PICARRO

SI2205 HYDROGEN FLUORIDE ANALYZER

USER GUIDE

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This manual is the original instruction provided in English.

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Table of Contents

1. Introduction

1.1. Intended Use

The Picarro SI2205 analyzer detects Hydrogen Fluoride in parts per billion.

This manual describes analyzer operation only. For service tasks, refer to the *SI2000 Series Service Manual* 40-0046.

Proper use of the SI2000 instruments do not include personnel protection, or monitoring of the occupied space. The SI2000 instruments are not safety devices.

1.2. Personal Protective Equipment

Any protective equipment shall be used in accordance with the instructions provided by the protective equipment supplier.

1.3. MSDS Required

Users must obtain the MSDS for sample gasses used in the proxy validation procedure for their respective suppliers

1.4. Warning Symbols and Text Conventions

This manual uses safety icons to emphasize important information in the text:

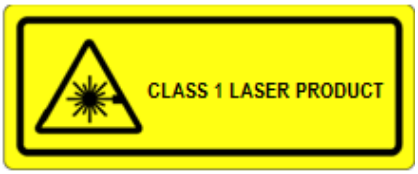
- *Italic* text identifies screen names and to emphasize important text or features.
- **Bold** text if for cautions and warning statements and text you should type or select in screens.

Icon notes and warnings provide information on dangers to either yourself or to the analyzer. The purpose of these icons is to provide a visual convention to alert you important information.

	**NOTE** is an important procedure of which you should be aware of before proceeding
 **WARNING**	**LASER WARNING** alerts you of a laser danger.
 **DANGER**	**DANGER** indicates an imminently hazardous situation that, if not avoided, will result in death or severe injury.
 **WARNING**	**WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or severe injury.
 **CAUTION**	**CAUTION** indicates a potentially hazardous situation which, if not avoided, could result in moderate or minor injury.
	**REMINDER** is a helpful prompt to remember procedures listed in the text.

1.5. 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 3B 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.**



1.6. 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	**This analyzer weighs 48 lbs. Lifting it is a two-person job. Use the technique described below when lifting the analyzer.**
WARNING	**HOT SURFACE: The heating block and metal tubes connected to the filter are HOT (up to 100°C). Let the heating block cool before attempting to change the filter**

2. Unpack the Analyzer

2.1. Inspect the Shipping Boxes

Picarro products are inspected and tested before leaving the factory. The shipping container system has been specially tested and proven to be safe for most dropping, crushing or spiking events.

Picarro shipping containers consist of:

- An inner box equipped with a shock detector (Figure 1)
- An outer box

Figure 1 shows acceptable outer box condition /inner box shock indicator condition.

Figure 1: Shipping Boxes

If the equipment arrives damaged, photograph the damages and contact Picarro (email pictures if possible) for consultation on best course of action.

2.2. Unpack the Shipping Boxes

The section describes the contents of the shipping boxes:

Figure 2 shows the box contents and the Table 1 and Table 2 list the box contents.

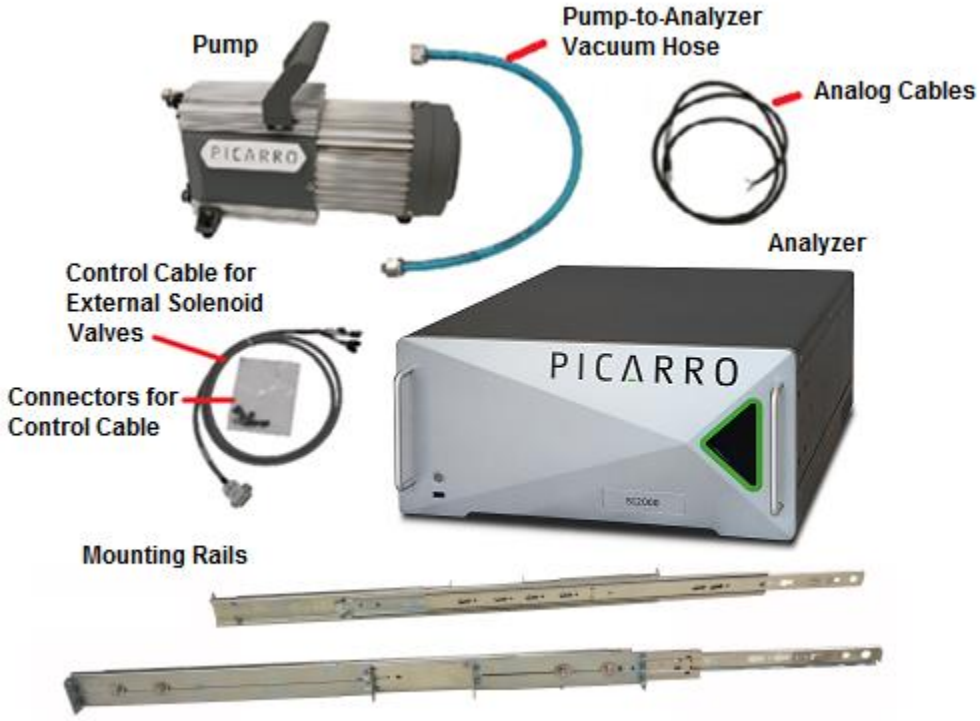


Figure 2: Box Contents

Table 1: Box 1 Contents

QTY	Item	Description
1	Analyzer Module	Includes all of the data acquisition, control, and communications hardware and firmware to perform all gas handling, spectral collection and analysis.
1	Slides	1 pair of slides and hardware for 19” rack mounting.
2	A/C Power Cables **NOT SHOWN**	2 power cables with connectors appropriate to your country are provided. The pump and analyzer automatically adjust to local voltage.
1	Accessories	1 Certificate of calibration 1 Hardcopy User Manual (this document)

Table 2: Box 2 Contents

1	Pump Module	Provides vacuum required for sample gas sequencing into and out of the analyzer.

- Inspect each item to assure it is not damaged.
- If items are missing, contact Picarro for a replacement.
- Keep the shipping packages to reuse when transporting the analyzer.
- Contact Picarro for options on transporting systems to remote labs.

3. Analyzer Overview

3.1. Front and Back Panel Description

Figure 3 shows the analyzer front panel and Figure 4 shows the analyzer back panel.

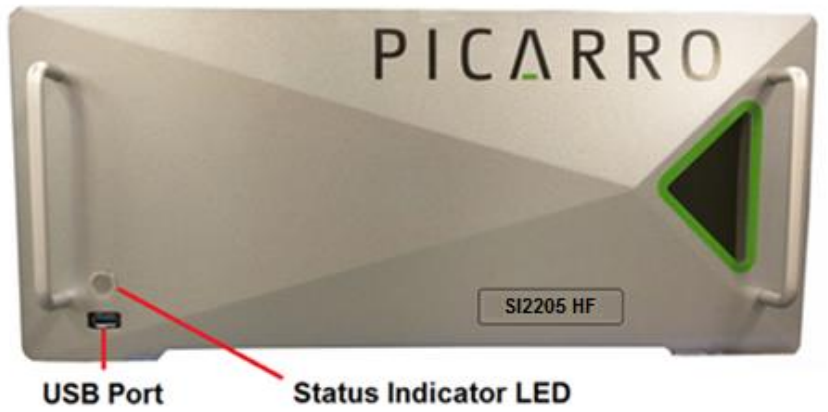


Figure 3: Analyzer Front Panel

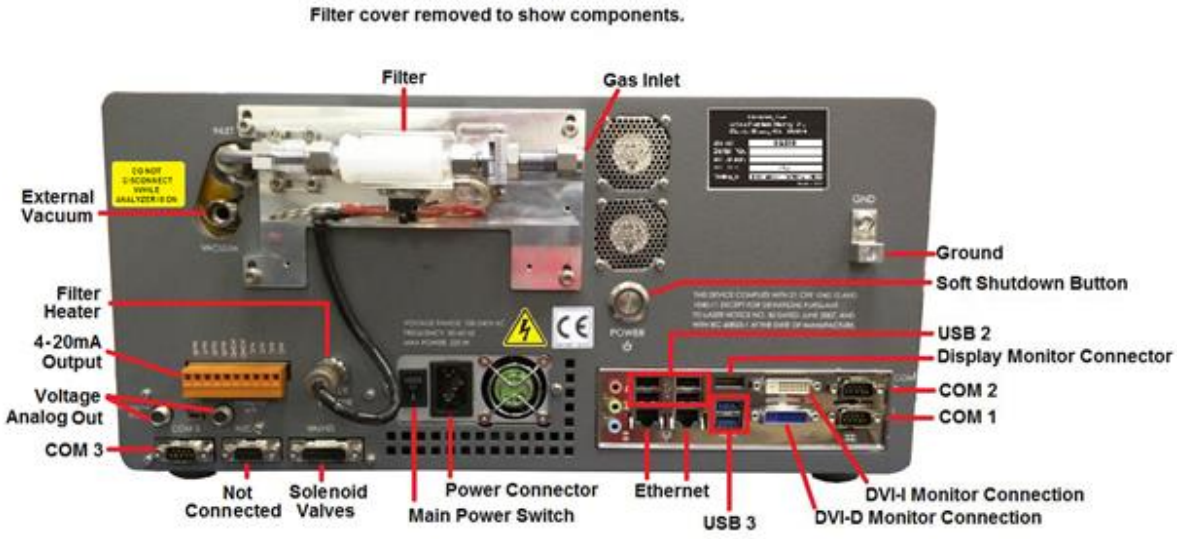


Figure 4: Analyzer Back Panel

CAUTION	**Do not connect USB hubs or unauthorized USB devices (except flash drives, mice and keyboards) to the USB ports (Figures 3 and 4). Unauthorized USB devices may interfere with the analyzers functioning.**
NOTE	The analyzer has a universal power supply that automatically adjusts to power sources ranging from 100-240 VAC, 50/60 Hz, 250 W max.

3.1. Front Panel Operating Status Indicator

The LED indicator on the front panel (Figures 3 and 5) shows the current operating state of the analyzer. Figure 5 shows and describes the status indicator states. The status states and colors are linked to the *System Alarm Panel* on the *CRDS Data Viewer Screen*. See Figure 9.

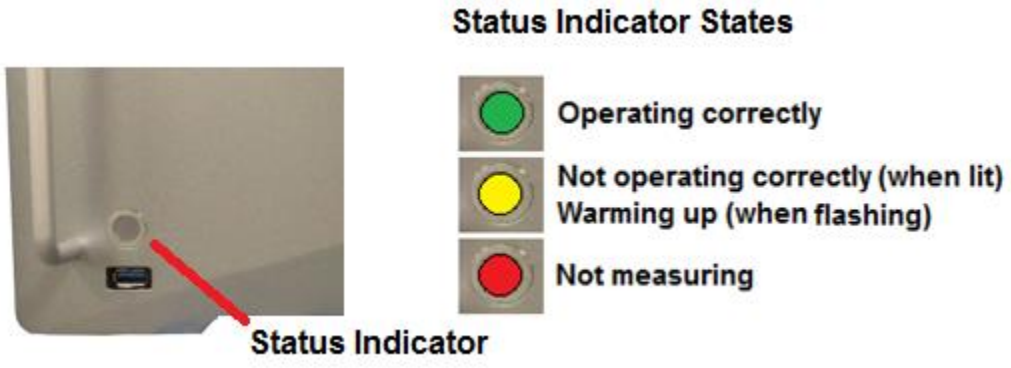


Figure 5: Status Indicator States

3.2. External Vacuum Pump

Figure 6 shows an example of an external vacuum pump.

Figure 6: Vacuum Pump

3.3. Specifications

- Weight: 48lbs. The analyzer must be lifted by two people.
- Dimensions
  - Length: 24.38”
  - Width: 7.5”
  - Width with rails:17.75”
  - Height: 7.88
  - Height with feet: 8.38”
- Temperature range
  - Storage: 0°C-70°C
  - Operation: 0°C-35°C
- Ambient humidity range: <99% R.H. non-condensing
- Maximum altitude: 10,000 ft (operation)
- Front and rear clearance: 6” for ease of connection
- Power requirements: 100-240 VAC, 50/60 Hz, 250 W max
- Power supply voltage fluctuation: ± 10% of nominal voltage
- 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.**

4. Hardware Setup

Electrical Safety Task Type 2

Items/Tools Required:

- 9/16'' 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 host solution in which the instrument and pump are being installed inside of must have sample gas and CDA purge isolation valves provided by the host to system.**
 **Caution**	**The host solution in which the instrument and pump are being installed inside of must have main overcurrent protection devices and main disconnect devices rated for at least 10,000 RMS symmetrical amperes interrupting capacity (AIC).**
 **Caution**	**The host solution in which the instrument and pump are being installed inside of must have an EMO. Activation of the host system EMO must shut off power and CDA to the instrument and pump. The location of the EMO button must be within 3 meters of the instrument.**
 **Caution**	**The host solution or facility in which the instrument and pump are being installed inside of must have lockable shutoff valves for the sample and CDA lines.**
 **Caution**	**The host solution in which the instrument and pump are being installed inside of must have adequate overcurrent protection for the power supply to the instrument, pump, and voltage supply (maximum of 7A).**
 **Caution**	**The instrument is intended to measure concentrations of NH_3 up to 10 ppm, HF up to 0.5 ppm and HCl up to 1 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, shown in Figure 5 indicates one or more lasers are on**
 **Note**	**Analyzer performance may degrade (increased measurement intervals, or increased measurement noise) while exposed to RF Radiation in an Industrial Environment between the frequencies of 80MHz - 1GHz at a field strength of 10V/m per IEC 61326-1-2013. Make sure normal operation conforms to the datasheet for the analyzer during the initial start-up sequence after the installation procedure is completed.**

1. Remove the analyzer and the external vacuum pump from the shipping containers.
2. Install the analyzer in a rack, or place it on a cart or table.

 **WARNING!**	**This analyzer weighs 48lbs. Lifting it is a two-person job.** **Use the technique described below when lifting the analyzer.**

Use this technique to lift heavy objects:

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.

Figure 7 shows the warning label positions on the top and back of the analyzer.

Figure 7: Warning Label Positions

3. Place the external vacuum pump near the analyzer in a rack, or on a cart or table.

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

4. Unpack the analyzer accessories. (vacuum line, AC power cables, manual, certificate of compliance and certificate of calibration).
5. Remove the caps from the analyzer gas connection inlet and vacuum connection ports. Save the caps from the analyzer and pump. Reinstall the caps when the analyzer is stored, moved or shipped.

Note	**Store the certificates in a safe place. They may be required if you call us for service or questions.**

6. Remove the caps from external vacuum pump. Save the caps for later use. Reinstall the caps when the pump is stored, moved or shipped.
7. Connect the vacuum hose between the external vacuum port and the external vacuum pump. See Figure 8. Hand tighten the nut, then make an additional $^{1}/_{4}$ turn with an $^{11}/_{16}$" wrench (not supplied).
8. Connect the AC power cable to the analyzer and to the external vacuum pump.
9. Refer to Picarro's *SI2000 Series Service Manual* 40-0046 for service instructions.

Caution	**Use 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, attach a tube to the external vacuum pump exhaust port and direct the exhaust to a safe place for venting the mixture of sample gases.**

Figure 8: Analyzer and Pump Connections

Note	**The analyzer has a universal power supply that automatically adjusts to power sources ranging from 100-240 VAC, 50/60 Hz, 10 W max.** **Refer to Manual Number 999085 included in the box for the Vacuubrand MD1 external pump safety, operation, specification, and service Instructions.**

5. Operate the Analyzer Using the GUI

This section describes the GUI and explains how to operate the analyzer using the GUI.

1. Switch on the external vacuum pump.
2. Switch on the main power to the analyzer (Figure 4).

CAUTION

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

The software starts automatically and the analyzer displays the opening screen. Figure 9.

Use the buttons on the opening screen to select the activity you want. These buttons are password protected to prevent accidental shutdown or configuration changes. From the opening screen select:

- **HF** to begin normal operation
- **Files** to copy data to an external device
- **Config** to perform configuration tasks (password is *picarro*)
- **Service** to perform service tasks (for trained personnel only)
- **Power Off** for a soft shutdown (password is *picarro*)

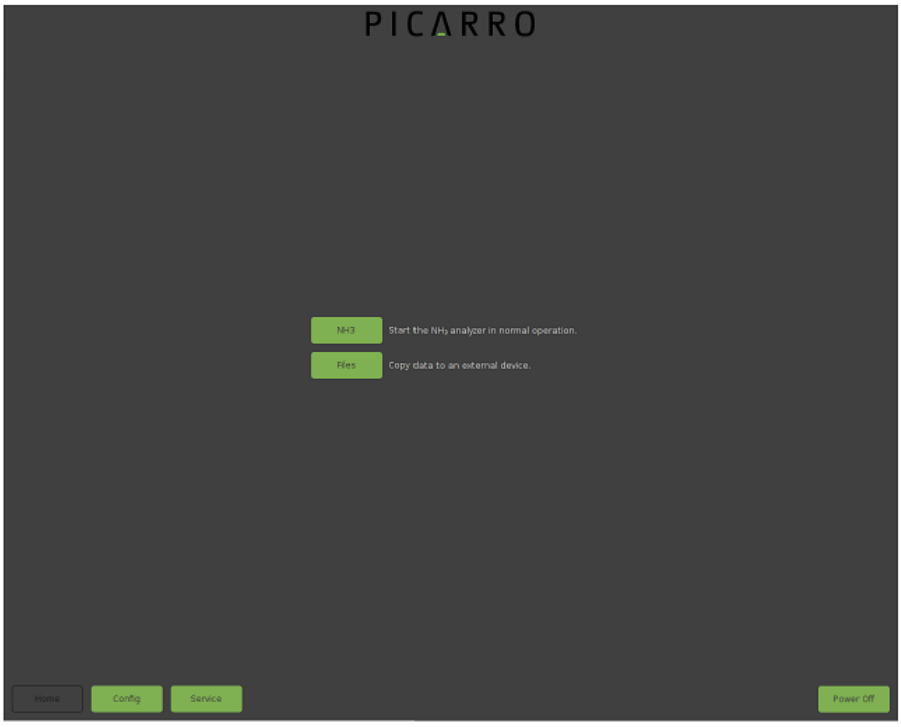


Figure 9: Opening Screen

5.1. The CRDS Data Viewer (Main Screen)

Single click on the **HF** button and wait about 30 seconds while the acquisition software initializes. When initialization is complete the *CRDS Data Viewer* screen displays.

This section describes the CRDS data viewer. This is the analyzer main screen. The data viewer shows a graph for HF and H_2O.

Analyzer initialization is complete when the CRDS Data Viewer screen displays and sampling begins. Figure 10 shows the CRDS data viewer for Hydrogen Fluoride.

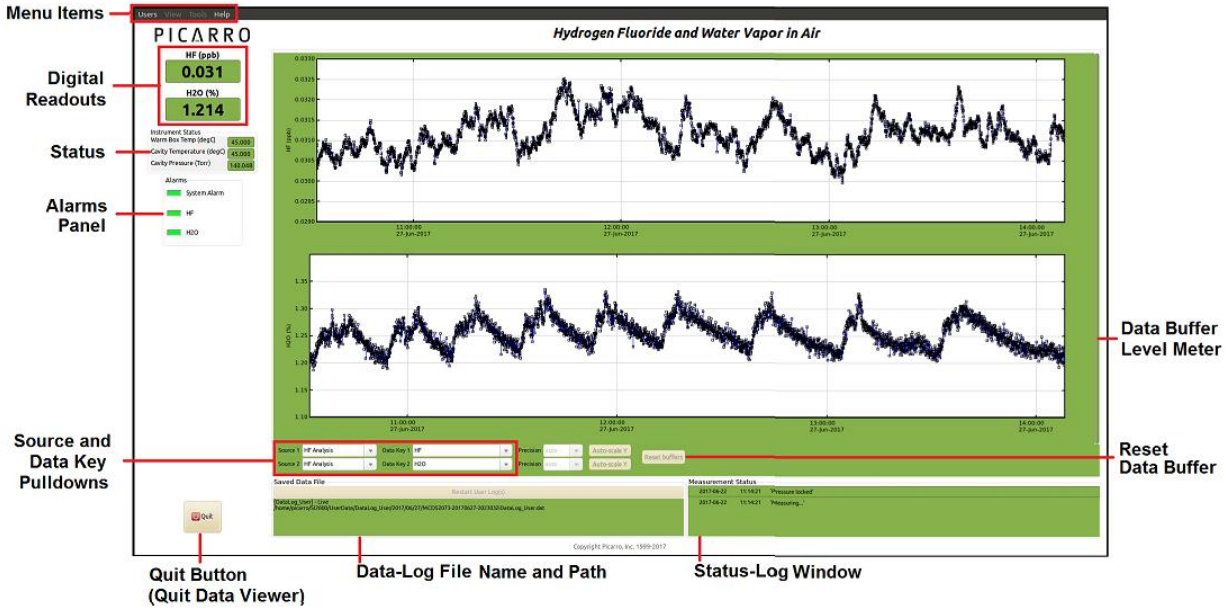


Figure 10: CRDS Data Viewer Screen

Data is saved automatically whenever the analyzer produces data. The data displayed on the CRDS is the continuous real time read-out from the analyzer.

A user-relevant subset of this data is stored in */home/picarro/SI2000/UserData/DataLog_User/YYYY/MM/DD*, where:

- *YYYY* = year
- *MM* = month
- *DD* = day

For example: June 28, 2017 is written 2017/06/28

Further details can be found in the file management section.

5.2. CRDS Data Viewer Field Descriptions

Users Menu

Left clicking on the *Users* menu shows the drop-down *User Login*. Depending on your level of access, different menu items will be enabled.

Figure 11 shows the *Users* Drop-Down Menu.

Figure 11: Users Drop-Down Menu

View Menu

This menu item has three choices (Figure 12):

3. *Lock/Unlock time access* when zoomed: This is a toggle. When locked, forces the data windows to display the same time scale during zoom.
4. Show/hide statistics: Toggles the measurement statistics display.
5. Show/hide instrument status: Toggles the instruments status display.
   Figure 12 shows the *View* Drop-Down Menu.

Figure 12: View Drop-Down Menu

Tools Menu

Use the tools drop-down menu to *Show/Hide Valve Sequencer GUI*. This option toggles the display of the external valve sequencer window.
Figure 13 shows the *Tools* Drop-Down Menu.

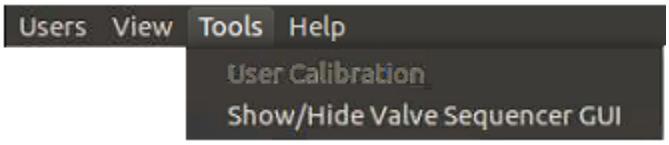


Figure 13: Tools Drop-Down Menu

Help Menu

Click **About** to display the version number of the analyzer.

Alarm Panel

Click on an item in the alarms panel to view the Setting Alarm dialog for that item. This panel is used to monitor the status of the internal analyzer alarms.

System Alarm monitors the current analyzer status, such as pressure, temperature, and measurement.

Figure 14 shows the *Alarms* panel.

Figure 14: Alarm Panel

The HF alarm is a gas concentration alarm indicator. The gas concentration alarm indicators (Figure 14) are:

- Green when the concentrations are at the set value
- Yellow when the analyzer is not operating properly
- Flashing yellow when the analyzer is warming up
- Red when the concentrations are above or below the set values

To view the alarm set points for a gas, click on the indicator next to that gas (Figure 14). The Alarm Set dialog displays (Figure 15). You can read or change the alarm settings and allow the user to enable it or change the set point. In Figure 15, the indicator illuminates when the concentration goes above 50 and resets (indicator off) below 45.

The alarm modes for gasses are:

- Higher
- Lower
- Inside
- Outside

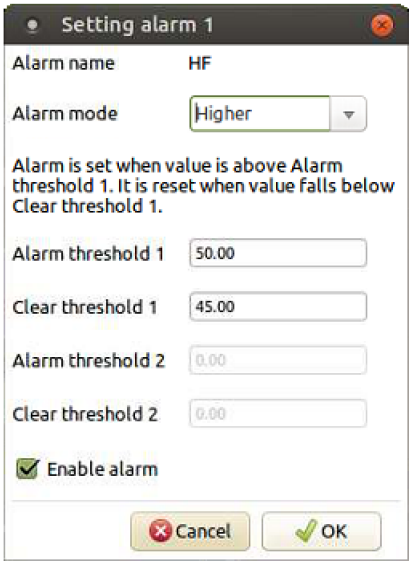


Figure 15: Alarm Set Dialog

To set the alarm, type the desired threshold values and click **OK**.

If you don't need to change the alarm value, click **Cancel**. The dialog box will disappear and the alarm value will remain unchanged.

Digital Readouts

The digital readouts show the latest value recorded for the selected data key for each data window. The changes in the data key are reflected in the digital readout in the data window view. If the *Show Statistics* entry is enabled in the *View* menu (Figure 12), the mean, standard deviation and slope of the data in the graph is dynamically calculated and indicated below the digital concentration readout. These numbers change to reflect statistics of whatever data is in the data window.

Figure 16 shows the digital readout panel.

Figure 16: Digital Readout Panel

Restart User Log

The analyzer automatically records all data collected and saves it for later analysis. These files are called DAT files after their extension (.dat) see Appendix A: File Management. Click *Restart User Log(s)* to start recording a new data file. Figure 17.

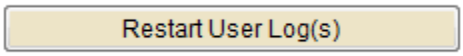


Figure 17: Restart User Log(s)Button

Data Log Filename and Path

The filename and path of the active data log is displayed in this panel.

Figure 18 shows the data log and filename and path panel.

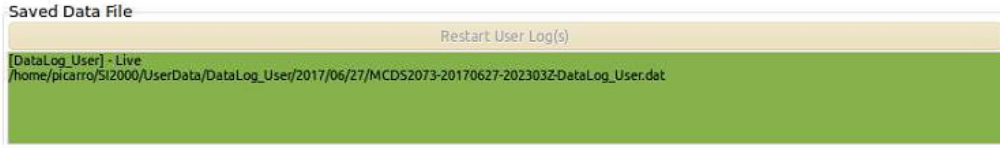


Figure 18: Data Log Filename Panel

Data Window

The data window displays graphs of streams of data vs. system time, with a format of hh:mm:ss.

- Select which data streams are displayed using combinations from the *Data Source* and *Data Key* drop-down menus.
- Adjust the number of significant figures displayed using the *Precision* menu.
- Adjust the auto-scaling of the Y axis using the *Auto-Scale* drop-down.

Figure 19 shows the data window.

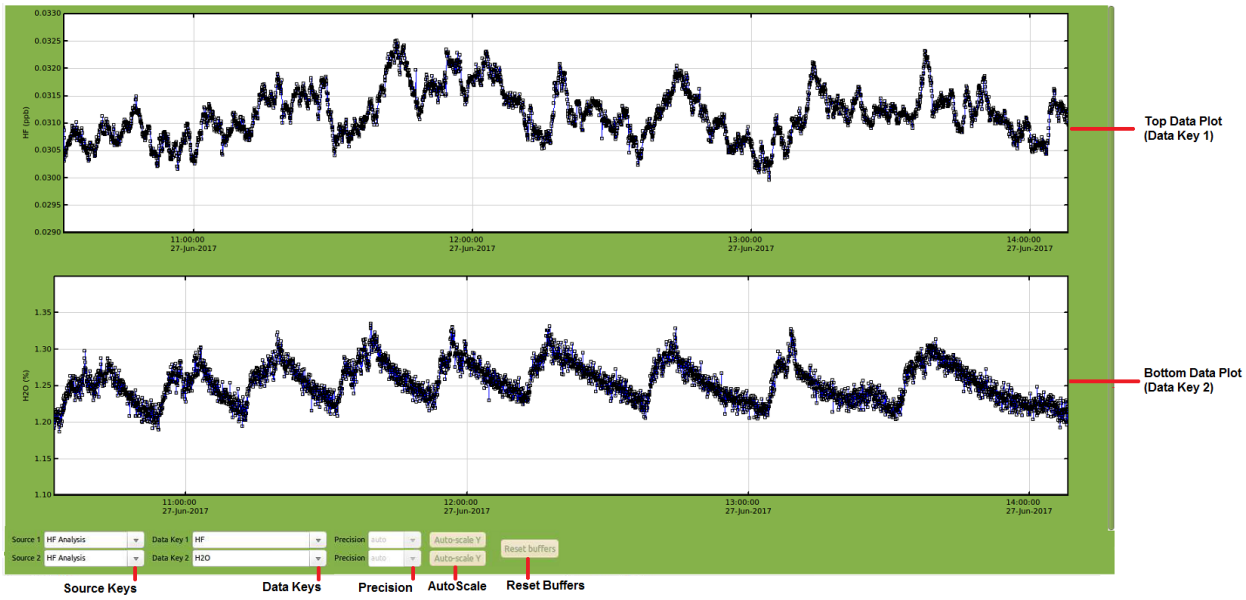


Figure 19: Data Window

Instrument Status

Enable the *Show Instrument Status* using the *View* menu on the main toolbar digital readouts for these parameters are displayed to the left of the data windows.

- Warm box temperature in ^{0}C
- Cavity temperature in ^{0}C
- Cavity pressure in torr

Figure 20 shows the Instrument Status.

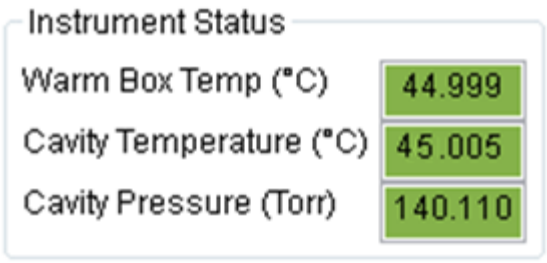


Figure 20: Instrument Status

Data Source Drop-Down Menus

Use these menus to select the data stream that is viewed in the *data plot*. Left click on the arrow next to a source to view the available data streams:

- *Instrument Analysis* shows gas concentrations.
- *Sensors* displays data from the analyzer's sensors.

Figure 21 shows the *Source Key* drop-down menus.

Figure 21: Source Key Drop-Down Menu

Data Key Drop-Down Menus

Left-click on the drop-down menu for a data key (Figure 22) to get the test options available for that key. When you select an option, the analyzer generates a data plot for that option.

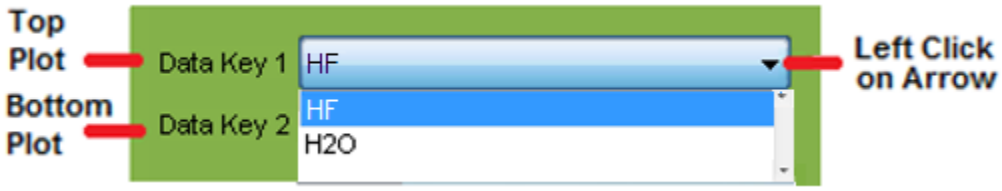


Figure 22: Data Key Drop-Down Menu

Precision Drop-Down Menu

Click on these drop-down menus to select the precision displayed on the y-axis of the data plot, between 0 and 4 digits of precision or *auto*. This affects *only* the data plot displayed in the *data window*, not the data stored in any files. Figure 23 shows the Precision drop-down.

Figure 23: Precision Drop-Down Menu

Status Log Window

Click here to display analyzer status messages, in this format: *MM/DD/YYYY hh:mm:ss generic message text*. These messages include all messages sent to the DAS.

Reset Data Buffer Button

Click here to clear the internal data buffer of the GUI (this clears the current data traces from the graphs). This has the effect of clearing all data in the data window. Clicking this button has no effect on any of the data log files stored by the analyzer. See Figure 24.

Data Buffer Level Meter

The green bar to the right of the *Data Window* shows the amount of GUI buffer memory used to retain historical data collected by the analyzer. When the maximum number of data points is collected and the buffer is full, old data is removed from the buffer as new data is collected. This affects *only* the data displayed in the *data window*, not the data stored in any files.

This buffer automatically resets when the analyzer starts, and can be emptied at any time by clicking the *Reset buffers* button in the lower-right-hand corner of the GUI. Figure 24 shows the *Data Buffer Level Meter* and *Reset buffers* button

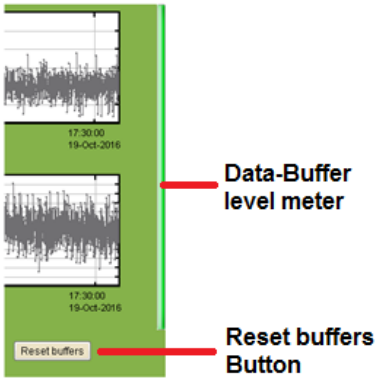


Figure 24: Data Buffer Level Meter and Reset Buffer Button

Zoom in a Data Window

Zoom in on a section of the data window to get a detailed view of the graph. To zoom an area of a data window:

1. Move the cursor over the graph you want to magnify.

   The cursor changes from an arrow to a magnifying glass.

2. Drag the magnifying glass over the section you want to zoom while holding down the left button.

   A box appears to show the zoom area.

3. Release the left button and boxed area will automatically scale to fill the data window.

- To auto-scale the y-axis of either graph, use the auto-scale buttons below the graph.
- To lock or unlock the time axes of each graph during zooming, select that menu item in the *View* menu.

Figure 25 shows the auto-scale buttons.

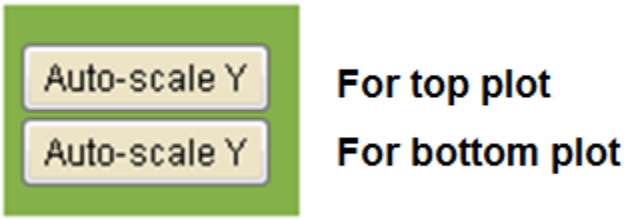


Figure 25: Auto-Scale Buttons

5.3. File Transfer

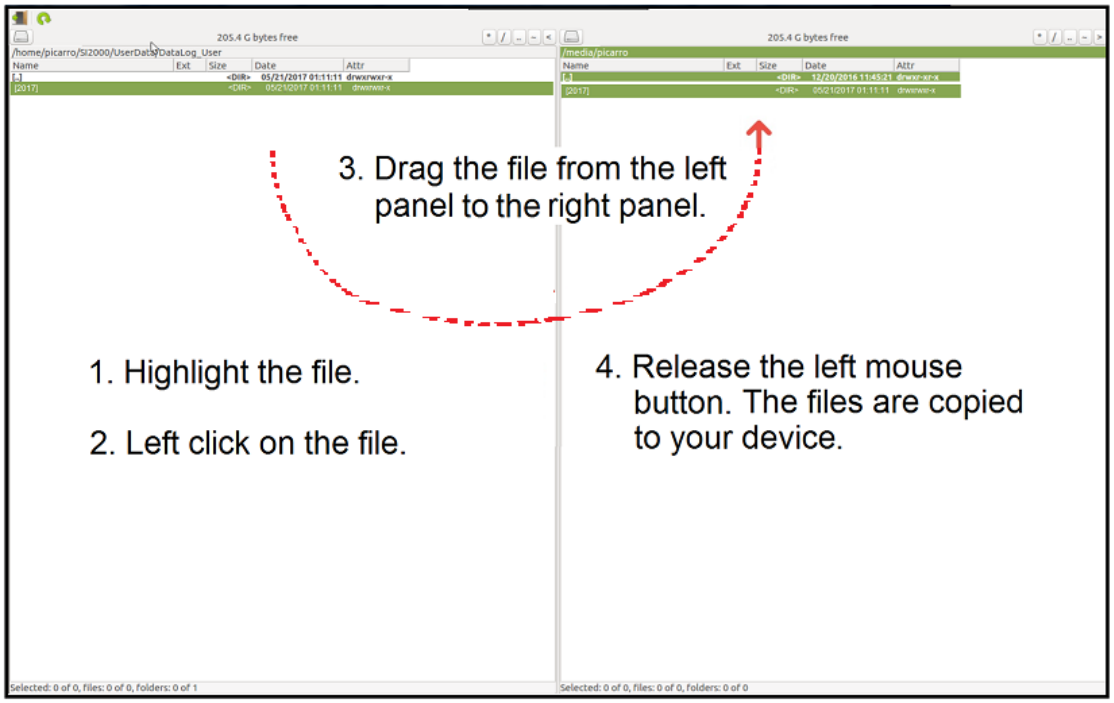
Click on **Files** to copy data to an external device.

The *File Transfer* screen displays. Figure 26 shows the *File Transfer* screen.

To transfer a file:

6. Highlight the file in the left panel.
7. Left-click on the file.
8. Drag the highlighted file to the right panel.
9. Release the left mouse button

The files transfer to the selected device.



f

Figure 26: Transfer Files

5.4. Configuration Menu

To access the configuration menu:

1. Click on the **Config** button to configure the analyzer. See Figures 9.

   The *Config Password* dialog displays. See Figure 27.

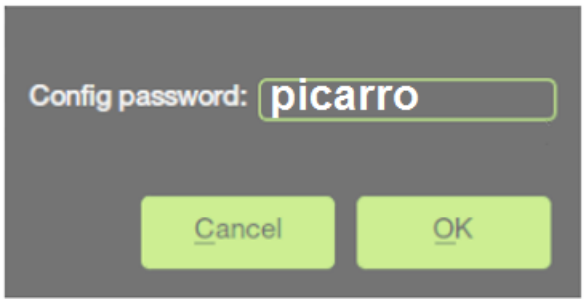


Figure 27: The Config Password Dialog

2. Enter the Config Password: **picarro**.
3. Click **OK**.
4. The *Configuration* Menu displays. See Figure 28.

Figure 28: The Config Screen

Network

Click on **Network** to view the current IP address of the analyzer. Figure 29.

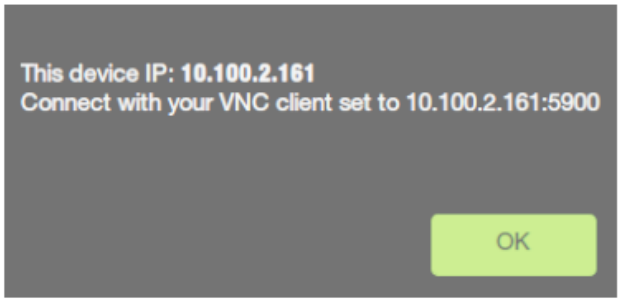


Figure 29: The Network Dialog

Clock

Click on **Clock** (Figure 28).

The *Set Time and Time Zone* dialog displays (Figure 30).

Use this dialog to:

- Set the clock for a new time zone.
- Manually set the correct time.

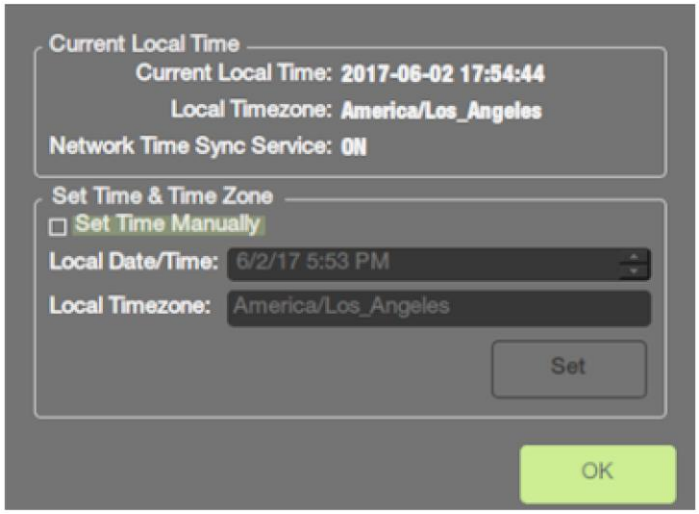


Figure 30: The Clock Set Dialog

Set the Local Time Zone

1. Click on the **Local Timezone** drop-down and select the location you want. Figure 31. The *Local Date/Time* field changes to the date and time for the location you selected.
2. Click **Set** to save the changes and return to the config menu.

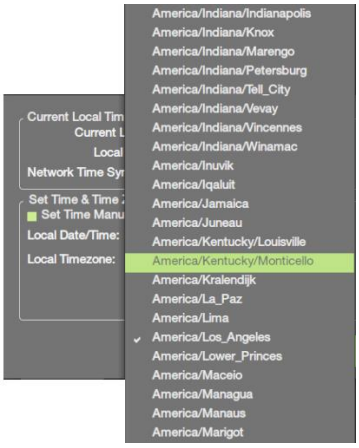


Figure 31: The Clock Set Menu

Manually Set the Time

Use the *Set Time Manually* check box (Figure 32) to manually reset the clock to the correct date and time when the clock is set to the wrong time.

1. Check the **Set Time Manually** check box.
2. Click **Set** to save the changes and return to the config menu.

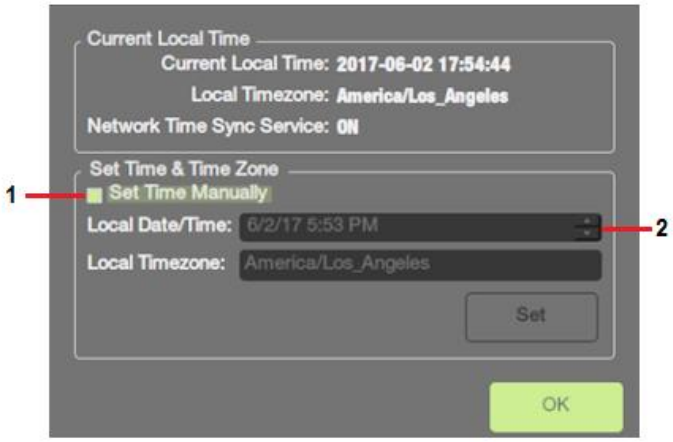


Figure 32: The Clock Set Dialog

Serial Port

Click on Serial Port on the Config screen (Figure 28) to access the Serial Port Dialog. The serial port dialog lets you change the baud rate. Figure 33 shows the serial port dialog.

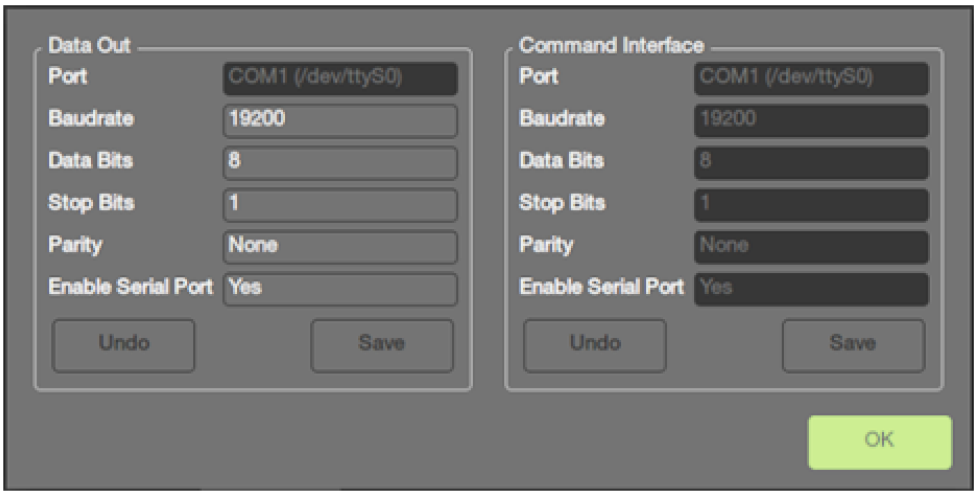


Figure 33: The Serial Port Dialog

To Change the baudrate:

1. Click on the *Baudrate* dialog. Figure 33.
2. Select the baudrate from the menu options. Figure 34.
3. Click Save.
4. Click OK.

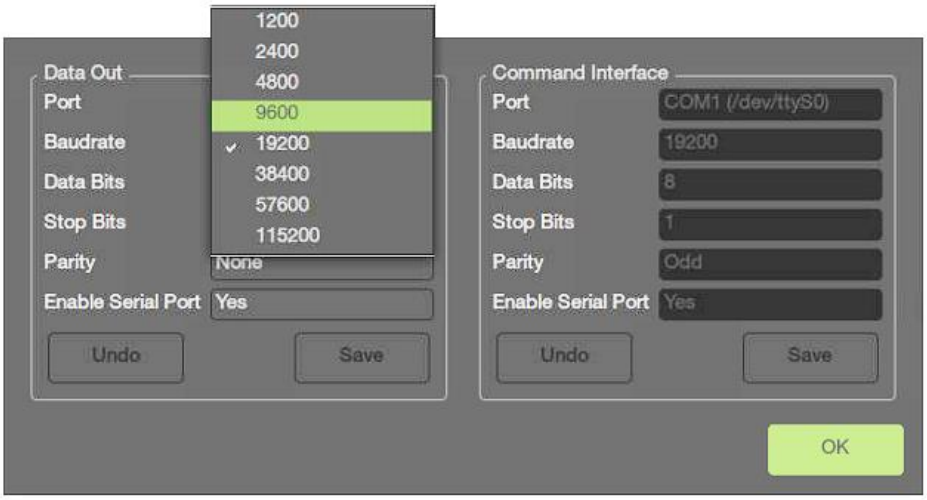


Figure 34: Baudrate Options

User Management

1. Click on **Users** (Figure 35) to access add users or change user permissions. The user login dialog displays. Figure 36.
2. Enter the user name **(admin)** and password **(admin)** and click the **Login** button.

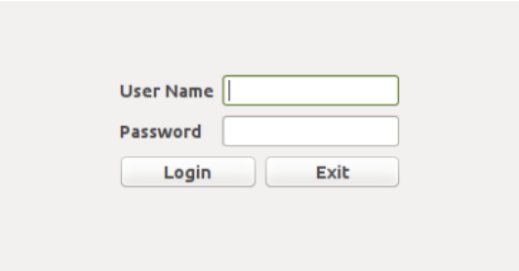


Figure 35: Users Login

3. The User Accounts dialog displays. Figure 36. This dialog lists user accounts and roles authorized for the analyzer.
4. From the user accounts dialog, you can:
   - Change Passwords
   - Change Role
   - Disable Users
   - Add Users

NOTE

Tech, *operator* and *admin* are the default users and rolls that are shipped with the analyzer.

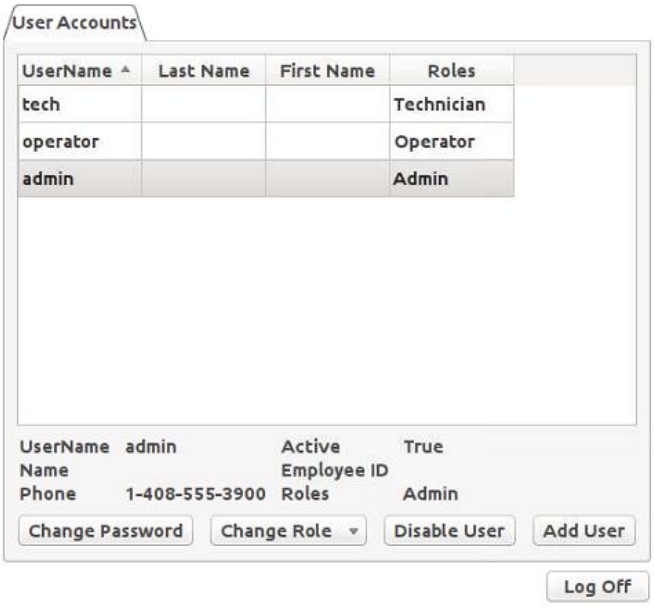


Figure 36: User Accounts Dialog

To change a password:

1. Click to highlight the user whose password you want to change. Figure 36.
2. Click **Change Password**.
3. Click on the user password you want to change.
   The Change Password dialog displays. Figure 37.
4. Enter the new password.
5. Confirm the new password.
6. Click **Next** to save the password.

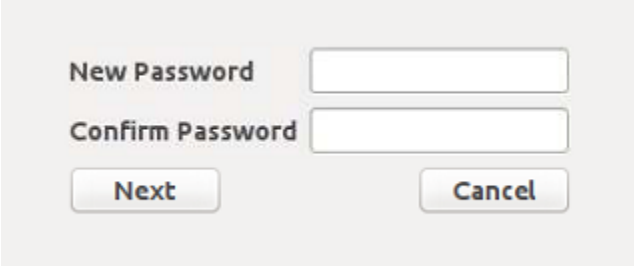


Figure 37: Change Password Dialog

To change a user's role:

1. Click to highlight the user role you want to change. Figure 38.
2. Click **Change Role**.
   The Change Role drop-down menu displays. Figure 38.

Figure 38: Change Role Drop-Down

3. Select the role for the user.

   The *Confirm Action* dialog displays. Figure 39.

4. Click **OK** to confirm the changed role.

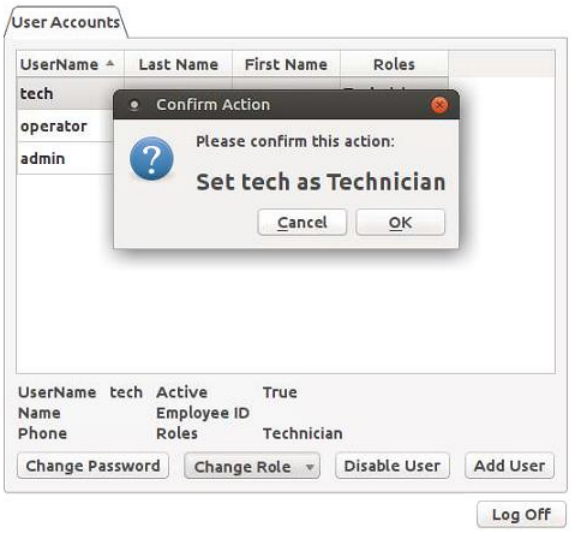


Figure 39: Change Role Confirmation

To Disable a user:

1. Click **Disable User**. Figure 40.

   The *Confirm Action* dialog displays.

2. Click **OK** to confirm the action.

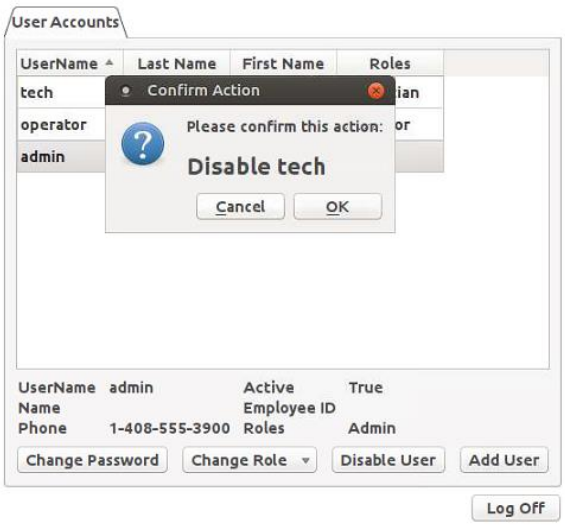


Figure 40: Disable Confirmation

To add a user:

1. Click **Add User**. Figure 41.

   The *Add User* dialog displays.

2. Fill in the fields in the *Add User* dialog.
3. Click **next** to go to the next step.

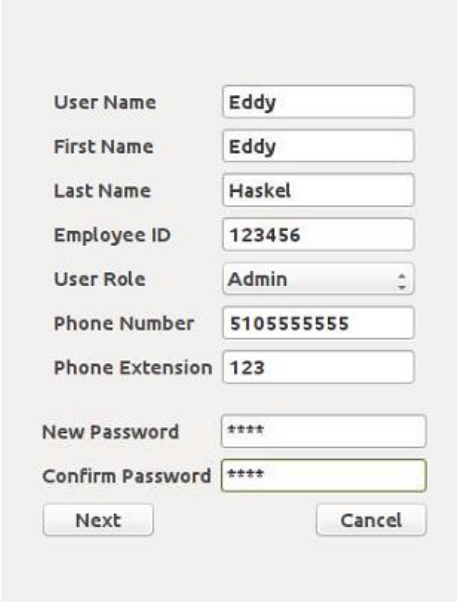


Figure 41: Add Users Dialog

The *New User Account Verification* dialog displays. Figure 42.

4. Review the user information and click **OK** to accept or **Cancel** to reject the new account.

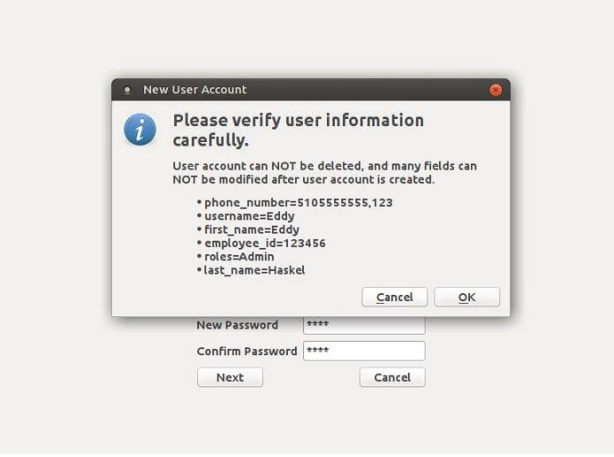


Figure 42: Add Users Account Verification

5.5. Shutdown Procedure

To shut down the analyzer:

NOTE

You must be logged in to shut down the analyzer.

1. Log in as admin:
   a. On the Menu Bar click on **Users** and choose User Login. Figure 43.

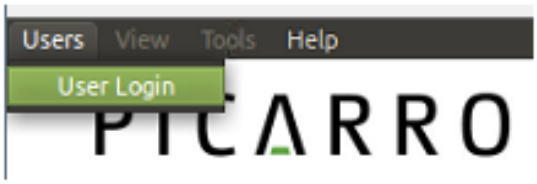


Figure 43: User Login Tab

   b. Enter the password a username (both are **admin**) and click **OK**. Figure 44.

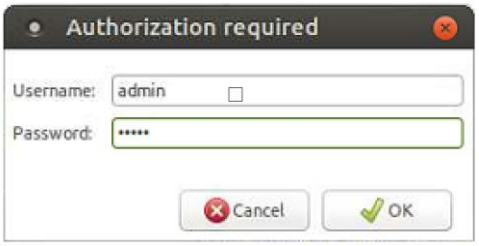


Figure 44: User Login Dialog

2. Click **Quit** on the data viewer screen (Figure 10).

   The analyzer displays the *Analyzer Shut Down* dialog. Figure 45.

Figure 45: Analyzer Shutdown Dialog

3. Click **Yes**.

   The analyzer shuts down:

   a. Cavity fills with clean gas from the inlet until it reaches near atmospheric pressure.
   b. Status log shows the pressure as the cavity is filled.
   c. Proportional valves close.
   d. Software shuts down.
   e. Analyzer powers off.

5.6. Recovery from Power Outage

When the power returns after an unplanned outage, the analyzer restarts automatically. The Picarro software:

- Closes files that were interrupted by the power outage.
- Opens new files for data collection.
- Data, analyzer diagnostics and other parameters recorded up to the time of power outage are retained.

If short power outages will be a routine operating environment, Picarro recommends using power conditioning or an uninterrupted power supply to help prevent damaging operating system and software corruption problems that can occur with repeated crashes.

6. Troubleshooting

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.

Status State Indicator on the Analyzer Front Panel is Not On

Pressing the main power switch does not start the analyzer and the status indicator on the front panel is not on when the analyzer is on.

The indicator on the front panel (Figures 3 and 46) shows the current operating state of the analyzer. Figure 46 shows and describes the operating status indicator states.

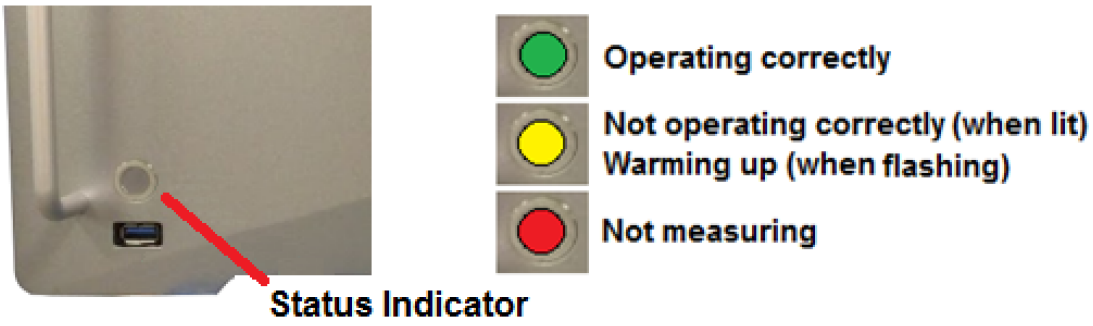


Figure 46: Status Indicator States

1. Check that the AC power cord is attached and plugged into a working outlet.
2. Check that the rear ON-OFF switch near the AC power cord is in the ON position.
3. Press and hold the rear panel power switch for at least 5 seconds as the analyzer may take several seconds to respond.

CAUTION

Do not restart windows without cycling the power to the analyzer. Restarting windows will not fix this problem.

Cavity Pressure Cannot be Adjusted for Concentration Measurements

The cavity pressure is automatically locked to the correct value during normal operation.

The *Pressure Locked* message on the lower left corner of the GUI indicates that the cavity pressure is within operating parameters. See Figure 47.

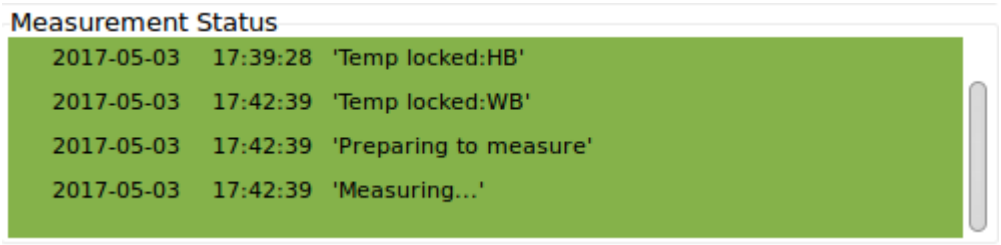


Figure 47: Status Log for New Filter

If the cavity pressure is out of operating specification the GUI displays a *Pressure high* or *Pressure Low* message.

1. The *Pressure Low* message on the GUI indicates that there is insufficient gas available at the analyzer gas inlet.
   - Check the inlet plumbing to the analyzer.
   - Ensure that the pressure/flow at the inlet is within specifications.
2. The *Pressure High* message on the GUI indicates that gas cannot exhaust from the analyzer at a sufficient rate.
   - Check the vacuum line between the analyzer and the power vacuum unit for leaks.
   - Check the vacuum pump. Make sure it is functioning correctly.
   - Check the gas pressure inlet for excessive pressure.

User Interface Program Does Not Update Graphs as Data is Collected

The computer may become unresponsive causing the programs that control the analyzer to stop functioning. If this happens:

Shut Down the Computer

If the computer responds to the mouse:

1. Wait until the computer is completely shut down.
2. After a few seconds, start the computer using the power button.

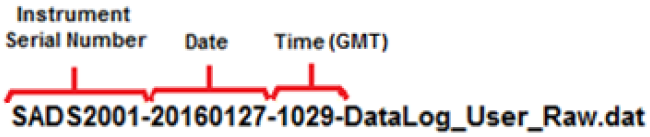
If the computer does not respond to the mouse:

1. Hold down the power switch on the rear panel (Figure 4) for a few seconds until the computer and the analyzer turn off.
2. After another few seconds, restart the analyzer using the power button.

Appendix A: File Management

The analyzer generates ASCII-format text output files. The data files are created every 60 minutes by default.

The file name is generated from the analyzer serial number, the date, and the time when the analyzer was started. For example:



SADS2001-20160127-1029-DataLog_User_Raw.dat

SADS2001 is the analyzer serial number

20160127 is the date, 1/27/2016, in format yyyymmdd (to allow chronological sorting of data files).

1029 is the time the file was started in GMT, 10:29 am, formatted as hhmm using a 24-hour clock.

The raw user data is contained in folders in the directory:

- */home/picarro/si2000/userdata/datalog_user/year/month/day/hour* for data sampled at the analyzer's native sampling rate
- */home/picarro/si2000/userdata/datalog_sync/year/month/day/hour* for data sampled at the analyzer's native sampling rate

Data files are created every 60 minutes and stored for 90 days (default for SADs analyzers) before they are automatically deleted. File deletion frequency and details can be modified in the file: */home/picarro/si2000/appconfig/config/archiver/archiver.ini*. See ***Error! Reference source not found.***.

During data acquisition, the analyzer creates directories to store the data, filed by the date the data were acquired.

Figure 48 shows a partial example of a data file.

	DATE	TIME	FRAC_DAYS_SINCE_JAN1	FRAC_HRS_SINCE_JAN1	JULIAN_DAYS	EPOCH_TIME	ALARM_STATUS
2	2016-10-15	00:24:44.483	287.68384819	6904.412357	288.68384819	1476491084.484	0
3	2016-10-15	00:24:46.444	287.68387089	6904.412901	288.68387089	1476491086.445	0
4	2016-10-15	00:24:48.415	287.68389370	6904.413449	288.68389370	1476491088.416	0
5	2016-10-15	00:24:50.385	287.68391650	6904.413996	288.68391650	1476491090.386	0
6	2016-10-15	00:24:52.355	287.68393931	6904.414543	288.68393931	1476491092.356	0
7	2016-10-15	00:24:54.335	287.68396222	6904.415093	288.68396222	1476491094.336	0
8	2016-10-15	00:24:56.309	287.68398506	6904.415641	288.68398506	1476491096.309	0
9	2016-10-15	00:24:58.246	287.68400748	6904.416179	288.68400748	1476491098.246	0

Figure 48: Data File

Datafiles are closed every 60 minutes and moved to an archive directory and a new datafile is started.

The archive directory is */home/picarro/si2000/*log/archive and has subdirectories datalog_mailbox, datalog_private and datalog_eventlogs with files arranged by year/month/day/hour.

There are more complete data files which include additional information beyond the concentration data including parameters such as analyzer temperatures and pressure, setpoints and spectroscopic information. This information is generally not useful to the user, but can be useful for diagnostic purposes and is store in the directory */home/picarro/si2000/log/archive/datalog_private /year/month/day/hour*.

For more information about how to include various columns of data from the datalog_private in the */home/picarro/si2000/userdata datalog* files, contact Picarro.

The currently active data file can be found in */home/picarro/si2000/log/datalogger*.

Archive directory contain subdirectories arranged by file type and internally organized by */year/month/day/hour*.

To keep the data files easy to manage and to limit the size of individual files and directories, new files are automatically generated whenever the analyzer is operating.

The software automatically generates new files each time the analyzer is powered up and also at midnight (GMT) each night. When new files are created at midnight, their file name will contain the new date and a time of 00:00.

For example, if the system was started at 10:29 am on 2/5/2016 it would create a file named *20160205/sads2001-20160205-1029-userlog.dat*. Then at midnight a new file will be created *sads2001-20160206-0000-userlog.dat*.

Appendix B: Status Log Messages

Normal Start Up Messages

Temperature Locked: WB

The system waits for the warm box (WB – the temperature-controlled electronics and wavelength monitor chamber) to reach operating temperature.

Temperature Locked: HB

The system waits for the hot box (HB – the temperature-controlled chamber containing the analyzer's optical cavity and gas handling system) is stabilized.

This is typically the longest step in the startup sequence. The duration of this step can range from 5 to 60 minutes, depending on the ambient temperature and how much time has elapsed since the last startup.

Preparing to Measure

Spectral scanning has started. Concentration measurements will be available in approximately 30 seconds. The analyzer continues to scan and report concentration measurements until the analyzer is shutdown using the procedure below.

Figure 49 shows an example of the status log messages for startup.

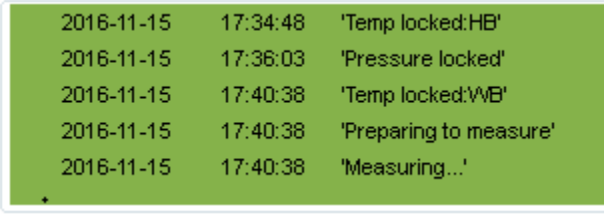


Figure 49: Sample Status Log Messages for Startup

Pressure Stabilizing/Locked

The valve control system begins to allow flow through the analyzer and stabilizes the pressure inside the cavity.

Measuring

This is the normal mode of operation after startup has completed.

Appendix C: Controlling External Valves

This section explains how to control external valves using the built-in External Valve Sequencer GUI.

If you are using the optional Picarro 16 Port Distribution Manifold with the analyzer, see the *16 Port Distribution Manual User Guide* for instructions on using the External Valve Sequencer GUI.

Display the Show/Hide Valve Sequencer GUI

5. Start the analyzer by double-clicking the **Start Analyzer** shortcut on the desktop.

   Wait for the analyzer to begin measuring.

6. On the status bar menu of the analyzer *Data Viewer* screen, select **Show/Hide Valve Sequencer GUI** drop-down (Figure 50).

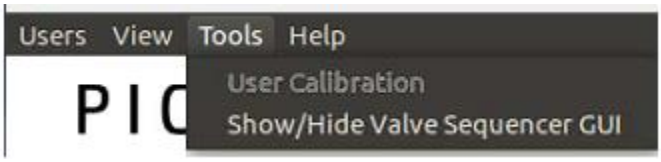


Figure 50: Show/Hide Sequencer Drop-Down

The External Valve Sequencer GUI displays (Figure 52).

The External Valve Sequencer Window

This section describes the *External Valve Sequencer* window.

Figure 51 shows the *External Valve Sequencer* window status bar menu items and actions.

Figure 52 shows and describes the *External Valve Sequencer* window.

File Menu

Load a Valve Sequence File

Click here to load saved files. Sequence Files are in:
C:\Picarro\SI2000\InstrConfig\ValveSequencer\Name of the Sequence File

Save a Valve Sequence File

Click **Action/Save Valve Sequence File** to save a valve sequence file.

Action Menu

Start Sequencer

Click here to start a sequence.

Go to First Step

Click here to run step one (automatically resets to 1 from whatever step is currently being sampled).

Reset All Valves

Click here to change the current valve state to *All Off*.

Hide Sequencer Interface

This toggle shows or hides the *Sequencer Interface* window. To reveal the window click on the **Show Sequencer Interface**.

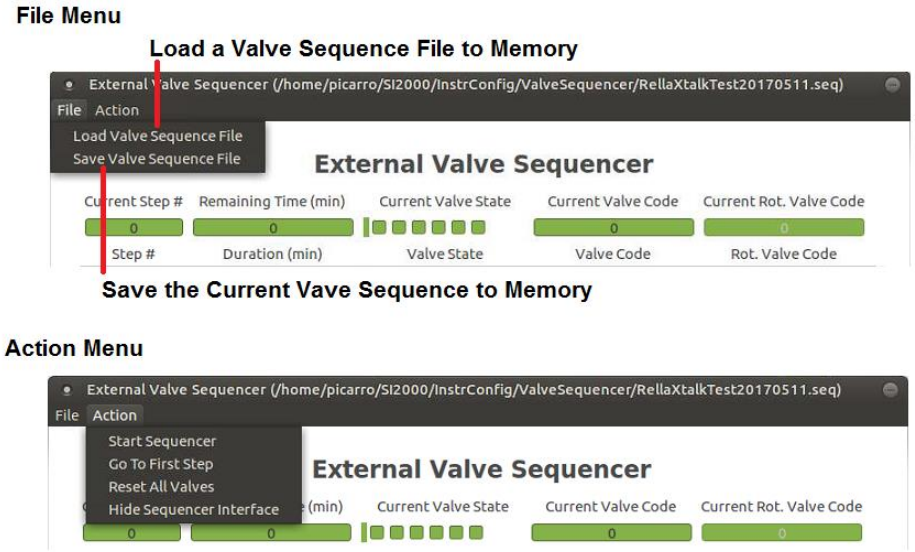


Figure 51: External Valve Sequencer Window Drop-Down Menus

Current Status Fields

The top row on the menu (see Figure 51 and 52) gives the current status of the current step.

Current Step

Gives the number of the current step as defined by the setup

Remaining Time (min)

Time remaining on the current step

Current Valve State

Check boxes indicate which valves are energized

Current Valve Code

Binary code representing which valves are energized

Current Rot. Valve Code

Used only with gas distribution manifold

Step Definition Fields

Use the step definition fields to define the test sequence.

Step

Enter the step number.

Duration (min)

Enter how long you want the step to last.

Rot. Valve Code

Used only with the gas distribution manifold

Bottom Panel

Use the bottom section of the window (Figure 52) to configure the sample.

Total Steps

Use this field to enter the total number of steps in the test. When the last step is finished, the sequencer loops back to the first step.

Run Step

Shows the number of step currently running. If a different step is desired, enter that step number and click on *Apply* (Figure 52).

Apply

Click here to apply changes made using the *External Valve Sequencer* window.

Run Next Step

Forces the next step in the sequence.

Start Date

Use this field to enter the date to start the test.

Start Time

Use this field to enter the time to start the test.

Schedule Sequence

Click this button to have the sequence start automatically at the date and time specified in the *Start Date* and *Start Time* fields.

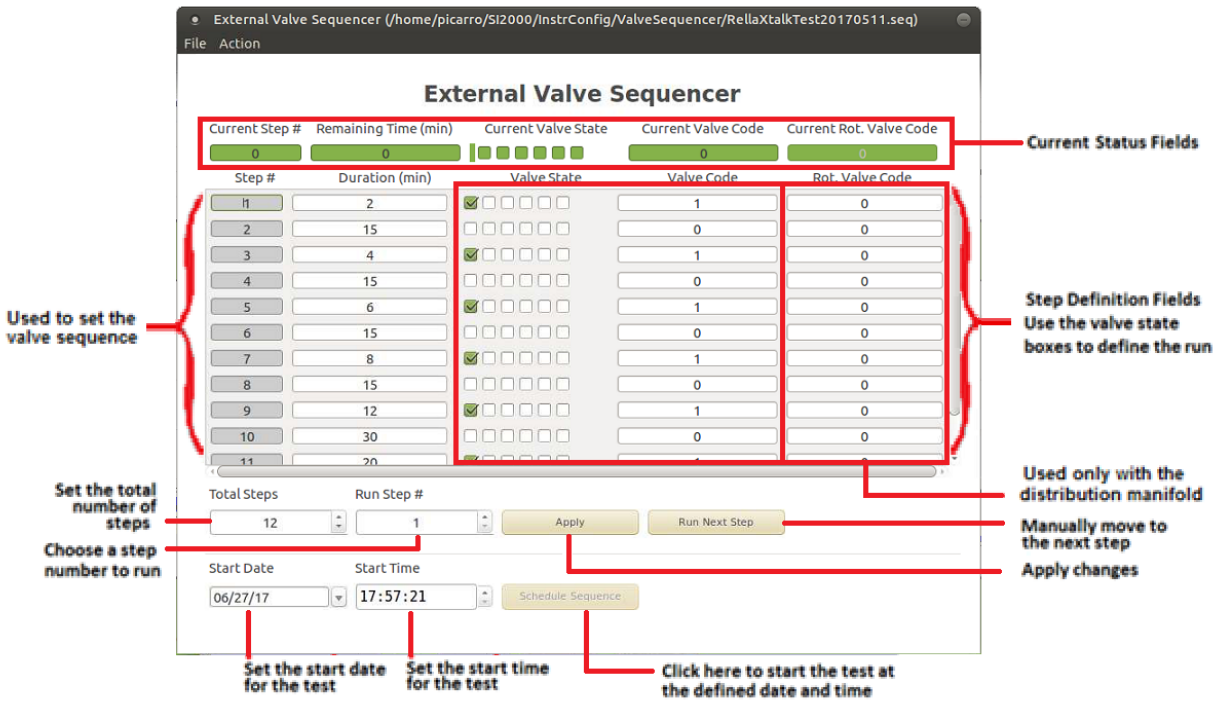


Figure 52: External Valve Sequencer Field Descriptions

Set Up a Test Sequence Using the Valve Sequencer Window

A variety of sequences can be created and saved *External Valve Sequencer* window. This section explains how to set up a test sequence using the *External Valve Sequencer* window.

To set up a sampling sequence:

1. On the Picarro analyzer GUI, go to:
   - Tools
   - Show/hide valve sequencer

   The External Valve Sequencer window displays. See Figure 52.
2. Use the *Rot. Valve Code* column to set the rotary selector valve position.
3. Enter the number (1-16) that corresponds to the desired valve position.

   A value of 1 in the *Rot Valve* Code field corresponds to position 2 on the valve. Only one rotary position can be selected per step.
4. Enter the Step duration in the *Duration (min)* field, where the duration of the step is in minutes. If duration values are set to less than 0.1 minutes they may not be carried out correctly.
5. Save the valve sequence as:
   /home/picarro/si2000/log/archive/datalog_private /year/month/day/hour

Load and Run a Saved Sequence

Load saved sequence files by clicking File/Load Valve Sequence. All the Sequence Files are in

/home/picarro/si2000/InstrConfig/ValveSequencer/Name of the Sequence File.

1. Click **Apply** to run the sequence.

   To skip the next step click **Run Next Step** (even while in middle of running a step):
2. Click on the *Action* drop-down menu (Figure 51 and 52).
3. Reset all Valves by changing all the *Rot. Valve Code* fields to Zero.
4. Click on **Go to the First Step** (Whatever the step the user is at, step 1 will be played).
5. Click on **Start/Stop Sequencer** (While the sequence is running, it will read *Stop Sequencer*).
6. Click on **Hide Sequencer Interface** (this hides the *External Valve Sequencer* window).

Appendix D: Hazards

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

Hazardous Voltage

 **WARNING**	**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.**

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 Gas 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.

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 SI2000 Series Gas Analyzers 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.

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.

Appendix E: Analog Signal Output

Overview

This 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. The pinout for each connector is listed in the table below.

Figure 41 shows the analog channel connectors on the back of the analyzer.

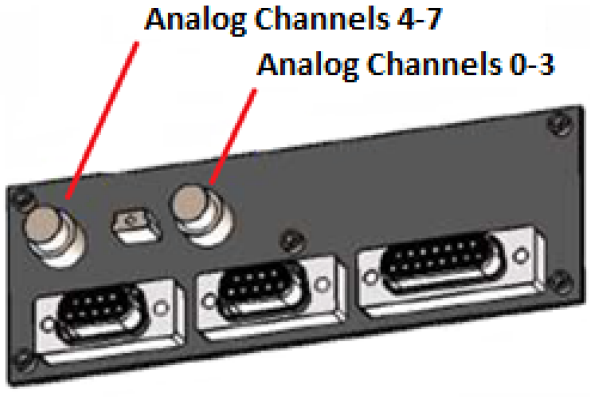


Figure 53: Analog Channel Connectors

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

Table 3 lists the analog pinouts and Figure 42 shows the analog pinout map.

Table 3 Analog Pinout Table

Pin	Function
1	GND 0
2	Channel 0
3	GND 1
4	Channel 1
5	GND 2
6	Channel 2
7	GND 3
8	Channel 3

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

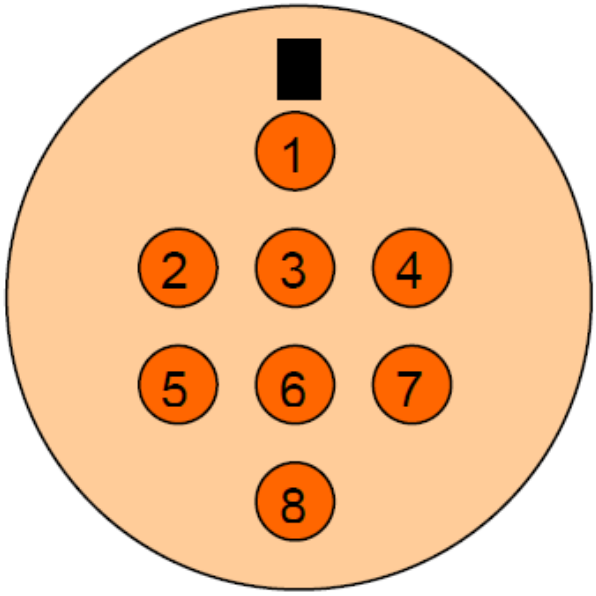


Figure 54: Analog Pin Map

Configuration

The default configuration is set at the factory and is listed in the table below. It can be modified by editing the electricalInterface.ini file located in the *C:\Picarro\G2000\AppConfig\ElectricalInterface* directory.

Analog Output Configuration

+1 volt indicates 0 in all cases: Each channel has a +1 volt offset. Treat <=0 volts as an error. This helps prevent reading the wrong values because of improper wiring (ground loops).

Example for Channel 0: 1V = 20ppb with a 1V offset. 9v x 200 ppb/V = 180 ppb = 1.8 ppm.

Table 4 is the analog configuration master table.

Table 4 Analog Configuration Master Table

Channel	Parameter	Output Scale (<1V indicates error)	Conversion All channels have a +1V offset (+1V=0)	Indicating Range 1V to 10V or 0 to 90 ppb
0	HF Concentration	0-10V	10 ppb/V	0 to 90 ppb
1	HF Concentration	0-10V	100 ppb/V	0 to 0.9 ppm
2	H2O Concentration	0-10V	2%/V	0 to 18%
3	DAS Temp	0-10V	10º C/V	0 to 90 º C
4	None	NA	NA	NA
5	None	NA	NA	NA
6	None	NA	NA	NA
7	None	NA	NA	NA

Appendix F: Analog Current Signal Output

Overview

Four channels of output are available on the back of the analyzer by default, the settings for the four channels are as follows:

	Iout0	Iout1	Iout2	Iout3
Monitoring	HF	H_2O	DAS Temperature	Cavity Pressure
Units	ppb	%	Degrees C	Torr
Min	0.0	0.0	0.0	0.0
Max	1000.0	20.0	100.0	1000.0

- HF: displays the HF concentration reading in parts per billion (ppb)
- H_2O: displays H_2O in percent (%)
- DasTemp: displays the internal logic board temperature in degrees Celsius
- CavityPressure: displays the cavity pressure in Torr

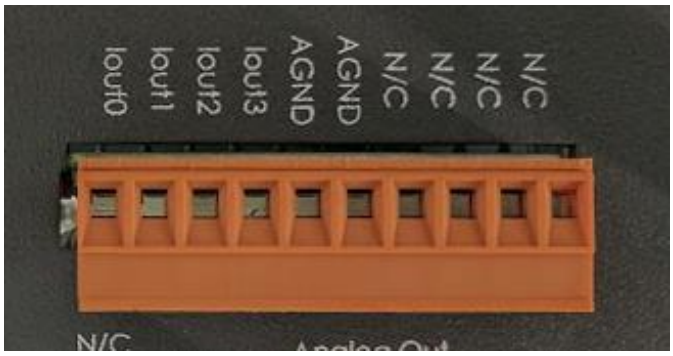


Figure 55: 4–20mA output with terminal connector in place

Connecting the 4–20mA Signal Output

1. Using your fingers, pull the 4–20 mA terminal connector straight back away from the analyzer.
2. Use a small slotted screwdriver to loosen the retaining screw for the desired terminal.
3. Insert the stripped end of the wire into the terminal.

Figure 56: Removing the terminal connector

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.

Figure 57: Retaining screws at the bottom of the terminal connector

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

Appendix G: Serial Communication Protocols

Overview

The Serial Port Menu is accessible from the Config Menu and displays the configurations of COM1 (used for Command Interface) and COM3 (used for Data Out). The COM1 port is preconfigured and its settings cannot be changed. The COM3 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.

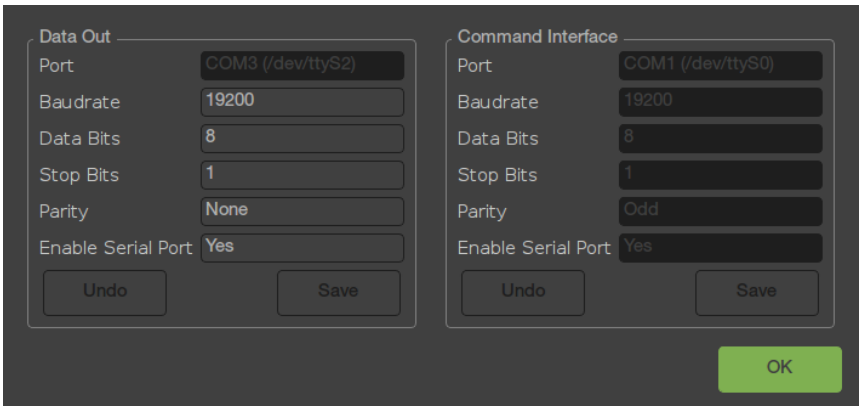


Figure 58: Default Serial Port Configuration

COM1 (Command Interface) Protocol

The headers below correspond to each column of data and are not included in the output:

CavityPressure,CavityTemp,DasTemp,WarmBoxTemp,species,MPVPosition,OutletValve,solenoid_valves,HF,H2O,O2,HF_raw,HF_sigma,HF_tau,base_77

Command Examples

_MEAS_GETCONC (no time stamp):

139.987;45.000;30.812;45.001;60.000;0.000;49941.121;0.000;0.041;0.939;20.685;0.008;0.025;60.358;968.312

_MEAS_GETCONCEX (same header order, but with time stamp):

2017-09-25 18:14:57.409;140.004;45.001;30.812;45.002;60.000;0.000;49946.886;0.000;0.041;0.895;20.695;0.001;0.025;55.767;968.342

Output Frequency:

Data will be output when command is sent to COM1 via RS232

COM3 (Streaming) Protocol

The column headings for the streaming interface are as follows:

Column0 = Timestamp

Column1 = CavityPressure

Column2 = CavityTemp

Column3 = DasTemp

Column4 = WarmBoxTemp

Column5 = species

Column6 = MPVPosition

Column7 = OutletValve

Column8 = solenoid_valves

Column9 = HF

Column10 = H2O

Column11 = O2

Column12 = HF_raw

Column13 = HF_sigma

Column14 = HF_tau

Column15 = base77

Column16 = ymd

Column17 = hms

The data in columns 12-17 are reserved for diagnostic use by Picarro-authorized technicians.

Data Example

1506363968.96 139.9877 45.0003 31.0000 45.0008 61.0000 0.0000 49907.2541 0.0000 0.0349 0.9588 20.6750 0.0169 0.0000 0.2499 968.3100 0.0000 0.0000

Output Frequency

Data will be output automatically in real time similar to the GUI display.

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 Customer Service:

Email: orders@picarro.com

Phone: 408.962.3900 ext. 3992

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

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