Ametek 9900-Series Analyzers
Configurator Software

User's Guide

COMMITTED TO TOTAL QUALITY

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Canada, Inc.

A DIVISION OF AMETEK PROCESS & ANALYTICAL INSTRUMENTS

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1 Introduction

This Guide describes the Configurator software for Ametek 9900-series Analyzers. It is used to configure and calibrate the analyzer, and to graph and log data from the analyzer. The Configurator can also be used while performing maintenance or while troubleshooting the analyzer.

Ametek 9900-series analyzers can be also configured from the front panel of the analyzer. A small number of operations can only be performed using the front panel.

You can also view the configuration by connecting the analyzer to a web browser (see details on page 5-1).

For information about the analyzer itself, including how to configure it from the front panel, please refer to the User Manual for the specific analyzer that you have. For example, document PN 903-8726: Model 9900^{RM} (Rack Mount) Analyzer User Manual.

About This Guide

This Guide is for the following AMETEK Western Research analyzers:

- Models 9900^{RM} and 9900^{WM}
- Models $992x^{RM}$ and $992x^{WM}$
- Models $993x^{RM}$ and $993x^{WM}$

Models other than the 9900^{RM} and 9900^{WM} can be configured to include a UV Bench, a SEN Sensor board, or both. This Guide covers all of these configurations.

> ⚠ *The Configurator screens in this manual are example screens only. Some of the screens are only available if you have installed optional hardware in your analyzer.*

How This Guide is Organized

This Guide starts with a description of the user interface conventions used by the software, and of how to view the documentation.

It's followed by a description of how to configure the analyzer, screen by screen. This section covers both the UV Bench and the SEN Process Sensor Controller board, although an individual analyzer may be configured with either or both of these systems—.

Next are the data acquisition and charting functions.

Appendix I covers software installation.

Appendix II is intended for factory use and advanced users, and describes the Modbus Register map spreadsheet.

Appendix III describes the Configurator Preference settings, and how to set up communications ports. It is intended for all users of the software.

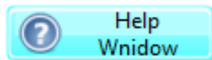
Getting Help

There are several levels of help available in the Configurator.

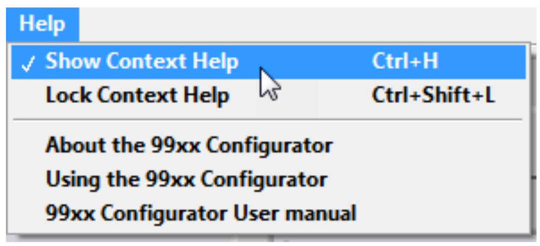
If you hover the cursor over a control or table, a tip strip pops up with a short description.

Help Window

For more detailed documentation, you can display a floating help window by clicking the Help button (it turns blue when the floating help window is visible):

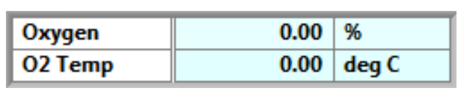


You can also display the floating help window by selecting *Show Context Help* from the Help menu, or by pressing Ctrl-H on the keyboard:



The Help window contains information specific to whatever the cursor is hovering over. In many cases, the text is taken from this Guide.

For example, if the cursor is hovering over the Oxygen table on the Home screen:



The floating help window shows you more about the table, and the Modbus registers that the information comes from:

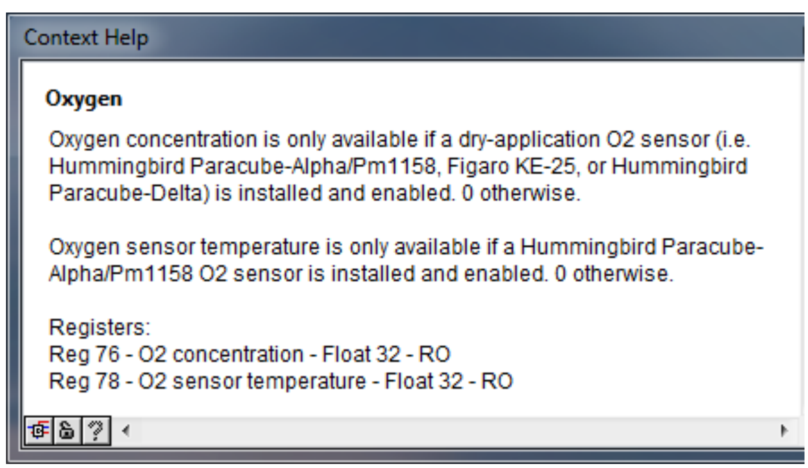


Figure 1 – The Context Help window

For each register, you see:

- The register number, using standard 1-based numbers. For more information, please refer to the Modbus specification in the analyzer's User Manual.
- The name of the register as found in the Modbus Register Map (see Appendix II).
- The data type of the register, and any scaling factors that will be applied to the register value if it is an integer data type.
- The access level (read, write, or read/write)

More Help

You can also get general help about using the configurator from the Help menu:

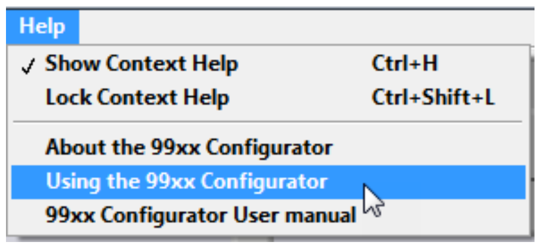
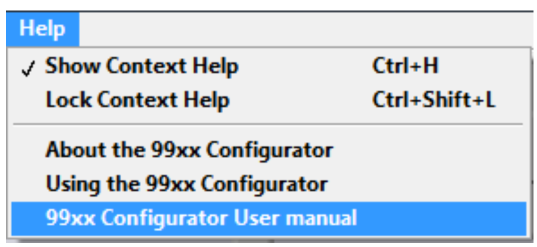


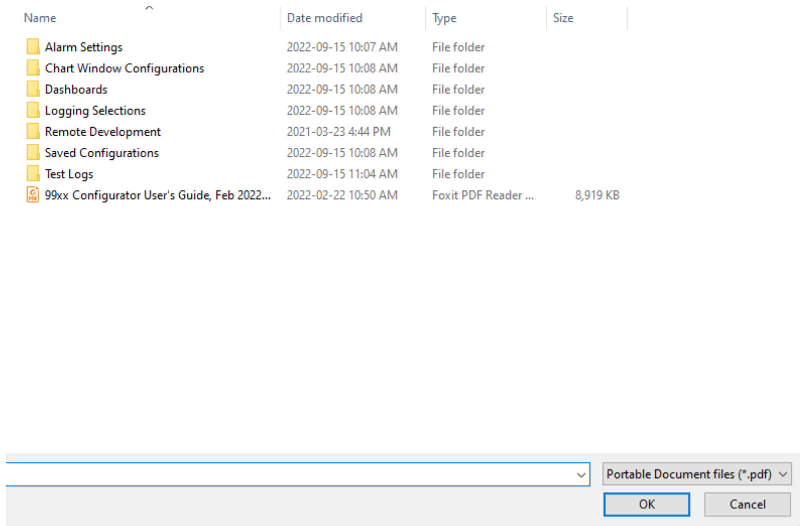
Figure 2 – The Help menu

User's Guide

The User's Guide to the configurator (this document) is installed along with the software. You can launch it from the Help menu:

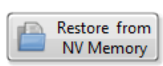


You will be taken to a file selection window that is set to the location where the User's Guide can be found:



Controls

This section describes the items that can appear in a configurator window, and how they work. One important difference between this configurator and others that you may have used, is that everything is live. When you make a change to a screen, any new values are sent to the connected analyzer right away, so there's no "Apply" or "Send" button. If you make a mistake and want to undo it, you can selectively undo any changes that you've made by selecting "Selective Undo" on the main screen. If you simply want to undo everything you've done since last saving the configuration to non-volatile memory on the analyzer, you have several options:

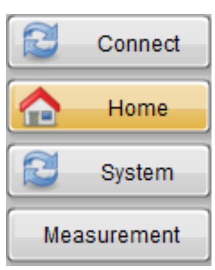
- 

- Restore the configuration from the "Undo file" that's automatically created every time you connect to an analyzer (you can also restore from configuration files that you create manually – please see page 1-9 for more information).
- Power cycle the analyzer.

Buttons

Buttons trigger an action.

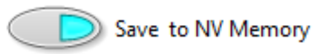
The left-hand part of the Configurator window has buttons that control what's displayed in the main part of the window (there are more buttons than are shown here):



The active selection is amber.

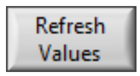
Combination Buttons

Some buttons contain an LED that indicates something about what the button controls. For example, the *Save to NV Memory* button illuminates if there are unsaved changes. Clicking the button saves the current analyzer settings to the analyzer's non-volatile memory:



Refresh

Most of the configuration screens have a Refresh button:



When you click it, it turns temporarily blue and reads "Refreshing…" while the screen contents are read from the analyzer. It's primarily useful if changes have been made using the analyzer's front panel, and you'd like them to be reflected in the Configurator.

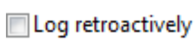
LEDs

LEDs show the status of an operation, action, or task.

A dark LED means that the state isn't present on the analyzer.
Green means OK,
Amber means Warning, and
Red means Fault.

Checkboxes

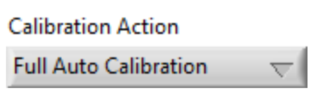
Checkboxes work just like you'd expect them to:

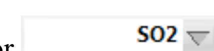


If the inside of the checkbox is white, you can change the setting.
If it's grey, you can't.

Menus

Pop-up menus usually have a little downward pointing triangle:

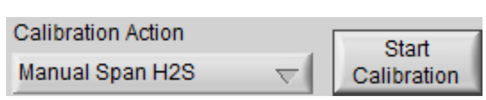


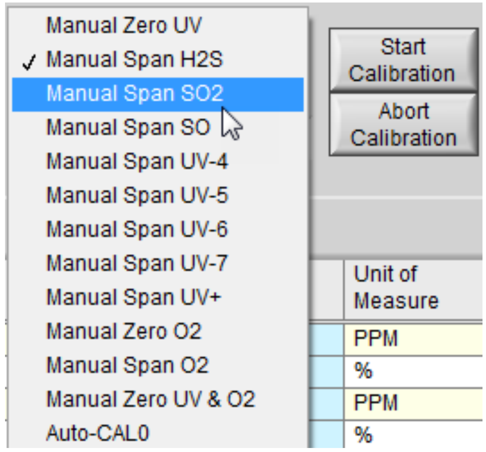
or


When you click one, a menu appears. You select an item by clicking it.

Most pop-up menu selections, such as those in the dashboard, take effect right way.

In some cases where a time-consuming process is involved, such as calibration, there is an action button to the right of the pop-up menu that starts the action:





Tables

Temperature Zone

	Bench	Cell		Bench Board	O2
Control setpoint (deg C)	0.0	0.0			
Kp (deg C)	0.0	0.0			
Ti (sec)	0.0	0.0			
Duty cycle (%)	0	0			
Present reading (deg C)	28.26	24.76		27.89	0.00

Much of the information in the configurator is shown in tables, such as the one above. When you change an item, the new value is immediately sent to the analyzer, but not saved in its non-volatile memory.

Cells with a light blue background are live value cells. You can't change them.

Cells with a grey background are disabled. Any changes you make to them are ignored.

You can move between cells using the tab key, the return key, or the arrow keys. Live value cells and disabled cells are skipped over. Or you can just click in a cell that you want to change.

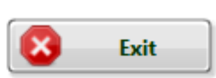
The light yellow stripes on alternate lines are a visual aid to help you follow lines of the table. If you don't like them, you can switch them off in the Preferences window (see Appendix III – Preferences).

Graphs

Graphs have so many options that they have their own section in this User's Guide – please refer to the Data Logging and Charting section on page 3-3-1.

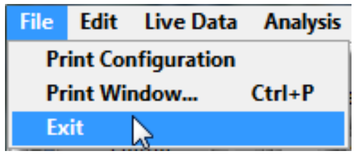
Exiting from the Configurator

To exit from the Configurator, click the Exit button, or the window's close icon:



or


You can also select “Exit” from the File menu:



If you haven’t saved your changes to Non-volatile memory, you’ll get a reminder alert and a chance to save them before the Configurator actually exits.

Connecting to an Analyzer

If you haven't already installed the software, please refer to Appendix I – Installing the Configurator Software.

Appendix III describes the Preferences screen, which lets you specify communication settings, and contains some tips for troubleshooting connection issues.

When you launch the configurator, the *Connect* panel is displayed:

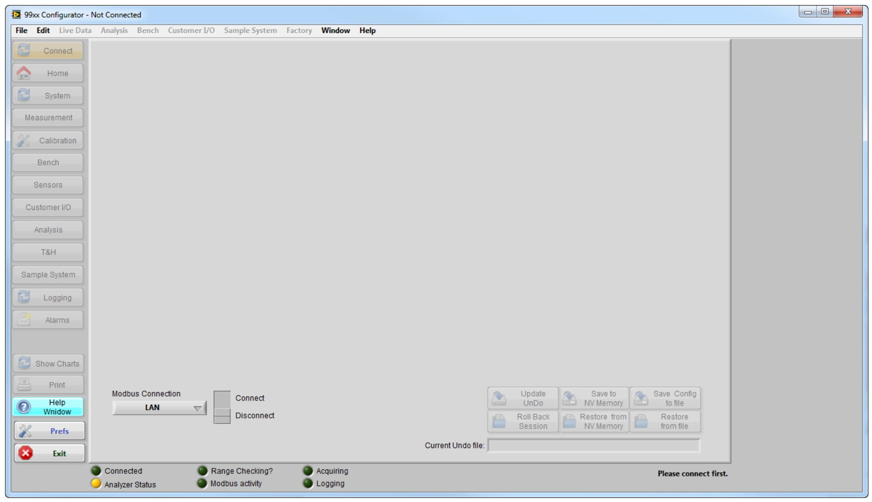
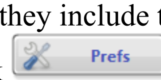


Figure 3 – The Connect Panel

If this is the first time you are using the Configurator, this would be a good time to review the connections that are listed in the *Preferences* window, and make sure that they include the way you intend to connect to an analyzer. Click 

, and turn to Appendix III for more information.

In most cases, you can just pick the connection that you'd like to use from the pop-up menu shown below, and click the Connect switch:

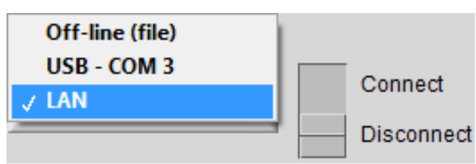


Figure 4 – Choosing a Modbus connection

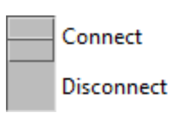
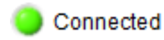


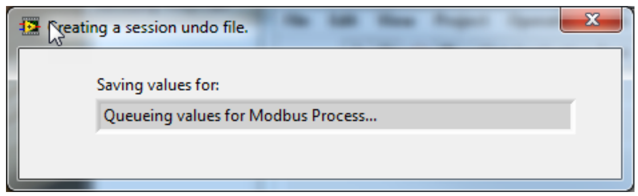
Figure 5 – The Connect switch

The Connect switch and the Connected LED turn green when the analyzer is connected:

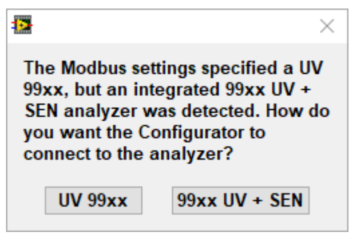


For your convenience, the Configurator remembers your connection choice, and initially positions the pop-up menu to the connection you used last time.

You should briefly see a message as the Configurator establishes communications with the analyzer. After that, you'll see a new window appear briefly while the configurator reads every Modbus register on the analyzer. This snapshot of the analyzer's configuration is saved as an *Undo file*.

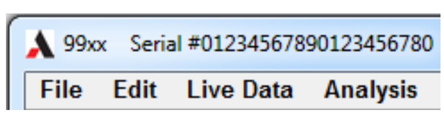


If the Configurator detects an analyzer configuration that doesn't match the configuration specified in your preferences, it will ask you what to do:



If all goes well, the Configurator will take you to the *Home* screen: a quick visual summary of the analyzer's state. It's described on page 2-1.

The window's title bar is updated to show the analyzer model and serial number:



If things don't go well, it's likely that the communication settings are incorrect. Please refer to *Appendix III — Preferences* for ways to resolve communications issues.

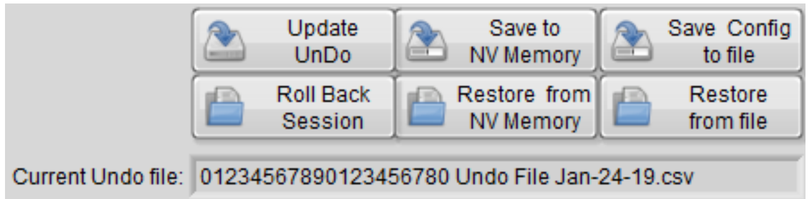
Undo files

When you make changes to a Configurator screen, the new values are immediately sent to the analyzer. This is why there are no buttons labeled "Send to Analyzer", or "Apply".

Every time you connect to an analyzer, the entire configuration is read from the analyzer, and is written to a spreadsheet-format file. This file is located in the directory you specify in *Preferences*, in a subdirectory named *Saved Configurations*. The file name has the form:

Analyzer serial number Undo File *date – sequence number*.csv

The name of the Undo file is shown on the Connect panel:



To restore all configuration settings from the most recent Undo File, click “Roll Back Session”.

To create an updated Undo file, click “Update Undo”. A new Undo file is created, with an incremented sequence number at the end of the name.

Oops!

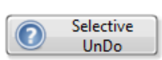
If you make a mistake and don’t remember what the original value was, you have several options:

- You can selectively undo any changes that you’ve made during the current session. See the next section, *Selective Undo,* for more on this powerful feature.
- Click “Roll Back Session” to restore the analyzer configuration from the current Undo file.
- Click “Restore from file” to restore from an older Undo file, or another saved configuration.
- Click “Restore from NV Memory”.
- Power cycle the analyzer.

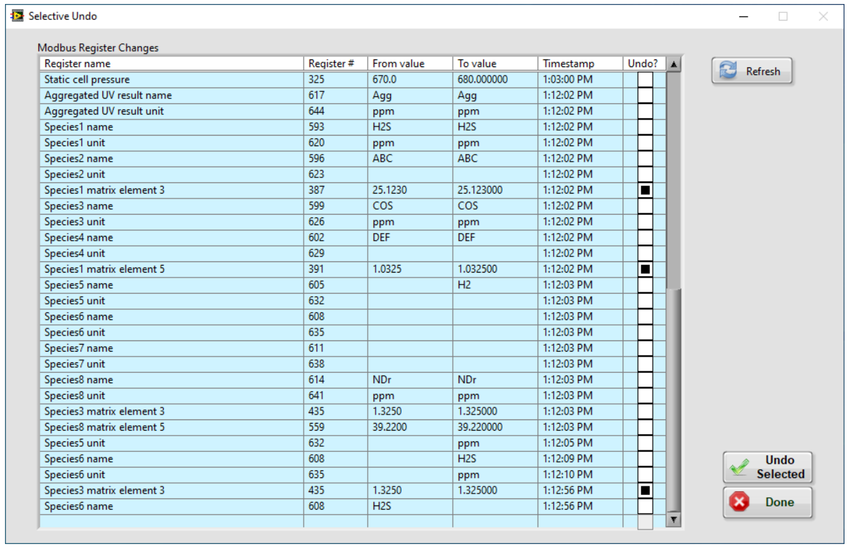
Selective Undo

The Configurator operates by modifying Modbus registers on the analyzer. Whenever you make a change, the Configurator keeps track of the old and new values of every register that is affected by the change.

You can selectively choose to Undo any of those changes. Start by selecting *Selective Undo* from the main menu, or choose its keyboard shortcut (Ctrl + Shift + Z):



Every change you've made appears in the following window:



Register name	Register #	From value	To value	Timestamp	Undo?
Static cell pressure	325	670.0	680.000000	1:03:00 PM	
Aggregated UV result name	617	Agg	Agg	1:12:02 PM	
Aggregated UV result unit	644	ppm	ppm	1:12:02 PM	
Species1 name	593	H2S	H2S	1:12:02 PM	
Species1 unit	620	ppm	ppm	1:12:02 PM	
Species2 name	596	ABC	ABC	1:12:02 PM	
Species2 unit	623			1:12:02 PM	
Species1 matrix element 3	387	25.1230	25.123000	1:12:02 PM	■
Species3 name	599	COS	COS	1:12:02 PM	
Species3 unit	626	ppm	ppm	1:12:02 PM	
Species4 name	602	DEF	DEF	1:12:02 PM	
Species4 unit	629			1:12:02 PM	
Species1 matrix element 5	391	1.0325	1.032500	1:12:02 PM	■
Species5 name	605		H2	1:12:03 PM	
Species5 unit	632			1:12:03 PM	
Species6 name	608			1:12:03 PM	
Species6 unit	635			1:12:03 PM	
Species7 name	611			1:12:03 PM	
Species7 unit	638			1:12:03 PM	
Species8 name	614	NDr	NDr	1:12:03 PM	
Species8 unit	641	ppm	ppm	1:12:03 PM	
Species3 matrix element 3	435	1.3250	1.325000	1:12:03 PM	
Species8 matrix element 5	559	39.2200	39.220000	1:12:03 PM	
Species5 unit	632		ppm	1:12:05 PM	
Species6 name	608		H2S	1:12:09 PM	
Species6 unit	635		ppm	1:12:10 PM	
Species3 matrix element 3	435	1.3250	1.325000	1:12:56 PM	■
Species6 name	608	H2S		1:12:56 PM	

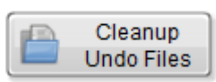
Figure 6 – Selective Undo

Select the items that you wish to undo by selecting the checkbox on the right of each row, and click *Undo Selected.*

The changes you selected are reversed, and the window is refreshed, showing you the effect of the Undo action.

Click *Done* to dismiss the window. You can also leave the window open while you continue to use the Configurator, To update the window, click the *Refresh* button in the upper right corner of the window.

Cleaning up Undo files



Over time, you may accumulate quite a few Undo files. You can remove them manually, or you can click *Cleanup Undo Files* to bring up a dialog that shows how many undo files are in the *Saved Configurations* directory. You also see how many there are for just the currently connected analyzer:

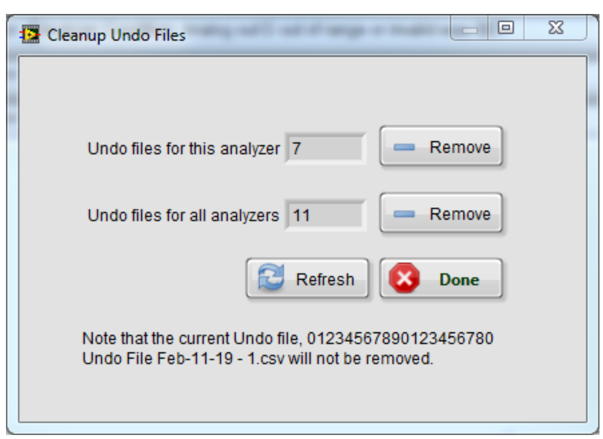
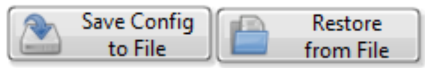


Figure 7 – Cleaning up unused Undo files

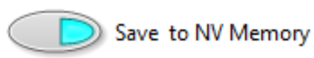
You can remove just the Undo files for the currently connected analyzer, or all of the accumulated Undo files. In either case, the current Undo file will be left alone.

Saving and Restoring Analyzer settings

You can also save the analyzer's configuration at any time by clicking "Save Config to File". You'll be asked to name the file. By default, it will be saved in the same directory as the Undo files.



To restore from either a session undo file, or from a snapshot you made yourself, click "Restore from File". You'll be asked to locate the file, after which all of the writable registers in the analyzer will be set to the values that were stored in the file. To retain these through an analyzer power cycle, don't forget to click ***Save to NV Memory***.

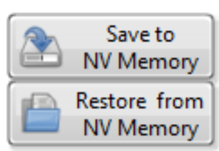


We recommend that you make a reference copy of the analyzer configuration parameters from time to time. This file can then be used to restore all parameters to their original settings in the event of an EEPROM failure, such as it being physically or electrically damaged, or if it is being replaced.

NV Memory

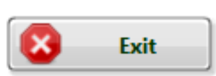
The analyzer stores all of its configuration parameters in non-volatile memory. On power-up, it transfers all of those values into working memory.

To save all of the changes that you've made in the analyzer's working memory into non-volatile memory, click "Save to NV Memory". To copy a saved configuration from non-volatile memory into working memory, click "Restore from NV Memory".



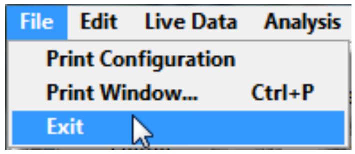
Exiting from the Configurator

To exit from the Configurator, click the Exit button, or the window's close icon:



or

You can also select "Exit" from the File menu:



If you haven't saved your changes to Non-volatile memory, you'll get a reminder.

Configurator Overview

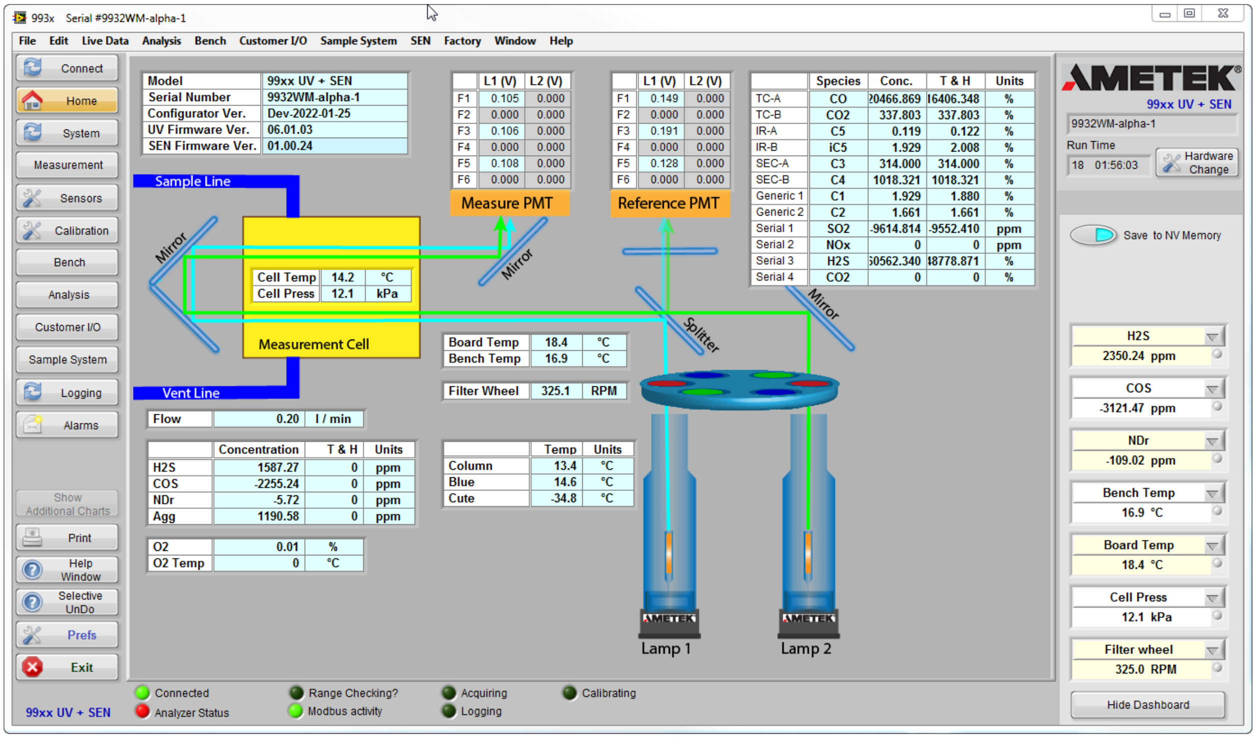


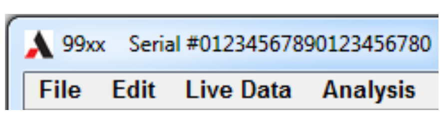
Figure 8 – The Configurator window, showing the Home panel

If you haven't already installed the software, please refer to Appendix I — Installing the Software. You may need "local administrator" or other security privileges to install the software, but you don't need to be an administrator to run the software.

Before beginning, you should have already installed and commissioned the analyzer (and set up additional hardware, if required) as explained in the analyzer *User Manual*.

Once you've installed the software and connected to an analyzer (see the previous section), you'll see the Home panel shown above.

The model and serial number of the analyzer are shown in the title bar:



The right-hand part of the window shows the *Dashboard* – a customizable area that shows information about the analyzer, half a dozen live values, and whether you have made changes that have not been saved to non-volatile memory. It's covered in more detail in the next section.

The main part of the window displays panels that you select using the buttons on the left hand size of the window (or the menu bar).

In Figure 8 above, the Home button has been selected, so the Home panel is visible.

In the following figure, the System Status panel has been selected:

You can also select which panel to view using the menu bar at the top of the window:

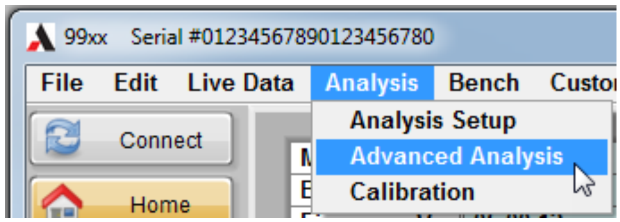


Figure 9 – The Menu bar

The web interface uses a similar menu system:

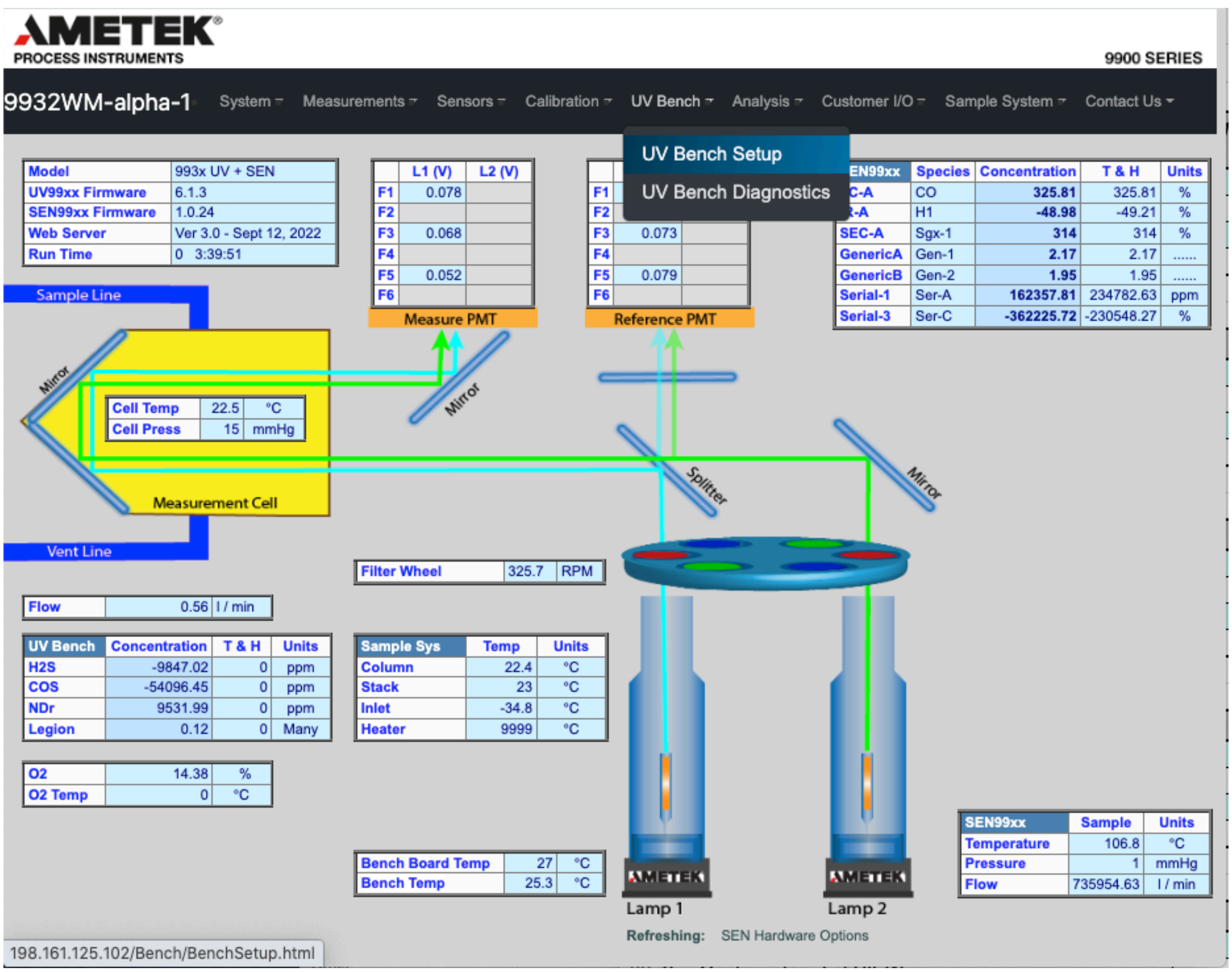


Figure 10 – The Web Interface Home Screen, showing menu selection

Status LEDs

The bottom part of the Configurator contains several status LEDs:

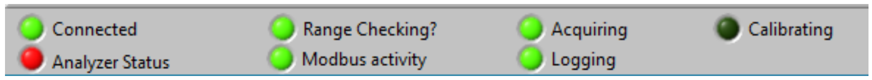


Figure 11 – Status LEDs

Connected	The Connected LED should be green while you are working with an analyzer. If it isn't, you'll need to select the Connect panel, and re-connect to the analyzer.
Analyzer Status	This is the analyzer health as reported by the analyzer Green: OK Amber: Warning Red: Fault
Range Checking?	Green if the Configurator is currently checking Range (Alarm) limits
Modbus Activity	Flashes green when Modbus packets are read or written
Acquiring	Green when the Configurator is acquiring data for logging or graphing
Logging	Green if values are being logged to a spreadsheet file
Calibrating	Green if the UV bench is currently being calibrated, or if the optional SEN board is being calibrated. This LED does not show the calibration status of an analog output on the optional Customer I/O board.

The Dashboard

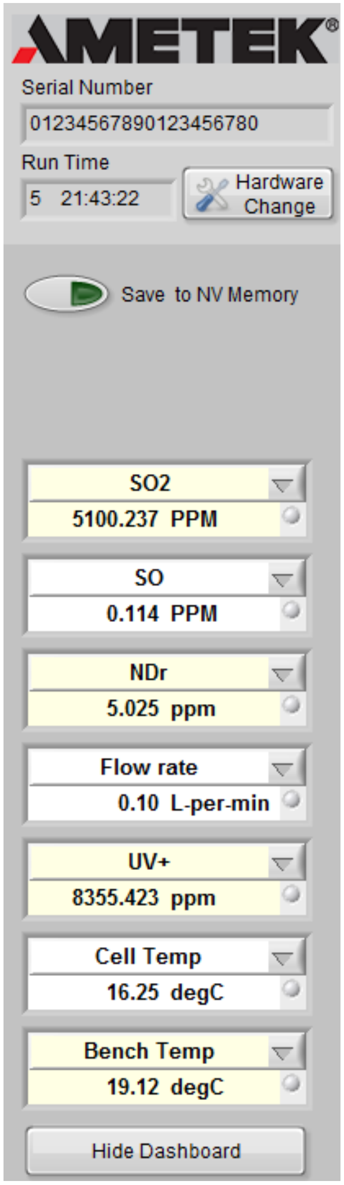
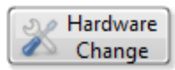


Figure 12 – The Dashboard

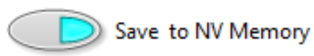
The Dashboard lets you monitor signals generated by the analyzer.

At the top are the analyzer serial number, and how long it has been running (days hours: minutes: seconds).

You can also update the hardware configuration on the Analyzer if optional hardware has been installed or removed:



The *Save to NV Memor*y button lights up if you have made changes to the analyzer configuration, but haven't saved them to non-volatile memory (NVRAM). Click the button to save them.



You can display seven items in the lower part of the dashboard by simply picking them from the pop-up menus (click the little downward pointing triangles):

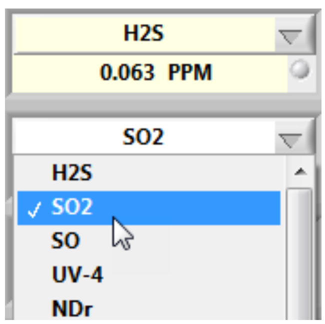


Figure 13 – Selecting a Dashboard signal

The software remembers your selections, and restores them the next time you run the configurator. The small LED to the right of each item shows whether it's inside the alarm limits (green) or not (amber or red). If you haven't set up alarms for a signal, the LED will be grey.

Figure 14 – A dashboard item inside the alarm limits

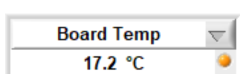


Figure 15 – A dashboard item in warning

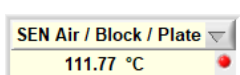


Figure 16 – A dashboard item in alarm

The signals that appear in the pop-up menu are determined by the Modbus register map: they are the rows with "Yes" in the

Dashboard? column. You can add or remove Dashboard signals by editing the register map – see Appendix III for more information.

Additionally, only species that are currently marked as being valid by the analyzer appear in the menu (you can see which of them have been marked valid by looking at the System Status panel – see page 2-5).

If you find the dashboard to be distracting, you can hide the live values by clicking “Hide Dashboard”. This also eliminates the associated Modbus traffic.

The Connect Panel

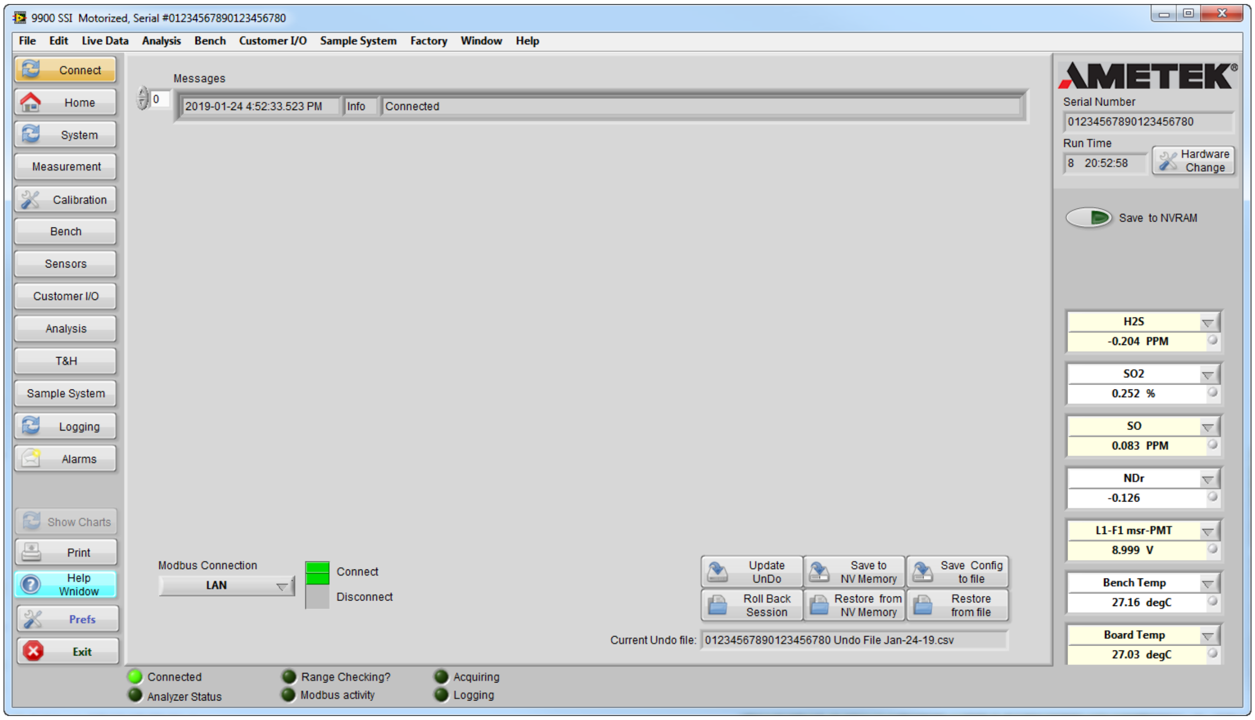


Figure 17 – The Connect panel, showing the Messages area

Most of the items in the Connect panel were covered in *Connecting to an Analyzer,* on page 1-9.

There is a *Messages* area that displays error and information messages. These messages are also logged in a directory named Messages, which is a subdirectory of the *Test Logs* directory specified by your preferences (see Appendix III – Preferences – by default, *c:\Ametek Configurator\99XX\Test Logs\Messages*).

You can use the Configurator even when you are not connected to an analyzer. For more information, please see the “Off-line Mode” chapter on page 4-1.

2 Configuring the Analyzer

The Home Panel

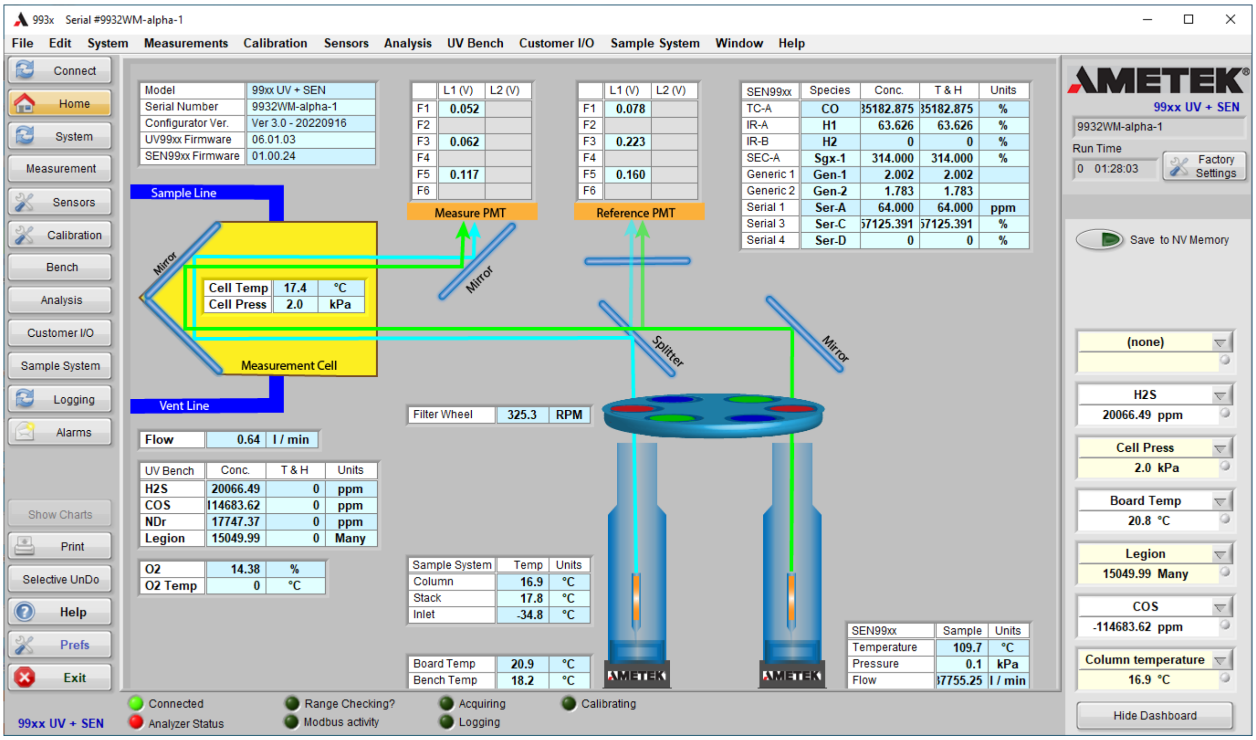


Figure 18 – The Home panel

The Home panel is intended to provide an overall picture of the analyzer's operation. The diagram is a functional view of the UV Optical Bench and any attached sensors, including those attached to the optional SEN99xx board. It's not available when connected to analyzers that don't have an Optical Bench.

You can't change the values displayed on this screen (the registers are read only). For information about each of the items in the Home screen, remember that you can hover the cursor over them. You can also display a floating help window to show more information, such as which Modbus registers provide the values (see page 1-3).

All measurements are in SI units of measure[1].

Analyzer Model

Model	99xx UV + SEN
Serial Number	9932WM-123456
Configurator Ver.	3.21
UV Firmware Ver.	06.01.03
SEN Firmware Ver.	01.00.24

[1] Strictly speaking, the analyzer does not use SI-10 base units. It uses cm for length, deg C for temperature, and either mm Hg or kPa for pressure.

Depending on the model, some items will not be displayed. For example, *SEN Firmware Ver* is only displayed when connected to an analyzer with a SEN board.

Cell Conditions

Cell Temp	11.6	°C
Cell Press	12.1	kPa

Measurement cell pressure and temperature are available for all models of the 99xx that contain an optical bench, but only if optional sensors have been installed (they are zero otherwise). See page 2-11 for more information.

UV Species Concentrations

	Concentration	T & H	Units
H2S	-0.795	0.000	PPM
SO2	0.072	0.000	%
SO	0.193	0.000	PPM
UV-4	0.497	0.000	%
NDr	-0.287	0.000	
UV+	-0.989	0.000	ppm

This table only shows species that have been marked as being valid by the analyzer. To see which species have been so marked, please see the System Status panel described on page 2-6.

Sample System temperatures

Sample Sys	Temp	Units
Zone1	23.33	deg C
Zone2	22.45	deg C
Zone3	-34.82	deg C

This table is only visible if the optional sample system has been installed. You can assign names to each of the three temperature zones (see page 2-84). Temperature measurements are always shown in degrees Celsius. If an oven temperature RTD has been installed, the oven temperature is also displayed.

PMT Voltages

	L1 (V)	L2 (V)
F1	0.183	
F2		
F3	0.108	
F4		
F5	0.029	
F6		

Measure PMT

	L1 (V)	L2 (V)
F1	0.153	
F2		
F3	0.237	
F4		
F5	0.030	
F6		

Reference PMT

The Optical Bench contains two photomultiplier tubes that measure ultraviolet light intensity. On motorless analyzers, the wavelengths used are L1F1, L1F2, and L2F6. On motorized analyzers, all six possible filter positions are shown, even if they are not configured for that analyzer. Invalid lamp + filter combinations are greyed out.

Filter Wheel Speed

Filter Wheel	324.7	RPM

The measured speed of the filter wheel. Nominally 325 RPM.

SEN Measurements

If an optional SEN99xx board has been installed, the gas concentrations for all configured SEN sensors are shown.

	Species	Conc.	T & H	Units
TC-A	CO	19631.004	19631.004	%
TC-B	CO2	337.804	337.804	%
IR-A	C5	0.108	0.108	%
IR-B	iC5	1.880	1.880	%
SEC-A	C3	314.000	314.000	%
SEC-B	C4	1018.310	1018.310	%
Generic 1	C1	1.929	1.929	%
Generic 2	C2	1.636	1.636	%
Serial 1	SO2	10642.481	10642.481	ppm
Serial 2	NOx	0	0	ppm
Serial 3	H2S	58136.687	58136.687	%
Serial 4	CO2	0	0	%

Gas Sample Conditions

If an optional SEN99xx board has been installed, you can also see the conditions of the sample gas:

SEN99xx	Sample	Units
Temperature	109.4	°C
Pressure	0.1	kPa
Flow	37755.25	l / min

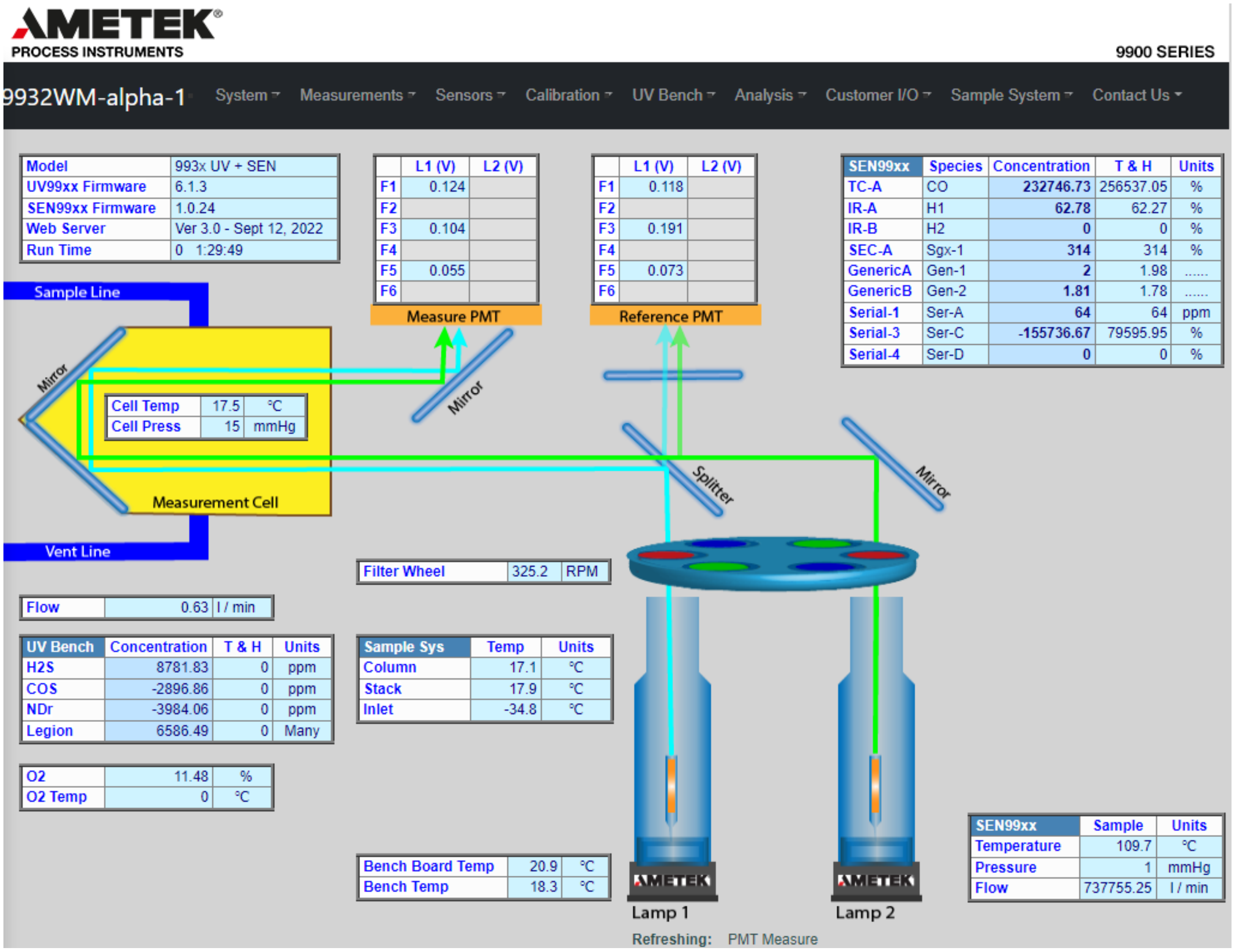


Figure 19 – The Home panel in a browser

The Home panel, along with all of the other panels, is also available from any browser. See section 5 of this Guide for more details.

System Status Panel

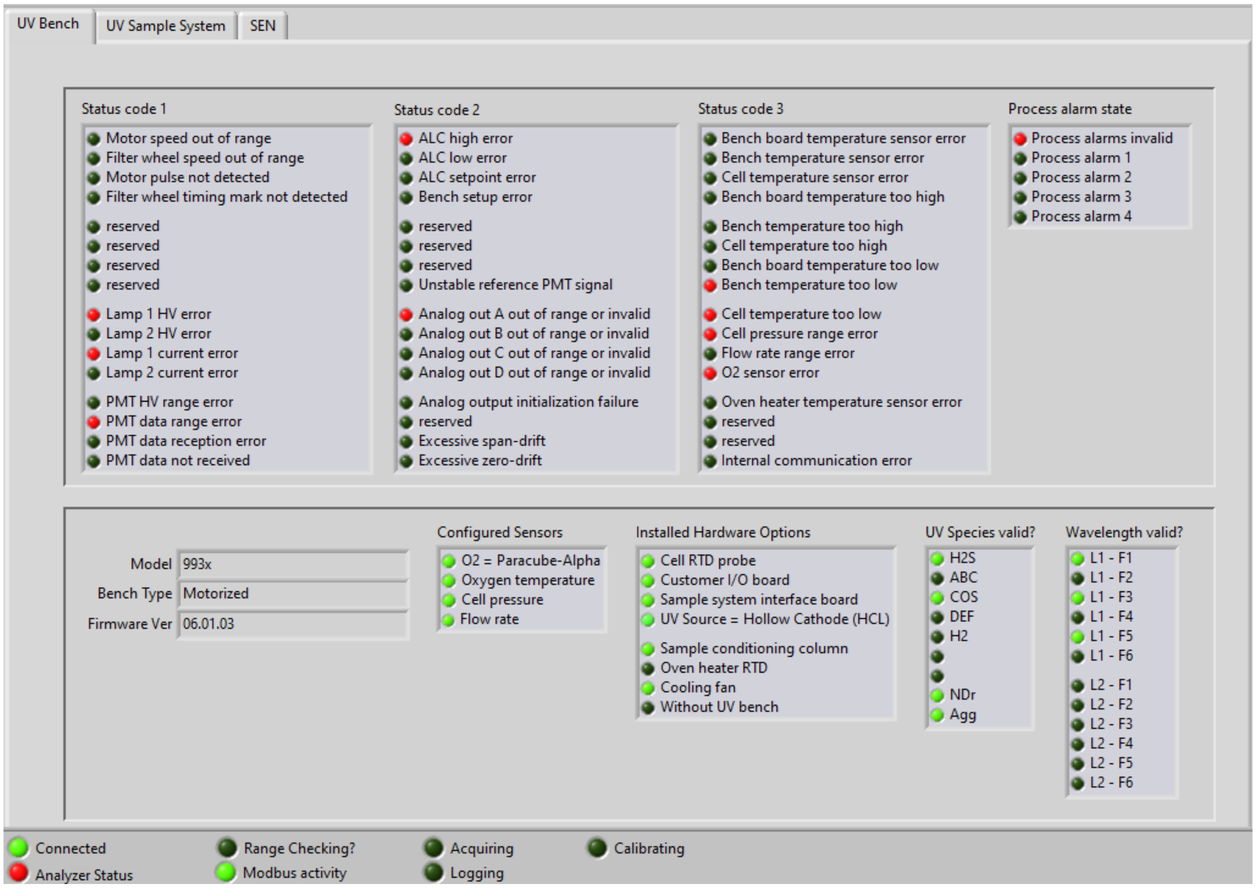
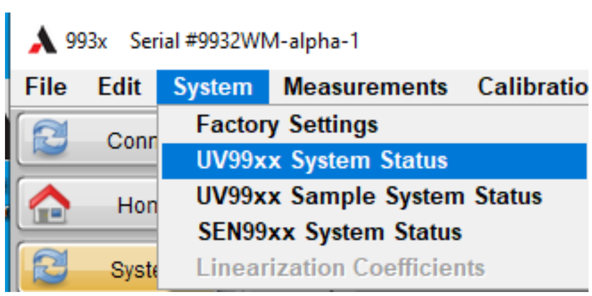


Figure 20 – System Status panel (UV Bench)

The System Status panel gives you an overall indication of the analyzer's health. To view it, select "System" from the buttons on the left side of the window, or select *System Status* from the menu bar:



What does each indicator mean?

If the meaning of an indicator isn't immediately clear, you can display the Context Help Window (Ctrl-H), and hover the cursor over that indicator to get more information about it.

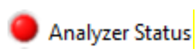
Status codes

The three status codes all signal error conditions on the attached analyzer. They are red when the condition is present, and dark otherwise.

When a status code changes, a message is generated and displayed in the Messages part of the Connect panel. In addition, the message is logged in a spreadsheet file located in the *Messages* subdirectory of the Test Logs directory (see Appendix III – Preferences for the location of this directory).

These status codes are monitored by the analyzer. When a status code changes, and the particular item has been assigned a “warning” or “error” status in the Customer I/O – Relays panel (see page 2-72), the “Relay Status Output Bitmask” register is updated by the analyzer. The color of the Analyzer Status LED at the bottom of the Configurator window is determined by this register.

The Analyzer Status LED at the bottom of the main window is red if faults are present, amber if warnings but no faults are present, and green otherwise.



Valid Species

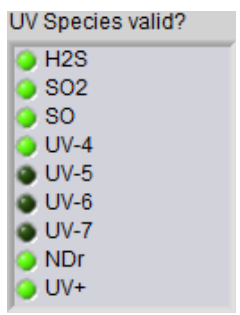


Figure 21 – Valid UV Species

The analyzer maintains a list of UV-absorbing species that it considers to be valid (register 231), based on the analysis matrix and the analysis algorithm.

The Configurator will only show the names of valid species in pop-up menus, and will only let you acquire and chart valid species.

Valid Wavelengths

Figure 22 – Valid wavelengths

The analyzer also maintains a list of valid wavelengths (register 230), based on the analysis matrix.

The Configurator will let you select any lamp and filter combination, regardless of whether it is valid or not.

UV99xx Sample System Status Panel

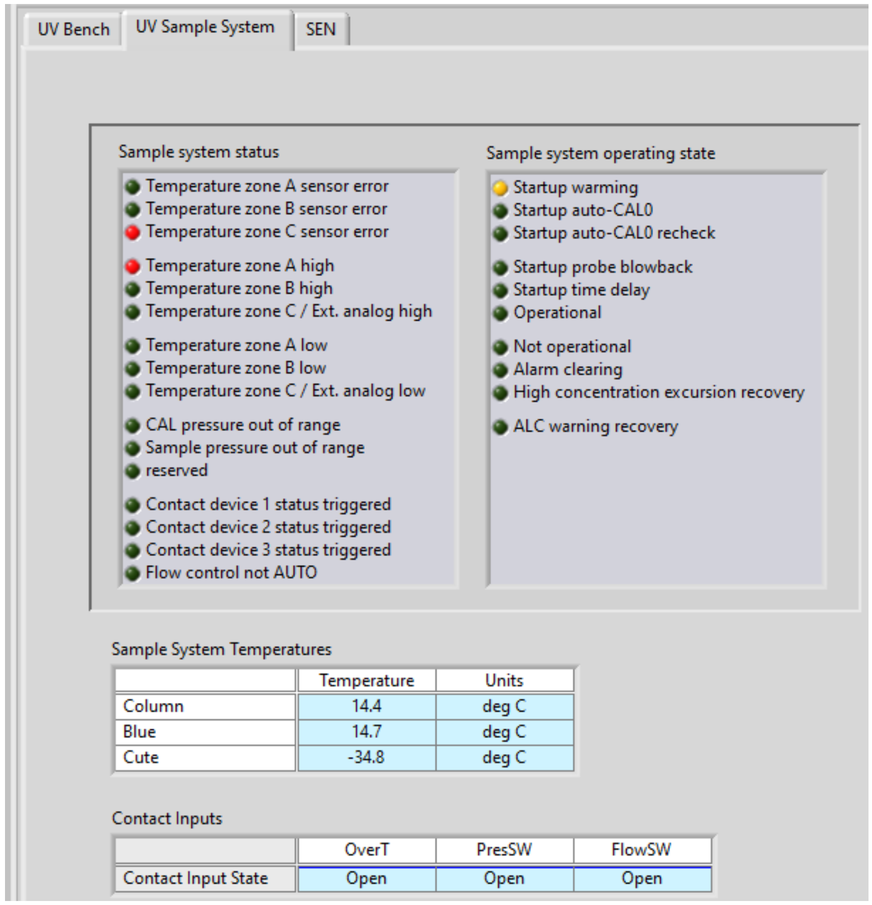
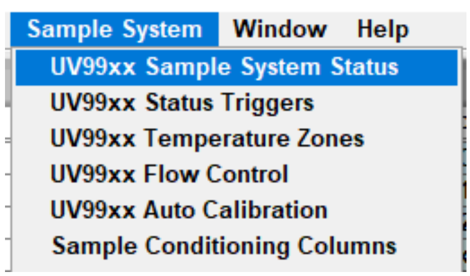


Figure 23 – Sample System Status panel

If the optional Sample System has been installed, the Sample system tab can be selected by clicking the Sample System tab on the System Status panel, or from the main menu:



You can see the operating state of the sample system, and any fault conditions that the sample system has detected.

The current sample system zone names and temperatures are also shown.

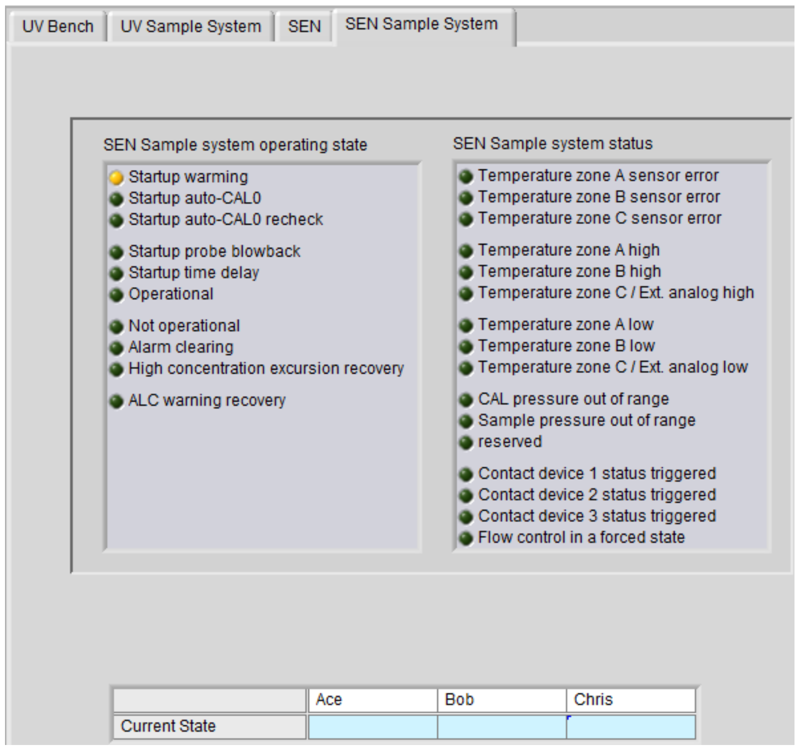
The sample system has three dry contact inputs, each of which can be assigned a name (in the Sample System panel, under the Status Trigger tab).

This panel shows whether the contact is currently open or closed. You can specify whether the contact is normally open or closed in the Sample System panel, under the Status Trigger tab.

Two Sampling Systems

It's possible to configure a 99xx analyzer with two sampling systems — one attached to the UV Bench, and one to the SEN board.

In this case, an additional tab appears, showing the status of the SEN sampling system:



This tab also appears if an analyzer has a SEN board with a sampling system, but no UV Bench.

UV99xx Measurement Panel

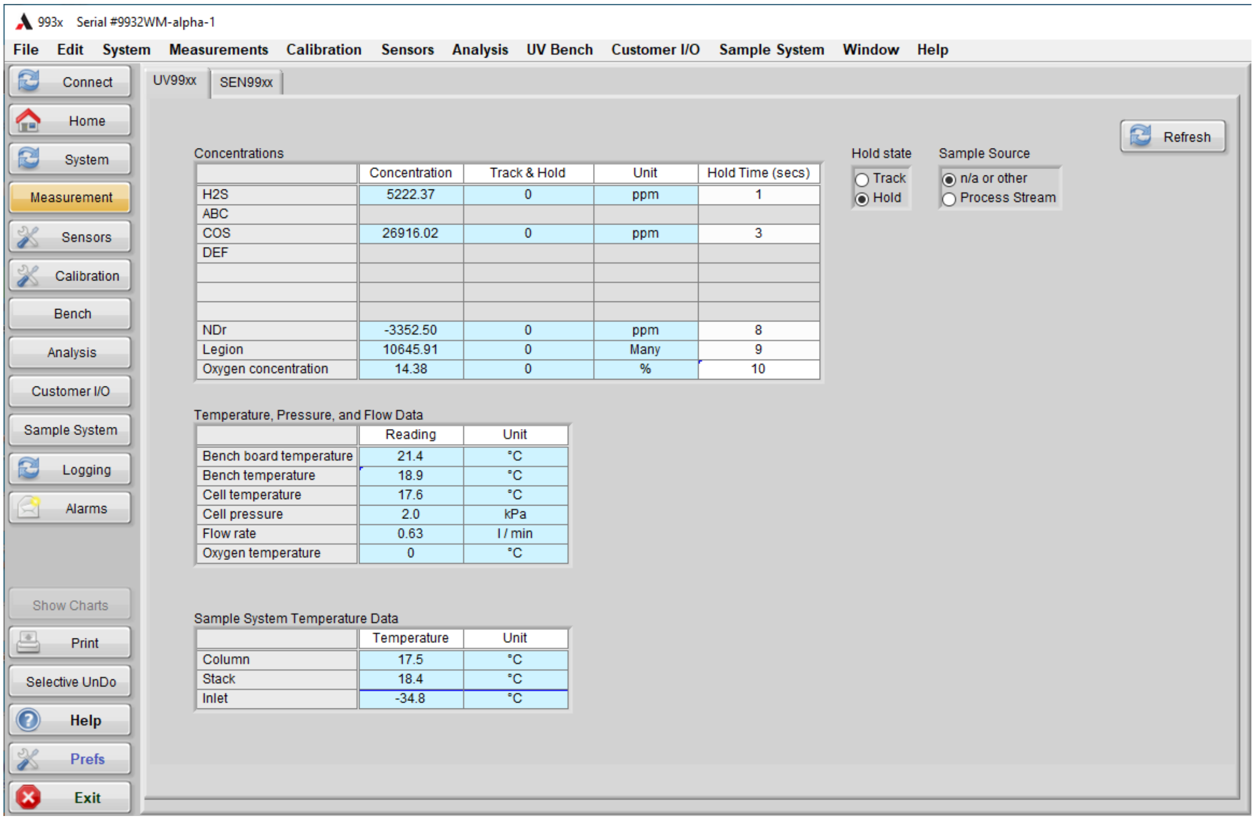


Figure 24 – Measurement Panel

The Measurement panel shows the current concentrations of each species measured by the UV Bench. Species that the analyzer has not marked as being valid are greyed out.

You can tell the analyzer whether to hold concentration results, and specify how long concentration results will be held in the Track and Hold registers. The Track and Hold concentration results are also used when live results are unavailable during a calibration.

If the hold time for a species is 0, the corresponding concentration result is held until the analyzer stops holding concentration results.

If the hold time for a species has a positive value, the result is held for the time specified and returns to tracking when the time expires, unless at the end of the specified hold time, the switch is still set to “Hold”. In that case, the hold continues until the switch is set to “Track”.

You can also set hold times using the analyzer's HMI:

Figure 25 – Setting Hold times using the analyzer's HMI

Concentrations

This table shows the concentrations and units of measure for the UV-absorbing gas species that are currently configured for this analyzer, plus the aggregated Species concentration.

When NOx measurement is enabled in the Algorithm bitmask (register #321.b3), the aggregated Species is NOx, which is the sum of Species2 (NO2) and Species3 (NO) concentrations.

When the Advanced Analysis panel is available and NOx measurement is not enabled in the Algorithm bitmask, the Species to be aggregated is defined by the Aggregated Species inclusion bitmask (REG#761) and the Species Factors (register #802-816).

For more information on Aggregated Analysis, please refer to Aggregated UV Results Setup on page 2-58.

If an oxygen sensor has been installed, the oxygen concentration is shown.

Temperature, Pressure and Flow Data

Sensor data values are measured by dedicated sensors.

Cell temperature is only shown if an Ametek ACT or DCT sample cell pressure transducer is installed and enabled.

Flow rate is only present if an Omron MEM sample gas flow sensor is installed and enabled.

Oxygen concentration is only available if a dry-application O2 sensor (i.e. Hummingbird Paracube-Alpha/Pm1158, Figaro KE-25, or Hummingbird Paracube-Delta) has been installed and enabled.

Oxygen sensor temperature is only available if a Hummingbird Paracube-Alpha/Pm1158 O2 sensor has been installed and enabled.

Sample System Data

Sample System temperatures are only displayed if an optional Sample System has been installed. The temperature zone names, current temperature, and temperature unit of measure are displayed.

The oven heater plate temperature is only displayed if an oven heater RTD is installed (register #248.b9).

SEN993x Measurement Panel

UV Bench | SEN

SEN Analysis Data

	Species	Concentration	T&H Concentration	Unit
TC A	CO	28632.131	28632.131	%
TC B	CO2	337.803	337.803	%
IR A	C5	0.120	0.120	%
IR B	iC5	1.829	1.829	%
SEC sensor A	C3	314.000	314.000	%
SEC sensor B	C4	1018.382	1018.382	%
Generic sensor A	C1	1.929	1.929	%
Generic sensor A	C2	1.661	1.661	%
Serial sensor 1	SO2	-8971.426	-8971.426	ppm
Serial sensor 2	NOx	0	0	ppm
Serial sensor 3	H2S	45653.305	45653.305	%
Serial sensor 4	CO2	0	0	%

Temperature, Pressure, Flow, and Duty Cycle Data

	Reading	Unit
Sample Gas Flow rate	735954.62	l / min
Sample Gas Pressure	50.0	kPa
Temperature	111.18	°C
Heater Temperature	112.9	°C
Heater Duty Cycle	0	%

SEN Sample System Temperatures

	Reading	Unit
Sensai	0	°C
SENDit	0	°C
SEN-C	0	°C

In 99xx analyzers that include a SEN system, there is a SEN tab in the Measurement panel showing measurements taken by the SEN board.

SEN Analysis Data

This table show live and track and hold concentration values for every sensor attached to the SEN system.

It is not possible to tell the SEN system whether to track or hold concentration values, or to specify the hold times.

Temperature, Pressure, and Flow Data

Sample gas flow and pressure are available if an Ametek PMT Model DCT or an Omron D6F flow sensor has been installed (register 3165, bits 0 [pressure] and 1 [flow]).

Sample cell, oven air, or block pressure is available if register 3165, bit 2 is set.

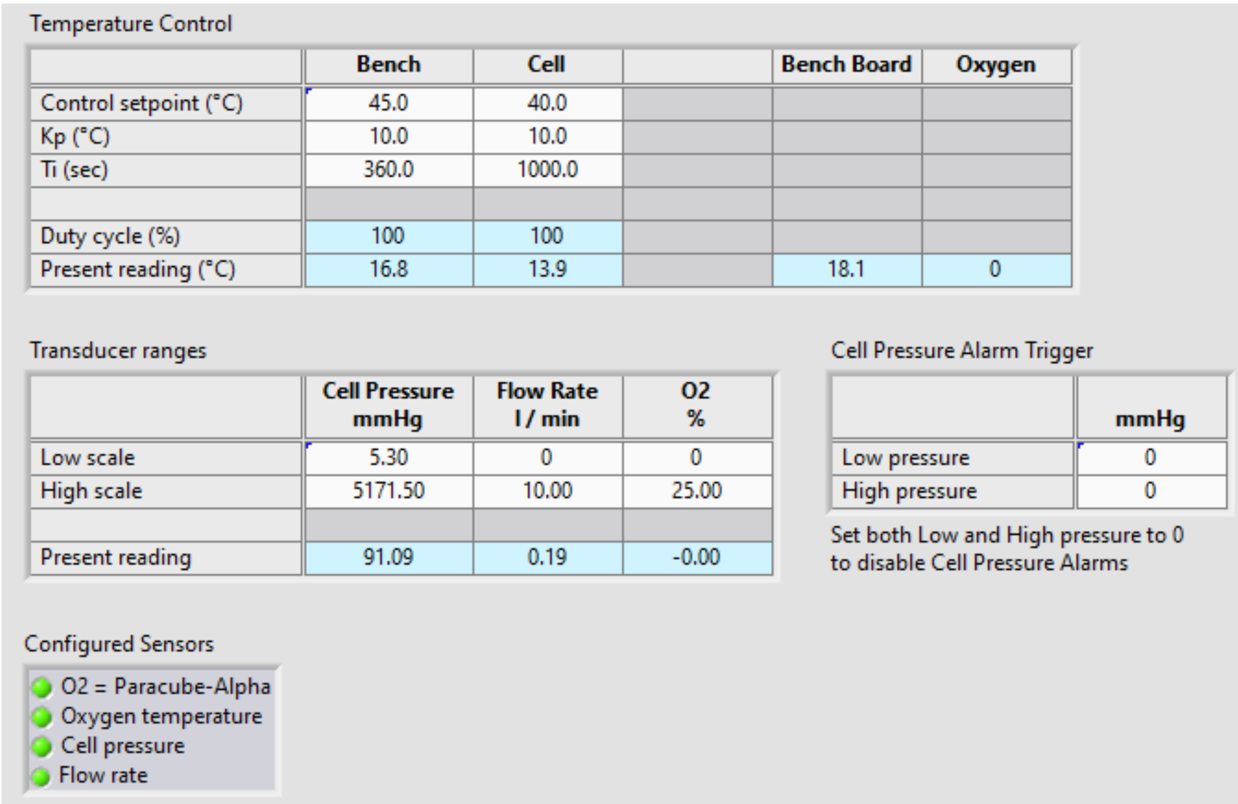
The heater temperature and duty cycle are available if a heater RTD has been installed (register 3165, bit 3).

Sample System Temperatures

If an optional Sample System is attached to the SEN system, three temperature zone readings are displayed.

UV99xx Sensors

The UV99xx can optionally be equipped with dedicated sensors to measure cell temperature and pressure, oxygen concentration, and flow rate:


Temperature Control

	Bench	Cell		Bench Board	Oxygen
Control setpoint (°C)	45.0	40.0			
Kp (°C)	10.0	10.0			
Ti (sec)	360.0	1000.0			
Duty cycle (%)	100	100			
Present reading (°C)	16.8	13.9		18.1	0

Transducer ranges

	Cell Pressure mmHg	Flow Rate l / min	O2 %
Low scale	5.30	0	0
High scale	5171.50	10.00	25.00
Present reading	91.09	0.19	-0.00

Cell Pressure Alarm Trigger

	mmHg
Low pressure	0
High pressure	0

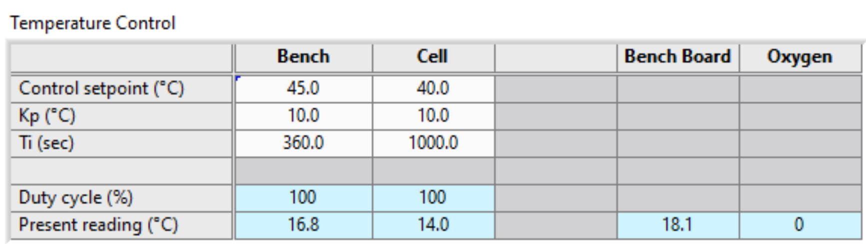
Set both Low and High pressure to 0 to disable Cell Pressure Alarms

Configured Sensors

- O2 = Paracube-Alpha
- Oxygen temperature
- Cell pressure
- Flow rate

Figure 26 – The UV Bench Sensors panel

Heaters


Temperature Control

	Bench	Cell		Bench Board	Oxygen
Control setpoint (°C)	45.0	40.0			
Kp (°C)	10.0	10.0			
Ti (sec)	360.0	1000.0			
Duty cycle (%)	100	100			
Present reading (°C)	16.8	14.0		18.1	0

Figure 27 – Temperature control coefficients

The bench and (optionally) cell are equipped with heating elements to allow their temperatures to be controlled (the set point must be above both ambient temperature and the process gas dew point).

The bench board may be similarly equipped. The Bench Board temperature provides a general indication of the analyzer electronics cabinet temperature. If the bench board temperature is not available, the reading is displayed as zero.

If the optional PM1158 Oxygen sensor has been installed, its temperature reading is displayed in the Oxygen column (otherwise, the reading will be greyed out or not displayed).

The heater control algorithm is PI (proportional + integral).

Transducer Ranges

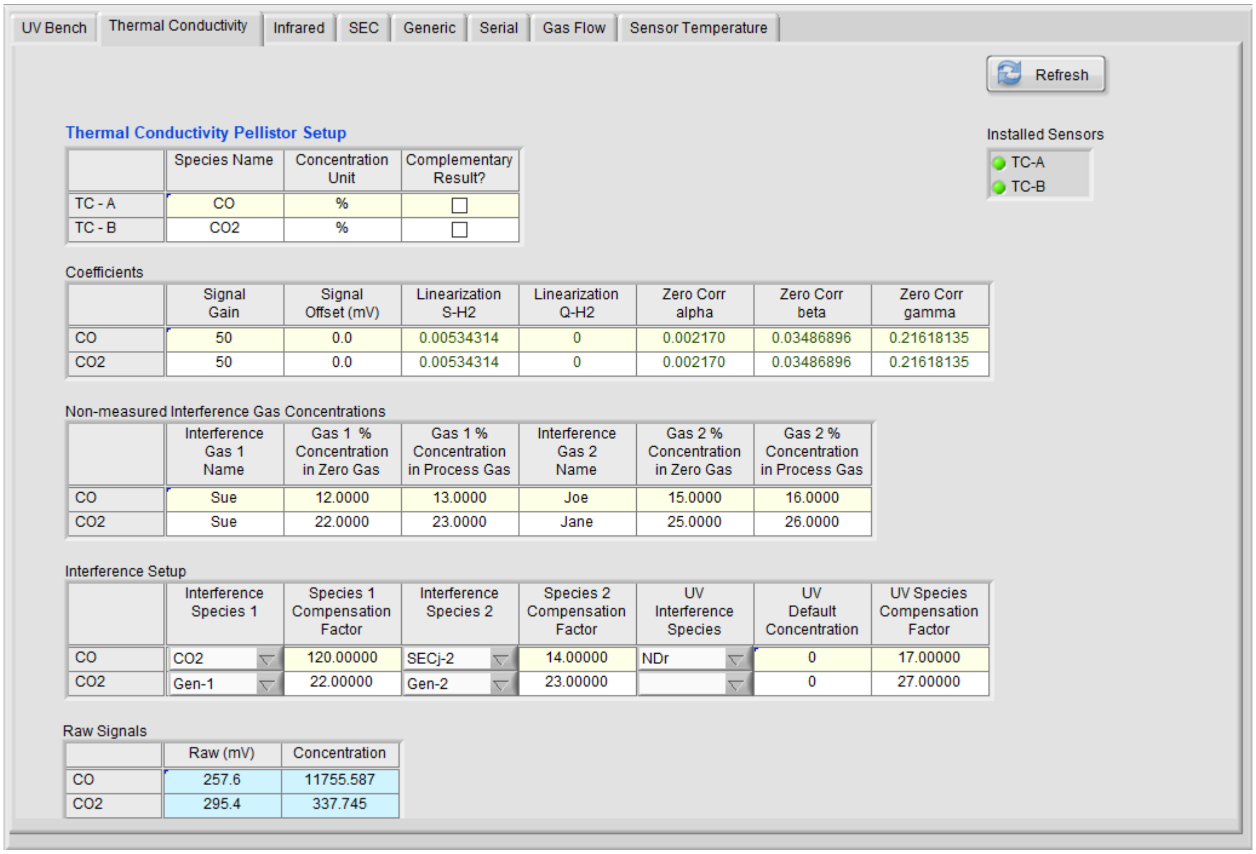
Transducer ranges

	Cell Pressure mmHg	Flow Rate l / min	Oxygen %
Low scale	5.30	0	0
High scale	5171.50	10.00	25.00
Present reading	91.09	0.20	-0.00

The cell pressure transducer (optional), flow rate sensor (optional), and oxygen sensor (optional) can each be assigned a scale range.

If a sensor is not installed, the corresponding High scale value should be set to zero (this tells the analyzer that the sensor has not been configured).

SEN993x Sensors – Thermal Conductivity



	Species Name	Concentration Unit	Complementary Result?
TC - A	CO	%	☐
TC - B	CO2	%	☐

Coefficients

	Signal Gain	Signal Offset (mV)	Linearization S-H2	Linearization Q-H2	Zero Corr alpha	Zero Corr beta	Zero Corr gamma
CO	50	0.0	0.00534314	0	0.002170	0.03486896	0.21618135
CO2	50	0.0	0.00534314	0	0.002170	0.03486896	0.21618135

Non-measured Interference Gas Concentrations

	Interference Gas 1 Name	Gas 1 % Concentration in Zero Gas	Gas 1 % Concentration in Process Gas	Interference Gas 2 Name	Gas 2 % Concentration in Zero Gas	Gas 2 % Concentration in Process Gas
CO	Sue	12.0000	13.0000	Joe	15.0000	16.0000
CO2	Sue	22.0000	23.0000	Jane	25.0000	26.0000

Interference Setup

	Interference Species 1	Species 1 Compensation Factor	Interference Species 2	Species 2 Compensation Factor	UV Interference Species	UV Default Concentration	UV Species Compensation Factor
CO	CO2	120.00000	SECj-2	14.00000	NDr	0	17.00000
CO2	Gen-1	22.00000	Gen-2	23.00000		0	27.00000

Raw Signals

	Raw (mV)	Concentration
CO	257.6	11755.587
CO2	295.4	337.745

Figure 28 – SEN 993x Thermal Conductivity Sensor Setup

The Thermal Conductivity Pellistor can be used to measure a variety of gases such as hydrogen, methane and other combustible gases.

Thermal Conductivity Pellistor Setup

The species name can be up to 6 characters, as can the concentration unit of measure (typically %).

The complementary result checkbox converts the calculated concentration to 100% - the concentration.

Coefficients

These factory-set parameters perform static corrections for the Thermal Conductivity Detector (TCD):

Coefficients

	Signal Gain	Signal Offset (mV)	Linearization S-H2	Linearization Q-H2	Zero Corr alpha	Zero Corr beta	Zero Corr gamma
H2	1	0	1.01	1.02	1.1	1.2	1.3

Signal Gain for the SGX Sensortech VQ6000 thermal conductivity sensor signals is set using jumpers. Since these jumpers are not read by the board firmware, the gain factor needs to be entered here as Signal Gain. Allowable values are 1, 2, 4, or 8.

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Signal Offset is a DC voltage offset in the range of 0 .. 2500 mV. It allows the DAC to measure negative voltages. During zero calibration, the analyzer will adjust a zero-offset DAC for the sensor to the level you specify here, before performing averaging.

Linearization S-H2 is a linear factor used to scale the mV reading from the TCD.

Linearization Q-H2 is a nonlinear factor used to scale the mV reading from the TCD.

Zero-Corr Alpha is used to correct the gas concentration reading for the effect of pressure changes.

Zero-Corr Beta is used to correct the gas concentration reading for interference from Interference Gas 1.

Zero-Corr Gamma is used to correct the gas concentration reading for interference from Interference Gas 2.

Zero Correction

Gases other than the target species can affect the TCD readings. This section lets you specify the concentration of up to two non-measured gases in both the zero gas and the process stream, that affect zero correction.

They are used in conjunction with the zero correction alpha, beta, and gamma coefficients in the table above this one.

$$\mathrm{ZeroCorrection} = \mathrm{alpha}\left(\frac{P_p}{P_z}\right) + \mathrm{beta}\left(\frac{\mathrm{Gas1}_p}{\mathrm{Gas1}_z}\right) + \mathrm{gamma}\left(\frac{\mathrm{Gas2}_p}{\mathrm{Gas2}_z}\right)$$

where:

P_b = absolute pressure of the process gas

P_z = absolute pressure of the zero gas

$\mathrm{Gas1}_p$ = interference gas-1 concentration in process-gas

$\mathrm{Gas1}_z$ = interference gas-1 concentration in zero-gas

$\mathrm{Gas2}_p$ = interference gas-2 concentration in process-gas

$\mathrm{Gas2}_z$= interference gas-2 concentration in zero-gas

So, ignoring the effect of measured interference gases (next section), the concentration is corrected for zero correction:

$\mathrm{CONC}_{\mathrm{comp}} = (\mathrm{CONC}_{\mathrm{lin}} * \mathrm{SpanFactor}) - \mathrm{ZeroCorrection}$

Interference Setup

You can also correct for the interference effects of species that are measured by the analyzer. You can compensate for the effect of two gases that are measured by sensors on the SEN board, and for one gas that is measured by the UV Bench (if installed).

The interference calculation simply subtracts the concentration of the interfering species (without performing any unit of measure conversions) multiplied by the appropriate compensation factor.

$$
\begin{aligned}
CONC_{comp} = {} & CONC_{lin} \cdot SpanFactor - ZeroCorrection \\
& + UVConc[UVSpecies] \cdot UVCompensationFactor \\
& + SenConc[SenSpecies1] \cdot SenCompensationFactor1 \\
& + SenConc[SenSpecies2] \cdot SenCompensationFactor2
\end{aligned}
$$

where:

UVConc[UVSpecies] is the concentration value of an interfering UV species, which is to be obtained from the UV Bench in Integrated Mode, or a static value in Standalone Mode; and

SenConc[SenSpecies1], SenConc[SenSpecies2], SenCompensationFactor1 and SenCompensationFactor2 are the concentration values and the compensation factors of interfering sensor species. The concentration values are measured by the SEN board (there is no provision for default values, and the pop-up menus prevent you from creating circular references).

SEN993x Sensors – Infrared Spectroscopy

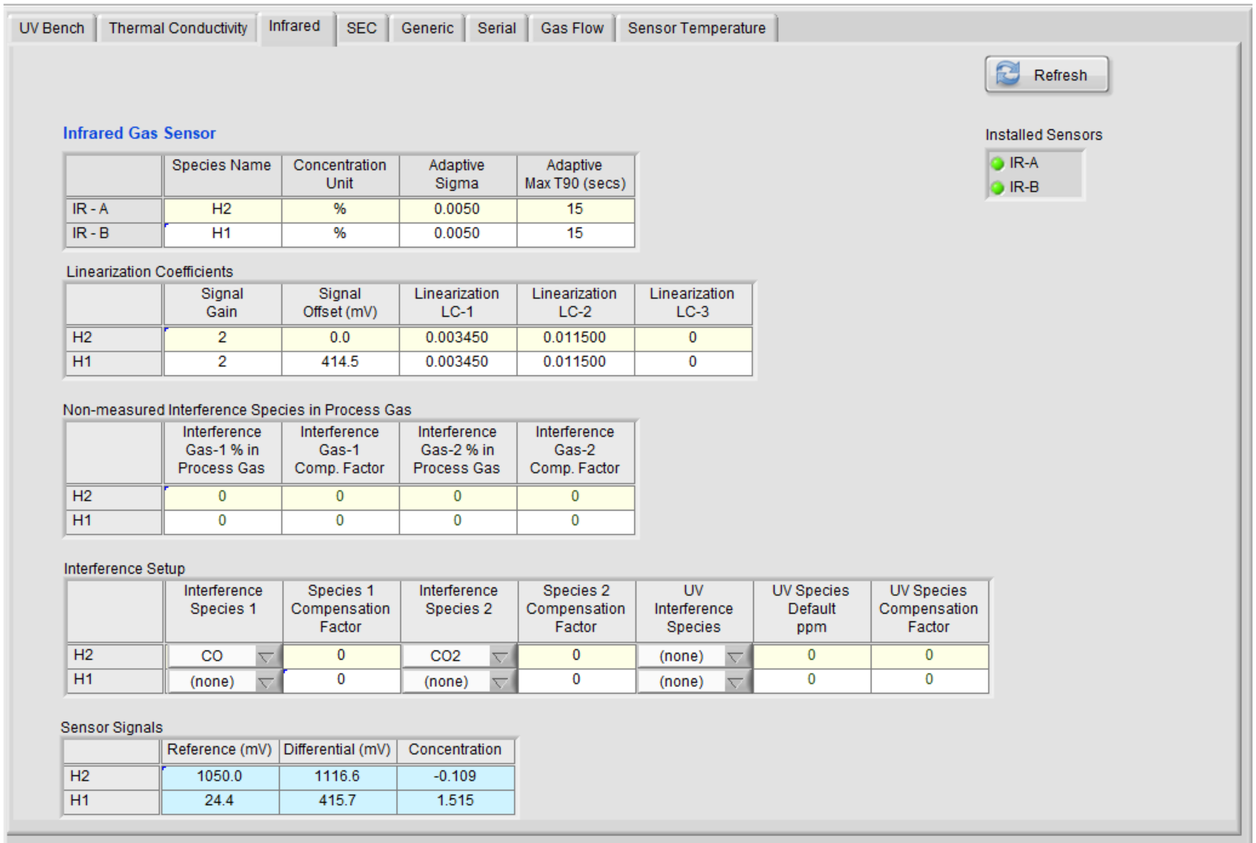


Figure 29 – SEN 993x Infrared Absorption Spectrography Setup

The Process Sensor Controller board is designed to interface with two SGX IR600 series infrared sensors, usually measuring CO_2 or hydrocarbon concentrations in % using infrared absorption spectroscopy.

Infrared Gas Sensor setup

The species name can be up to 6 characters, as can the concentration unit of measure (typically %).

The signal conditioning circuit for each sensor produces two analog signals: reference and differential. These signals are passed through an FIR low pass filter and an adaptive FIR smoothing filter.

You can provide a Max T90 time value, which is used to determine a low pass filter attenuation rate (see the description of this filter on page 2-31).

You can also provide an Adaptive Sigma, or noise floor value (see the description of Adaptive Sigma on page 2-31).

Signal Processing

In absorption spectroscopy, gas concentration is a non-linear function of the difference between the reference and active (measure) signals. The analyzer filters noise from the signals, linearizes the absorption signal, and compensates for the effect of other gases that may also absorb infrared energy.

Analog signal processing

The analog signal gain is set using jumpers. Since these jumpers are not read by the board firmware, the gain factor needs to be entered here as Signal Gain. Allowable values are 1, 2, 4, or 8.

The signal offset is a DC voltage offset in the range of 0 .. 2500 mV, which allows the DAC to measure negative voltages. During zero calibration, the analyzer will adjust a zero-offset DAC for the sensor to the level you specify here, before performing averaging.

Low pass filter

The digitized signals are passed through a low pass FIR filter, as described on page 2-31, and a smoothing FIR filter as described on page 2-31.

Linearization

The absorption signal Δ is linearized using a second or third order polynomial:

$$\mathrm{Abs} = \mathrm{LC1}\Delta + \mathrm{LC2}\Delta^2 + \mathrm{LC3}\Delta^3$$

A separate spreadsheet can be used to calculate the linearization coefficients, or you can optionally do this using the linearization utility described on page 2-33.

This is normally done at the Ametek factory and requires calibration gases with several known concentrations.

$$Transmittance \quad T_p = \left(\frac{Measure\ signal}{Reference\ signal}\right)$$

$$Absorbance\ \Delta = -log\left(\frac{T_p}{T_z}\right)$$

where:

T_p is the transmittance with process gas

T_z is the transmittance with zero gas

Non Measured Species in Process Gas

Absorption spectroscopy can be affected by the presence of gases other than the species of interest, that absorb light in a particular wavelength band. This table allows you to compensate for the effect of gas species that are not measured but are known to be present in the gas being measured.

The concentration of up to two non-measured gases in the process stream can be specified (but unlike the TCD sensor, concentrations in the zero gas are not considered). For each of these gases, a linear compensation factor can be entered. This compensation factor is automatically applied by the analyzer firmware.

The names of any interfering gas species are not recorded, and no unit of measure conversions are performed.

Interference Setup

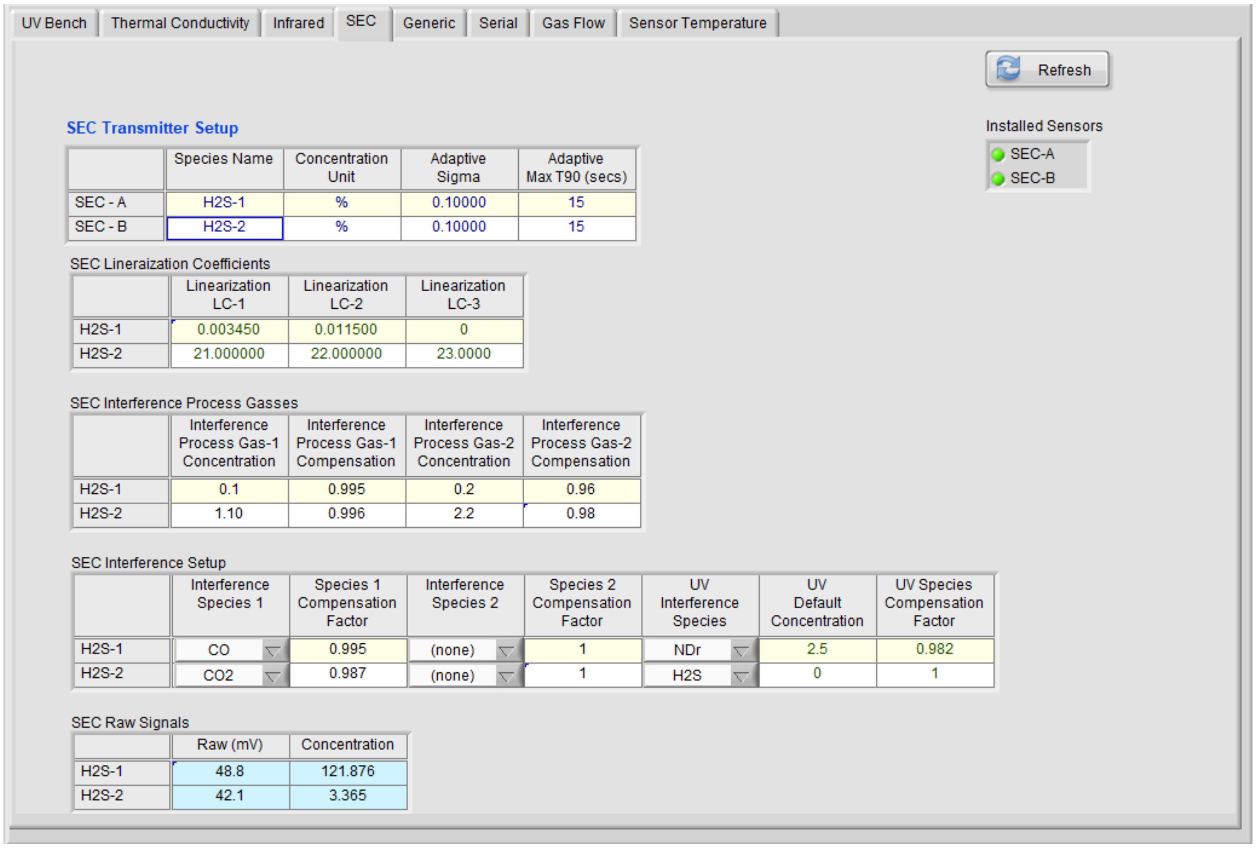
This table allows you to compensate for the effect of gas species that are measured by the 99xx UV Bench or by other 993x SEN sensors.

In the event that a UV Bench is not available, the UV gas species are named as UV Species 1, etc. This allows the sensor to be set up for an environment that will eventually include a 99xx UV Optical Bench.

Sensor Signals

The raw reference and difference signals are displayed, along with the calculated concentrations.

SEN993x Sensors – SEC



SEC Transmitter Setup

	Species Name	Concentration Unit	Adaptive Sigma	Adaptive Max T90 (secs)
SEC - A	H2S-1	%	0.10000	15
SEC - B	H2S-2	%	0.10000	15

SEC Lineraization Coefficients

	Linearization LC-1	Linearization LC-2	Linearization LC-3
H2S-1	0.003450	0.011500	0
H2S-2	21.000000	22.000000	23.0000

SEC Interference Process Gasses

	Interference Process Gas-1 Concentration	Interference Process Gas-1 Compensation	Interference Process Gas-2 Concentration	Interference Process Gas-2 Compensation
H2S-1	0.1	0.995	0.2	0.96
H2S-2	1.10	0.996	2.2	0.98

SEC Interference Setup

	Interference Species 1	Species 1 Compensation Factor	Interference Species 2	Species 2 Compensation Factor	UV Interference Species	UV Default Concentration	UV Species Compensation Factor
H2S-1	CO	0.995	(none)	1	NDr	2.5	0.982
H2S-2	CO2	0.987	(none)	1	H2S	0	1

SEC Raw Signals

	Raw (mV)	Concentration
H2S-1	48.8	121.876
H2S-2	42.1	3.365

Figure 30 – SEN 993x SEC Sensor Setup

The SEN 993x SEC board is designed to interface with two SE Sensor Electronics SEC 3000 sensors, attached via a 0..20 mA connection, often measuring H2S concentrations in %.

SEC Transmitter Setup

The species names and concentration units of measure can be 6 characters each. The linearization coefficients and interference compensation factors will not be changed if you change the units of measure.

The raw signals from the sensor are passed through an FIR low pass filter and an adaptive FIR smoothing filter (page 2-31).

You can provide a Max T90 time value, which is used to determine the low pass filter attenuation rate (see the description of this filter on page 2-31).

You can also provide an Adaptive Sigma, or noise floor value (see the description of Adaptive Sigma on page 2-31).

SEC Linearization

The filtered signal (x) is linearized using a second or third order polynomial:

$$\mathrm{Y} = \mathrm{LC1}\ x + \mathrm{LC2}\ \ x^2 + \mathrm{LC3}\ \ x^3$$

The polynomial coefficients are normally set up at the Ametek factory. In order to create or validate them, it's necessary to collect measurements for several known concentrations of calibration gas, and to perform a curve fit on the measured data points (you can optionally do this using the linearization utility described on page 2-33).

SEC Interference

The SEC concentration calculation can compensate for the effect of up to two species that are measured by the 993x SEN board, and one that is measured by the UV Bench. You can also compensate for another two gases that are not measured. For more details on the interference calculation, please see the common calculation section on page 2-32.

SEC Raw signals

The raw sensor value (in mV) and the calculated gas concentration are shown in real time.

SEN99xx Sensors – Generic

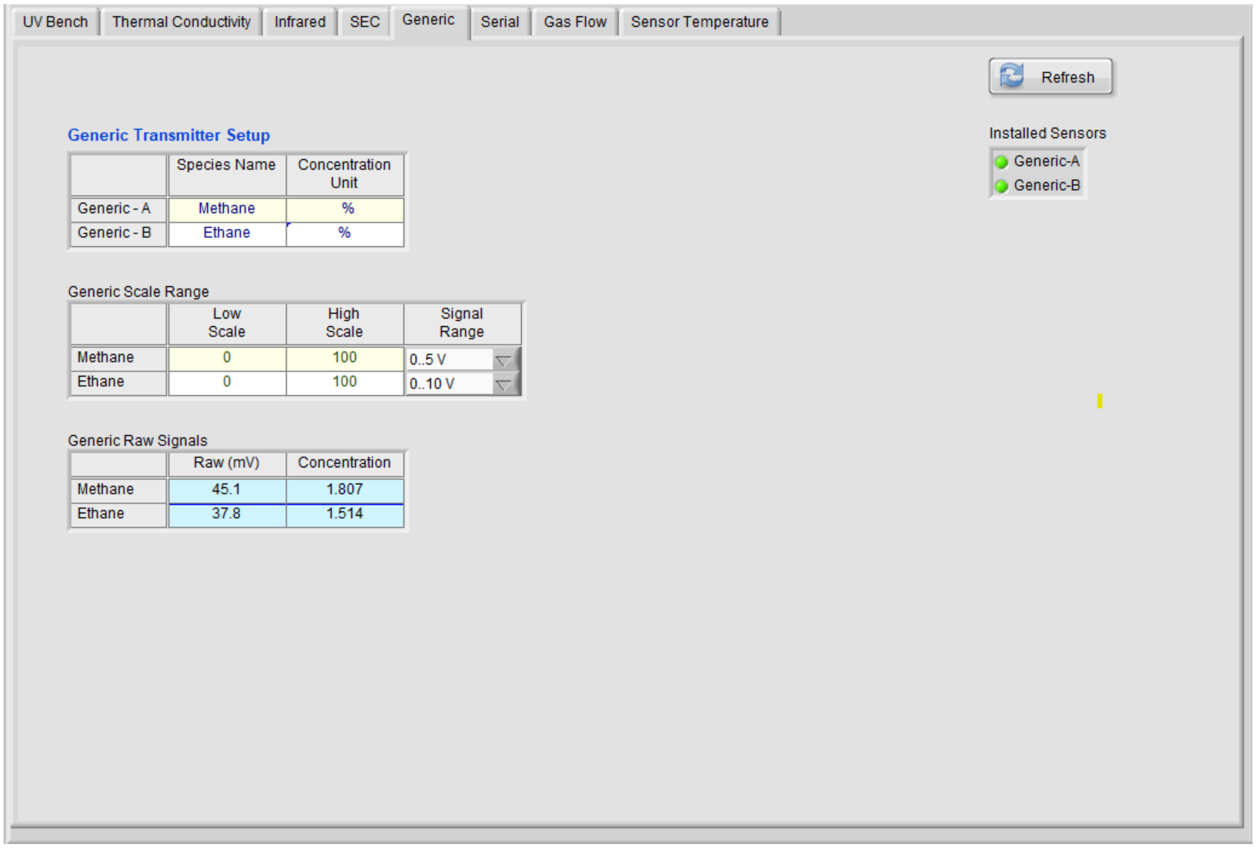


Figure 31 – SEN Generic Sensor Setup

All SEN99xx models are designed to interface with up to two generic sensors that emit voltage signals that are proportional to gas concentrations.

For each of them, a simple linear scaling is performed. You can see the raw and scaled signals in real time.

SEN99xx Serial Sensors – Nenvitech Net3 Cyber

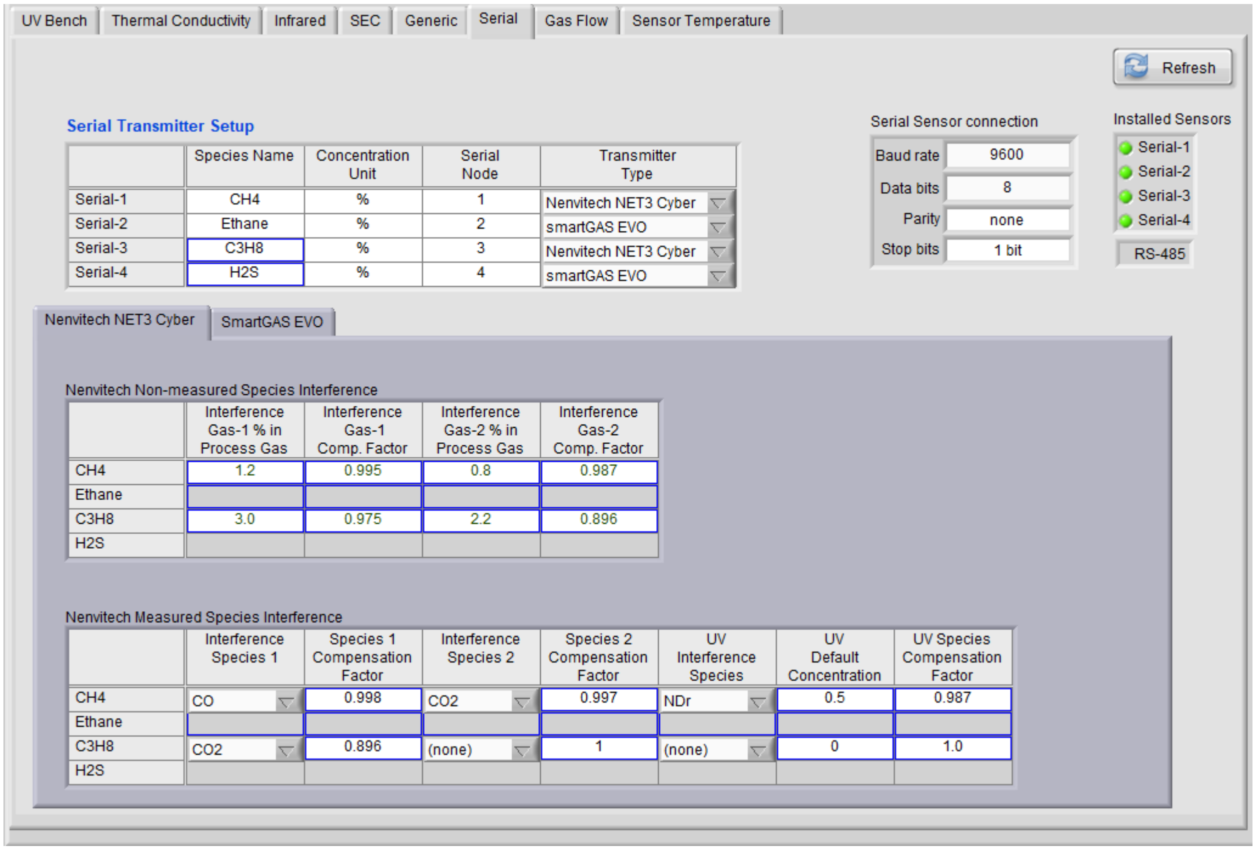
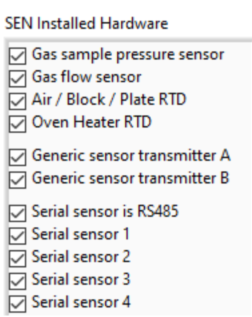


Figure 32 – SEN99xx Serial Nenvitech Net3 Cyber Sensor



You can connect up to four Nenvitech Net 3 Cyber sensors (or a mix of serial sensors) via an RS-485 serial connection. To do this, the serial port must be configured in RS-485 mode (rather than RS-232 mode) in Factory Settings. You can enable up to four serial ports in RS-485 mode, each with its own Modbus nodeID and transmitter type.

You can assign a six character species name and unit of measure to each serial port. You can select a transmitter type from the pop-up menus in *Serial Transmitter Setup.* Note that the available ports and transmitters will change if you set the serial port to RS-232 mode.

Interference Setup

You can compensate for the effect of other gases in the process stream as described on page 2-32.

SEN99xx Serial Sensors – SmartGas EVO

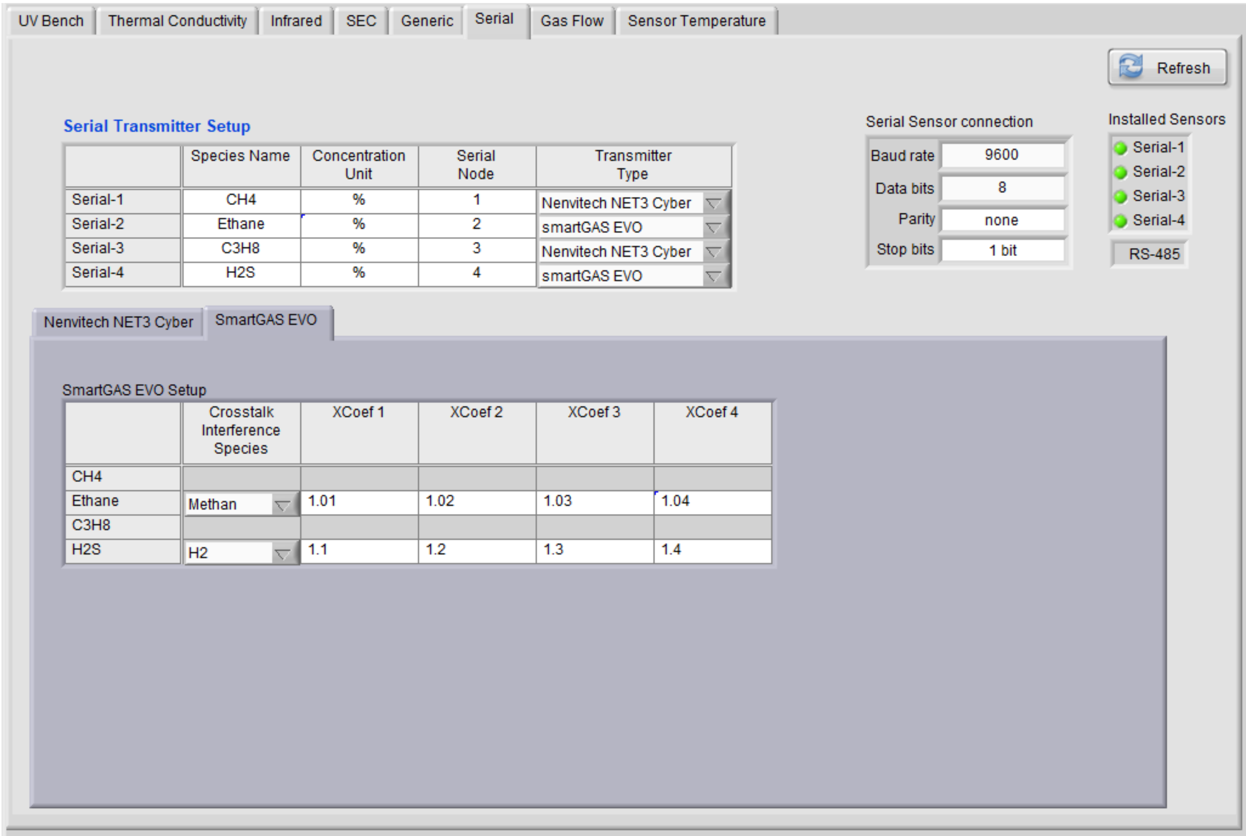
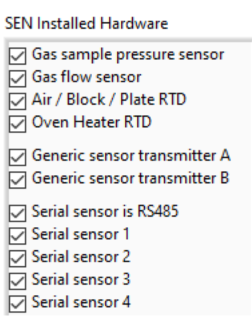


Figure 33 – SEN Serial SmartGas EVO Sensor



You can connect up to four SmartGas EVO sensors (or a mix of serial Modbus sensors) via an RS-485 serial connection. To do this, the serial port must be configured in RS-485 mode (rather than RS-232 mode) in Factory Settings. You can enable up to four serial ports in RS-485 mode, each with its own Modbus nodeID and transmitter type.

For each serial port, you can assign a six character species name and unit of measure. You can select a transmitter type from the pop-up menus in *Serial Transmitter Setup.* Note that the available ports and transmitters will change if you configure the serial port to RS-232 mode.

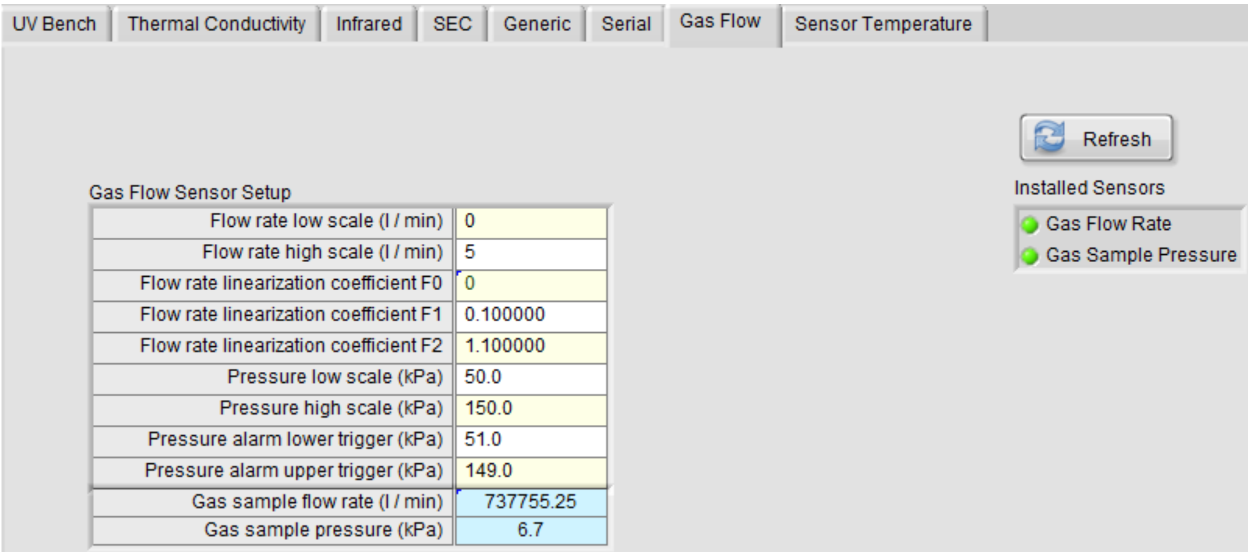
SmartGas EVO Setup

You can compensate for the effect one other gas in the process stream, using a third order correction polynomial. Four crosstalk coefficients are provided, where XCoef1 is the 0th order coefficient and XCoef4 is the 3rd order coefficient. These are normally set up at the Ametek factory, but you can also calculate them using the linearization utility described on page 2-33.

SEN99xx Serial Sensors – Axetris LGD

If the SEN serial port is set to RS-232 mode, an Axetrix Laser Gas Detection sensor can be attached. However this is a future capability of the SEN system, and its configuration parameters have not yet been determined.

SEN99xx Sensors – Gas Flow



Sample Gas Flow

Sample gas flow can be measured using an optional Omron D6F Flow Sensor. The output of the D6F flow sensor is slightly non-linear with zero bias and is dependent on the dominant background gas. The general equation for linearizing the filtered ADC data to flow rate is:

$$Flow\ Rate = (F_2 \cdot Sig^2) + (F_1 \cdot Sig) + F_0$$

where:

F_2, F_1, and F_0 are linearization coefficients.

$$Sig = Filtered\ Data - ADC\ Data\ Zero\ Bias$$

$$ADC\ Data\ Zero\ Bias = \frac{(2^{12}-1)}{5} = \frac{4095}{5} = 819$$

If the flow rate is primarily used as an indication of flow, and slight non-linearity is acceptable, the linearization coefficients can be calculated automatically if F_2 is set to 0:

F_1 = Flow low scale

$F_1 = \frac{Flow\ high\ scale - Flow\ low\ scale}{ADC\ Data\ Range\ ZB}$ = (Flow high scale - Flow low scale) / ADC Data Range ZB

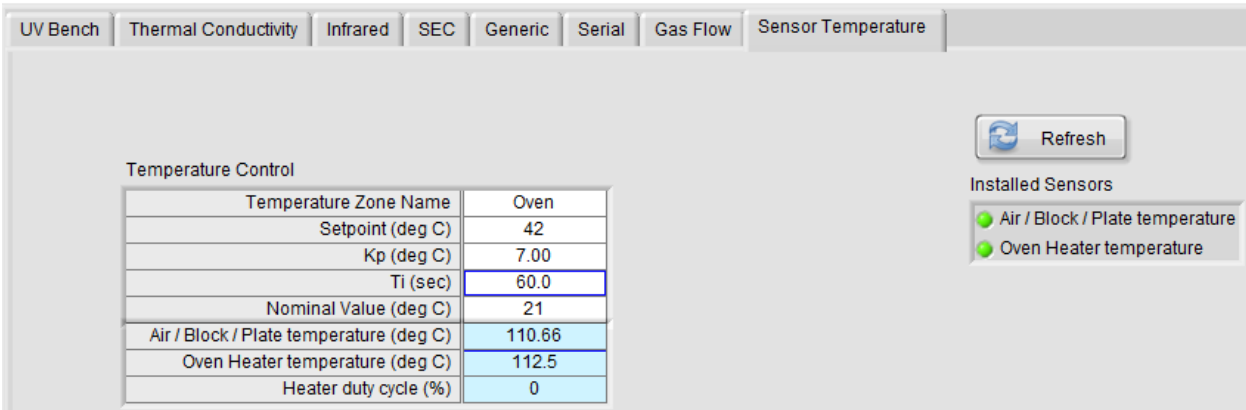
where:

$$DC\ Data\ Range\ ZB = ADC\ Data\ Range - ADC\ Data\ Zero\ Bias = 3276$$

Sample Pressure

The output of the Ametek DCT pressure transducer is linear without zero bias, so the sample gas pressure value is linear within the scale range specified in this table. The pressure scale values are greyed out if no pressure transducer has been installed.

SEN99xx Sensor Temperature



If optional RTDs are installed for temperature control, the SEN system can control the temperature of an oven or heating plate.

Temperature Control

In integrated configurations (UV Bench plus SEN system), the oven heater is normally controlled by the UV Bench board. This panel only appears when connected to SEN-only analyzer, or a UV + SEN configuration that include a temperature RTD that controls a non-oven temperature.

The temperature is controlled using a PI (proportional - integral) algorithm. The air / block / plate temperature is measured using an RTD.

Optionally, a heater RTD can be installed, in which case the SEN board will limit the temperature and duty cycle of the heater.

The temperature is sampled every 200 ms, and the difference between the measured temperature and the setpoint, T_{err} is accumulated over the time period T_i to yield T_{err}.

$$Heater\ Duty\ Cycle\ \% = 100 \cdot \left. \frac{\left(T_{err} + \sum T_{err} \cdot 20\right)}{T_i} \middle/ K_p \right.$$

where:

K_p is the proportional control constant

T_i is the integral reset time

20 is the control interval, in seconds

The nominal temperature will be used if an air / block / plate temperature RTD has not been installed, or if it has failed.

SEN993x Common Calculations

Several calculations are performed in the same way for several of the SEN sensors:

FIR Low pass filter

The analog sensor signals are digitized and passed through a low pass FIR filter:

$Y_i = X_i + Y_{i-1} - (Y_{i-1} \gg N_{\mathrm{LPF}})$

where:

> X_i is the current signal from the analog to digital converter
>
> i refers to the current sampling period (X_i is the current sample, and X_{i-1} is the previous sample).
>
> Y_i is the filtered signal at time i
>
> Y_{i-1} was the previous filtered signal value
>
> N_{LPF} is the number of bits to right-shift Y_{i-1}

The signal acquisition interval is 200ms, so $N_{\mathrm{LPF}} = 4$ yields a T90 value of 7s, and $N_{\mathrm{LPF}} = 5$ yields a T90 value of 14s. You can specify a value for MaxT90, but not for N_{LPF}.

Y_i is scaled down to fit the word length of the analog to digital converter:

$Z_i = (Y_i \gg N_{\mathrm{LPF}})$

Adaptive Filter

Several of the 993x SEN sensors let you specify a value for Adaptive Sigma.

This value, in combination with $\mathrm{T90}_{\mathrm{max}}$, controls an adaptive FIR filter in which the filter gain is determined dynamically based on the amount of change in the signal:

let $\Delta = Z_i - Z_{i-1}$ {ie: new value – old value}

and $\mathrm{G1} = \left(\frac{|\Delta|}{100\ \sigma}\right)$ where σ is the value of Adaptive Sigma

The minimum gain is:

$$G_{\min} = \left(\frac{1}{\mathrm{Int}\left(\frac{0.45\ \mathrm{T90}_{\mathrm{max}}}{\mathrm{SampleInterval}}\right) + 1}\right)$$

The filter gain is:

$\mathrm{Gain} = \mathrm{G1} + \mathrm{G}_{\mathrm{min}}$

And the filtered value is:

$Z_{i-1} + (\mathrm{Gain}\ \Delta)$ {ie: old value + Gain * Δ)

Other Species Interference Compensation

Thermal conductivity and absorption spectroscopy readings can be affected by the presence of other gas species. Several of the SEN 993x sensor readings can be compensated for this effect.

Up to two gas species measured by the SEN board, and one species measured by the UV Bench can be selected as interfering species. The compensation is assumed to be proportional to the concentration of the interfering gas species.

Note that no unit of measure conversions are performed when performing this calculation.

In general,

$$\mathrm{Conc_{corrected}} = \mathrm{Conc_{uncorrected}} - (\mathrm{Conc_{Sen1}} \cdot \mathrm{Corr_{Sen1}}) - (\mathrm{Conc_{Sen2}} \cdot \mathrm{Corr_{Sen2}}) - (\mathrm{Conc_{UV1}} \cdot \mathrm{Corr_{UV1}})$$

Where:

Conc is a concentration,
Corr is a correction factor,
Sen refers to the SEN board, and
UV refers to the UV board.

For some sensors, you can also specify the concentration of another two gas species that are not measured but are known to be present in the process gas (the Thermal Conductivity sensor panel also lets you specify the concentration of an interfering gas species that is present in the zero gas).

Linearization

Several of the sensor signals can be linearized using a polynomial. In general, the Ametek factory will provide values for the polynomial coefficients.

The filtered signal (x) is linearized using a second or third order polynomial:

$$\mathrm{Y} = \mathrm{LC1}\ x + \mathrm{LC2}\ x^2 + \mathrm{LC3}\ x^3$$

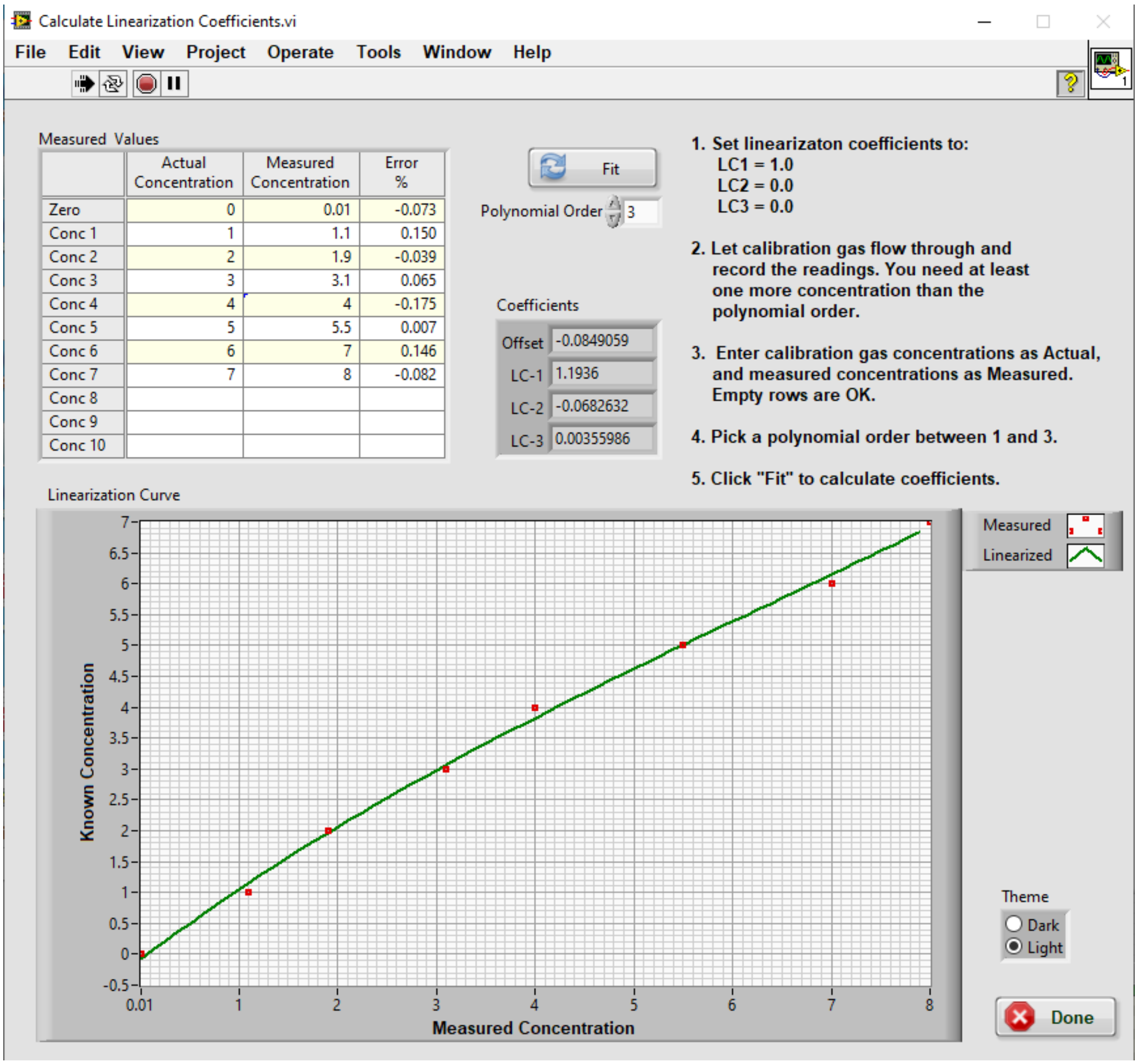
In order to calculate linearization coefficients, it’s necessary to have calibration gases at a variety of known concentrations of the species of interest (you need to have, at minimum, one more concentration than the polynomial order).

You should remove interference species compensation, and set the linearization coefficients to zero, except for the first order coefficient, which should be set to one.

Collect concentration values for each of the known concentrations, taking care to let the readings stabilize. The most common method for creating polynomial coefficients is to use a least squares fit. Once you’ve created coefficients, it’s good practice to verify the linearization and the calibration by running several known gas concentrations through the analyzer, and recording the deviation from the known calibration.

Linearization Utility

You can calculate linearization coefficients by selecting “Linearization Coefficients” from the System menu:



This simple utility lets create a linearization polynomial to compensate for sensor non-linearity.

For the sensor and species of interest, start by setting any existing linearization coefficients to zero, except for the first order coefficient, which should be set to 1.0. You should also remove any entries for interfering species, unless they are also known to be present in the calibration gas.

You’ll need to run calibration gas through the analyzer at a number of known concentrations. At minimum, you’ll need one more than the order of the polynomial you wish to fit, but you can use as many as you wish.

In the first column, enter the known concentrations of the species of interest, and in the second column, enter the readings you get from the analyzer. Blank rows are fine.

Set the desired polynomial order and click “Fit”. A polynomial is generated using the least-squares method of curve approximation and is graphed as a solid plot. Your calibration vs. measured concentrations are shown as discrete data points (the “Measured” plot).

The absolute difference between the measured reading and the fitted polynomial is shown in the Error column of the Measured Values table. Although the example is shown in percentage, you can use either ppm or percentage.

The utility does not automatically transfer the linearization coefficients to the analyzer: you’ll have to do that manually using the setup screen for the sensor and species of interest.

For some sensors, there is no provision for an offset (zero-order) coefficient in the analyzer.

UV Bench Calibration

The UV Bench Calibration panel lets you calibrate UV-absorbing gas concentrations.

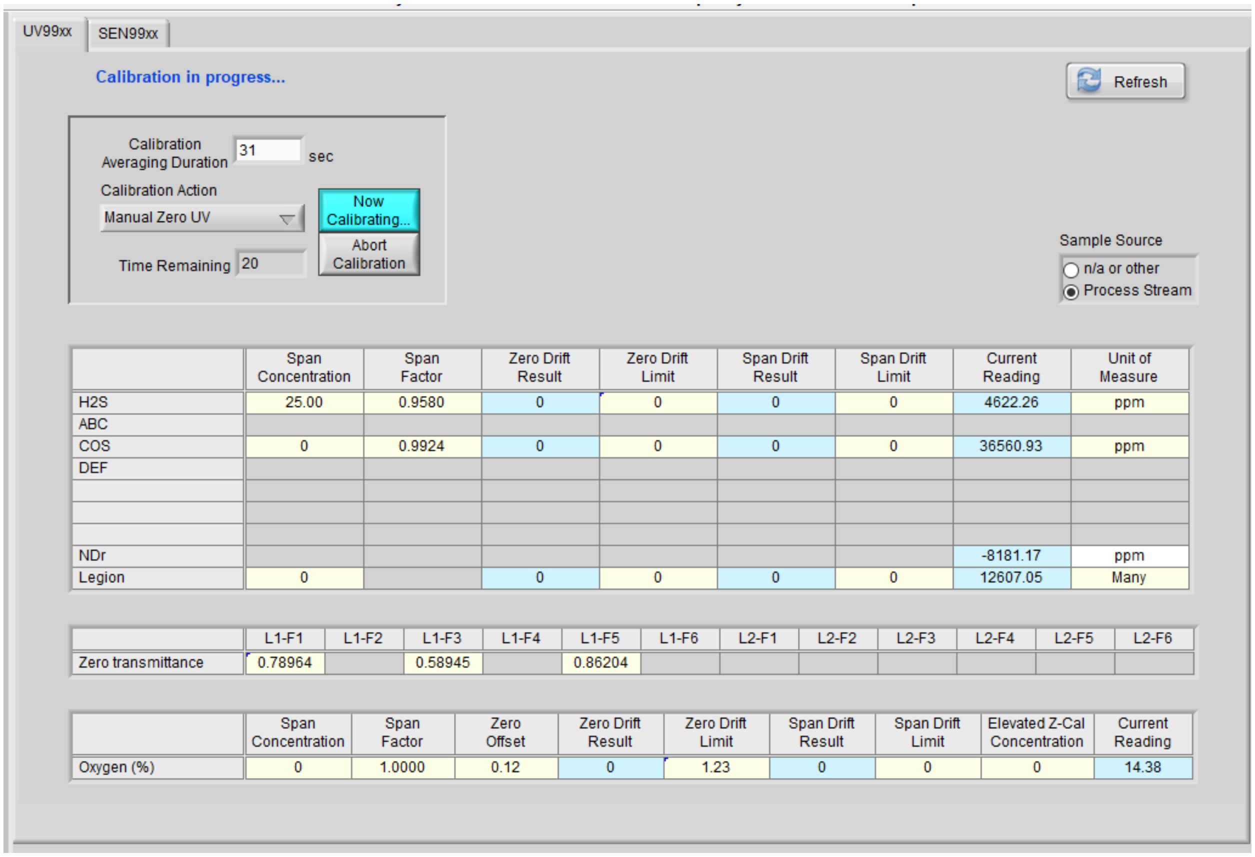
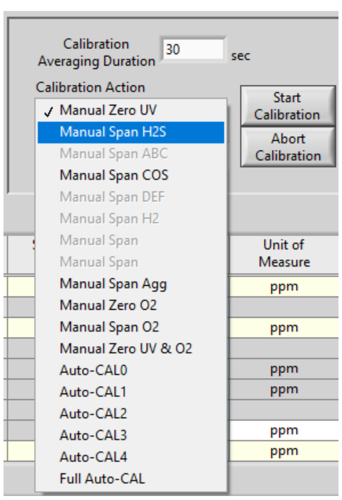


Figure 34 – Calibration Panel



Several types of calibration can be specified using the pop-up Calibration Action menu:

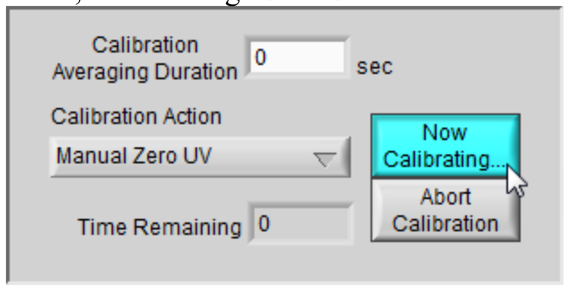
Zero calibration can be done automatically in response to a contact input, or manually. An appropriate Zero gas must be flowing through the analyzer.

If the analyzer will be used to measure a sample concentration that is significantly different from that of the original (factory-set) range, Ametek recommends re-spanning the analyzer.

To re-span each gas species:

- Enter the concentrations of the components in the Calibration Gas in the “Span Concentration” column of the table.
- Let Zero Gas flow through the analyzer, and adjust the Zero Gas regulator to:
 < 35 kPa gage @ 1 litre/min (<5 psig @ 2.0 scfh).
- When the live concentration value stabilizes, perform a Manual Zero by selecting “Manual Zero UV” from the Calibration Action

menu, and clicking “Start Calibration”:



The button changes to read “Now Calibrating”, and the “Time remaining” counts down to zero.

- The Zero-Drift result will be updated on the screen.
- Let Span Gas flow through the analyzer, and adjust the Span Gas regulator to:
  < 35 kPag @ 1 litre/min (<5 psig @ 2.0 scfh).
- Wait for the live reading to stabilize (the value should be close to the concentration in the Span gas).
- Perform a manual Span for the gas species being calibrated by selecting the species to be calibration from the Calibration Action menu and clicking “Start Calibration”:

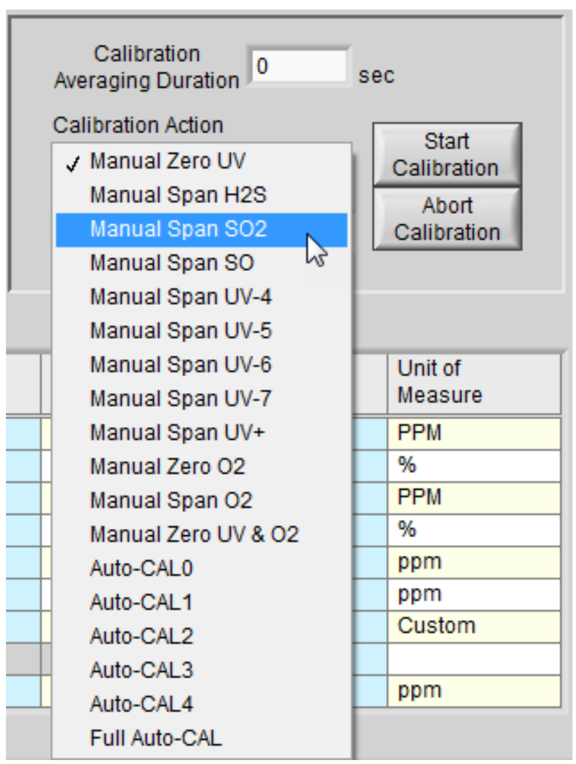


Figure 35 – Calibration options

- The Span-Drift result will be updated on the screen.
- Oxygen can also be zeroed at the same time as the UV-absorbent species (requires an oxygen sensor to be installed, and requires the Zero Gas to be nitrogen). This option is only visible if an oxygen sensor has been installed.

Abort

You can abort a calibration by clicking "Abort Calibration". The "Calibration in Progress" indicator will remain on the screen until the calibration has been aborted (this may take a few seconds).

Auto Calibration

The analyzer can also perform calibration actions automatically if the Zero gas and Calibration gas supply valves are actuated by solenoids in the analyzer.

These solenoids are part of the optional Sample System module. For information about assigning the solenoids to auto calibration tasks, please refer to Sample System Panel – Solenoids on page 2-86.

The analyzer will introduce Zero Gas into the sample system by energizing the Zero Gas Solenoid, and then wait a configurable time for Zero gas to flow through the analyzer (you set this up using the Sample System – Auto CAL panel: see page 2-87).

The Zero Offset values are adjusted based on the average reading during the *Calibration Averaging Duration*.

The analyzer will introduce calibration gas into the sample system by energizing the corresponding solenoid, and wait for it to flow through the analyzer.

The span is automatically adjusted based on the average reading during the *Calibration Averaging Duration*.

Auto-CAL 0…4

Up to four species can be calibrated automatically. Auto-CAL 0 is reserved for Zero Gas calibration.

Full Auto Calibration

In *Full Auto Calibration,* the analyzer will automatically cycle sequentially through each of the Auto-CAL functions.

The zero offsets and calibrations will be adjusted automatically.

Triggered Calibrations

If the optional Customer I/O board has been installed, dry contact inputs can trigger auto-CAL functions. Please refer to page 2-67 for more information (Customer I/O Panel – Contact Inputs).

The Calibration Table

	Span Concentration	Span Factor	Zero Drift Result	Zero Drift Limit	Span Drift Result	Span Drift Limit	Current Reading	Unit of Measure
H2S	25.00	0.9580	13249.44	0	0	0	-4099.41	ppm
ABC								
COS	0	0.9924	-24383.31	0	0	0	92115.06	ppm
DEF								
NDr							5915.36	ppm
Legion	0		16978.60	0	0	0	23028.89	Many

Span Concentration

Enter the concentration of each species in the calibration gas.

Span Factor

At the end of a calibration, the analyzer calculates a new Span Factor. However, it is possible to override the calculated Span Factor. If you enter your own Span Factor, no validation is performed on the new Span Factor.

Please note that if the calculated span factor is not reasonably close to 1.0 (typically between 0.85 and 1.15), it is likely that either the old calibration or the new calibration is invalid.

Zero Drift Result

At the end of a calibration, the analyzer calculates the difference between the new zero calibration and the previous one.

Zero Drift Limit

If the Zero Drift Result is greater than the Zero Drift Limit, at the end of a zero calibration, the new calibration is considered to have excessive drift, and is automatically discarded.

Span Drift Result

At the end of a calibration, the analyzer calculates the difference between the new Span Factor and the previous one.

Span Drift Limit

At the end of a calibration, the analyzer calculates the difference between the new Span Factor and the previous one. If this difference is greater than the Span Drift Limit, the calibration is considered to have excessive drift, and is discarded.

Zero Transmittance Table

	L1-F1	L1-F2	L1-F3	L1-F4	L1-F5	L1-F6	L2-F1	L2-F2	L2-F3	L2-F4	L2-F5	L2-F6
Zero transmittance	0.85938		0.39725		0.86630							

When the analyzer performs a zero calibration, it also automatically measures the transmittance at each filter position.

The zero transmittance values can be changed manually if necessary, but this should not normally be necessary.

Ametek suggests recording these values for long-term diagnostics.

Oxygen Calibration Table

	Span Concentration	Span Factor	Zero Offset	Zero Drift Result	Zero Drift Limit	Span Drift Result	Span Drift Limit	Elevated Z-Cal Concentration	Current Reading
Oxygen (%)	0	1.0000	0.12	0	1.23	0	0	0	14.38

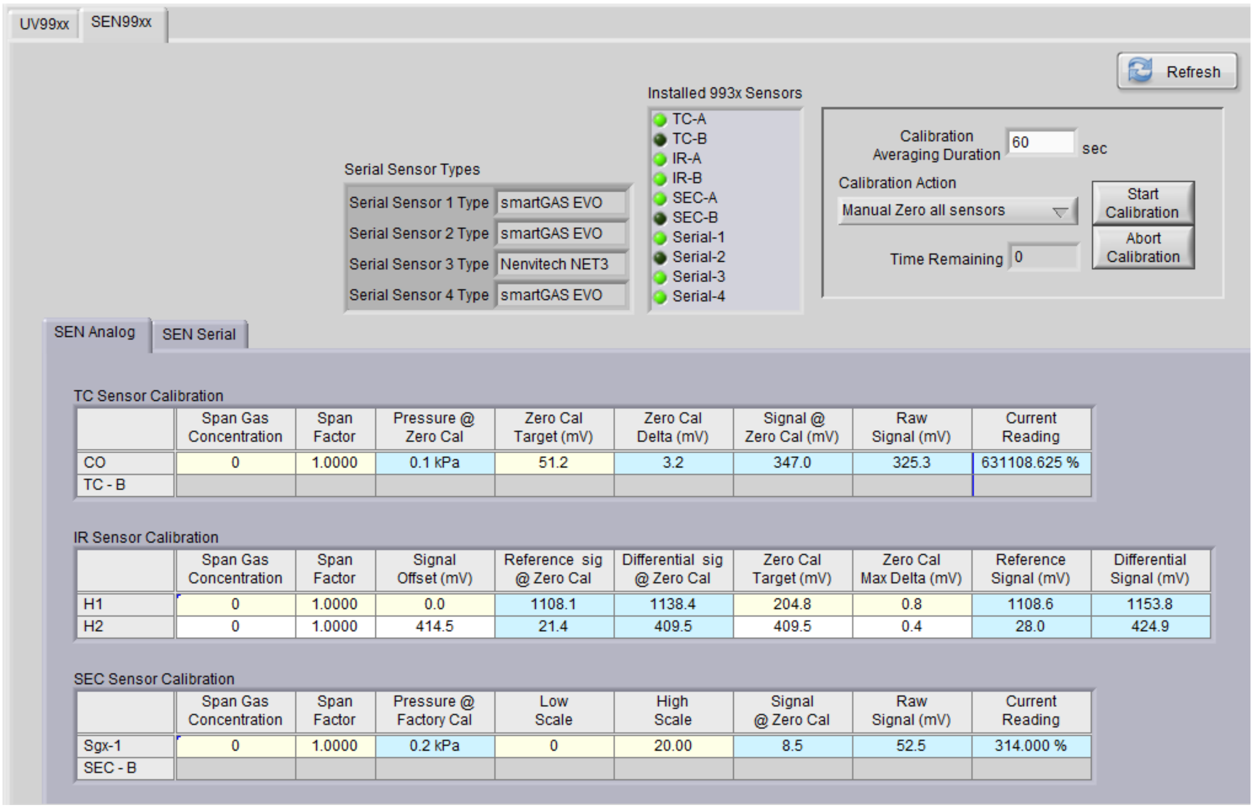
If an optional Oxygen sensor has been installed, it can be calibrated in the same way as the UV-absorbent species.

Note that if you wish to Zero the Oxygen sensor in the same sequence as a UV-absorbent species, the Zero gas must be Nitrogen.

Ametek suggests recording these values for long-term diagnostics.

SEN993x Calibration Panel

The SEN993x Calibration panel lets you calibrate the sensors attached to a SEN993x system:



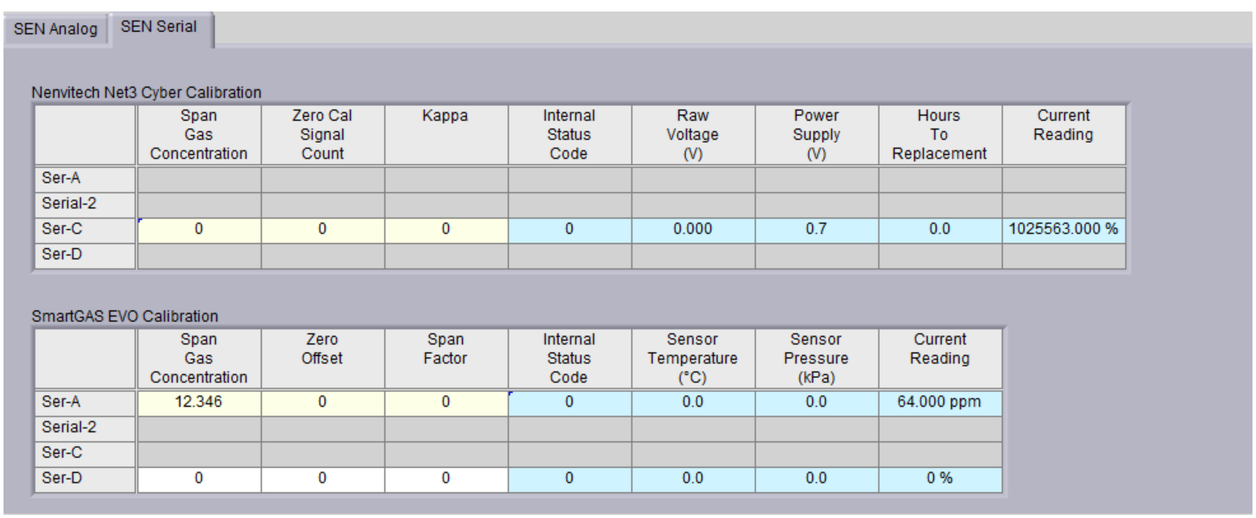
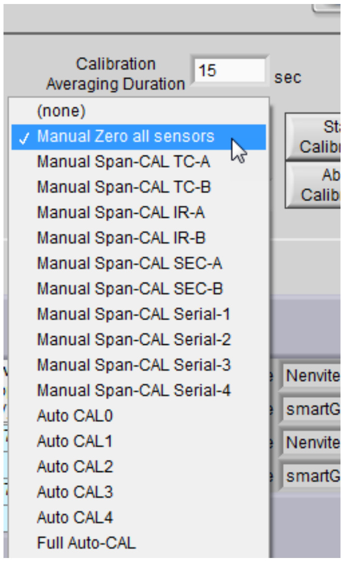


Figure 36 – SEN Calibration Panel



Several types of calibration can be specified using the pop-up Calibration Action menu:

Zero calibration can be done automatically in response to a contact input, or manually. An appropriate Zero gas must be flowing through the analyzer (this can be automated using the solenoids in the optional Customer I/O board).

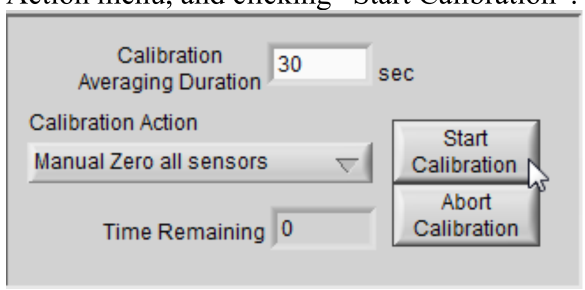
If the analyzer will be used to measure a sample concentration that is significantly different from that of the original (factory-set) range, Ametek recommends re-spanning the analyzer.

To re-span each gas species:

- Enter the concentrations of the components in the Calibration Gas in the "Span Concentration" column of the table.

- Let Zero Gas flow through the analyzer, and adjust the Zero Gas regulator to:
 < 35 kPa gage @ 1 litre/min (<5 psig @ 2.0 scfh).

- When the live concentration value stabilizes, perform a Manual Zero by selecting "Manual Zero all sensors" from the Calibration Action menu, and clicking "Start Calibration":



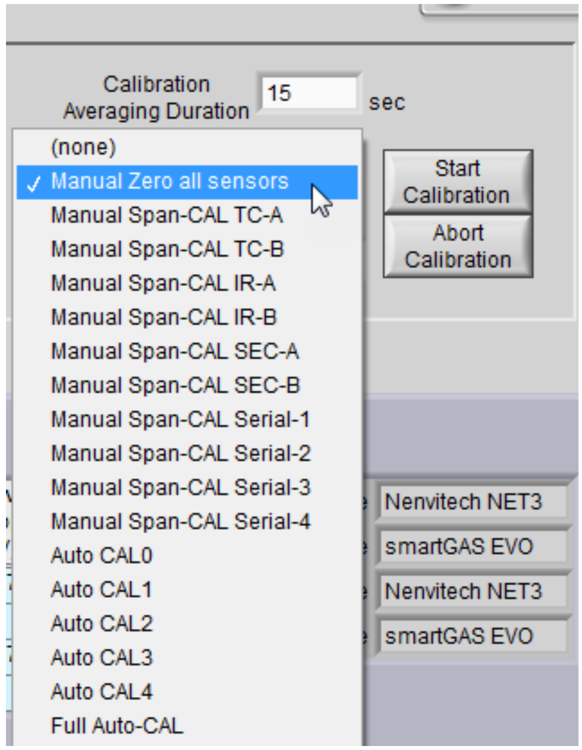
The button changes to read "Now Calibrating", and the "Time remaining" counts down to zero. Please note that it can take up to a minute for the calibration countdown to start (you'll see a message on screen to this effect).

- When the Zero Calibration completes, the Zero-Drift result will be updated on the screen.

- Let Span Gas flow through the analyzer and adjust the Span Gas regulator to:
 < 35 kPa gage @ 1 litre/min (<5 psig @ 2.0 scfh).

- Wait for the live reading to stabilize (the value should be close to the concentration in the Span gas).

- Perform a manual Span for the gas species being calibrated by selecting the species to be calibration from the Calibration Action menu and clicking "Start Calibration":



- The Span-Drift result will be updated on the screen.

Abort

You can abort a calibration by clicking “Abort Calibration”. The “Calibration in Progress” indicator will remain on the screen until the calibration has been aborted (this may take a few seconds).

Auto Calibration

The analyzer can also perform calibrations automatically if the Zero gas and Calibration gas supply valves are actuated by solenoids in the analyzer.

These solenoids are part of the optional Sample System module. For information about assigning the solenoids to auto calibration tasks, please refer to Sample System Panel – Solenoids on page 2-86.

The analyzer will introduce Zero Gas into the sample system by energizing the Zero Gas Solenoid, and wait for a configurable time for Zero gas to flow through the analyzer (the Sample return/flush delay on the Sample System – Auto CAL panel: see page 2-87).

The Zero Offset values are adjusted based on the average reading during the *Calibration Averaging Duration*.

The analyzer will introduce calibration gas into the sample system by energizing the corresponding solenoid, and wait the *Sample return/flush delay* for it to flow through the analyzer.

The span is automatically adjusted based on the average reading during the Calibration Averaging Duration.

Auto-CAL 0…4

Up to four species can be calibrated automatically. Auto-CAL 0 is reserved for Zero Gas calibration.

Full Auto Calibration

In *Full Auto Calibration*, the analyzer will automatically cycle sequentially through all of the Auto-CAL functions.

The zero offsets and calibrations will be adjusted automatically.

Triggered Calibrations

If the optional Customer I/O board has been installed, dry contact inputs can trigger auto-CAL functions. Please refer to page 2-67 for more information (Customer I/O Panel – Contact Inputs).

SEN993x – TC Sensor Calibration

TC Sensor Calibration

	Span Gas Concentration	Span Factor	Pressure @ Zero Cal	Zero Cal Target (mV)	Zero Cal Max Delta (mV)	Signal @ Zero Cal (mV)	Raw Signal (mV)	Current Reading
CO	1.5	12.34	50.0 kPa	51.2	3.2	238.3	280.8	5642.307
CO2	8	13.13	50.0 kPa	102.4	1.6	281.5	332.1	337.803

Span Gas Concentration — Enter the concentration of each species in the calibration gas.

Span Factor — At the end of a calibration, the analyzer calculates a new Span Factor. However, it is possible to override the calculated Span Factor. If you enter your own Span Factor, no validation is performed on the new Span Factor.

Please note that if the calculated span factor is not reasonably close to 1.0 (typically between 0.85 and 1.15), it is likely that either the old calibration or the new calibration is invalid.

Pressure @ Zero-Cal — *Pressure @ Zero-Cal* is factory assigned, unless a sample gas sensor that measures pressure has been installed, in which case it is updated by the analyzer following a Zero Calibration. The zero gas signal at the time of calibration is also recorded.

Zero Cal Target (mV) — The Zero Cal signal target is the desired signal from the sensor with zero gas flowing through the system.

Zero Cal Max Delta (mV) — If the Zero Drift Result is greater than the Zero Cal Max Delta at the end of a zero calibration, the calibration is considered to have excessive drift, and is discarded by the analyzer.

Signal @ Zero Cal (mV) — At the end of Zero calibration, the analyzer records the raw sensor signal.

Raw signal (mV) — The raw signal from the thermal conductivity sensor is continuously displayed.

Current Reading — The current calculated concentration of the gas species shown in the row header.

SEN993x – IR Sensor Calibration

IR Sensor Calibration

	Span Gas Concentration	Span Factor	Signal Offset (mV)	Reference sig @ Zero Cal	Differential sig @ Zero Cal	Zero Cal Target (mV)	Zero Cal Max Delta (mV)	Reference Signal (mV)	Differential Signal (mV)
CO2	12	1.111	25	1006.2	54.2	100	2.5	1046.3	101.9
Acetl	5	0.987	25	200.5	8.5	100	1.5	230.8	18.8

Span Gas Concentration	Enter the concentration of each species in the calibration gas.
Span Factor	At the end of a calibration, the analyzer calculates a new Span Factor. However, it is possible to override the calculated Span Factor. If you enter your own Span Factor, no validation is performed on the new Span Factor. Please note that if the calculated span factor is not reasonably close to 1.0 (typically between 0.85 and 1.15), it is likely that either the old calibration or the new calibration is invalid.
Signal Offset (mV)	The signal offset can range from zero to 2,500 mV.
Pressure sig @ Zero Cal	Updated by the analyzer at the end of a zero calibration
Differential sig @ Zero Cal	Updated by the analyzer at the end of a zero calibration.
Zero Cal Target (mV)	The Zero Cal signal target is the desired signal from the sensor with zero gas flowing through the system.
Zero Cal Max Delta (mV)	If the Zero Drift Result is greater than the Zero Cal Max Delta at the end of a zero calibration, the calibration is considered to have excessive drift, and is discarded by the analyzer.
Reference signal (mV)	The reference signal is the voltage at the detector for the signal path that does not pass through the gas being measured.
Differential signal (mV)	The difference between the voltage measured at the detector for the reference signal, and the voltage at the detector for the signal that passes through the gas under test.

SEN993x – SEC Sensor Calibration

SEC Sensor Calibration

	Span Gas Concentration	Span Factor	Pressure @ Factory Cal	Low Scale	High Scale	Signal @ Zero Cal	Raw Signal (mV)	Current Reading
H2S	5000	1.0101	100.95 kPa	0	5	7.7	48.8	314.000
Cl	5000	0.96960	101.325 kPa	0	5	6.1	40.9	314.000

The SE Sensor Electronics SEC 3000 is typically used to detect H2S.

Span Gas Concentration — Enter the concentration of each species in the calibration gas.

Span Factor — At the end of a calibration, the analyzer calculates a new Span Factor. However, it is possible to override the calculated Span Factor. If you enter your own Span Factor, no validation is performed on the new Span Factor.

Please note that if the calculated span factor is not reasonably close to 1.0 (typically between 0.85 and 1.15), it is likely that either the old calibration or the new calibration is invalid.

Pressure @ Factory Cal — This value is set at the Ametek factory, but can be changed using the analyzer front panel.

Pressure sig @ Zero Cal — Updated by the analyzer at the end of a zero calibration

Low Scale — Low scale, in engineering units.

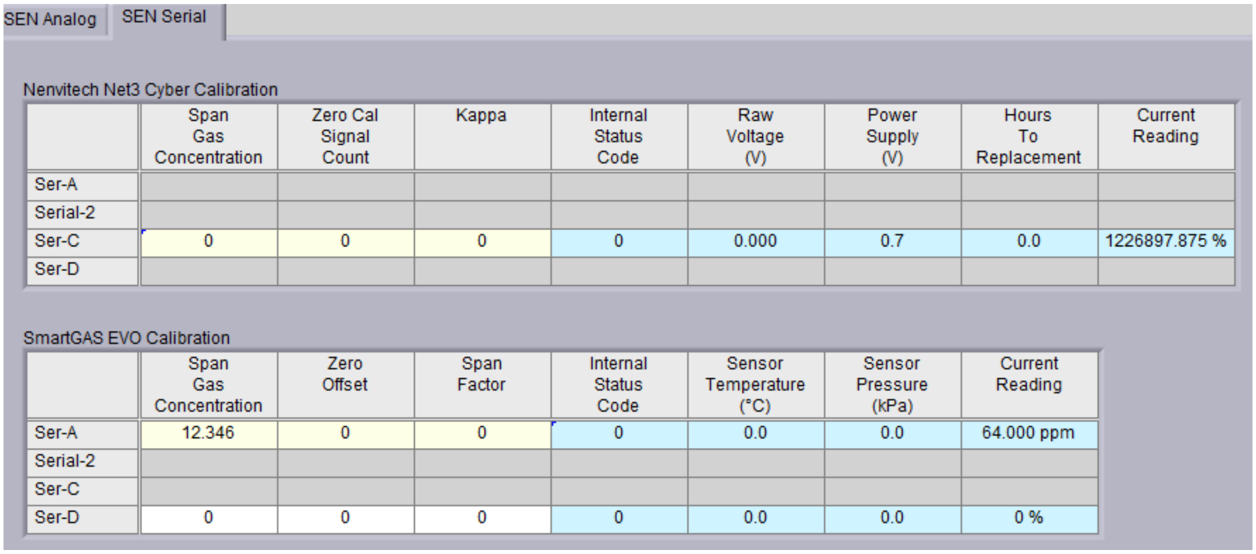
High Scale — High scale, in engineering units.

Signal @ Zero Cal (mV) — At the end of Zero calibration, the analyzer records the raw sensor signal.

Raw signal (mV) — The current raw signal from the SE sensor.

Current Reading — The current calculated concentration of this gas species.

SEN99xx Serial Sensor Calibration


SEN Analog | SEN Serial

Nenvitech Net3 Cyber Calibration

	Span Gas Concentration	Zero Cal Signal Count	Kappa	Internal Status Code	Raw Voltage (V)	Power Supply (V)	Hours To Replacement	Current Reading
Ser-A								
Serial-2								
Ser-C	0	0	0	0	0.000	0.7	0.0	1226897.875 %
Ser-D								

SmartGAS EVO Calibration

	Span Gas Concentration	Zero Offset	Span Factor	Internal Status Code	Sensor Temperature (°C)	Sensor Pressure (kPa)	Current Reading
Ser-A	12.346	0	0	0	0.0	0.0	64.000 ppm
Serial-2							
Ser-C							
Ser-D	0	0	0	0	0.0	0.0	0 %

Up to four sensors can be attached to the SEN serial port if is configured in RS-485 mode. Only one sensor (on serial port 4) can be attached if the port is in RS-232 mode.

This panel lets you calibrate Nenvitech Net3 Cyber sensors, or SmartGAS EVO sensors.

There is a table for each sensor type, which only shows rows for that sensor (any other rows are greyed out).

NenviTech Net3 Cyber Calibration

Span Gas Concentration	Enter the concentration of each species in the calibration gas, in the concentration units that you are using for that species.
Zero Cal Signal Count	At the end of Zero calibration, the analyzer records the raw signal value from the Nenvitech sensor.
Kappa	Kappa is a scaling factor, and is stored on the Nenvitech sensor.
Internal Status Code	The Net3 Cyber sensor reports an internal status code.
Raw Voltage (V)	The real-time voltage reported by the sensor (transmitted serially to the analyzer).
Power Supply (V)	The real-time voltage reported by the Nenvitech sensor (transmitted serially to the analyzer).

SmartGas EVO Calibration

Span Gas Concentration	Enter the concentration of each species in the calibration gas, in the concentration units that you are using for that species.
Zero Offset	

The EVO sensor stores a raw signal value at the end of Zero calibration, and this value is updated. You can change it, but no validation will be performed on your changes.

Span Factor

At the end of a calibration, the analyzer calculates a new Span Factor. It is possible to override the calculated Span Factor, but if you enter your own Span Factor, no validation is performed on the new Span Factor.

Please note that if the calculated span factor is not reasonably close to 1.0 (typically between 0.85 and 1.15), it is likely that either the old calibration or the new calibration is invalid.

Internal Status Code

The EVO SmartGas sensor internal status code can be interpreted as a 16 bit status code, where the meaning of each bit is:

0 test
1 Warmup
2 Syserr
3 Alarm
4 Warning
5 Startup
6 Corr (normally on)
7 MW_OK (normally on)
8 Inc
9 Ex
10 Tox
11 MW active
12 EEP error
13 WDG Warn
14 Power On (normally on)
15 Reserved

The individual bits can be viewed on the analyzer front panel:

Diagnostic … Sensors … EVO Sensor Diagnostic Readings … Status Code Screen

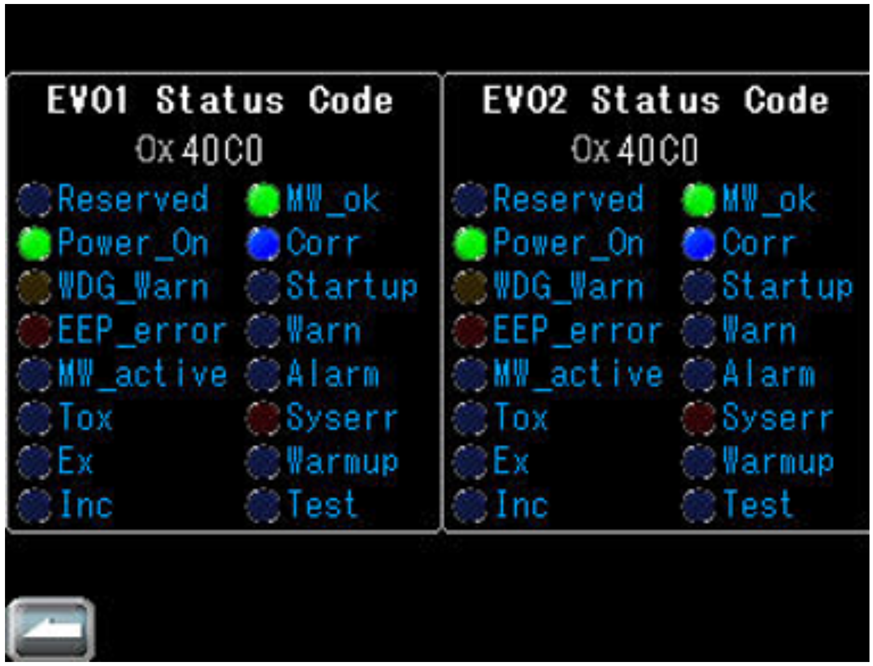


Figure 37 – EVO SmartGas status codes, shown on the analyzer's front panel

Informational LEDs are blue. If the WDG Warn, EEP Error, or Syserr bits are set, the sensor should be replaced.

Sensor Temperature (C) The self-reported EVO Smartgas temperature.

Sensor Pressure The self-reported EVO Smartgas gas pressure.

UV Bench Setup Panel

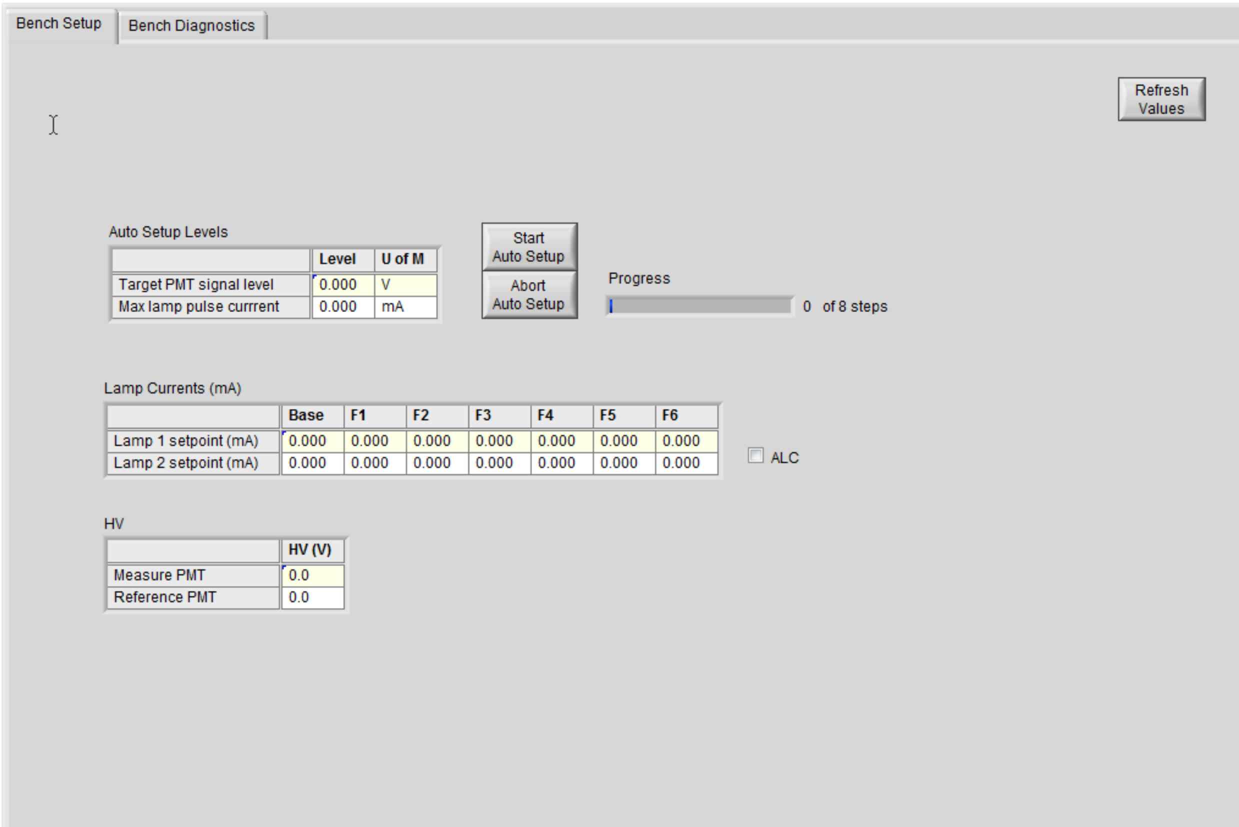
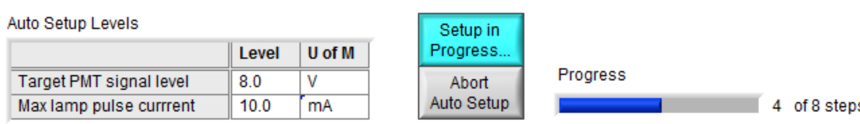


Figure 38 – Bench Setup panel

Auto Setup



Start Auto Setup

Auto Setup optimizes the PMT gains and source lamp currents, and takes approximately three minutes. Always perform an Auto-Setup after any lamps, optical filters, or PMTs have been installed or replaced.

When you click *Start Auto Setup,* the button changes to read *Setup in Progress…* and the Progress bar is updated as the auto setup progresses.

Abort Auto Setup

It can take a few seconds to abort the setup sequence if you choose to click *Abort Auto Setup.*

Auto Setup Levels

Target PMT Signal is the maximum PMT signal level (volts) that will be used during Auto Setup (0..10 V).

Max Lamp Pulse is the maximum pulse current that will be applied to the key filter during Auto setup (0..14 mA).

AMETEK recommends leaving Auto Setup Levels at the factory defaults.

REVIEW DRAFT

Lamp Currents

Lamp Currents (mA)

	Base	F1	F2	F3	F4	F5	F6
Lamp 1 setpoint (mA)	2000	5500	6000	10000	8500	7500	9000
Lamp 2 setpoint (mA)	2000	5500	6000	9500	8500	7200	9200

☑ ALC

Base (mA)

The base-current set point (the minimum operating current) for each source lamp. This is the "simmer" current when the lamp is not being pulsed. Ametek does not recommend changing it.

Lamp 1 is closest to the Measuring Cell
Lamp 2 is farthest from the Measuring Cell

Lamp Setpoint (mA)

Defines the source lamp pulse current control signal for each filter. The normal operating range is between the Lamp Base and the Lamp Max settings. The control signal for the key filter is Lamp Max.

The Automatic Lamp Control Setpoint signal is automatically calculated from the Reference PMT for each filter when Auto-Setup completes. The Automatic Lamp Control function adjusts the lamp pulses to maintain the Reference PMT signals.

The filter with the highest current level is the *weakest wavelength* for each lamp. This is the filter position that you should choose when aligning a new UV lamp.

If a filter position is not being used, the auto-setup procedure will set the current at that filter position to the Base current.

ALC

Automatic Lamp Control automatically turns on at the completion of an Auto-Setup function, and should be on during normal operation. It should only be turned off while performing a lamp alignment.

High Voltage

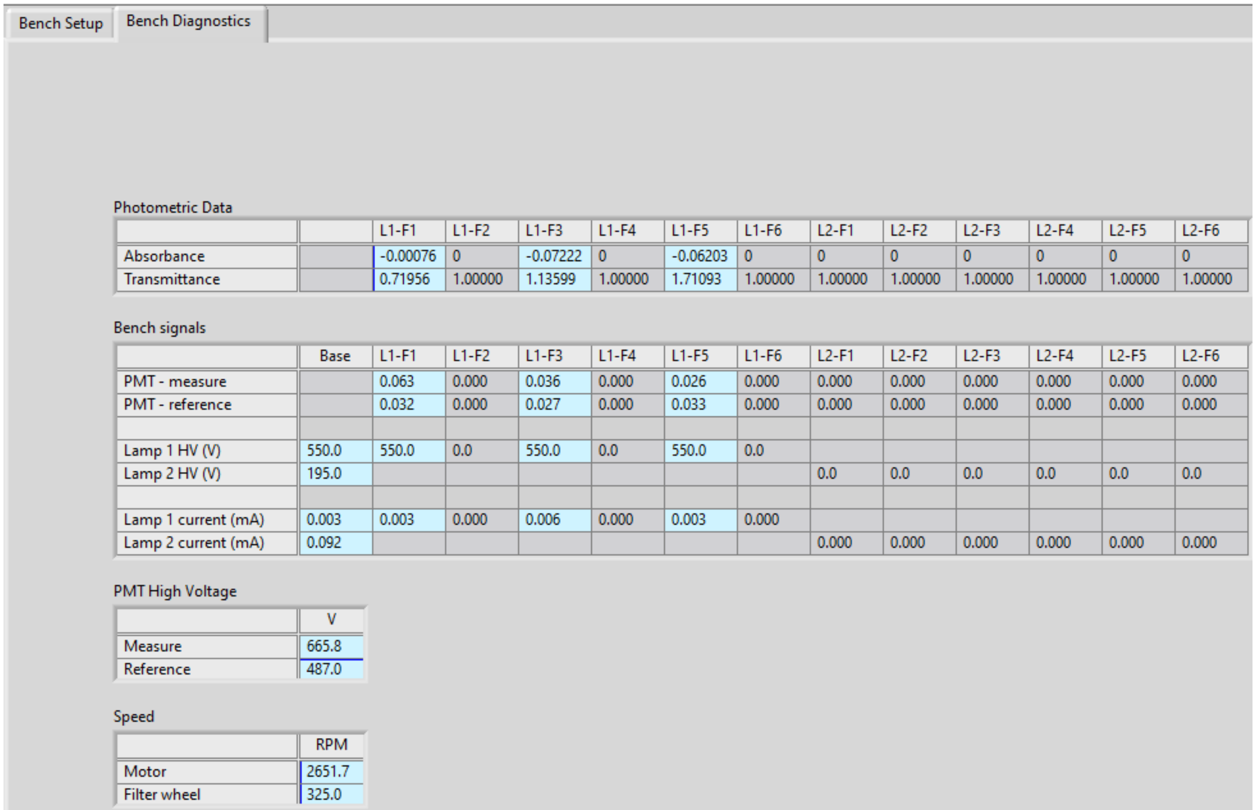
HV

	HV (V)
Measure PMT	550
Reference PMT	750

The high voltage range is 300…800V for each lamp, and can be measured at test points HV1 and HV2 on the PMT Supply board.

After an auto setup completes, Ametek recommends recording the values on this panel for diagnostic purposes.

UV Bench Diagnostics Panel



Photometric Data

		L1-F1	L1-F2	L1-F3	L1-F4	L1-F5	L1-F6	L2-F1	L2-F2	L2-F3	L2-F4	L2-F5	L2-F6
Absorbance		-0.00076	0	-0.07222	0	-0.06203	0	0	0	0	0	0	0
Transmittance		0.71956	1.00000	1.13599	1.00000	1.71093	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

Bench signals

	Base	L1-F1	L1-F2	L1-F3	L1-F4	L1-F5	L1-F6	L2-F1	L2-F2	L2-F3	L2-F4	L2-F5	L2-F6
PMT - measure		0.063	0.000	0.036	0.000	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PMT - reference		0.032	0.000	0.027	0.000	0.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lamp 1 HV (V)	550.0	550.0	0.0	550.0	0.0	550.0	0.0						
Lamp 2 HV (V)	195.0							0.0	0.0	0.0	0.0	0.0	0.0
Lamp 1 current (mA)	0.003	0.003	0.000	0.006	0.000	0.003	0.000						
Lamp 2 current (mA)	0.092							0.000	0.000	0.000	0.000	0.000	0.000

PMT High Voltage

	V
Measure	665.8
Reference	487.0

Speed

	RPM
Motor	2651.7
Filter wheel	325.0

Figure 39 – The Bench Diagnostics panel for a multi-species analyzer

The *Bench Diagnostics Panel* lets you compare photometric results with the lamp control parameters and PMT signal levels at each filter position. It is particularly useful when performing diagnostics on the analyzer. Information in this panel is read-only.

Photometric Data

Absorbance and transmittance values are shown for each filter position.

$$Transmittance \quad T_p = \left(\frac{Measure\ PMT}{Reference\ PMT}\right)$$

$$Absorbance = -log\left(\frac{T_p}{T_z}\right)$$

where:

T_p is the transmittance with process gas @ $lamp + filter$

T_z is the transmittance with zero gas @ $lamp + filter$

Bench Diagnostics

The Measure and Reference PMT voltage at each Filter position can also be measured at test points TP3 and TP5 on the PMT signal board.

The Lamp excitation pulse voltages and currents are shown at each filter position.

HV

The voltages at the PMT supply board are displayed (they can also be read at test points HV1 and HV2, and should be in the range 300…800V).

RPM

Applicable to motorized (multi-species) analyzers only.

UV99xx Standard Analysis Panel

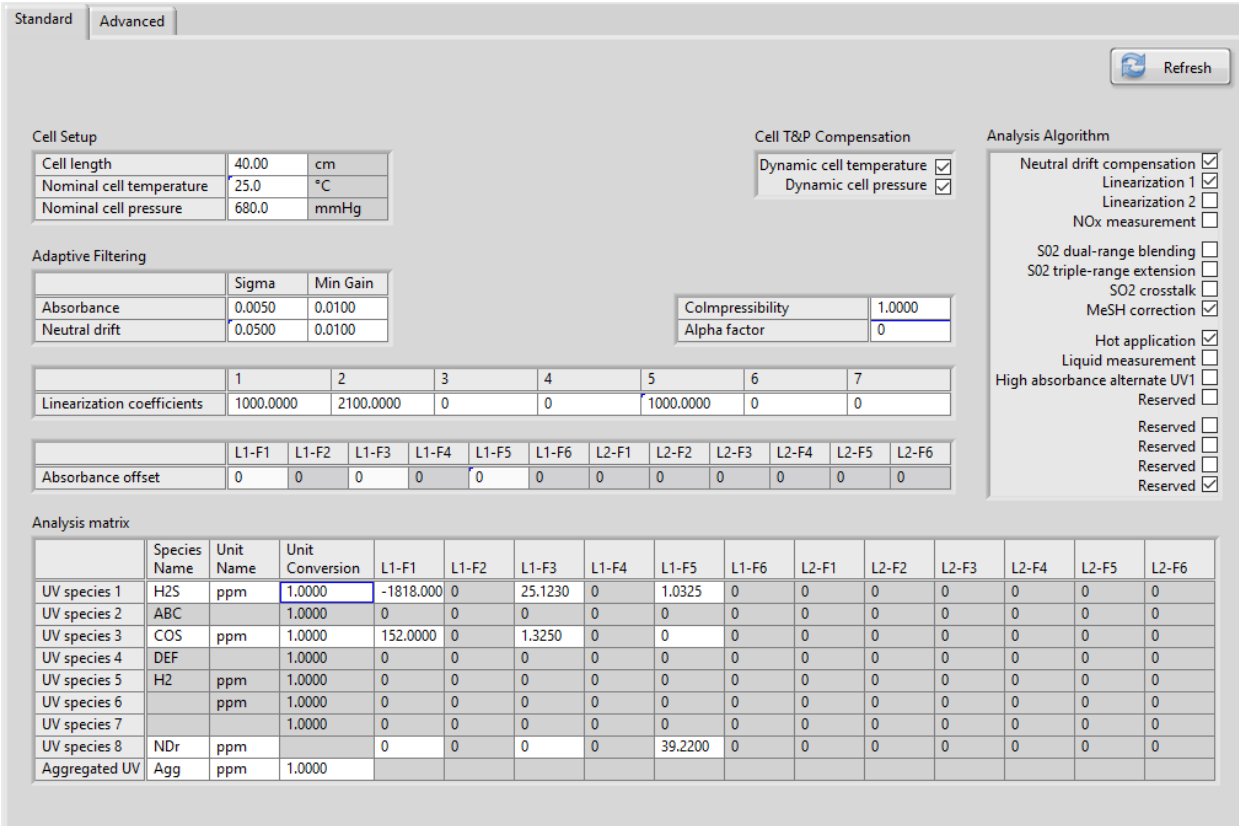
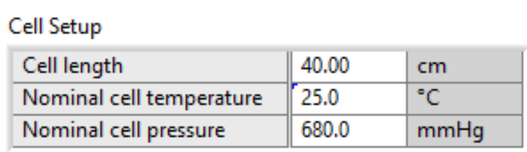


Figure 40 – Analysis Setup

The Analysis panel lets you configure the concentration analysis process.

Measurement Cell



You can specify the cell length (on the transmittance axis) and nominal operating conditions (ie: the values that are used if a sensor has not been installed).

Your preferred unit of measure is used for pressures.

Cell T&P Compensation

The measurement cell can be compensated for the measured pressure and temperature if pressure and temperature transducers have been installed. Leave them unchecked to use the nominal values described in the previous section.

Cell temperature compensation:

☐ static or pseudo-dynamic via Modbus master update

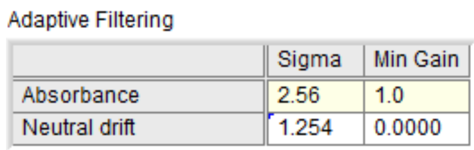
☑ dynamic using the cell temperature measurement

Cell pressure compensation:

☐ static or pseudo-dynamic via Modbus master update

☑ dynamic using the cell pressure measurement

Adaptive Filtering



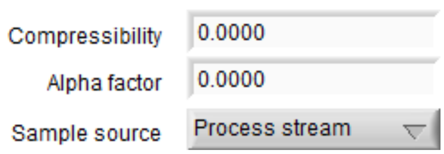
Adaptive Filtering

	Sigma	Min Gain
Absorbance	2.56	1.0
Neutral drift	1.254	0.0000

You can apply an adaptive filter to absorbance and neutral drift.

These values should not be changed unless advised by Ametek.

Correction Factors



The super compressibility factor, usually notated Z, is a function of the composition of the sample gas, and gas pressure (notated Z_b at contract base conditions, and Z_f at flowing conditions). It is normally calculated from a molar analysis using an equation of state calculation such AGA-8, AGA-10 or SGERG. If it is unknown, enter 1.0 to simply use ideal gas law. The analyzer does not perform an equation of state calculation.

$$Concentration_{corrected} = {Concentration}/{Z}$$

The analyzer automatically calculates the Dual-range SO2 blending alpha correction factor when the SO2 crosstalk procedure is performed.

Do not change it unless advised to by Ametek.

The Sample source can be set to either of:
- Process stream
- non Process stream

Analysis Algorithm

- [x] Neutral drift compensation
- [x] Linearization 1
- [ ] Linearization 2
- [ ] NOx measurement
- [ ] S02 dual-range blending
- [ ] S02 triple-range extension
- [ ] SO2 crosstalk
- [x] MeSH correction
- [x] Hot application
- [ ] Liquid measurement
- [ ] High absorbance alternate UV1
- [ ] Reserved
- [ ] Reserved
- [ ] Reserved
- [ ] Reserved
- [x] Reserved

The Analysis algorithm can include a variety of optional calculations:

Neutral drift compensation

NOx measurement requires a motorized filter wheel

SO2 dual-range blending requires a motorized filter wheel

SO2 extended range requires a motorized filter wheel

SO2 crosstalk correction requires a motorized filter wheel

MeSH (methyl mercaptan) correction requires the analyzer to be configured to measure MeSH

The High absorbance alternate UV1 algorithm is configured in the *Advanced* tab.

Hot application enables the analyzer to perform additional calculations in a hot wet gas sample, and requires an optional oven to be installed

Liquid application is for liquid samples

Ametek cautions that the Analysis Algorithm should only be modified by service personnel.

Absorbance Offsets

Every lamp + filter position can be assigned a linear offset.

	L1-F1	L1-F2	L1-F3	L1-F4	L1-F5
Absorbance offset	0.00000	0.00000	0.00000	0.00000	0.000(

These values should not be changed unless advised by Ametek.

Linearization Coefficients

There are seven coefficients that can be used for either linearization or interference polynomial compensation.

	1	2	3	4	5	6	7
Linearization coefficients	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

They are used if the analysis algorithm includes Linearization-1 or Linearization-2.

These values should not be changed unless advised by Ametek.

Analysis Matrix

One of the challenges of UV-absorbance spectroscopy is that a species that absorbs UV light will generally do so at multiple wavelengths. This means that multiple UV-absorbent species may affect UV absorption within the wavelength range of an analyzer filter.

The Analysis Matrix is responsible for partially calculating the concentration output and negating the effects of cross-talk by interfering gas species.

If the row for a species is contains only zeros, that species will be flagged as not valid, and will not be displayed in pop-up menus. It cannot be acquired or logged. To enable a species, simply enter matrix coefficients in the row for that species.

Similarly, a lamp & filter combination will be flagged as invalid if all entries in the column are zero. To enable a lamp & filter combination, enter matrix coefficients in the appropriate column.

Only two rows can be used for non-motorized analyzers, as only L1-F2 and L2-F6 are available.

Analysis matrix

	Species Name	Unit Name	Unit Conversion	L1-F1	L1-F2	L1-F3	L1-F4	L1-F5	L1-F6	L2-F1	L2-F2	L2-F3	L2-F4	L2-F5	L2-F6
UV species 1	H2S	ppm	1.0000	-18.2000		22.6300		0							
UV species 2															
UV species 3	COS	ppm	1.0000	151.5200		0		0							
UV species 4															
UV species 5															
UV species 6															
UV species 7															
UV species 8	NDr	ppm		0		0		39.2200							
Aggregated UV	Legion	Many	1.0000												

Figure 41 – The Analysis Matrix

For each species, you set the name of the species and the unit of measure here. The matrix coefficients are normally calculated by Ametek to produce concentration results in ppm. To change the concentration unit of measure to % or other unit of measure such as $\frac{mg}{m^3}$, an appropriate unit conversion factor can be supplied.

The unit conversion factors are normally set at the factory to scale concentrations to the customer's desired units of measure.

Please consult Ametek if a different unit of measure is required.

Dual-range naming convention

By convention, if the analyzer is configured to have both a high range and a low range calibration for a species, the species name for the low range is in lower case letters (eg: so2) and the high range is in upper case (eg: SO2).

UV99xx Advanced Analysis Panel

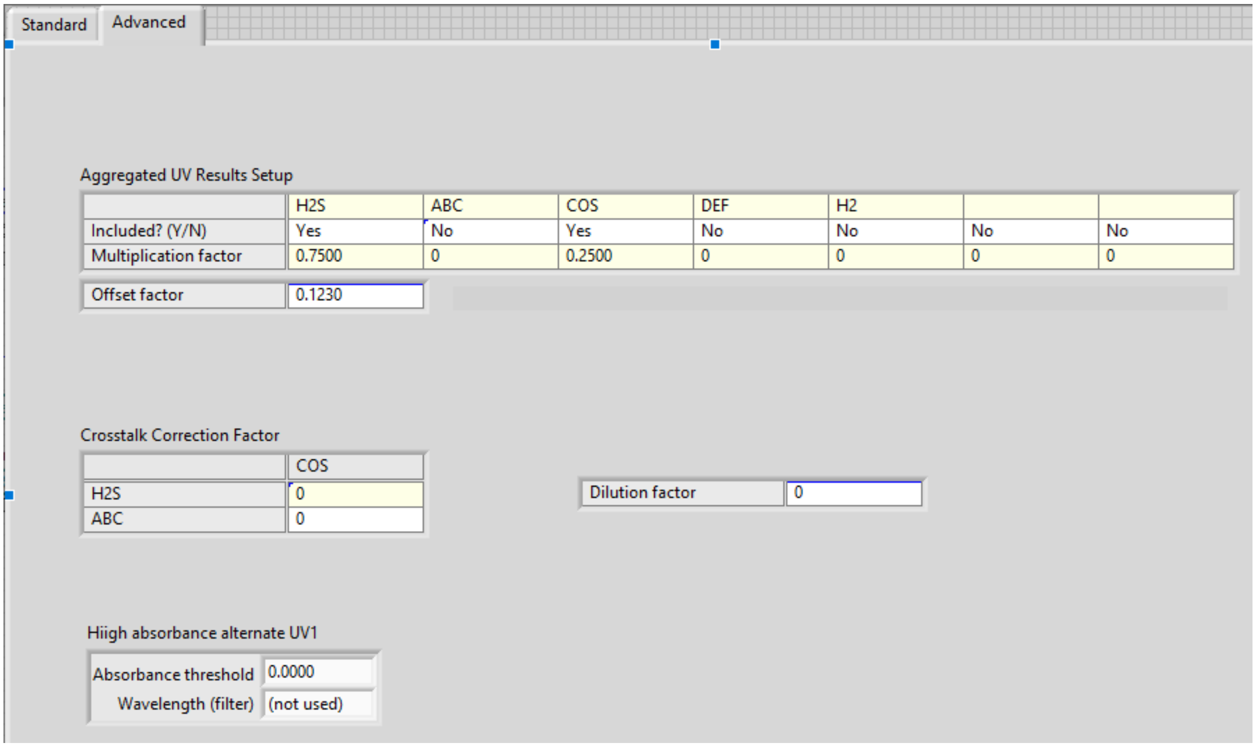


Figure 42 – The Advanced Analysis panel

A few more aspects of the species analysis can be configured in the Advanced tab of the Analysis panel.

Aggregated UV Results Setup

The aggregated UV concentration is the sum of each of the individual gas species concentrations times the aggregation factor for that species:

$$Aggregated\ UV\ Result = \left(\sum_{i=1}^{7}(C_iF_i)\right) + Offset\ factor$$

where:

C_i is the concentration result for UV species i

F_i is the multiplication factor for UV species i in Figure 43

To include or exclude a species, press the "y" or "n" key to indicate "Yes" or "No", or press the spacebar to toggle between them.

If NOx analysis is selected in the Analysis Algorithm, the aggregated UV species is NOx, which is the sum of Species 2 (NOx) and Species 3 (NO) concentrations, and this control is disabled.

Aggregated UV Results Setup

	H2S	SO2	SO	UV-4	UV-5	UV-6	UV-7
Included? (Y/N)	No	No	No	No	No	No	No
Multiplication factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Offset factor	0.0000

Figure 43 – Aggregated UV analysis setup

Crosstalk Correction Factor

The Crosstalk Correction Factors are used to correct the cross interference of UV Species 3 onto UV Species 1 and UV Species 2.

They are typically used when MeSH is assigned as UV Species 3 and the MeSH correction algorithm is enabled.

Crosstalk Correction Factor

	SO
H2S	0.0000
SO2	0.0000

Dilution Factor

In CEM applications with very high concentration, a dilution probe might be used to dilute the sample gas flowing into the analyzer. Each dilution probe has a Dilution Factor. This control is only visible if sampling columns have been installed.

Dilution factor	0.0000

Customer I/O Board

Both the UV99xx and the SEN99xx can be configured with an optional Customer I/O board that lets you perform a variety of useful functions:

Analog Outputs	let you assign up to four voltage or current loop outputs to a variety of signals.
Contact Inputs	let you assign actions to each of four contact closure inputs.
Relays	let you generate a relay contact closure in response to a variety of internal conditions.
Process Alarms	cause the analyzer to monitor up to four signals, and generate alarms if they exceed configurable limits.
SEN Process Alarms	cause the SEN system to monitor up to four signals, and generate alarms if they exceed configurable limits. Appears with the UV Bench Customer I/O board, except for SEN-only configurations, and configurations with two Customer I/O boards.

These functions all operate even if the Configurator is not connected to the analyzer.

If an analyzer contains both a UV Bench and a SEN system, each of them can have its own Customer I/O board.

In this configuration, you can configure each Customer I/O board separately. The Customer I/O board connected to the UV Bench can see signals that originate on the UV Bench board, plus up to four signals from the SEN board. The SEN board can only see signals that originate on the SEN board.

Even if there is only one Customer I/O board attached to the UV Bench, up to four signals from the SEN board can be monitored and used for analog output and process alarms.

Customer I/O Panel – Analog Outputs

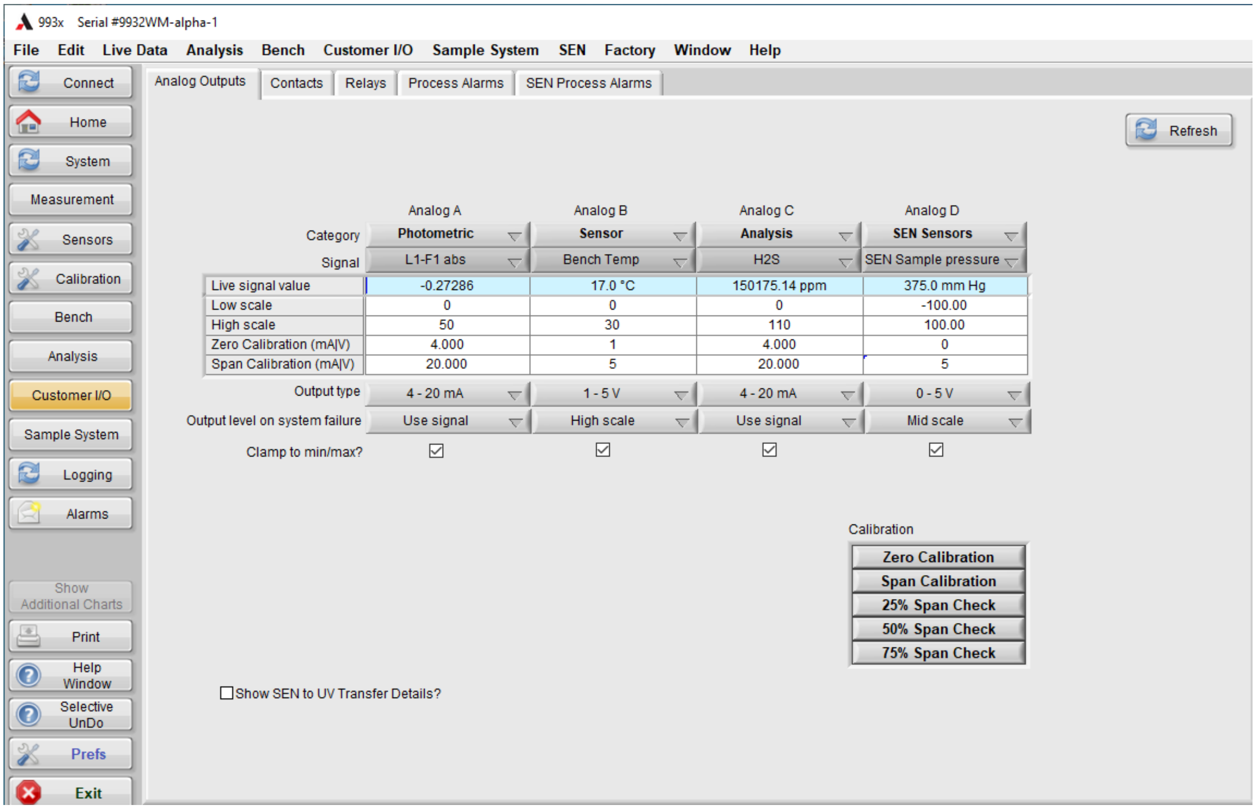
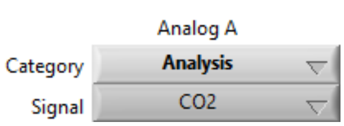


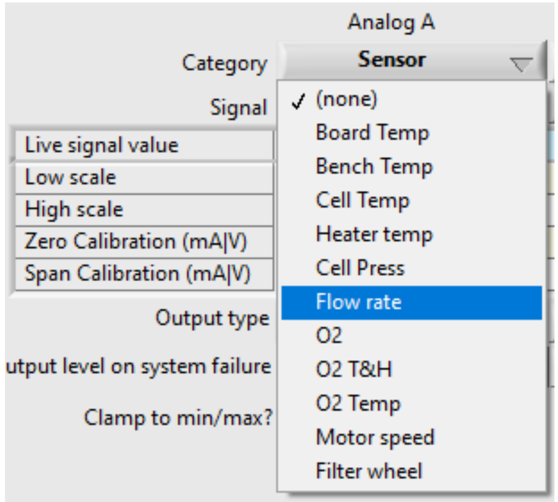
Figure 44 – The Customer I/O panel – Analog Outputs

Ametek 99xx analyzers can be configured with an optional Customer Input / Output system, which allows up to four analog output channels to be configured.

Sample System signals are only available if the optional Sample System Interface board is installed. SEN signals are only available if the optional SEN board has been installed.



The pop-up menus at the top of the panel let you select from a large number of signals. The specific signals that are available depends on how you have configured the analyzer, but generally includes the measured gas concentrations, lamp PMT values, sensor readings, track & hold readings, and sample system temperatures:



Scaling

You can (and should) map the signal of interest into the voltage or current range of the output channel.

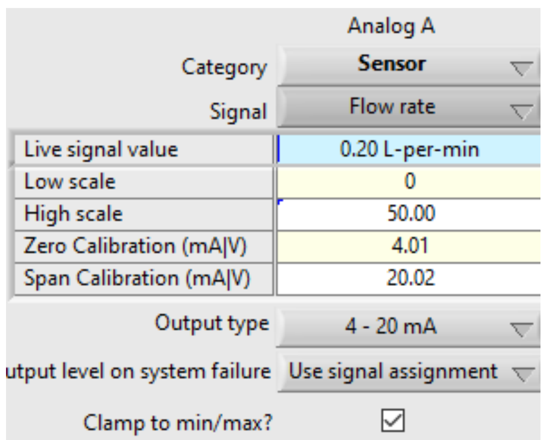
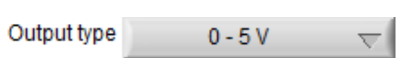


Figure 45 – Scaling an analog output signal

Here, the measured gas flow rate will be mapped to a current loop range. The range of 0..50 litres/minute will be scaled to fill the 4..20 mA range of the output channel. Values outside that range will be clamped to the specified output range if *Clamp to min/max?* is checked.

Output Type



You can set the analog output signal type to any of:

- 0..5 V
- 1..5 V
- 0..20 mA
- 4..20 mA

If changing a channel's output setting from voltage to current, or current to voltage, the corresponding dip switch on the Customer I/O board must first be changed to the required setting, followed by changing the Output Type on the screen. Refer to the ***Customer I/O*** *board drawing in the analyzer User Manual.*

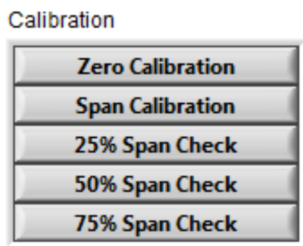
If the output Type is changed, the channel must be re-calibrated.

The 4–20 mA outputs are electrically isolated.

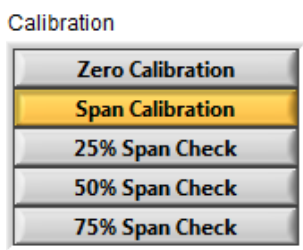
The low end of each analog output range can be non-zero.

Calibrating Analog Outputs

To obtain the best accuracy from the analog output signals, you can check the linearity of each channel.



Click any of the Calibration buttons to generate a calibration signal:



Read the actual voltage or current level at the analog output terminal for the Zero Calibration and Span Calibration, and enter those values in the Zero Calibration (V|mA) and Span Calibration (V|mA) rows.

The 25%, 50%, and 75% span check readings are not recorded in the analyzer, but can be used to manually confirm linearity of the output channel using a voltage or current meter.

Click the selected Calibration button again to deselect it and return the analog output system to normal operation.

If a calibration has been initiated from the analyzer's front panel, the appropriate button will be illuminated here (but the Calibration LED at the bottom of the main window is not).

	Analog A	Analog B	Analog C	Analog D
Category	**Sensor**	**Analysis**	**SEN Analysis**	**SEN Sensors**
Signal	Flow rate	H2S	CO	SEN Sample pressure
Live signal value	0.20 L-per-min	149446.31 ppm	14975.113 %	375.1 mm Hg
Low scale	0	0	0	0
High scale	50.00	250	10	800
Zero Calibration (mA|V)	4.01	1.000	4.000	0.000
Span Calibration (mA|V)	20.02	5.000	20.000	5.000
Output type	4 - 20 mA	1 - 5 V	4 - 20 mA	0 - 5 V
Output level on system failure	Use signal assignment	High scale	Use signal assignment	Mid scale
Clamp to min/max?	☑	☑	☑	☑

Figure 46 – Calibrating analog outputs

High Scale

The value, in engineering units, that should correspond with the maximum output of the channel (nominally 20 mA for current loops, and 5 V for voltage outputs).

Zero Calibration (V|mA)

The actual (measured) voltage or current when the output is set to zero scale during the Zero calibration procedure.

To measure current, it may be necessary to add a precision sampling resistor across the current loop, and measure the voltage drop across the sampling resistor. In this case, the current in mA is:

$$I = \frac{V}{R}$$

where:

I is the current in amps
V is the voltage drop across the sampling resistor
R is the sampling resistor value in ohms

Span Calibration V|mA)

The actual (measured) voltage or current (mA) when the output is set to full-scale during the Span calibration procedure.

Assigned data reading

Displays the current value of the signals, in engineering units.

For example, if the Channel 1 signal is the SO2 concentration in PPM, and the maximum expected SO2 concentration is 1000 PPM, you would set the Full-Scale value for channel 1 to 1000. This means that when the SO2 concentration is 1000 PPM, the current will nominally be 20 mA, and when the SO2 concentration is 0 PPM, the current will nominally be 4 mA.

The next step is to measure the actual current produced at the nominal current levels of 4 mA and 20 mA (which you generate by clicking the appropriate button). The values you measured with a current meter go into the Zero Calibration (mA) and Span Calibration (mA) lines.

99xx Integrated Models

If a 99xx analyzer has been configured with both a UV Bench and a SEN board, you can also choose SEN analysis or sensor signals, in the same way that you select signals from the UV Bench.

However, there are some limitations: only four signals can be transferred from the SEN board to the UV board, but the Analog Output and Process Alarm functions can both use SEN signals. So it's possible to run out of SEN signals.

The Configurator will automatically select one of the four channels that transfer signals from the SEN board to the UV board, but you can also control the signal assignments yourself by checking *Show SEN to UV Transfer Details:*

☒ Show SEN to UV Transfer Details?

A signal assignment matrix appears:

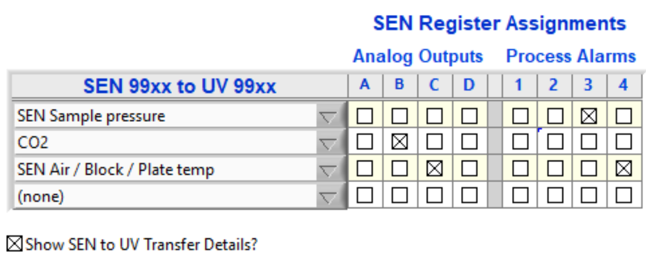


Figure 47 – SEN Signal Assignment Matrix

In the SEN Signal Assignment Matrix, each of the four SEN to UV data transfer channels is a row of the table. You can assign any SEN signal to that channel using the pop-up menus on the left. You can then set the checkboxes to assign that signal to any combination of analog output channels and process alarms. Your changes are reflected in the selection menus at the top of this panel and the Process Alarm panel.

If you do this in the "normal" way, by simply selecting SEN signals from the Category and Signal menus in the same way that you select

UV Bench signals, the SEN Signal Assignment Matrix is updated automatically.

If you try to assign a fifth SEN signal to either an analog output channel or a process alarm, a message lets you know that you've run out of SEN to UV channels.

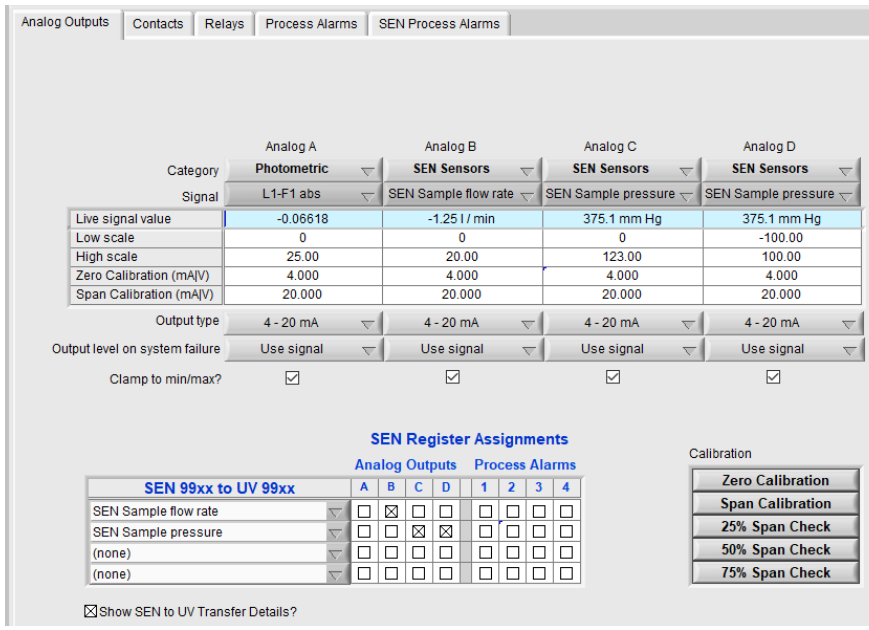


Figure 48 – Analog Output Panel with SEN Signal Assignment Matrix

Customer I/O Panel – Contact Inputs

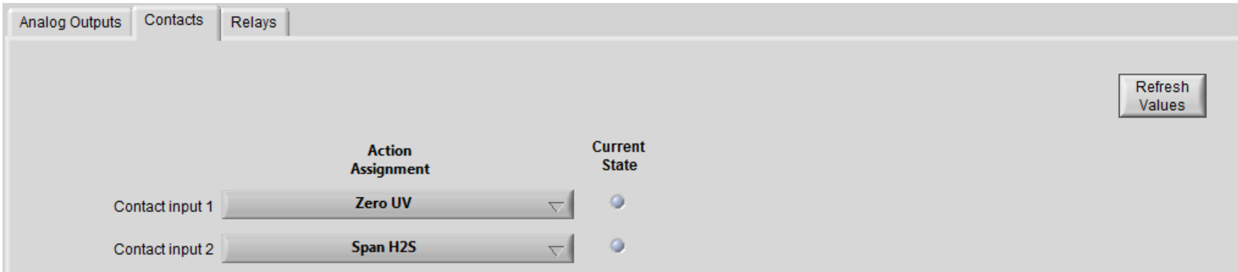


Figure 49 – Contact Inputs panel – Ametek 9900RM

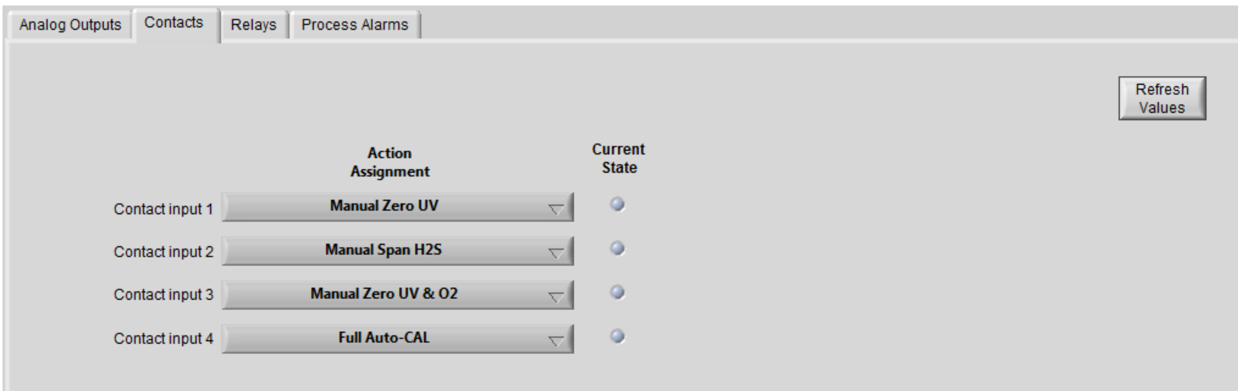


Figure 50 – Contact Inputs panel – Ametek 99xx

The optional Customer I/O module for the Ametek 99xx provides four dry-contact inputs. A number of actions can be assigned to each of them:

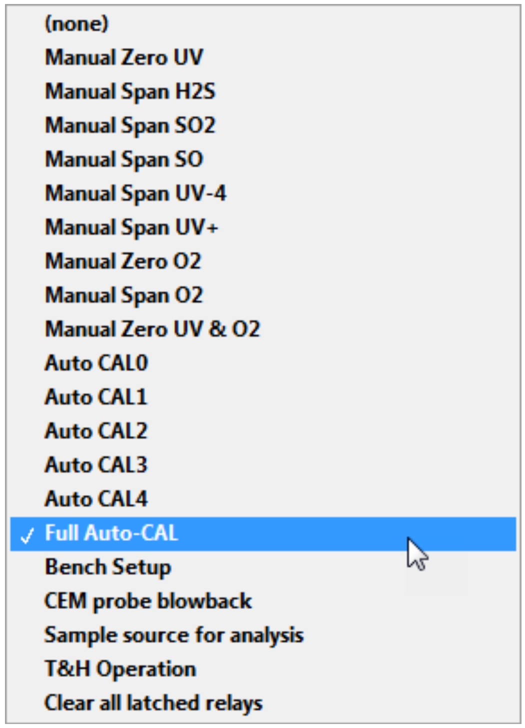


Figure 51 – Contact assignments with optional Customer I/O module

The *Current State* LEDs to the right of each pop-up menu are illuminated (in red) if the contact is currently closed.

Ametek 9900^{RM} and 9900^{WM} models only provide two contact inputs, which can trigger the following actions:

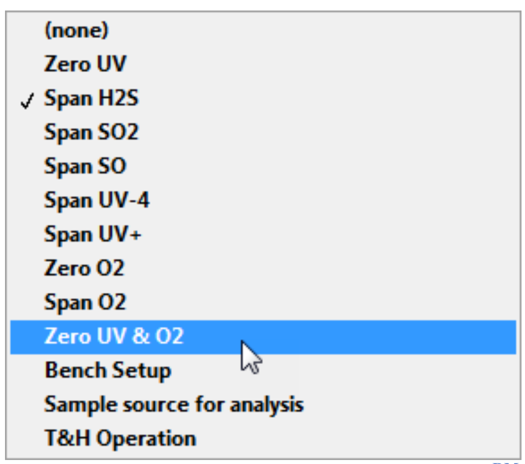


Figure 52 – Contact assignments - Ametek 9900^{RM}

Customer I/O Panel – Relays

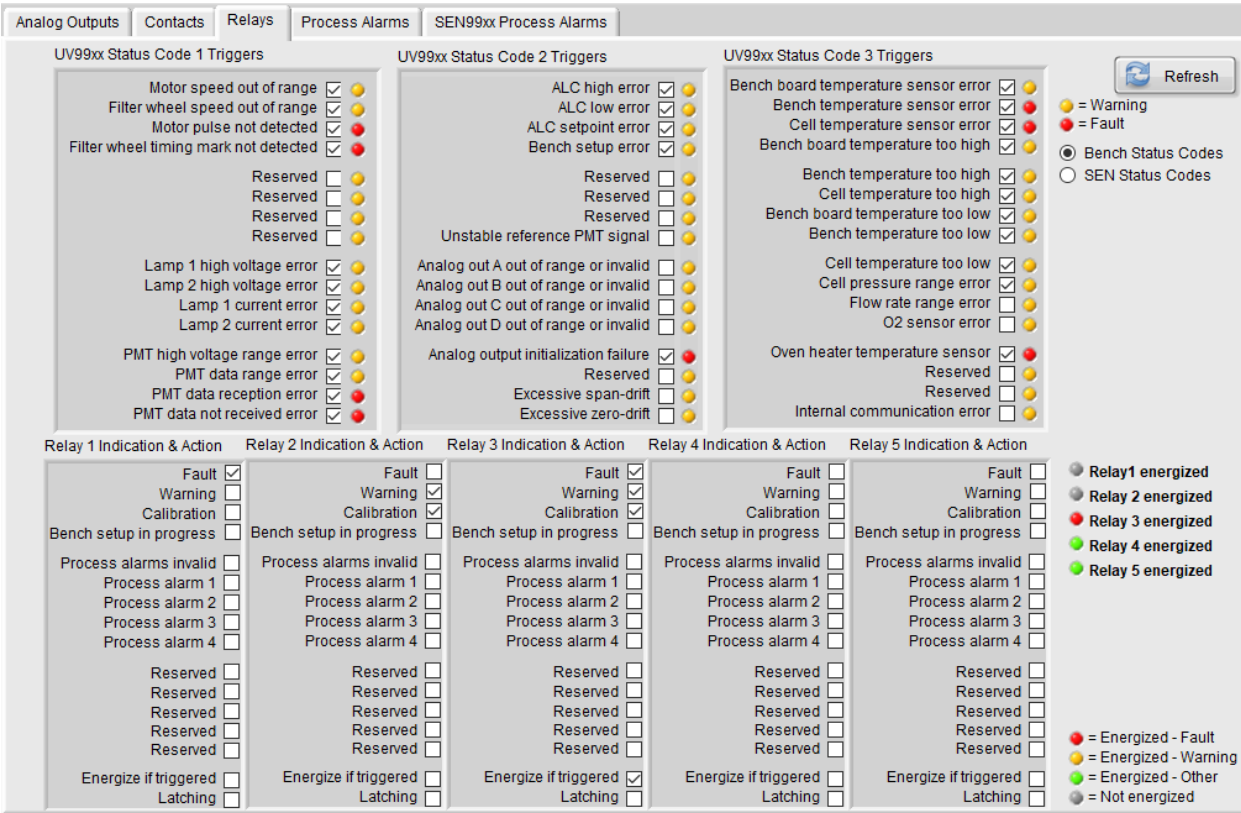
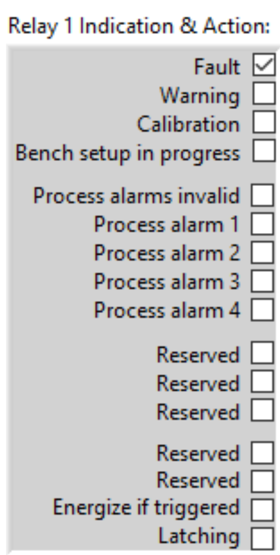


Figure 53 — Customer I/O Relays

UV99xx Models

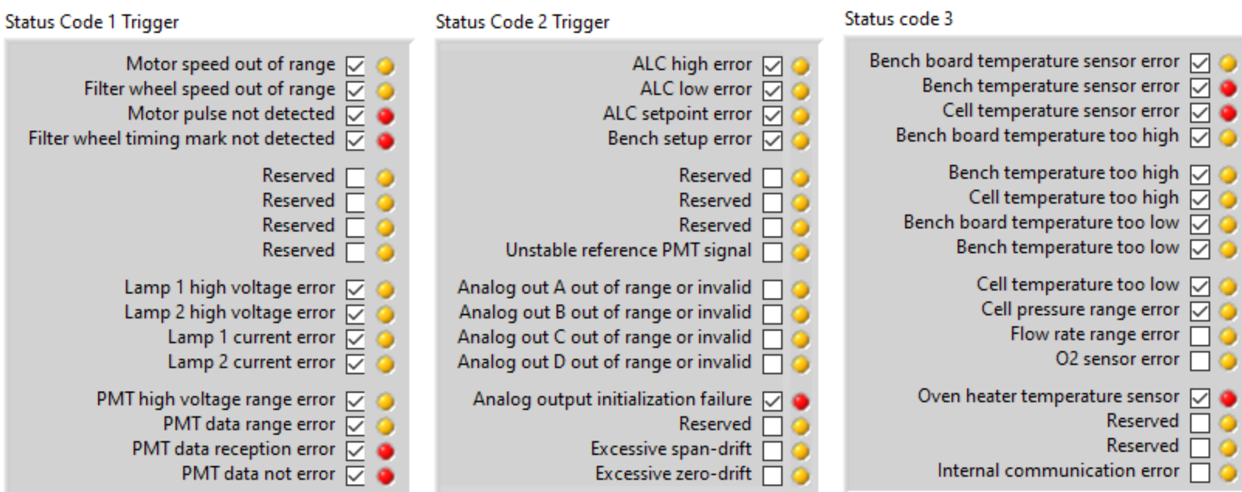
Ametek UV99xx models configured with the optional Customer I/O board contain five configurable relays (one if a Customer I/O board has not been installed, in which case it acts like a 9900[RM]).

Each of them can be triggered by any combination of several conditions:



Status Code Triggers

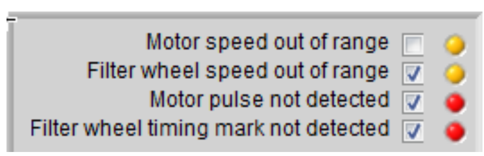
Faults and Warnings are triggered by any of the three Status Code Triggers in the upper part of the panel:



For each item within a Status Code Trigger, you can:

- Include the condition (check the checkbox)
- Treat the conditions as a Warning (set the LED to amber)
- Treat the condition as a Fault (set the LED to red)

For example, here are the first four items in Status Code 1 Trigger:



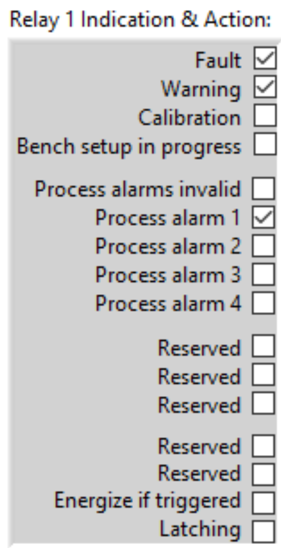
Motor speed out of range will be ignored, because the checkbox has been left unchecked.

Filter wheel speed out of range will trigger a Warning condition, because the checkbox is checked, and the LED is amber (click the LED to toggle it between amber and red).

Motor pulse not detected will trigger a Fault condition.

Filter wheel timing mark not detected will also trigger a Fault.

Here, Relay 1 will be triggered if either a Fault or a Warning occurs:



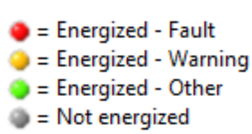
Relay 1 will also be triggered if Process alarm 1 is present. If a Process alarm is present, but neither Fault nor Warning states are triggered by the Status Code Triggers, the legend will show Relay 1 as “Energized - Other”, and the LED will be green.

If Relay 1 should be triggered for Faults but not for Warnings, simply uncheck *Warning*.

Relay State

You can see which relays are currently triggered:

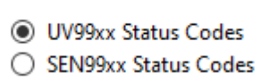
The LEDS are illuminated if the relay has been energized, and grey otherwise. They are color-coded to indicate the severity of the condition that the relay is signaling:



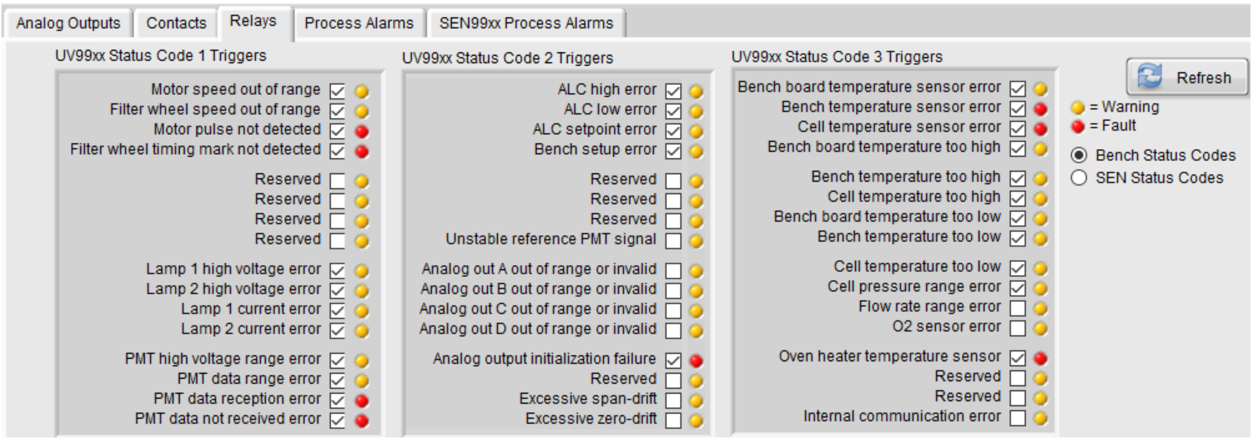
SEN99xx Status Relays

If an optional SEN99xx board has been installed, status conditions on the SEN99xx board can also trigger the relays on the Customer I/O board.

You can see and set them by selecting SEN99xx Status Codes:



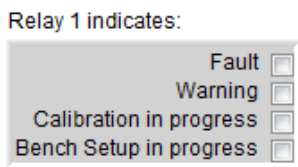
The SEN99xx Status Codes become visible:



Both the UV99xx and the SEN99xx status code triggers are active.

9900RM

Ametek 9900RM analyzers and 99xx analyzers that do not contain a Customer I/O board contain one configurable relay. It can be triggered by any combination of the following conditions:



The three Status Code triggers operate in the same way as they do for 99xx models.

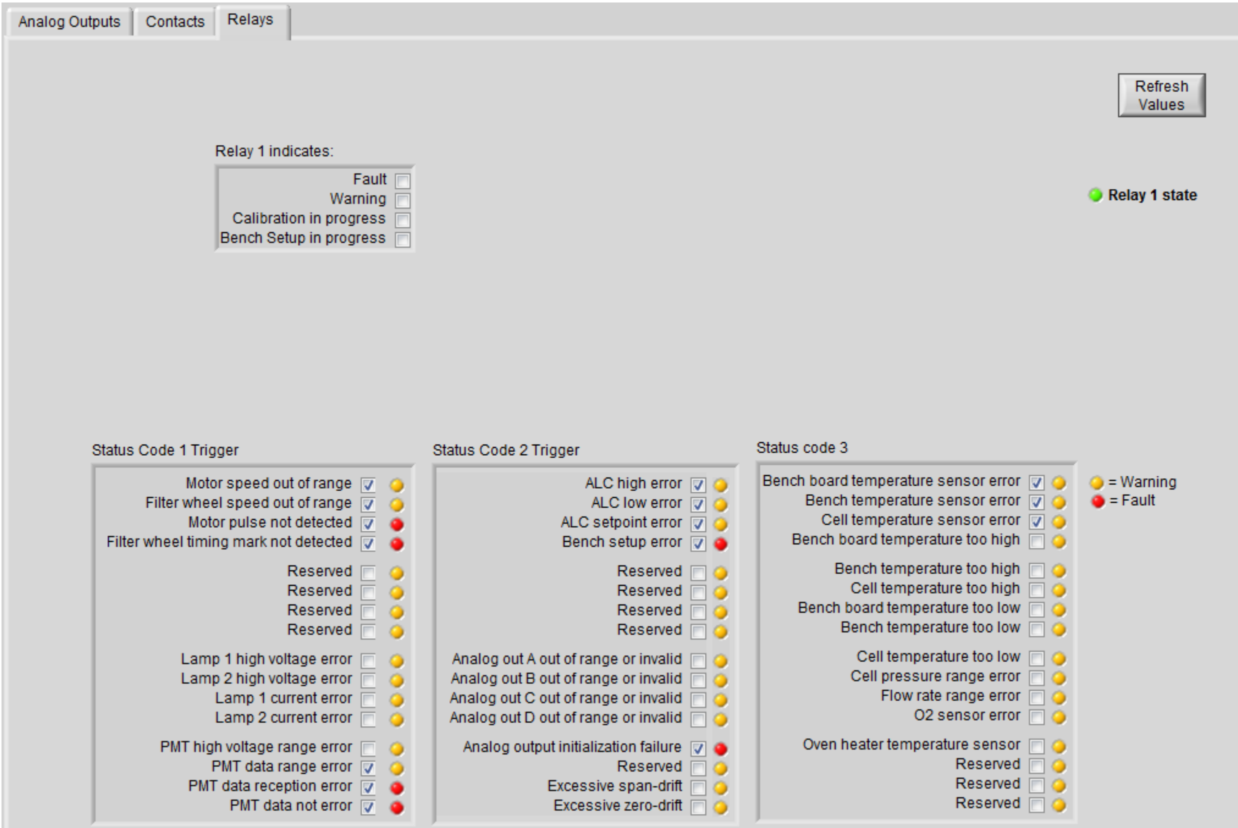
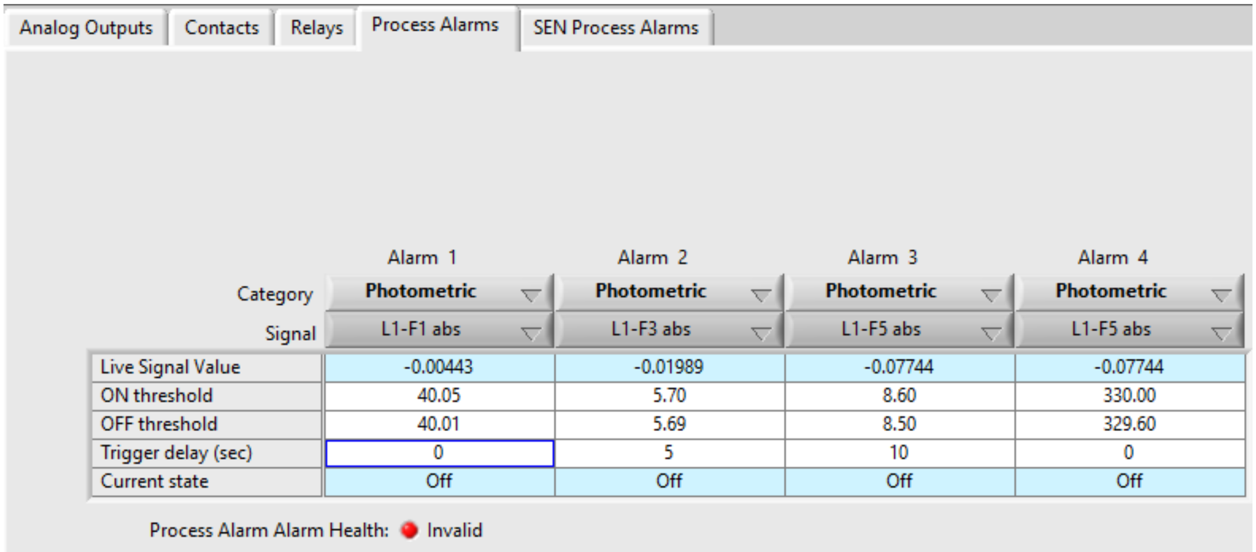


Figure 54 – Customer I/O Relays, 9900RM

Customer I/O Panel – Process Alarms



An Ametek 99xx analyzer, if equipped with the optional Customer I/O module, can monitor up to four signals while the analyzer is in normal operation. It is not necessary for the Configurator to be connected.

The specific signals that can be monitored depend on how the analyzer has been configured, and which optional components have been installed. In general though, it includes all of the measured UV-absorbance species concentrations, photometric data, sensor data, and track & hold signals.

Alarm Limits

ON threshold	2.50
OFF threshold	2.00
Trigger delay (sec)	2
Assigned data reading	0.045
Current state	Off

Separate ON and OFF thresholds are provided, so you can provide some hysteresis to prevent repeated triggering of alarms when the signal level is close to the alarm threshold. For the same reason, you can require the condition to be continuously present for some period of time before an alarm is asserted.

If the ON threshold is higher than the OFF threshold, the alarm is considered to be a HIGH limit alarm. If the ON threshold is lower than the OFF threshold, the alarm is treated as a LOW alarm limit.

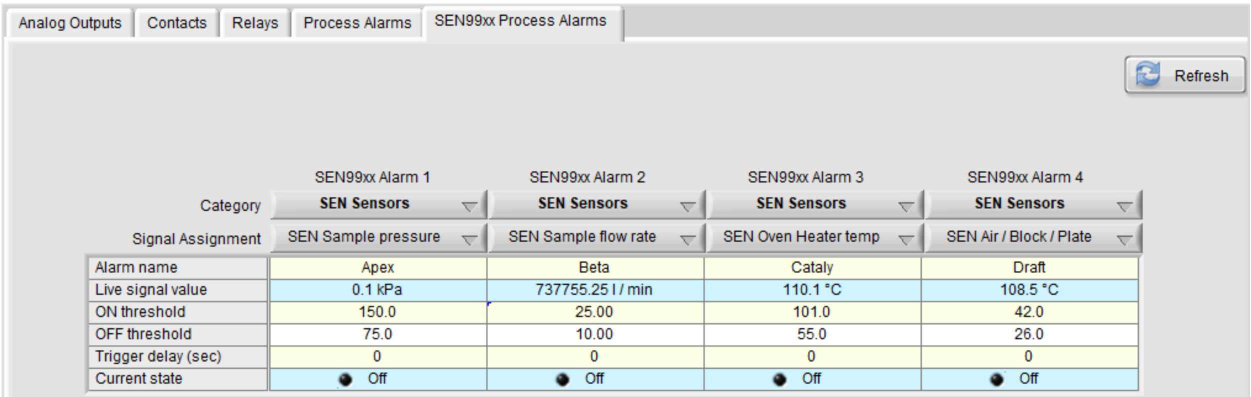
You can also see the current value of the signal that you selected from the pop-up menu for that alarm, and whether the alarm is currently asserted.

REVIEW DRAFT

Just as with Analog Outputs, SEN signals can be monitored, provided that the optional SEN board has been installed. A maximum of four SEN signals can be monitored by the UV Bench, as discussed in the Analog Outputs section on page 2-63.

Customer I/O Panel – SEN99xx Process Alarms

If a UV99xx analyzer has been configured with both the optional Customer I/O module and a SEN99xx board, a tab appears that lets you configure process alarms on the SEN99xx board:

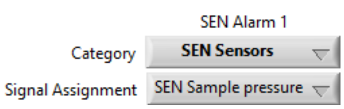


	SEN99xx Alarm 1	SEN99xx Alarm 2	SEN99xx Alarm 3	SEN99xx Alarm 4
Category	SEN Sensors	SEN Sensors	SEN Sensors	SEN Sensors
Signal Assignment	SEN Sample pressure	SEN Sample flow rate	SEN Oven Heater temp	SEN Air / Block / Plate
Alarm name	Apex	Beta	Cataly	Draft
Live signal value	0.1 kPa	737755.25 l / min	110.1 °C	108.5 °C
ON threshold	150.0	25.00	101.0	42.0
OFF threshold	75.0	10.00	55.0	26.0
Trigger delay (sec)	0	0	0	0
Current state	Off	Off	Off	Off

Figure 55 – SEN99xx Process Alarms

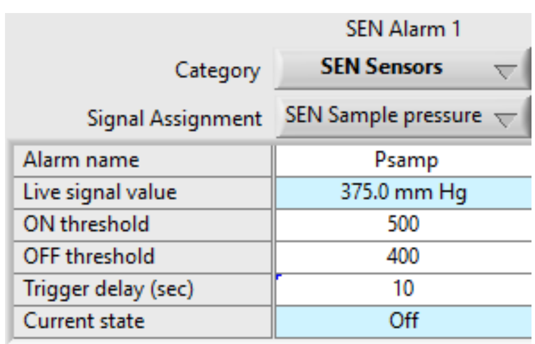
The process alarm processing occurs on the SEN99xx board, so you are not limited to the four channels that transfer SEN99xx values to the UV99xx. Alarm processing occurs even when the Configurator is not connected to the analyzer.

The four process alarms that you can configure in this tab are in addition to the process alarms that you configure in the Process Alarms tab, so it's possible to set process alarms on up to eight SEN99xx signals.



The specific signals that can be monitored depend on how the analyzer has been configured, and which optional components have been installed. There are two categories: SEN Analysis (gas concentrations), and SEN Sensors (pressure and temperature sensors). The list of signals in the Signal Assignment pop-up menu changes when you change the Category.

Alarm Limits



	SEN Alarm 1
Category	SEN Sensors
Signal Assignment	SEN Sample pressure
Alarm name	Psamp
Live signal value	375.0 mm Hg
ON threshold	500
OFF threshold	400
Trigger delay (sec)	10
Current state	Off

Separate ON and OFF thresholds are provided, so you can specify some hysteresis to prevent repeated triggering of alarms when the signal level is close to the alarm threshold. For the same reason, you can require the condition to be continuously present for some period of time before an alarm is asserted.

If the ON threshold is higher than the OFF threshold, the alarm is considered to be a HIGH limit alarm. If the ON threshold is lower than the OFF threshold, the alarm is treated as a LOW alarm limit.

You can also see the current value of the signals that you selected, in the *Live signal value* row.

Sample System

The Ametek 99xx can be configured with an optional Sample System, which can control three temperature zones (page 2-84). Three dry contact inputs can also be monitored (page 2-82), and eight solenoids can be used for a variety of purposes (page 2-86), including automatic calibration (page 2-87).

If the sample system is attached to the UV Bench, sample conditioning columns can be controlled by the solenoids.

It's possible to configure a 99xx analyzer with two Sample Systems: one attached to the UV Bench, and one attached to the SEN system.

Sample System Panel – Status Trigger

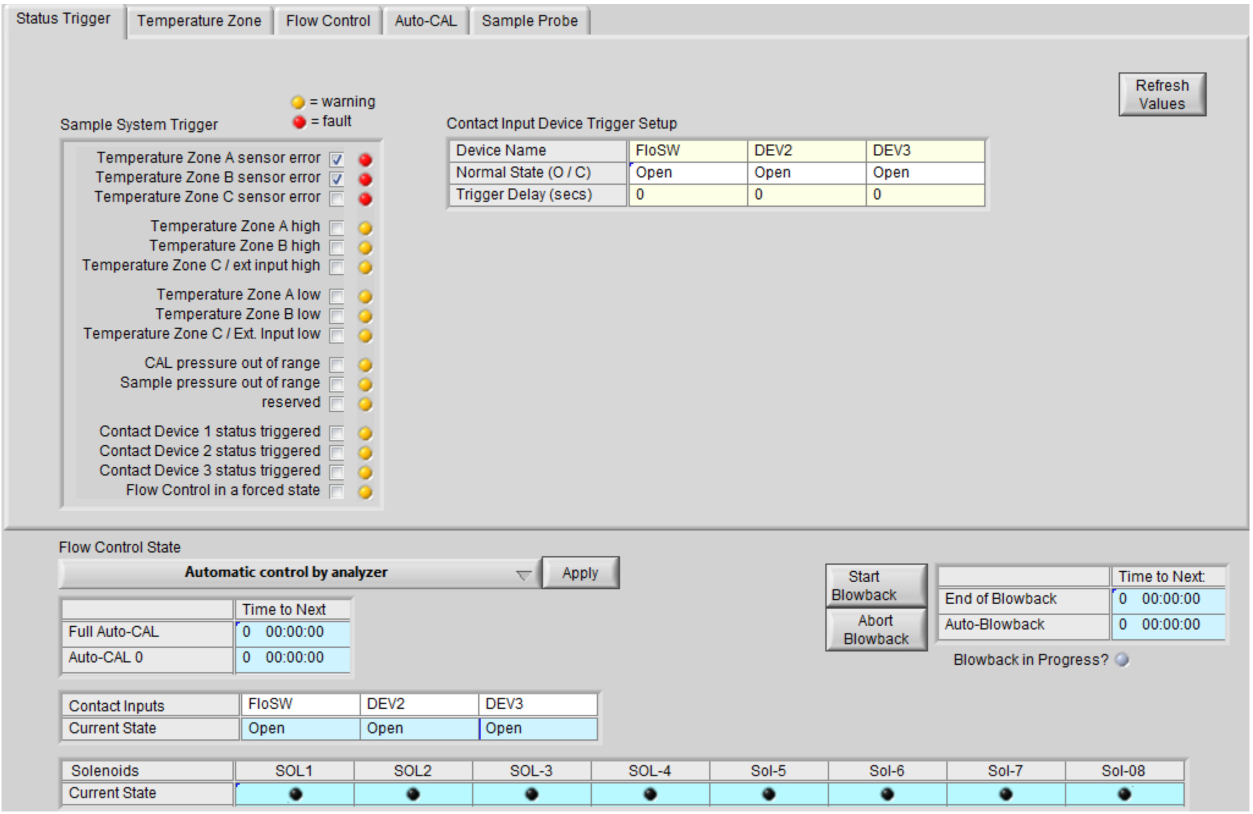


Figure 56 – The Sample System – Status Trigger panel

You can decide which internal conditions to monitor, and their severity:

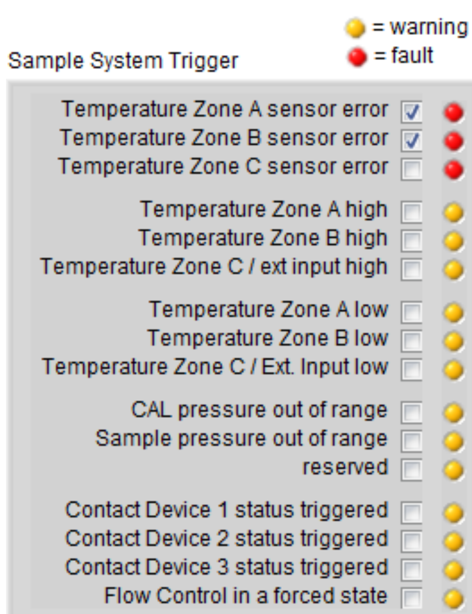


Figure 57 – Setting up faults and warnings

If an item is checked, the analyzer will monitor it. You can toggle whether the condition is to be treated as a warning or as a fault by clicking the LED. When the LED is amber, the condition is treated as a warning. When it's red, the condition is treated as a fault.

Contact Inputs

The Sample System has three dry contact inputs. You can give each of them a six character name and specify whether the normal state is open or closed (press the "o" or "c" key to set it to "Open" or "Closed").

If you specify a Trigger Delay, the contact will not be asserted until it has been the new state for the specified time (in seconds).

Contact Input Device Trigger Setup

Device Name	FloSW	DEV2	DEV3
Normal State (O / C)	Open	Open	Open
Trigger Delay (secs)	0	0	0

Sample System Panel – Common Items

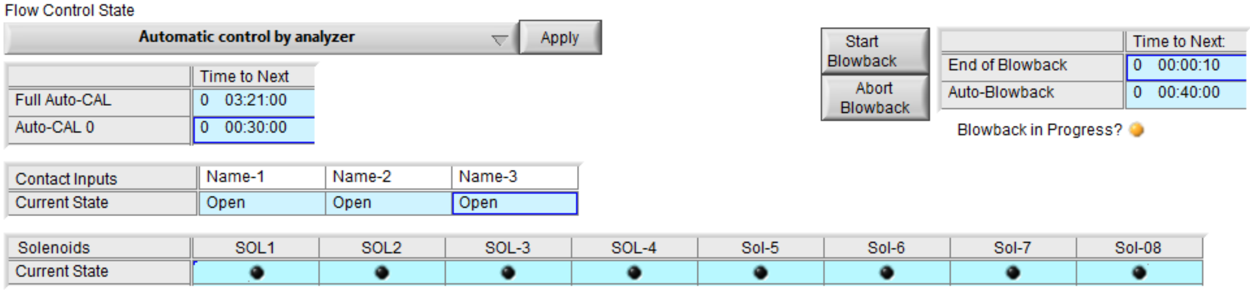


Figure 58 – The Sample System panel – Common Items

The lower part of the Sample System panel contains items that are visible regardless of which tab is selected.

Flow Control State

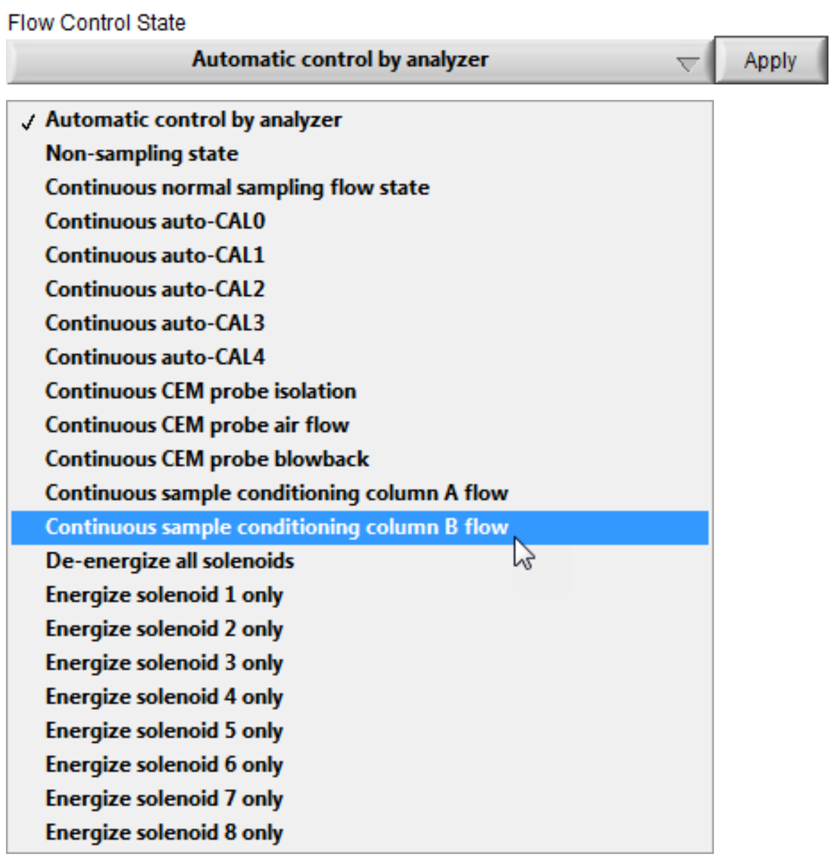


Figure 59 – Flow control options

The *Flow Control State* menu lets you introduce Zero Gas or Calibration Gas into the system. You can also return flow control back to the Analyzer for normal operation.

Depending on the analyzer you are working with, certain Flow Control modes listed here may not be available. Only the Flow Control modes available for the analyzer you are working with are included in the pop-up menu.

Automatic Control by Analyzer

Lets the analyzer automatically determine and set the mode of operation (sampling, calibration, or backpurge) by monitoring the state of the Fault alarm relay contacts.

Non-sampling state

The Sample System is inactive (shut in, shut off, or in backpurge).

Continuous normal sampling

If the optional sample conditioning columns have been installed, the "continuous normal sampling" flow control state will switch the columns as configured in the Sample Column tab (page 2-82 – registers #922-#924).

Continuous auto-CAL

Continuous auto-CALx flow state, where x can be 0..4.

CEM probe

If installed, the CEM probe can be forced into continuous isolation, flow, or blowback. In the "continuous CEM probe blowback" flow control state, the blowback air will be pulsed as configured in the Sample Probe tab

Sample Column

Flow through the sample system can be forced to either of the sample conditioning columns.

Solenoids

You can force all of the solenoids to be de-energized, or you can energize them selectively.

Timers and Contact State

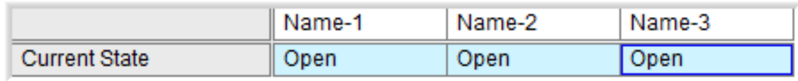
You can also see when the next calibration or blowback is scheduled to occur, and the current state of the contact inputs.

Auto-CAL timers

	Time to Next
Full Auto-CAL	0 03:21:00
Auto-CAL 0	0 00:30:00

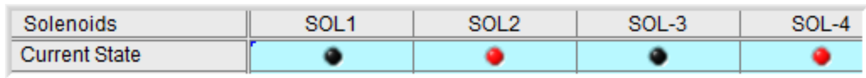
The time to the next full auto calibration, or auto-CAL 0 is shown in format: days hours:minutes:seconds.

Input Contacts



You can see the current state of each contact, but not whether it's currently in the normal or active state.

Solenoid Status



Similarly, you can observe the state of each of the 8 solenoids (not all pictured above).

Blowback State

If a sample conditioning column has not been installed (which allows a CEM probe to be connected), you can initiate or abort a CEM probe blowback, see when the current blowback will end, and when the next one will start. The time format is: days hours:minutes:seconds.

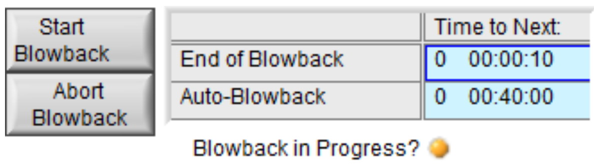
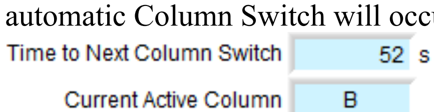


Figure 60 – CEM probe blowback

Sample Column Switch

If a Sample Conditioning Column has been installed, you can see which column is current active (or "Neither"), and when the next automatic Column Switch will occur:



The time remaining to the next automatic sample conditioning column switch is in seconds by default, but you can edit the unit of measure to any time unit by right-clicking the unit of measure and selecting your preferred temporal unit of measure.

Sample System Panel – Temperature Zones

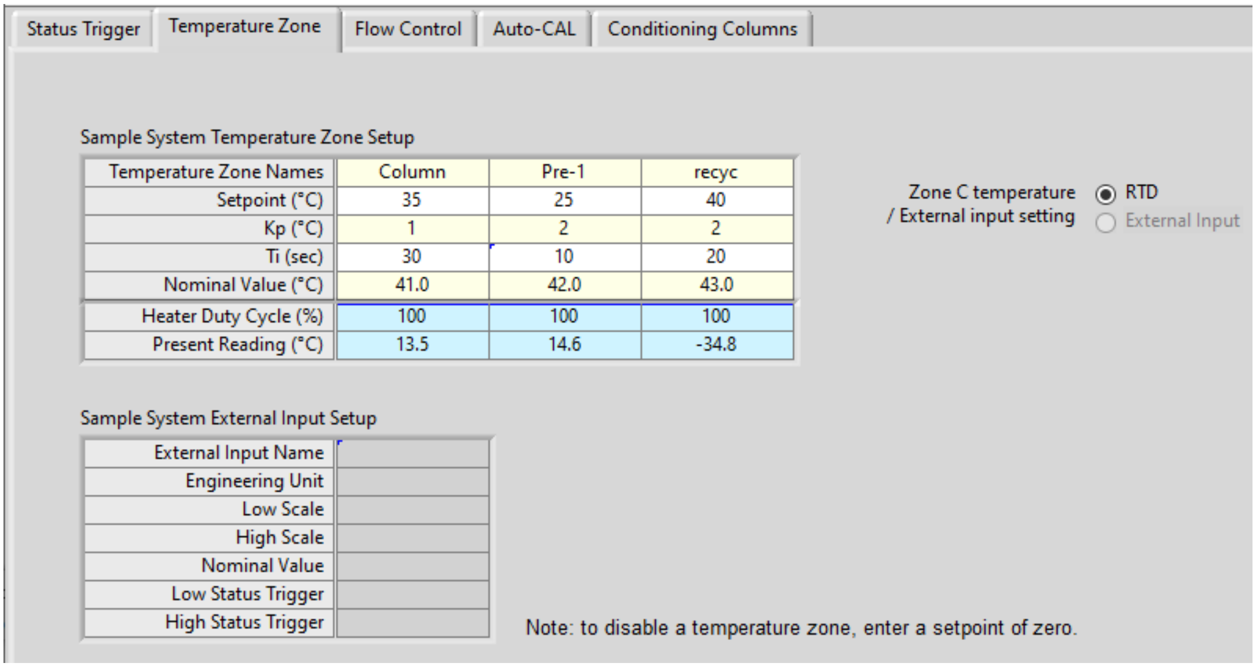


Figure 61 – The Sample System – Temperature Zone panel

The Sample System can control the temperature of three zones:

Sample System Temperature Zone Setup

Temperature Zone Names	Column	Pre-1	recyc
Setpoint (°C)	35	25	40
Kp (°C)	1	2	2
Ti (sec)	30	10	20
Nominal Value (°C)	41.0	42.0	43.0
Heater Duty Cycle (%)	100	100	100
Present Reading (°C)	13.6	14.7	-34.8

You can provide a six-character name for each heating zone.

The control algorithm is PI (proportional + integration). For each zone, you provide:

Setpoint	The desired temperature, in deg C
Kp	The duty cycle changes as a Proportion of the difference between the current temperature and the setpoint. Ametek suggests leaving this at the factory setting.
Ti	The Integral constant in PI, expressed as an integration time constant. The Ti value helps to prevent slow temperature drift away from the setpoint. Ametek suggests leaving this at the factory setting.

The analyzer can be configured to use either:

a) An RTD to measure and control the Zone C temperature, or
b) An external transducer that produces a voltage or current output

Switch SW4 on the Sample System Interface board determines the temperature input type, which is shown on the screen as a radio button. Modbus register 893 contains the switch setting:
0 = RTD
1 = External analog input

To switch from one to the other, it's necessary to physically change switch SW4.

External Temperature

If SW4 has been set to "External", the External Input Setup table becomes active:

Sample System Temperature Zone Setup

Temperature Zone Names	Zone1	Zone2	
Setpoint (deg C)	50.00	50.00	
Kp (deg C)	25.00	30.00	
Ti (sec)	10	30.00	
Nominal Value (deg C)	10.00	25.00	
Duty Cycle (%)	0	0	
Present Reading (deg C)	23.77	22.89	

Sample System External Input Setup

External Input Name	Zone-3
Engineering Unit	deg C
Low Scale	-10.00
High Scale	50.00
Nominal Value	25.00
Low Status Trigger	15.00
High Status Trigger	40.00
Present Reading	34.82

Figure 62 – External temperature setup

Note that if an external temperature measurement is used for Zone 3, the analyzer will not attempt to control the temperature.

Sample System Panel – Solenoids

Sample System Flow Control Setup

☑ = Energized

Solenoid Name	Sample	Zero	Span1	Sol-4	Sol-5	Sol-6	Sol-7	Sol-8
Non-Sampling State	☐	☐	☐	☐	☐	☐	☐	☐
Normal Sampling Flow	☑	☐	☐	☐	☐	☐	☐	☐
Auto-CAL0 Flow	☐	☑	☐	☐	☐	☐	☐	☐
Auto-CAL1 Flow	☐	☐	☑	☐	☐	☐	☐	☐
Auto-CAL2 Flow	☐	☐	☐	☑	☐	☐	☐	☐
Auto-CAL3 Flow	☐	☐	☐	☐	☑	☐	☐	☐
Auto-CAL4 Flow	☐	☐	☐	☐	☐	☑	☐	☐

Figure 63 – The Sample System – Solenoids panel

The Sample System contains 8 solenoids, which can allow some actions to be carried out automatically.

Non-Sampling State

The analyzer energizes the checked solenoids in this row during warm-up and upon detecting a fault.

Normal Sampling Flow

The analyzer energizes the solenoids that are checked in this row after warming up or completing an auto-CAL action, and upon all faults being cleared.

Auto Calibration

If auto calibration has been enabled (see Auto Calibration on pages 2-37 and 2-87), this table specifies which solenoid(s) will be activated to enable Zero Gas to flow for Auto-CAL 0, and to allow Span Gas flow for Auto-CAL 1, 2, 3, and 4.

It is possible to actuate more than one solenoid for any of the Auto-CAL actions.

Sample System Panel – Auto-CAL

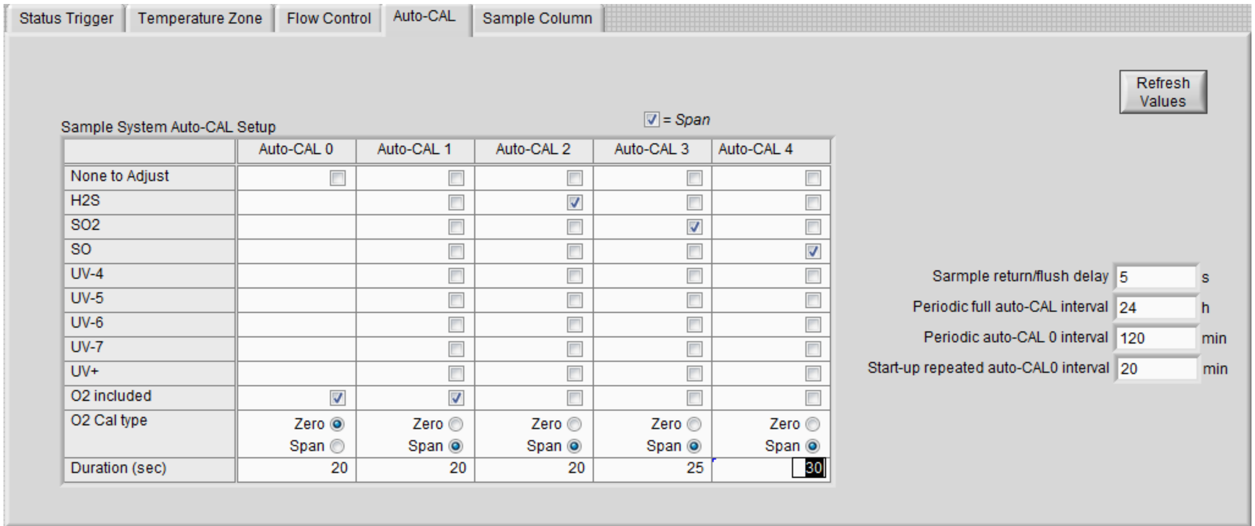


Figure 64 – Sample System Panel – Auto-Cal

If the optional Sample System module has been installed, automatic calibrations can be performed at regular intervals.

Auto-CAL Setup

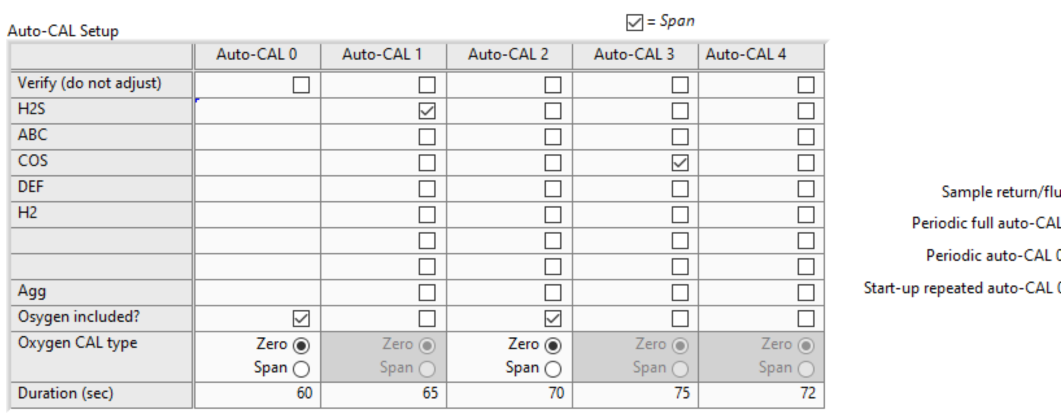


Figure 65 – Auto Calibration setup

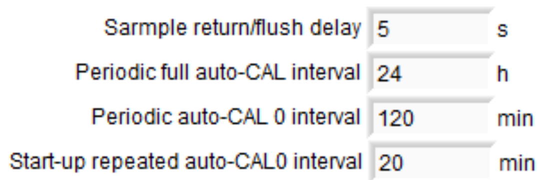
You can define up to five automatic calibrations, and select which species are to be calibrated for each of them. In general, it will be necessary to actuate valves to allow the appropriate Zero Gas or Span Gas to flow through the analyzer. These are controlled by solenoids, and you can define which solenoids are activated for each of the Auto-CALs using the Flow Control tab, which is described in the previous section on page 2-86.

Auto-CAL 0 is used for Zero Gas calibration of all species.

The Oxygen rows are disabled if no oxygen sensor has been configured.

Note: If a zero calibration is performed for a Paramagnetic or Electrochemical Oxygen sensor, the Zero gas must be Nitrogen.

Auto-CAL Timers



Sample return/flush delay

The analyzer waits this long before returning to on-line status, for sample gas to fill the system after an auto-CAL action, clearing of fault conditions or CEM probe blowback.

Similarly, it waits this long for sample gas to be flushed from the sample system, including the sample cell, before an auto-CAL action.

Periodic full auto-CAL interval

Set the time interval to 0 to disable the corresponding auto-CAL function.

While this is expressed in hours by default, you can right-click on the unit of measure (‘h’) to select a different temporal unit.

Periodic auto-CAL 0 interval

Your environment determines how often you should perform a Zero Gas calibration. You can perform a manual Zero periodically, and monitor the Zero-CAL drift to determine how often to perform an automatic Zero-Gas calibration. You can change the unit of measure if desired.

Set to 0 to disable periodic Zero Gas calibration.

Start-up repeated Auto-CAL 0 interval

The analyzer can automatically perform a repeated Zero Gas calibration as necessary during analyzer start-up.

Sample System Panel – Sample Columns

Sample System Conditioning Column Setup ☑ = *Energised*

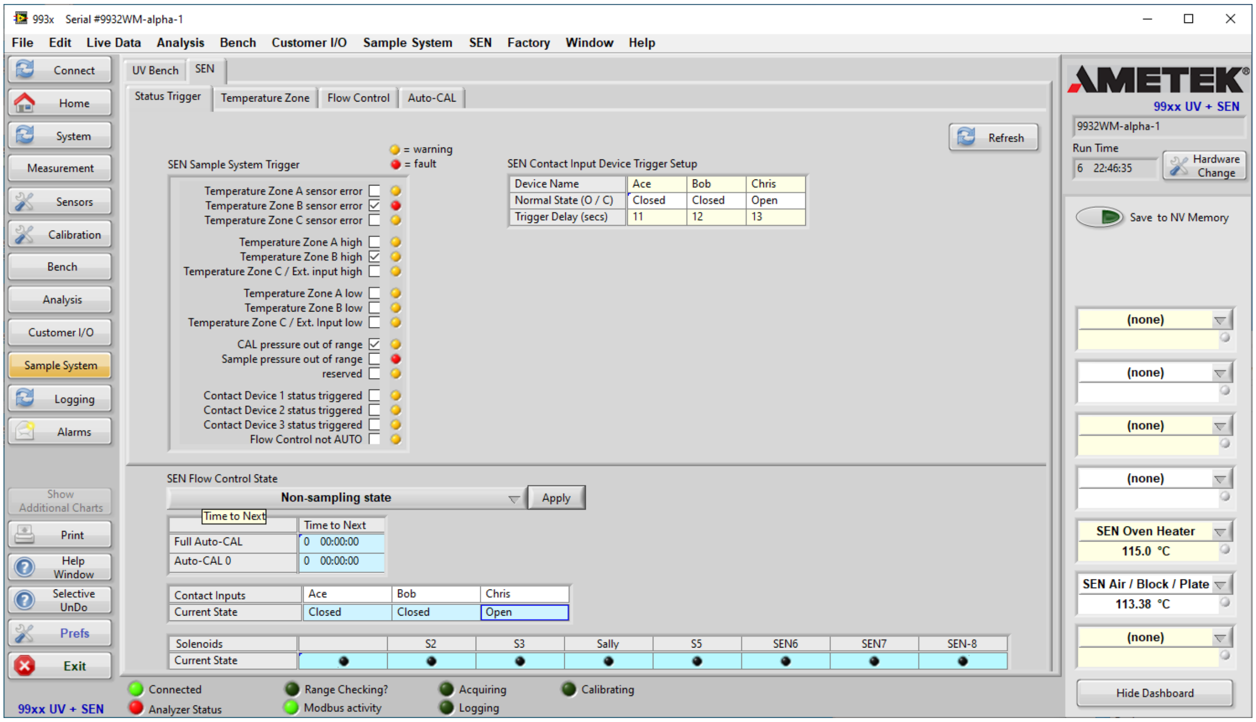
Solenoid Name	Zero	Sample	Span1	Sol-4	Sol-5	Sol-6	Sol-7	Sol-8
Column A Flow	☐	☑	☐	☐	☐	☑	☐	☐
Column B Flow	☑	☐	☐	☐	☑	☐	☐	☐

Column Switching Interval 60 s (0 to disable auto-column switching)

Figure 66 – Sample System Panel – Sample Columns

If optional sample conditioning columns have been installed, you can specify how frequently the analyzer should switch from one sample system conditioning column to the other, and which solenoids should be actuated to accomplish the switch.

SEN99xx Sample System



The Sampling system can be attached to the UV Bench, the SEN board, or a sampling system can be attached to each of them.

In this last case, a tab appears to let you select which sampling system to view and control.

If the sampling system is attached to the SEN board, there will be no sample conditioning columns.

Alarms

You can monitor any of the *Dashboard Variables*, to see if they are within limits that you set.

These variables are only monitored while the Configurator is connected to an analyzer. Please note that they are independent of the analyzer's Process Alarms described on page 2-74.

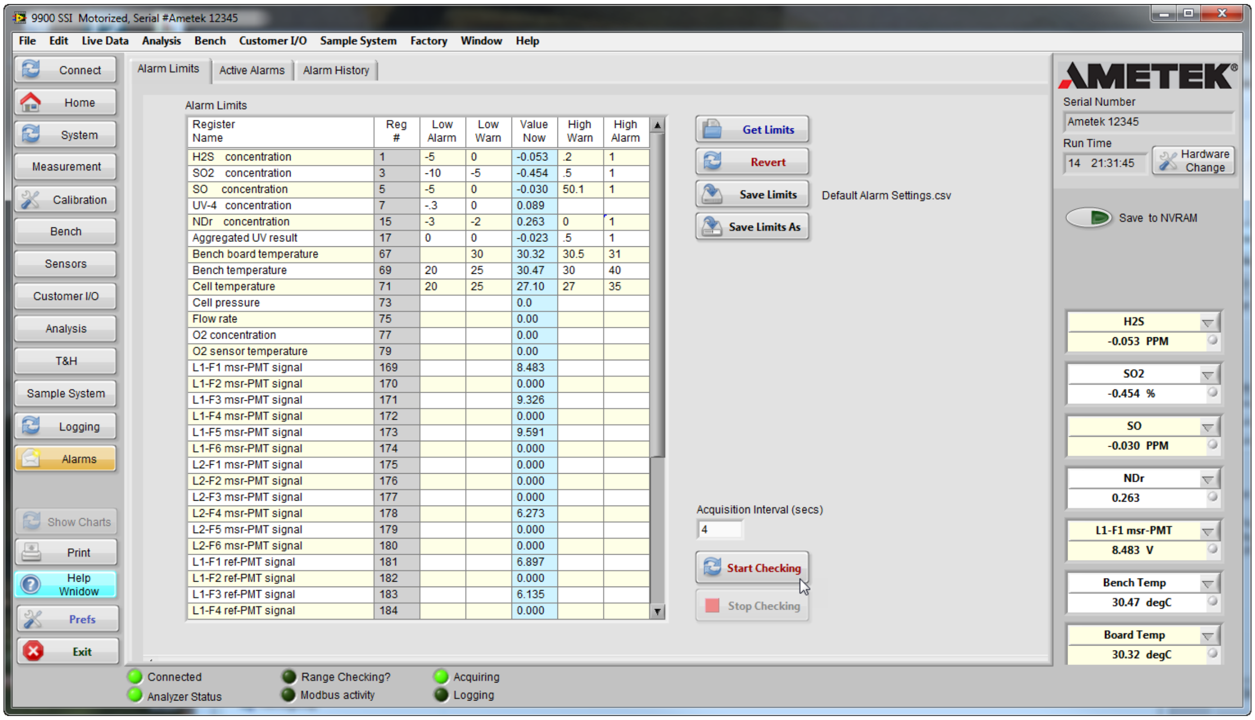


Figure 67 – Alarms panel – Setting Alarm Limits

The dashboard variables are defined in the Modbus Register Maps, which are discussed in Appendix II.

When you first view this panel, all of the dashboard variables appear in the table shown above, along with their register numbers, and current values (the light blue column).

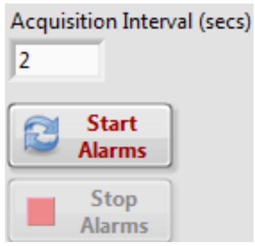
For each row, you can enter both alarm and warning limits. If you don't wish to use warning levels, just leave them blank. If you don't wish to check a particular variable, just leave the limits blank.

When you've defined a set of alarm limits, you can save them as a spreadsheet format file by clicking either *Save* or *Save As*. You can also revert this table to its last saved values.

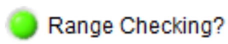
The next time you wish to monitor the same set of alarm limits, you can retrieve them:

Start Checking

When you're ready to start checking the alarm limits, set the interval between checks and click *Start Alarms.*



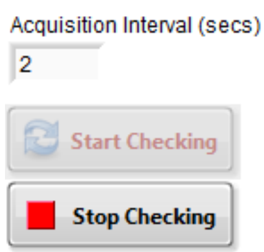
As long as you are running the alarm checking process, the alarm status LEDs in the dashboard will be updated, and the *Range Checking?* LED at the bottom of the Configuration window will be green.



You can modify the alarm limits or add new items without having to cycle alarm checking off and back on.

Stop Checking

Click *Stop Alarms* when you wish to stop checking for alarm conditions:



> *While this tab is displayed, the configurator reads every possible Dashboard variable so that it can display their current values. This adds to the Modbus traffic load, so you may wish to navigate to a different panel or a different tab in the Alarms panel when you're done using this panel.*

Active Alarms tab

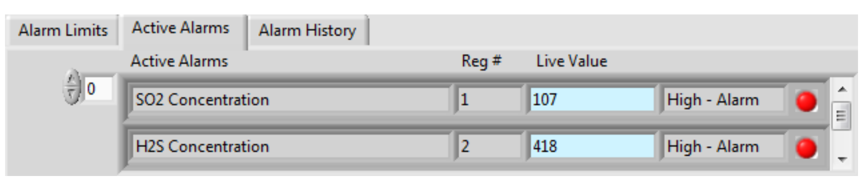


Figure 68 – Currently active alarms

The Active Alarms tab shows which variables are currently in either a warning or alarm state, and their current values.

Alarm History tab

You can also monitor the history of when variables enter or leave alarm or warning states by selecting the *Alarm History* tab:

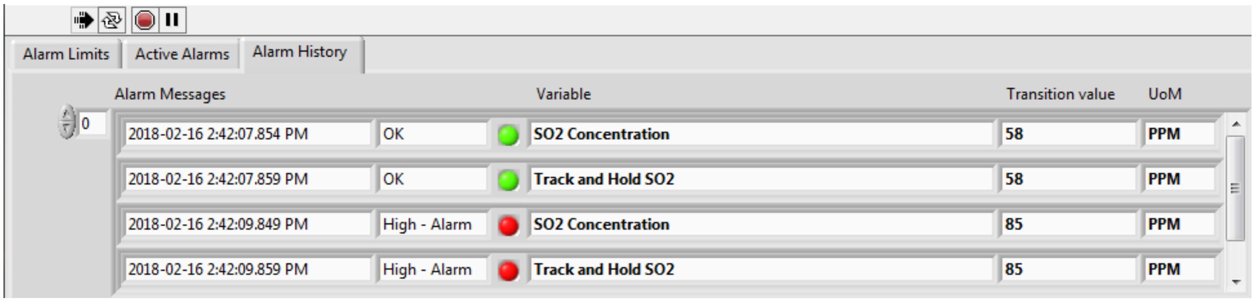


Figure 69 – Alarm history

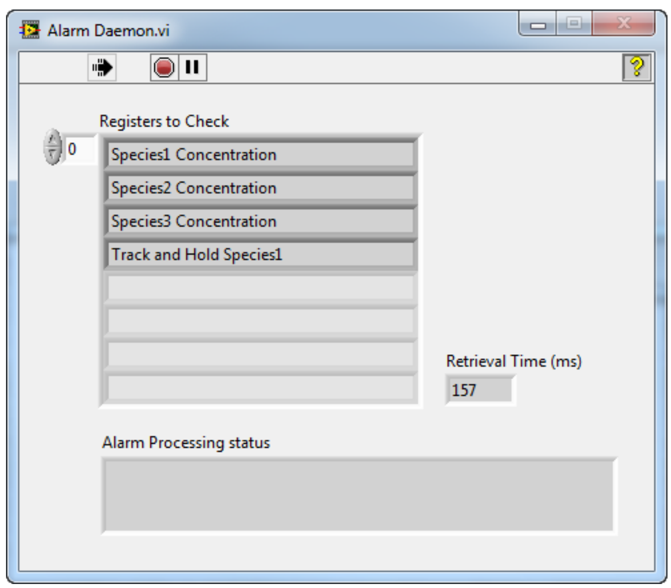
This information is also logged to a spreadsheet-format file located in an *Alarms* subdirectory of the test logs directory.

The file name format is:

Serial Number – Alarm Log – *Timestamp*.csv

Alarm Daemon

The alarm logging processing task[2] is normally minimized, but you can select it from the Windows menu, or the Windows task bar:



This window shows which registers are being checked, and the length of time it takes to retrieve them from the analyzer.

Naturally, the more variables you check, the longer it will take to retrieve them. This can slow the configuration screens down, and can also affect the maximum speed at which data logging can occur, even though data logging runs at a higher priority than alarm processing and configuration tasks.

[2] For historical reasons, background processes are often called daemons in computer parlance.

Factory Settings – Hardware Options

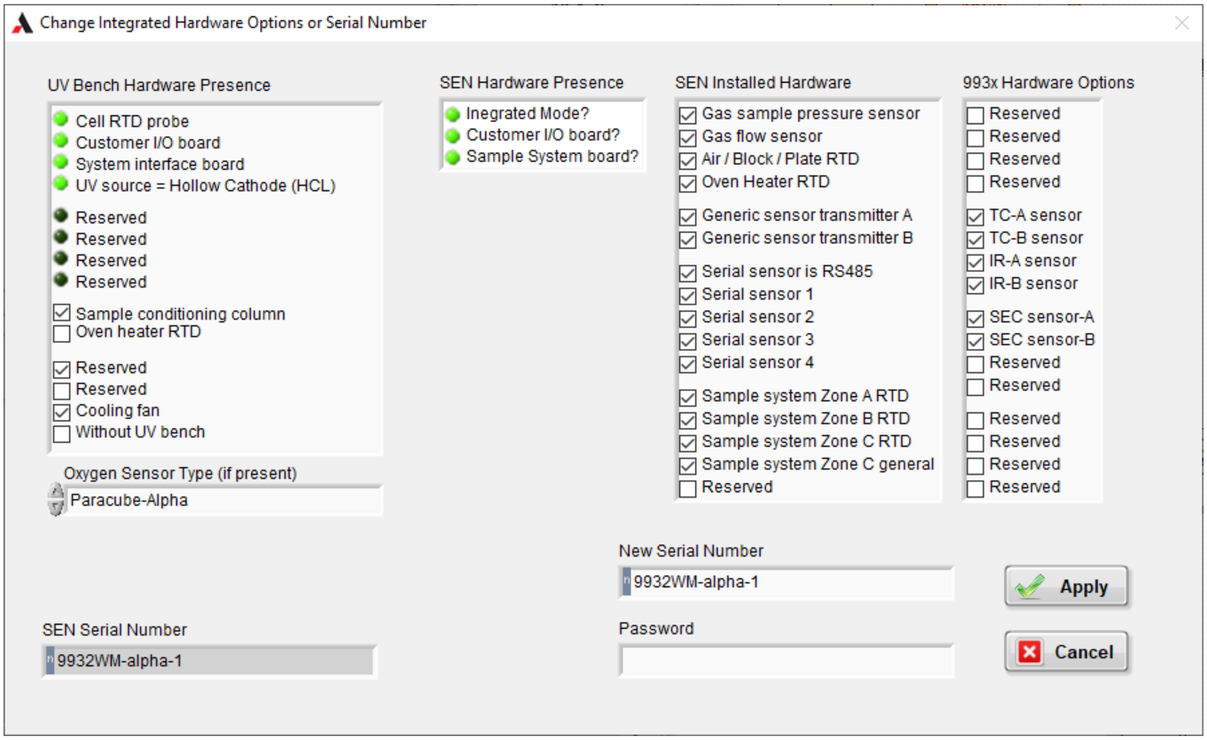
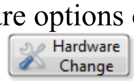


Figure 70 – Factory Settings for Integrated Configurations

The installed hardware options can be changed by selecting “Factory Settings” from the Factory menu, or by clicking 

. The window that appears lets you change a number of hardware configuration options (the window shown above is for integrated configurations: for UV-only or SEN-only configurations, you see one of the windows shown below).

The New Serial Number field is for use by the Ametek factory only.

Items shown as LEDs are read-only, and are shown for information only. Checkboxes can be changed, as can the Oxygen Sensor Type (if present).

For UV Bench system, the hardware options are stored as a bitmap in register 248.

For SEN systems, the hardware options are stored as bitmaps in registers 3165, 3165, and 3167.

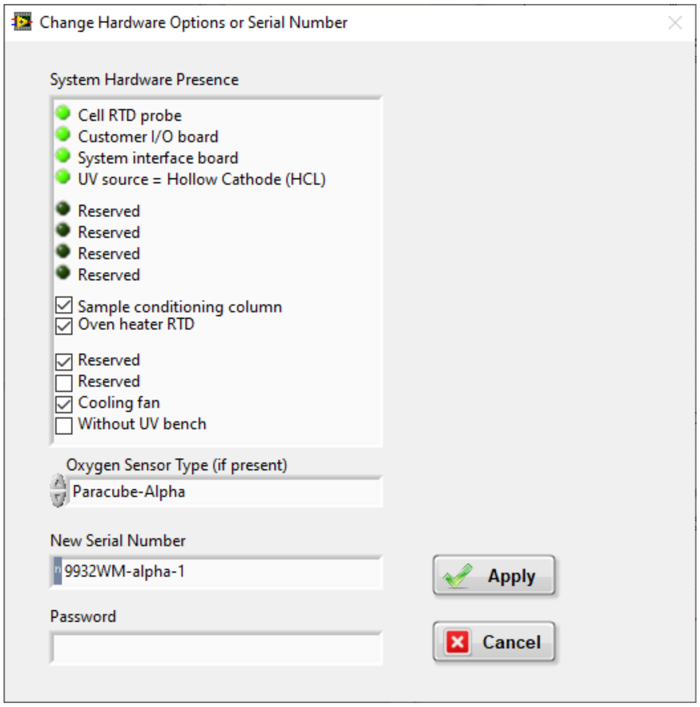


Figure 71 – Factory Settings for UV99xx Analyzers

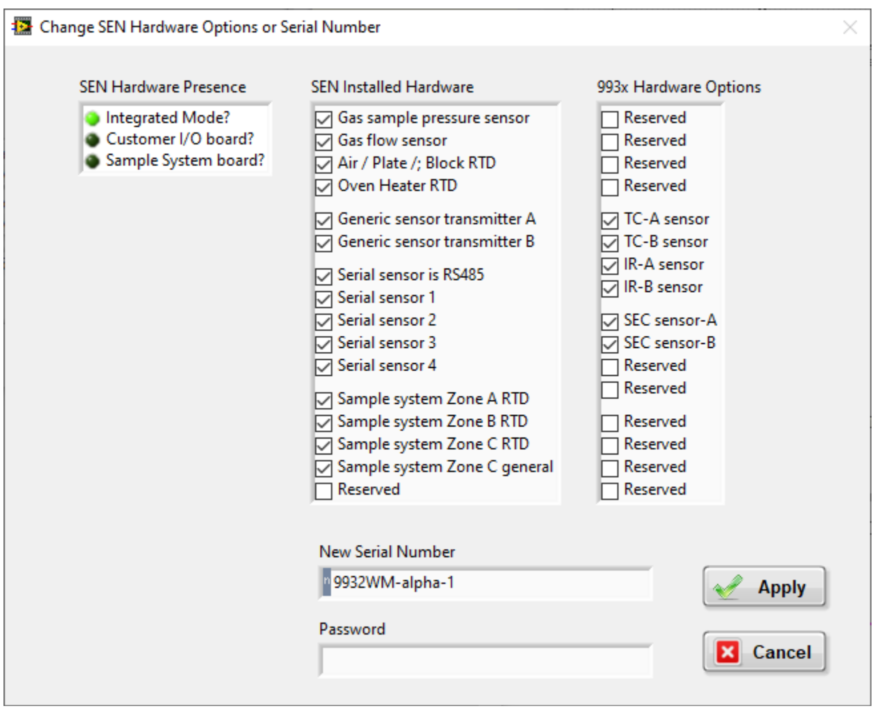


Figure 72 – Factory Settings for SEN99xx Analyzers

3 Data Logging and Charting

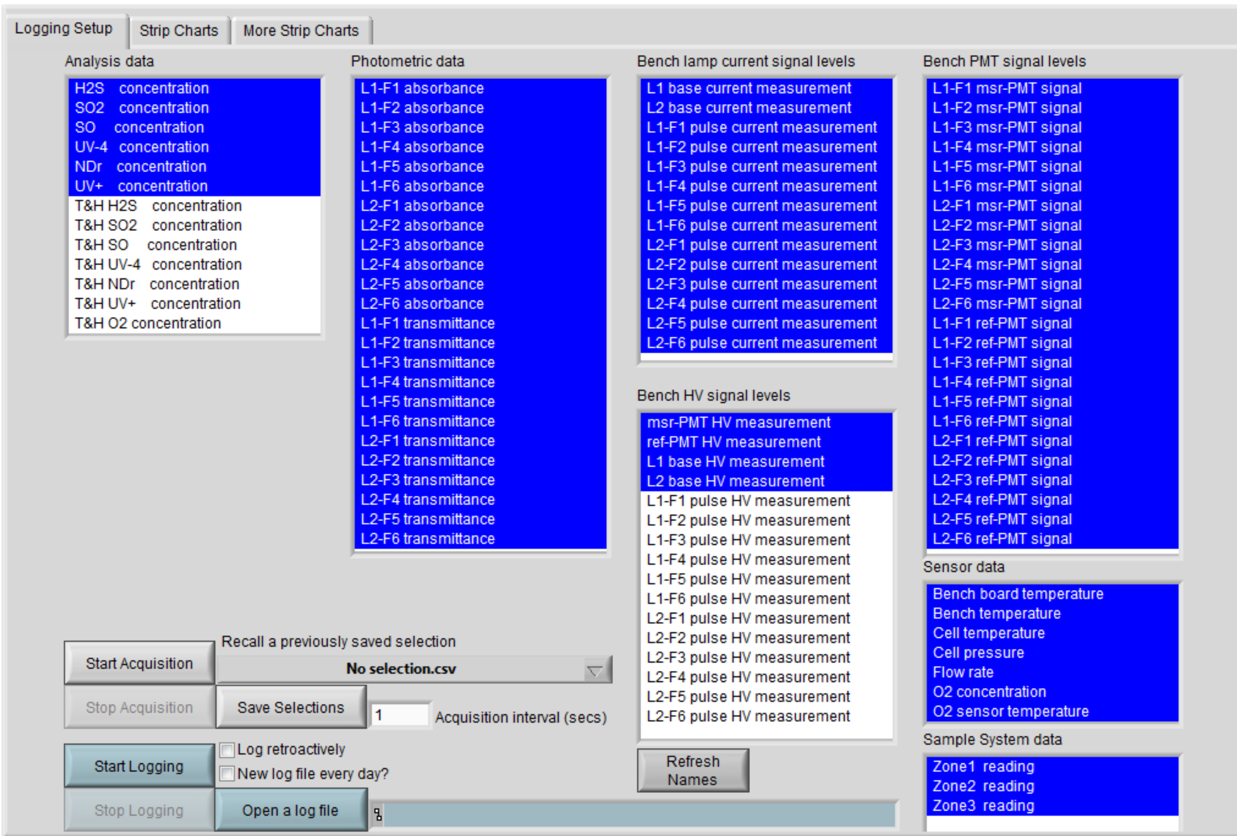


Figure 73 – The Logging Setup panel – UV Bench Signals

The 99xx Configurator can read your choice of variables at regular intervals, and optionally log them to a spreadsheet file.

You can also display powerful graphs.

Start by selecting the “Logging” panel of the Configurator.

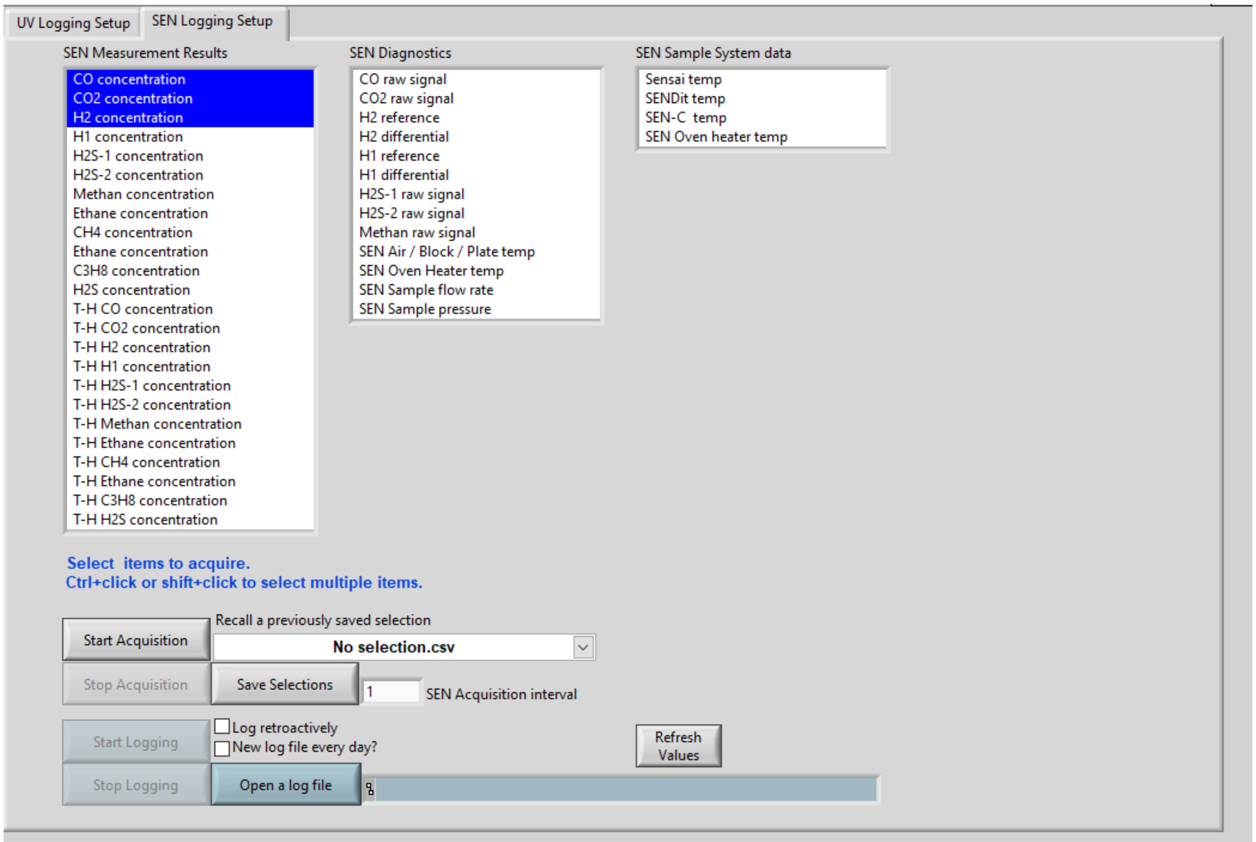


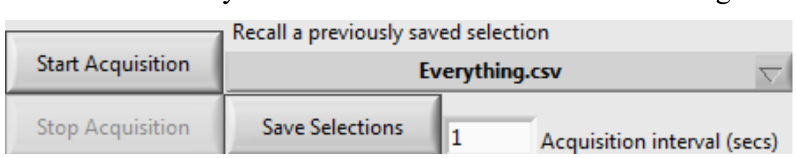
Figure 74 – Logging Setup panel — SEN Signals

Data Acquisition

The first step is to start reading the signals that you are interested in. In Figure 73 and Figure 74 above, you can see a list of signals, grouped into several *categories*. The specific signals that appear in each of these categories are specified in the Modbus Register Map (see Appendix II for details).

In Figure 73, most of the available signals have been selected. You can select any combination you'd like. Within each category, shift-click and control-click extend your selection.

You can select any combination of UV Bench and SEN signals.



If you've made a selection of signals that you'd like to use again, click the *Save Selections* button to save them as a spreadsheet file.

All of your previously saved selection sets are contained in the pop-up menu:

As soon as you choose an item from this menu, your saved selections are restored. Pick *No Selection* to unselect everything. In many cases, you might just choose to acquire all of the available signals. This option is predefined as “Everything.csv”.

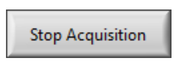
Decide how often you’d like the signals to be acquired (in the figure above, it’s set to every second), and click *Start Acquisition.*

The data acquisition task is started immediately.

You can configure and troubleshoot the analyzer while data acquisition is in progress, but your response times may suffer, depending on how many signals you are acquiring, and how frequently they are read from the analyzer.

Once you’ve started data acquisition, a “Strip Charts” tab and a “More Strip Charts” tab appear. They are described on page 3-7.

Stopping Data Acquisition



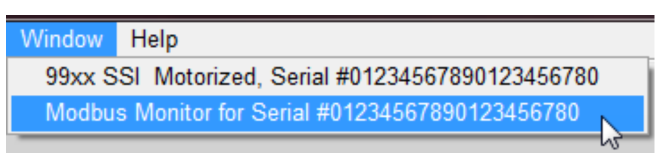
Stop Acquisition doesn’t destroy the in-memory buffers used for charting, so any charts that are running will simply stop updating.

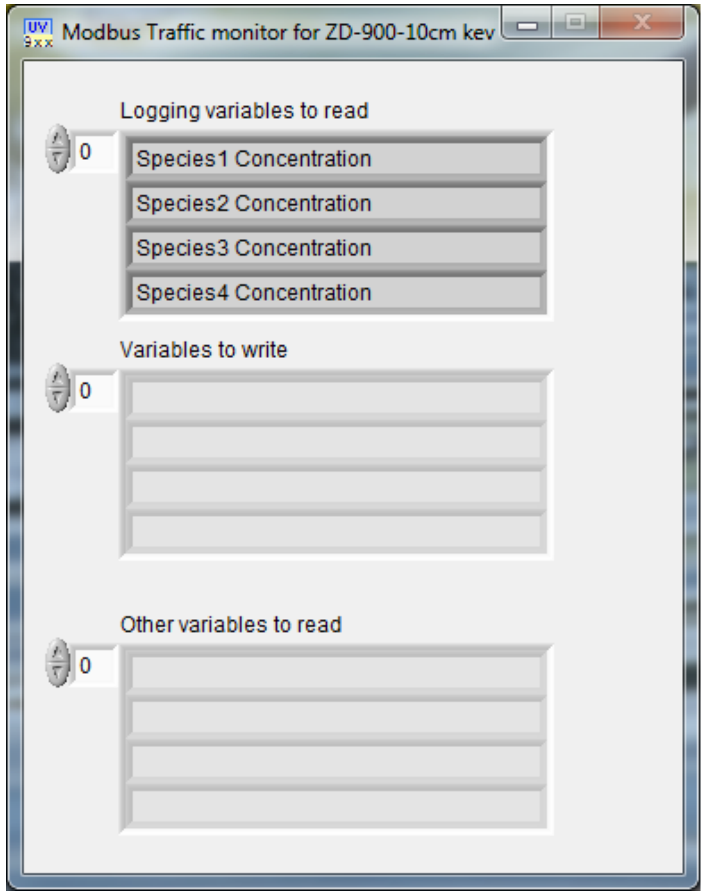
Modbus Traffic

Modbus traffic is prioritized into three different queues:

- Variables being logged (highest priority)
- Variables being written to the analyzer
- Configuration tasks (lowest priority)

When you start data acquisition, a new Modbus Traffic monitor window is created. It’s initially minimized, but you can select it from the Windows task bar, or from the Windows menu:





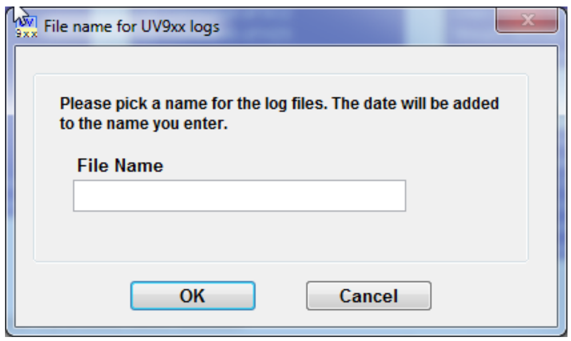
This window lets you see the variables being sent to the Modbus data acquisition process. In the example above, we see that the concentration values are being requested by the data logging process.

Data Logging

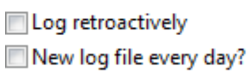
It's not necessary to log data in order to graph it.

Once data acquisition has started, you can begin logging. All of the variables being acquired will be logged in .csv spreadsheet format in the Test Logs directory (see Appendix III – Preferences to see where that is).

You'll be asked to enter a name for the log file(s):



There are a couple options:



The analyzer's serial number is prepended to the file name you specify, to help you keep track of which log files are from which analyzer.

Log retroactively

It's possible that you want to start logging but wish that you'd started it earlier. If you select *Log retroactively*, the data in the circular memory buffer that is used for graphing will be written out to the log file first, allowing you to log variables that were acquired before you started logging.

New log file every day?

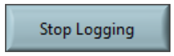
You can split a long session into calendar days. This helps to keep the file sizes manageable, and provides some insurance against computer mishaps.

Recall a Previous Session

If you haven't started data acquisition, you can open a previously saved log file, and graph the data:

The name of the file you selected is shown to the right of the button. This is handy for off-line demos (see the chapter on Demo Mode for more details).

Stop Logging



Stop Logging does just what you'd expect. Data acquisition continues, so stopping data logging doesn't affect graphing.

Charting

Once you've started data acquisition, a *Strip Charts* tab and a *More Strip Charts* tab appear, and you can start charting.

Strip Charts

The *Strip Charts* tab lets you quickly create a couple of synchronized strip charts:

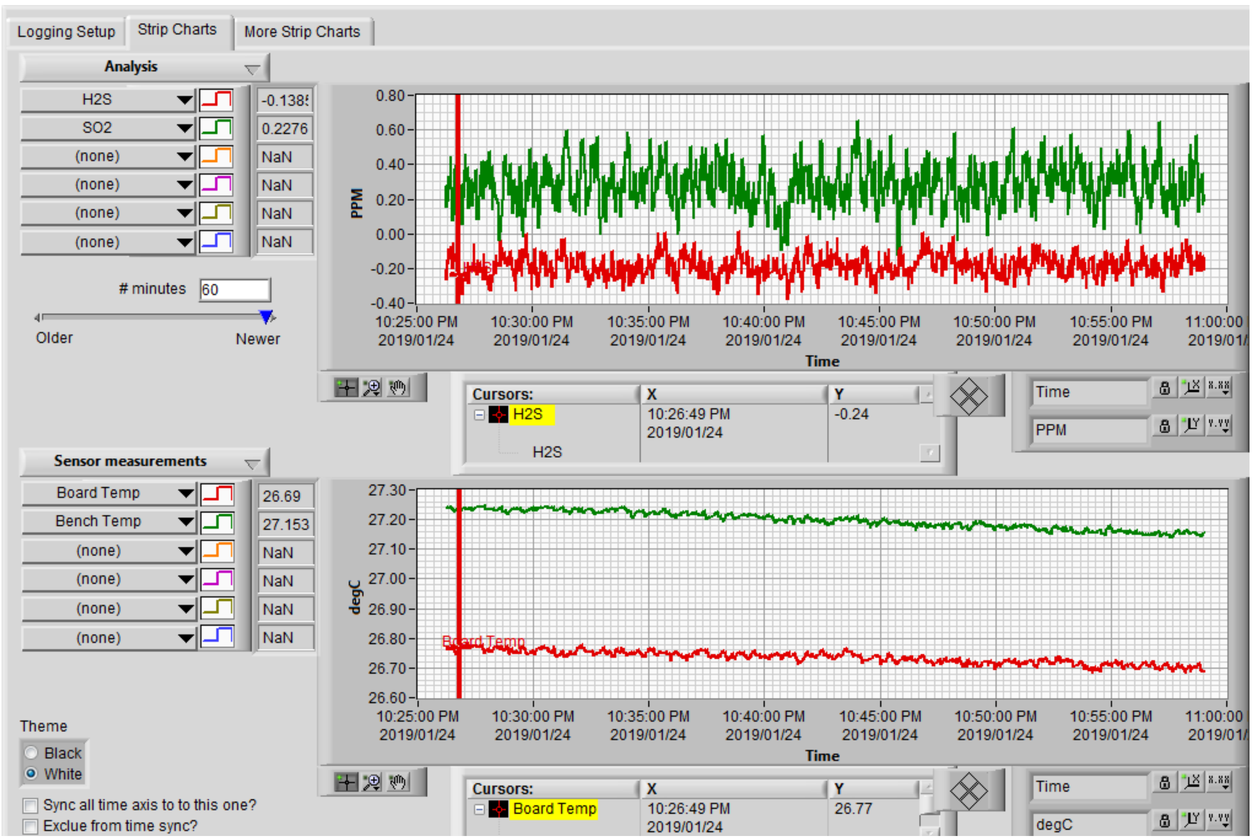


Figure 75 – Simple Strip Charts

This tab gives you the same controls as the more advanced strip charts described in the next section, but is designed to require fewer mouse clicks and be a bit easier to use.

You can use them either alone, or in conjunction with the flexible charting options on the *More Strip Charts* tab.

The graph controls are described in detail in the following sections.

More Strip Charts

The *More Strip Charts* tab lets you create arbitrary sets of charting windows that you can arrange and size to suit your requirements. You can save and restore any number of sets of windows.

There are several predefined sets of windows – when you select one of them, the windows will be sized and arranged to fit your largest monitor.

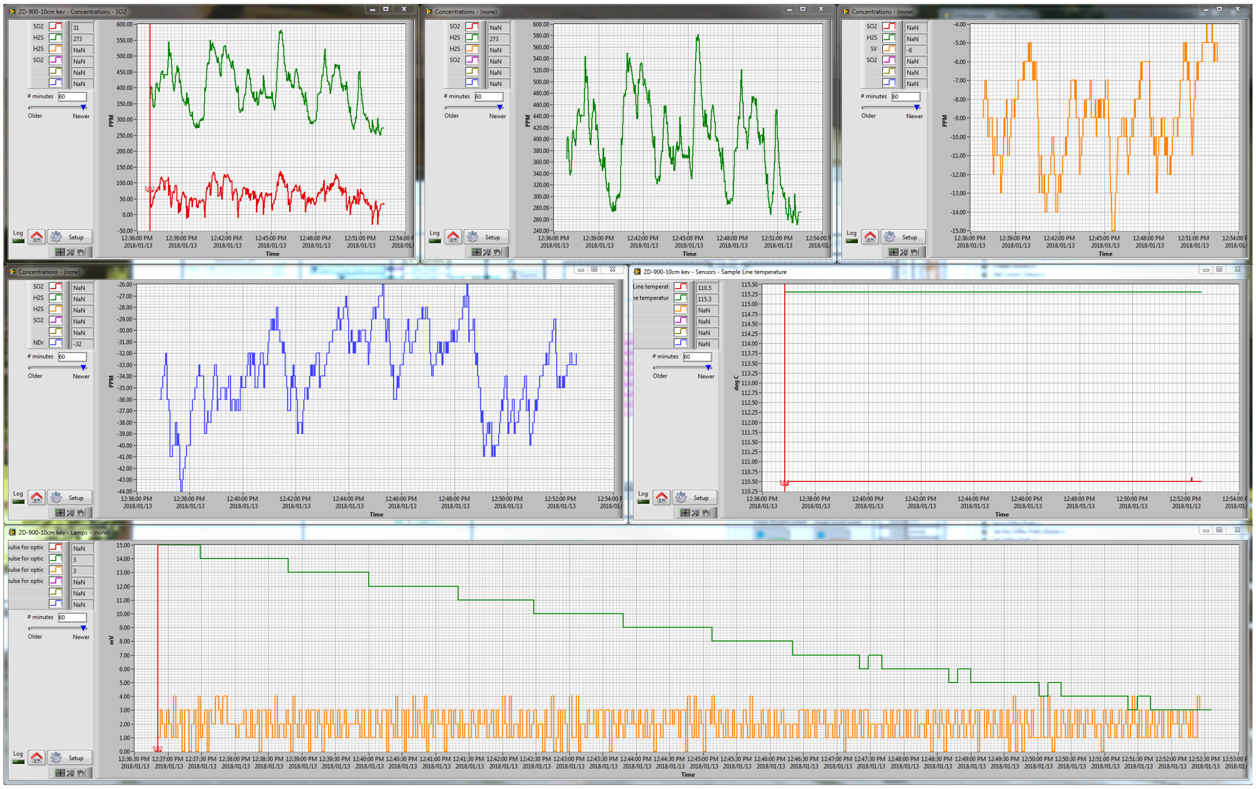


Figure 76 – Six charts, sized to fit your largest monitor

You can also create you own sets of charts. In the More Strip Charts tab, you can choose either one of the predefined sets of charts, or one of your own saved window sets:

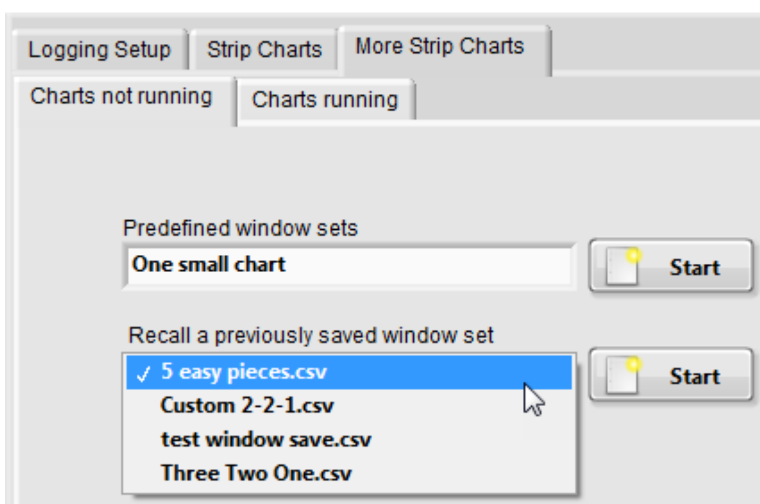
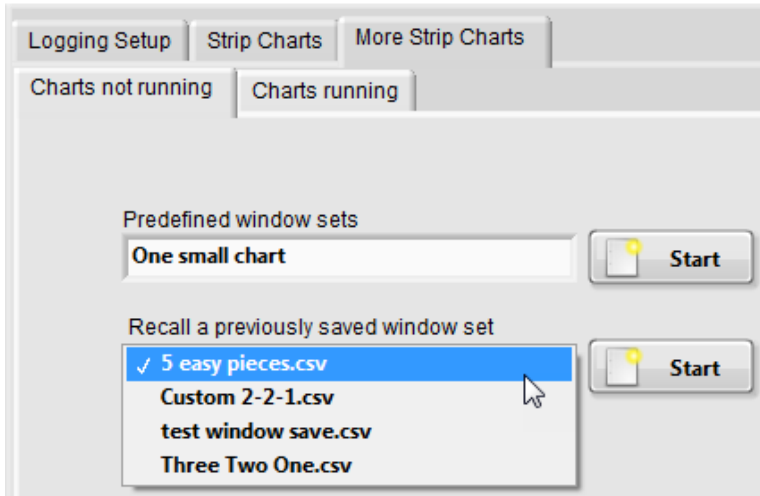
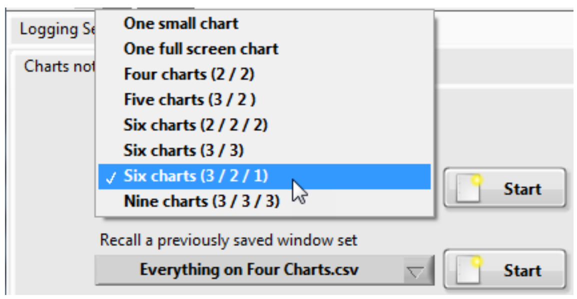


Figure 77 – Predefined and User-Defined Sets of Charts



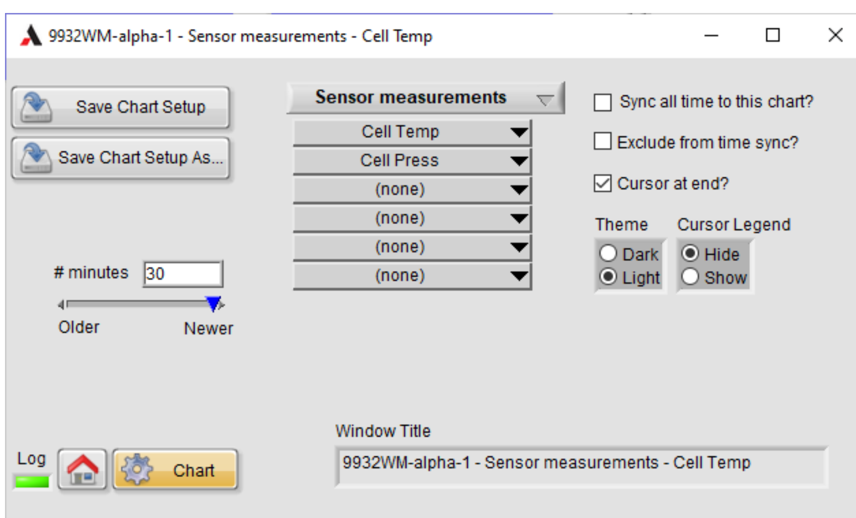
A New Set of Charts

The first time you use the configurator, there won't be any saved chart sets, so you would choose one of the pre-defined layouts:



The charts will be tiled and sized to fill your largest monitor. If you have more than one monitor that is the same size, the charts will be placed on a secondary monitor.

Each of them will initially show the configuration options:



The upper pop-up menu lets you select a logging group (these are defined in the Modbus Register Map, and are discussed in Appendix II):

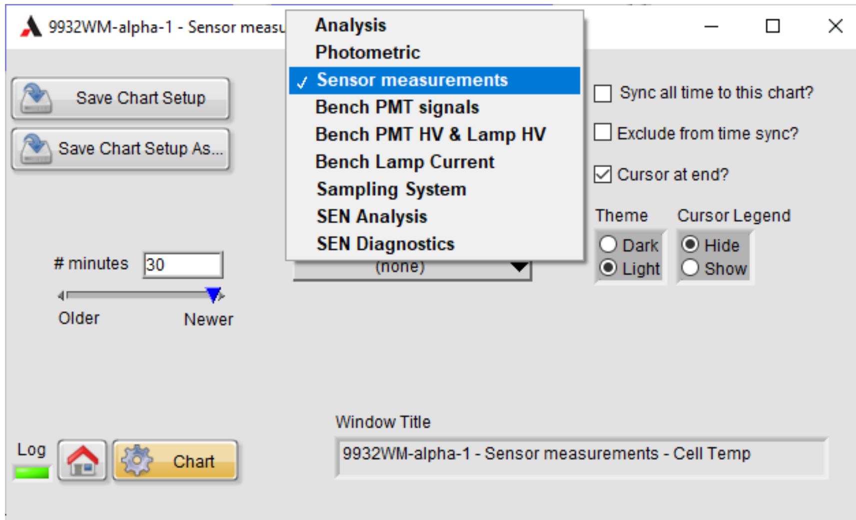


Figure 78 – Choosing a logging group to chart

You can select up to six different signals from the six pop-up menus below the logging group:

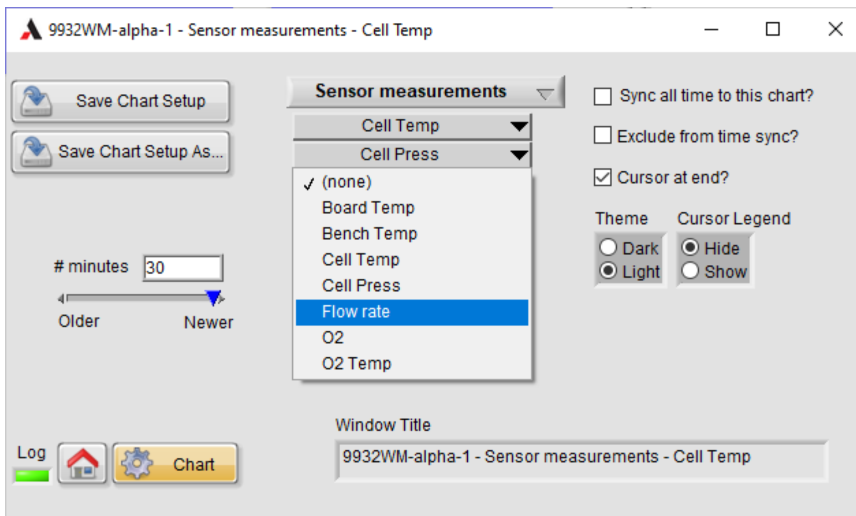
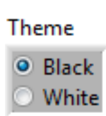


Figure 79 – Choosing signals to chart

Chart Themes

It's possible to change many aspects of the chart appearance, but two main visual schemes have been predefined:



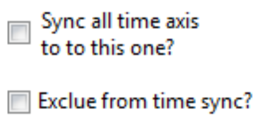
Selecting *Black* gives you a black background with brightly colored traces.

Selecting *White* gives you a white background with darker traces.

Both themes have the same functionality, but the white theme is better suited to printing on most printers.

Synching Charts

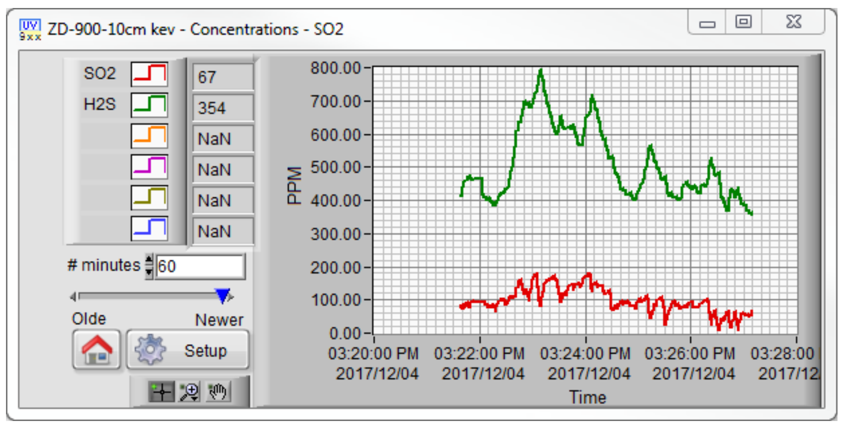
Two checkboxes are devoted to synchronizing the time axis of all of the charts that are currently running:



If you check *Sync all time axis to this one?*, all of the other charts will follow any changes you make to the X-axis on this chart. It’s OK to select this option on more than one chart. If you do, each of them will act as the master if you change its time axis.

If you check *Exclude from time sync?*, this chart will ignore time axis changes that are initiated from other charts.

If you click “Chart”, the chart becomes visible:



You can resize the chart windows, move them around, and save the new layout (along with what you want to have logged in each window). To save the current group of chart windows, select *Save Chart Setup* in the main window:

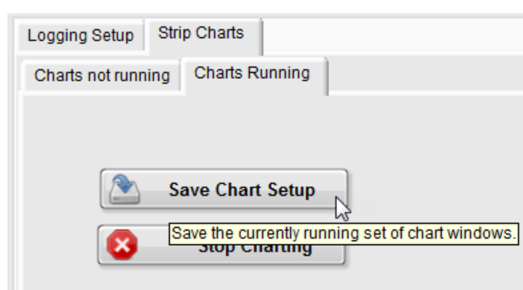
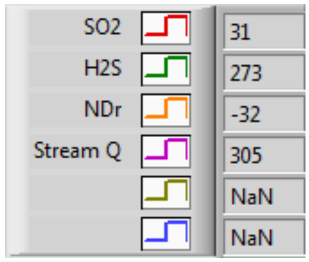


Chart Options

The charts have many configuration options.

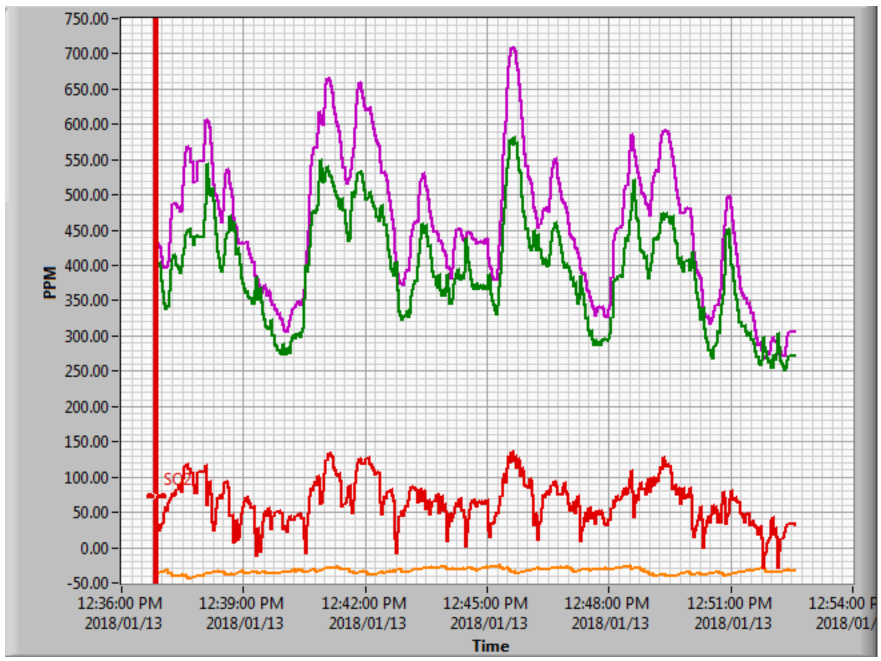
Plot Legend

The upper left-hand portion of the graph window shows the plot legend:

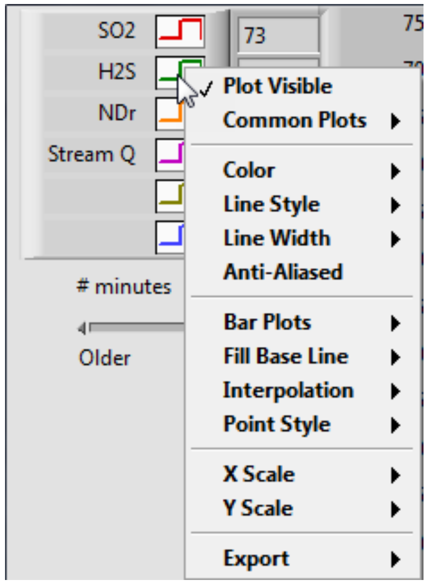


The *Short Name* of each signal is shown at the left. These short names are defined in the Modbus register map, and you can change them to suit your needs. For more details, please refer to Appendix II — The Modbus Register Map.

Live values are displayed at the right. The units of measure can be seen on the Y-axis scale:



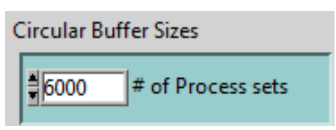
If you click inside one of the coloured legend boxes, a pop-up menu appears:



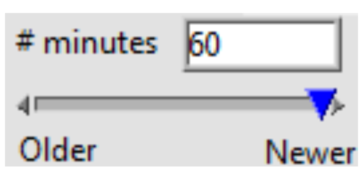
From here, you can configure the appearance of the plot traces, and export the underlying data values to the clipboard or to an Excel-format file.

Data Scrolling

As long as data acquisition is running, all of the variables being acquired are accumulated in circular buffers in main memory. You can specify how large you wish these buffers to be in *Preferences* (see Appendix III – Preferences):



In most cases, these buffers hold much more information than is convenient to view at once, so each chart has a control that lets you specify which portion of the circular buffer you wish to view:



If you change these settings in one of the graphs, they will be reflected in every running graph.

By the way, data logging isn't affected by the size of the circular buffers. The only limit on the number of data points you can log is your available disk space.

Home Button

If you are using a single monitor computer, the chart windows are likely to fill the entire screen.

If you click the Home button on any of the graphs, they will all be hidden, and the configuration window will become visible if it was hidden.

To hide the configuration window (on a single monitor system) and view the graphs again, click “Show Charts” on the configuration window.

On multi-monitor systems, “Show Charts” also switches the main configurator window to show the main charts.

The graphs continue to run while the configuration window is visible, and you can make them visible individually by selecting them from the Windows Task Bar.

The Log LED is illuminated if data is being logged to a spreadsheet file (you control this from the Logging Setup tab).

Cursors

You can create as many cursors as you want. They can be configured to snap to a particular trace, to snap to any trace, or to be unconstrained.

The easiest way to create a cursor is to click anywhere in a graph. A cursor is created and moved to the time value of the mouse location. This cursor is initially set to snap to the first signal you’ve set up for that graph. A similar cursor is created in every graph window.

As long as you keep the primary mouse button pressed, the *live values* area will display the values at the timestamp where you clicked.

This is done for every graph that is running, including the main charts.

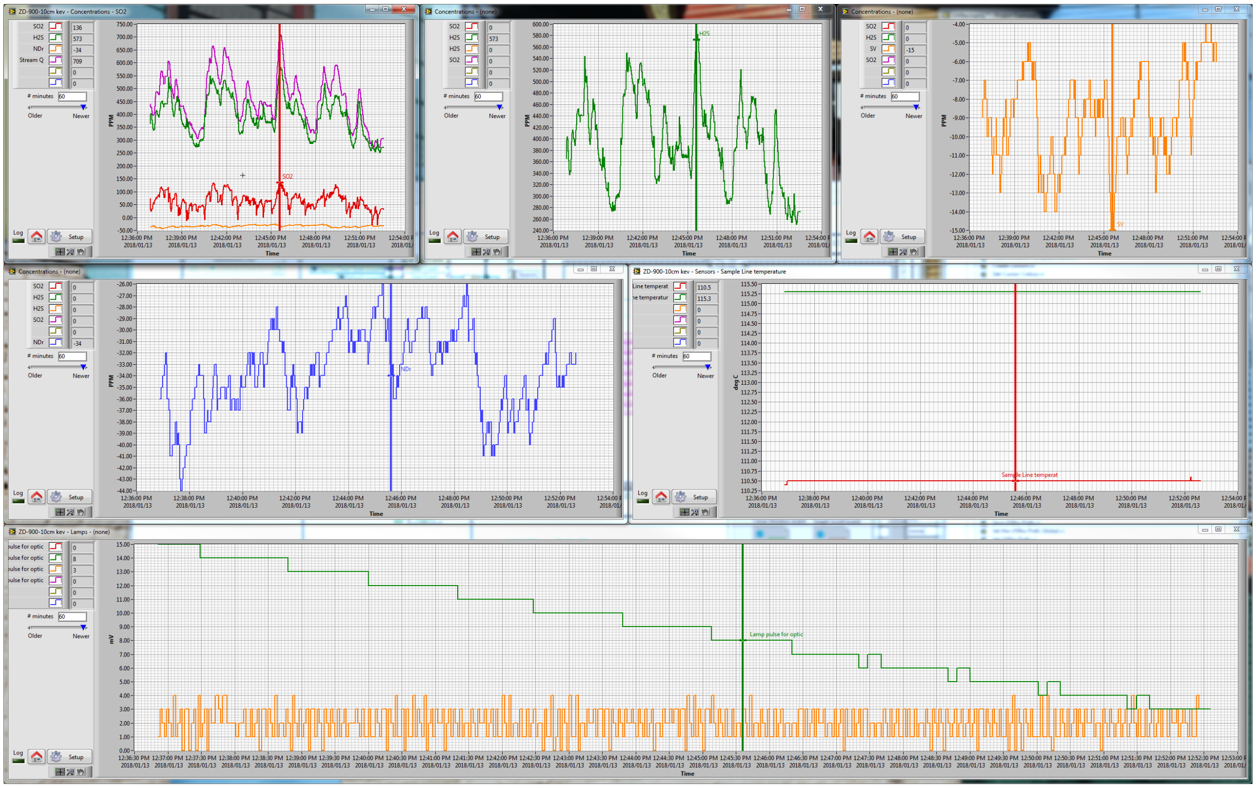


Figure 80 – Click inside any graph to create cursors in every graph at that timestamp

You can drag any of the cursors, and the cursors in all of the other graphs will follow along. As you drag, the live values area in every window shows the values at the cursor location. Note that you have to release the mouse button, and then click again, to “grab” the cursor.

The Graph Palette

The Graph Palette has three main controls, which determine what the cursor does:

The active control is “depressed”.

The first tool is for moving cursors around the graph.

The second tool lets you refine what’s displayed on the graph. It has a fly-out menu containing selection tools:

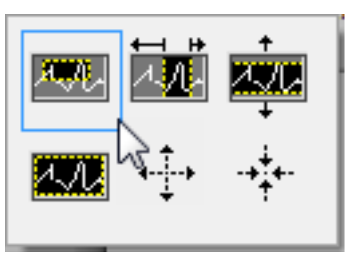


Figure 81 – Graph Selection Tools

- The marquee tool lets you draw a rectangle around an area of interest in the graph. When you release the mouse button, the graph is redrawn to fit your selection. X-axis and Y-axis auto-scaling are turned off.

- The second tool lets you pick a time range. X-axis auto-scaling is turned off. If you selected time-axis synchronization, the other graphs are updated to show the same time range.
- The third tool lets you select a Y-axis range. Y-axis auto-scaling is turned off.
- The fourth tool resets the zoom to its original values.
- The fifth tool zooms in around the cursor, and the sixth tool zooms out.

To turn auto-scaling back on, you can right-click on the time axis, and select *Autoscale X,* or right click on the Y-axis, and select *Autoscale Y.*

Graph Annotations

You can also add annotations to a graph. Right-click at a point of interest, and select “Add Annotation”:

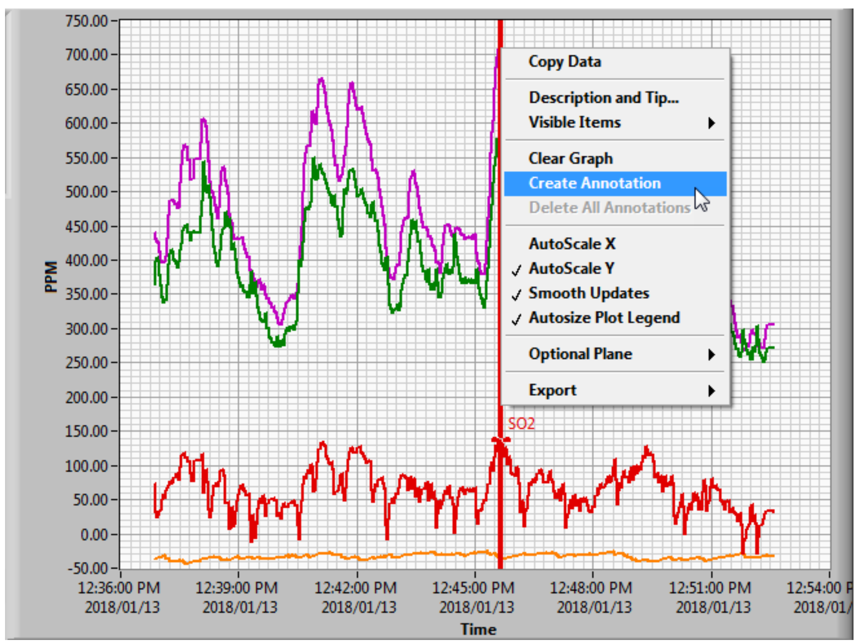
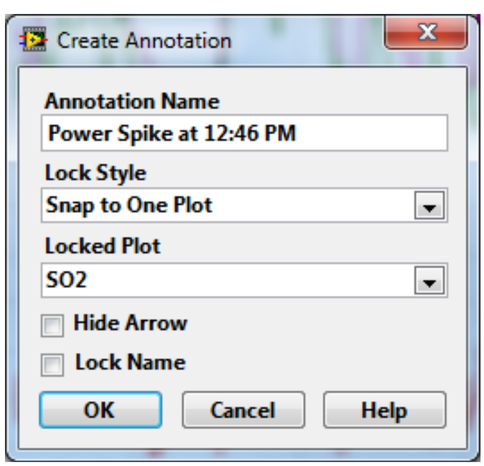
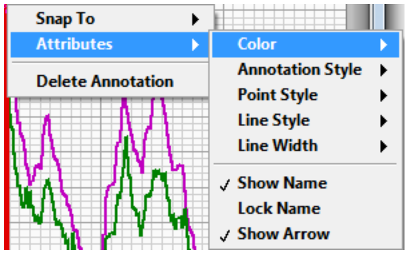


Figure 82 - Annotating a graph



If you right-click the origin of the annotation, you can change the colour and other features of the annotation:



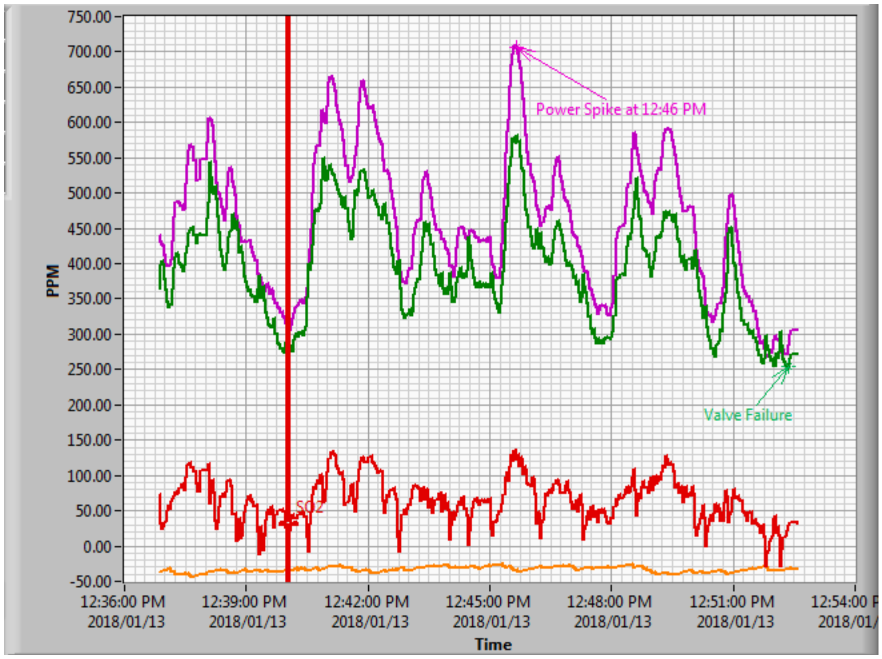
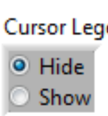


Figure 83 – A graph with annotations



If you display the Cursor Legend, a number of additional controls become visible:

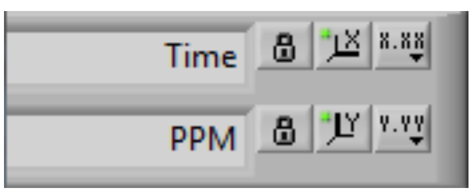
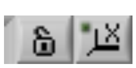


Figure 84 – Changing an axis name

For each axis, you can change the axis name. The lock icon is “locked” when the axis is being auto-scaled, and a little green “LED” is displayed on the icon to the right:

 Autoscale on

 Autoscale off

The effect is the same as right-clicking on an axis and checking or unchecking Autoscale.

The right-most icon lets you specify more axis options:

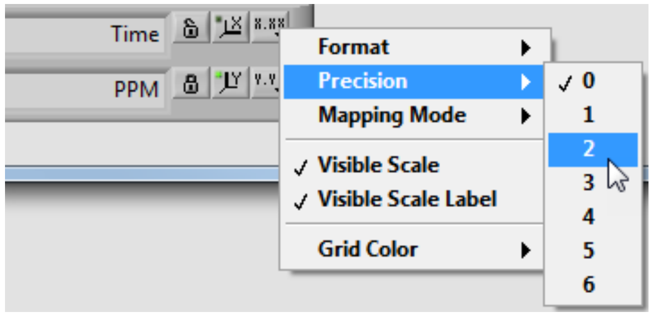


Figure 85 – Customizing a graph axis

The default Y-axis precision is the display precision of the first variable that you are charting. It's the display precision in the Modbus register map (you can modify it to suit your needs).

You can add additional cursors by right-clicking inside the cursor legend:

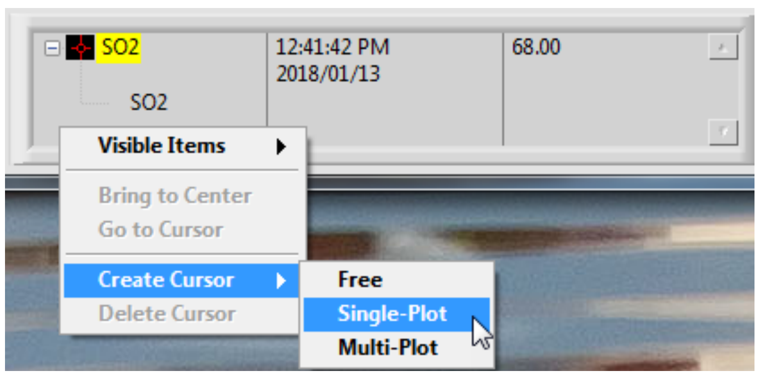
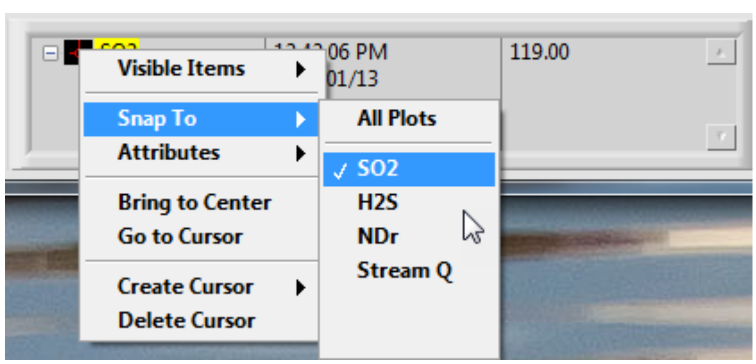


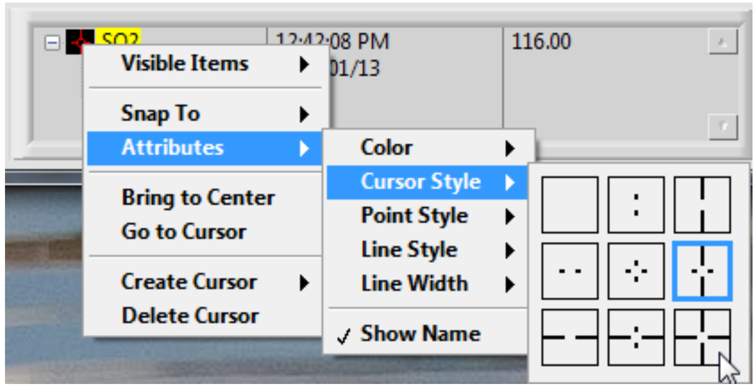
Figure 86 – Adding cursors to a graph

For Single-Plot cursors, you can specify which plot the cursor will snap to. This is the kind of cursor that is automatically created when you click inside the graph frame.

You can also right-click an existing cursor, and configure it to follow a specific plot:



You can also configure many aspects of the cursor's appearance:

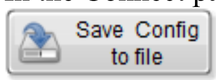

SO2
12:42:08 PM
01/13
116.00
Visible Items
Snap To
Attributes
Bring to Center
Go to Cursor
Create Cursor
Delete Cursor
Color
Cursor Style
Point Style
Line Style
Line Width
Show Name

4 Offline (demo) Mode

You can use the Configurator without being connected to an analyzer. To do so, you'll need a configuration file for the specific analyzer that you wish to simulate.

The easiest way to do this is to connect to a working analyzer with the same configuration that you wish to simulate while offline, and save the configuration to a spreadsheet-format text file.

In the Connect panel, click:

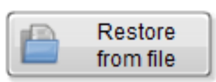


and save the configuration file with a name that describes the configuration. This configuration file contains the current value of every Modbus register in the attached analyzer.

Offline mode

Now you can use the Configurator offline. Start the Configurator, and select "Offline" from the Modbus Connection menu:

Next, click:



and select the configuration file that you created while you were online.

At this point, you can view any of the panels. You can change values and they will be remembered the next time you want to view that data element. You can even initiate actions, such as calibration, but they will not complete successfully, because offline mode does not attempt to simulate the response you would get from a live analyzer.

Preparing for Offline Charts

Before using charts offline, it's necessary to collect information over a period of time, so that there will be something to graph when you are offline.

Start by going to the Logging panel, and selecting the signals that you wish to acquire. Here, we suggest that you acquire all of the available signals every second:

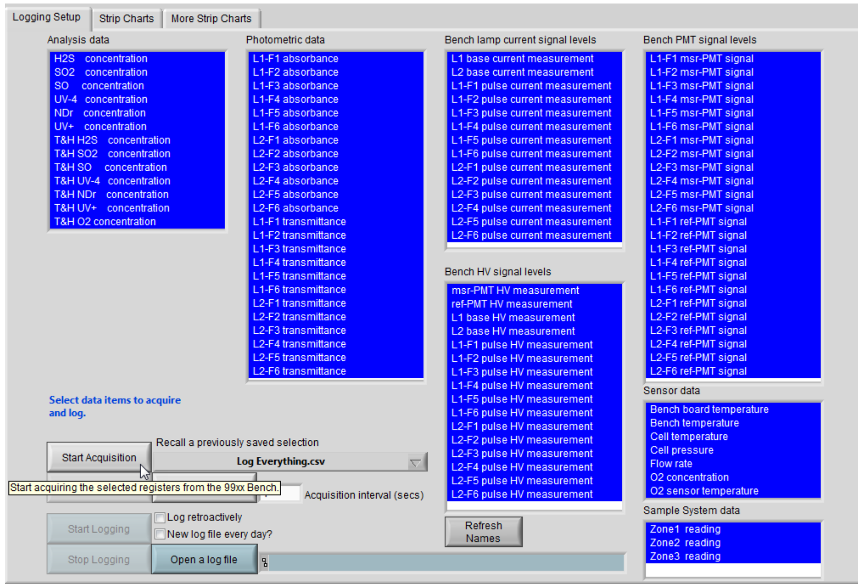
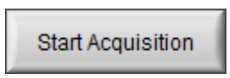
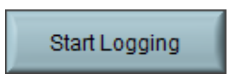


Figure 87 – Deciding which signals to acquire and log

Start acquisition:



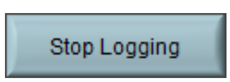
and then start logging:



Save the log file with a suitable name. The name you pick will be prefixed by the serial number of the analyzer that you are connected to.

We suggest that you collect several hours of information. If you wish to demonstrate or analyze interesting events, it should prove helpful to create those conditions while you are logging.

Click “Stop Logging” when you have logged enough information:



Offline Charts

While you are in offline mode, you can select the Logging panel, and open the log file that you saved in the previous step:

Now you can navigate to the “Strip Charts” tab or the “More Strip Charts” tab. You can select any combination of signals that you would like to chart, and you can restore a saved charting windows set.

All of the charting function described in the *Data Logging and Charting* chapter on page 4-3-7 can be used. The time axis will be the time that each data point was collected.

REVIEW DRAFT

You can pan and zoom the graphs, synchronize the time axis, drag the time axis synchronization cursor around, and graph whatever you wish (provided that it was acquired and logged while the analyzer was online).

Uses for offline mode

Offline mode can be useful for diagnosing issues at a remote site. To do this, create an appropriate configuration file and logging file, and send them to domain experts for evaluation.

Offline mode may also be useful as a sales tool.

It is not strictly necessary to use the Configurator to create configuration and logging files. If data has been collected in some other way, it can be formatted as a spreadsheet file in the required format (it’s almost certainly easiest to start with a logging file that was created by the Configurator, and then change the contents of the data columns and timestamp column so that they contain the data of interest).

5 Web Server

The analyzer's HMI unit can be used to configure the analyzer without using the Configurator.

The HMI unit also includes a web server that serves read-only versions of all of the Configurator's screens.

Getting Started

You can connect to the 99xx analyzer using any standard web browser. Make sure that the analyzer is reachable from your browser, and enter its IP address in the web address bar.

You should see the Home screen:

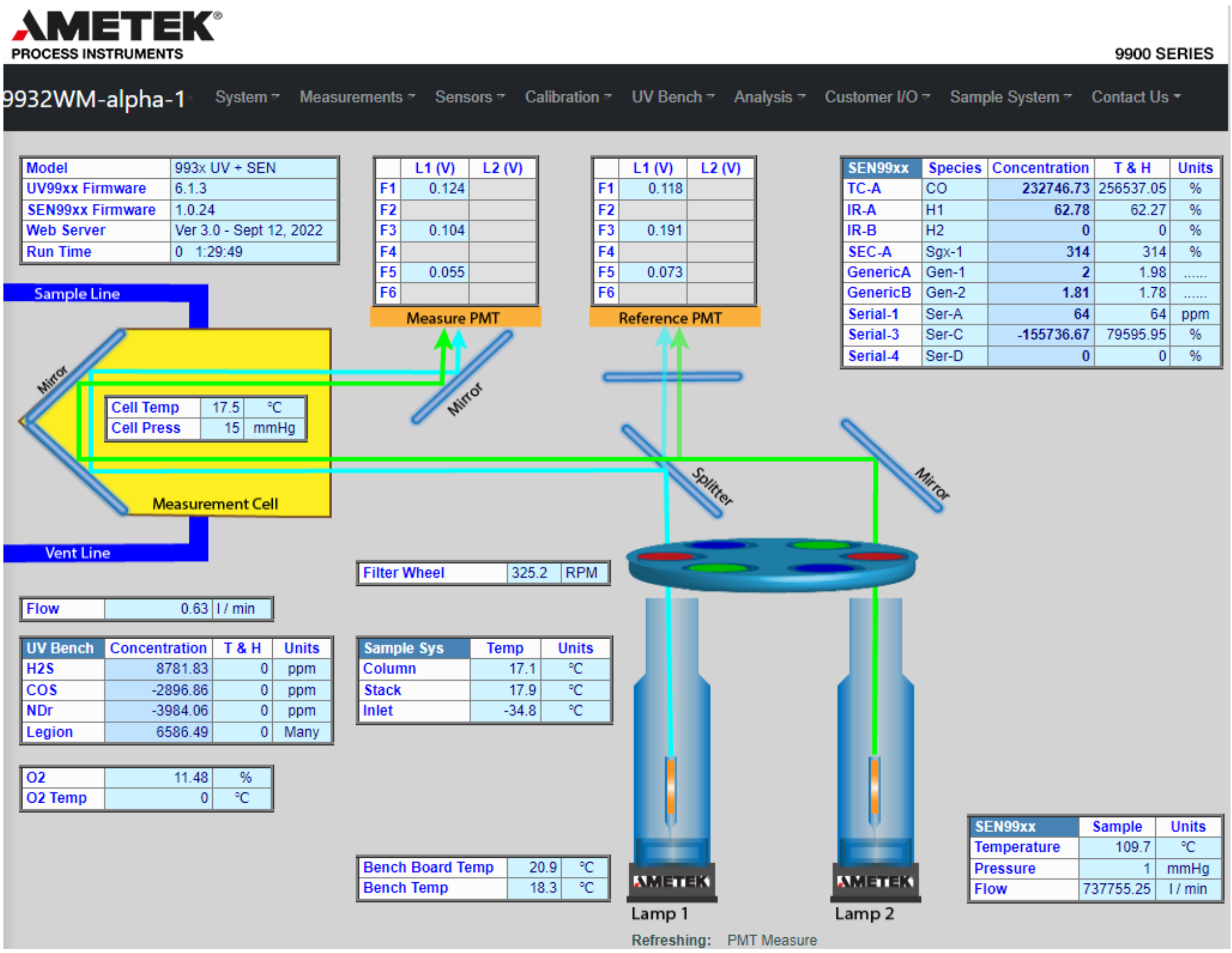


Figure 88 – The Web Home Screen

Finding the IP Address

In case you do not know the IP address of your analyzer, here's how to find it:

1. Tap the upper right-hand corner of the HMI screen, and then tap the lower left-hand corner within one second. If you've done this correctly, a system menu bar will appear at the bottom of the screen.
2. Tap the *Offline* button.
3. Tap the *Main Unit* button near the top of the display.
4. Tap the *Ethernet* button.
5. Make a note of the IP Address.

Navigating

Use the drop-down menu bar near the top of the window to select webpages to display:

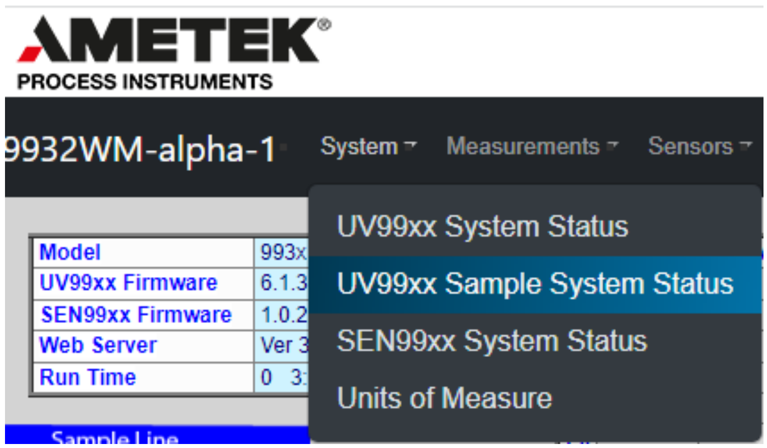


Figure 89 – The Web server navigation bar

The navigation bar is almost exactly the same as the menu bar in the configurator. To get back to the home screen, just click the serial number at the left of the navigation bar.

The webpages look very similar to the Configurator screens, so they are not reproduced here.

Because the webpages are display-only, most of the table cells have a light blue background, indicating that they are live values.

The appearance of the pages adapts to the configuration of the analyzer, and the navigation bar only shows options that apply to the analyzer that your browser is connected to. When you first connect, it will take a few seconds to get the analyzer configuration and create the navigation bar.

HMI vs. UV99xx and SEN99xx

The webserver is part of the analyzer's HMI (front panel display), which polls the UV Bench and the SEN boards via Modbus. Some

Modbus registers, such as analysis results, are updated every two seconds, so the HMI is never more than two seconds out of date.

However, some registers are considered to be less volatile, and are only updated when the analyzer is powered up, or when an HMI page requests values from the UV Bench or the SEN board. This means that the Configurator can update these values, but the web page will continue to have old values, until the front panel screen associated with those values is requested.

So, if you see a discrepancy between the Configurator screens and the web pages, this is usually the reason. You can update the web pages by requesting the front panel display for the values in question, which forces the HMI to poll the UV Bench or the SEN board.

Appendix I – Installing the Software

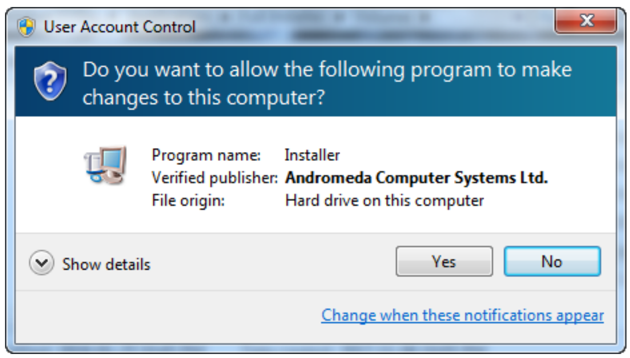
The 99xx Configurator software was developed using the National Instruments LabVIEW platform. When you run the full installer, the configurator software and its data files are installed, along with a LabVIEW run-time engine.

Once the initial installation has been done, a local administrator can usually simply replace the executable file 99xx.exe in {Program Files (x86)}\Ametek\99xx.

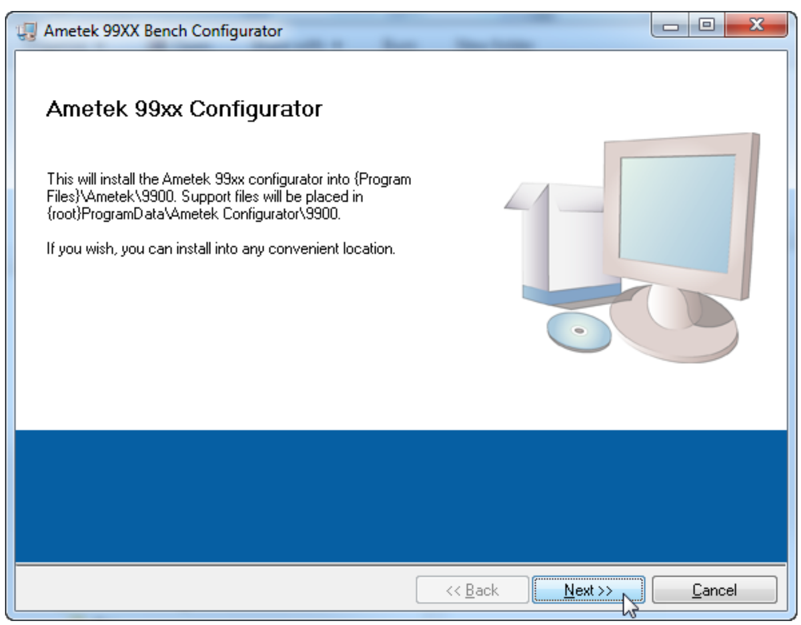
A Full Install

The full installer is normally in a directory named “Ametek 99xx Full Installer”. Open this folder, and then open the “Volume” subfolder. From there, run “setup.exe”.

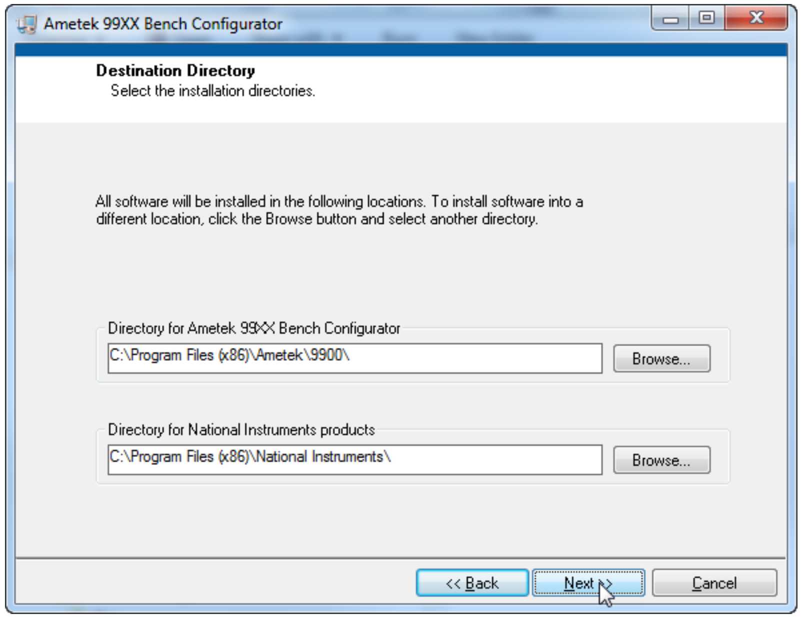
Windows will ask for permission to run the installer:



With your permission, the installer will launch:



You can install the software in any convenient location, but unless you have a specific need to install it in a particular location, we suggest that you use the default locations.



However, if security considerations prevent you from installing into the suggested locations, you can install the configurator software elsewhere. You will still need local administrator privileges to install the LabVIEW run-time engine, but the configurator software can be run from any location.

The data files can be installed anywhere, but you'll need to update your preferences to point to them.

The installer will place shortcuts on the computer all-users desktop, and in the all-users Start menu.

File Locations

The following files are installed along with the configurator software (not including the LabVIEW run-time files):

```
Program Files (x86)
     \Ametek
         \99xx
             99xx.exe
             99xx.ini
             99xx.aliases

{Root}
     \Ametek Configurator
         \99XX
             Test Logs
```
This is where data logs are stored.
```
                 Alarms
                 Messages
             Saved Configurations
```
Contains undo files, and any saved analyzer configurations (names and values of all Modbus registers).
```
             Logging Selections
```

Saves sets of variables to be acquired and logged.

`Chart Window Configurations`

Saves locations and characteristics of sets of charting windows.

`Alarm Settings`

Contains sets of alarm limits.

`Dashboards`

`Saved dashboard.csv`

Saves the dashboard settings.

`Saved connection.csv`

Remembers your last connection.

`{Root}`

`\ProgramData`

`\Ametek Configurator`

`\99xx`

`9900 Register Map.csv`

Defines the Modbus register map, units of measure, scaling factors, etc. See Appendix II for more information.

`992x Register Map.csv`

Used for analyzers that contain a SEN board for models in the 992x series.

`993x Register Map.csv`

Used for analyzers that contain a SEN board for models in the 993x series.

`ModelID Register Map.csv`

Lets the Configurator know which register maps to load..

`99XX Prefs.dat`

Stores the contents of the Preferences window (file locations, communication settings, etc.).

`Ametek 99xx Configuration Report.dotx`

A Microsoft Word template for the configuration report

99xx Configurator User's Guide, Sept 2022.pdf

This Guide

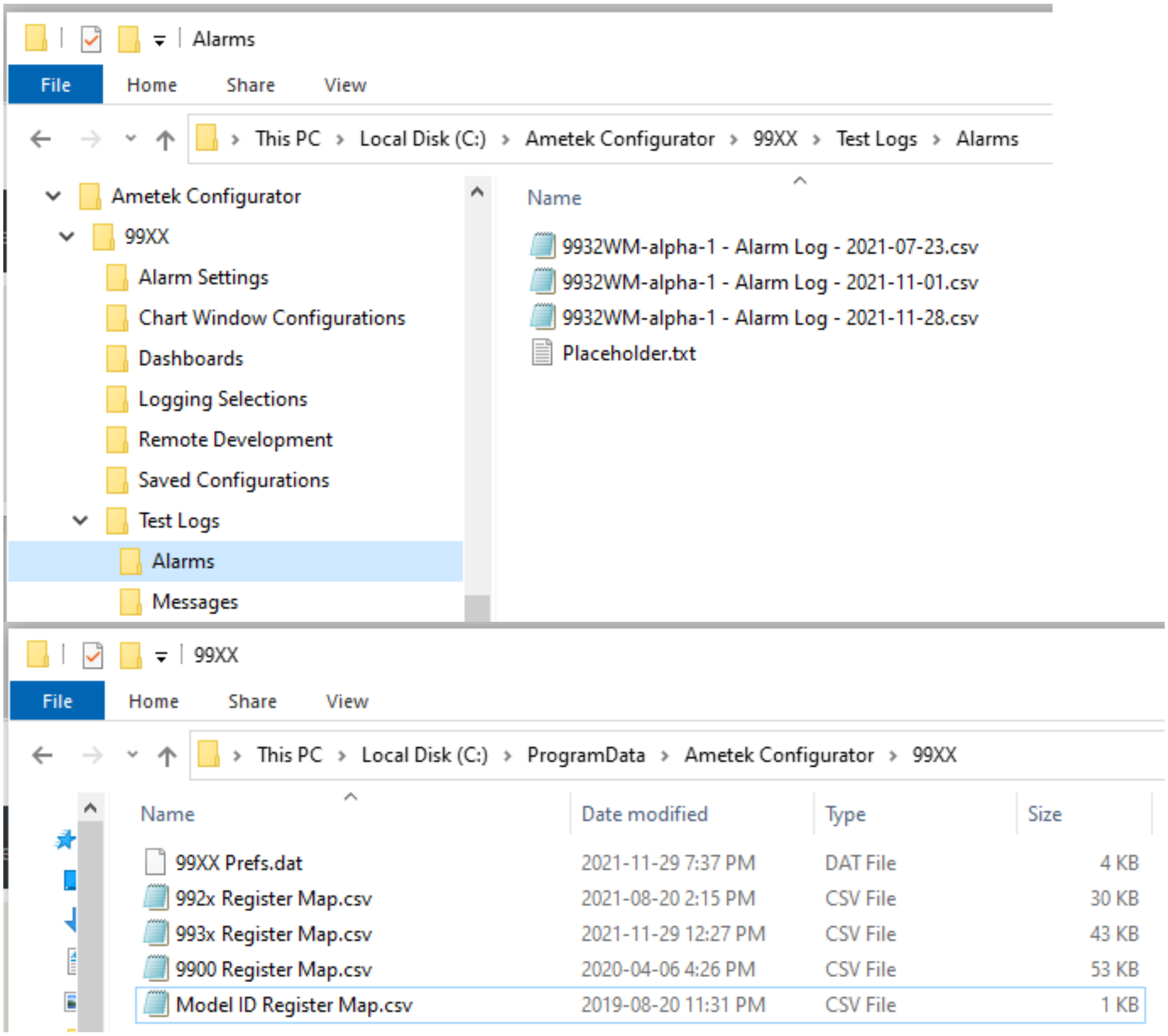


Figure 90– Data files and directories created by the installer

Appendix II – The Modbus Register Maps

The Modbus register map files contains the register numbers available in the 99xx analyzers, along with information about scaling factors and units of measure.

For detailed information about the Modbus registers used by the analyzer, please refer to document *Serial Communications Interface (Modbus) Manual Supplement* – PN 903-8652, and the corresponding documents for the SEN 99xx analyzers.

The Modbus register maps are normally installed in:

C:\ProgramData\Ametek Configurator\99xx\Model ID Register Map.csv
C:\ProgramData\Ametek Configurator\99xx\9900 Register map.csv
C:\ProgramData\Ametek Configurator\99xx\992x Register map.csv
C:\ProgramData\Ametek Configurator\99xx\993x Register map.csv

The first of these contains information about the registers that are read to determine the model ID of an analyzer. The other register maps are specific to a UV Bench or SEN analyzer configuration.

Spreadsheet columns

9900 Register Map.csv

	A	B	C	D	E	F	G	H	I	J
1	Version	2								
2										
3	Register Number	Register Name	Short Name	Unit Name	Type Nam	# Bytes	# Registers	Access Level	Saved Value	Dash
4	1	Species1 concentration	Species1	*	FLOAT	4	2	RO		Yes
5	3	Species2 concentration	Species2	*	FLOAT	4	2	RO		Yes
6	5	Species3 concentration	Species3	*	FLOAT	4	2	RO		Yes
7	7	Species4 concentration	Species4	*	FLOAT	4	2	RO		Yes
8	9	Species5 concentration	Species5	*	FLOAT	4	2	RO		Yes
9	11	Species6 concentration	Species6	*	FLOAT	4	2	RO		Yes
10	13	Species7 concentration	Species7	*	FLOAT	4	2	RO		Yes
11	15	Species8 concentration	Species8	*	FLOAT	4	2	RO		Yes
12	17	Aggregated UV result	Aggregated	*	FLOAT	4	2	RO		Yes
13	19	L1-F1 absorbance	L1-F1 abs	-	FLOAT	4	2	RO		No
14	21	L1-F2 absorbance	L1-F2 abs	-	FLOAT	4	2	RO		No

By column, the spreadsheet contains:

Register Number
: The Modbus register number, using standard 1-based numbering (ie: the convention used by most Modbus utilities).

Register Name
: The name of the Modbus register. When these register names are displayed by the configurator, the text “Species*n*” is replaced with the species name currently configured in the analyzer (where *n* is the species number).

Don’t change any of the names in this column, as the configurator requires these exact names.

Short Name

In most cases, the short name is what you see in the configurator screens. You can change the short names to suit your preferences. Again, the text "Species*n*" is replaced by the species name for species 1..8 (the species names are contained in Modbus registers 593-617).

Unit Name

The Si Unit of Measure. Allowable units are:

- %	(percent)
- %%	(forces percentage, regardless of the % vs. ppm setting)
- ppm	(parts per million)
- sec	(seconds)
- deg C	(degrees Celsius)
- mm H2O	(mm of water, gage)
- mm Hg)	(mm of mercury, gage)
- RPM	(revolutions per minute)
- mV	(millivolt)
- mA	(milliamp)
- Varies	Depends on the analyzer configuration Change to your particular units of measure.

Data Type

The storage convention used by the analyzer. Do not change the values in this column.

Bytes

The number of bytes used to store the value. Do not change the values in this column.

Registers

The number of sequential Modbus registers used to store the value. Do not change the values in this column.

Access Level

Shows whether the register is read-only, write-only, or read-write. You cannot force a read-only register to be writable by changing this value, as read-only access is enforced by the analyzer.

Saved Value

When you save an analyzer configuration, the saved data file has the same format as the Modbus register file (this file). This column is used to store the saved values. The values are strings, and can contain decimal places to represent floating point numbers.

You can edit these values if you wish to set an analyzer to specific register values.

Dash

This column contains the word "Yes" for variables that can be displayed in the Dashboard section of the main screen. These can be changed to suit your preferences. The short name of every register containing "Yes" in this column is added to the pop-up menus in the dashboard.

Category

The category is for information only, and shows in general terms what the register is used for.

Logging Group

This is the logging / graphing group name. If you do not wish to be able to log or graph a particular variable, you can blank out the logging group name. You can also move a register from one logging group to another, but this may cause the register selection screen to run out of space for the new logging group (this isn't harmful, but may make it difficult to select the variables you wish to acquire).

Decimal Places

This specifies the displayed decimal precision of the variable.

Appendix III – Preferences

You can specify communication settings, set the locations where tests are to be logged, and a variety of other settings by clicking the "Prefs" button in the main window:

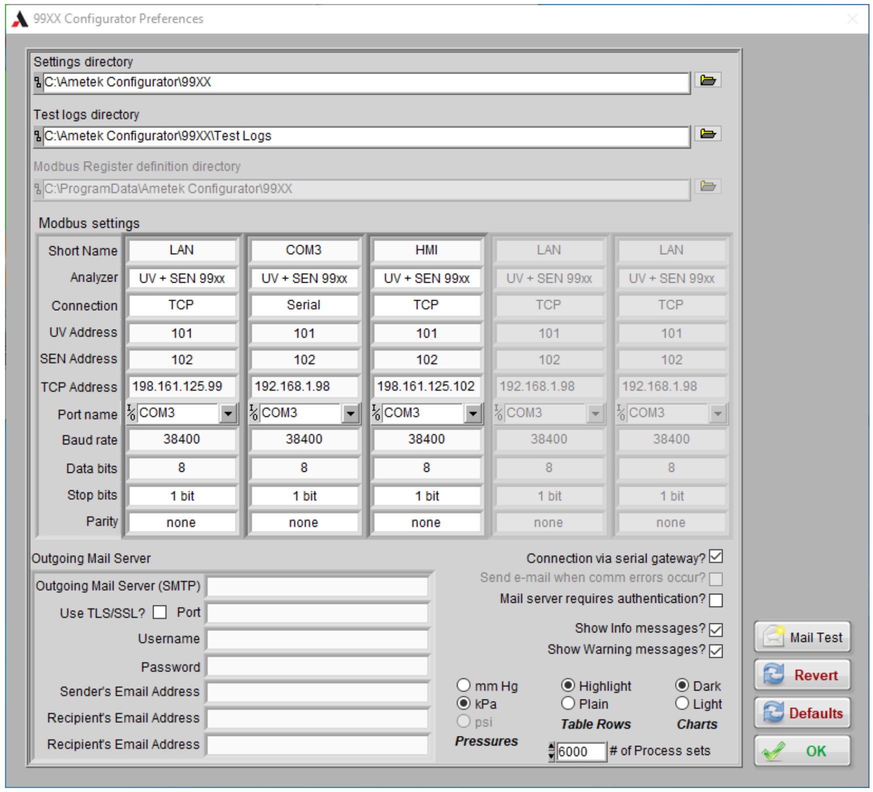
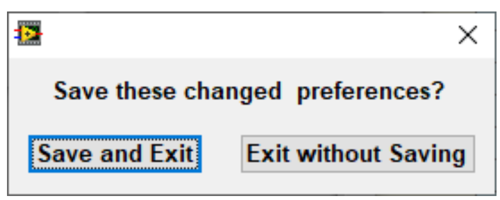


Figure 91 – The Preferences Window

This window will float above any other windows until you click "OK", and will be hidden if you switch to another application.

If you have made changes, you will be prompted to save them:



In most cases, the directory settings at the top of the window should be fine as they are. If you wish to use different locations, you can either type them in, or click the little folder icon to browse to the location where you want to store the files.

Microsoft has historically recommended that files that are to be shared by different computer users should be placed in the

"ProgamData" folder in the root of the boot volume. However, Microsoft now hides this directory by default, so you may wish to use a different location. By default, the installer will suggest a directory named "\Ametek Configurator\99xx" located at the root level of your boot volume.

The installer creates several subdirectories inside the settings directory. If you decide to change the location of the settings directory after installing the software, you should create the following subdirectories inside your new directory:

Alarm Settings
Chart Window Configurations
Dashboards
Logging Selections
Saved Configurations
Test Logs
Test Logs \Alarms
Test Logs \Messages

The user preferences are stored in {root}\ProgramData, as are the Modbus register maps. Subdirectories are also created to hold settings and test logs, in the event that your organization wishes to store them in{root}\ProgramData. If so, you simply need to change your preferences to point to that location.

Communication Settings

Most of the time, you'll use the Preferences window to set up communication settings. You can have several of these, each of which appears in the pop-up menu in the connection window:

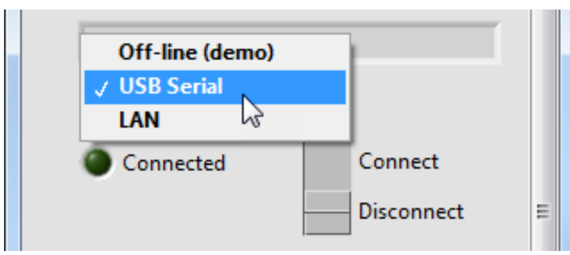


Figure 92 – Picking a communications port

For each communications port you give it a name, and the Modbus node address of your analyzer:

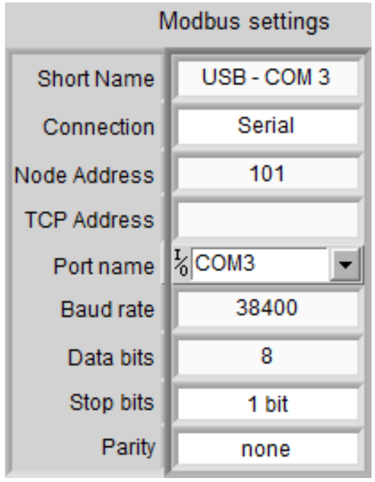


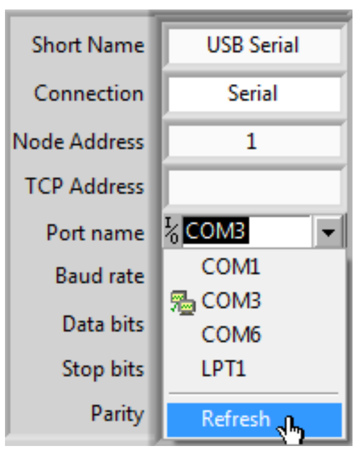
Figure 93 – Communications settings

You can create more communications settings by clicking in the grey area to the right of the last one:

Serial Modbus

In Figure 93 above, this port will be named “USB – COM 3”. It’s a serial port, and the Modbus address is 1. You should create names that are meaningful for you – these are the names that appear in the pop-up menu in Figure 93 – Communications settings. For example, you could name the connections using the serial number, or the function of specific analyzers, if that is useful in your environment.

If you’re not sure which serial ports are available, you can pull down the Port name menu, and select “Refresh…”:



This will cause the list of available com ports to be refreshed.

The serial settings for a 99xx analyzer should normally be:

38400 baud
8 data bits
1 stop bit

no parity

If you have difficulty connecting to an analyzer, you may wish to use the analyzer's HMI to confirm that the analyzer is using the same communications settings. You can't change the analyzer's serial port settings using the Configurator – you must use the analyzer's HMI to do that:

From the analyzer's *HOME* screen press the *Config* button to view the Configuration sub-menu. Press the *UV Bench Modbus* button to view the *UV Bench Modbus Communication screen*:

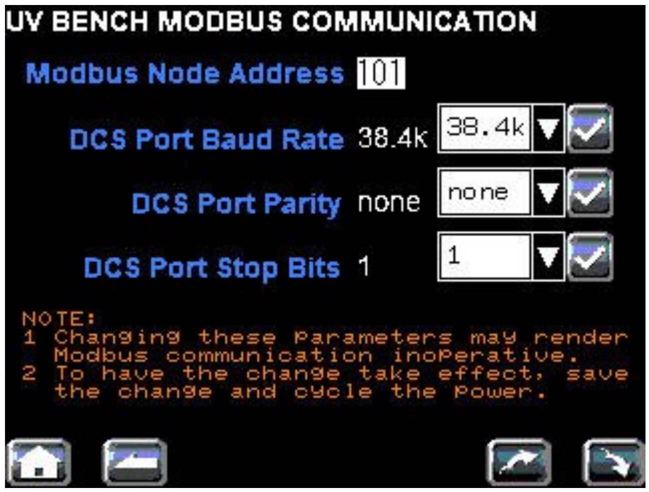
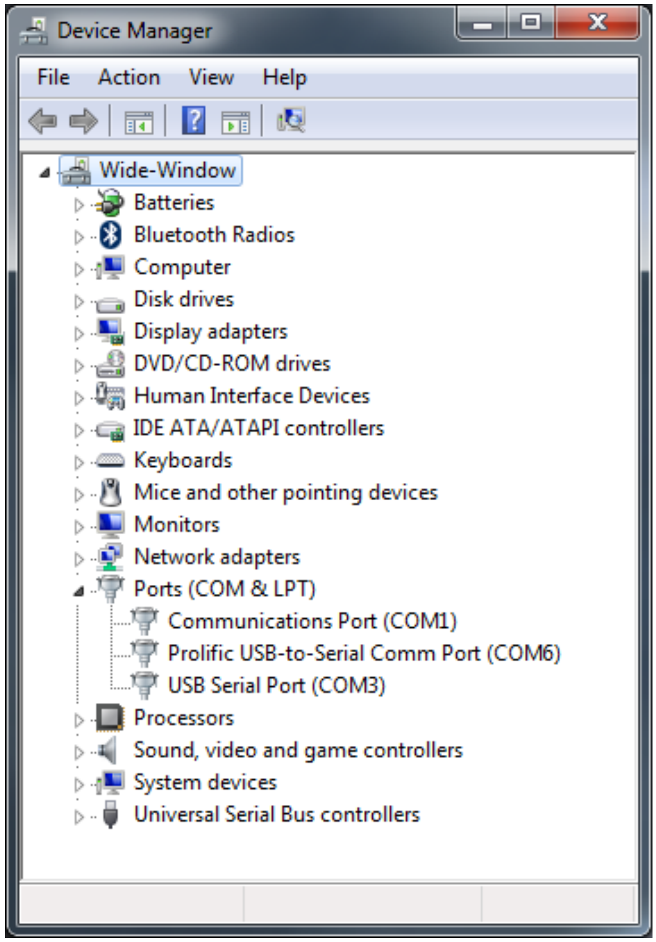


Figure 94 – Communications settings in the analyzer's HMI

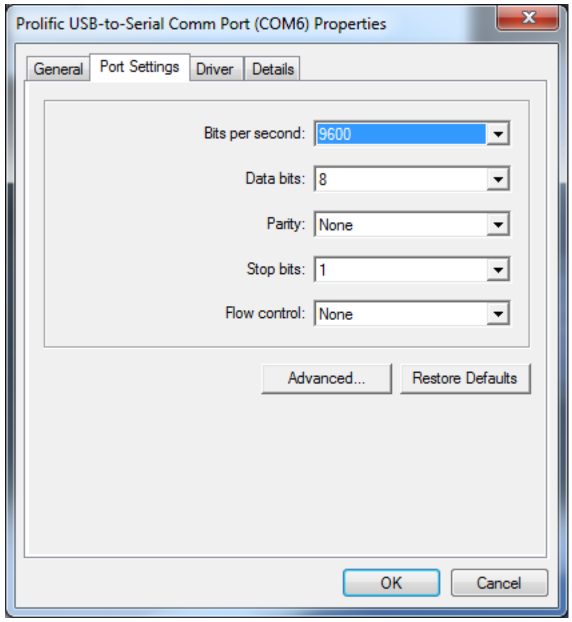
> *If you are unsure of the Modbus address assigned to the analyzer, you can enter 255 in the Node Address field. Every connected analyzer will reply to this "broadcast address".*

If you are using USB serial port adapters, you can configure the port name from the Windows Device Manager:

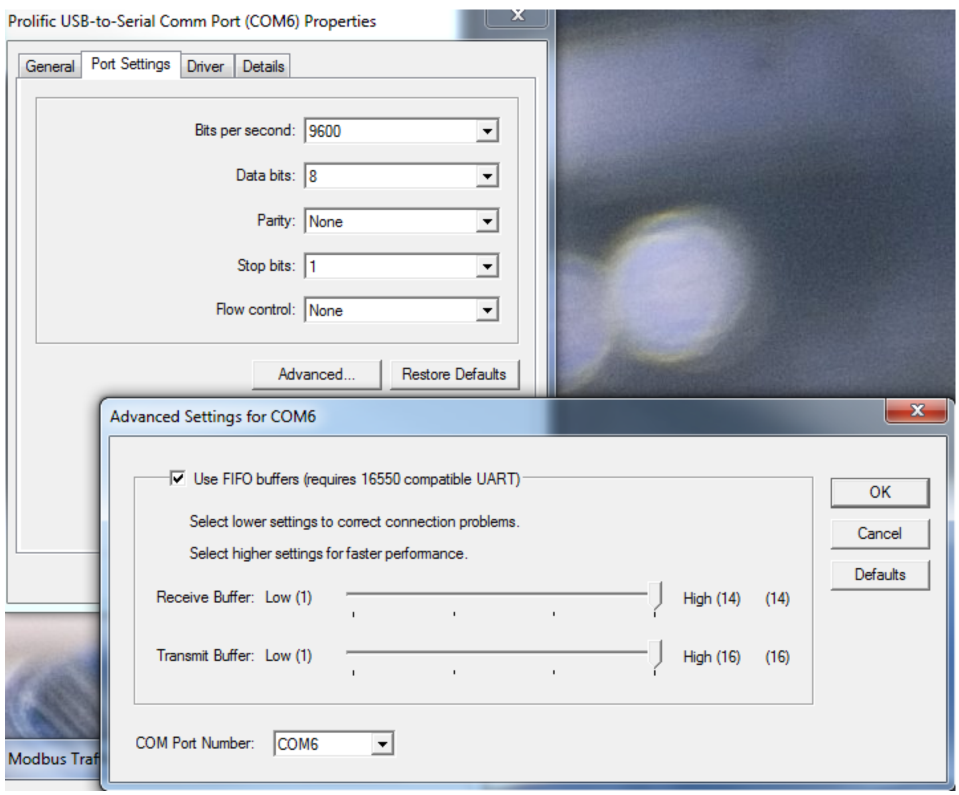


If you expand the Ports list, you can see which ports are currently configured (note that COM1 is reserved, and can't be used by the

Configurator). You can right-click on a port, and set its properties, including the Com port name:



The setting here are unimportant, as the Configurator will set them. Click “Advanced…”, to change the port name:



Connection via serial gateway? ☐

If you select “Connection via Serial Gateway?”, Modbus communication will use timeout values and retry values that work best if your serial connection is to a Moxa gateway installed in the analyzer chassis.

If you have a 9900RM, and your analyzer does not include this gateway, you should leave this box unchecked.

Modbus/TCP

If you are using Modbus/TCP, you will normally be connected to a Modbus/TCP gateway such as an MGate MB3270. The manufacturer provides a utility that allows you to configure settings such as the IP address:

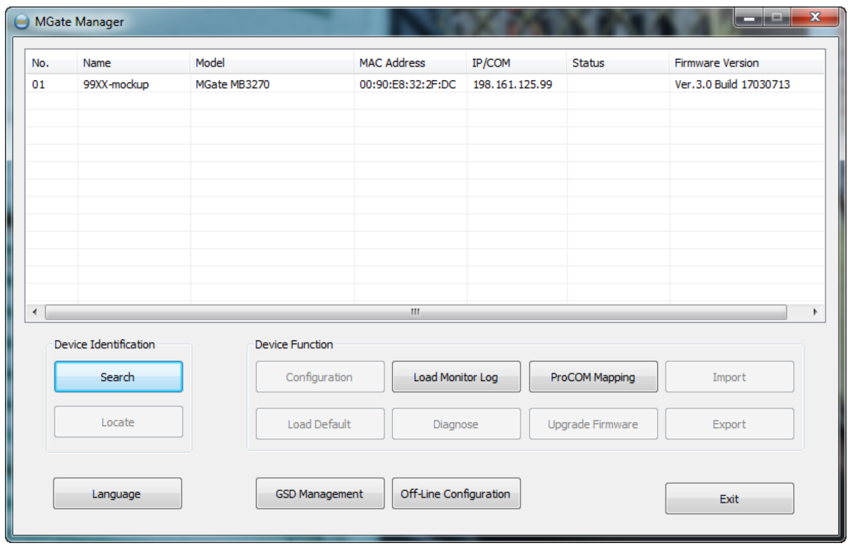


Figure 95 – The MGate Manager

Adding a new connection

To add a new communication setting, click in the first greyed-out column:

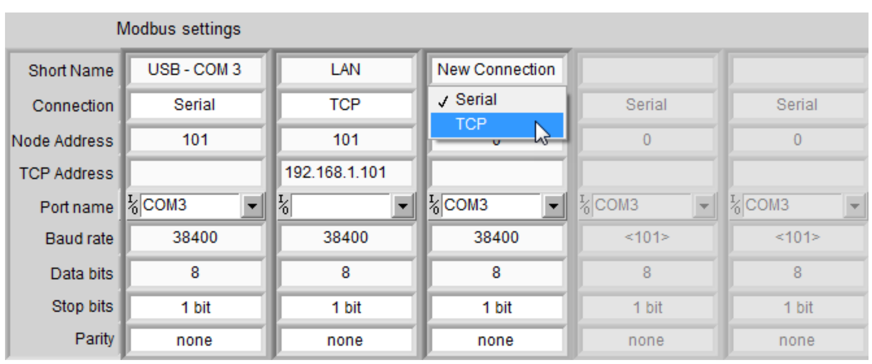


Figure 96 – Adding a new communication settings

To remove one, right-click on the one you wish to remove, and select "Delete Element":

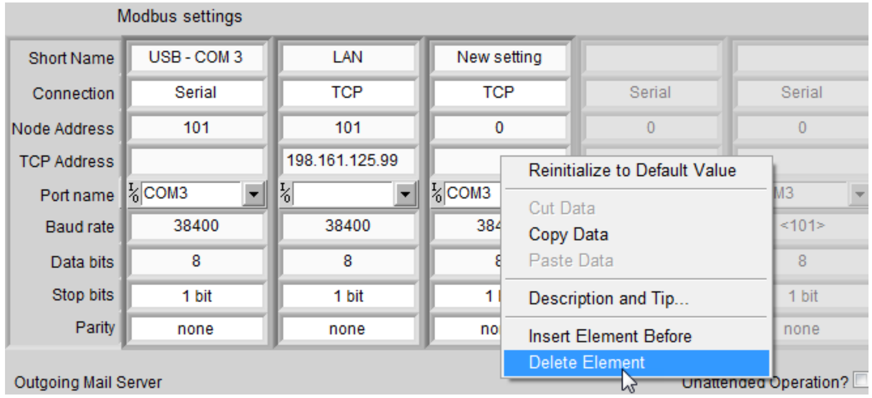


Figure 97 – Removing a communication setting

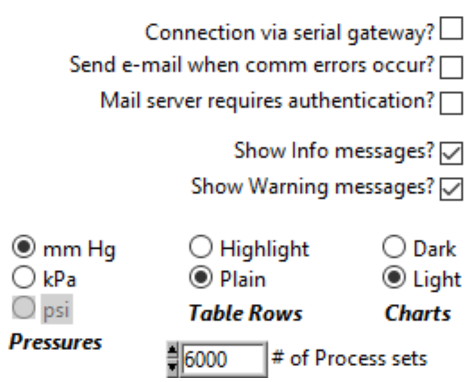
Similarly, you can add a communication setting between two existing settings by right-clicking and selecting "Insert Element Before".

Email Alerts

The e-mail section of the Preferences window allows an automated e-mail to be sent in the event that the data logging task fails.

To use it, you will need access to an SMTP server, and appropriate credentials on the server. You can optionally use TLS/SSL (which uses a secure link layer in the ISO protocol stack).

Other Preferences



You can display pressures in either mm-Hg, or kPa. Note that if you have an optional Customer I/O board installed, the scale range for

Analog Outputs, and the alarm range for Process Alarms are displayed and set in your preferred unit of measure.