SAM User Guide

PICARRO

Version 1.1

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1 Introduction

1.1 Introduction to SAM

SAM stands for Sample, Analyze, Monitor.

SAM is a fully integrated AMC monitoring system with hardware and software working seamlessly together, enabling you to efficiently and effectively monitor your fab.

Airborne Molecular Contamination (AMC) can affect your final product, processes, and equipment. With contaminants coming from inside and outside the fab, it is vital to monitor and understand changes to the ambient environment. SAM monitors your fab conditions, using integrated sensors to track AMC trends in key fabrication areas; the system actively and accurately visualizes, analyzes, and stores data continuously, so you can view conditions and evaluate them according to your unique needs.

Figure 1: SAM Integrated System

1.1.1 Key Features

SAM offers the following elements as prime advantages in AMC detection:

- **FAST SYSTEM RESPONSE**: The gas-handling hardware of the SAM integrated system has been specifically designed to minimize the "time-to-detection" response function of the sampling system. SAM's flow control hardware allows you to monitor up to 16 unique locations throughout your fab and can rapidly detect concentration changes within the various monitored environments.
- **A USER-FRIENDLY GUI:** While the SAM hardware system is complex, its GUI is simple, easy-to-use, and configurable. From the SAM interface, you can evaluate the concentration of one species or multiple species, and you can assess conditions of specific ports, multiple ports, specific instruments, multiple instruments, a bank or the entire fab. In addition, these conditions can be reproduced in both graph and tabulated forms, so you can see patterns and changes and generate reports for offline analysis and archiving.
- **MOBILE MANAGEMENT**: For network connected installations, SAM enables you to access all of its software features and have full system control from your desktop; you don't have to gown-up and enter the fab to modify plans and adjust measurement conditions. SAM also dynamically detects hardware connections and configures itself; you can easily validate these connections via the hardware status page on the GUI.
- **EASY-TO-USE DATA EVALUATION TOOLS:** The SAM GUI enables you to track current conditions and to track the history of conditions. SAM is always monitoring and collecting concentration data on multiple species from each port in your fab. You can view a history of changes and spot trends, by species, by location, and by specified time frame. This enables you to respond to AMC conditions in the moment and also make improvements based on your analysis of historical trends.
- **AUTOMATED PLAN EDITOR:** SAM's plan editor allows you to customize, save, edit, and load plans that automate monitoring of your fab. From the editor, you can run a reference gas through the system and also run clean cycles in the middle of plans. SAM also keeps track of the last plan run and automatically recovers it in the event of a power-loss, resuming fab monitoring immediately.

1.1.2 How SAM Works

Picarro's SAM is a cohesive system that maximizes the overall effectiveness of its AMC monitoring equipment.

First and foremost, Picarro's SAM leverages the excellent responsiveness of Picarro's gas analyzers. Picarro analyzers effectively and rapidly respond to any change in gas concentration, up or down. Most multiport sampling systems—placed upstream of gas analyzers—decrease the overall system responsiveness. This problem is compounded with each additional meter of upstream sample tubing. If these inherent issues are unaddressed by the sampling system design, events in your fab will go unnoticed and, potentially, you may respond to conditions that may be hours, if not days, in the past.

With SAM's specialized design, Picarro has made great strides in reducing, and in some cases eliminating these effects entirely. It allows you to monitor up to 16 sample lines with high throughput and use pressurized clean and reference gases to run periodic checks on analyzer baseline and calibrations. This enables you to respond immediately to changes in your fab's environment.

In addition, SAM's software supports this monitoring system with its simple and easy-to-use GUI. You can manually control the sampling hardware and make long-term test plans that can be looped indefinitely. The software continuously collects and indexes all pertinent data and allows you to analyze it in any number of configurations. It collects and stores data by location, time frame, and species. You can also adjust plans at any time from any place, with its portable and remote application option.

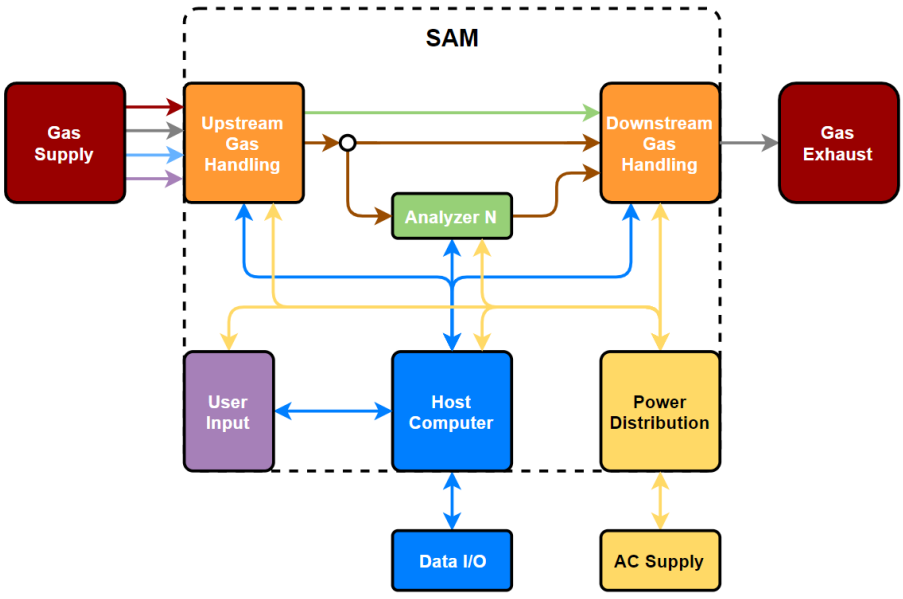


Figure 2: System Diagram

1.2 Audience & Scope

This manual is designed for technicians, production managers, fab managers, and those involved in the monitoring and management of semiconductor fabrication facilities.

1.3 Manual Purpose & Organization

This manual begins with a brief introduction and then provides compliance and safety requirements and basic setup and start-up instructions. Most of the setup, installation and maintenance of SAM will be done by a manufacturer trained service partner, so the manual provides a basic hardware description and then focuses on explaining the GUI. You can advance to the GUI section and learn more on the following pages:

- **Home Page**: This page shows the current condition on your port setup.

  Go to page 23.

- **Flow Setup Page**: This page allows you to adjust your system plans and schedule.

  Go to page 27.

- **Current Values**: The page shows the most recent concentration values of each species in your system.

  Go to page 36.

- **Analyzer Output Graphs**: This page shows a graph of concentration values over time.

  Go to page 38.

- **Concentration by Channel**: This page shows the species concentration by channel.

  Go to page 40.

- **System Status**: This page shows the condition of the CPU, analyzers, hardware, and log messages.

  Go to page 41.

- **User Data File Generator**: This page enables you to download files into CSV format, so you can build spreadsheets and graphs.

  Go to page 46.

- **Viewer**: This page shows user data and login data. You can log in and out here.

  Go to page 48.

2 Product Safety Warnings, Cautions & Hazards

2.1 Advisory Notice – General Use

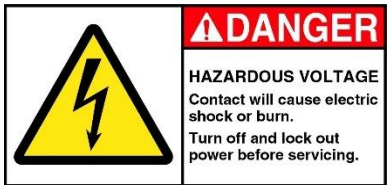
Using SAM in a manner not specified by Picarro may result in damage to SAM, and render it unsafe to operate.

2.2 Warning Symbols and Text Conventions

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

Symbol	Meaning
	**NOTE**: This shows when you should be aware of something before proceeding.
 **MANUAL USE**	**MANUAL USE**: This shows when you should consult this manual for important information.
 **DANGER**	**DANGER**: This indicates an imminently hazardous situation that, if not avoided, will result in death or severe injury.
 **WARNING**	**WARNING**: This indicates a potentially hazardous situation which, if not avoided, could result in death or severe injury.
 **CAUTION**	**CAUTION**: This indicates a potentially hazardous situation which, if not avoided, could result in moderate or minor injury.
	**REMINDER**: This is a helpful prompt to remember procedures listed in the text.

The following symbols will appear as stickers on the SAM system as needed to indicate potential hazards.

Symbol	Meaning
	**HEAT**: This indicates easily touched surfaces that can exceed normal temperature conditions.
	**VOLTAGE**: This shows an area on the machine that when touched, may cause an electric shock or a burn.
	**PINCH POINT**: This shows an area on or near the machine in which the user may have their hands or fingers pinched.

2.3 Label Locations

Figure 3: Warning Labels

2.4 EQUIPMENT RATINGS/SPECIFICATION TABLE

Subject	Value
Power Ratings	• 220-240 Vac • 50/60Hz • 2.2kW Max.
Degrees of Ingress Protection	• IPx0
Environmental Range for Equipment	• **Indoor Use**: Indoor Use Only • **Altitude**: 10,000 Feet Operating • **Operating Temperature Range**: 10°C to 30°C (operating), -10°C to 50°C (storage) • **Maximum Relative Humidity**: <85% R.H. non-condensing • **Mains Supply Voltage Fluctuations**: MAINS supply voltage fluctuations up to ±10 % of the nominal voltage
Equipment Size – Standard	• **HxWxD**: 1220 mm by 840 mm by 840 mm • **Monitor height:** 320 mm
Sampling Line	• 1/2-inch OD x 3/8-inch ID UHP-PFA tubing
Communication	• TCP/IP remote interface
Model Numbers	• SAM-S-xx where xx indicates the number of ports (08, 16)

3 Hardware System Setup & Prerequisites

3.1 Personal Protective Equipment

Any protective equipment shall be used in accordance with the instructions provided by the protective equipment supplier and as appropriate to the conditions in your fab.

3.2 Prerequisites

- **Space Requirements:** The space requirements are 990 mm width, 2060 mm depth (with doors open), 1600 mm height with monitor up.
- **Power Requirements**: SAM is designed to operate with a 220-VAC power supply. If only a 110-VAC power supply is available, then a step-up transformer is required.

  In the case of industrial field use, power the Picarro analyzer and sampling system from a clean and steady power source. Avoid intermittent electrical fluctuations or electrical power surges, as they can damage the Picarro analyzer and sampler electronics.
- **Step-up Transformer Requirements**: If required, Picarro recommends the following step-up transformer specification: 1700-Watt, 220-VAC, 35-Amp fuse.
- **Gas Cylinder Requirements**: Use chains and/or a cage to securely hold compressed gas cylinders in place. Be sure the setup meets safety requirements as outlined by the gas supplier as well as the health and safety codes at the installation site.
- **PFA Tubing**: Use the 1/2-inch outer diameter and 3/8-inch inner diameter PFA tubes as much as required for your setup.
- **Ventilation**: The customer is responsible for safely venting potentially toxic exhaust from all pumps.

3.3 Clean and Reference Gases

This section applies only to users that want to supply external clean and reference gases to the SAM system.

- **Gas Supply Requirements**:
  - Regulated to 20-25 PSIG
  - Flow capacity greater than 50 SLPM
  - Gas input ports are 3/8-inch OD push-to-connect fittings. Recommended tubing is 3/8-inch OD x 1/4-inch ID, PFA tubing.
- **Recommended Clean Gases**:
  - House nitrogen, N_2.
  - Clean Dry Air (CDA).
- **Viable Surrogate Reference Gases**:
  - Use a CO_2 Bottle ~1% to validate NH_3 measurement.
  - Use a CH_4 Bottle ~100 ppm to validate HCl measurement.
  - Use Zero Air cylinder ~21% O_2 to validate HF measurement.

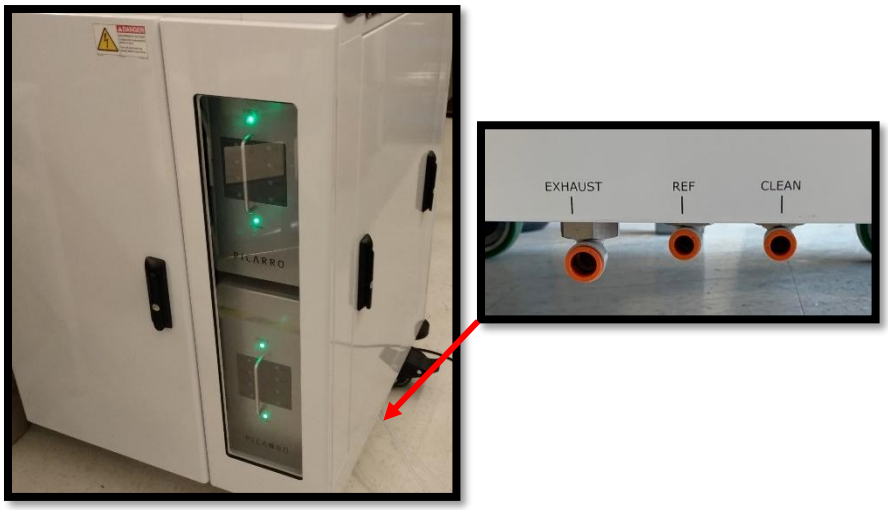


Figure 4: Exhaust, Reference and Clean Gas Ports

NOTE: The line from the clean source must be plugged into the “CLEAN” fitting, and the line from the Reference Gas tank must be plugged in to the “REF” fitting.

3.4 Hardware Equipment Installation

While it is likely that SAM's hardware will be installed by a manufacturer trained service partner, the following guidelines are Picarro's recommendations for installation. Be aware of your fab safety requirements during installation. The safety of your overall system is the responsibility of your onsite staff.

3.4.1 Visual Inspection

A manufacturer trained service partner will install the system and perform the following visual inspection.

Figure 5: SAM System Front

Prior to powering on the system, inspect the following items

1. The sampling system's physical condition and the overall condition of the system
2. The sampling ports and pneumatic connections
3. The external pump (220V) and cooling fan
4. The emergency electric safety switch, the integrity of the wiring connections, and the switches

3.4.2 SAM Equipment – Key Components

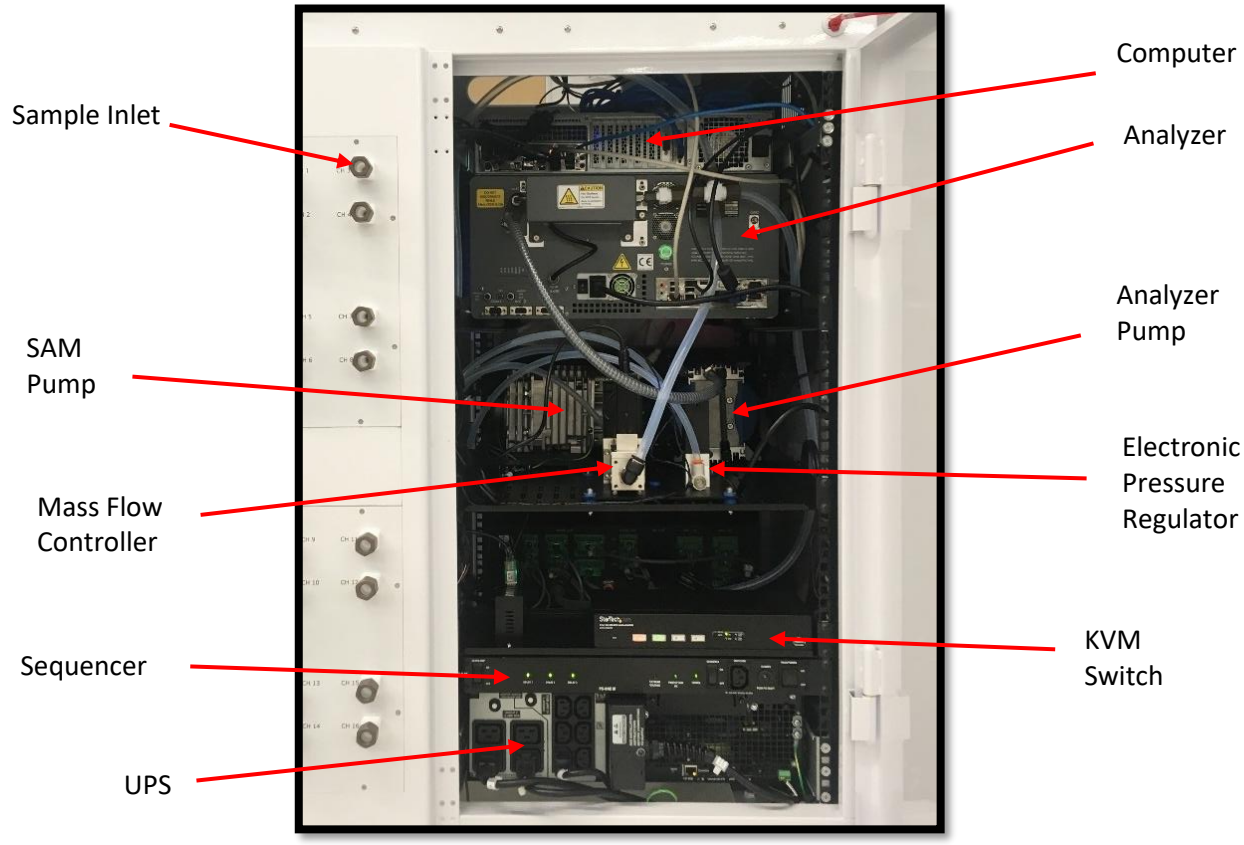


Figure 6: SAM System Components (Back View)

Figure 7: SAM Side Panel

CAUTION: The front and back doors are hinged and swing open. The side panels are NOT hinged and come off completely. They should only be removed by a manufacturer trained service partner.

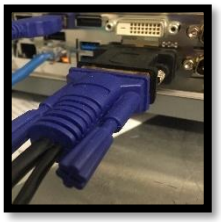
3.4.3 Analyzer Installation and Setup

1. Install the front rack-mount onto the analyzer.
2. Make the following connections to the analyzer (back side) area.

3. Connect the power cord to the analyzer and ensure that the power switch is in ON position.

4. Connect the sample line to the sample port.

5. Connect the external pump line to the exhaust port.



6. Connect the DVI cable (along with USB) to the DVI port.

NOTE: Do NOT connect the USB cable to USB-3 ports on the analyzer.

7. Connect the RJ45 ethernet cable in the network port (labeled) into the network sharing port on the back side of the analyzer.

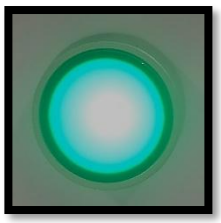
3.4.4 Electrical Connections and Startup

1. Ensure that all the power cables are seated properly. Check the sampling controller back side, the analyzer back side, and the external power distribution unit for the power cord connection.

2. Ensure that the **Emergency OFF (EMO)** button is in the release position.

3. Double-check that the pump voltage is set to 220-VAC. All the SAM pumps are shipped with the 220-VAC setting as default.

4. Connect the sampling system (220-VAC EU type connector) to the 220-VAC power supply outlet (rated 32A). If connected with a step-up transformer, connect the step-up transformer to a 110-VAC power supply (CE rated) and connect the sampling system electrical connection to the step-up transformer 220-VAC outlet.



5. On the mobile system, make sure to switch on the UPS. The **Green Power** button on the sampling system should light up.

6. After powering up the sampling system, verify that all the ventilation fans are operational.

3.5 Hardware Equipment Operation

3.5.1 Power Up Sequence

1. Uncoil the AC power supply cord and plug the connector into an appropriate 220-VAC wall socket (or step up transformer in areas with 110-VAC supply).

2. If necessary, toggle the rocker switch on the front of the power distribution box to the ON position. The switch should light up in green. Under factory default settings, the rocker switch is set to ON. If so, skip this step.

3. Press the **ON** switch on the front face of the SAM chassis. The indicator should light up in green

   This supplies AC power to the UPS, but the UPS is off at this point, as indicated by the UPS LED indicator on the SAM chassis (not lit).

4. Press the **Power** button on the front panel of the UPS to turn it on. The front panel should turn blue. (When the **Power** button shows red, the system is not on.)

5. Press the **Power** button on the front panel of the UPS again.

6. Press the down arrow key to highlight “Turn On Immediately” and press the **OK** button to select it. This turns on the UPS and supplies power to the SAM. (Refer to UPS manual for more detailed operation instructions.) The UPS LED indicator on the SAM chassis will light up in blue. The analyzer pump, sample pump, and analyzer should be set to ON by default. These components will power up when SAM is on.

7. Press the **Power** button on the PC to turn on the computer. The SAM software system will start automatically at this point.

3.5.2 Power Down the System Sequence

You will shut down the following items in this order:

1. Analyzer 1 & Analyzer 2 (if applicable)
2. The SAM Computer
3. The SAM Main Power Supply
4. The UPS (if applicable)

Analyzer 1 & 2 – KVM Port Power Down Sequence

A KVM switch is used to toggle between the SAM and internal analyzers. You will use the keyboard hot keys to Power Down. If the hot keys are not functioning, see the note below.

1. Press the hot keys on the key board. Press <Ctrl> <Ctrl> <2>. You will see the analyzer GUI.
2. Follow the instructions in the Analyzer user manual to properly shut down the analyzer.

3. Repeat these steps for any additional analyzers, changing the KVM port number pressed based on KVM position.

NOTE: If the hot keys are not functioning, toggle the KVM Switch manually. The Switch can be found by opening the door at the back of the SAM. Use the buttons on the front of the KVM.

SAM Computer Power Down Sequence

4. Using the keyboard press <Ctrl> <Ctrl> <1>. You will see the SAM GUI.

5. Press the **Windows** key on your keyboard.
6. Scroll up to the Power button (upper-right) and press the **Power** button from the drop-down list.
7. A pop-up Window displays, click the **Power Off** button.

SAM Main Supply Power Down Sequence

8. Once the computer is shut down, press the red **OFF** button on the front of SAM. This turns off AC power.

   If your system has a UPS, the UPS battery will activate and keep the SAM powered on.

   The UPS will enter battery power mode and the front panel will turn from blue to orange. It will also emit intermittent beeping when on battery power.

UPS Power Down Sequence (If Applicable)

9. On the front panel of the UPS, press the **Power** button and toggle the arrow keys to “Turn Off Immediately.”
10. Press the **OK** button on the lower left.

11. Press the **Power** button and then, select “Internal Power Off” to completely power down the SAM.
12. Press the **OK** button on the lower left of the UPS.

3.5.3 SAM Emergency Off Sequence

The Emergency OFF switch (EMO) is located on the front left side of the SAM.

1. Press the EMO switch to activate the emergency shut down sequence.

2. Once activated, all power including UPS battery power will be cut immediately.

Figure 8: Location of EMO Switch

3.5.4 SAM Emergency Reset Sequence

1. To reset the EMO switch, twist the knob clockwise (in the direction indicated) to release.
2. Check that SAM is properly connected to a suitable VAC outlet (see the SAM Power Up Sequence).

3. Press the green **ON** button on the front of the SAM chassis. The ON indicator should light up in green.

The UPS will emit an audible alarm and the front panel will turn to red, indicating that it is still in EMO OFF mode.

4. Press the **ON** button on the front panel. It will show red, when the system is off and white when on.

5. To reset the UPS, press the **OK** button and follow the on-screen instructions. Proceed with the normal power up sequence once the EMO has been reset.

Figure 9: Location of EMO Switch

4 Using SAM – Basic GUI Operations

The SAM Home Port page is your launching point for accessing all SAM features, and it will be configured in advance according to your desired specifications. It shows the analyzer readings, the most recent species values, and the analyzer conditions. The navigation pane along its left side will advance you to each page. You can learn more about the navigation pane on the following page. To access this page, you must first log in to the system.

4.1 Home Port Page

4.1.1 Login

1. Log in to your SAM System.

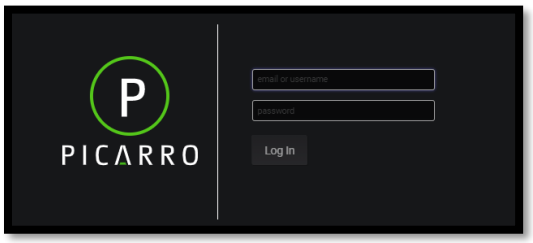


Figure 10: Login Page

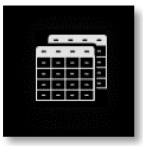
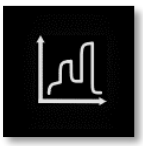
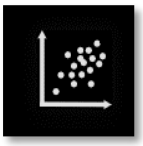
2. Enter your user name and password. You will be advanced to Home Port page, as shown.

4.1.2 The Home Port Page

Figure 11: SAM Home Port Page

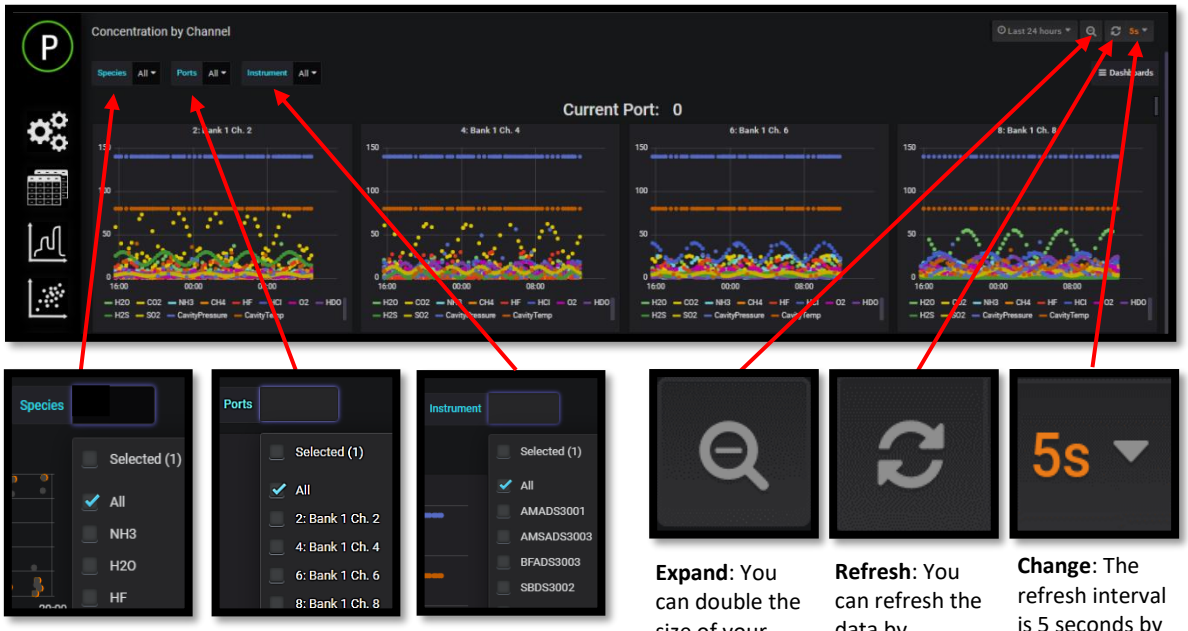
4.1.3 The Navigation Pane

From the Home Port page and any page, you can navigate through SAM's system by selecting the icons on the left side of the screen.

Icon	Functionality
	**Home Port**: This icon takes you to the Home Port page, which shows the current condition on your port setup. This is the default page.
	**Flow Setup**: This icon takes you to the Flow Setup page. You can adjust your system plans and schedule here. Go to page 27 to learn more.
	**Current Values**: This icon takes you to the Current Values page. It shows the most recent values of species in your system. Go to page 36 to learn more.
	**Analyzer Output Graphs**: This icon takes you to the Analyzer Graphs page. It shows a graphical representation of the species over time. Go to page 38 to learn more.
	**Concentration by Channel**: This icon takes you to the Concentration by Channel page. It shows the species concentration by channel. Go to page 40 to learn more.
	**System Status**: This icon takes you to the System Status page. It shows the conditions of the CPU, the analyzers, the hardware, and log messages. Go to page 41 to learn more.
	**User Data File Generator**: This icon takes you to User Data File Generator Page. It enables you to download files into a CSV format, so you can build spreadsheets and graphs. Go to page 46 to learn more.
	**Viewer**: This icon takes you to the Viewer page. It shows user and login data. You can log in and out here. Go to page 48 to learn more.

4.1.4 General GUI Page Usage

The GUI has consistent functions across most pages, which are shown and described in the following picture and callouts.



Species: You can choose the species shown.

All or selected.

Ports: You can choose the ports shown.

All or selected.

Instrument: You can choose the instrument shown.

All or selected.

Expand: You can double the size of your chosen time frame viewed, expanding both the start and end times.

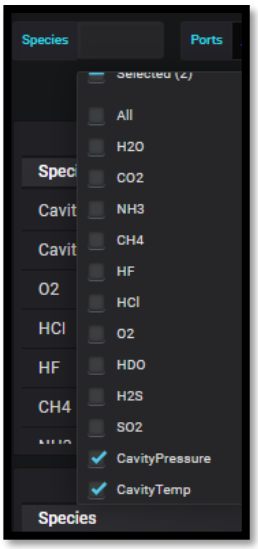
Refresh: You can refresh the data by clicking this button. You can change the refresh time interval. The refresh intervals range from 1 second to 1 day.

Change: The refresh interval is 5 seconds by default. If the time interval does not show, the system is not refreshing values.

4.1.5 General GUI Terminology

- **Port**: The end-point where the species value is read.
- **Channel**: The tubing and end-point where the species value is read.
- **Bank**: A collection of ports/channels in a specific area.
- **Species**: The element being measured.
- **Reference Gas**: The gas used to verify the calibration of the analyzer.
- **Cleaning a Bank**: This runs a clean gas through the analyzer to return it to baseline.
- **Run Plan**: This runs the plan you've established with your schedule.
- **Run Channel**: This takes measurements of a selected channel.
- **Loop Plan:** This runs your plan continuously.

4.1.6 View Cavity Pressure and Cavity Temperature



1. To view cavity pressure and temperature, select the species drop-down menu on the upper left of your page.
2. Select multiple or single. You can narrow this down to specific ports and instruments.
3. When finished making your selections, click on the screen. The new values will display.

   This can be done on the following pages:

   - Home
   - Current Values
   - Analyzer Output Graphs
   - Concentration by Channel
   - User Data File Generator

4.2 The Flow Setup Page

The **Flow Setup** page allows the user to control all flow hardware for the SAM system. A list of available functionalities is shown in this section.

4.2.1 Create or Edit your Plan

1. Click the **Flow Setup** button.

   The Flow Setup page will appear according to your default setup.

   From this page, you will choose the channels and banks within your system to monitor.

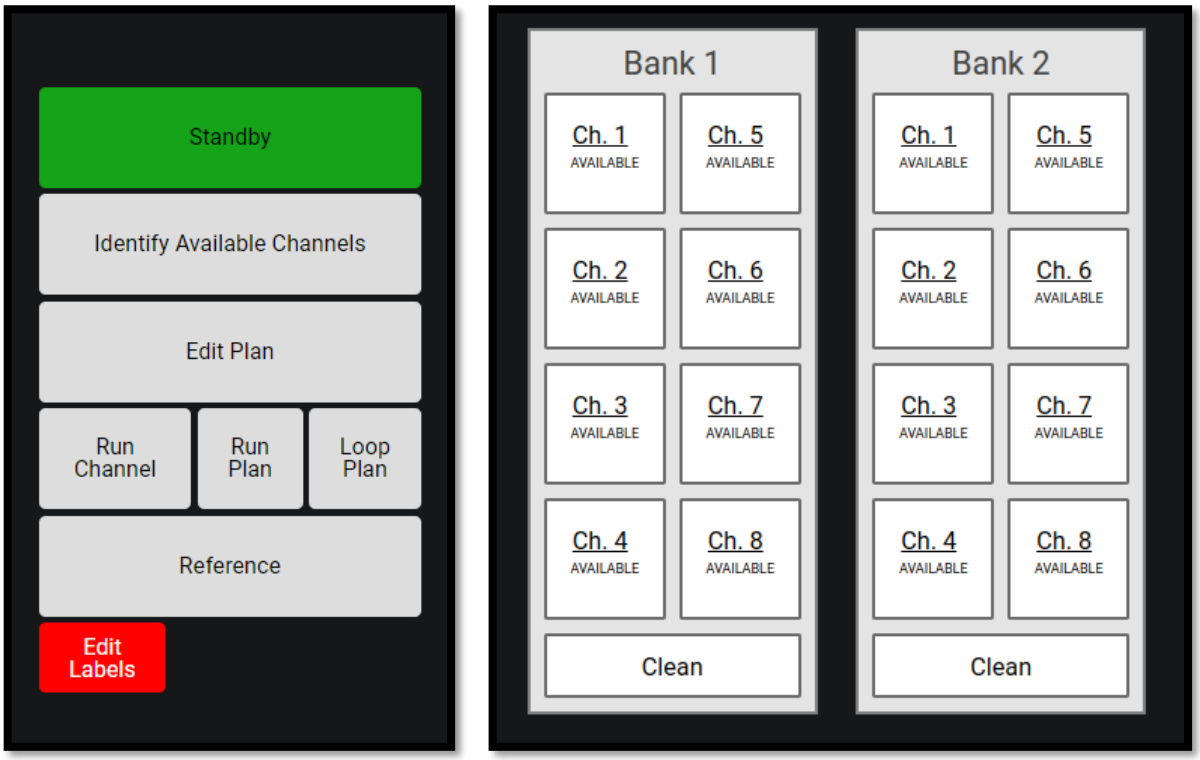
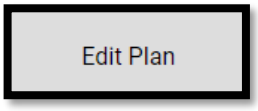


Figure 12: The Flow Setup Page



2. To create a measurement cycle, click the **Edit Plan** button in the left panel. A default schedule with an existing measurement plan will display.

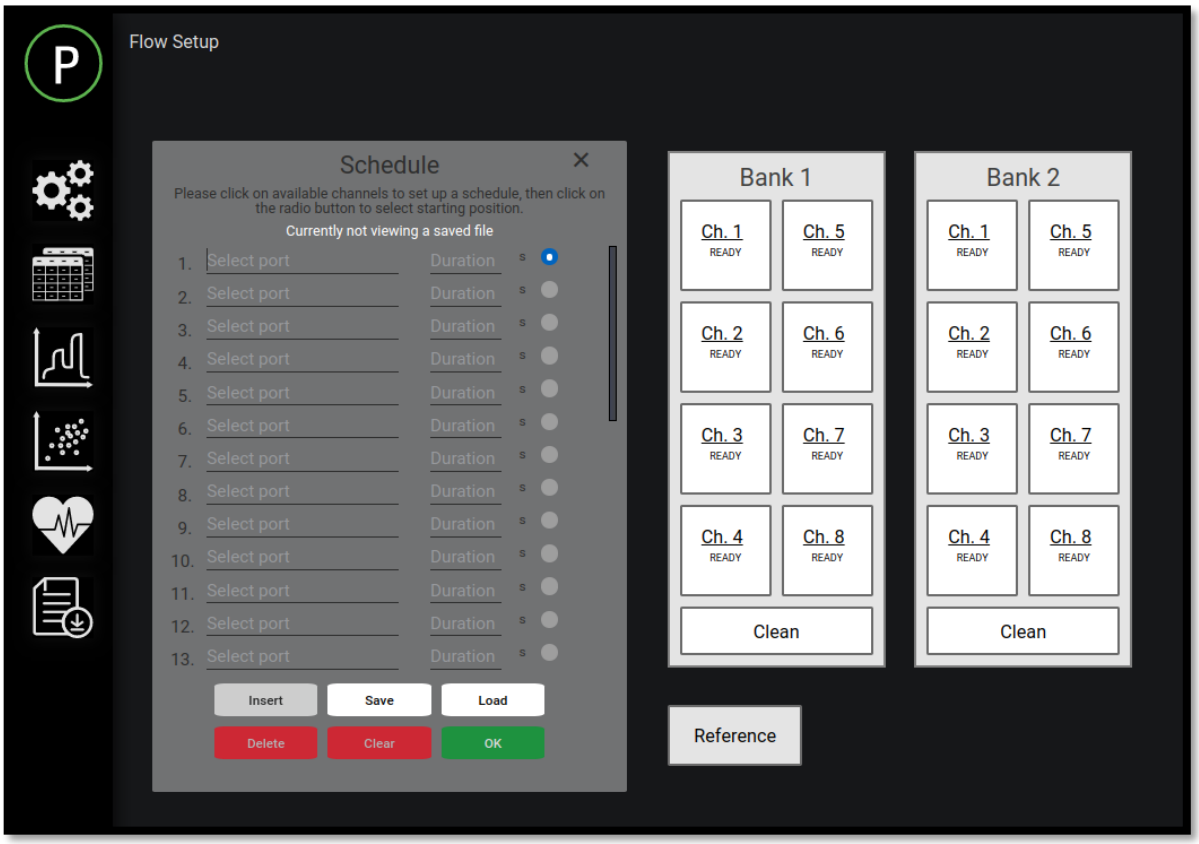


Figure 13: Schedule Screen

3. Clear the plan to create a new one. To do so, click the **Clear** button in the lower center of schedule panel.

   The schedule sheet will clear.

4. To add to the plan, click on a line in the schedule and then click on an available channel. Available channels are shown in white.

   A line in the schedule will fill, when you click on the channel.

5. Enter the measurement duration in seconds only. (You must enter the duration.)

6. Repeat steps 4 and 5 for as many channels as you like. The maximum number of measurements that can be taken is 32.

NOTE: The location of the blue radio button determines where the plan begins. Before you save your plan, ensure that the blue radio button is in the appropriate location.

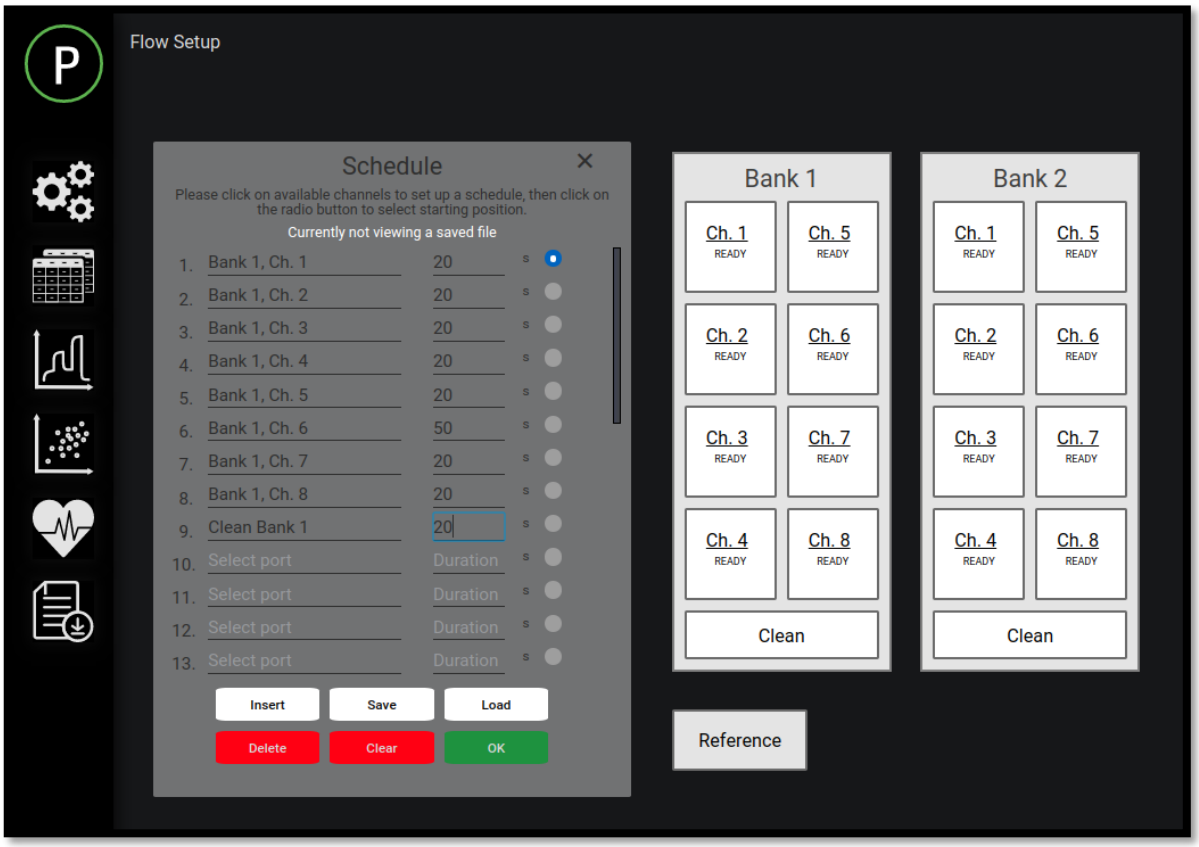
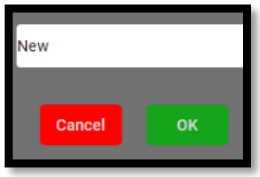


Figure 14: Blue Radio Button Showing on the Schedule Screen

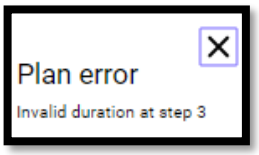
7. When ready, save your plan by clicking the **Save** button.



8. Name, rename, or save over an existing plan.

9. Save the file by clicking **OK**. If you are overwriting an existing file, a window will pop up asking you to confirm the overwrite. Respond as appropriate.

NOTE: If you do not enter data properly into the system (for example, you don't enter the duration), the system won't let you save the file. You will receive a Plan error notice.

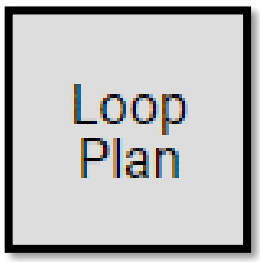


10. Adjust as needed.
11. Click **OK**. Close the schedule.

12. Start the plan by clicking the **Run Plan** button.

NOTE: If the **Run Plan** button is blacked out, it is because the current schedule is not properly defined and needs to be edited.

13. Click the **Edit Plan** button, make changes as needed, and click **Save**.
14. Close the schedule page, and then click the **Run Plan** button.



15. Once you've completed your plan, you can click the **Loop Plan** button, to loop your plan indefinitely.

    Click the **Standby** button to stop running the plan.

4.2.2 Clean a Bank

When you click the **Clean** button, you will be cleaning the manifold and all paths between the manifold and the analyzer. The system will deliver clean gas through the analyzer pathways to return the analyzer to baseline. To do so, a clean gas must be connected to the clean port according to the requirements outlined in section 3.3 on page 12.

To clean a bank, perform the following steps.

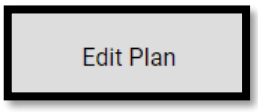
1. Click on the **Flow Setup** button.

   The **Flow Setup** page will appear according to your default setup.

2. Click the **Clean** button at the bottom of the bank you'd like to clean. When the bank is cleaning, the bank will be highlighted in blue. See the following figure.

3. To stop the **Clean** cycle, select **Standby.** The border will return to the default color.

Figure 15: Cleaning Bank in Blue



4. You can also clean a bank as part of a plan. To do so, click on the **Edit Plan** button.

5. Click on a line in the schedule.

6. Click the **Clean** button and add a duration to the schedule. Save your plan. Click the **OK** button.

7. Click the **Run Plan** button or the **Loop Plan** button.

4.2.3 Measure a Reference Gas

When you measure with a reference gas, you will deliver a reference gas through the analyzer pathways to verify the calibration of the analyzer. To do so, a reference gas must be connected to the Reference port according to the requirements in section 3.3 on page 12.

To measure a reference gas, perform the following steps:

1. Click on the **Flow Setup** button.

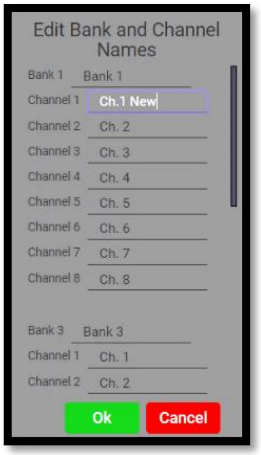
   The **Flow Setup** page will appear according to your default setup.

2. Click the **Reference** button at the bottom of the bank to manually activate the reference gas valve.

   You can also run a reference gas as part of a plan.

4.2.4 Edit Labels

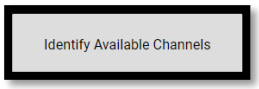
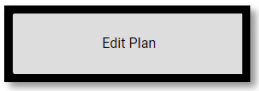
1. To change the label of your channels, click on the **Edit Labels** button.



2. Under the Edit Bank and Channel Names menu, enter a new name or many new names.
3. Click the **Ok** button.

4.2.5 The Flow Setup Panel

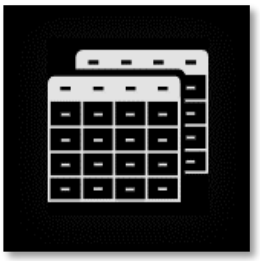
The Flow Setup panel has many different options for managing your fab and the SAM system.

Main Panel	Button	Purpose
		**Standby:** This button shows green when the analyzers are not monitoring the sample lines.
		**Identify Available Channels:** ***This function is not enabled, at the time of publication***.
		**Edit Plan**: This button enables you to edit your plan or plans.
		**Run Channel**: This button enables you to sample from a single channel. Select Run Channel and then the channel you want to measure. Both will be highlighted green until you select another channel or Standby. **Run Plan**: This button enabled you to run the plan. **Loop Plan**: This button enables you to loop the plan indefinitely.
		**Reference**: This button allows the user to deliver a reference gas to all analyzers to verify analyzer measurement performance. All banks will be highlighted yellow while reference gas is flowing. Refer to section 3.3 on page 12 to set up a reference gas line.
		**Edit Labels**: This enables you to change the names of channels.

4.3 The Current Values Page

From the **Current Values** page, you can see the current conditions in the channels and banks that you have chosen to monitor.

4.3.1 View Current Values



1. Click the **Current Values** button. The Current Values page will display. It will show the last value read from each port.

   The refresh interval is five seconds by default. If you don't see values, you might need to adjust the time frame viewed.

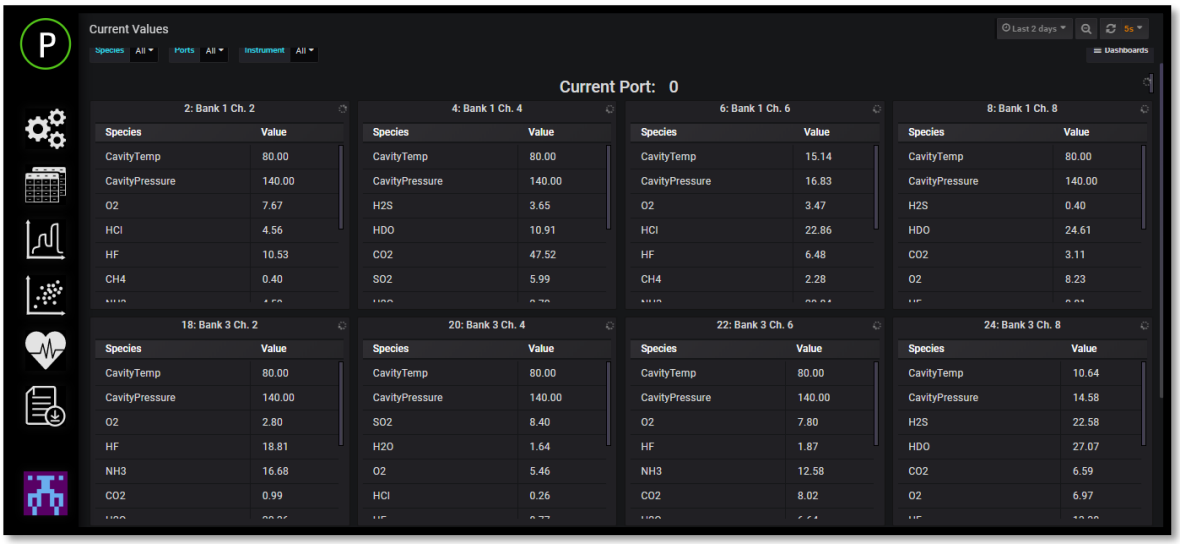
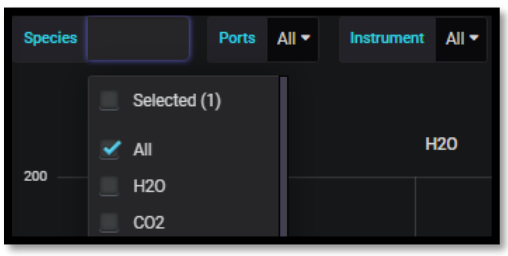


Figure 16: The Current Values Page

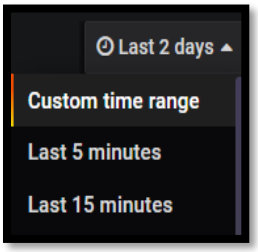
The current values will be displayed for the species in each channel.



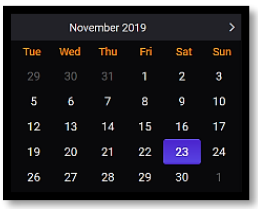
2. Select port, species, or instruments from drop-down list, on the upper left of the screen.
3. Select multiple, single, or all.

   When finished, click on the screen. The new values will display.

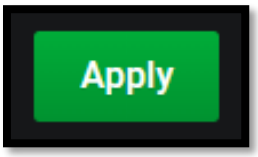
4. From the species drop-down list, you can also select cavity pressure and cavity temperature.



5. To change the time range viewed, select **Custom time range** from the drop-down list on the upper right of your screen. Calendars will display.



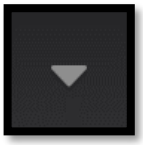
6. Choose the time frame, start and end.



7. Click **Apply**. It will show the last value read within the time frame you've selected.

8. To double the size of your chosen time frame, click the **Zoom** button. This will expand the time range outward, affecting both the start and end times.

9. Click the **Refresh** button to refresh the values.



10. Click the drop-down arrow to see or change the refresh interval. The available refresh intervals are: Off, 1, 2, 5, 10, 30 second(s), 1, 5, 15 minutes, 1, 2 hour(s), and 1 day.

4.4 The Analyzer Output Graphs Page

This **Analyzer Output Graphs** page shows the species values over time in graphic form. You can adjust the values shown by port, species, or time frame.

4.4.1 View Analyzer Output Graphs

1. Click the **Analyzer Graphs** button. The concentration values will show.

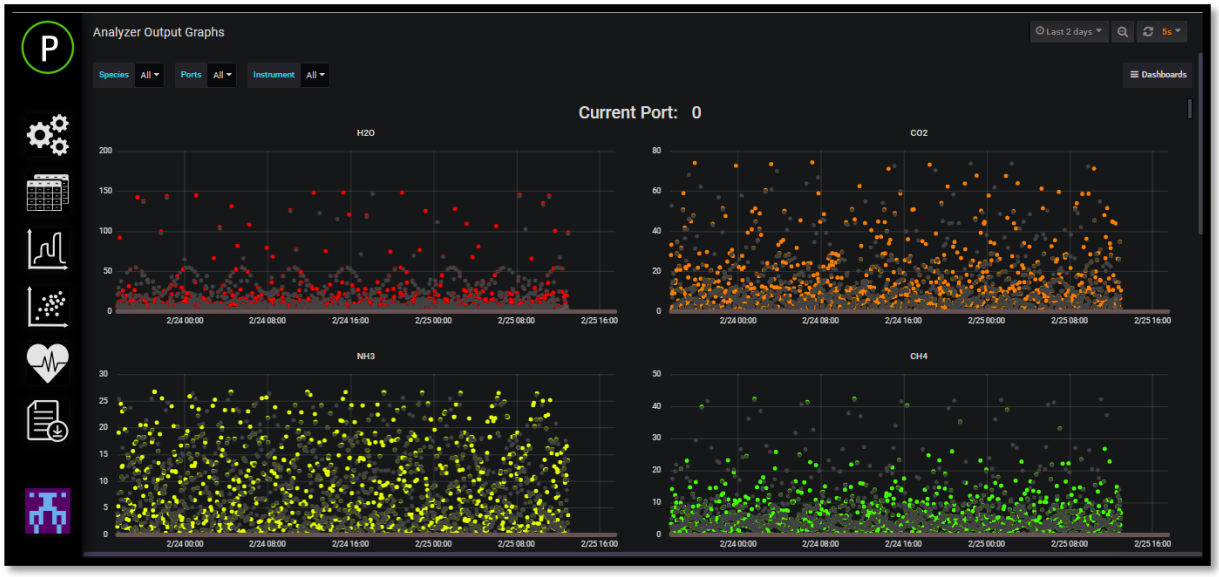
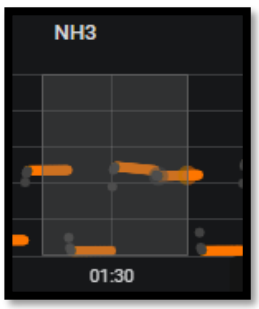
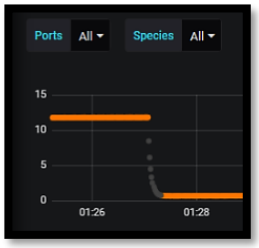


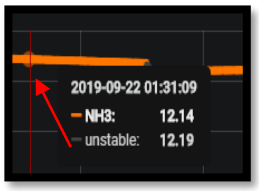
Figure 17: The Analyzer Output Graphs Page



2. To get a closer view of values shown, select an area of the screen.



The graph will update to display only the portion selected.

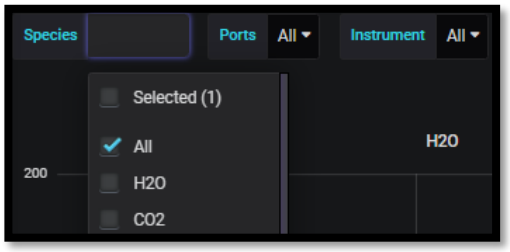


You can also view values for individual data points by placing the cursor over any single point. The following data will be displayed:

- The species measured
- The date that the species was measured
- The value of that species in PPB, as appropriate.
- The species condition, if measured in a stable or unstable state

If the species was measured in a stable state, the word “unstable” is NOT bold. If the species was measured in an unstable state, the word “**unstable”** will be bold.

4.4.2 Change the Ports, Species or Instruments Shown



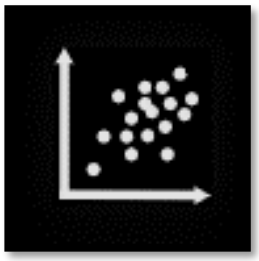
1. Select port, species, or instruments from the drop-down menu, on the upper left of the screen.
2. Select multiple, single, or all.
3. When finished, click on the screen. The new values will display.

4. From the species drop-down menu, you can also select cavity pressure and cavity temperature.

4.5 The Concentration by Channel Page

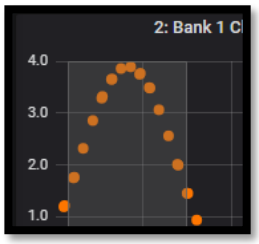
The **Concentration by Channel** page shows the chemical name and gas concentration by channel.

4.5.1 View the Concentration by Channel Page



1. Click the **Concentration by Channel** button. This shows the following data:
   - Species Values
   - The Vertical shows the Species Concentration (Y)
   - The Horizontal shows the Time Frame (X)

Figure 18: The Concentration by Channel Page



2. To get a closer view of values shown, select that area of the screen.

   A detailed range of values will display.

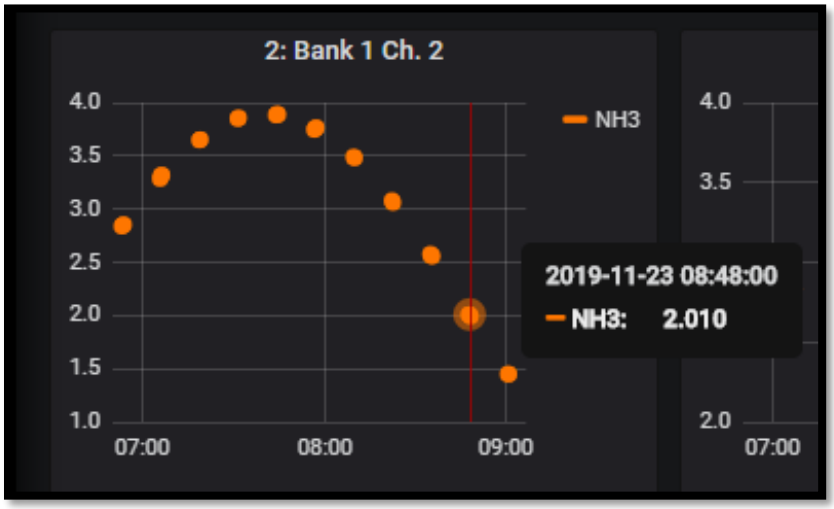
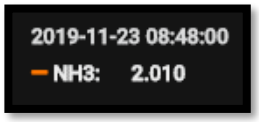
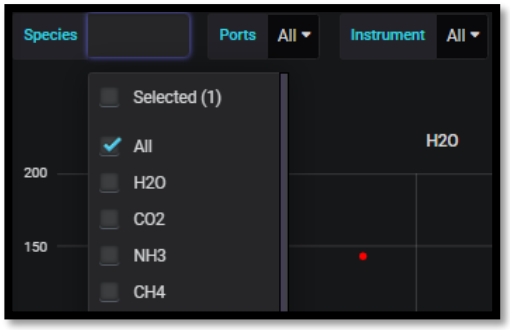


Figure 19: Close Up View of Values



3. To see the time stamp and value of a single point, hover over that data point.

4.5.2 Change the Ports, Species or Instruments Shown



1. Select the port, species, or instruments from the drop-down list, on the upper left of the screen.
2. Select multiple, single, or all.
3. When finished, click on the screen. The new values will display.

4. From the species drop-down list, you can also select cavity pressure and cavity temperature.

4.6 The System Status Page

The **System Status** page shows the status of the analyzers, the SAM CPU, disk usage, memory usage, the connected hardware, and log messages.

4.6.1 View System Status

1. Click the **System Status** button.

   The System Status page displays.

   This first half of the page shows the status of the CPU Usage (memory), RAM, CPU Temp (temperature), Disk 1, Disk 2, and Memory Usage. The second half of the page shows the analyzer condition, the log data, and the connected hardware.

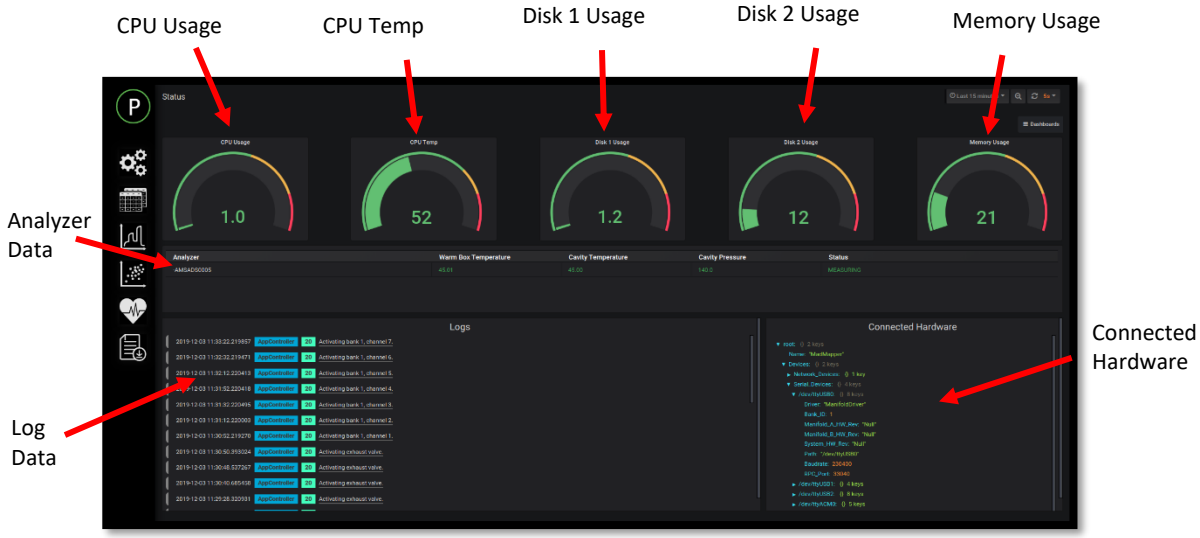
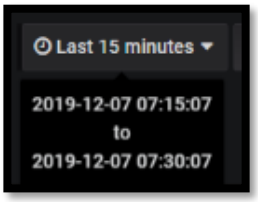


Figure 20: The System Status Page



2. To adjust the time frame viewed, select values from the **Custom time range** drop-down list on the upper right of your screen.

   The system status page is primarily for viewing system conditions, not for managing them.

4.6.2 View Analyzer Status

The Analyzer section shows the warm box temperature, the cavity temperature, the cavity pressure, and the measuring status.

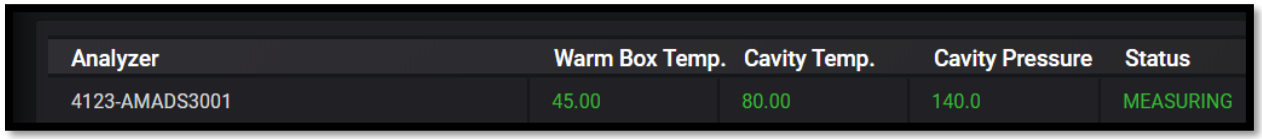


Figure 21: Analyzer Status

In general, the analyzer hardware conditions should be in following ranges:

- **Warm Box Temp**: 44.95 - 45.05°C
- **Cavity Temp**: 44.95 - 45.05°C **or** 79.9 - 80.1°C (analyzer dependent)
- **Cavity Pressure**: 133 – 147 Torr
- **Status**: MEASURING/WARMING. If the values listed here are not in their appropriate range, the analyzer section will read WARMING. If in range, it will read MEASURING.

Threshold values will change with different types of instruments. They show green, when they are within tolerance; if they are white, they are not within tolerance.

4.6.3 View Log File Data

The log file data section shows events with the time stamp, the log course (blue), the current severity (see chart below) and the appropriate tags.

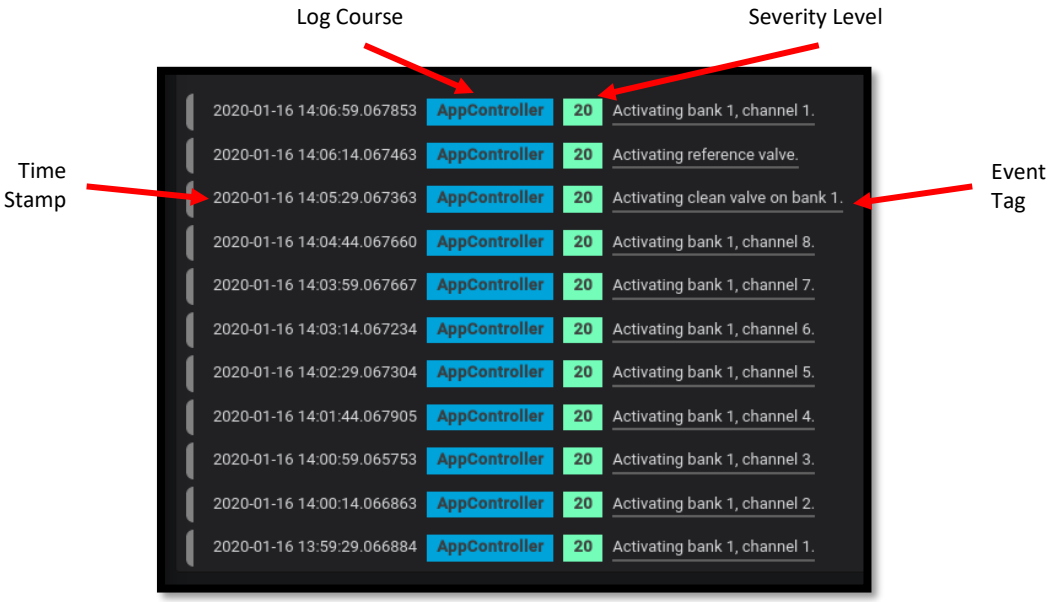


Figure 22: Log Data

Severity Number	Color	Meaning
Level 20	Green	**Info**: Any normal, expected activity, or event.
Level 30	Light Pink	**Warning**: Handled exceptions, statuses approaching thresholds, non-fatal conditions that you can continue operating in, or recover from via software control, improper user inputs.
Level 40	Rose	**Error**: Handled exceptions, you cannot recover to the normal operating state via software control, missing files, missing configuration, unintended web-socket disconnection.
Level 50	Red	**Critical**: Unhandled exception, traceback info, crash.

4.6.4 View Connected Hardware Status

SAM dynamically detects the hardware that is connected to its system and configures itself. Use this section to validate your connections. It shows the status of network devices and serial drivers, and their associated hardware.

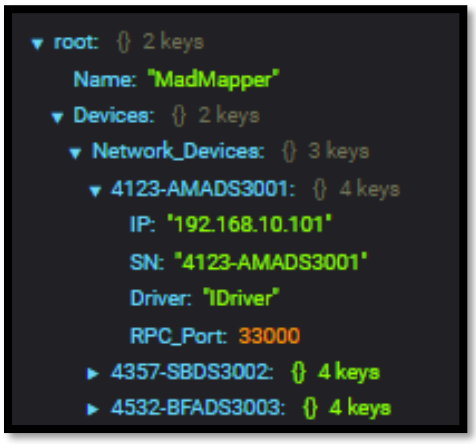


Figure 23: Network Device Status

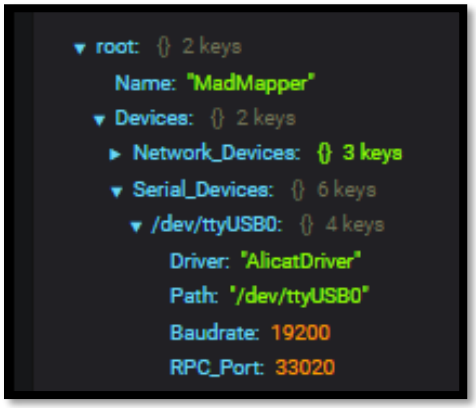


Figure 24: Serial Driver Status

4.7 The User Data File Generator

This **User Data File Generator** page enables you to generate a spreadsheet that shows the species conditions over time.

4.7.1 Generate a New File

1. Click on the **User Data File Generator** button.

   The following page will display.

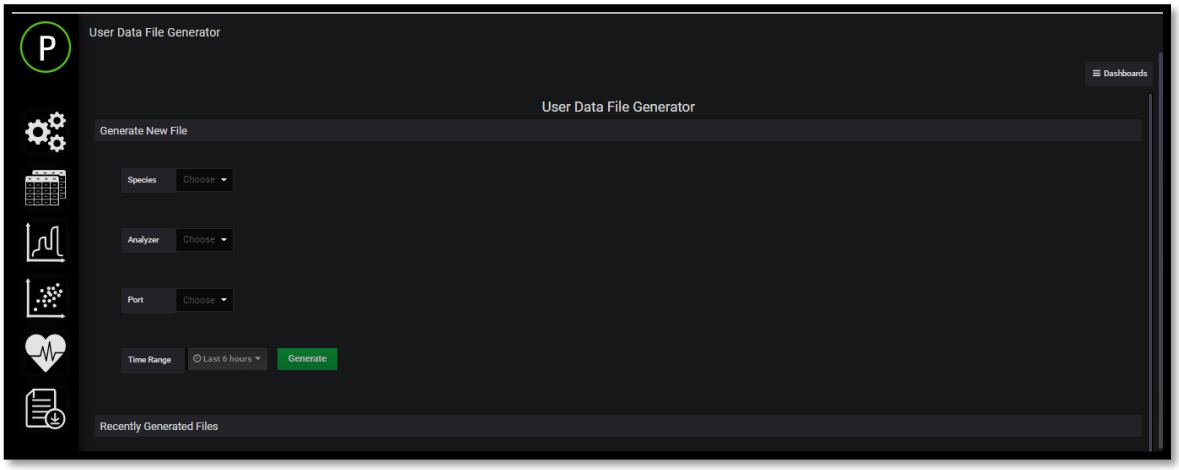
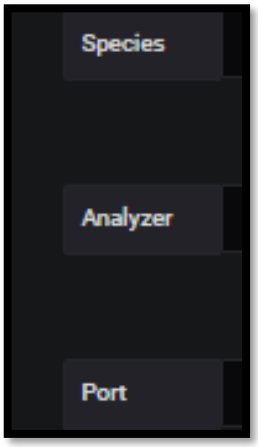


Figure 25: The User Data File Generator Page

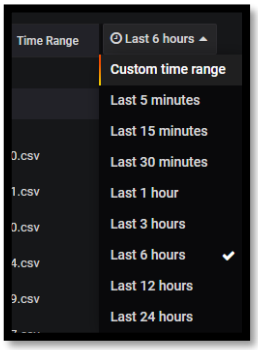


2. From the drop-down lists on the left of the page, select the species, analyzer, or port you would like to evaluate.

   Select one, multiple, or all.

3. From the species drop-down list, you can also select the Warm Box Temperature, the Cavity Pressure and Cavity Temperature.

   You can select one, multiple, or all.

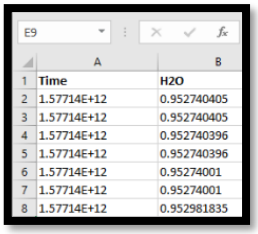


4. Choose a time range from the drop-down list.

   You can select the last 5 minutes, 15 minutes, 30 minutes, 1 hour, 3 hours, 6 hours, 12 hours, or 24 hours.

   You can also choose your own custom time range.

5. Click the **Generate** button. A pop-up window will show that the file successfully downloaded.



	A	B
1	Time	H2O
2	1.57714E+12	0.952740405
3	1.57714E+12	0.952740405
4	1.57714E+12	0.952740396
5	1.57714E+12	0.952740396
6	1.57714E+12	0.95274001
7	1.57714E+12	0.95274001
8	1.57714E+12	0.952981835

The file will download to your downloads folder. It will be in a Comma Seperated Value (CSV) file format.

The file will show the timestamp in Epoch time, that is the seconds from Jan 1, 1970.

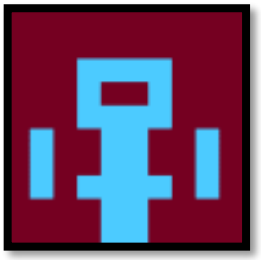
The file will show the species in the appropriate value format.

NOTE: These files are also temporarily saved to the SAM system; they will be purged from the SAM system when you reboot.

4.8 The Viewer Settings Page

From the **Viewer Settings** page, you can edit your profile, change your password, sign out, change your default home page, and set your time zone.

4.8.1 Change your Settings



1. Click on the **Viewer** button.

   The following page will display.

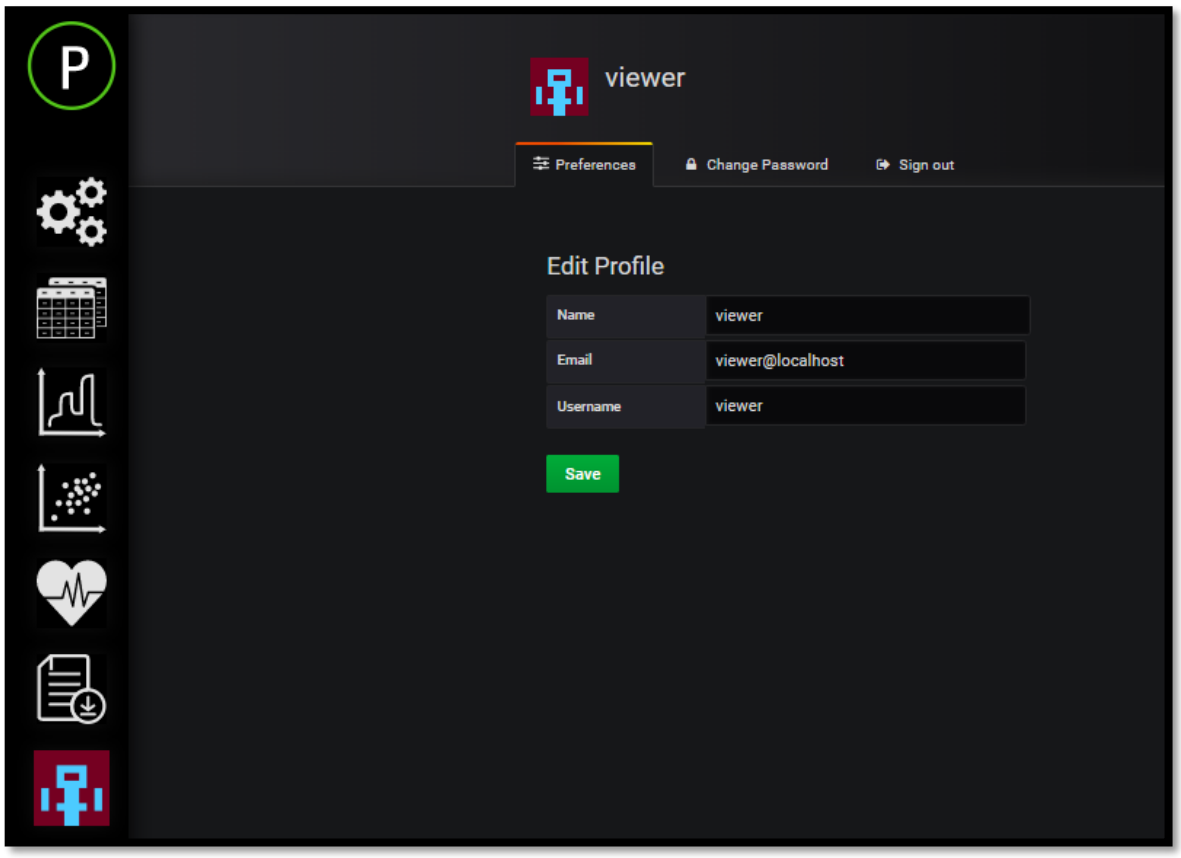


Figure 26: Viewer Setting Page

2. Make adjustments, and click the **Save** button when done.

5 Troubleshooting

Problems/Issues	Inspection	Corrective Action
Valve not switching between lines	Valve Indicator light	• Check the power connection and USB connection.
Slow response	Gas Leak Tube blockage Pump operation degraded Operation sequence	• Check that the sample lines are connected properly. • Check the sample line for any blockage. • Check to see if the sample pump is functioning by feeling for exhaust. • Check that the operation sequence has been defined adequately and is running.
No power	Electrical cable connection	• Check the breaker at the back of the power distribution box. • Check that the EMO switch is not engaged. • Check the integrity of the power connection on all sampling boxes.
Keyboard not functioning	Keyboard USB connection	• Ensure that only the keyboard USB is connected to the KVM unit and that all other USBs are connected to the rack integrated PC.

6 Equipment Maintenance and Service

All service and maintenance shall be done by a manufacturer trained service partner. There are no customer serviceable parts on this system. Please contact your manufacturer trained service partner to schedule service calls, and trained personnel will perform any required service or maintenance.

7 Replacement of Consumable Materials

There are no customer serviceable parts on this system.

8 Document Revision History

#	Date	Revised By	Description of Revision
1	3/5/2020	D. Wulff	Updates to GUI, additional sections for instruments and new callouts.
2			