Shutdown	

Message	Description
Starting	
Temp and Pressure Stabilizing	Entering warming state.
Temperature Locked: HB	The temperature of the “hot box” (HB – the chamber containing the analyzer’s optical cavity and gas handling system) is stable. Achieving stability is typically the longest step in the startup sequence. It may take from 5 to 60 minutes to lock, depending on the ambient temperature and how much time has elapsed since the unit was shut down.
Temperature Locked: WB	The temperature of the “warm box” (WB – the chamber containing the electronics and wavelength monitor) is stable.
Temperature Unlocked: HB	
Temperature Unlocked: WB	
Uploading warmbox cal to DAS…	Entering warming state.
Warming…	

14. Warranty Claims

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:

   - PI2114 Analyzer Serial Number
   - Your Company or 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.

2. A 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 and insurance. Units returned without a valid RMA number will not be processed until the RMA process is complete.

15. Contact Information

Please contact Picarro or your authorized Picarro distributor for questions regarding specific applications and additional information.

Contact Technical Support:

Email: support@picarro.com

Phone: 408.962.3900 ext. 3991

Contact European Technical Center:

Skype: picarro.europe

Email: support@picarro.com

Phone: +31 208.934.279

Contact Customer Service:

Email: orders@picarro.com

Phone: 408.962.3900 ext. 3992

Web:

www.picarro.com

Mailing Address:

3105 Patrick Henry Drive

Santa Clara, California, 95054

USA

Phone 408.962.3900 • Fax 408.962.3200