SIEMENS

Maxum, MicroSAM

PD PA AP
Gas Chromatograph Portal

Reference Manual

Using the Gas Chromatograph Portal software to control networked analyzers and other devices, and to gather and analyze data.

10/2019
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Legal information

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1.1 Introduction

The Gas Chromatograph Portal workstation software allows a user to communicate with and control various Siemens devices, including the Maxum and MicroSAM gas chromatographs, the Advance Network Access Unit, and some legacy devices such as the Optichrom Advance Plus. The information in this manual can help familiarize the user with the basic operation and navigation within the Gas Chromatograph Portal software.

1.2 Overview of Maxum User Interfaces

Maxum has two types of user interface as shown in the figure below. These two interfaces have two different levels of capabilites.

The first user interface is the built-in touchscreen panel, also called the human-machine interface (HMI). The HMI addresses the analyzer "immediately" and in real time. It is intended for routine field maintenance, including:

- calibration and validation
- checking status and alarms
- viewing current measurements and results

If a user makes a change with the maintenance panel, it is immediately implemented in the analyzer.

The maintenance panel does not perform all possible functions. For example, if a user wants to make a significant change to the analyzer set up, configuration, hardware or application programming, the second user interface is necessary, the workstation software which runs on a personal computer.

1.3 Workstation Introduction

The Gas Chromatograph Portal (GCP) software that runs on the PC enables the user to do three things:

1. Make large or significant changes to the programming, hardware or application set up of the device.
2. Perform maintenance without stopping the analyzer itself. It is possible to experiment with changes to the method without disturbing the analyzer by downloading a backup of the database and running simulations. For example, if a user wants to change a gating method, they can make changes and test the changes in the memory of the PC. This can be done without waiting for the analyzer to complete a cycle and without disturbing the analyzer.
3. Perform background and utility functions including: data logging; capturing chromatograms in quantity; and backing up the memory of the analyzer itself.

While the GCP user interface is different than the maintenance panel, Siemens also provides an additional special software feature that emulates the HMI on the workstation PC. Therefore, anything that a user can do from the HMI on the analyzer can also be done at the PC.

Two versions of workstation user interface software exist for use with Siemens gas chromatography devices. The original version was a software bundle that included a System Manager program, EZChrom analysis software, and other utilities. The newest version is an integrated software package called Gas Chromatograph Portal, which is the subject of this manual.

The Gas Chromatograph Portal, or GCP, is cross compatible to communicate with any device currently connected to the original System Manager workstation. No changes to the device are necessary. The new GCP software makes the Siemens Gas Chromatographs easier to use and maintain.

The GCP software has two primary parts, a Network View window and an Analyzer View window. The Network View is used to view and manage multiple devices on the network. The Analyzer View window is used to manage and control individual devices.

Software installation 2

2.1 Installation of Gas Chromatography Portal Software

Minimum System Requirements:

- *Operating System:*
  - Windows XP (Service Pack 3 required)
  - Vista (Service Pack 2 required)
  - Windows 7 (Service Pack 1 recommended)
- *System Memory:* Minimum 2 GB of RAM (4GB recommended)
- *Free Hard Disk Space:*
  - 2.5 GB on 64-bit OS versions or 1.5 GB on 32-bit OS version
    Note: This includes possible additional Microsoft support packages. Actual software is less than 500 MB if Microsoft .Net 4.0 is already installed on the computer.
  - In addition: For use of the GCP data logger at least 1 GB of hard disk space per monitored Gas Chromatograph is recommended.
- *Processor:* Minimum 1.8 GHz (2.5 GHz recommended)

Driver Information:

The Windows XP security patch MS11-011 (KB2393802) has a known incompatibility with obsolete drivers for some AMD and Intel graphics chips. This incompatibility might cause a Windows stop error (Blue screen) in conjunction with use of Gas Chromatograph Portal software. Please use latest graphic card drivers to avoid this problem. Detailed information relating to the incompatibility is provided by Microsoft at http://support.microsoft.com/kb/2393802.

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For the safe operation of a plant/machine, however, it is also necessary to integrate the automation components into an overall IT security concept for the entire plant/machine, which corresponds to the state-of-the-art IT technology. You can find information on this at http://www.siemens.com/industrialsecurity. Products used from other manufacturers should also be taken into account here.

Installation:

1. Insert installation disc. The installation menu should open automatically. Select the Gas Chromatograph Portal Setup Wizard from the menu.
2. The Setup Wizard will determine if any additional windows packages are necessary and install them automatically. If system prompts for reboot, then do so before continuing. Otherwise, the GCP installation may not complete properly.
3. After reboot, if required, continue installation, answering prompts from the screen.
4. By default, the Setup Wizard installs all features. However, it is possible to select custom setup of desired features. To select or exclude specific components click the small down-arrow next to the component.

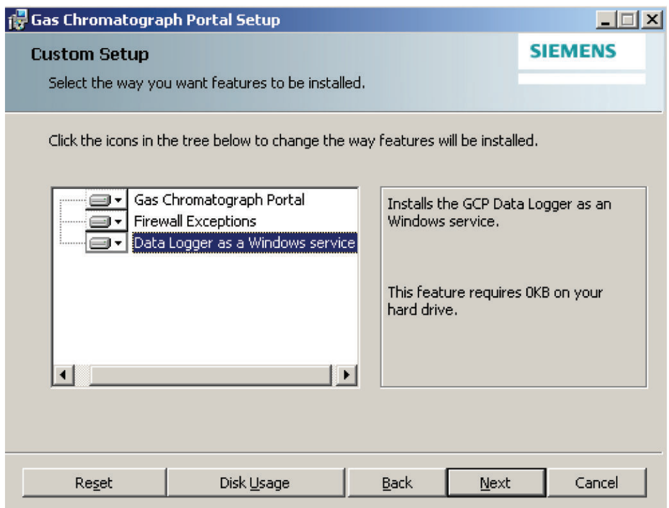


Figure 2-1 GCP Custom Installation

5. After installation, the software may indicate that a reboot is required. If so, then reboot before continuing.
6. The GCP software utilizes parts of the Maxum System Manager file system. For this reason, installation/upgrade of GCP software also requires installation/upgrade of Maxum System Manager software. Select the System Manager installation from the installation menu and follow the instructions to upgrade the software.

Network Window 3

3.1 Introduction to Gas Chromatograph Portal Network View

The Gas Chromatograph Network View is the part of the Gas Chromatograph Portal workstation software that is used to view and manage devices on the network. This window allows the user to perform the following functions:

- Monitor the statuses of devices on the network
- Sort and group the displays of various devices
- Connect to devices by launching the Gas Chromatograph Portal window
- Launch the Human Machine Interface (maintenance panel) emulator for devices
- Upgrade software and operating system files for devices
- Execute backups of devices
- Restore devices from saved backups

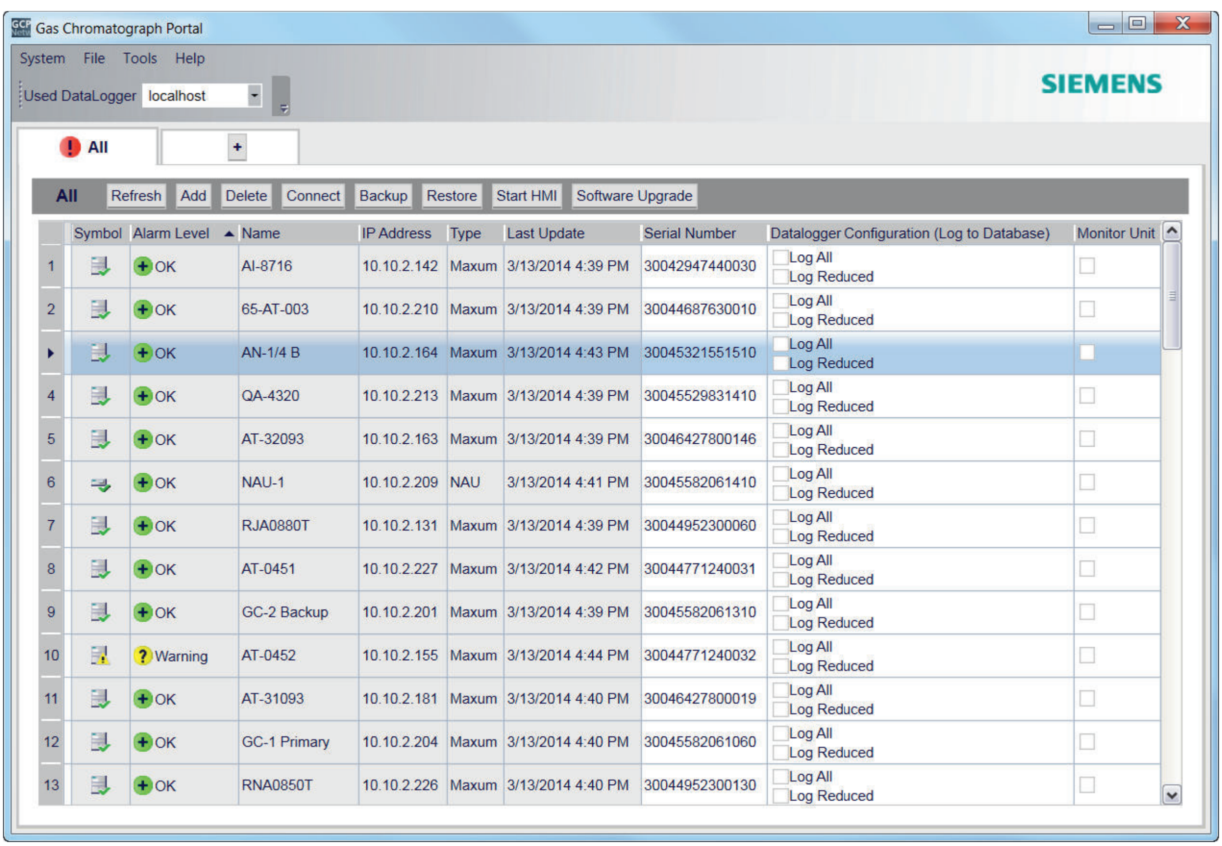


Figure 3-1 Gas Chromatograph Portal Network View

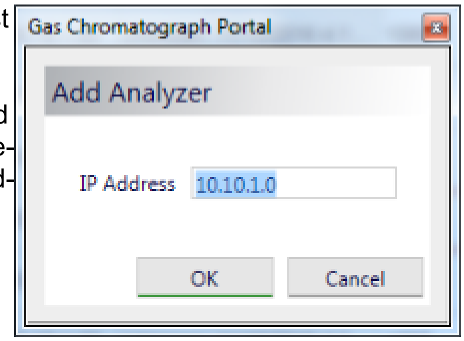
3.2 Action Buttons

The action buttons allow the user to execute the primary functions provided by the Gas Chromatograph Portal Network window.

Refresh Attempts to refresh the status for the selected device.

Add Clicking the Add button in the analyzer list window of the Network Portal allows the user to manually configure the Portal for a new device. Devices can only be added using the device IP address. To add a device, click the Add button, enter the IP address, and then click OK.

The Add button is only available on the "All" group tab.



Add Analyzer Window

Delete Clicking the Delete button manually removes the selected analyzer button from thelist of devices that the Portal recognizes. The Delete button is only available onthe "All" group tab.

Note: There is no confirmation for the Delete operation and the action cannot be undonewithout adding the device again using the Add button. Verify that the correct deviceline is selected before clicking the Delete button.

Connect The Connect button launches the Gas Chromatograph Portal Analyzer Window for theselected device. When connecting, the user is prompted to login using the usernameand password for the device. After logging in, the Analyzer Window will be displayedfor the device. The user authorization level must be at least ‘configure’ as GCPis intended for configuration. See *Connect to an Analyzer* for more detailed information.

Backup The Backup button is used to save the database from the selected device to the harddrive of the GCP computer. To backup, the user enters a file name and then clicks OK. During the backup, the Portal will display a status message window. See the user task instructions for *Backing Up an Analyzer* for more information.

Restore The Restore button is used reload a device from a saved database. This is neededfor certain tasks, such as when a processor board is replaced. To restore, see the user task instructions for *Restoring an Analyzer*.

Note: The Restore operation overwrites any database on the device. Carefully verify that the correct device is selected. Selection of an incorrect device removes that device from service and deletes its database.

Start HMI The "Start HMI" button on the Network Portal window launches the HMI Emulator for the selected device. Online Help for the HMI emulator is integrated into the program. To access HMI help information for an item click on the question mark icon (?) in the upper right corner of the HMI emulator and then click the spot on the screen for which help is desired.

Software Upgrade The Software Upgrade button launches the utility which allows the user to modify the current software version and OS files for a device. The upgrade utility automatically detects the version of software and OS files for the connected device. The user selects the desired version for the connected device, and the utility will determine the components that need to be upgraded. Clicking OK starts the upgrade.For further information, see the user task instructions for *Upgrading an Analyzer*.

Configure View Add and remove devices from the group view. See *Adding/Configuring/Deleting a Group*.

These functions are described in the next sections

3.3 Menu Options

The following options are available from menus at the top of the window:

- System Exit
- File - Open Local Database (with or without scripts enabled)
- File - Close Local Database
- Tools - Start Data Logger Service
- Tools - Import Groups from System Manager
- Help - Launch online help
- Help - About GCP
- Help - License Information

3.4 Analyzer List Window

The device list window seen below allows the user to easily see the basic information and status for each device on the network. This list will populate automatically for any analyzer that broadcasts on the network.

	Symbol	Alarm Level	Name	IP Address	Type	Last Update	Network State
▸		OK	M1217 (Virtual)	127.0.0.1	Maxum	2/27/2012 12:01 AM	Alive
2		OK	OF-??-LT-HRVOC-Flare-CTW	161.218.54.61	Maxum	2/27/2012 12:01 AM	Alive
3		OK	OF-MB-ST-1app_TCD-FID	161.218.54.6	Maxum	2/27/2012 12:01 AM	Alive
4		OK	OF-MB-ST_PulseDO_SYSCON2	161.218.54.22	Maxum	2/27/2012 12:01 AM	Alive
5		OK	LT_Verif&PINa_1App	161.218.54.140	Maxum	2/27/2012 12:01 AM	Alive
6		OK	OF-MB-ST_PulseDO_SYSCON1	161.218.54.131	Maxum	2/27/2012 12:01 AM	Alive
7		OK	OF-MB-ST-TotalSulfur	161.218.54.54	Maxum	2/27/2012 12:01 AM	Alive
8		OK	HT-2appTCD-FPD-FuelGasAnalyzer	161.218.54.139	Maxum	2/27/2012 12:01 AM	Alive
9		OK	OF-MB-ST_PulseDO_SYSCON2	161.218.54.141	Maxum	2/27/2012 12:01 AM	Alive
10		OK	SL-??-ST-2appTCD-BTU	161.218.54.37	Maxum	2/27/2012 12:01 AM	Alive
11		OK	CAC_SH4	161.218.54.137	Maxum	2/27/2012 12:01 AM	Alive
12		Alarm	OF-??-ST-1app-FID	161.218.54.32	Maxum	2/27/2012 12:01 AM	Alive
13		Warning	SW-FG-LT-5.0--HRVOC-Modbus Tester	161.218.54.150	Maxum	2/27/2012 12:01 AM	Alive

Figure 3-2 Network Device List

The information in the list includes the following:

- Alarm Level - Indicates whether the device is in a normal or alarmed state
- Name - The name of the device
- IP Address - The IP address used to connect to the device.
- Type - The type of the device such as Maxum, NAU, or MicroSAM
- Last Update - The last time that an automatic update broadcast was received from the unit.
- Network State - Shows whether or not the network connection to the device is in operation.

Note: In the previous System Manager software the user was required to enter information including the device name and the device type. With the Gas Chromatograph Portal software these fields are automatically populated.

The columns can be selected to suit the needs of the user. Right-click on the column-title bar to display the options menus.

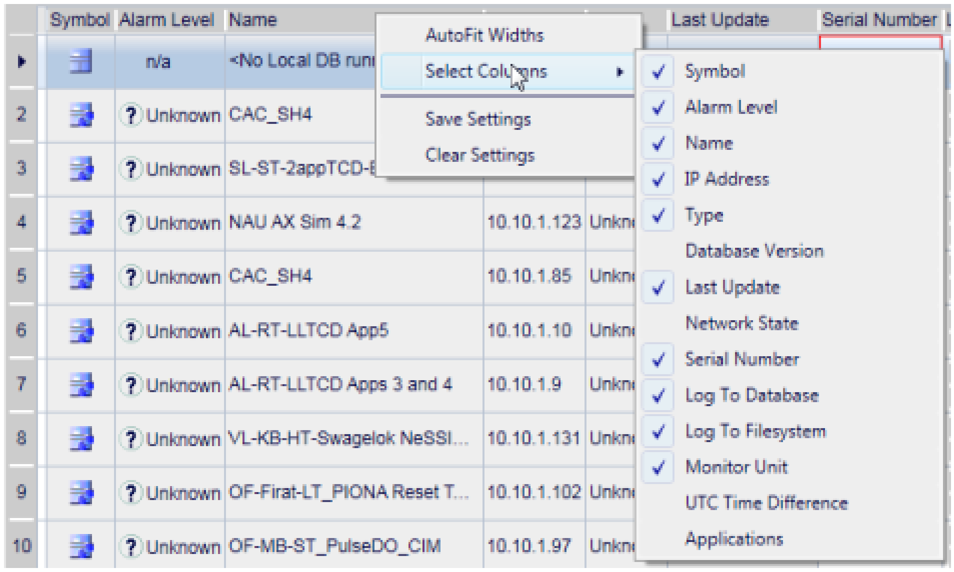


Figure 3-3 Custom Column Selection

3.5 Group Tabs

In addition to allowing the user to connect to and view multiple analyzers at one time, the Gas Chromatograph Portal Network window allows the user to sort these analyzers into user defined sub-lists called groups or views. For example, groups may be defined according to sections of a plant or any other criteria desired.

This feature is similar to the Groups feature in the prior workstation software, System Manager. For prior users of System Manager, GCP has a feature which allows users to import groups from System Manager to the GCP Network view. The import feature is described below.

Adding Groups:

To add a view, click on the tab with the + symbol. This will populate a new group tab.

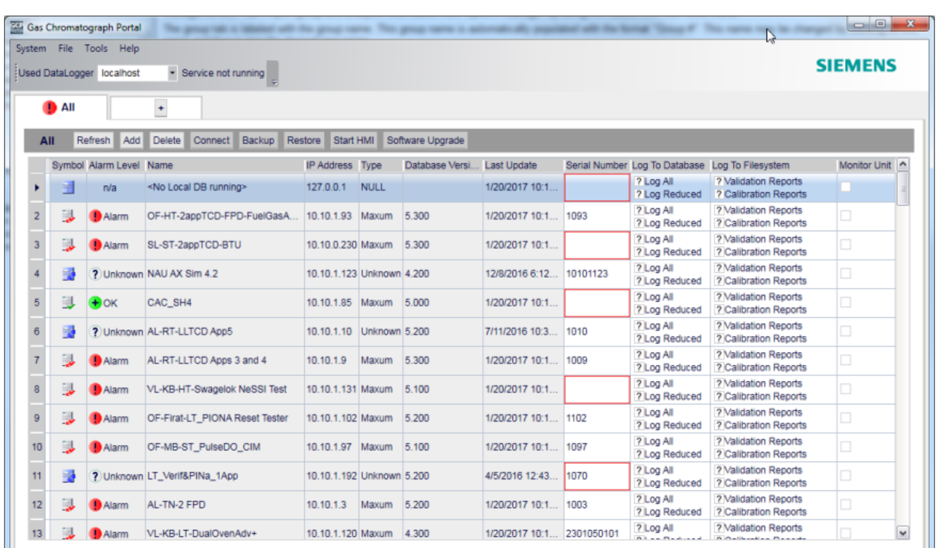


Figure 3-4 Network View Group Tabs

Customizing Group Views:

Groups are automatically named with a group number when they are created. To customize a group name simply click on the name of the group and then type the desired name.

The device list for a group can be customized using the "Configure View" button (this button is not visible on the All tab) as shown below. To add or remove devices on the list for a group, click the Add button or the Remove button in the Configure window when the desired device is selected.

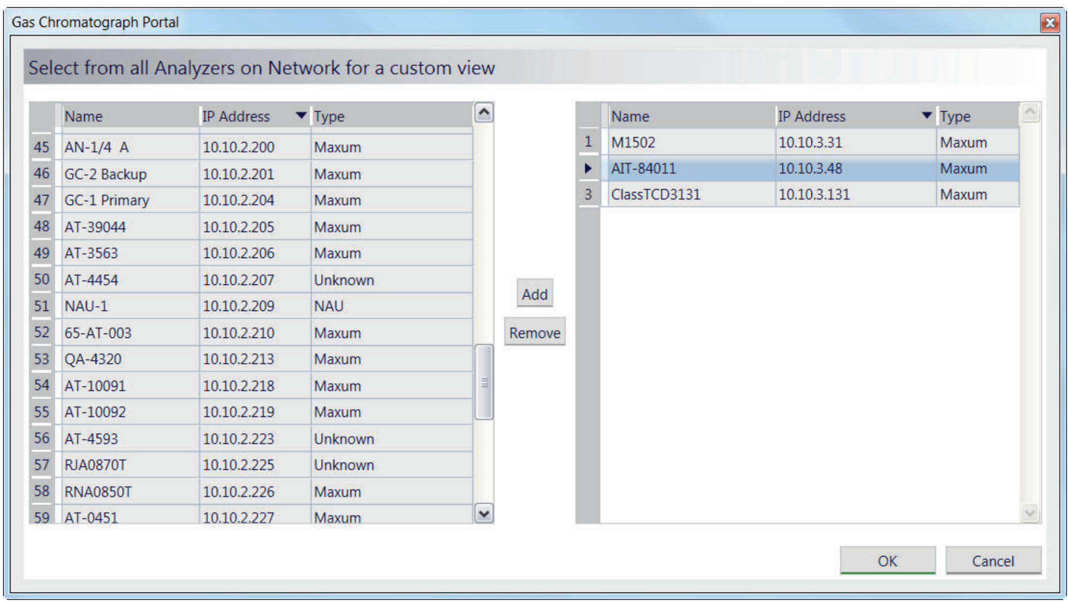


Figure 3-5 Customizing a Group View

Deleting Groups:

To delete a group simply click the X next to the name of the group. A verification message will appear before the group is deleted. Click Yes to confirm.

Importing Groups from System Manger:

The prior workstation software, System Manager, also has a Group feature. Because groups may include large numbers of analyzers, rebuilding those groups could be a lengthy process. For this reason, the GCP software is equipped with a feature to allow prior users of System Manager to import Group and Analyzer information.

To import group and analyzer data from System Manager:

- Select "Import Groups from System Manager" from the Tools menu in the Network view.
- A browse menu box will appear. Choose the menu path for System Manager and then click OK.
- When the import is complete, a message is displayed indicating the number of groups and analyzers that were imported. Click OK to remove the message.

3.6 Network Window User Tasks

3.6.1 Upgrade Software for an Analyzer

All Maxum family and MicroSAM devices can be upgraded to the most recent software, or downgraded to any of the currently installed firmware versions.

The Software Upgrade button in the Network Portal launches the upgrade utility. To perform an upgrade select the desired device from the Network Portal list and then click the Software Upgrade button. The GCP software will read the configuration information from the device and then prompt the user to log into the device. After logging in the Upgrade window will be displayed.

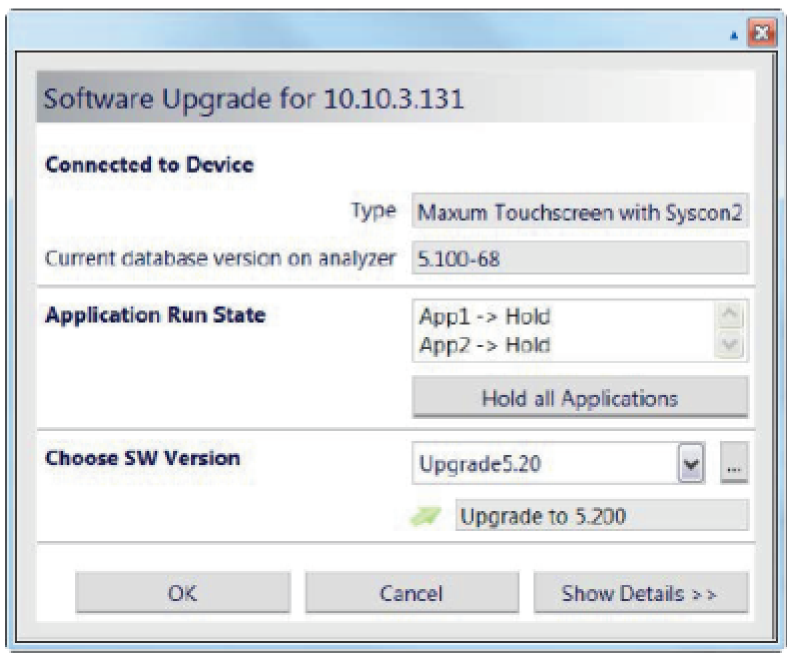


Figure 3-6 Software Upgrade Window

Note

Upgrading a device is a potentially hazardous function that can result in loss of data if it is not executed correctly. For this reason it should only be attempted by qualified personnel. Always save the database of the device before attempting an upgrade

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The Software Upgrade utility within the Gas Chromatograph Portal Software will automatically read the installed version numbers on the selected analyzer, compare them with the most recent version numbers and populate the options depending on software version selected by the user. The following options are possible.

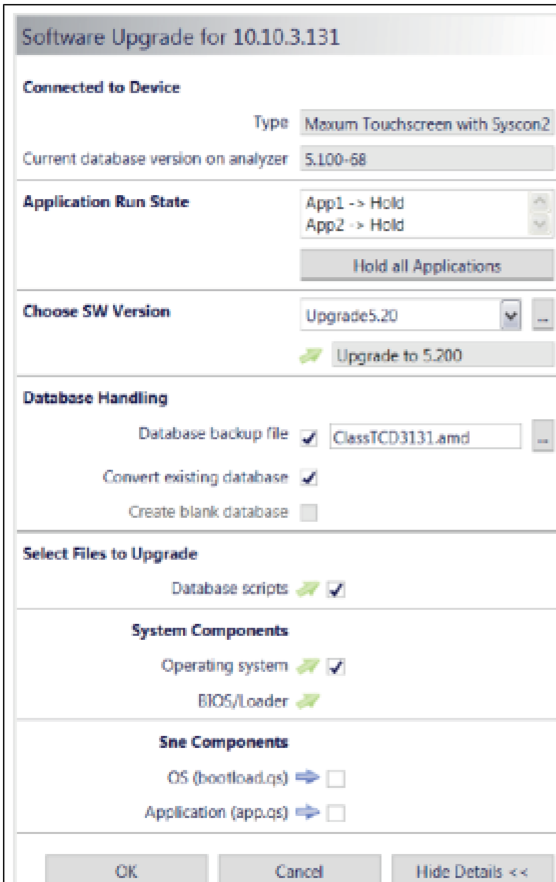
- Upgrade to the most recent database schema (analyzer database schema version is lower than the currently selected version),
- Update the analyzer (analyzer database schema version is the same as the currently selected version, although some system files are at different versions),

- Do nothing (all version numbers match)
- Downgrade the analyzer (analyzer database schema version is higher than the currently selected version).

Selecting a different software version from the possible options will change the outcome displayed below the selection window. Note that the outcome is also denoted by the type of arrow displayed. A red downward pointing arrow indicates a downgrade. A blue right pointing arrow indicates an update (or no change if all version numbers match). A green upward pointing arrow indicates an upgrade.

Description of Upgrade Window

The upgrade window displays information relevant to the current and target version of the device. At the bottom of the window is a "Show Details" button. This button displays additional information about the starting and target versions as shown in the following screen.



Software Upgrade Window Details

Type - The type of device and controller that is configured within the device.

Current Database Version on Analyzer - The current database schema version and revision are displayed here

Application Run State - The current state of each application configured within the device. All applications that are not already in Hold should be placed in hold using the "Hold all Applications" button, and wait for their cycle to complete prior to continuing the upgrade.

Choose SW Version - This is a drop-down menu of all available versions. Note that only versions applicable to the hardware will be displayed. For example, for SYSCON2 only versions 5.0 and above will be displayed. Below this field is another field highlighted in gray. This field shows the outcome of the selected version (upgrade, downgrade, or same version). Note that by default the highest available version is selected.

Database Backup File - The name of the AMD file that will be saved on the computer during the upgrade. By default, the analyzer name with an appended ".amd" is put in this field, and the file is saved in the TempUpgrade subdirectory of the Maxum System Manager directory. Click on the >> button next to the backup file name to manually specify a directory and file name.

Convert Existing Database - Selects whether the existing database will be converted using the DBConverter utility.

Create Blank Database - Indicates that the upgrade will be executed with a resulting blank database (deletes the existing database)

Select Files to Upgrade - At the bottom of the window all files are presented that the upgrade tool has selected for the upgrade step. Each file is also accompanied by an arrow indicating the status of the version change (green for upgrade, blue for update/no change, and red for downgrade). Hover the mouse pointer over these arrows to display the actual version number change.

- **Select Files to Upgrade/Database Scripts** - Selects whether database script components will be changed.
- **Select Files to Upgrade/System Components** - Selects whether the operating system or the BIOS Bootloader for the processor board will be changed.
- **Select Files to Upgrade/SNE Components** - Selects whether the OS bootload file or the Application file for the SNE will be changed.

Running the Upgrade or Downgrade

To upgrade a device to the latest version, the default options are recommended. Alternatively, the user may choose different options as noted above.

Once the desired version and options are selected, click the OK button to run the upgrade.

The upgrade will take several minutes, typically 10 minutes or more depending on factors such as network speed and the size of the database. During the upgrade a series of messages detailing the progress of the upgrade will be displayed. Monitor for any errors. Note that if the version is being upgraded or downgraded, then at a certain point during the upgrade a DBConverter window will pop up. This is an automatic function of the upgrade script. No user intervention is necessary.

When the upgrade is finished, a "Software uppgrade finished successfully" message should be displayed. Click OK to continue. If the success message is not displayed then the upgrade may not have completed successfully.

Log Files

The GCP version 5.3 upgrade/downgrade tool automatically generates two logs in the C:\Maxum System Manager\TempUpgrade folder for every upgrade and downgrade attempt. The naming convention for these files is given below:

Log file#1:
`<ip address>_<date>_<time>.log`

(condensed easier-to-read log)

Log file#2:
`<ip address>_<date>_<time>_Verbose.log`

(contains additional log details for further investigation)

GCP versions 5.2 and earlier only generate one log in the C:\Maxum System Manager\TempUpgrade directory. This file uses a similar naming convention:
`<ip address>_<date>_<time>.log`

3.6.2 Opening and Closing a Local Database

The Open/Close Local Database feature from the File Menu opens a database file on the computer hard drive within the Network Portal. This populates the first selection on the All tab of the Network Portal.

Opening a local database allows the user to connect to the database as a virtual analyzer. The user may open either .amd or .dat database files. The user may also choose to open the database with scripts disabled.

Opening a Local Database

To Open a local database select the "Open Local Database..." selection from the File menu (or, alternately, choose the "Open Local Database (scripts disabled)...").

A file selection window will open. Choose the desired file (navigating to the correct folder, if necessary) and click "Open".

The file is opened as the "virtual analyzer", the first selection of the All group tab. The name of the analyzer is followed by the "(Virtual)" identification.

The user may now connect to the database using the Analyzer Window as if it were a physical analyzer. To do so either choose the line and click the Connect button, or double click the line.

Closing a Local Database

If a local database is activated in the Analyzer Window and it is closed in the Network Window, then the Analyzer Window will be closed. If any changes have been made to the database then this data will be lost.

To close the local database from the Network Portal, choose the "Close Local Database" selection from the File menu. A confirmation message will appear. Choose OK to continue with closing the database.

3.6.3 Connect to Analyzer/HMI

Connecting to an Analyzer:

To connect to an analyzer using the GCP Network window, click on the line for the desired device and then click the Connect button. Alternatively, it is possible to double-click on the line for the device to open the Gas Chromatograph Portal for that device.

Alternatively, you may connect while in the GCP Analyzer window. This is done using the toolbar "Connect" feature. Refer to the Analyzer Portal Chapter (Toolbar Icons section) for more information.

Connecting to a Virtual Analyzer:

A virtual analyzer is created by the Gas Chromatograph Portal software when a user opens an .amd file on disk as if it were a physical analyzer. The virtual analyzer is created in the computer memory by a process that the GCP software launches. In this way, the virtual analyzer is treated as a separate device much as an actual hardware device works. This allows the user to test out different configurations without making changes to working hardware. For more information see *Opening and Closing a Local Database*.

The first line of the "All" Analyzer List window is reserved for the Virtual Analyzer. Before connecting to a virtual analyzer using the Network Portal, it is necessary to have a local database loaded. If no database is loaded, then the virtual analyzer line in the analyzer list will show "<No Local DB Running>".

Connecting to the HMI Emulator

To connect to the HMI emulator for an analyzer using the GCP Network window, click on the line for the desired device and then click the "Start HMI" button.

Alternatively, you may connect while in the GCP Analyzer window. This is done using the toolbar "Start HMI" feature. Refer to the Analyzer Portal Chapter (Toolbar Icons section) for more information.

3.6.4 Backup an Analyzer

The backup function saves an analyzer database to a file on the computer. All password levels are authorized to make a backup.

To backup an analyzer from the Network Portal select the line entry for the device and then click the Backup button at the top of the view.

The "Save backup file as..." dialog box will appear. Type or select a name for the backup file in the File Name field. If the user does not identify a file extension, then the default extension of .amd will be used.

Click the Save button in the dialog box to begin the backup. A progress dialog box will appear, showing the saving of the database to flash memory and then the saving of the file to the computer. When the backup is complete the progress box displays "Successful" and then closes.

Multiple Device Backup

Multiple devices may be selected, by holding the control key and click each device, then click the Backup button and all selected devices database files will be save in the selected file folder. User can select which folder on the workstation computer the files will be saved. File names are a compilation of the date, time and device name.

3.6.5 Restore an Analyzer

The Restore function reloads an analyzer from a database stored on the computer.

Note

Use of the Restore function overwrites the existing database of the analyzer. Backup of the existing database, if one exists, is recommended before restoring. Make sure that the correct analyzer is selected and that the correct file name is selected when restoring an analyzer. Loading of the wrong device or use of the wrong file will adversely affect the operation of the device.

To restore an analyzer from a saved database perform the following steps:

1. Select the desired analyzer and then click the Restore button.
2. The user is instructed to log on. This action is restricted to Super or Configure level passwords. Once the proper user name and password is entered, click OK.
3. A file selection box appears. Choose the correct file name (verify that only the correct file name is selected), and then click Open.
4. A confirmation message appears indicating that all current data on the analyzer will be destroyed. Only select the Yes option if you are sure that you wish to continue.
5. The restore proceeds, with a dialog box showing progress. When the restore is complete, the device will reboot. After the reboot, the restoration is complete.

3.6.6 Adding/Deleting a Device

Adding a Device:

Clicking the Add button in the analyzer list window of the Network Portal allows the user to manually configure the Portal for a new device. Devices can only be added using the device

IP address. The Add button is only available on the "All" group tab. To add a device, click the Add button, enter the IP address, and then click OK.

Devices will automatically populate as broadcast from each device is received at the GCP software.

Deleting a Device:

Clicking the Delete button manually removes the selected analyzer row from the list of devices that the Portal recognizes. The Delete button is only available on the "All" group tab.

Note

There is no confirmation for the Delete operation and the action cannot be undone without adding the device again using the Add button. Verify that the correct device line is selected **before** clicking the Delete button.

Analyzer Window

4

4.1 Analyzer Window Introduction

Gas Chromatograph Portal is the primary part of the workstation software. It is used to control and configure devices.

- Monitor device status on the network
- Manage alarms
- View and modify device information
- View stored or real-time chromatograms
- Modify a method
- Launch various system utilities and programs, including Maxum Utilities, EZChrom, HMI Emulator, MaxBasic, and also the original System Manager.

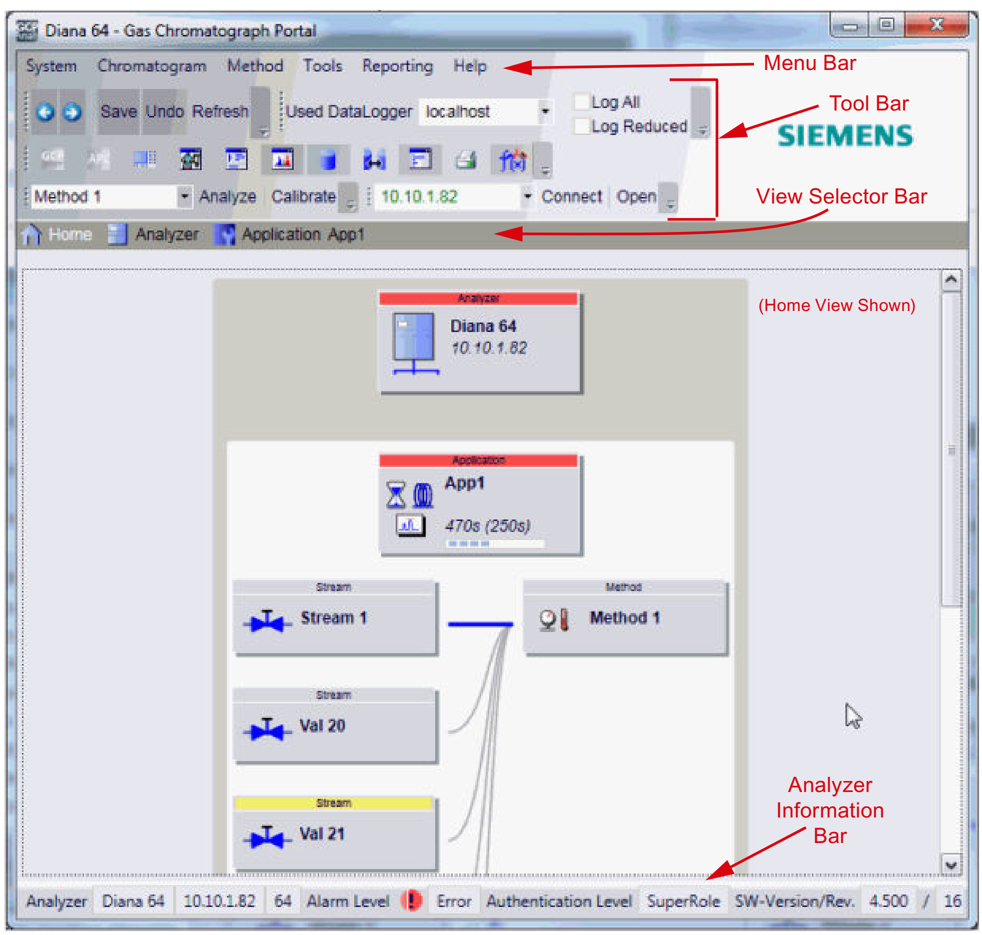


Figure 4-1 Analyzer View

The following section describes the psrts of the Gas Chromatograph Portal Analyzer Window and how to navigate through it.

See also

Toolbar Icons (Page 34)

4.2 Menu Options

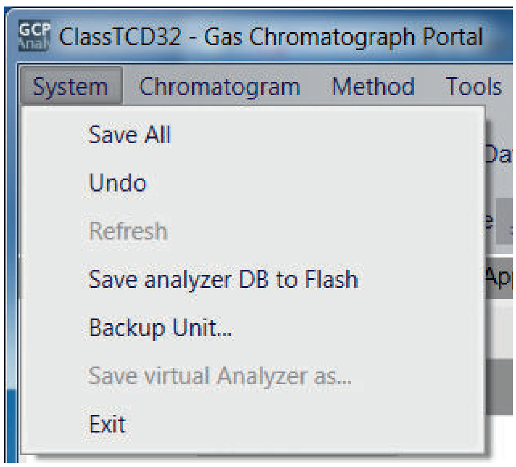


Figure 4-2 System Menu

Save All - Save Changes
Undo - Undo action
Refresh - Reload data from the analyzer
Save to Flash - Save database to flash
Backup Unit - Perform a backup (same as in network window)
Save Virtual Analyzer As - For saving changes to a virtual analyzer
Exit - Exit the program

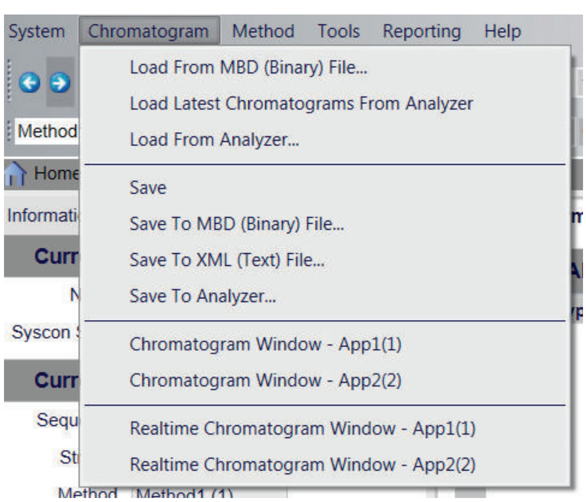


Figure 4-3 Chromatogram Menu

Load From MBD (Binary) File - Select and load chromatograms from the PC
Load From Data Logger - Load chromatograms from Data Logger
Load From Analyzer - Select chromatograms to load from analyzer
Load Latest Chromatograms From Analyzer - Load the most current stored results from the

analyzer.
Save - Save chromatograms
Save to MBD (Binary) File - Save chromatograms to a binary file (format that can be opened later)
Save to XML (Text) File - Save chromatograms to a text file
Save to Analyzer - Save chromatograms to analyzer
Chromatogram Window - Open the window for stored chromatograms
Realtime Chromatogram Window - Open the window for real time chromatograms

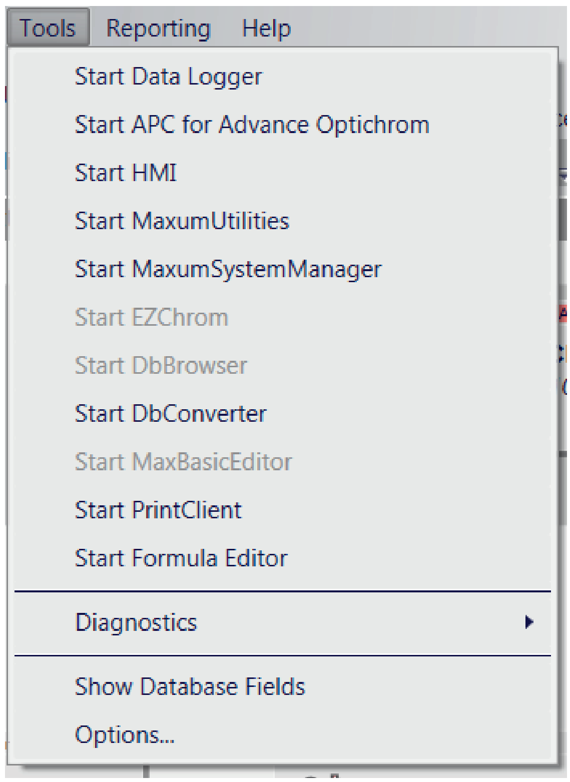


Figure 4-4 Tools Menu

Start Data Logger Service - Start the Data Logger
Start APC for Advance Optichrom - Launch the control software for the Optichrom Advance
Start HMI - Start the Human Machine Interface Emulator
Start MaxumUtilities - Start the Maxum Utilities program
Start MaxumSystemManager - Launch the System Manager Software (older version workstation)
Start EZChrom - Start EZChrom analysis and method development software
Start MaxBasicEditor - Start the program editor for MaxBasic
Options - Edit options, such as preferred units and program paths for executable programs.

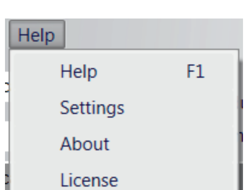


Figure 4-5 Help Menu

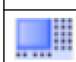
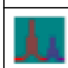
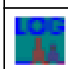
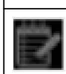
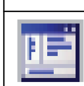
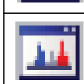
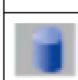
Help - Online Help
Settings - Color Settings for the Gas Chromatography Portal
About/License - Information about the program and user license

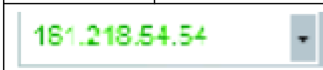
4.3 Toolbar Icons

The toolbar icons are described below:

Figure 4-6 Toolbars in the Gas Chromatograph Portal

Table 4-1 Analyzer View Toolbar Icon Descriptions

	Go to previous/next screen viewed.
Save/Undo	Save last change in memory/Undo last change.
Refresh	Refresh all information from analyzer.
	**Start Data Logger Service** - Starts the Data Logger application, if it is configured.
	**Start APC for Advance Optichrom** - Starts the APC 8.1 Software that is provided as an interface to the Optichrom Advance Gas Chromatograph
	**Start HMI** - Starts the HMI emulator software, connecting to the current analzyer
	**Start ChromViewer -** Starts the chromatogram viewer utility to display saved chromatograms loaded from 3 different sources: MBD files, EXChrom ASCII files, or X/Y data text files. Once loaded, the chromatogram can be saved as MBD, XML, or EXChrom ASCII files.
	**Start StreamLogger -** Starts the chromatogram viewer utility to display saved chromatograms loaded from 3 different sources: MBD files, EXChrom ASCII files, or X/Y data text files. Once loaded, the chromatogram can be saved as MBD, XML, or EXChrom ASCII files.
	**Start Data Logger Explorer -** The Data Logger Explorer (DLExplorer) is a standalone program to give the GCP user a way to manipulate saved data and methods.
	**Start Maxum Utilities** - Starts the Maxum Utilities application which provides tools for data logging, database conversion, and upgrades. These functions are also available using other features of the Gas Chromatograph Portal.
	**Start Maxum System Manager** - Starts the legacy Maxum workstation application, Maxum System Manager.
	**Start EZChrom** - Starts the Maxum EZChrom workstation software used to add and modify application methods for a Maxum or MicroSAM GC. The functions of Maxum EZChrom are available in the Maxum Gas Chromatograph Portal Software.
	**Start DbBrowser**- Starts the DbBrowser application used by advance users to locate and manage database addresses outside the normal user platform. DbBrowser is installed separately from the Maxum Gas Chromatograph Portal Software.
	**Start DbConverter** - Starts the DbConverter application which is used to import and export database information to and from text files, compare databases, and convert databases for software upgrades.
	**Start MaxBasic Editor** - Starts the MaxBasic program editor, if installed. MaxBasic is a programming language for the Siemens Gas Chromatographs. It allows users to create programs to perform custom functions. The MaxBasic Editor is licensed separately from the Maxum Gas Chromatograph Portal software.

	**Start PrintClient** – Starts the PrintClient program. The Maxum PrintClient application runs on the workstation and allows users to gather printed reports from all the Maxums/MicroSams on the network. A printer directed to PrintClient is configured on the device to collect reports for the PrintClient application to gather and direct to a workstation file(s). Reports may be collected into a single file or a set of files.
	**Start Formula Editor** – Starts the Formula Editor application which is used to add formulas to result that will function as post processing of analysis results. The Formula Editor can be used to develop and test a formula prior to putting the formula in the analyzer.
 **Current selected application/method**. Drop-down box of available methods within the current application.	
Analyze	Analyze currently opened chromatograms with selected method.
Calibrate	Calibrate selected method with currently opened chromatograms.
 / Connect - This field is used to connect to a different analyzer. The arrow is a drop-down menu of available devices. The user may choose a device from the list and click Connect. If a device is not in the list users may type the device IP address in the field and click 'Connect'. The "localhost" selection connects to an open local database from the GCP Network window.	
Open	Used to open a device from an existing .amd file. Clicking this selection brings up a browse window from which to choose a database file.
 Defines the IP address of the Datalogger workstation used with this device. The Datalogger can be installed as a service (installed with the initial GCP software installation) or as an application (Tools – Start Data Logger). No check in the Log All or Log Reduced check boxes will disable Data Logger for this device. Select Log All to log results, chromatograms and stream related alarms for each cycle. The current method is also logged if the method has changed since the last cycle. Select Log Reduced to stop logging chromatogram and continue all other log activities. In the Log Reduced mode chromatograms will be logged on cycles where a stream alarm occurs. Data Logger must be running as a service or application on the work-station. Data Logger data can be viewed from the Analyzer View – Logged Data window and the Logged Alarms (Data Logger) tab under Alarms.	

4.4 View Selector Bar

The Gas Chromatograph Portal allows the user to switch between viewing a basic Analyzer Home screen, an Analyzer Details Screen, or Application Screens. These are selected by choosing the relevant tab as seen below.

Figure 4-7 View Selection Bar

Clicking the relevant tab takes you to the screen. More information regarding these screens is available in later sections, or refer to the online help available within the program.

4.5 Viewing Basic Mode

On the far right side of the Gas Chromatograph Portal window there is a checkbox titled, Basic Mode. This checbox toggles between a simplified version of the available information. One of the primary differences of Basic Mode is that the Navigation section of the window has a different format and fewer choices. See below.

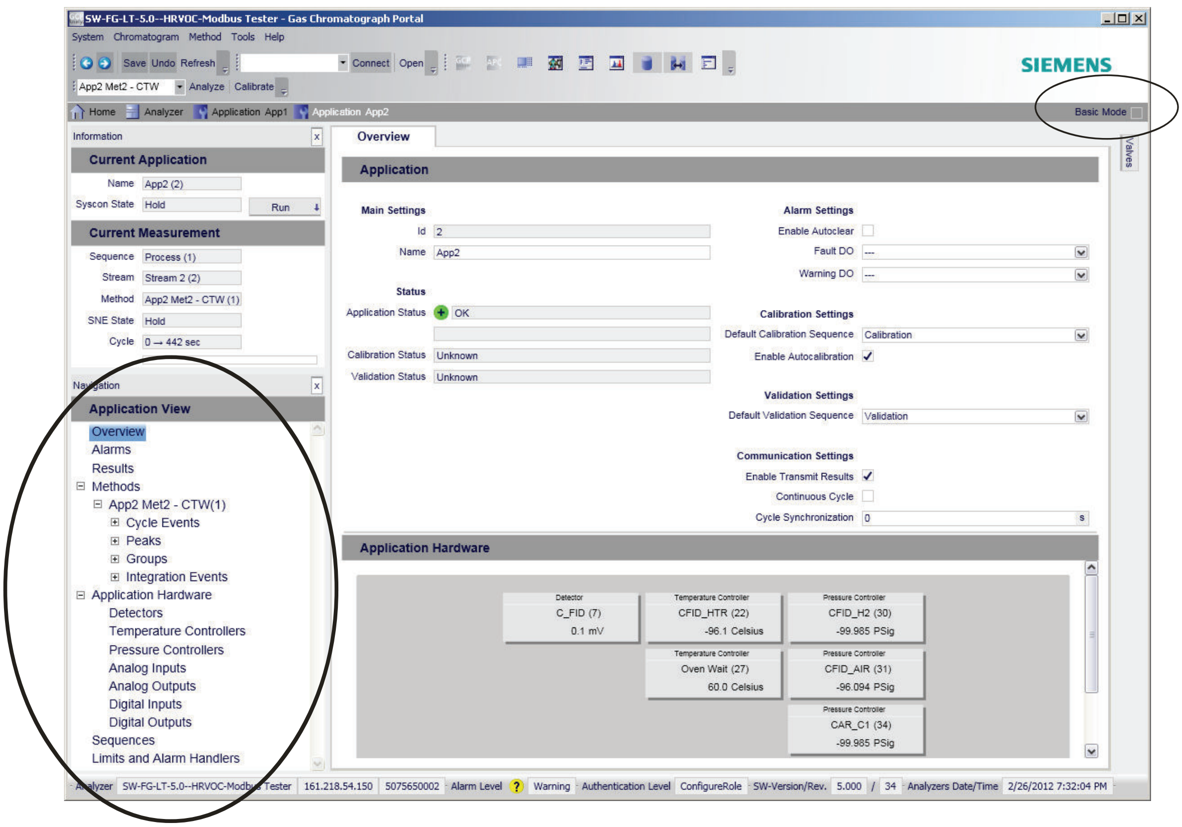


Figure 4-8 View with Basic Mode Off

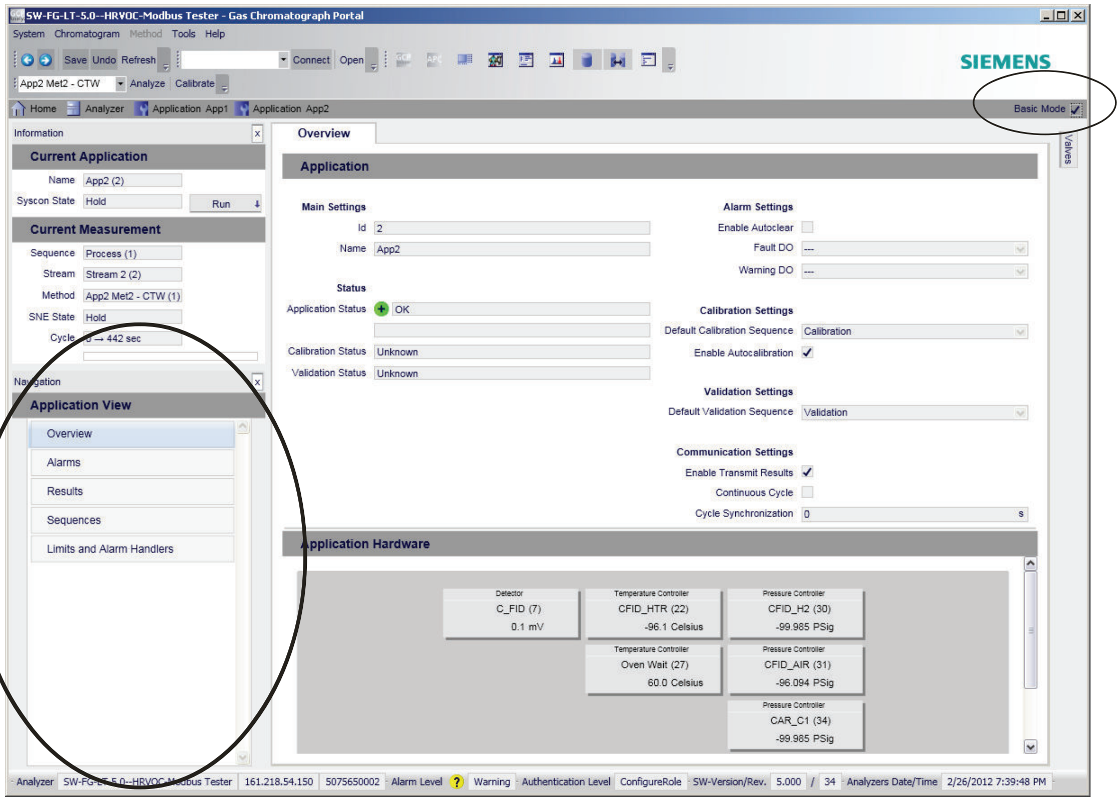


Figure 4-9 View with Basic Mode On

4.6 Analyzer Information Bar

The Analyzer Information Bar, below, is located at the bottom of the Gas Chromatograph Portal window. This part of the window provides basic information concerning the device. This information is provided for user reference and is visible from all screens. The information cannot be changed directly from the information bar. Included is:

- Analyzer - Device name, device IP address, and device serial number
- Alarm Level
- Authentication level (level of current password access)
- Software version/Revision
- Date/Time as set in the device

Figure 4-10 Analyzer Information Bar

4.7 Analyzer Home Page - Overview

The analyzer "home" page provides full details about the setup and operating status of the analyzer. Get to the "home" page any time by clicking the "HOME" tab.

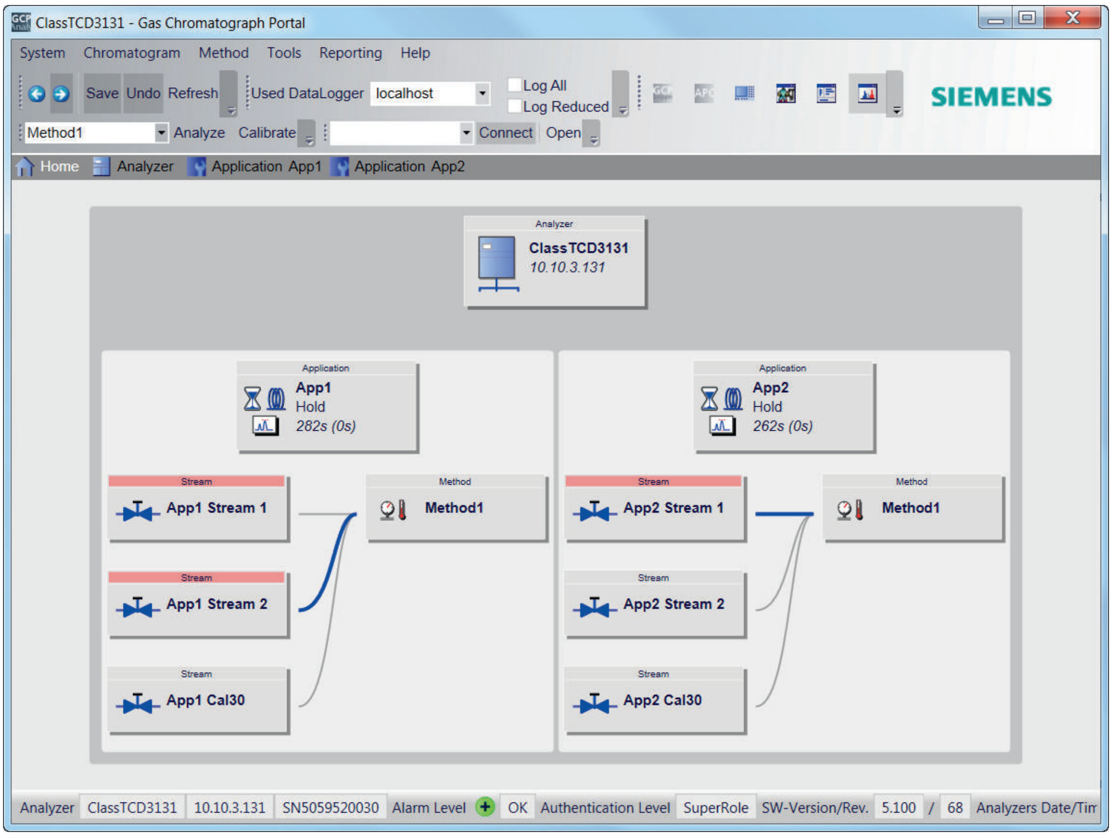


Figure 4-11 Analyzer Home Page

In the image above, the analyzer is the "Propylene GC". It’s IP address is 127.0.0.1. The analyzer is running a single application with a single method, one process stream and one calibration stream. Clicking anywhere on the analyzer structure takes you directly to information about that aspect of the analyzer.

4.8 Application Setup and Control Page - Overview

Clicking the Application tab takes the user directly to an overview of information about that application as shown below. Multiple applications may exist for a given analyzer, and each will have a tab. This screen allows the user to manage and modify settings relating only to the selected application.

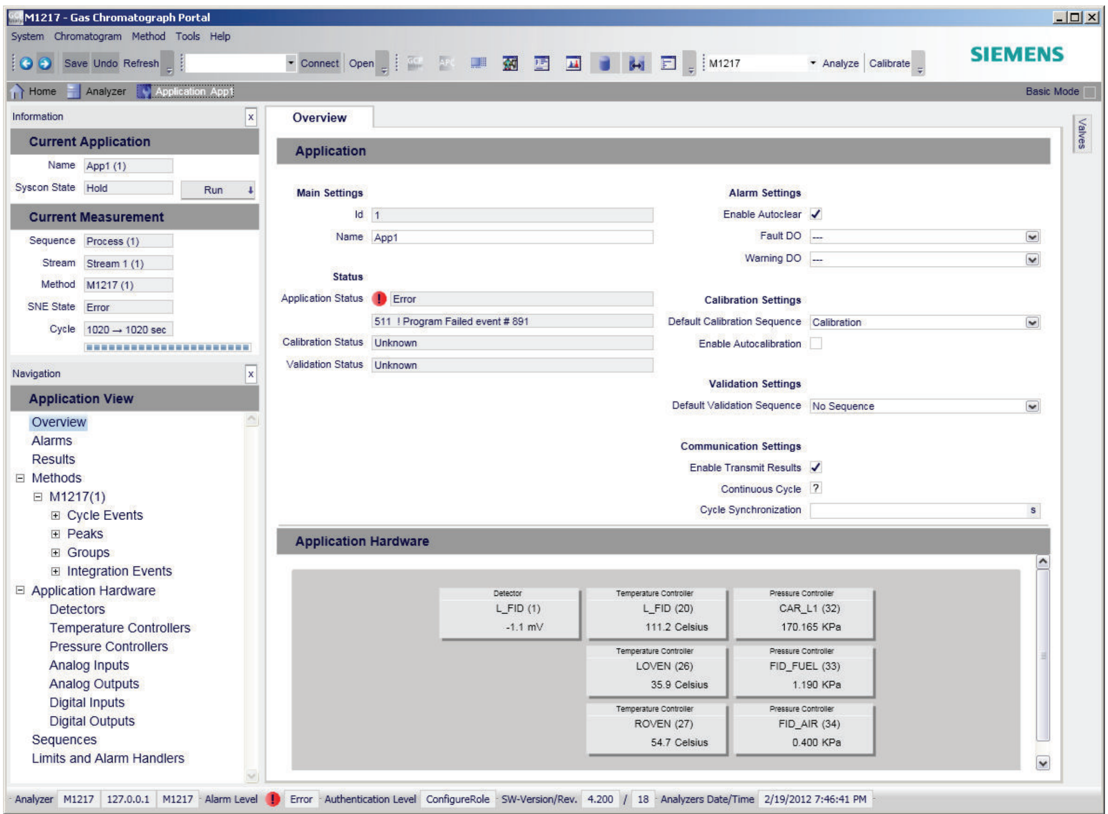


Figure 4-12 Application Setup and Control Page

The layout of the Application Page is similar to the Analyzer Page, with Application information boxes and a Navigation menu on the left, as well as detailed information windows on the right. Choosing different selections on the Navigation menu changes the information displayed in the information windows on the right.

4.9 Viewing Chromatograms

Starting from any screen, the user can bring up the chromatogram window, shown below. The user can select from:

- previously saved (filed) chromatograms
- data logged chromatograms from history
- a selection of any chromatogram in the analyzer
- loading the most recent chromatograms the analyzer

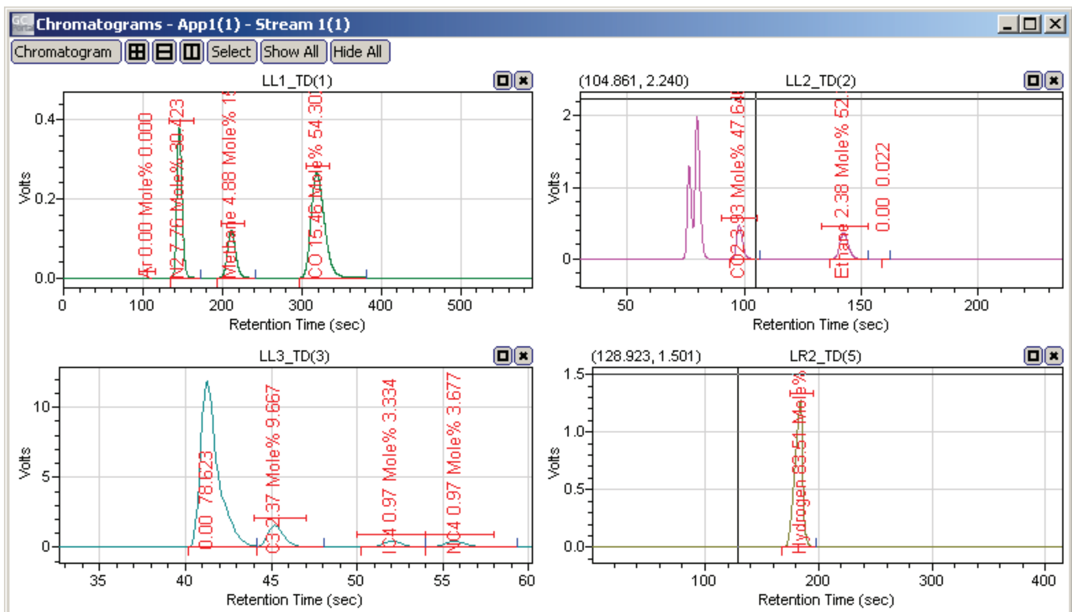


Figure 4-13 Chromatogram View and Control Window

The buttons in the upper left corner allow the user to display and arrange the chromatograms, or load different chromatograms. In addition, a right mouse click allows access to several additional functions. The analyzer window is a powerful display tool that allows the user to view chromatograms in many different ways including:

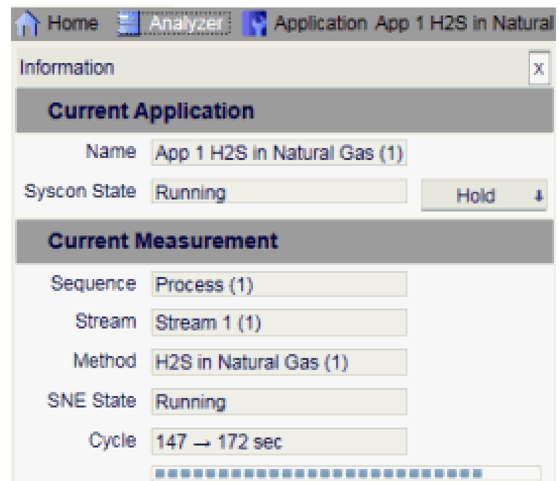
- Selecting specific chromatograms to view
- Zooming in on specific areas
- Overlaying multiple chromatograms on the same graph
- Modifying the method while viewing chromatograms

4.10 Analyzer View

The Analyzer View consists of three main parts, the Navigation Menu, the Information Pane, and the primary Data Window.

Information Pane

In the top left corner of the Analyzer View is the information pane that shows basicinformation about the current application and measurement. This information paneis the same for both the Analyzer View and the Application Views.



Name - This is the name of the current application.

SYSCON State - This field shows the state of the application, whether it is in Run or Hold state. Other states, such as the transient states PgmWait and Waiting, may also be displayed here.

Run/Hold Button - This action button is used to place the analyzer in either a Run or a Hold state.

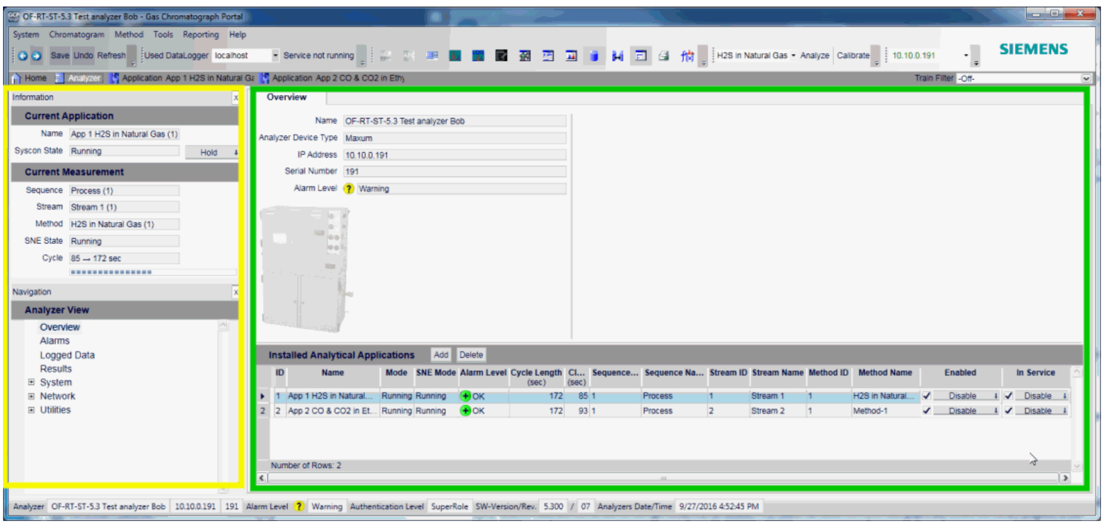
Note

The Run/Hold button has a small blue arrow on the right side of the button. In the Maxum Gas Chromatograph Portal software the blue arrow on a button indicates that the action relating to the button will be executed and saved immediately to the database/analyzer without further action from the user.

Sequence/Stream/Method - Shows the names of the current Sequence, Stream, and Method.
SNE State - This field shows the state of the SNE Controller. Typically, the status will be either Running or Hold. Others states such as Error, or the transient Finished state are possible as well.

Cycle - This field shows the current cycle clock in seconds. The number on the left denotes the current cycle time (counting up when in Run and paused when in Hold) and the number on the right shows the full duration. The status bar below the Cycle field graphically shows the current progress of the cycle.

Navigation Menu: On the left hand side of the Analyzer View (yellow outline below) is the NavigationMenu. The Analyzer Navigation Menu selections are used to display and modify information related to the Analyzer.	**Data Window:**The bulk of the Analyzer view is devoted to the Data Window (green outline below).This area contains various data windows, tabs, and graphics. The information displayed in the Data Window is dependent on which Navigation Menu selected is chosen. For example, the Alarm Log selection displays in the Data Window a list of all existing alarms and warnings as well as a pane displaying details for the selected alarm.



4.10.1 Analyzer Overview Screen

The Analyzer Overview screen on the Navigation menu provides basic information about configuration and status of the analyzer.

The top pane of the window includes a table of information. This includes the name of the device, type of device, IP address, serial number, and alarm level.

The bottom pane of the window, titled "Installed Analytical Applications", gives basic information about the applications configured in the device.

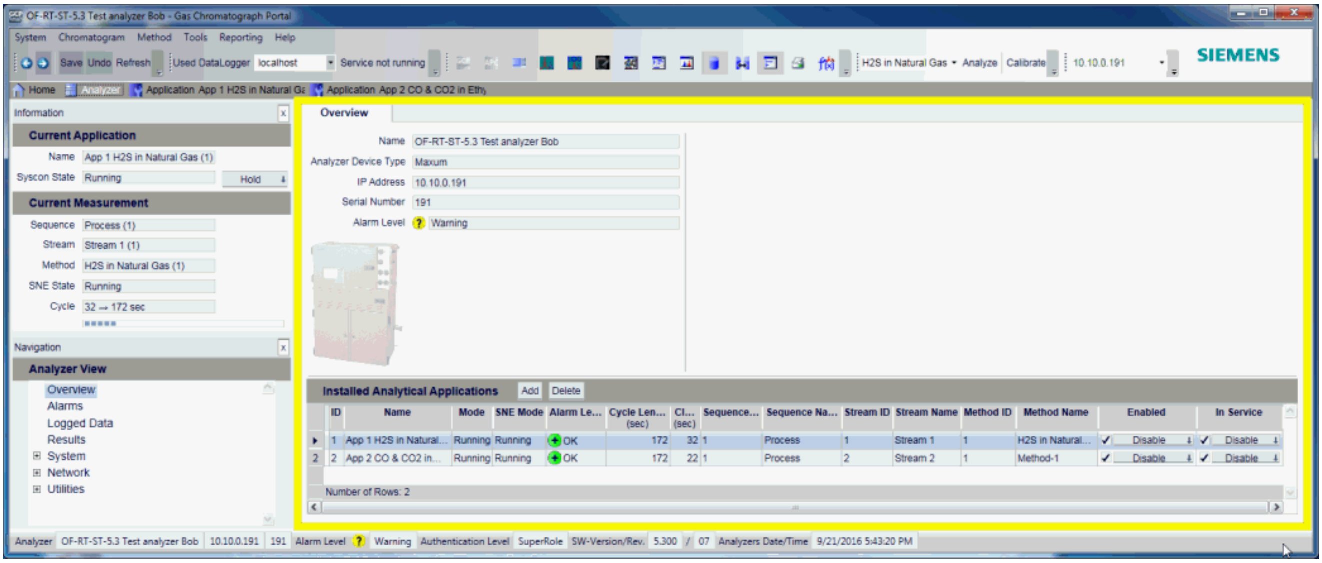


Figure 4-14 Analyzer View Overview Screen

User Functions

Possible actions from the Analyzer Overview window include adding/deleting applications and enabling/disabling an application. The button selections for these actions are in the bottom panel as shown in the example above.

4.10.2 Alarms Log

Current Alarm State Tab

The Alarm screen displays information regarding all errors, warnings, and informational messages that exist in the analyzer. The information on this screen is updated automatically when new information is received via broadcast message. The Alarm screen can be accessed from the Analyzer View or from the Application View. The Alarm screen is the same for all views.

Alarm Types - Different types of alarm status messages may be received from a device. Each message received must be assessed by the user to determine what, if any, further action is required.

Information - When a message is received from an analyzer that does not indicate a fault situation with that particular device, then it is typically classified as an informational message. Informational messages may be purely or information, such as noting that an application has been placed in service, or may indicate that an error situation exists other than in the device, such as a communication error on the network.

Warning - Warning messages typically indicate an abnormal situation with a device that does not usually affect analytical results. Depending on the message, this may be a minor error or a service affecting error.

Error - Error messages indicate faults with a device that are likely to affect analytical results.

Alarm Table

The top pane of the Alarm Log screen is a table of all alarms currently existing in the device. Each table line has information such as alarm type, time received, alarm text, etc. Alarms in this table may be sorted by clicking the desired column head by which to sort. They may also be acknowledged or cleared (see *User Actions* below).

Details

The bottom pane includes detailed information regarding the alarm that is currently highlighted from the alarm table. GCP provides the user with a unique troubleshooting tool in its detailed explanation of alarms and suggestions for recommended actions.

On the left side of the Details pane is the information received from the analyzer. This includes the type, code, applicable application and stream (if any), and any relevant parameters. Parameters are variables that identify specific information about an alarm, such as which device is affected.

The details on the left side of the Details pane are used by GCP to populate the right side of the Details pane. GCP uses this information to build the Alarm Text as well as to populate the Additional Information and Recommended Action fields. The additional information is an extended description of the message. The recommended action provides the user with guidance for troubleshooting. Note that the recommended action is intended to be a brief suggestion to point the user to the most likely cause. It is not intended to be a detailed troubleshooting procedure. See the relevant Maxum documentation for more details regarding troubleshooting, Including relevant safety precautions.

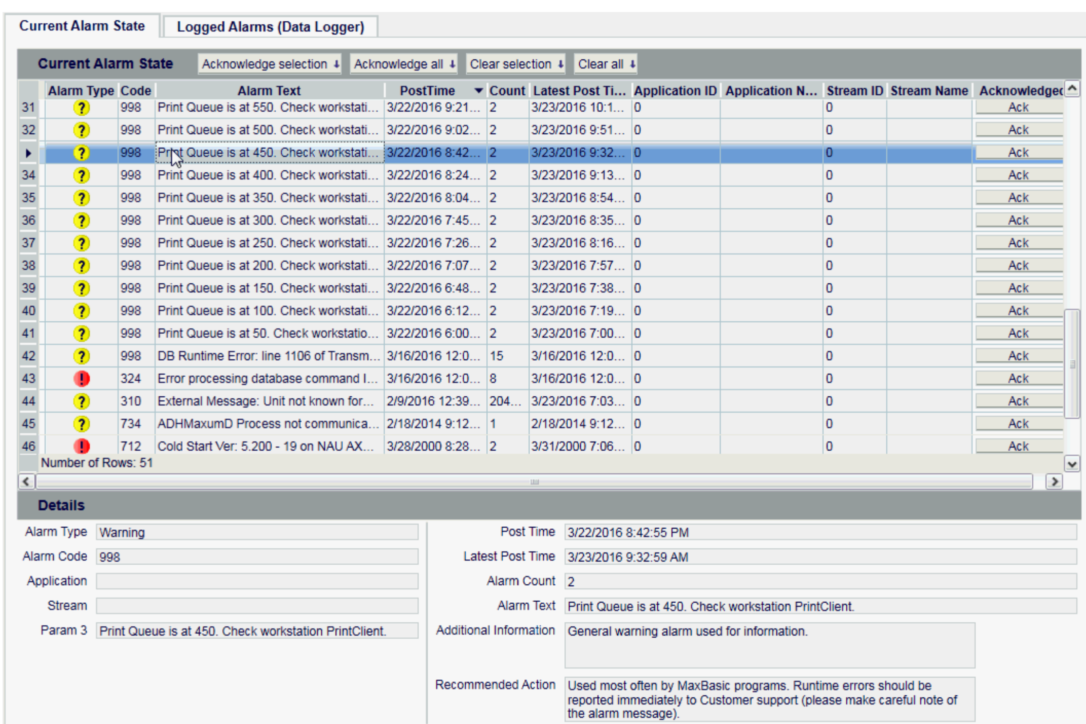


Figure 4-15 Alarm Current State Screen

User Actions

From the Alarm Log screen, the user may acknowledge and clear alarm messages. Acknowledging an alarm identifies it as having been addressed by the user, but does not clear it from memory. Clearing an alarm message removes it from memory so that it no longer appears in the Alarm Log.

Acknowledging Alarms - To acknowledge an alarm the user may click the Ack button on the far right of the alarm line (the Acknowledged column). Alternately, the user may select the line and click the Acknowledge Selection button at the top of the table. When an alarm is acknowledged, the Acknowledged column for that line changes from the Ack button to Yes. To acknowledge all alarms, click the Acknowledge All button.

Clearing Alarms - To clear an alarm, select it in the alarm table and click the Clear Selection button. The alarm should disappear from the list. To clear all alarms in the list click the Clear All button. An alarm that is permanently occurring (such as a purge alarm) may clear and then reappear immediately.

Logged Alarms (Data Logger) Tab

Logged Alarms stored in the Data Logger for this device are displayed in this tab. The logged alarm data is stored and displayed by Date of interest and back in time for the number of Span Days listed. If the Date of interest is the current date then the refresh button can be used to update current data stored after the display was opened. Details are described in Data Logger (Page 453).

4.10.3 Data Logger

The Data Logger is a part of the Gas Chromatograph Portal (GCP) Software that is used to poll and store data for multiple Maxum/MicroSAM analyzers on a network. Retrieval of the stored information is integrated into the GCP software.

For complete information see the Data Logger (Page 453) section.

4.10.4 Results

The Results screen displays the latest analytical results received by Gas Chromatography Portal for the equipped applications. Shown are the Stream ID, Result Name, Stream Name, Units, Cycle Run Time, Buffered Value, Saved Value, Compare Deviation Percent, and Compare State.

From the Results Viewer Tab only viewing and archiving is possible. The "Show Connections" button displays the connected elements, such as detector, that are used for the selected result. Connected elements can have links which when clicked will open the connected element table. If chromatograms are saved in the analyzer for the selected component then the chromatogram connected element can be clicked to open the chromatogram for the selected result. The "Add to Archive" button ads the current results to the archive. The archive is accessed via the Results screen on the Application tab.

The External Results tab manages the setup and properties of results accessed by this analyzer from other analyzers. External results from other analyzers can be read and saved to a result location on the selected analyzer. The External Results Properties include the Result Source (where the external result can be found) information, Result Target (where the external result is stored on this analyzer) information and Limit Check for Result information

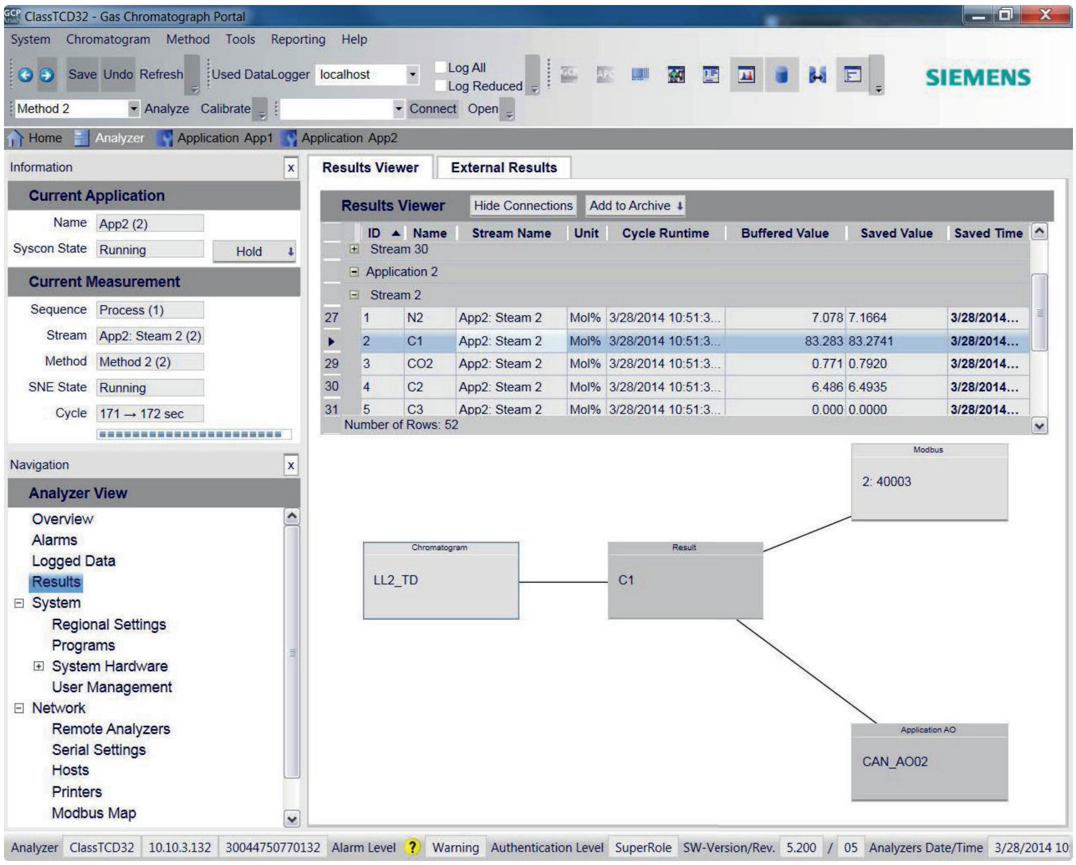


Figure 4-16 Results Screen

4.10.5 System

4.10.5.1 System Settings

The System Settings Screens allow the user to view and modify various system-wide data for the connected analyzer. Included is the main System Settings screen as well as a subdirectory of additional screens as shown below.

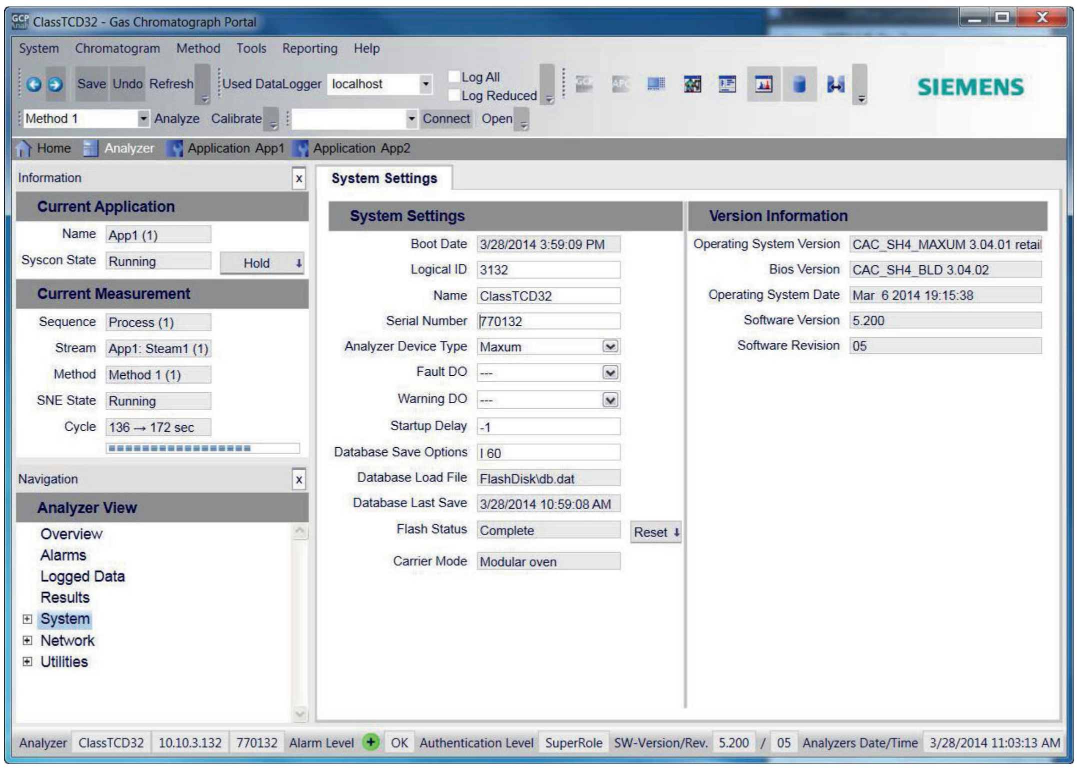


Figure 4-17 System Settings Screen

Various system-wide parameters are available for viewing and changing from this screen.

- *Boot Date* - Date and time device was last started (or date and time virtual database was loaded).
- *Logical ID* - The logical analyzer ID, typically the last three digits of the IP address for the analyzer.
- *Name* - The defined name of the analyzer.
- *Serial Number* - The factor set serial number of the analyzer.
- *Analyzer Device Type* - The type of hardware, selectable from a drop-down menu.
- *Fault DO* - Digital Output for additional fault indicator.
- *Warning DO* - Digital Output for additional warning indicator (can be the same as the Fault DO).
- *Startup Delay* - Seconds to delay at power-up.

- Database Save Options - Used to set interval for automatic database saves (required for compact flash). Format is I xx for interval save. For example, I 60 means save every 60 minutes (minimum interval is 6 minutes). C is for after calibrations. D is for disabled.
- *Database Load File* - The name and location of thee file that the database was loaded from.
- *Database Last Save* – The date and time of the last database load.
- *Flash Status* - Used internally to determine whether a save to flash is complete. This value can be reset to "Complete" using the Reset button.
- *Carrier Mode* – Describes the Analyzer Controller configuration; Modular Oven, indicates the analyzer only has a CIM board no Syscon; Syscon with touch screen door, indicates the analyzer has a Syscon and a CIM board used as a touch screen door; Syscon, indicates a Syscon without a CIM board; and Unknown, is an unknown configuration. Analyzers running older versions of the software may not display this System Setting.
- *System Log* (checkbox) - Used to log compact flash debug output to a file. Note that this is not available in systems that are not equipped with compact flash (e.g. Release 5.0 and higher).
- *Operating System Version* - The OS version of the system.
- *Bios Version* - The Bios version of the system.
- *Operating System Date* - The creation date of the OS.
- *Software Version* - The release version of the software.
- *Software Revision* - The revision number of the software.

System Settings Subdirectory:

Other available screens that are selectable under the System Settings sub-menu are as follows.

- *Regional Settings -* Settings relating to the location of the device, including country language, time zone, daylight savings time settings, time settings, etc.
- *Programs -* Settings relating to system programs. For example, there may be a program to ignite a detector. The information on these screens includes the list of available programs, properties for each program, available parameters, and program schedule information. New programs can be written by launching the MaxBasic Editor which is available from the toolbar or as a button on the Programs screen.
- *System Hardware -* This series of screens allow the user to view and change various information relating to system input/output (I/O), SNE hardware, and Advance+ detectors.
- *User Management -* This allows the user to administer user IDs for the device. The user authorization level must be “super” users to access this table.

4.10.5.2 Regional Settings

Regional Settings, found on the Navigation menu under the System heading, are designed to reflect the location where the device is installed. The various available settings are described below.

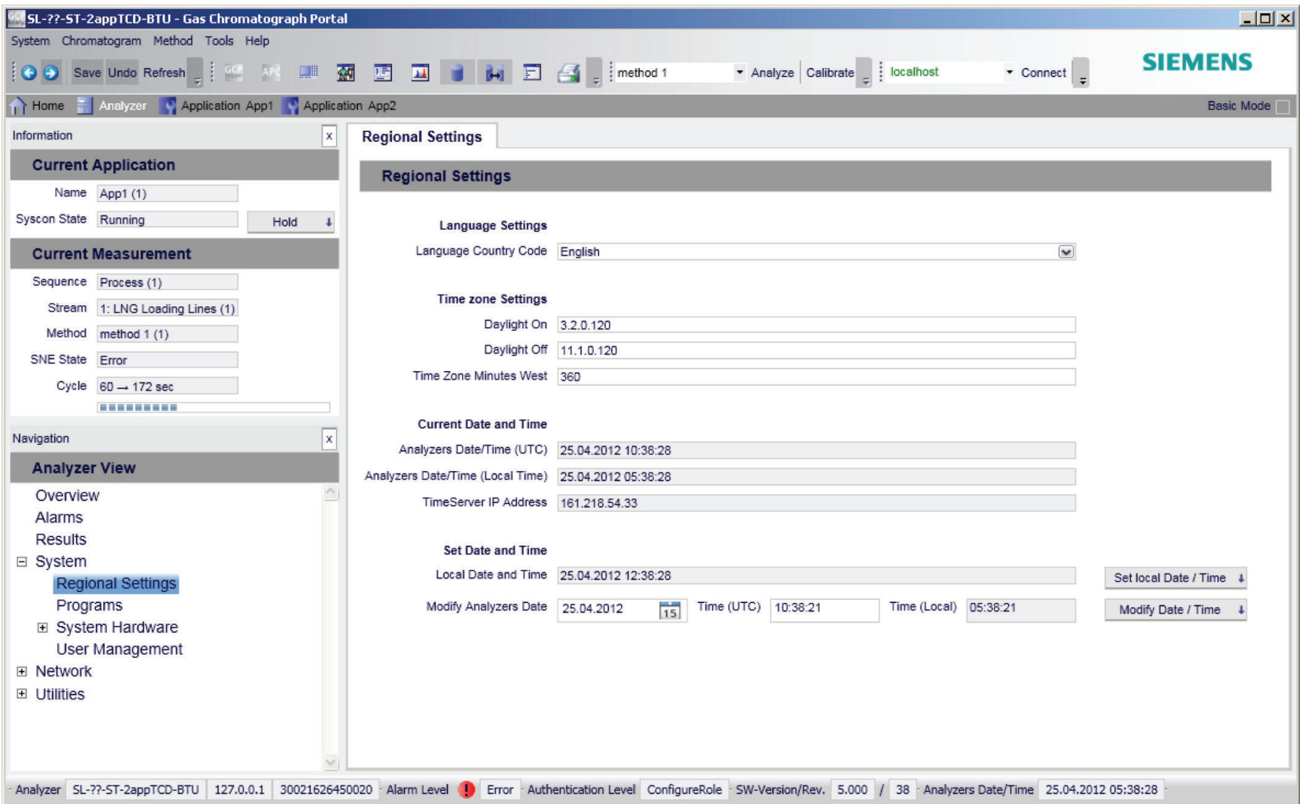


Figure 4-18 Regional System Settings

- *Language Country Code* - Language of the analyzer (sets the language of the HMI interface).
- *Daylight On* - Set the day and time to start Daylight Savings Time, where applicable. Format is mm.week.dayofweek.minutesoffset.bias. For example 4.1.0.120 is The first Sunday in April at 2:00am (fourth month, first week, 0 day of week for Sunday, at 120 minutes after midnight). The bias is automatically 60 minutes if not defined.
- *Daylight Off* - Set the day and time to return to Standard Time (end of Daylight Savings Time). The format follows the same pattern as Daylight On.
- *Time Zone Minutes West* - The time zone as defined in minutes west of UTC time. For example, for US Central time, the value is 360 (6 hours West of UTC). Negative numbers may also be used. For Germany the value is -60.
- *Analyzers Date/Time (UTC)* - The programmed date and time of the analyzer referenced to Coordinated Universal Time (UTC) .
- *Analyzers Date/Time (Local Time)* - The local date and time of the analyzer.
- *Time Server IP Address* - If the analyzer derives its time reference from a separate time server, this setting identifies the IP address of that server.

- *Set Date and Time* - Used to manually set the local date and time.
- *Set Local Date/Time* (button) - Sets the analyzer to match the date and time of the GCP workstation computer (displayed in the field to the left of the button).
- *Modify Date/Time* (button) - Sets the analyzer to the manually defined date and time (defined in the fields to the left of the button).

Language Settings

- *Language Country Code* - Language of the analyzer (sets the language of the HMI interface).

Time Zone Settings

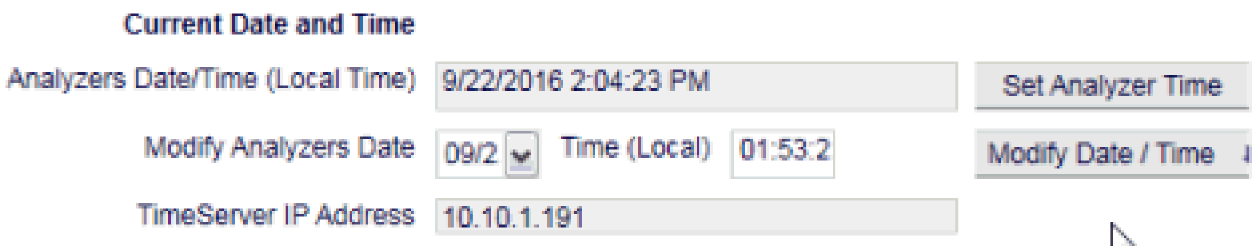
- *Daylight On* - Set the day and time to start Daylight Savings Time, where applicable. Format is mm.week.dayofweek.minutesoffset.bias. For example 4.1.0.120 is The first Sunday in April at 2:00am (fourth month, first week, 0 day of week for Sunday, at 120 minutes after midnight). The bias is automatically 60 minutes if not defined.
- *Daylight Off* - Set the day and time to return to Standard Time (end of Daylight Savings Time). The format follows the same pattern as Daylight On.
- *Time Zone Minutes West* - The time zone as defined in minutes west of UTC time. For example, for US Central time, the value is 360 (6 hours West of UTC). Negative numbers may also be used. For Germany the value is -60.

Current Date and Time

- *Analyzers Date/Time (Local Time)* - The local date and time of the analyzer.
- *Analyzers Date/Time (UTC)* - The programmed date and time of the analyzer referenced to Coordinated Universal Time (UTC) .
- *Time Server IP Address* - If the analyzer derives its time reference from a separate time server, this setting identifies the IP address of that server.
- *Set Analyzer Time* (button) - Sets the analyzer to match the date and time of the GCP workstation computer.

Set Date and Time

- *Local PC Date and Time* - Sets the analyzer to the manually defined date and time.



4.10.5.3 Programs

Maxum programs perform specific user defined tasks. Programs are resident on the GC and can be run using an internal trigger, an external trigger, manually, or on a scheduled cycle. Programs are created in the GCP or using the MaxBasic editor. The MaxBasic editor is a separately licensed program that, if installed, is accessible via GCP.

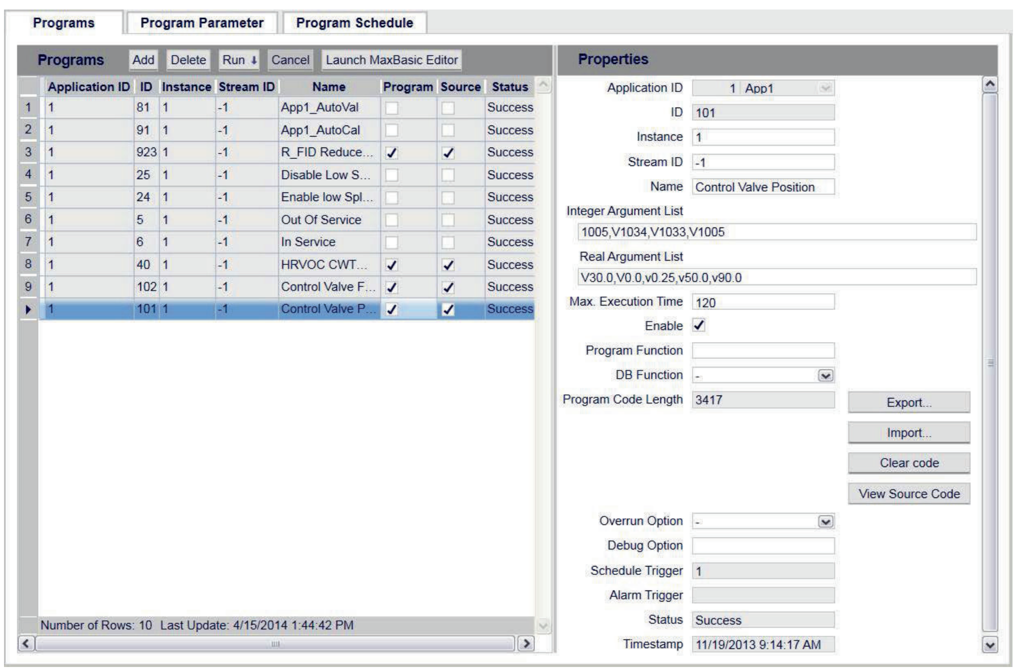


Figure 4-19 Programs Screen

- *Add* (Button) - Adds a program.
- *Delete* (Button) - Deletes the selected program.
- *Run* (Button) - Manually runs the selected program.
- *Cancel* (Button) - Stops a program that is currently running.
- *Launch MaxBasic Editor* (Button) - Launches the separate program for creating and editing MaxBasic programs (if the MaxBasic Editor program is installed).
- *Application ID* - Application ID of the program.
- *ID* - ID of the program.

- *Instance* - Used for differentiating between different instances of the same Program ID.
- *Stream ID* - Comma separated list of valid streams for this program (checked for validity at run time). A value of –1 is used to denote all streams.
- *Name* - The user defined name of the program.
- *Integer Argument List* - Comma separated list of parameter IDs (from the Program Parameter tab) that are sent to the program at run time. For auto calibration and auto validation this can contain the specific sequence ID of the calibration or validation sequence when there are multiple sequences. Constant values are indicated by a V in the first character of each item in the list.
- *Real Argument List* - Comma separated list of parameter IDs (from the Program Parameter tab) that are sent to the program at run time. Constant values are indicated by a V in the first character of each item in the list.
- *Maximum Execution Time* - Interpreter will cancel program if it runs beyond this time. A value of –1 means do not use.
- *Enable* - This checkbox is used to enable or disable the program. When not checked, the program will not run.
- *Status* - Indicates the status of the last program execution.
- *Program Function* - Integer that indicates special programming that does not require MaxBasic.
  - 0 = none
  - 1 = autocalibrate
  - 2 = autovalidate
  - 99 = end of cycle release of mvrpgm
  - >100 = program ID of the next program to run with format of ID+100 (e.g. 130 means run program 30).
- *DB Function* - Selection list of internal functions. Refer to Built In Programs Using DBFunction (Page 55) topic for more information.
- *Program Code Length* - This property appears when the selected program line is a MaxBasic program and represents the length of the program, in bytes. When this property is displayed, it is accompanied by four function buttons.
  - Export - This exports a program from the analyzer to the computer.
  - Import - This imports a program from the computer to the analyzer.
  - Clear Code - Clears the existing code.
  - View Source Code - Opens the program for viewing in text format in a Notepad editor.
- *Overrun Option* - Defines the action to take if the program is run while another occurrence of the same program is still running.

- *Debug Option* - Option for debugging, passed as argument to program and also used by the interpreter. Note the value should always be 0 (or empty) in normal for normal operation, as other settings place extra load on the CPU.
  - 0 = none
  - 8 = display execution time and error status
  - 16 = display arguments and start time
  - 32 = trace SQL statements
  - -1 = All of the above
- *Schedule Trigger* - The ID of the associated program schedule, if existing.
- *Alarm Trigger* - The ID of the associated alarm as defined in the Alarm Handler (found under the Application Tab in the navigation menu selection titled "Limits and Alarm Handlers"), if existing.
- *Timestamp* – The Date and time of the last time this program ran.

Program Parameters

The Parameter tab is a table that identifies database information can be accessed by programs. Entries from the Parameter table are accessed using the Integer Arguments and Real Arguments lists. The program/parameter method provides stream specific passing of a limited number of database values for read-only to a Basic program at run time.

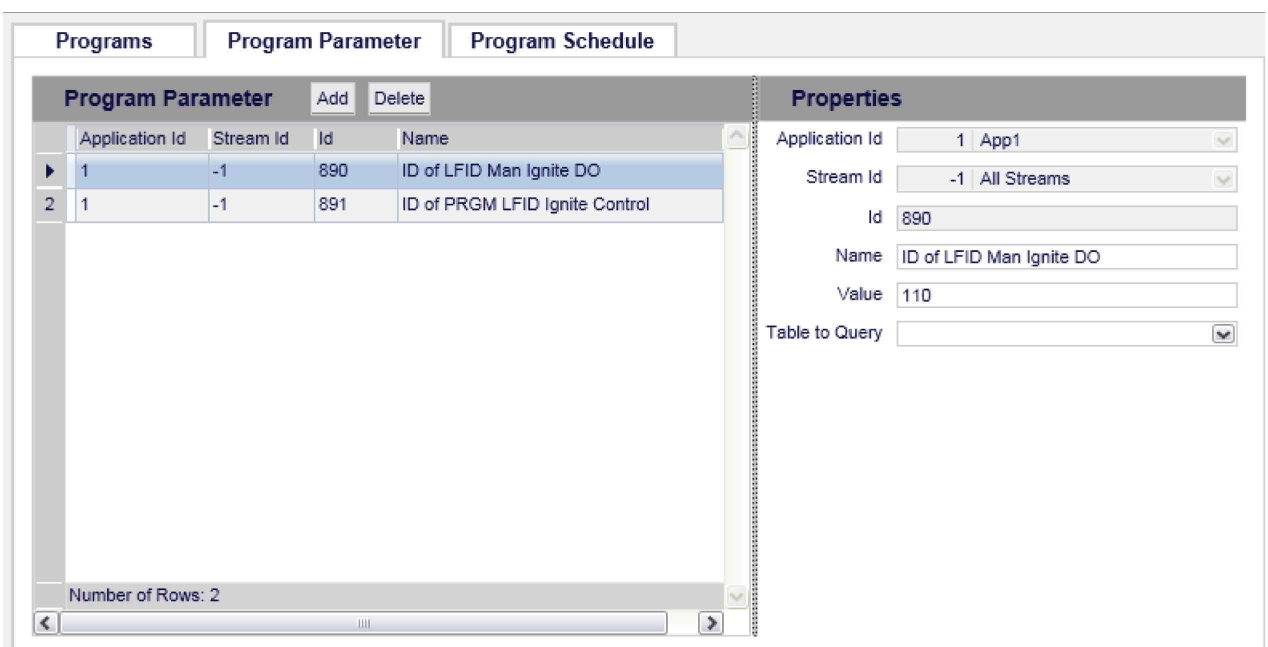


Figure 4-20 Program Parameters

- *Add* (Button) - Adds a parameter.
- *Delete* (Button) - Deletes the selected parameter.
- Application ID - Application ID of the selected parameter. A value of -1 equates to all applications.

- Stream ID - Stream related to the parameter. A value of -1 equates to all streams.
- ID - Program Parameter ID. Used by the Integer or Real Arguments lists to reference the parameter.
- Name - User defined name of the parameter. Some parameter names have special meaning to the system. OPCVALOFF means not to use validation as a run status for OPC. VALIDATION SEQUENCE STREAM and VALIDATIONFLAG are used for ADH communication.
- Value - Character string denoting the current evaluated value, or a constant value.
- Table to Query - Used to make queries at program run time.
- ID in Queried Table - Used with Table to Query to make queries at program run time.

Additional Options for Programs:

When a MaxBasic program is selected, there are additional action buttons that appear in the Properties box. These buttons are displayed regardless of whether MaxBasic is installed.

- *Export* - Export the program to the PC.
- *Import* - Import a program from the PC.
- *Clear Code* - Clear the program code from memory.
- *View Source Code* - Show the MaxBasic source code for the program (opens in Windows Notepad).

Program Scheduling

The Program Schedule tab is used to set the schedule on which programs run. A schedule can be set to run a program cyclically (run once every set amount of time) or at certain set times of the day, week, or month.

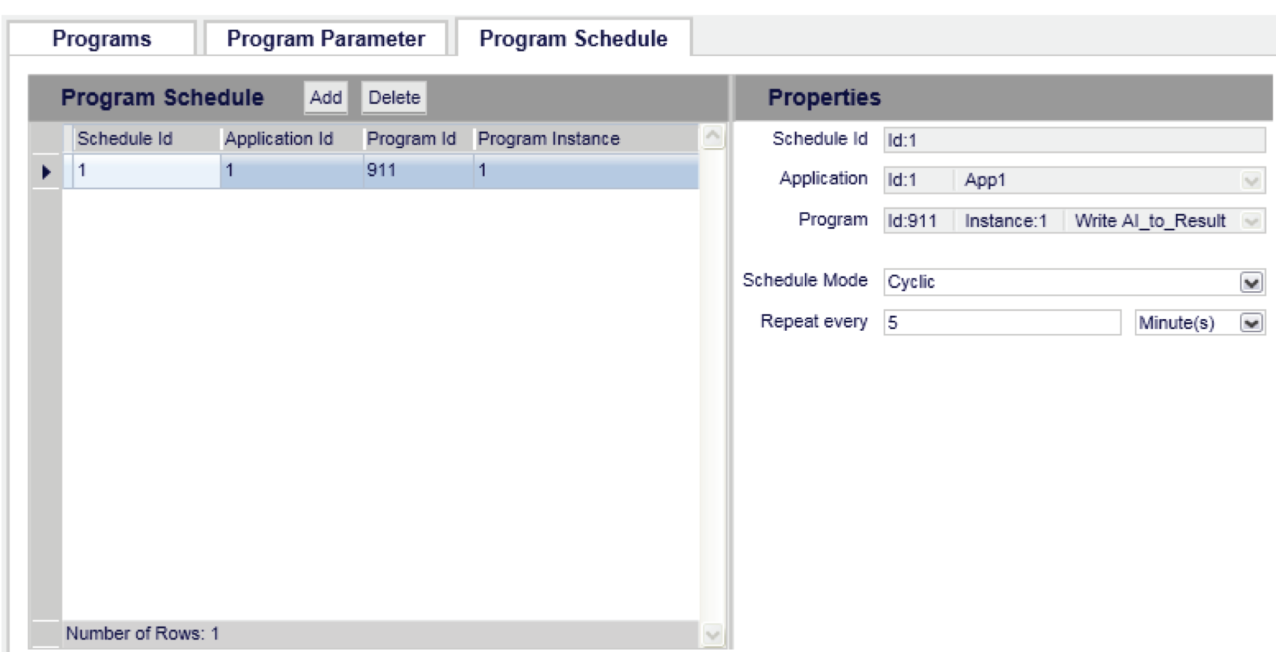


Figure 4-21 Program Schedules

- *Add* (Button) - Adds a schedule.
- *Delete* (Button) - Deletes the selected schedule.
- Schedule ID - The unique numerical identifier for the schedule.
- *Application ID* - Application related to the schedule. A value of -1 equates to all applications.
- *Program ID and Program Instance* - Identifies the specific ID and instance of the program to be scheduled.
- Schedule Mode - The criteria for the schedule, run either cyclically, daily, weekly, or monthly.
- Repeat Every - Used with the cyclic mode, sets the cycle to a set number of seconds, minutes, hours, or days.
- Start Time - For daily, weekly, or monthly modes. Sets the program to start at a certain time of day. Time is entered using the HH:MM 24 hour format. For the weekly mode, the user may choose any or all days of the week using check boxes that appear when this mode is selected.

4.10.5.4 Built In Programs Using DBFunction

Starting in software version 4.2, a new feature is added to the Program table to run some common functions without using MaxBasic. These built-in functions are easily invoked (especially with the new value arguments) and are optimized for quick execution. The DBFunction attribute in the Program table is set as described in the table below. Details relating to the available DBFunctions are below the table.

DBFunction*	Software Versions	Integer Argument List (IARGs)**	Real Argument List (RARGs)**	Comments
Normalize (1)	4.2+	1 = Index of total result	None	Requires pgmval in the result table to designate which results. Replaces the buffered_values of the original results.
Normalize (1)	4.3+ / 5.0+	1 = Index of total result 2 = Parameter ID with list of results to normalize	None	Uses a comma separated list in the parameter value to identify the result to normalize. Replaces the buffered_values of the original results.
Normalize (1)	4.3+ / 5.0+	1 = Index of total result 2 = Parameter ID with list of results to normalize 3 = Parameter ID with list of results for normalized values	None	Uses a comma separated list in the parameter value to identify the result to normalize. Use the 2nd list of results for the normalized values, preserving the originals.
Enable DI (2)	4.2+	1 = ID of application DI	None	

DBFunction*	Software Versions	Integer Argument List (IARGs)**	Real Argument List (RARGs)**	Comments
Disable DI (3)	4.2+	1 = ID of application DI	None	
Application in service (4)	4.2+	None	None	
Application Out of service (5)	4.2+	None	None	
Shutdown (6)	4.2+	1 = Application (available starting in version 5.1, optional)	None	
AO set from result (7)	4.2+	1 = Stream ID of result 2 = Result index 3 = ID of application AO	None	
I/O into result (8)	4.3+ / 5.0+	1 = Type (see Statmon documentation) 2 = ID of I/O 3 = stream_id for result 4 = Index of result	None	Place an I/O value into a result. Can be scheduled at any time in the cycle.
Peak or group value into result (9)	4.3+ / 5.0+	1 = Type (see Statmon documentation) 2 = Method 3 = Channel 4 = Peak or group ID from GCP result table 5 = Result index of target result	None	Place a peak or group value into a result. Best done at the end of the cycle.
FlameSense (12) (used with FlameLight)	4.3+ / 5.0+	1 = Detector ID 2 = Parameter ID for saved detector signal	None	FlameSense and FlameLight are patterened after MaxBasic programs commonly used in the US. The parameters work the same as with the MaxBasic programs.
FlameLight (13) (used with FlameSense)	4.3+ / 5.0+	1 = Detector ID 2 = Pressure AO ID 3 = Parameter for saved signal ON 4 = Parameter for saved signal OFF 5 = Power DO ID	1 = Threshold 2 = Pressure	

DBFunction*	Software Versions	Integer Argument List (IARGs)**	Real Argument List (RARGs)**	Comments
FlameControl (14) (used with programs 15, 16, and 17 below)	4.3+ / 5.0+	1 = DO ID 2 = Program ID 3 = Pressure AO ID	1 = Pressure	FlameControl is patterned after the MaxBasic program commonly used in Europe. The paramenters work the same as with the MaxBasic programs.
DI on (15)	4.3+ / 5.0+	1 = ID of application DI	None	
DI off (16)	4.3+ / 5.0+	1 = ID of application DI	None	
Enable program (17)	4.3+ / 5.0+	1 = ID of program	None	
Disable program (18)	4.3+ / 5.0+	1 = ID of program	None	
Transmit results (32)	4.2+	None	None	
* DBFunctions are identifed by by GCP using their name, but are identified in the database by a numerical ID. This ID is shown in parentheses. ** IARG and RARG lists are comma separated lists of values as described in the Programs help topic (ex. 1000, v2, 100). In the above table the number of the IARG (e.g. 1, 2, etc) references the position in the list (1 = first position in the comma separated list).				

DBFunctions Details:

Normalization (1) - The normalization function can be run 3 different ways:

- With 1 IARG, the function normalizes values in the result table that have the pgmval attribute set. The IARG indicates the result_index of the unnormalized total.
- With 2 IARGs, the function normalizes values that are stored in the parameter table in a comma delimited list. The first IARG is the result_index of the unnormalized total. The second IARG is the parameter ID of the result list.
- With 3 IARGs, , the function normalizes values that are stored in the parameter table in a comma delimited list. It stores the normalized values in a second list of results, retaining the original result values. The first IARG is the result_index of the unnormalized total. The second IARG is the parameter ID of the result list. The third IARG is the parameter ID of the list for storing the normalized values.

Enable DI (2) - Enables the DI that is designated in the first integer argument.

Disable DI (3) - Disables the DI that is designated in the first integer argument.

Application in service (4) - Places the Appcontext application in service.

Application out of service (5) - Places the Appcontext application out of service.

Shutdown analyzer (6) - Disables all temperature controllers, pressure controllers and puts Appcontext application in HOLD. Version 4.4/5.1 - added optional IARG for applicaiton.

Set AO from result (7) - For the appcontext application, sets AO value from the saved_value of the result. The Stream is the first integer argument, the result_index is the second integer argument and the AO id is the third integer argument.

I/O to result. I/O (8) (added Version 4.3/5.0) - The first IARG is the type of I/O designated from the Statmon table list:

- APPAI.VALUE = 400
- APPAI.AVERAGE = 401
- APPDI.VALUE = 410
- APPAO.READBACK = 420
- APPDO.READBACK = 430

The second IARG is the ID of the I/O. The third IARG is the stream_id of the target result and the fourth IARG is the result_index for the target result.

Peak or Group value to result (9) (added Version 4.3/5.0) - Place a peak or group value into a result. Best done at the end of the cycle.

Flamesense and FlameIgnite (12 and 13) (added Version 4.3/5.0) - Function 12 and 13 work together and the GC must be configured in a similar fashion, but not exactly. Argument configuration can be confusing. Contact Customer Support for assistance.

FlameControl (14, 15, 16, and 17) (added Version 4.3/5.0) - Function 14, 15, 16, 17 work together the GC must be configure the same way as the MaxBasic versions of these programs. This configuration is complex. Contact Customer Support for assistance.

DI ON (15) (added Version 4.3/5.0) - Sets the DI ON that is designated in the first integer argument.

DI OFF (16) (added Version 4.3/5.0) - Sets the DI OFF that is designated in the first integer argument.

Enable Program (17) (added Version 4.3/5.0) - Enables the Program that is designated in the first integer argument.

Disable Program (18) (added Version 4.3/5.0) - Disables the Program that is designated in the first integer argument.

Transmit result (32) - For the appcontext application and the running stream, transmit results.

4.10.5.5 System Hardware

Analog Input

System I/O tables contain the links between the hardware I/O channels and the applications on the local analyzer. An application can only use I/O that is defined in the system I/O tables. These tables are either automatically populated by the system at startup or are added through GCP.

Table entries for local SNE I/O are created automatically. Table entries for Optichrom and remote I/O must be created by hand using a text load file or GCP.

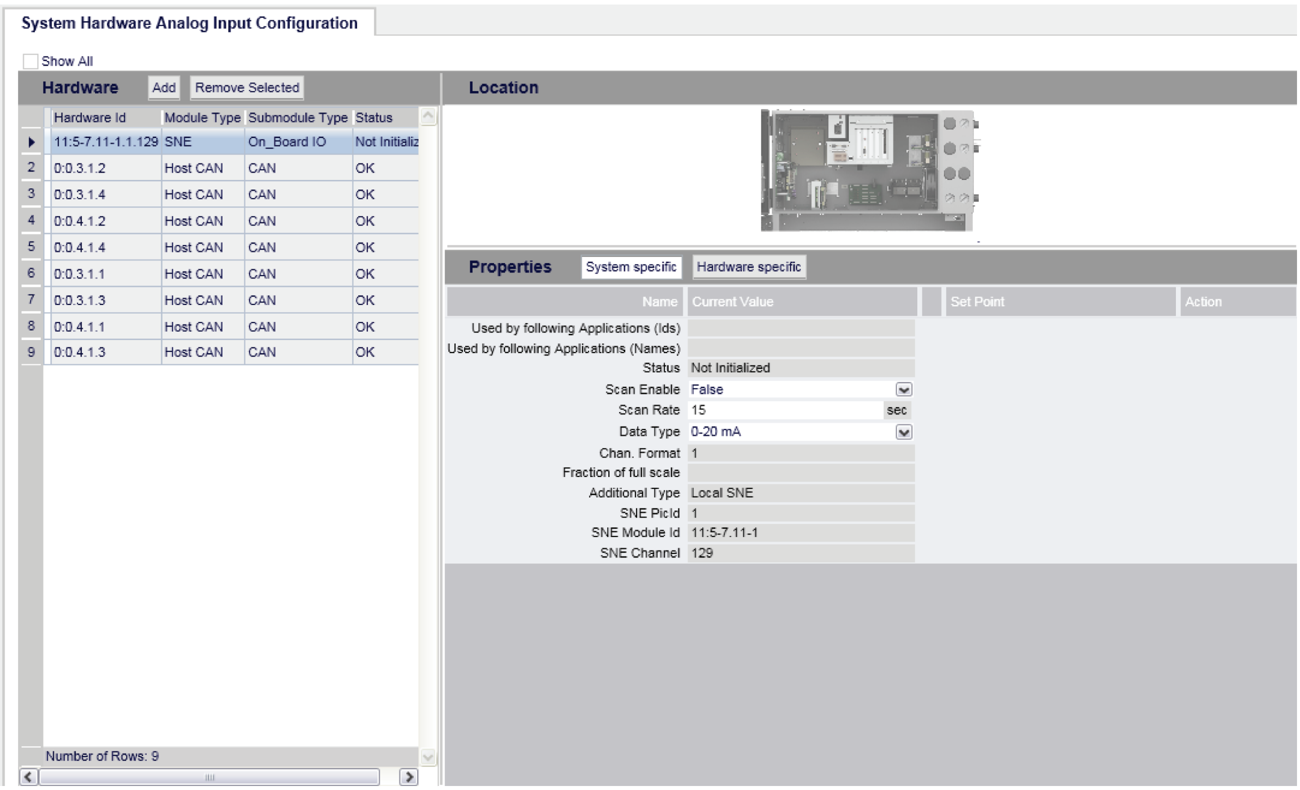


Figure 4-22 System I/O - Analog Inputs

- *Add* (Button) - Add an Analog Input.
- *Remove Selected* (Button) - Delete the selected Analog Input.
- *Hardware ID* - The hardware identification string that denotes the SNE ID (or SYSCON), Module Type, Submodule Type, Location ID, PIC Index, Channel Type, and Channel Number. A value of "Dummy" indicates a dummy entry for the purpose of creating an application AI that has no hardware AI.
- *Module Type* - Derived from the Hardware ID.
- *Submodule Type* - Derived from the Hardware ID.
- *Status* - The operating status for the Analog Input.
- System Specific Properties (Button) - These properties relate to the database configuration for the selected Analog Input. More information about each property can be obtained by using the available tool tips (hovering the mouse pointer over the Current Value field for the desired property). Fields that are in gray are either automatically set or set from the related Application I/O.
- Hardware Specific Properties (Button) - These properties relate to the hardware configuration. More information about each property can be obtained by using the available tool tips (hovering the mouse pointer over the Current Value field for the desired property).

Analog Output

The Analog Output screen is simlar to the Analog Input screen.

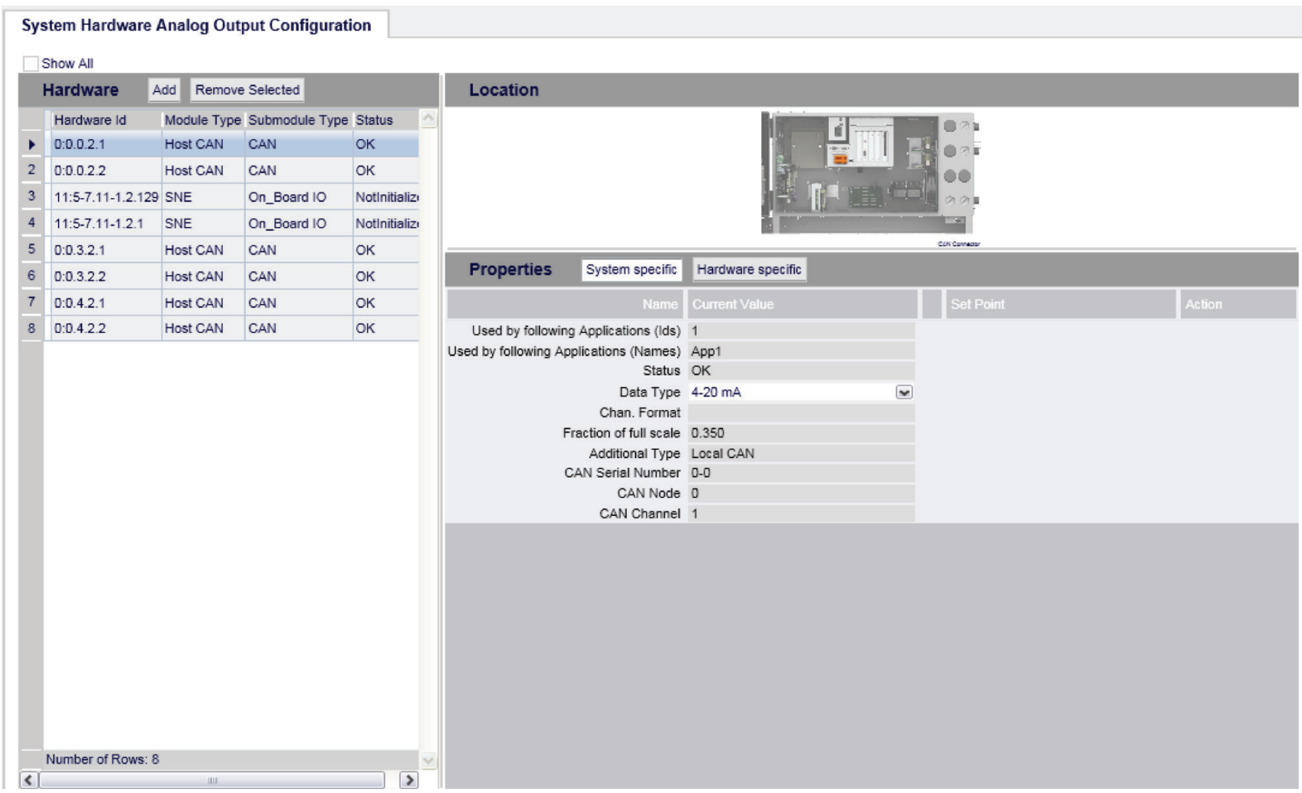


Figure 4-23 System I/O - Analog Outputs

- *Add* (Button) - Add an Analog Output.
- *Remove Selected* (Button) - Delete the selected Analog Output.
- *Hardware ID* - The hardware identification string that denotes the SNE ID (or SYSCON), Module Type, Submodule Type, Location ID, PIC Index, Channel Type, and Channel Number. A value of "Dummy" indicates a dummy entry for the purpose of creating an application AO that has no hardware AO.
- *Module Type* - Derived from the Hardware ID.
- *Submodule Type* - Derived from the Hardware ID.
- *Status* - The operating status for the Analog Output.
- System Specific Properties (Button) - These properties relate to the database configuration for the selected Analog Output. More information about each property can be obtained by using the available tool tips (hovering the mouse pointer over the Current Value field for the desired property). Fields that are in gray are either automatically set or set from the related Application I/O.
- Hardware Specific Properties (Button) - These properties relate to the hardware configuration. More information about each property can be obtained by using the available tool tips (hovering the mouse pointer over the Current Value field for the desired property).

Digital Input

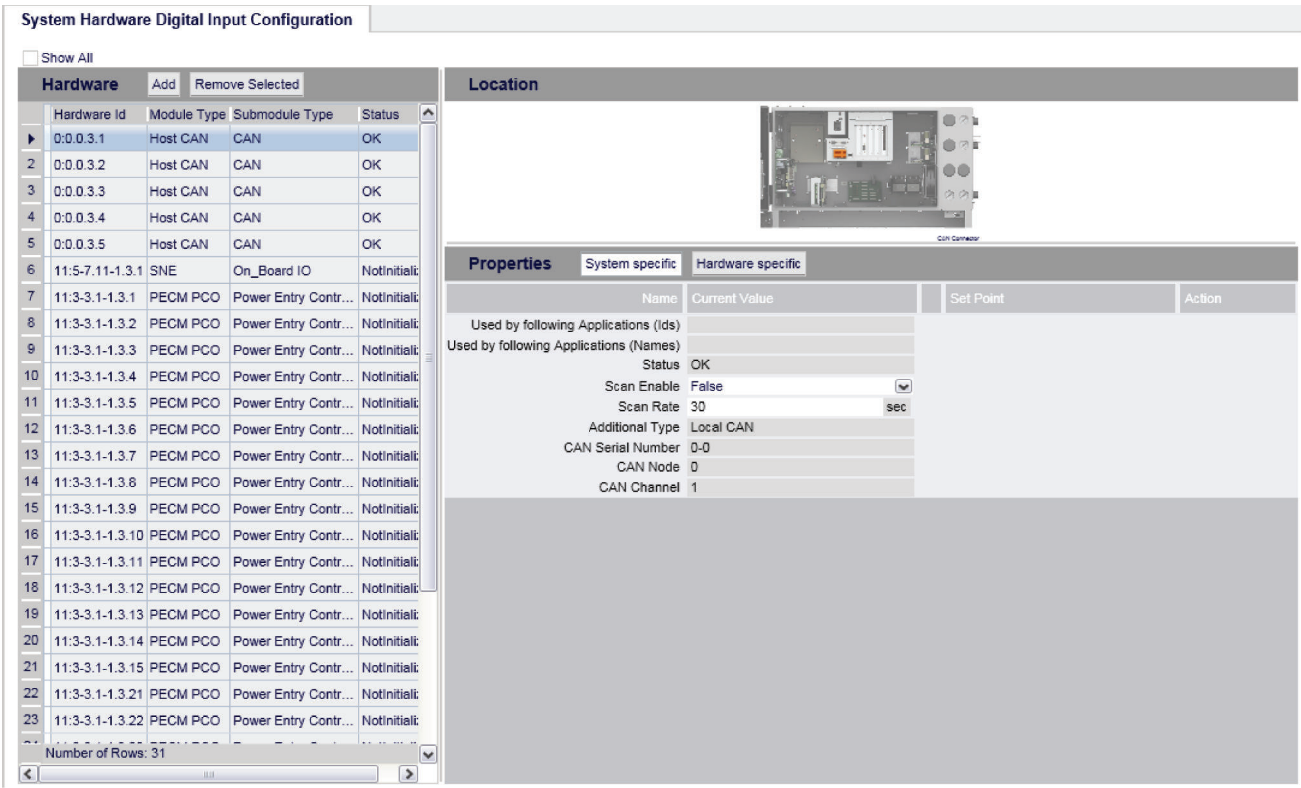


Figure 4-24 System I/O - Digital Inputs

- *Add* (Button) - Add a Digital Input.
- *Remove Selected* (Button) - Delete the selected Digital Input.
- *Hardware ID* - The hardware identification string that denotes the SNE ID (or SYSCON), Module Type, Submodule Type, Location ID, PIC Index, Channel Type, and Channel Number. A value of "Dummy" indicates a dummy entry for the purpose of creating an application DI that has no hardware DI.
- *Module Type* - Derived from the Hardware ID.
- *Submodule Type* - Derived from the Hardware ID.
- *Status* - The operating status for the Digital Input.
- System Specific Properties (Button) - These properties relate to the database configuration for the selected Digital Input. More information about each property can be obtained by using the available tool tips (hovering the mouse pointer over the Current Value field for the desired property). Fields that are in gray are either automatically set or set from the related Application I/O.
- Hardware Specific Properties (Button) - These properties relate to the hardware configuration. More information about each property can be obtained by using the available tool tips (hovering the mouse pointer over the Current Value field for the desired property).

Digital Output

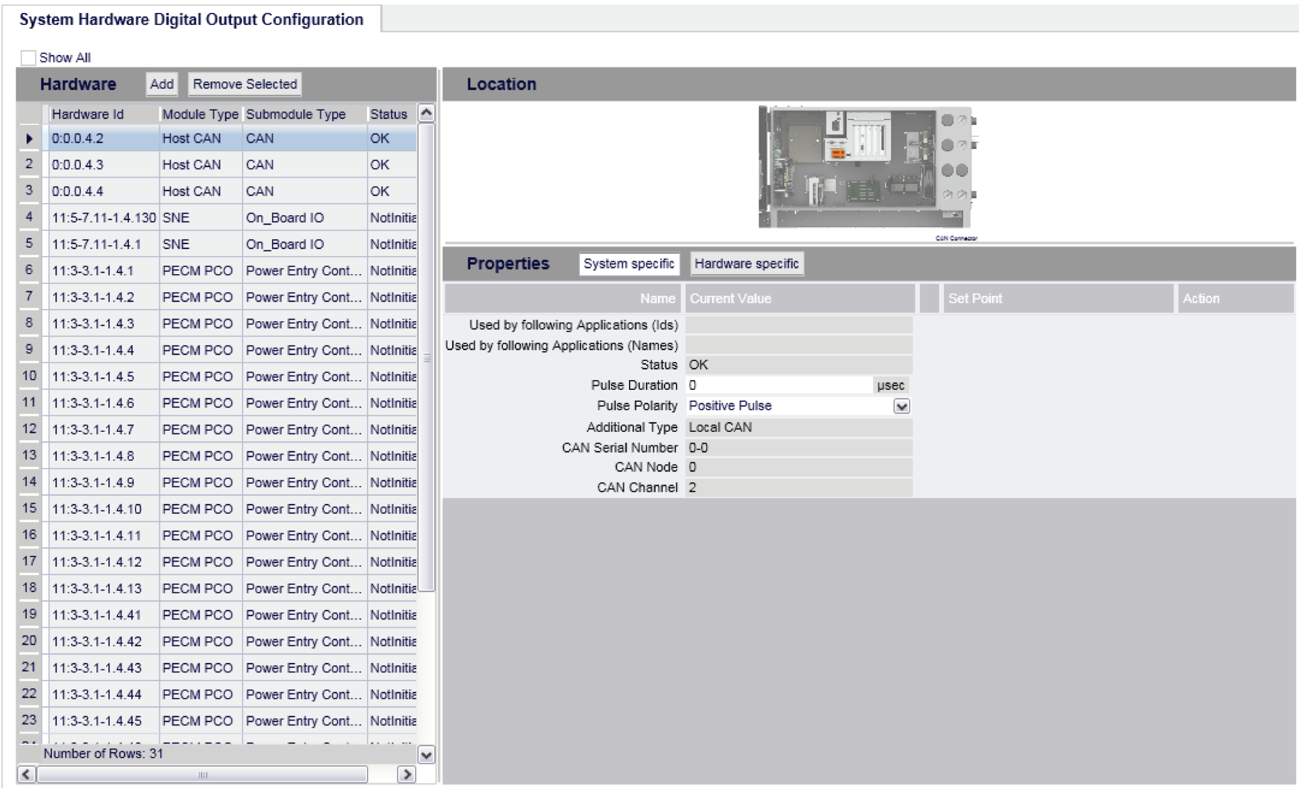


Figure 4-25 System I/O - Digital Outputs

- *Add* (Button) - Add a Digital Output.
- *Remove Selected* (Button) - Delete the selected Digital Output.
- *Hardware ID* - The hardware identification string that denotes the SNE ID (or SYSCON), Module Type, Submodule Type, Location ID, PIC Index, Channel Type, and Channel Number. A value of "Dummy" indicates a dummy entry for the purpose of creating an application DO that has no hardware DO.
- *Module Type* - Derived from the Hardware ID.
- *Submodule Type* - Derived from the Hardware ID.
- *Status* - The operating status for the Digital Output.
- System Specific Properties (Button) - These properties relate to the database configuration for the selected Digital Output. More information about each property can be obtained by using the available tool tips (hovering the mouse pointer over the Current Value field for the desired property). Fields that are in gray are either automatically set or set from the related Application I/O.
- Hardware Specific Properties (Button) - These properties relate to the hardware configuration. More information about each property can be obtained by using the available tool tips (hovering the mouse pointer over the Current Value field for the desired property).

Adv+ Detector Configration

Advance Plus detectors are configured automatically when they are part of the Adapter board. However, they must be configured manually when they use one of the two spare detector channels or are attached to an AI board in the backplane.

To configure manually select the Adv+ Detector Configuration screen under System Hardware and click the "Add" button. Input the Hardware ID and click OK. Then, fill out the relevant System Specific Properties.

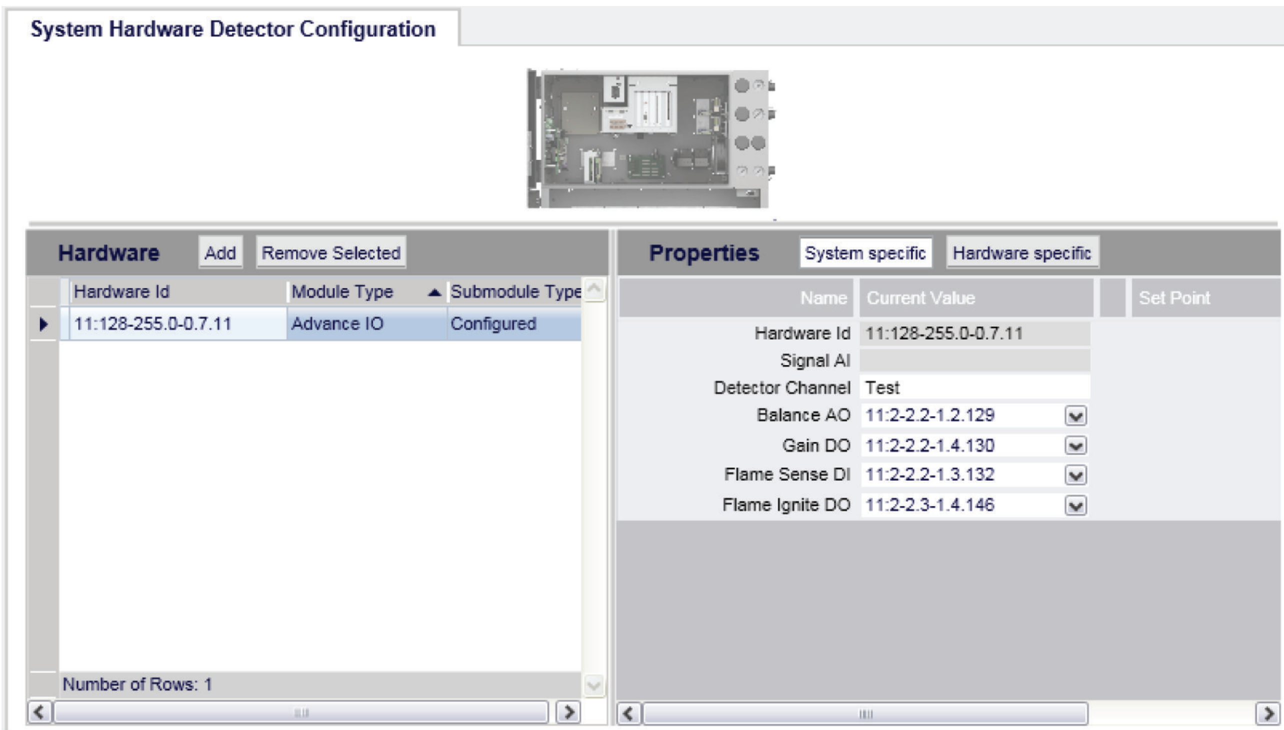


Figure 4-26 Adv+ Detector Configuration

SNE Controller

The SNE Controllers screen is used view the configuration information for installed SNE Controllers, and also to add or delete controllers.

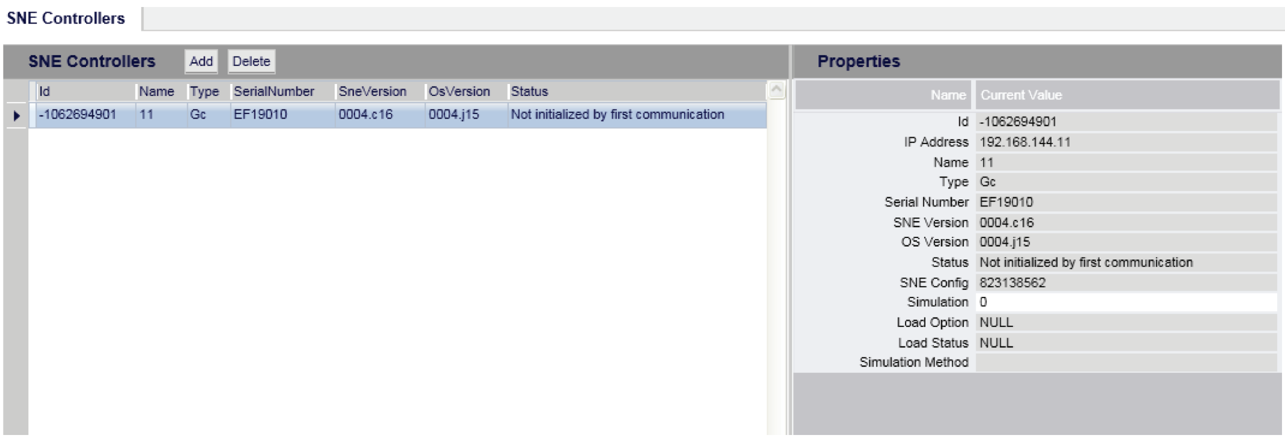


Figure 4-27 SNE Controllers

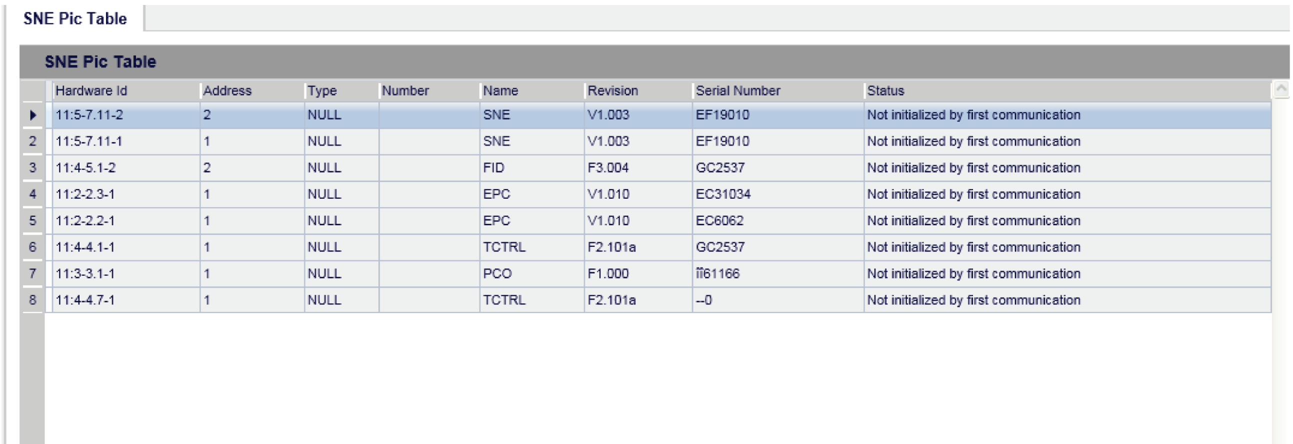
Additional information about each property can be obtained by using the available tool tips (hovering the mouse pointer over the Current Value field for the desired property). Most of the properties are downloaded from the installed SNE and automatically populated.

The SNE with Type listed as Embedded SNE does not use a physical SNECON board in the system. The SNE function is managed by software in the controller board; Syscon2 or CIM. Since this is a software component, several of the properties shown are indicative of a physical characteristic and can be ignored when using an Embedded SNE. This includes “IP Address”, “Serial Number”, “SNE Version” and “OS Version”

SNE PIC Table

The SNE PIC Table provides information relating to the SNE Peripheral Interface Controller (PIC) microcontroller chips. This table is for information only and is automatically populated by the database.

- Hardware addresses starting with 0: are associated with Embedded SNE,
- hardware addresses starting with 9: are CIM board addresses when accessed from a Syscon
  and
- hardware addresses starting with 11: are associated with physical SNE boards.



SNE Pic Table

	Hardware Id	Address	Type	Number	Name	Revision	Serial Number	Status
▶	11:5-7.11-2	2	NULL		SNE	V1.003	EF19010	Not initialized by first communication
2	11:5-7.11-1	1	NULL		SNE	V1.003	EF19010	Not initialized by first communication
3	11:4-5.1-2	2	NULL		FID	F3.004	GC2537	Not initialized by first communication
4	11:2-2.3-1	1	NULL		EPC	V1.010	EC31034	Not initialized by first communication
5	11:2-2.2-1	1	NULL		EPC	V1.010	EC6062	Not initialized by first communication
6	11:4-4.1-1	1	NULL		TCTRL	F2.101a	GC2537	Not initialized by first communication
7	11:3-3.1-1	1	NULL		PCO	F1.000	ïï61166	Not initialized by first communication
8	11:4-4.7-1	1	NULL		TCTRL	F2.101a	--0	Not initialized by first communication

Figure 4-28 SNE PIC Table

User Management

The User Management screen is available to supervisory personnel only (user level = super). It is used to authorize new users or remove authority for others.

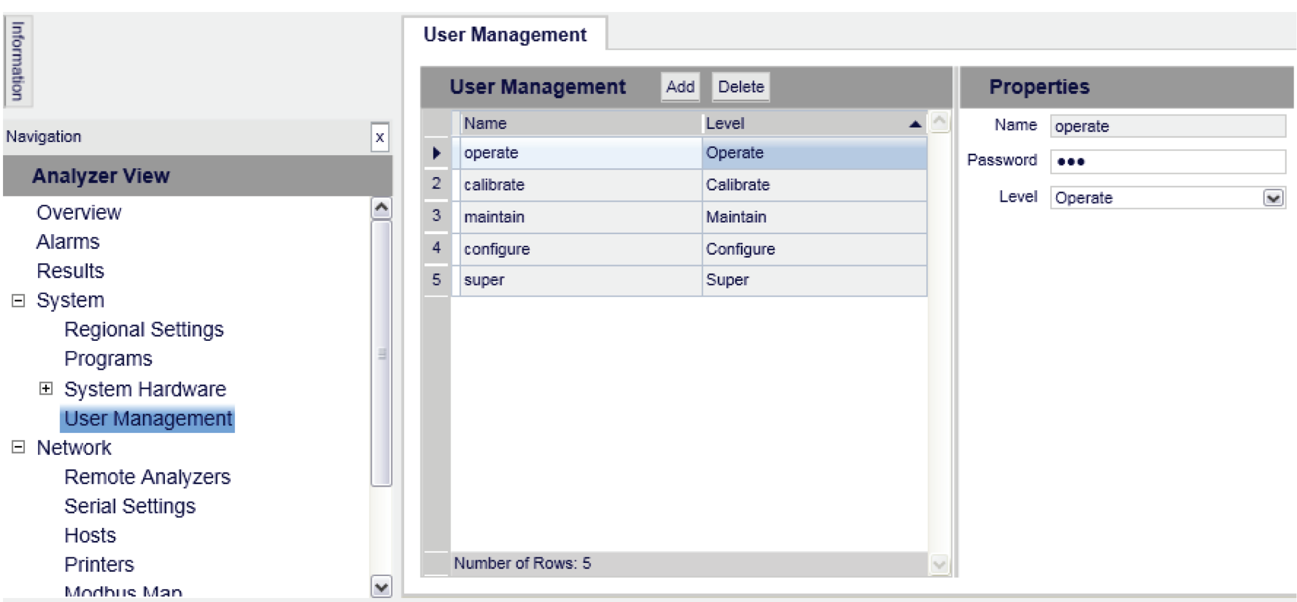


Figure 4-29 User Management

- *Add* (Button) - Add a user
- *Delete* (Button) - Delete the selected user

NOTICE
Do not delete the Super User. Doing so will make some functions inaccessible.

- *Name* - The chosen name for the user.

- *Level* - The level of access.
- *Password* - The password for the user. Passwords are set by the administrator. They cannot be set or changed by the individual users.

To add a user, click the Add button and then enter the name, password, and access level for the user.

To modify the password for a user, select the line in the table for that user and then remove the old password and enter the new one. The access level for a user can be changed in the same way.

Name and Password can be any alphanumeric value. Capital letters are permitted but ignored.

4.10.6 Network

4.10.6.1 Network Settings

The Network Settings Screens allow the user to view and modify data relating to the external network. Included is the main Network Settings screen as well as a subdirectory of additional screens as shown below.

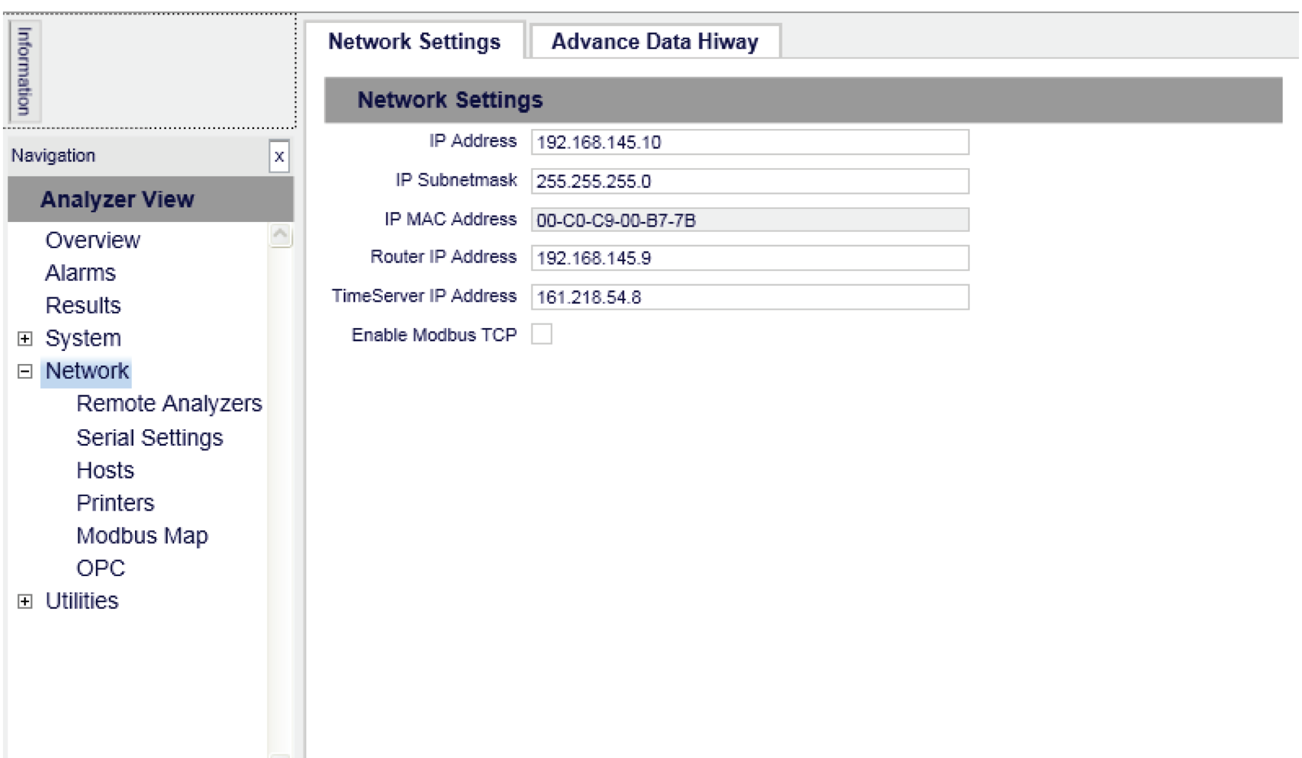


Figure 4-30 Network Settings

- *IP Address* - The IP address of the analyzer on the network.
- *IP Subnet Mask* - The mask address that is used to define the IP subnet.
- *IP MAC Address* - The hard coded IP MAC address of the analyzer.

- *Router IP Address* - The IP address of the network router, if equipped. If no Router is used enter the IP Address of the analyzer in the Router IP Address.
- *TimeServer IP Address* - If the system time is controlled by a separate time server, the IP address of that time server is entered here. Other Analyzers (SYSCON or CIM devices such as analyzers and NAUs) can be designated as a time server.
- *Enable Modbus TCP (checkbox)*- This checkbox is used to enable the Modbus TCP protocol. This allows a Modbus Master to retreive data from the device via the TCP/IP network connection for the device.

ADH Tab:

The ADH tab is used to enter settings to allow the analyzer to communicate on the Advance Data Hiway. The Loop and Unit are used to define a specific device address on the data hiway. The format is used to define the Optichrom HCI format for transmitting results. The application ID is the associated application.

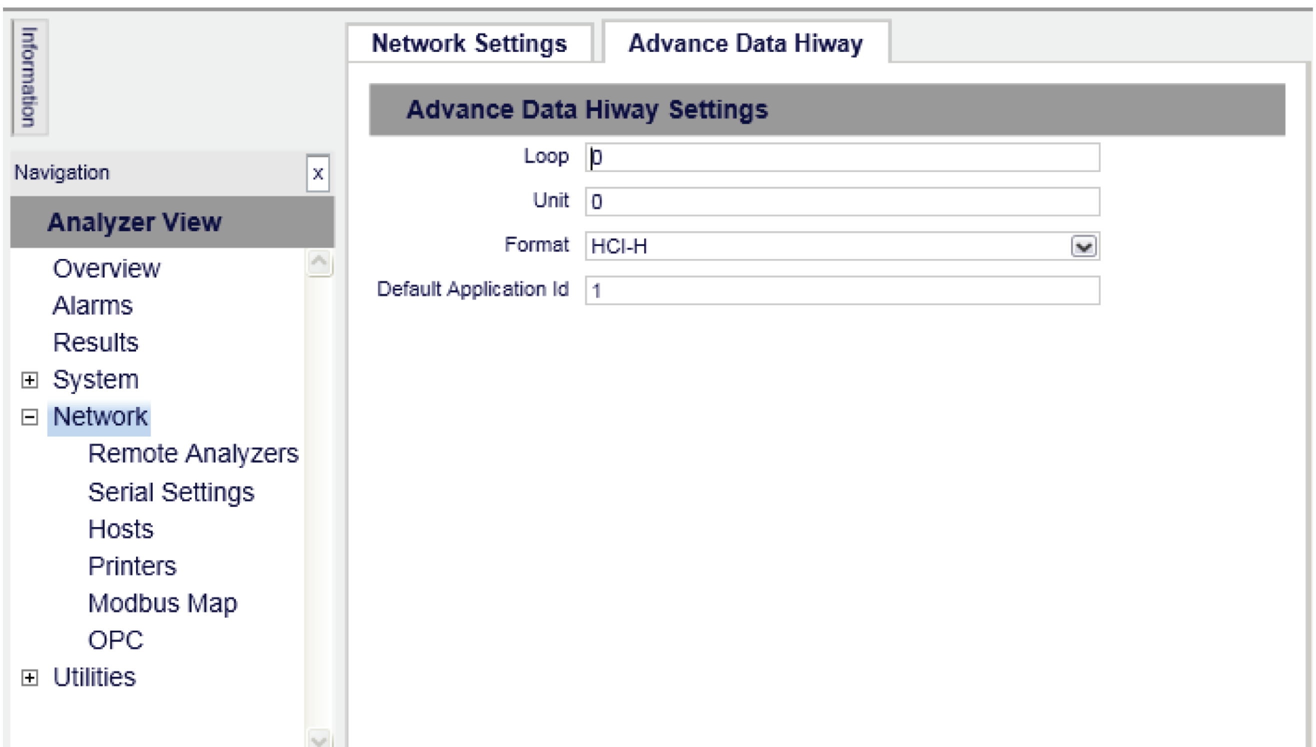


Figure 4-31 Network ADH Settings

Network Settings Subdirectory:

Remote Analyzers - This is the list of all remote analyzers known to the device. The user may add and removed devices from the list or make changes to some network settings (such as updating the list when a network setting has change for the remote analyzer)

Serial Settings - This is the settings for the serial ports in the analyzer.

Hosts - This allows the user to view and change settings for configured hosts, such as Modbus, and to add and delete hosts.

Printers - This allows the user to view, add, and remove printers connected to the device.

Modbus Map - This allows the user to view and edit the Modbus map, if configured.

OPC - This allows the user to see settings for OPC connection, if configured, and to enable/ disable OPC.

4.10.6.2 Remote Analyzers

The Remote Analyzers screen displays information for all external analyzers known to the device. This list is populated automatically from broadcast messages. Alternatively, remote analyzers can be added or deleted using the respective buttons.

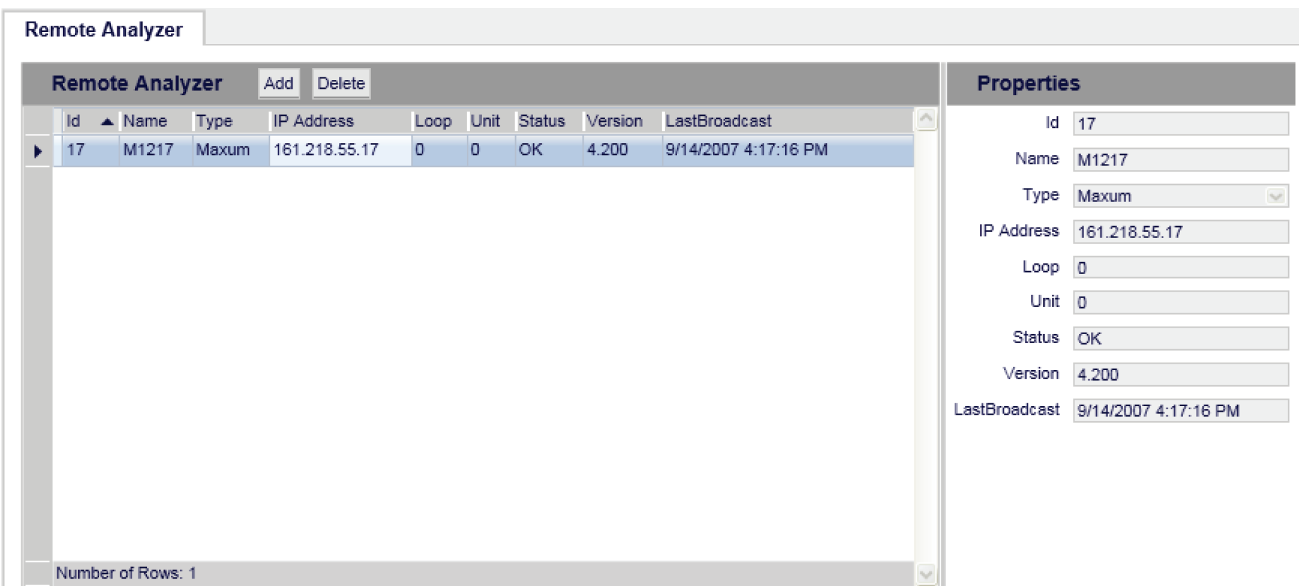


Figure 4-32 Remote Analyzers

Additional information describing the various properties can be found from the tool tips available in the GCP software (hovering with the mouse pointer over the relevant value in the Properties table).

4.10.6.3 Serial Settings

The Serial Settings screen is used to configure the Serial Ports. Serial port configuration varies depending on the type of controller module used and the software version. The database automatically detects the configuration and populates the Serial Settings table appropriately. Various communication settings can be configured in the Details section as shown below.

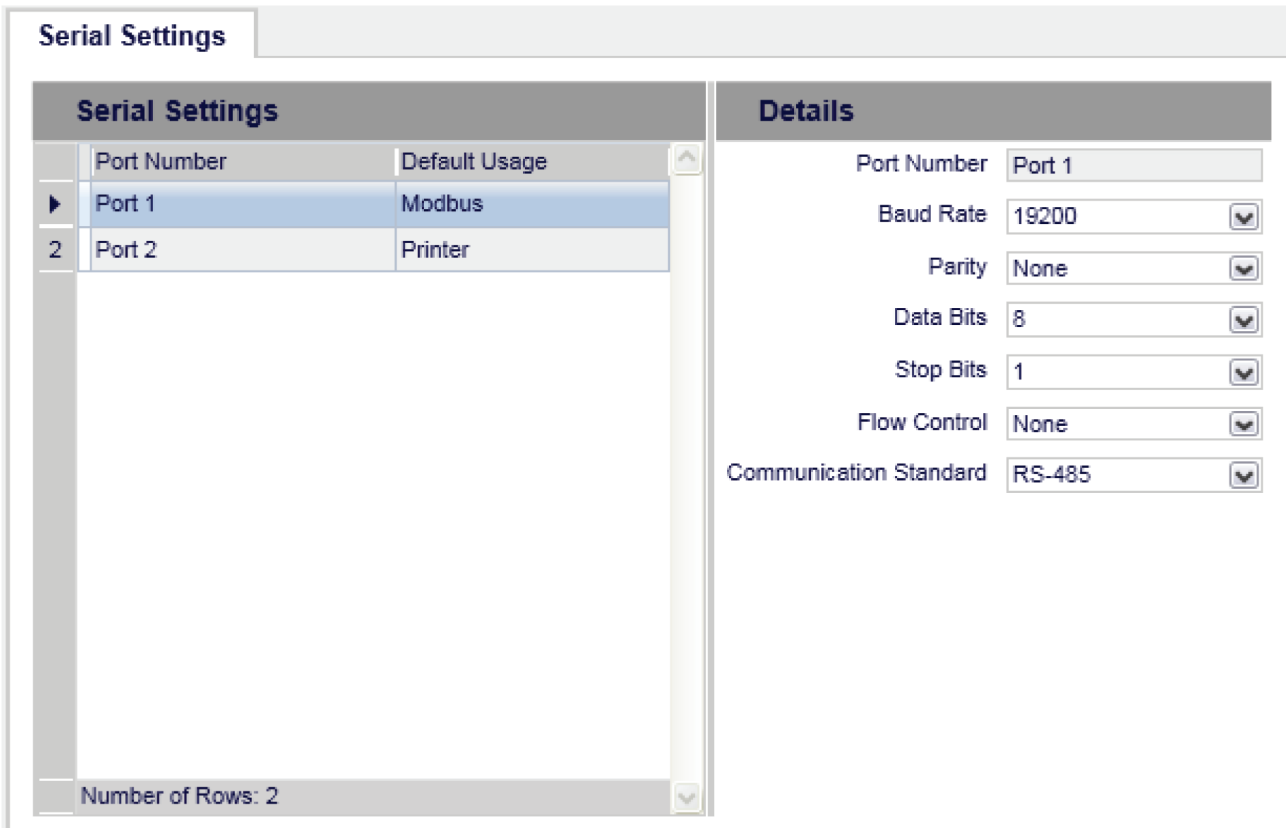


Figure 4-33 Serial Communication Settings

4.10.6.4 Hosts

Results transmission to an ADH (Advance Optichrom) Host Computer card, Maxum Modbus, or external result table is designated through entries in the Host table. In GCP, the Host table is accessed using the Network Hosts screen on the Navigation menu from the Analyzer view.

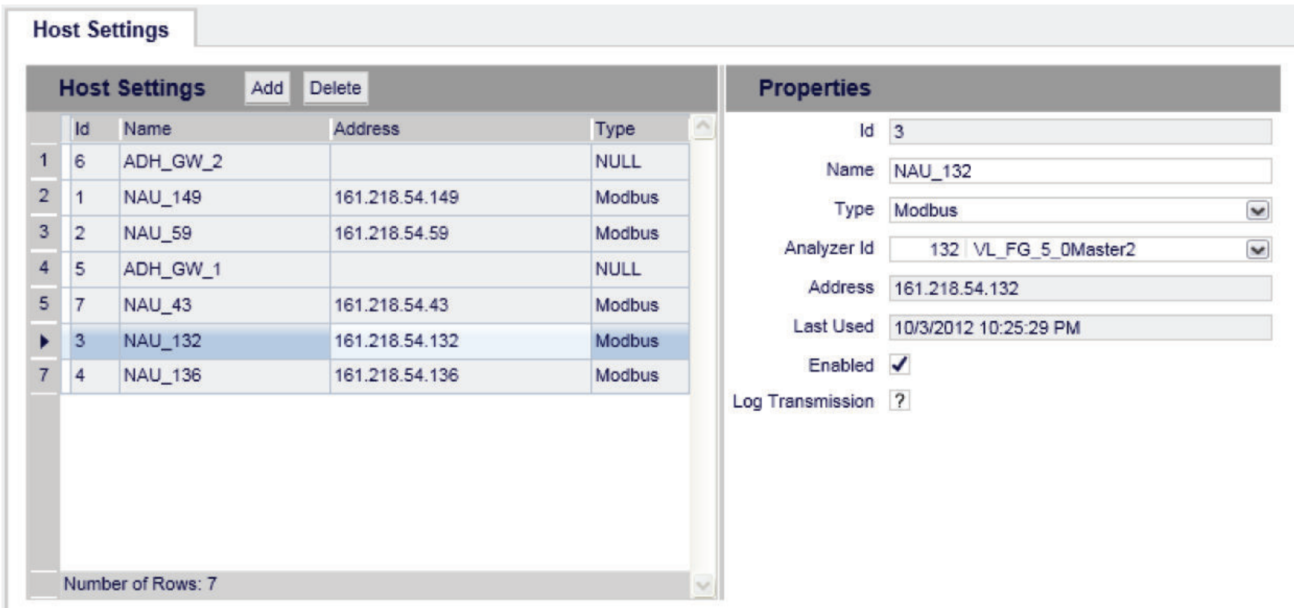


Figure 4-34 Hosts

Hosts are added and deleted using the relevant buttons. To add a Host, click the Add button and then fill out the Properties section. Depending on the type selected various properties will be listed.

- For ADH (types starting with HCI) - the properties *Loop* and *Unit* of the host device are required. The various HCI *Types* indicate the various formats. The property *Scale_factor* is used by HCIH. HCI *Types* require an event 32 which must be added to the program table in order for results to be transmitted to a Host on demand from the host interface card (HCI-A). Most ADH Types automatically include a specificly formatted header information in the transmission string. HCI Results Only does not include a formatted header so any header information (time, date, analyzer, stream) must be included in the results transmitted.
- For Modbus *Types* – the property Analyzer Id is set to the receiving NAU or other unit. If the Modbus map is in the local analyzer then the *Analyer Id* of the local analyzer must be entered in the *Analyzer Id* field. Modbus *Type Modbus free from* does not include the automatically generated header information in the result transmission. Any header information (time, date, analyzer, stream) must be included in the results transmitted.
- For external results setup: Analyzer ID is set to the receiving unit. Type is set to External results format. This will direct results to a receiving unit, where they will be read and placed in the extresult table.
- The Last Used value indicates the last date and time the host was used by the database.
- The "Enabled" checkbox must be checked for the Host to be active.
- The Log Transmission checkbox can be checked and the result transmission will be printed using the configured printer port.

Multiple hosts can be designated to receive results by creating multiple hosts in the table. Individual stream's results may be directed to different hosts by setting the hostdef in the stream_method table. For Modbus and OPC, the autotrt attribute in the stream_method table enables automatic end of cycle transmission and the trtval attribute in the result table indicates the order the results are transmitted(the trtval will match the result in the modbus_addmap table for Modbus). Transmission can be caused by setting the trtnow attribute in the stream_method table either manually or in MaxBasic. If the mvrpgm is used and automvr is disabled, it is recommended that autotrt be disabled also. The transmission would then be activated by setting the trtnow attribute. External results transmit all results for a stream using the result_index, instead of the trtval attribute (nothing has to be set in the result table for external results).

4.10.6.5 Printers

The printer table is used for configuring ADH Standard (Advance Optichrom), TCP printing, ADH Alternative (Advance Optichrom data logging), Email and Maxum PrintClient . The type of printer is defined using the Type property. The available types are dependent on the software version of the database.

The properties "Receive Alarms", "Receive Results",and "Receive Calibration" are used to designated the printer to receive the specified type of data.

The property "Last Used" identifies the date and time the specified printer was last used by the database.

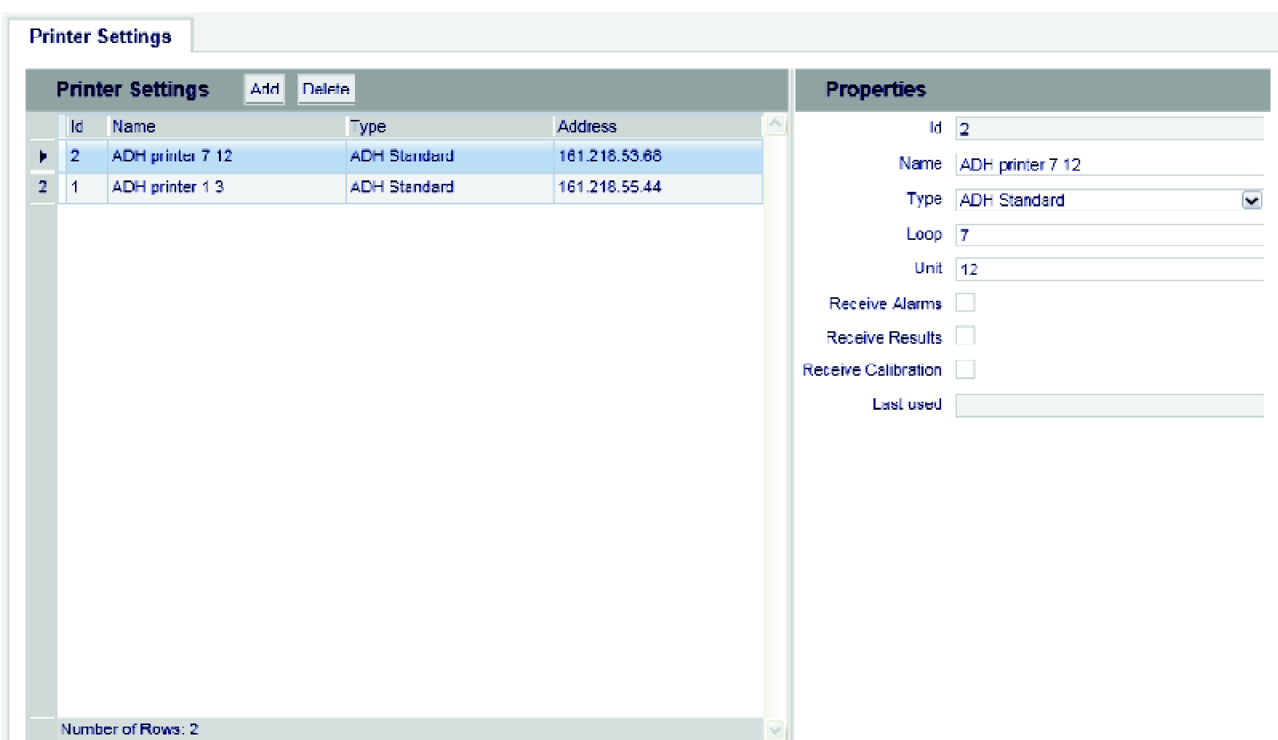


Figure 4-35 Printer Settings

For ADH printers the ADH Loop and Unit of the printer is required. For other printers the IP address is required. The three checkboxes indicate that information that the printer receives from the analyzer.

Maxum PrintClient is available from the Maxum Utilities software, which can be executed from the Tools menu of GCP. Help for Maxum PrintClient is available from the PrintClient dialog.

4.10.6.6 Modbus Map

To have Modbus communication between the between the Maxum devices and a host requires a Modbus Map customized to user specifications. The Modbus Address Map is a file used for loading the Maxum Network Access Unit (NAU) or any other Maxum device with details for processing the following:

- GC results to be placed at certain addresses so the host computer can read them.
- Control requests sent from the DCS to be directed to analyzers.

The map contains details about all addresses configured to send and receive data. Since no assumptions are made about what is contained at a certain address, the data type and a value type indicate what kind of information is stored at an address and any actions to be taken. For example, a RDME flag is set to "True" from the analyzer and reset to "False" automatically. The Current Value column in the Modbus Map Table in GCP contains information in readable format, not the format the Modbus Driver sends to the Host. A scaled result will be in the pre-scaled format, as it appears in the result table.

A Modbus map may be configured by Siemens according to customer requirements or configured by the customer – either by using a general default map or by editing that map to meet specific requirements. Microsoft Excel can be used as the configuration tool, by editing the map and saving it in comma delimited (.CSV) format. The resulting text file can be loaded onto the Maxum Device using the Loader tool in Maxum Utilities. Maxum Utilities is accessed via the GCP Tools menu. Map entries may also be entered manually using the Add button on the Modbus Map table screen in GCP.

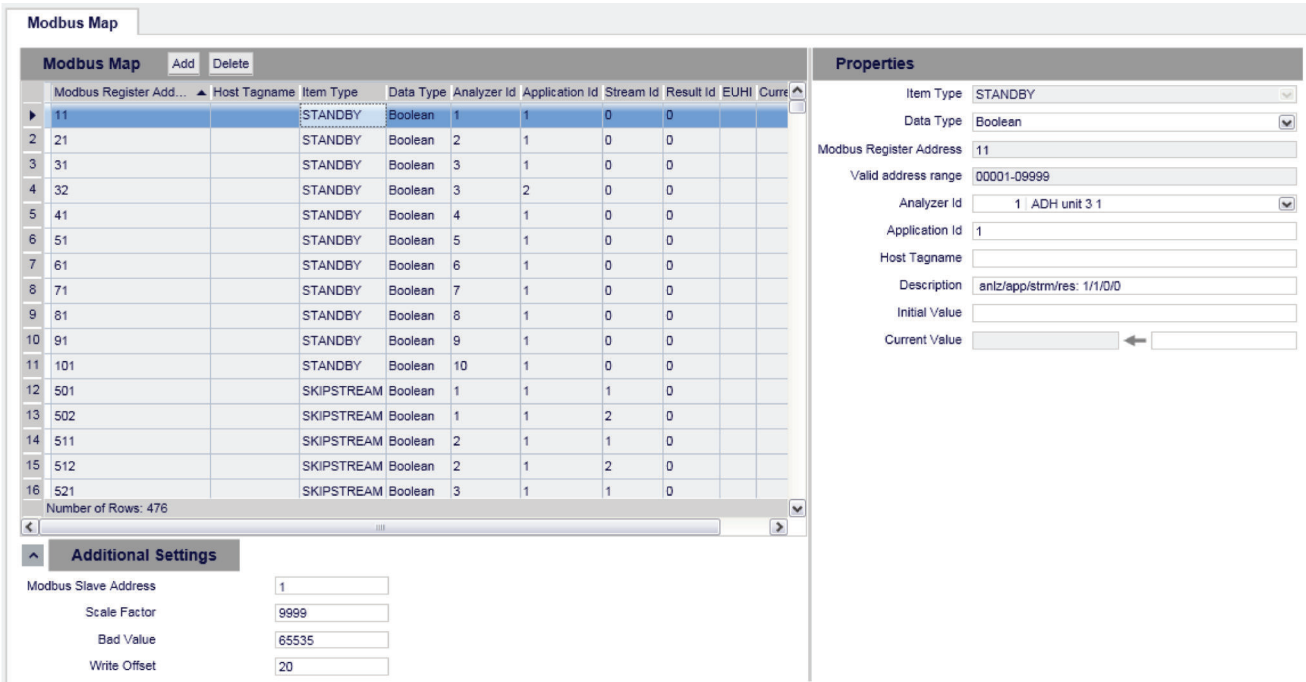


Figure 4-36 Modbus Map

Each transmitted result must be defined in the address map, and each transmitting application must have a status Item Type in the map.

For every result that the system needs to handle, the following information is required:

- Device LID
- Application ID
- Stream number
- Result Transmit Value (trtval)
- Modbus Register Address (normally defined by the DCS)

Additional host computer controls and information will be included in the Modbus Map when used by the interface. .

Note

Duplicate addresses where the Application ID, Stream Number, and Result Transmit Value match are not allowed. These will show red when entered manually from the Modbus Map screen. If they are part of a file that is transmitted, the redundant entry will be removed during loading of the map.

4.10.6.7 OPC

OLE for Process Control (OPC) is an open standard that permits a consistent method of accessing field data from industrial devices. OPC servers provide a method for many different software packages to access data from a process control device, such as the Maxum Gas Chromatograph.

Enable OPC check box must be checked to enable OPC on this device. In addition to this check box each result in each stream that is sent to the OPC must have a Transmit Value in the Properties of the Application View Result Configuration Table. The Auto Trainsmit Results check box must be checked for each stream sent to the OPC. This check box is located in the Application View, Sequences table and is in the Stream/Method Settings tab Properties.

Installation of the OPC server software is described in the Maxum OPC Server Manual. The OPC screen in GCP is used to view the OPC table settings for the Maxum device. This table is populated automatically by the analyzer when OPC is configured and activated. Each stream for which transmission is active is a line in the table. In addition, the table may be configured to gather information for more than just the local analyzer. Configuration is not possible from this screen, other than enabling or disabling OPC for this device.

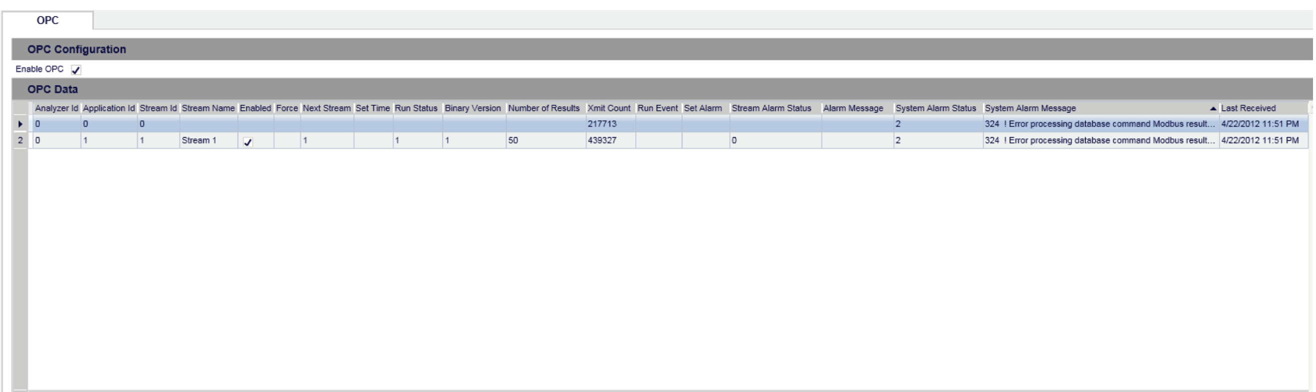


Figure 4-37 OPC Settings

4.10.7 StatMon - Historical Data Archive

Starting in version 4.2, the StatMon table in the database can be configured to store key database values over time. Because there is a limit to the amount of data that can be stored, this should be treated as temporary storage. The workstation interface in the Gas Chomatograph Portal provides configuration and viewing of StatMon values and the ability to export values to a file. Maxum Utilities Datalogger or GCP Datalogger provide more long-term storage of values. See the section on StatMon Table Limitations for important recommendations.

For more information on configuring StatMon, see Configuring the StatMon Table (Page 245).

4.10.8 Chromatogram Views

4.10.8.1 Chromatogram Appearance Settings

A command bar at the top of the chromatogram window controls the way multiple chromatograms are displayed, along with a load and save pulldown menu.

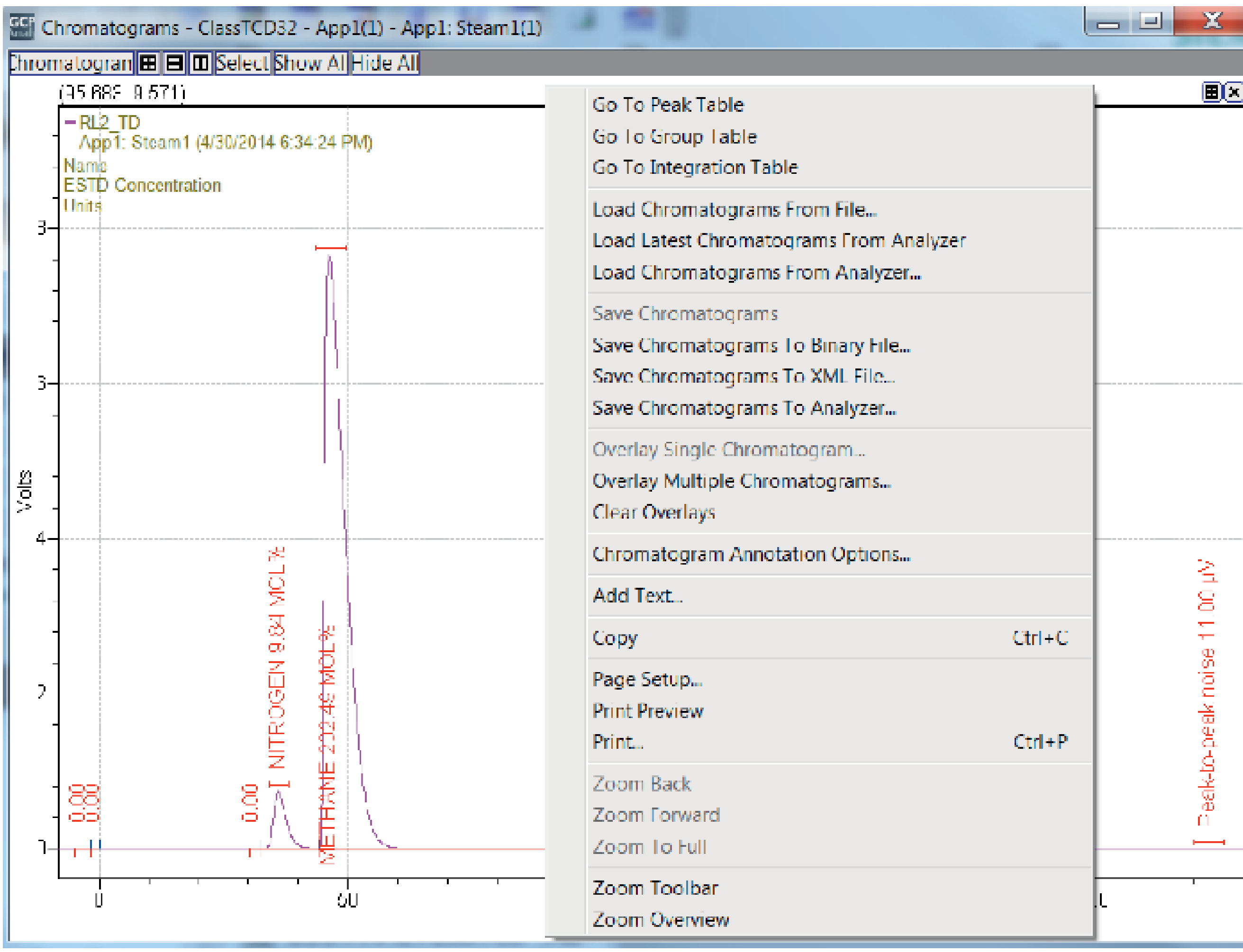


Figure 4-38 Chromatogram Options

A new feature for version 5.3 is the Chart Settings options, available from the right-click menu.

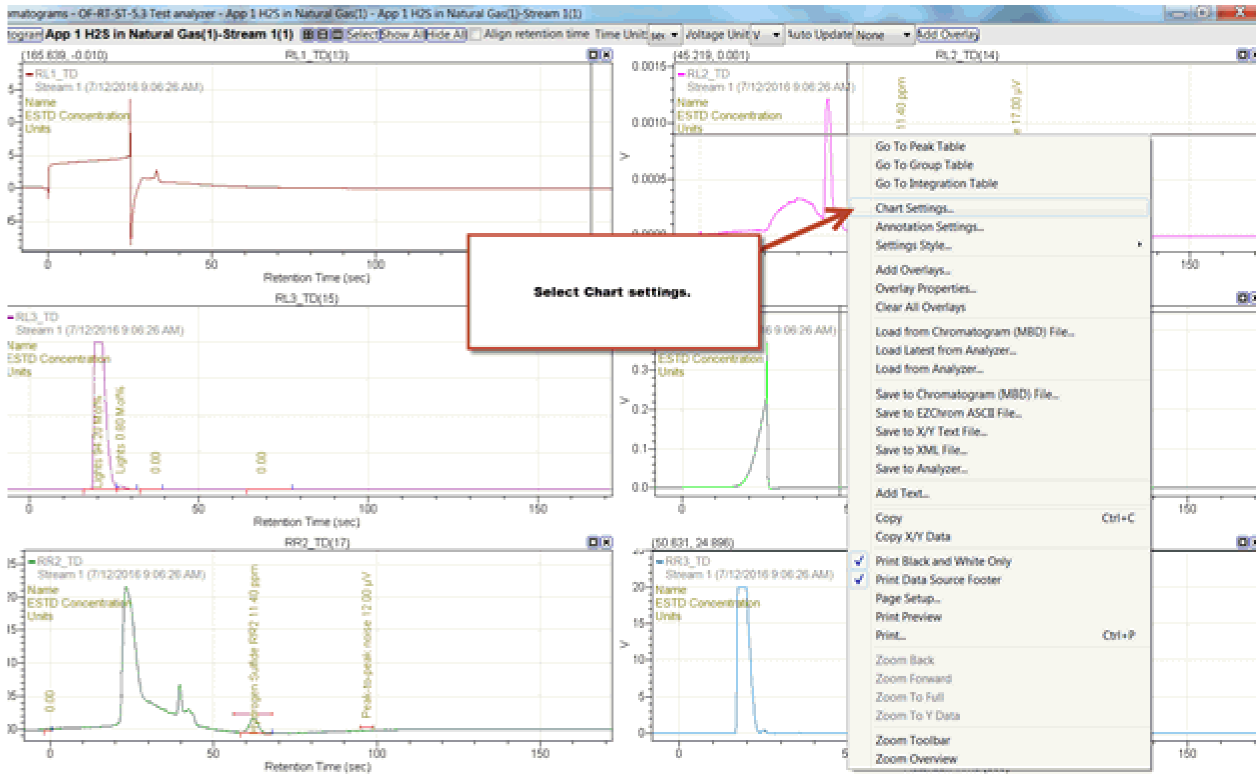


Figure 4-39 Chart Settings

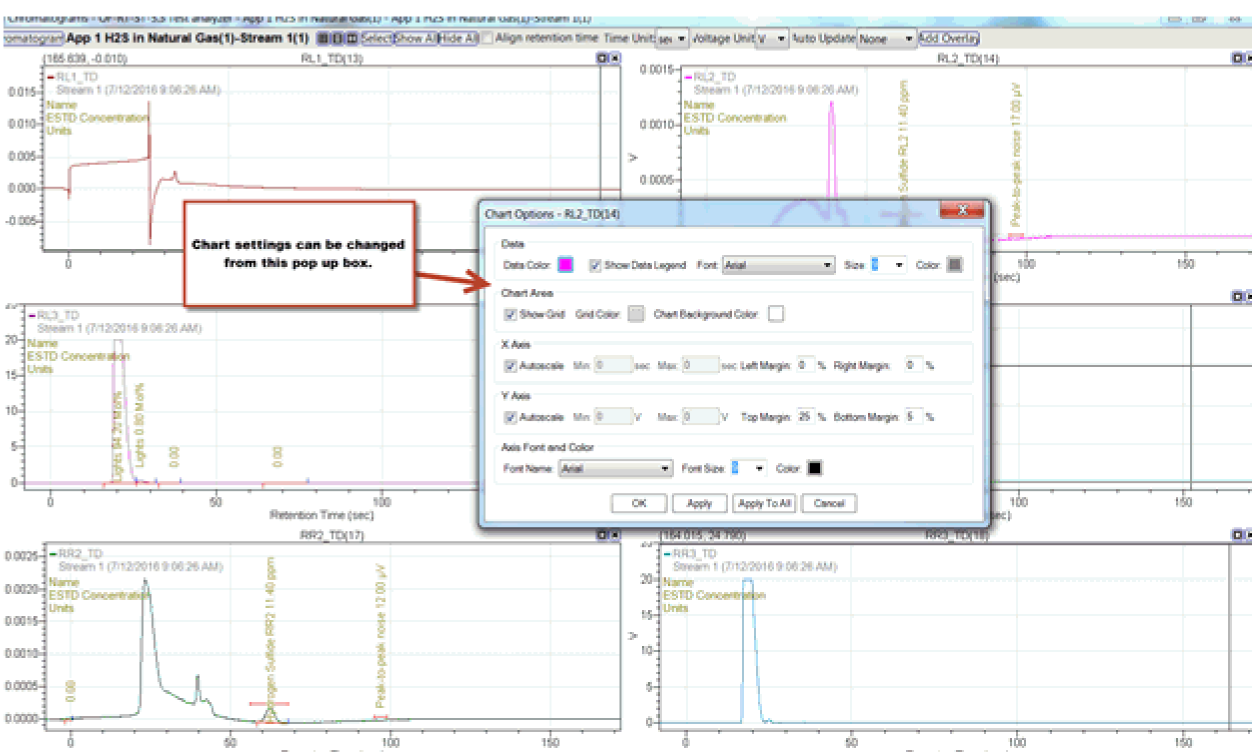


Figure 4-40 Chart Appearance Settings

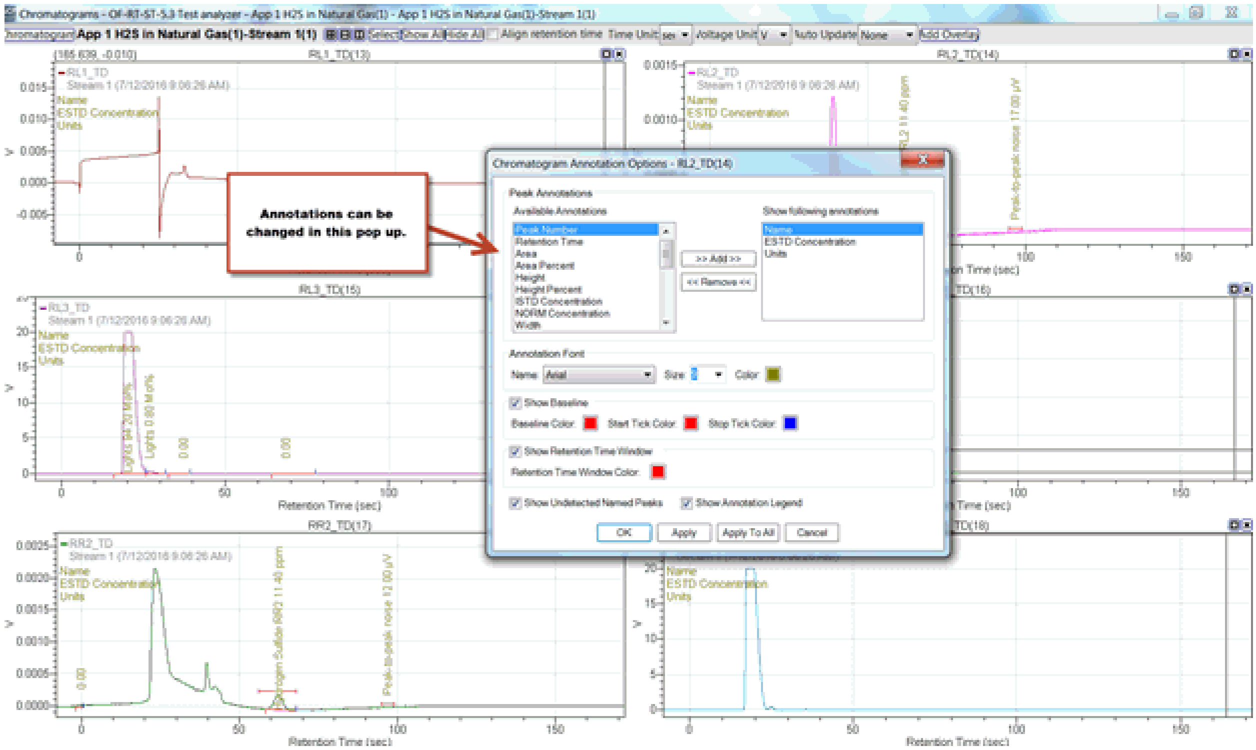


Figure 4-41 Annotation Appearance Settings

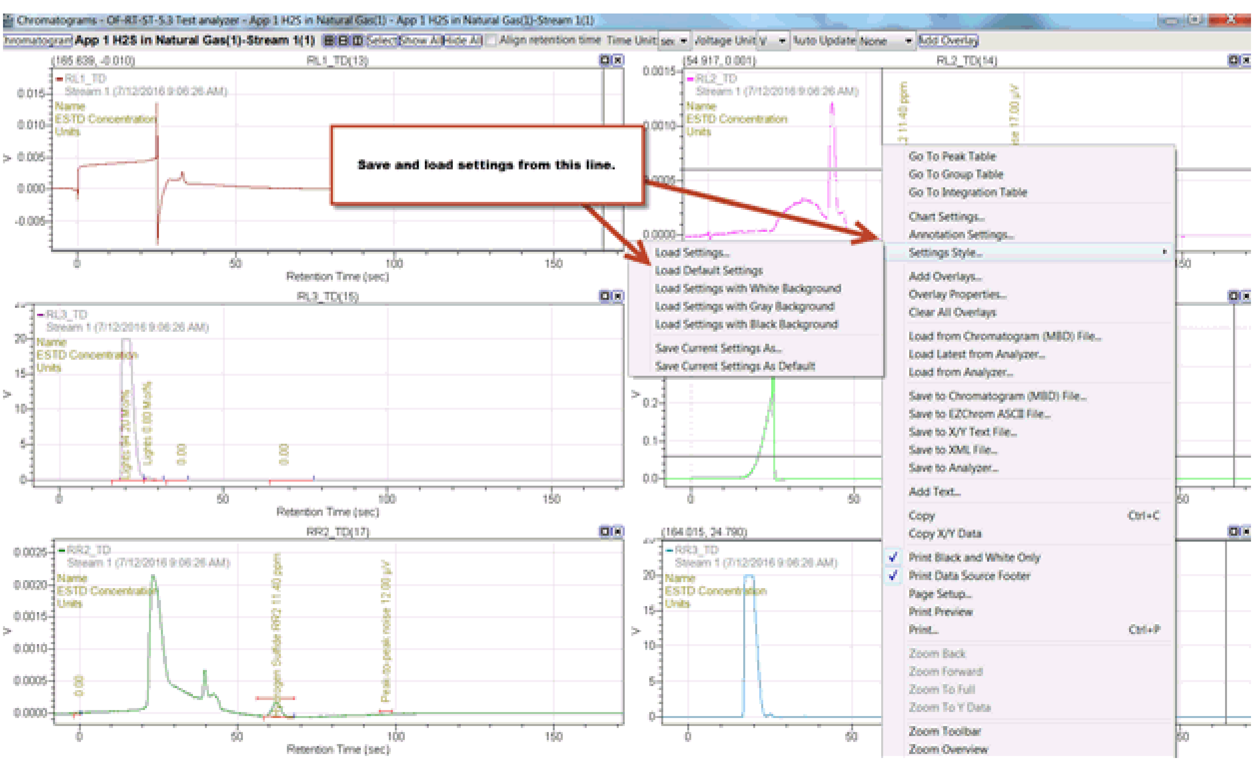
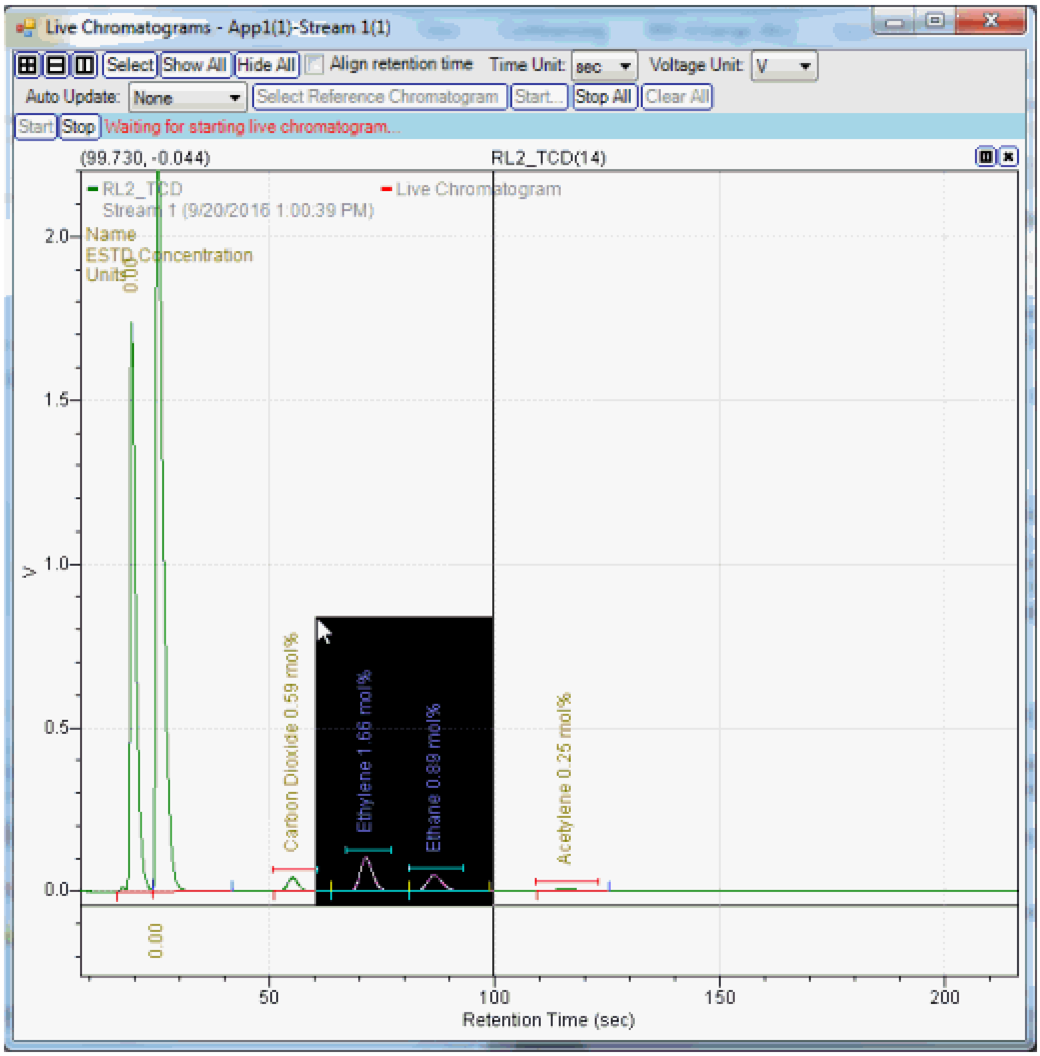


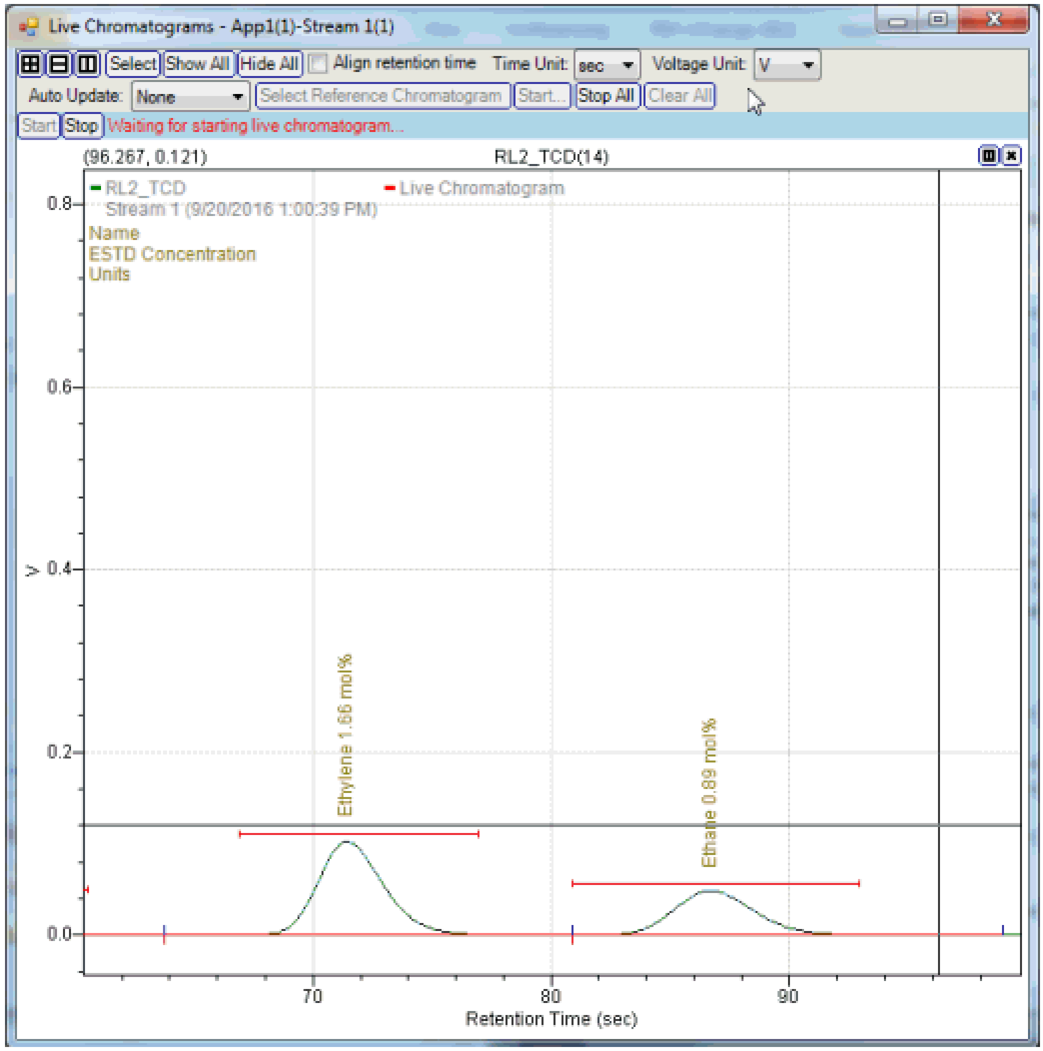
Figure 4-42 Saving and Loading Settings Styles

4.10.8.2 Zooming in a Chromatogram Window

You can zoom in on a portion of a chromatogram by clicking and dragging a box around it as shown below.



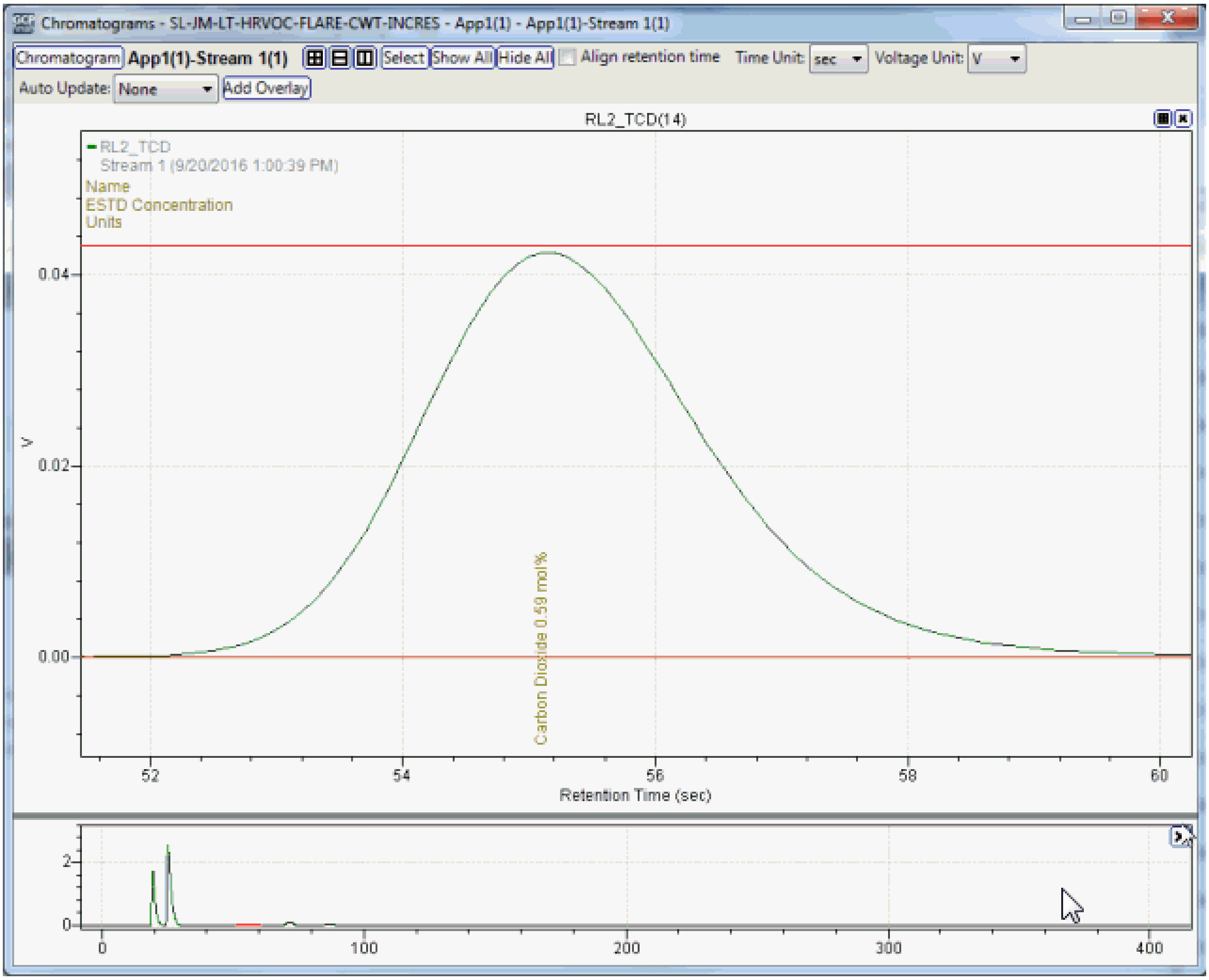
... which results in an expanded view of the selected area:



Double-clicking anywhere in the chromatogram window returns to the normal view.

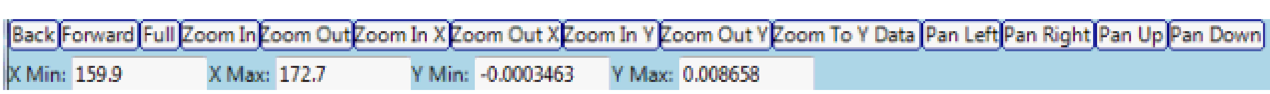
Zoom Overview

Zoom Overview is available from the right-click menu. This adds a small view of the entire chromatogram with the zoomed portion highlighted.



Zoom Toolbar

The Zoom Toolbar is also available from the right-click menu.



4.10.8.3 Chromatogram Menu

The Chromatogram Menu for the Gas Chromatograph Portal Analyzer Window includes options related to loading and saving either stored or realtime chromatogram information. The functions are as follows:

- **Load From MBD (Binary) File...** - Opens chromatogram information from a Maxum Binary Data File on the PC. These files have the .mbd extension.
- **Load Latest Chromatograms From Analyzer** - This option automatically loads the latest chromatogram information from the current analyzer. No selection box appears when this option is selected.
- **Load From Analyzer...** - Loads chromatogram information from the current analyzer. From the selection box, the user may choose from either the latest or archived information. The user may also choose from simulated results. Select the desired results and click 'Load'.
- **Save** - Saves the current application chromatograms to the most recently loaded .mbd file. Note that this overwrites the existing data on disk without confirmation.
- **Save To MBD (Binary) File...** - Saves the current chromatogram information to a selected .mbd file. The user may use a new file name or select the name of an existing file. If an existing file is selected, a confirmation is required before the file is overwritten.
- **Save To XML (Text) File...** -Saves the current chromatogram information to an XML file, so that it may be read by other software.
- **Save To Analyzer...** -Saves the current chromatogram information to the current analyzer. Note that this overwrites the existing information without confirmation.
- **Chromatogram Window** - The Chromatogram menu includes a "Chromatogram Window" selection for each application configured in the current database. These selections will display the stored chromatogram window for the specified application.
- **Realtime Chromatogram Window** - The Chromatogram menu includes a "Realtime Chromatogram Window" selection for each application configured in the current database. These selections will display the realtime chromatogram window for the specified application, allowing the user to monitor the current chromatographic results as they are received from a running analyzer. Window width (in seconds) and other parameters can be set to give the desired view.
- **Live Chromatogram Window** - Displays a stream list. Sources can be selected from Latest, Archived, or Simulation. The Live Chromatogram Window allows monitoring the sampling of the stream, overlaid on the previous chromatogram.

4.10.8.4 Realtime Chromatogram Window

The Chromatogram menu includes a "Realtime Chromatogram Window" selection for each application configured in the current database. These selections will display the realtime chromatogram window for the specified application, allowing the user to monitor the current chromatographic results as they are received from a running analyzer.

Gas Chromatograph Portal - Chromatogram Menu

Once a chromatogram is open several other options can be accessed by right clicking on the chromatogram. These include:

- Shortcuts to some of the tables where chromatograms can be displayed and used to graphically update the tables
- Load and save functions described above, overlay multiple chromatograms
- Annotation options
- Add text where the mouse is located when pressing the right click button
- Copy the chromatogram to the windows clipboard
- Print to the windows printer
- Zoom functions
- Zoom toolbar
- Zoom overview window

4.10.9 Tools Menu

The Tools Menu for the Gas Chromatograph Portal Analyzer Window is used to launch various software tools as well as to set user preferences for display options. The functions of this menu are as follows:

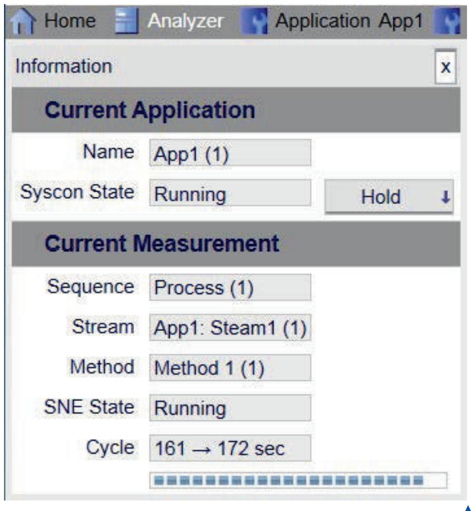
- **Start Data Logger** - Starts the Data Logger application, if it is configured. If Data Logger is currently running as a service on this workstation then a text box will be displayed “Found a running data logger”. See the Data Logger Overview for more information on Data Logger.
- **Start APC for Advance Optichrom** - Starts the APC 8.1 Software that is provided as an interface to the Optichrom Advance Gas Chromatograph.
- **Start HMI** - Starts the HMI emulator software, connecting to the current analyzer.
- **Start Maxum Utilities** - Starts the Maxum Utilities application which provides tools for data logging, database conversion, and upgrades. These functions are also available using other features of the Gas Chromatograph Portal.
- **Start Maxum System Manager** - Starts the legacy Maxum workstation application, Maxum System Manager.
- **Start EZChrom** - Starts the Maxum EZChrom workstation software used to add and modify application methods for a Maxum or MicroSAM GC. The functions of Maxum EZChrom are available in the Maxum Gas Chromatograph Portal Software.
- **Start DbBrowser**- Starts the DbBrowser application used by advance users to locate and manage database addresses outside the normal user platform. DbBrowser is installed separately from the Maxum Gas Chromatograph Portal Software.
- **Start DbConverter** - Starts the DbConverter application which is used to import and export database information to and from text files, compare databases, and convert databases for software upgrades.

- **Start MaxBasic Editor**- Starts the MaxBasic program editor, if installed. MaxBasic is a programming language for the Siemens Gas Chromatographs. It allows users to create programs to perform custom functions. The MaxBasic Editor is licensed separately from the Maxum Gas Chromatograph Portal software.
- **Start PrintClient –** Starts the PrintClient program. The Maxum PrintClient application runs on the workstation and allows users to gather printed reports from all the Maxum/ MicroSam's on the network. A printer directed to PrintClient is configured on the device to collect reports for the PrintClient application to gather and direct to a workstation file(s). Reports may be collected into a single file or a set of files.
- **Start Formula Editor** – Starts the Formula Editor application which is used to add formulas to result that will function as post processing of analysis results. The Formula Editor can be used to develop and test a formula prior to putting the formula in the analyzer.
- **Diagnostics -**
  - **Reset analyzer –** Performs an analyzer reset on the currently connected analyzer.
  - **Get debug log from analyzer –** Opens a text file of the current debug log in the selected analyzer.
  - **Enable Telnet and FTP Communication â€“** Telnet and FTP are disabled by default for security reasons. If a special maintenance situation arises that requires the use of these utilities, they can be enabled for a limited amount of time using this option. After the time limit expires, telnet and FTP are automatically disabled.
  - **Disable Telnet and FTP Communication â€“** This command manually disables Telnet and FTP before the automatic timeout.
- **Show Database Fields –** Selecting the Show Database Fields will toggle on or off additional information about where the displayed data is stored in the database. The database fields will be display next to or below the GCP parameter names in each table. Users programming in MaxBasic can use this feature to identify database fields.
- **Open User Config Folder** - The User Config folder contains the XML files that contain user settings.
- **Options** - Allows the user to modify various program options, such as Preferred units and decimal place settings for time, temperature, pressure and voltage may be set. Users can set other features such as 'Local Time Mode' from the analyzer or workstation, 'Auto refresh on Save' and 'Show Trains'. It also allows users to modify the default file path information for various software tools associated with the Gas Chromatograph Portal.

4.11 Application View

The Application View consists of three main parts, the Navigation Menu, the Information Pane, and the primary Data Window.

Information Pane



Information Field

In the top left corner of the Application View is the information pane that shows basic information about the current application and measurement. This information pane is the same for both the Analyzer View and the Application Views.

Name - This is the name of the current application.

SYSCON State - This field shows the state of the application, whether it is in Run or Hold state. Other states, such as the transient states PgmWait and Waiting, may also be displayed here.

Run/Hold Button - This action button is used to place the analyzer in either a Run or a Hold state.

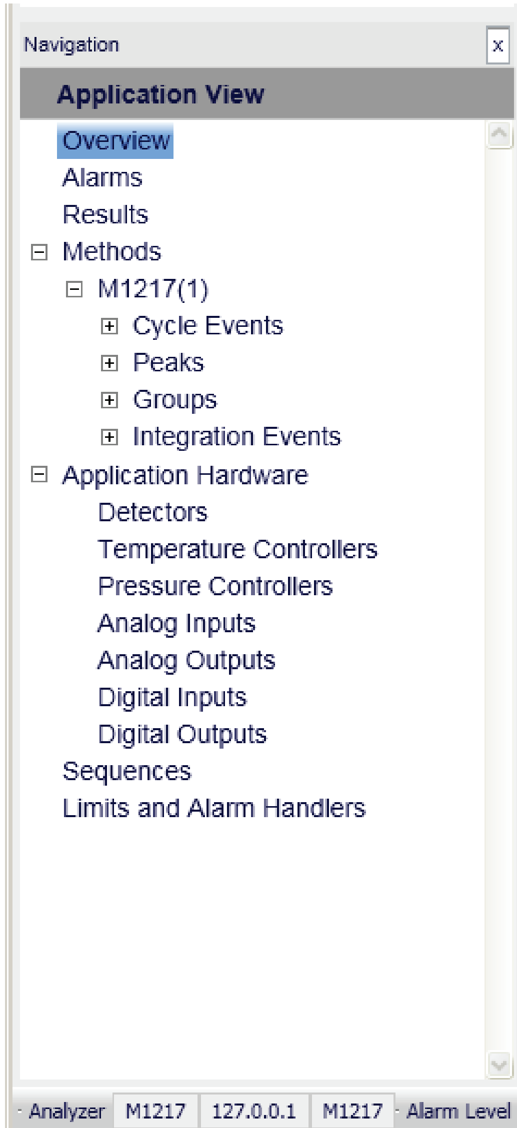
Note: Maxum Gas Chromatograph Portal software the blue arrow on a button indicates that the action relating to the button will be executed and saved immediately to the database/analyzer without further action from the user.

Sequence/Stream/Method - Shows the names of the current Sequence, Stream, and Method.

SNE State - This field shows the state of the SNE Controller. Typically, the status will be either Running or Hold. Others states such as Error, or the transient Finished state are possible as well.

Cycle - This field shows the current cycle clock in seconds. The number on the left denotes the current cycle time (counting up when in Run and paused when in Hold) and the number on the right shows the full duration. The status bar below the Cycle field graphically shows the current progress of the cycle.

Navigation Menu



On the left hand side of the Application View is the Navigation Menu. The Application Navigation Menu selections are used to display and modify information related to the Application.

Data Window

The bulk of the Application view is devoted to the Data Window. This area contains various data windows, tabs, and graphics. The information displayed in the Data Window is dependent on which Navigation Menu selected is chosen. For example, the Alarm selection displays in the Data Window a list of all existing alarms and warnings as well as a pane displaying details for the selected alarm.

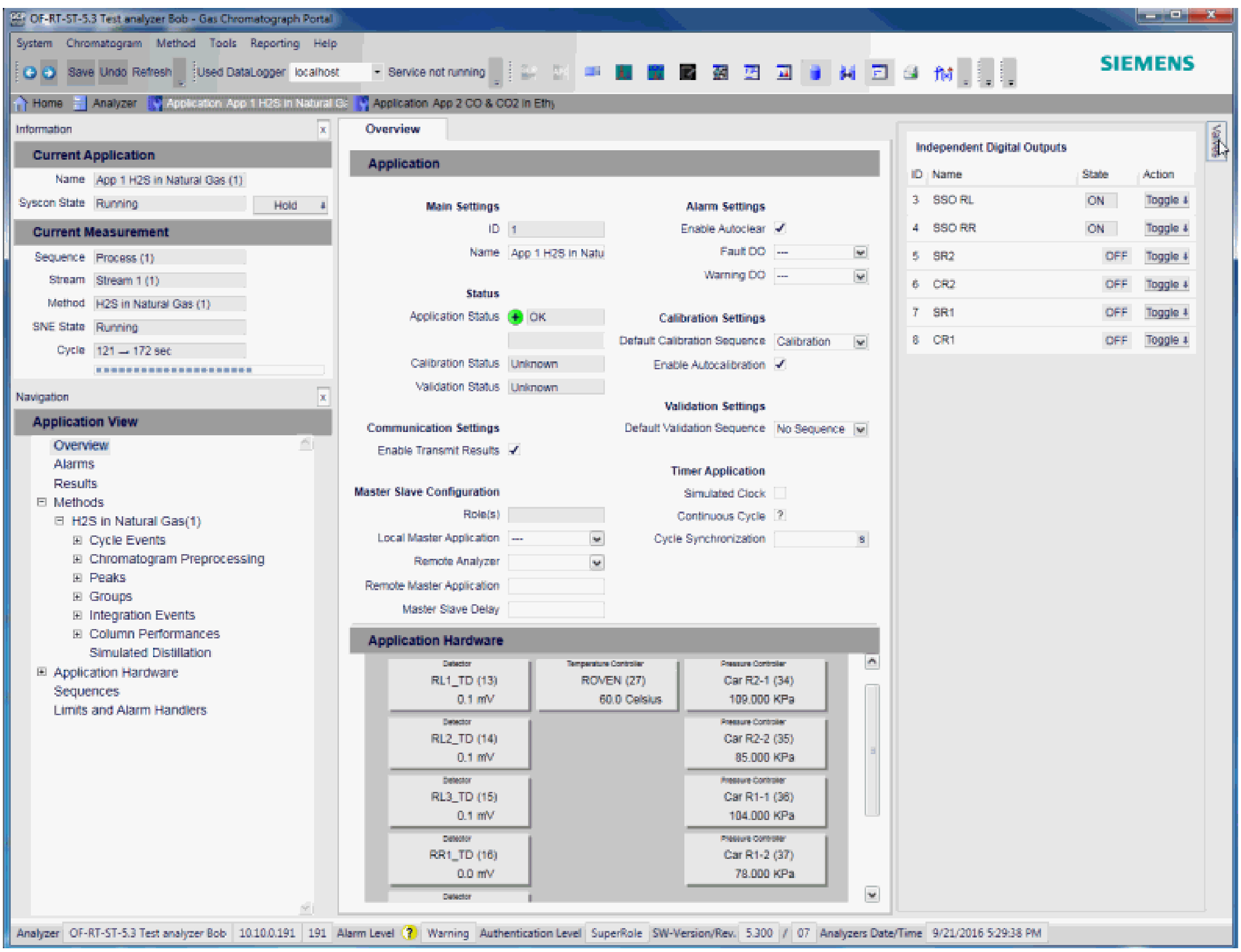
4.11.1 Application Overview Screen

The Application Overview screen on the Navigation menu provides basic information about the settings, status, and hardware of the selected application.

The top pane of the window includes a status and settings table. This includes the name, overall status, basic alarm settings, basic calibration settings, basic validation settings, basic communication settings and Master Slave Configuration and Timer Applications.

The bottom pane of the window, titled "Application Hardware", gives basic information about the hardware that is configured for the application. Each of the icons for the hardware can be clicked to navigate to the navigation pane selection for that hardware.

The right edge has a "Valves" button. Hovering over this button opens a pane for valve status and can be used to manipulate individual valves.



User Functions

The user can change various settings in the top half of the data window. Fields that are grayed out cannot be changed. When a field is changed the text turns blue. Data must be saved before navigating to a different window or any changes will be lost. The user may also use the boxes at the bottom to navigate to the screens relating to the various hardware.

4.11.2 Alarms

The Alarms table on the Application View Navigation Menu is the same as the Alarms table on The Analyzer View. See the help topic for the Analyzer View Alarms (Page 43) for a description.

4.11.3 Results

The Application Results screen displays the latest analytical results received by Gas Chromatography Portal for the selected application.

From the Results Viewer Tab shown are the Stream ID, Result Name, Stream Name, Units, Cycle Run Time, Buffered Value, Saved Value, Saved Time, Compare Deviation Percent, and Compare State.

From the Results Viewer Tab only viewing and archiving is possible. The "Show Connections" button displays the connected elements, such as detector, that are used for the selected result. Connected elements can have links which when clicked will open the connected element table. If chromatograms are saved in the analyzer for the selected component then the chromatogram connected element can be clicked to open the chromatogram for the selected result. The "Add to Archive" button ads the current results to the archive. The archive is accessed via the Results Storage tab on the Application View Results table.

Changes can be made from the Result Configuration Tab. This tab allows the user to add and delete result entries and to change properties for existing entries. The Edit order Values button opens a table which can be used to setup Log Values and Transmit Values in a table structure.

The Formula Editor button opens the Formula Editor application in a separate window. It is possible to add formulas to a result that will function as post processing of analysis results. Other advanced formulas perform specific actions. It is possible to replace some MaxBasic and DBFunction processing with formulas. The formulas can be developed and tested in this application before they are saved tot he analyzer database.

The Result Storage Tab is the access to view archived results.

The EZChrom Result Peak and Group tabs show peak attributes from the last cycle for the peaks and groups configured in the method.

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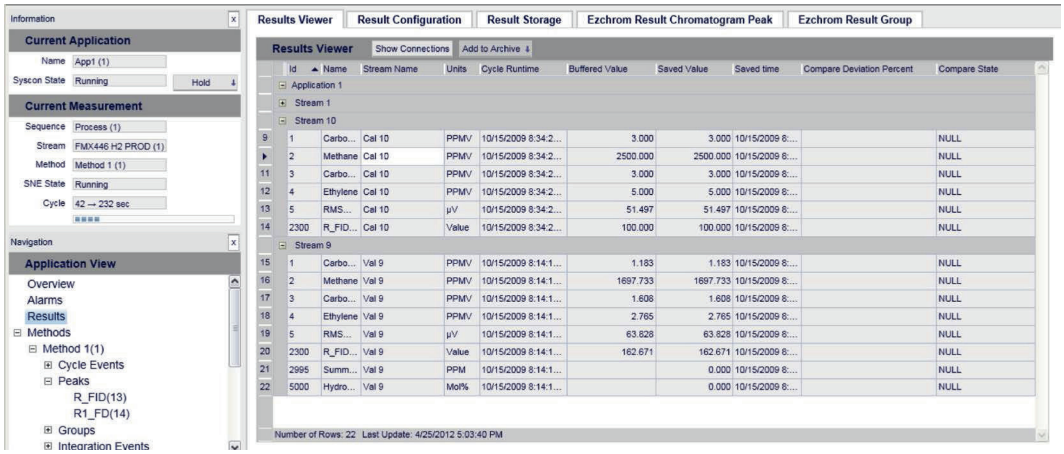


Figure 4-43 Application Results

4.11.4 Methods

4.11.4.1 Method Settings

The various Methods screens on the Navigation menu allow the user to access all configuration settings for each method configured in the application. This is a function similar to EZChrom© software.

The information that can be viewed and modified includes various cycle events, peaks, groups, and integration events. In addition to the descriptions in this online help system, refer to EZChrom software for further detailed descriptions of each of the types of settings and various parameters.

When making database changes in GCP, the user usually must save any changes before they navigate to a new screen. However, with changes under the method sub-menu, the user is allowed to navigate elsewhere within the GCP program. This is because the method database is treated as independent from the rest of the database file. This also allows the user to test a series of changes without affecting the live analyzer by running an offline analysis before saving.

When all changes are complete, then the user may save the method to the analyzer, overwriting the existing method. Alternatively, the user may also safe to a file on disk.

Methods Menu Selection:

The primary heading under the Navigation menu is "Methods". Selecting this menu item will show a table list of all methods created for the application, as shown below.

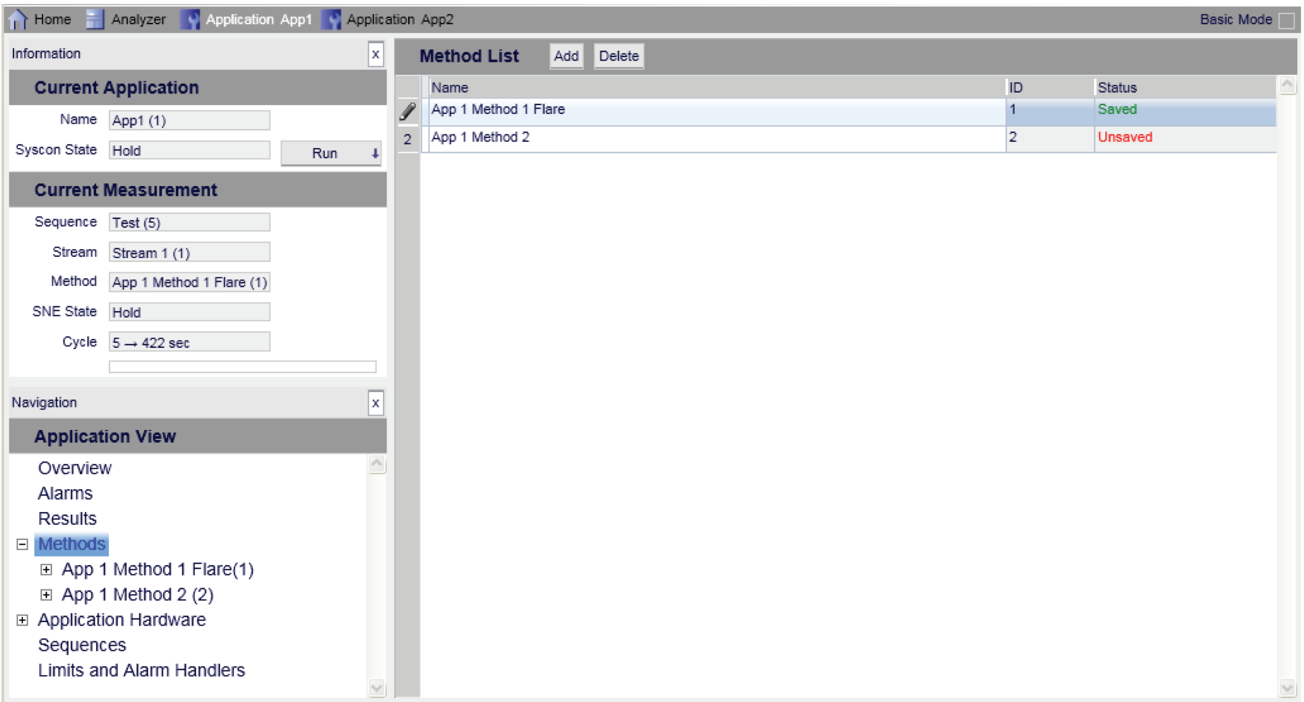


Figure 4-44 List of Methods

The list of methods shows basic information regarding each configured method. Included is the method name, the numerical ID of the method, and the status (saved or unsaved). It is also possible to add or delete a method from the list using the associated buttons.

Note

Deleting a method is a critical action that may affect the operation of the analyzer. Confirmation is required.

Subheadings under Methods:

The under the Methods listing on the Navigation menu there is a subheading for each method configured for the application. The title of the subheading is the name of the method. For each method, there exists a series of additional subheadings relating to various aspects of the method, including Cycle Events, Peaks, Groups, and Integration Events. Each of these, in turn, consists of various parts.

Creating/Loading Methods:

In addition to using the Add button, methods can be added to a database using the Method menu from the program menus at the top of the program window. Options include creating a new method and loading a method from a binary MBM file on the GCP workstation computer. These two options are also available by clicking the right mouse button on the Methods menu selection.

Saving Methods:

An individual method can be saved to either a MBM or XML file on the computer or to the analyzer. Save options are available from the Method menu (top of the screen) or by clicking the right mouse button on the desired method subheading in the Navigation menu.

4.11.4.2 Cycle Events

Cycle Events and the Cycle Graph

Cycle Events refers to a number of different actions that may occur during the analytical cycle and which are used to control the cycle. These include the following:

- Detector (Page 93) - Cycle specific detector settings, such as start and stop times referenced to the cycle clock.
- Temperature (Page 94) - The temperature program, such as the oven set point. Each heater (oven, FID heater, etc.) has its own temperature submenu.
- Pressure (Page 94) - The pressure program, indicating pressure settings and timing of any changes. A separate pressure submenu exists for each pressure controller configured in the application hardware.
- Valve and DO (Page 94) - The valve and other Digital Output timing, indicating On and Off times.
- Program (Page 95) - Settings for any programs that are run in association with the cycle.

The Cycle Event sub-menu under the Methods menu allows the user to view and modify various settings for the cycle events. This is the primary location that the user can make modifications to the method relating to actions that occur during the cycle.

Time-synchronized cycle events (such as pressure control and valve actuation) can be linked, so that the linked group can be treated as a functional unit. If the timing (start-stop times) for the source is changed, timings for the target events are automatically adjusted. This speeds up the process of adjusting a method and helps to prevent errors that can come from making multiple interrelated changes.

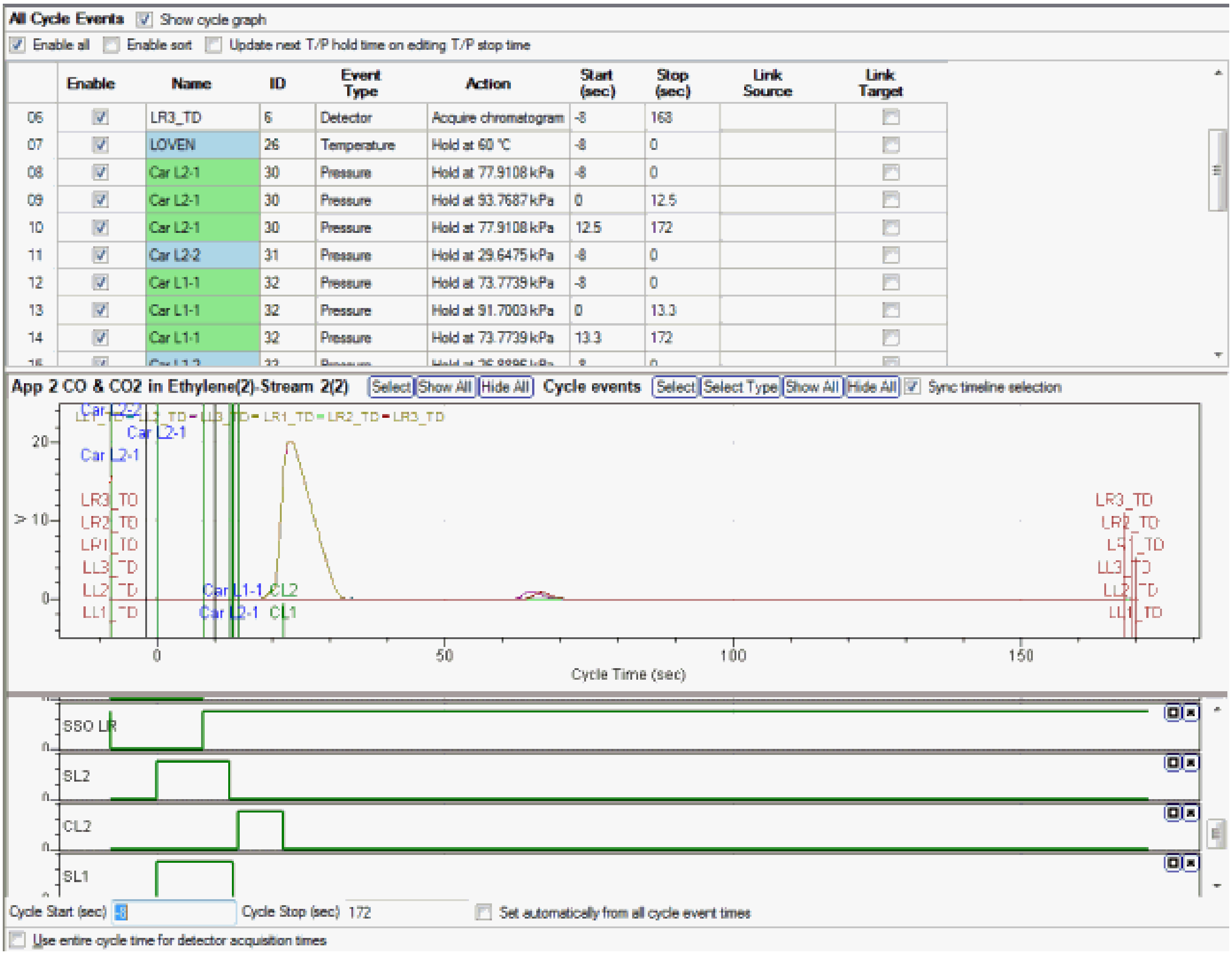


Figure 4-45 Cycle Events

The Cycle Graph:

In the preceding image, a check box can be seen at the top of the display window titled "Cycle Graph". This box enables a feature that is unique to the Gas Chromatograph Portal. The Cycle Graph is shown in the bottom half of the display window. The Cycle Graph overlays the current chromatogram with the timing of all cycle events. It also shows a separate timing graph for each event.

The Cycle Graph is a useful tool that allows the user to see a visual representation of all cycle events and how they affect the cycle. For example, valve timing can be seen on the same graph as the chromatogram. This tool is especially useful for making small changes in the timing of various cycle events, as it allows the user to quickly see how a change might affect the chromatogram.

The Cycle Graph shows the association between the Cycle Events table and the Chromatogram. The highlighted areas in the image below show this association. The highlighted Valve and DO event is annotated on the chromatogram graph and also the On and Off timing is shown in the graph for that event.

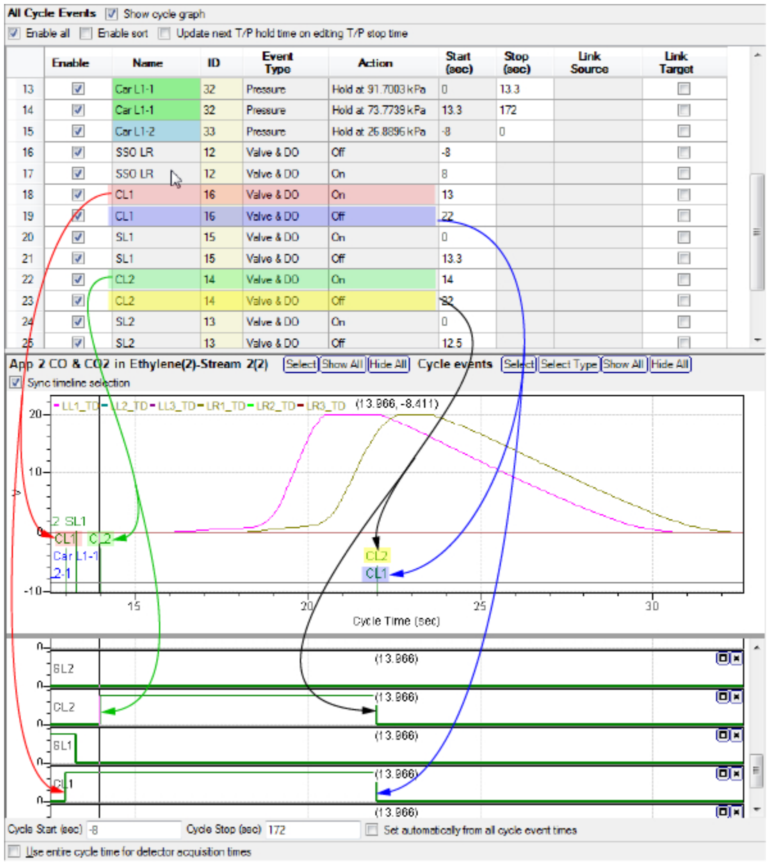


Figure 4-46 Association Between the Event Table and Cycle Graph

By default, the Cycle Graph displays all cycle events for all detectors. For more complex methods this can be a large amount of information for one graph, and can be difficult to read. For this reason, it is possible to select specific events and specific detectors using the function buttons at the top of the cycle graph. The following image shows the graph limited to just three different events.

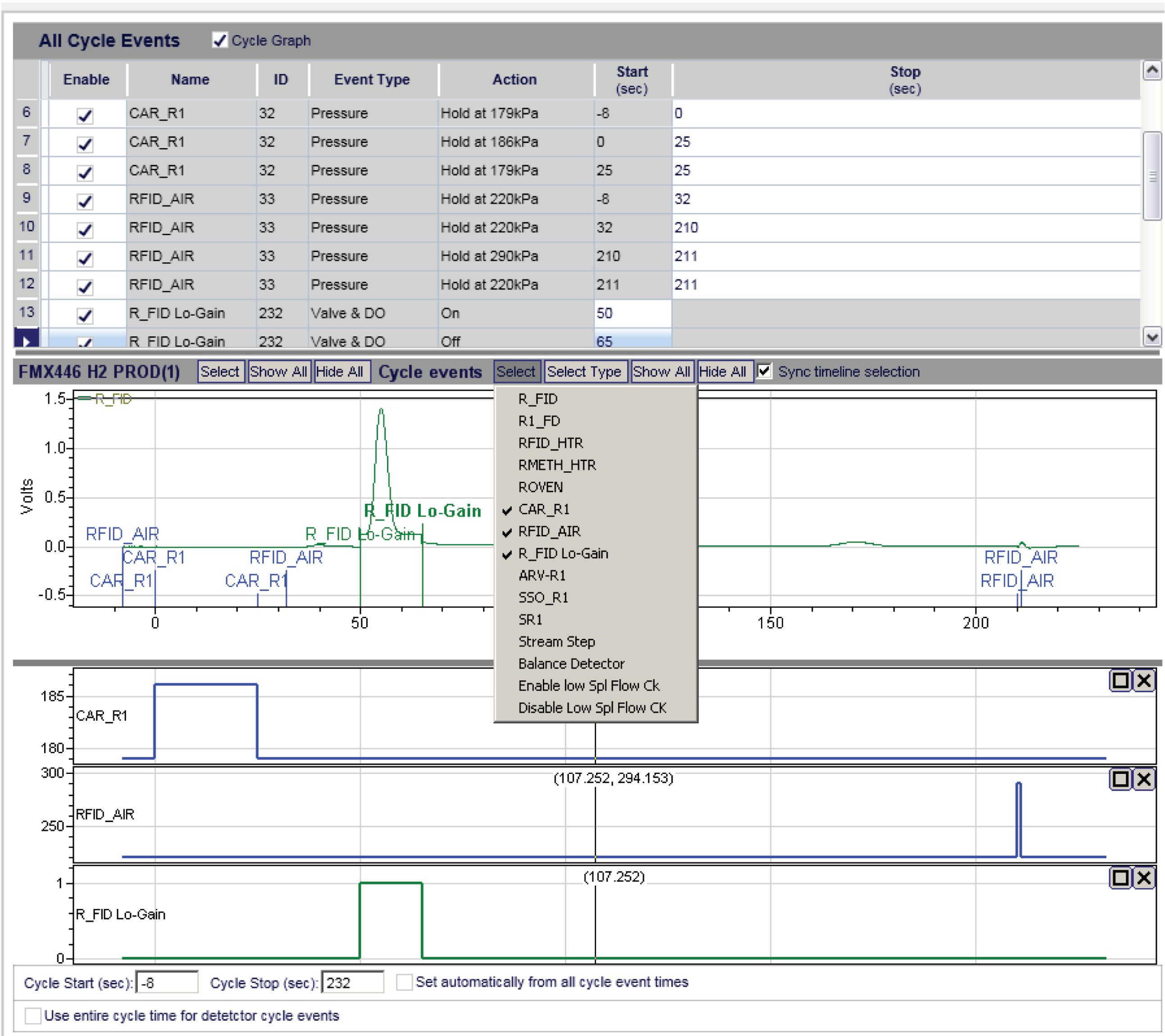
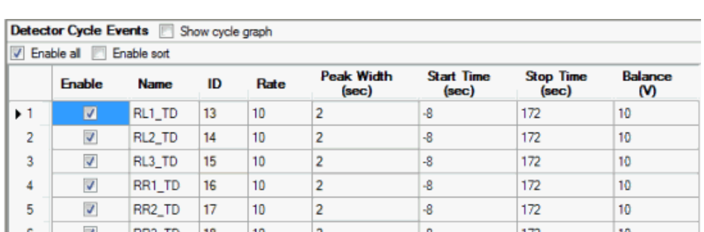


Figure 4-47 Cycle Graph - Selecting Information to View

Detector Cycle Events

All cycle events can be viewed from the main Cycle Events table. Some additional detailed information can be seen by clicking on the subheading for each type of cycle event.



Detector Cycle Events ☐ Show cycle graph

☑ Enable all ☐ Enable sort

	Enable	Name	ID	Rate	Peak Width (sec)	Start Time (sec)	Stop Time (sec)	Balance (V)
1	☑	RL1_TD	13	10	2	-8	172	10
2	☑	RL2_TD	14	10	2	-8	172	10
3	☑	RL3_TD	15	10	2	-8	172	10
4	☑	RR1_TD	16	10	2	-8	172	10
5	☑	RR2_TD	17	10	2	-8	172	10
6	☑	RR3_TD	18	10	2	-8	172	10

Figure 4-48 Cycle Event Table for Detectors

Temperature Cycle Events

All cycle events can be viewed from the main Cycle Events table. Some additional detailed information can be seen by clicking on the subheading for each type of cycle event.

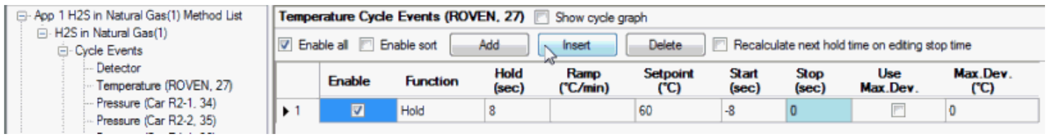


Figure 4-49 Cycle Event Table for Temperature Controllers

Pressure Cycle Events

All cycle events can be viewed from the main Cycle Events table. Some additional detailed information can be seen by clicking on the subheading for each type of cycle event.

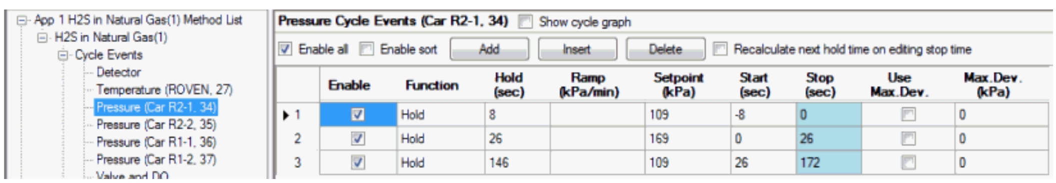


Figure 4-50 Cycle Event Table for Pressure Controllers

Valve & DO Cycle Events

All cycle events can be viewed from the main Cycle Events table. Some additional detailed information can be seen by clicking on the subheading for each type of cycle event.

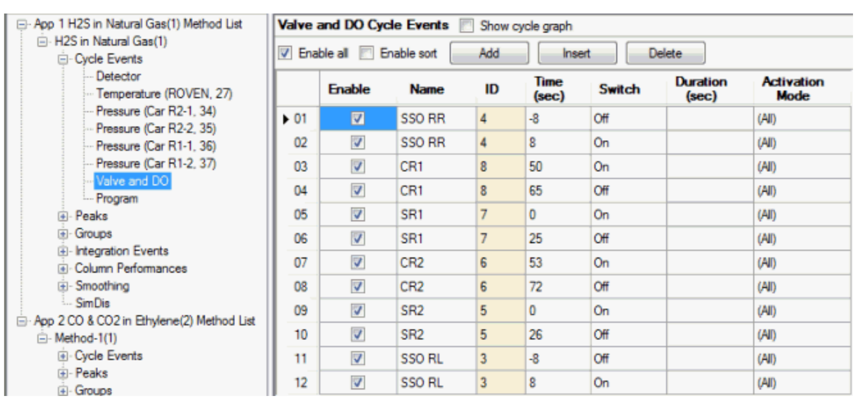


Figure 4-51 Cycle Event Table for Valve and DOs

Program Cycle Events

All cycle events can be viewed from the main Cycle Events table. Some additional detailed information can be seen by clicking on the subheading for each type of cycle event.

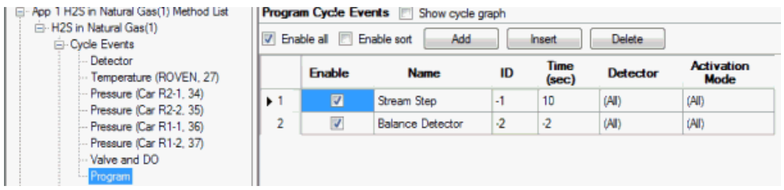


Figure 4-52 Cycle Event Table for Programs

4.11.4.3 Chromatogram Preprocessing (Smoothing)

The smoothing functions in Maxum Methods allow you to reduce the noise in a chromatogram before peak analysis. Smoothing improves the detection limit and the repeatability of the trace component analysis. In addition to smoothing functions, noise measurement functions are also provided so that you can measure and evaluate the baseline noises in a chromatogram.

Smoothing and noise measurement can be enabled as a part of a method. Therefore, they are available both in an analyzer for an online application and in GCP for method development and offline data processing.

This section is divided into three topics to help you to effectively use the smoothing and noise measurement features in Maxum GCP:

- **Quick Start** section describes a typical procedure for smoothing a chromatogram from a trace component analysis.
- **User Interface** section describes the user interface in detail so that you can experiment with different features associated with smoothing.
- **Algorithms** section describes the algorithms used in smoothing and noise measurement. This section is described in amendment 1 to this manual.

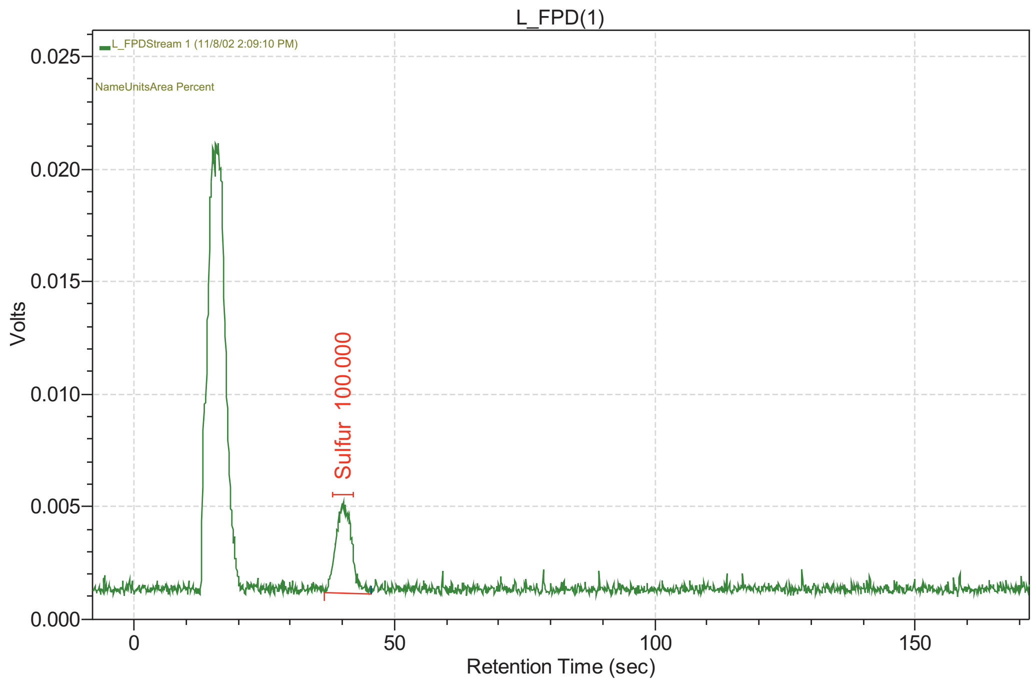
Quick Start

Smoothing is mainly used to reduce the noise in a chromatogram with very small peak(s) to improve the analysis detection limit and repeatability. A detailed example of usage is provided in this section. The procedure for developing a smoothing method is outlined below:

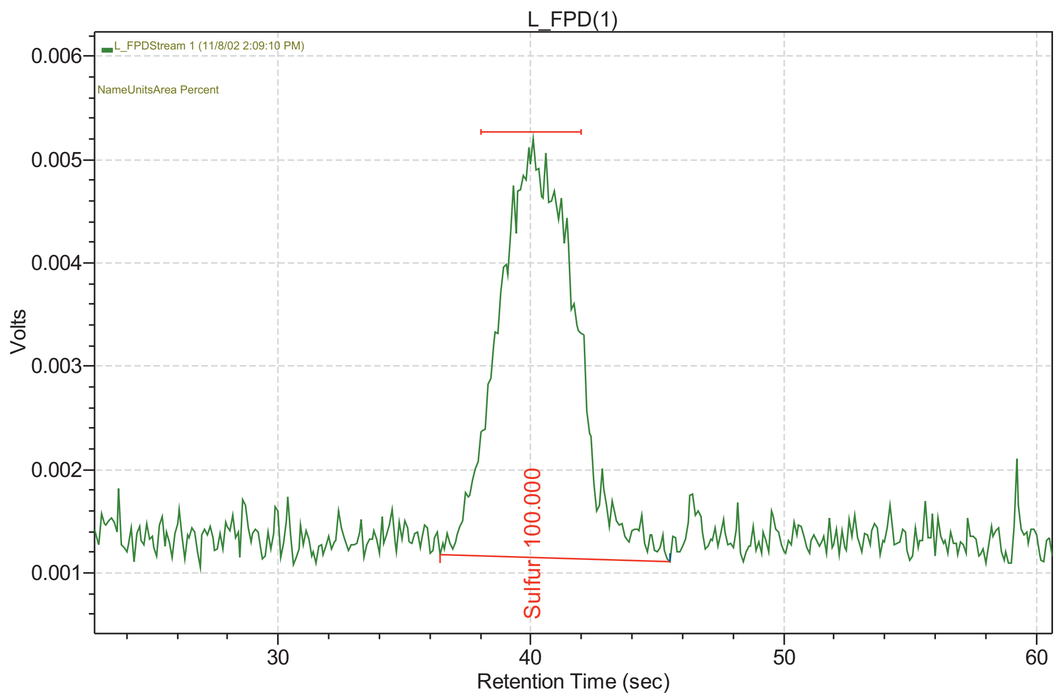
1. Open an analyzer database with a chromatogram of a low concentration sample.
2. Select an existing method or develop a new method.
3. Choose smoothing functions and optimize the smoothing parameters.
4. Calibrate the method using a stored calibration chromatogram.
5. Download the method to the analyzer.
6. Start sample analysis using the analyzer.

To maintain analysis accuracy, it is necessary to recalibrate a method whenever the smoothing functions and the associated parameters are changed. To recalibrate a method:

1. Open a typical application with a chromatogram.
   Open an application with a chromatogram of a lower concentration within the expected concentration range of your stream samples. Smoothing is not needed 2
   if the peaks of interest in all your chromatograms have low baseline noises relative to the peak heights.



Example Raw Chromatagram: Sulfur at 40 seconds is the only peak of interest in this chromatogram. The baseline noise interferes with the baseline calculation, causing an error in the calculated peak area.
As the next action, zoom the chromatogram in the range of interest as shown in the following example.



2. Open the Method subdirectory in the Application View.
   Smoothing function can be added to an existing method, so that most settings in a developed method are maintained.

3. Choose smoothing functions and optimize the smoothing parameters.
   - Open the Chromatogram Preprocessing subdirectory under the Method in the Application Navigation pane by clicking the plus sign.
   - Select the detector for the chromatogram to be smoothed in the Navigation pane under the Chromatogram Preprocessing subdirectory.
     This will open the Chromatogram Preprocessing Configuration table and display the selected chromatogram

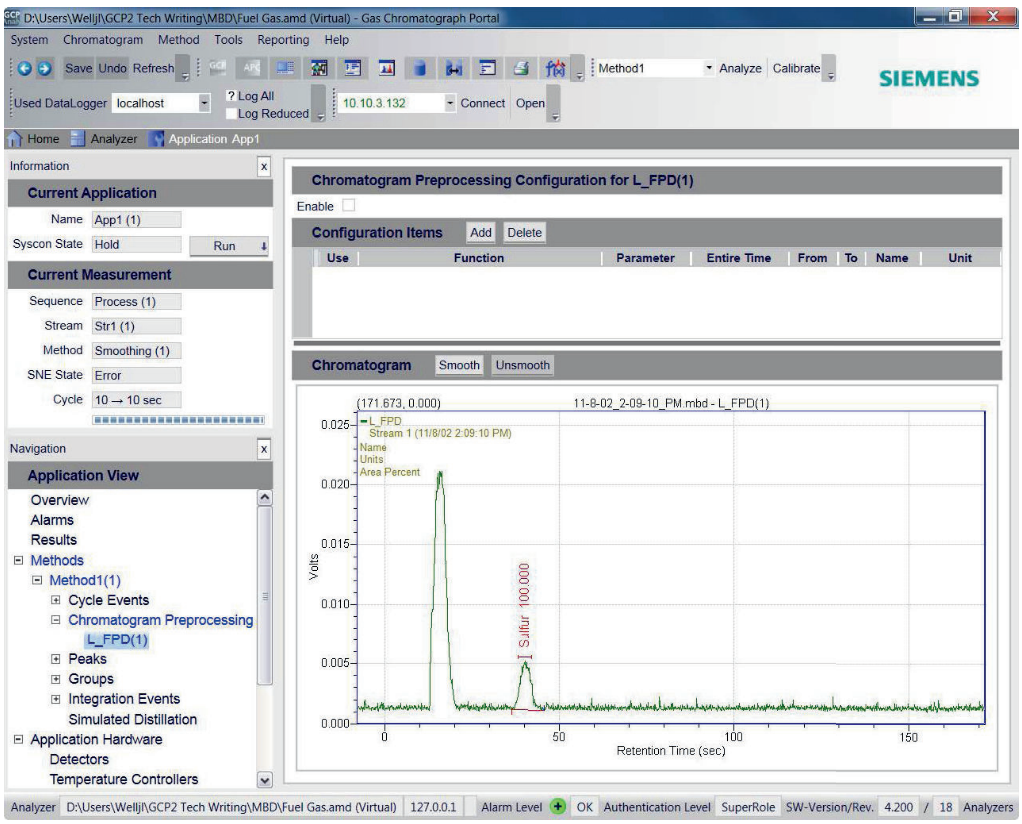


Figure 4-53 Smoothing Detector List

   - Click the Add Button in the Configuration Items title block.

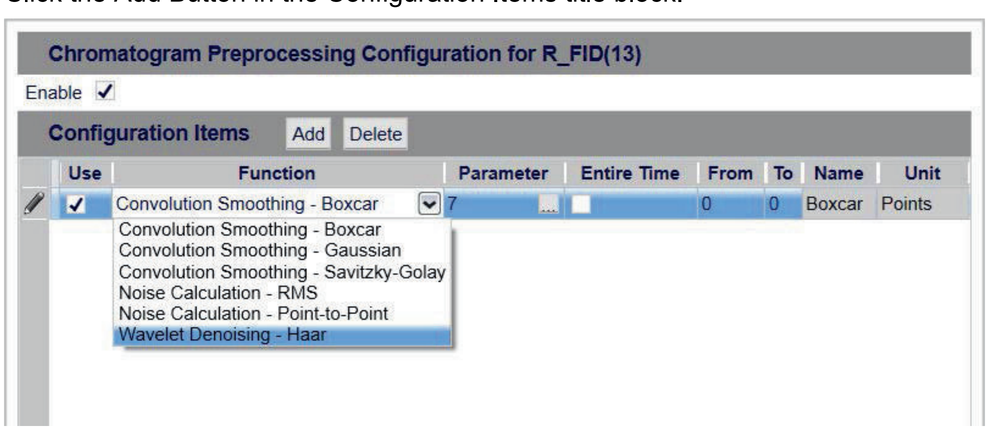


Figure 4-54 Smoothing - Configuration table showing the function list

– Select the Wavelet Denoising (Haar) function for the smoothing by clicking the cell under **function** header.
  For smoothing a peak analysis of a low S/N chromatogram, Wavelet Denoising – Haar should be used to reduce the noise in the chromatogram before the peak analysis.

  There are 3 other Smoothing functions and the Denoising function. Select the best function for the given application. When artificial spikes such as noise spikes and valve upsets exists in a chromatogram, the chromatogram may be smoothed better by using a boxcar smoothing first and then wavelet smoothing. Boxcar is the simplest and most widely used Convolution Smoothing function.

– Click on the grey box in the Parameter field to open the *Denoising Setup* window.

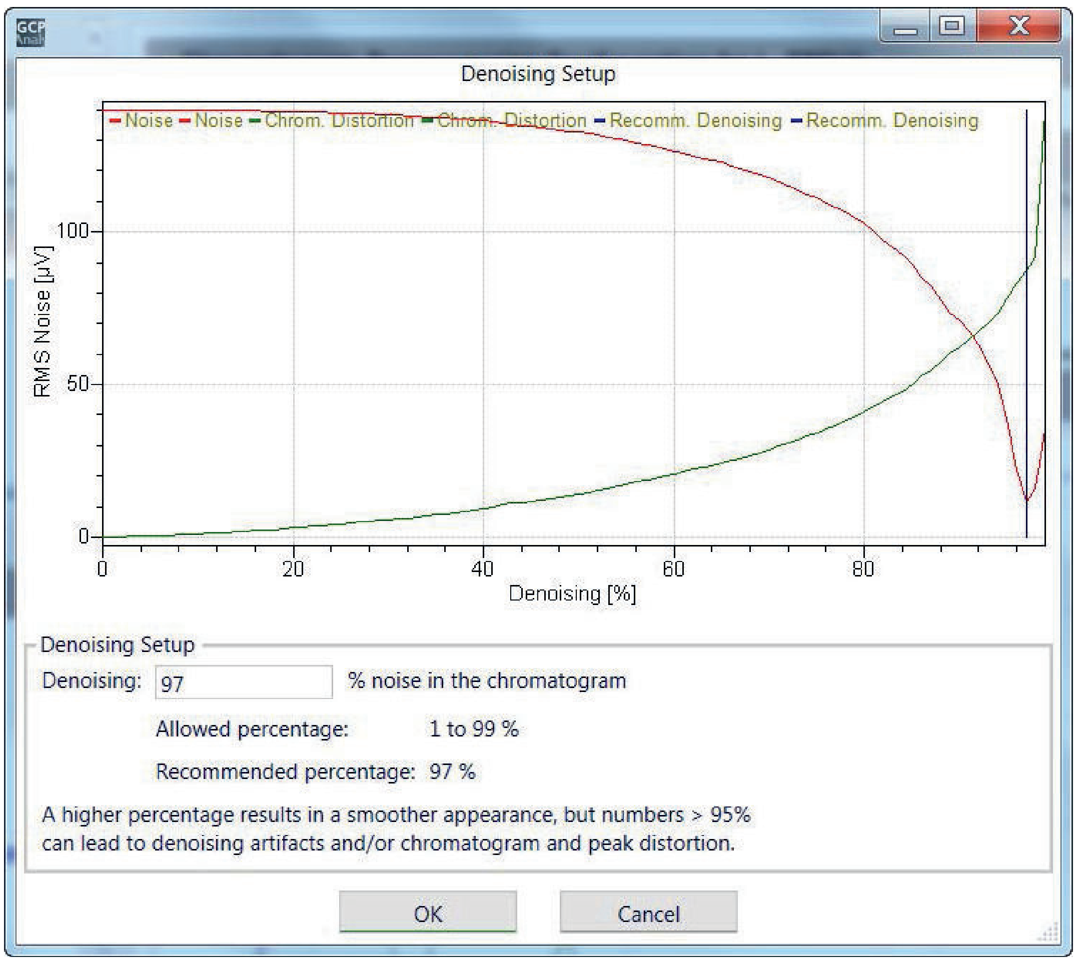


Figure 4-55 Denoising Setup Window

– Review the graph and recommended parameter settings. The graph displays a trace for the amount of noise reduction for a give Denoising percentage and a second trace for the expected chromatogram distortion. Similar graphs are provided for each of the different Smoothing functions.

– Close the *Denoising Setup* window (Figure 7) to accept default smoothing parameters by clicking the OK button.

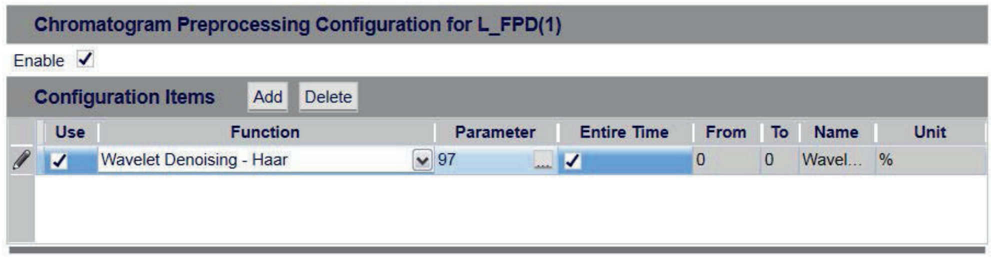


Figure 4-56 Default Wavelet Denoising smoothing parameters in the Configure Items table

– Click the **Smooth** button to smooth the chromatogram.

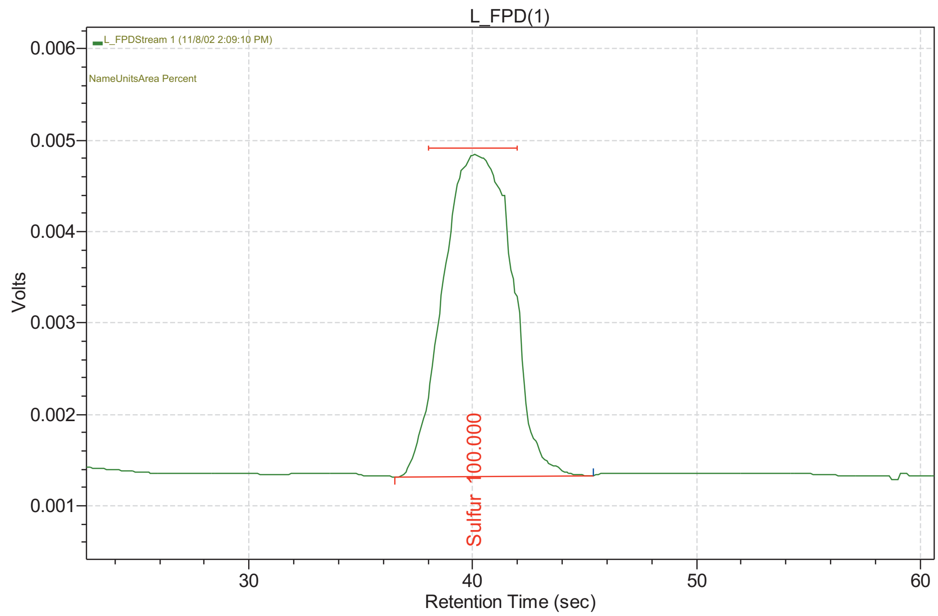


Figure 4-57 Default 97 % wavelet smoothing of the chromatogram

Over-smoothing a chromatogram introduces unnecessary peak distortion. To prevent the unnecessary peak distortion, iteratively change the smoothing parameter (percent of wavelet smoothing) and re-smooth the chromatogram until there is no high frequency noise left in the baselines on either sides of the peak. The lowest percentage that satisfies this should be used.

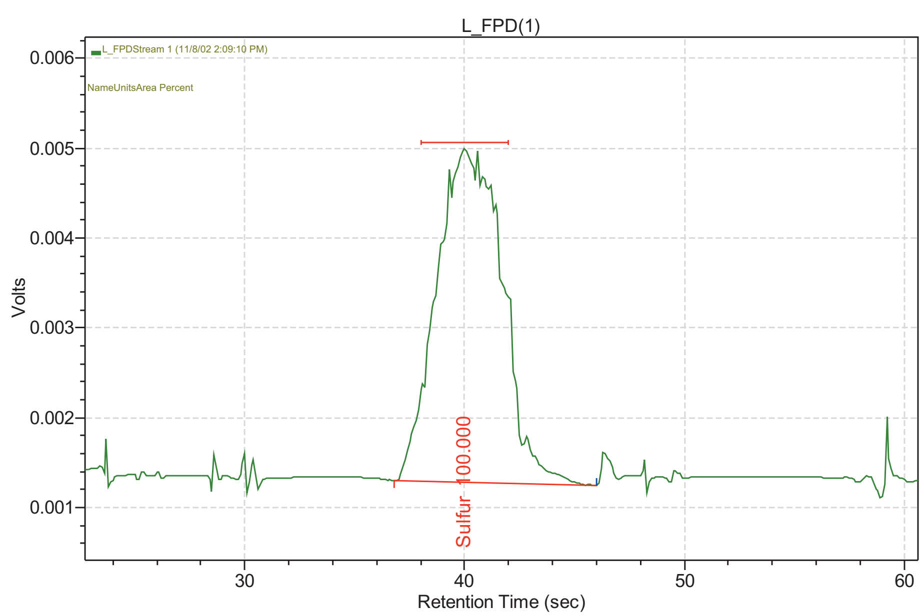


Figure 4-58 90 % wavelet smoothing of the chromatogram

The preceding figure shows high frequency noises left on the baseline at the side of the peak may interfere with the baseline calculation.

4. Adjust the threshold for the peak integration and **analyze** the chromatogram until the peak baseline is drawn properly at the bottom of the peak to include all the peak area as shown in the following figure. Because of smoothing, a lower integration threshold may be necessary in order to have baseline and peak area calculated properly.

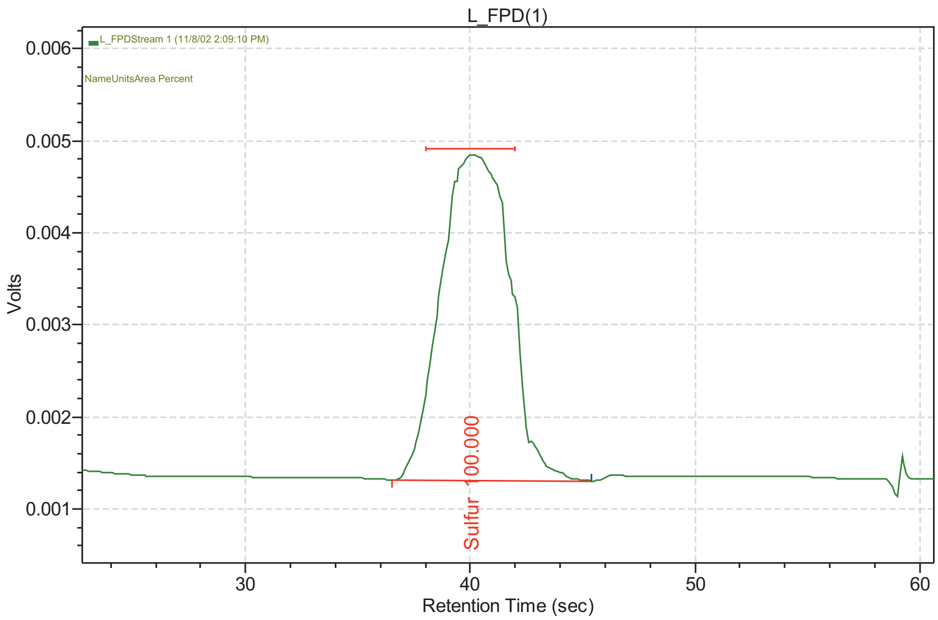
   

   Figure 4-59 96 % wavelet smoothing of the chromatogramSmoothing_96pc

   A lower integration threshold is used to have baseline calculated properly.

5. Save and calibrate the method.
   It is necessary to recalibrate a method whenever the smoothing functions and the associated parameters are changed.
   As a general rule, a sample of concentration close to a calibration concentration will always have higher analysis accuracy. If necessary, analysis accuracy can be improved further by using a two-point calibration.

6. Save the calibrated method to the analyzer.

7. Start sample analysis using the analyzer.
   All the peak results will be calculated from smoothed chromatograms.
   Only raw chromatograms will be displayed when importing the smoothed chromatograms from an analyzer to Maxum EZChrom.

User Interface

Chromatograms for setting up smoothing and noise measurement

A chromatogram must be displayed in Maxum GCP to set up smoothing and noise measurement. If Maxum GCP cannot find a chromatogram for the selected detector, it will suggest a default setting instead of attempting to calculate a recommended setting. The selected detector displays a chromatogram used to calculate the recommend settings.

Chromatogram Preprocessing Configuration Table

Select **Methods | Method1(1)** (or the name of the Method defined in the application) **|** Chromatogram Preprocessing. The root table will open as shown in the following figure with a list of all detectors defined in this method.

Chromatogram Preprocessing

	Detector ID ▲	Detector Name	Enable	Number of active Smoothing I...	Number of active Noise Calculatio...
▶	1	L_FID	☐	0	0
2	2	L1_FD	☐	0	0
3	13	R_FID	✓	1	0
4	14	R1_FD	☐	0	0

Figure 4-60 Chromatogram Preprocessing Table

The Chromatogram Preprocessing table lists all of the defined detectors Detector ID and Detector Name. The check box in the enable column will enable or disable all active smoothing functions for the selected detector. The *Number of active Smoothing Items* and *Number of active Noise Calculations* will display the values of the respective function types active on each detector.

Configure Items

Select a detector in the Navigation Pane Application View. This will open Configured Items table for the selected detector. Above the Configure Items table is the Enable check box. It is the same as the Enable column in the Chromatogram Preprocessing table. The check box will enable or disable all active smoothing functions for the selected detector.

- **Use, Enable smoothing**
  The **Use** column is used to include or exclude an existing function from an analysis. A check in this column indicates the selected function is active for this detector.
- **Function**
  The **Function** column is used to specify one of six smoothing or noise measurement functions:
  Convolution Smoothing – Boxcar
  Convolution Smoothing – Gaussian
  Convolution Smoothing – Savitzky-Golay
  Noise Calculation – RMS
  Noise Calculation – Point-to-Point
  and
  Wavelet Denoising – Haar
  These functions are defined in later in this document.

Note

- Smoothing functions are always applied before the noise is measured. To measure noise before smoothing in a chromatogram segment, all the smoothing functions that are overlapping with the segment must be disabled.
- The result value of a noise measurement is reported and labeled as a result.

- **Parameter**
  The **Parameter** column is used to specify the parameter value for the selected function. Click the box in the Parameter field to open the setup window.
- **Entire Time**
  The **Entire Time** column check box enables the function over the entire cycle time. Uncheck this box to define the start and stop times of a chromatogram segment. The From and To fields are activated when this box is unchecked so the user can set a specified time the function is active.
- **From**
  The **From** column is used to specify the starting time of a chromatogram segment. It is ignored (grayed out) when **Entire Time** is checked.
- **To**
  The **To** column is used to specify the ending time of a chromatogram segment. It is ignored (grayed out) when **Entire Time** is checked.
- **Name**
  The **Name** column displays the short name of the function.
- **Units**
  The **Units** column displays the units of measure for the parameter column.

Setup window

The **Parameter** column is used to specify the parameter value for the selected function.

Click the box in the Parameter field to open the Setup window. On selecting a smoothing function, Maxum GCP will calculate a recommended parameter (window size for a moving window smoothing function or percent smoothing for the wavelet function) for the function based on the chromatogram. The results of this calculation are also shown graphically in the two following figures, illustrating the dependency of chromatogram noise and peak distortion on a wide range of smoothing settings. The recommended parameter is found based on the trade-off between lower noise and higher peak distortion.

Please note that the recommended smoothing parameter is only a guideline and may not be optimal for your chromatogram.

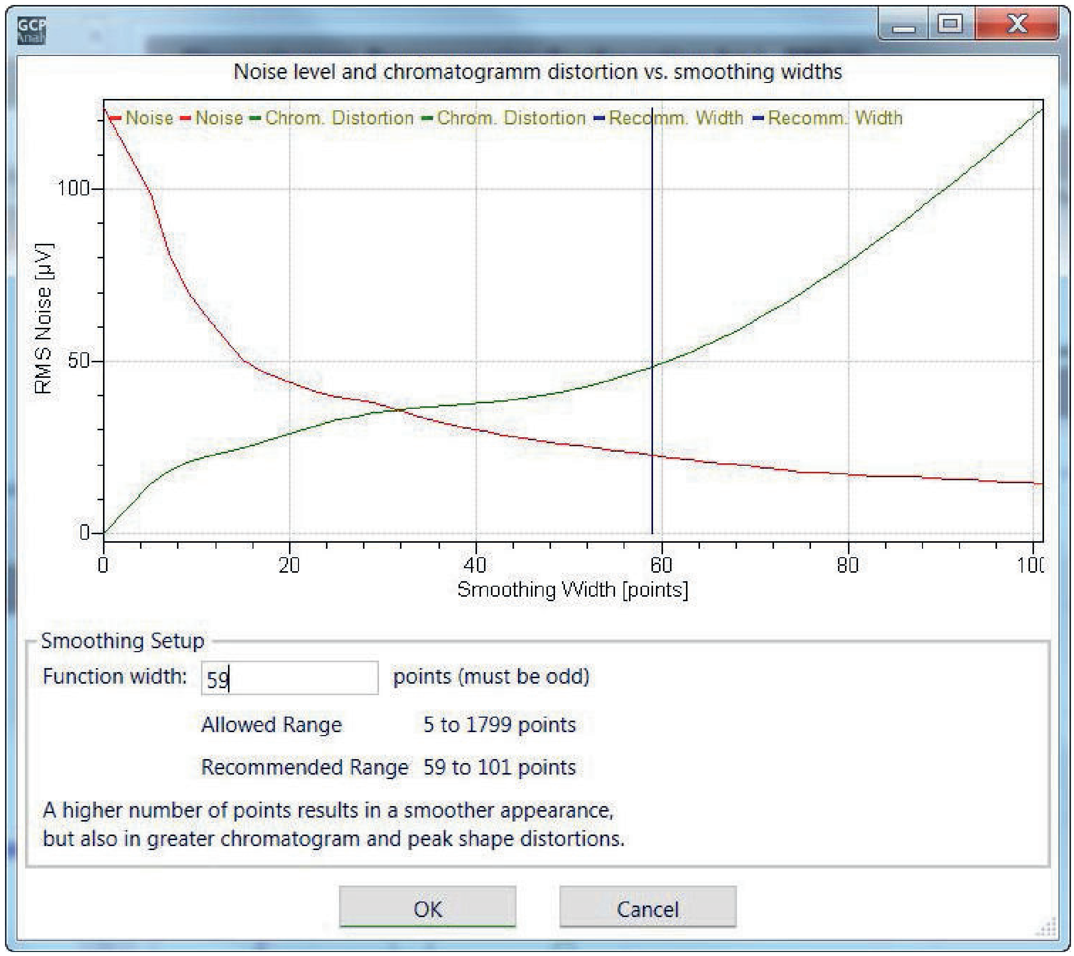


Figure 4-61 Graph window for choosing the convolution smoothing window size

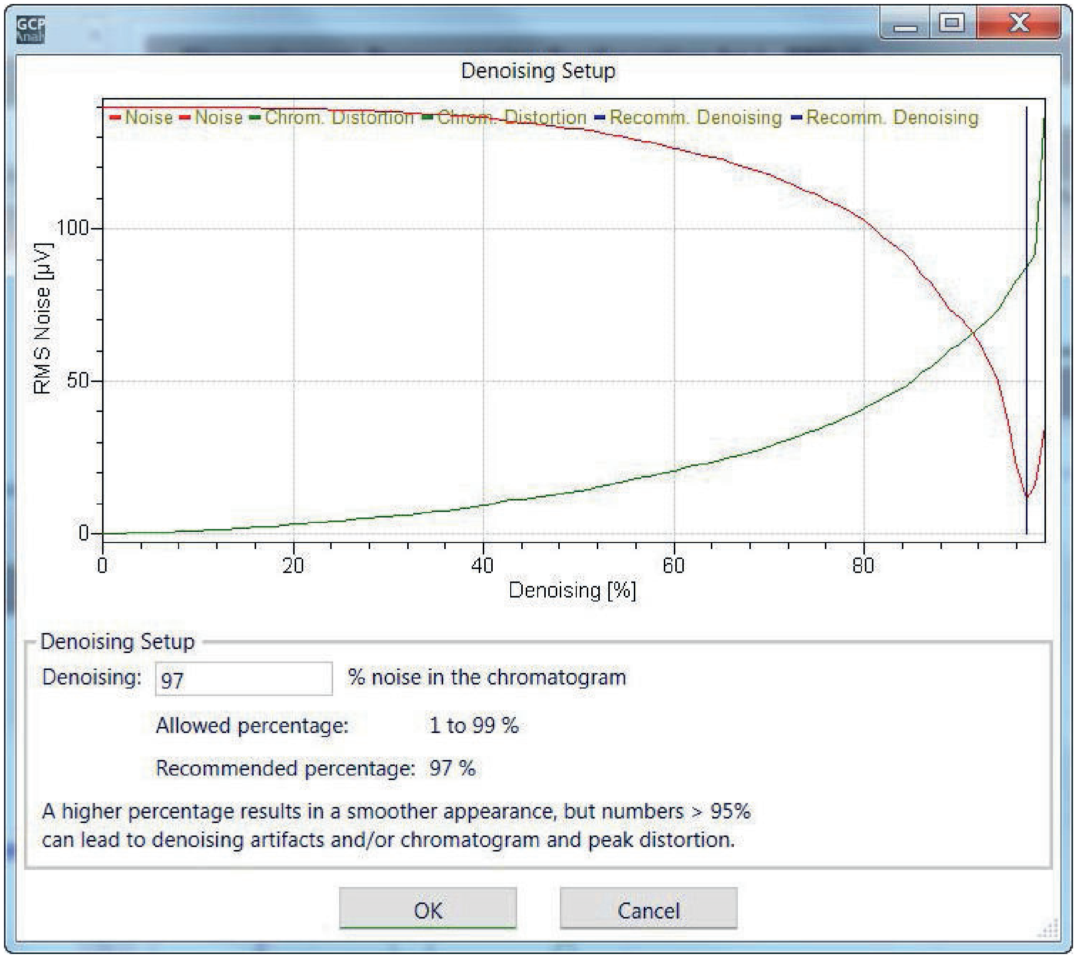


Figure 4-62 Graph window for choosing the wavelet denoising percentage

On selecting a noise measurement function, Maxum GCP will automatically find a recommended parameter (segment location in the chromatogram to calculate noise) for the function based on the chromatogram. The noise levels in the entire chromatogram are shown graphically in the following figure (which opens automatically), indicating the recommended location to calculate the noise. The recommended location is found based on a trade-off between finding the point with the lowest acceptable noise and the widest area for acceptable noise calculations. Maxum GCP will also suggest a result ID as the parameter for the noise calculation functions. If you want to use a different result ID for the noise measurement, make sure to use an ID that is unique.

Please note that the recommended location is only a guideline and may not be optimal for your chromatogram.

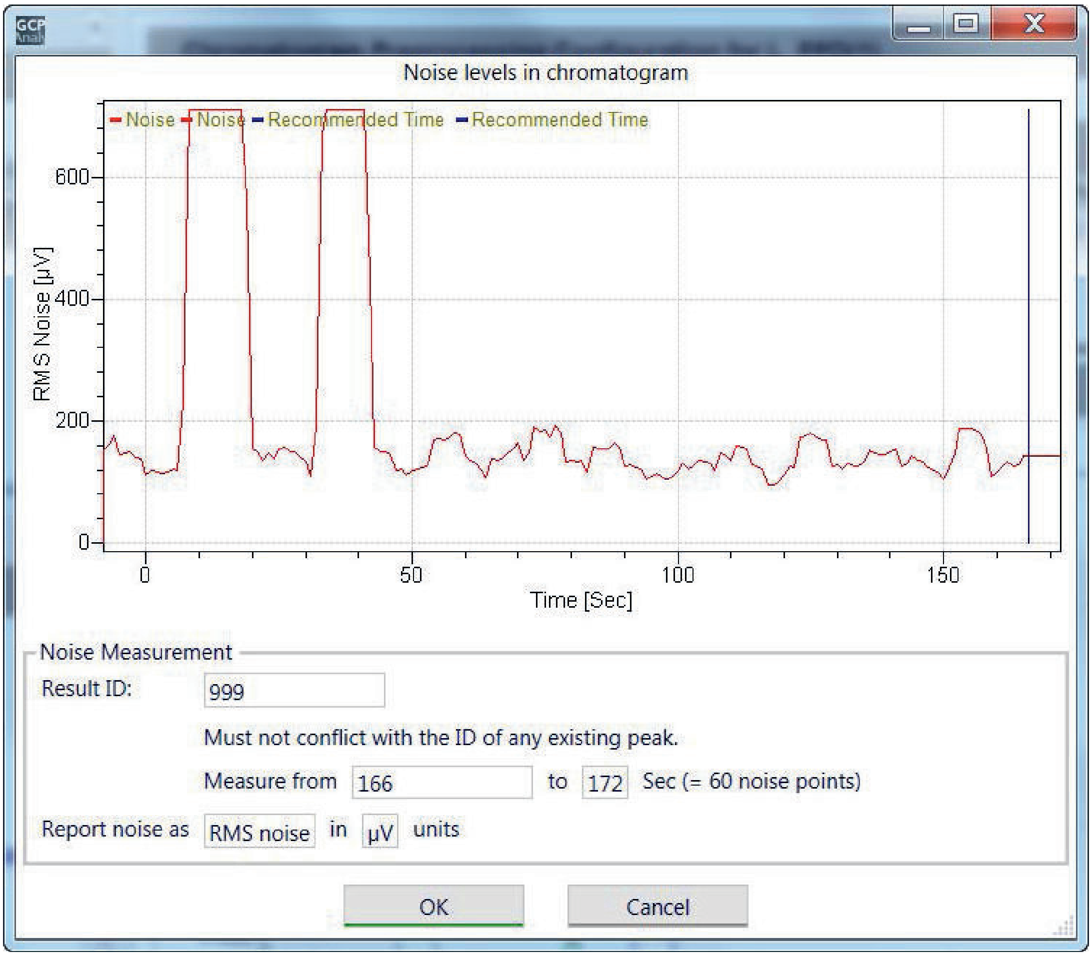


Figure 4-63 Parameter graph window for choosing the noise measurement location

These parameter graph setup windows can be opened manually by clicking the parameter cell and clicking the … box in the cell as shown in the following figure.

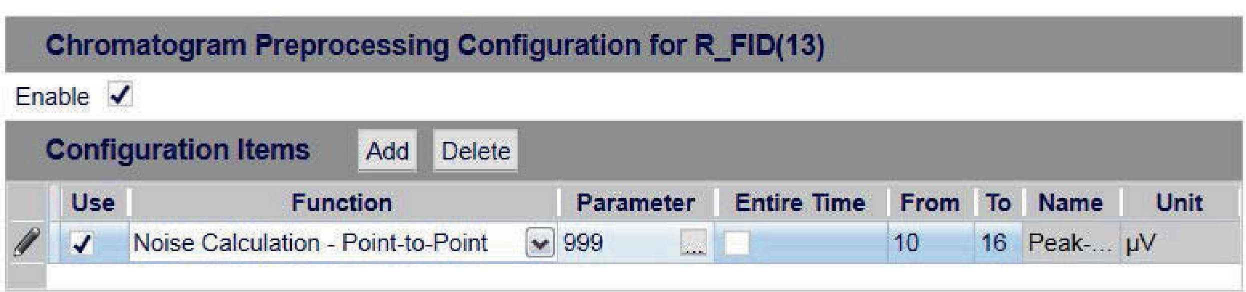


Figure 4-64 Configuration Items table showing the **Parameter** button to open the parameter graph and setup window

The parameters are as follows:

- **Entire Time**
  The **Entire Time** column is used for a smoothing function only to specify that the function is applied to the entire chromatogram. If **Entire Time** is checked for a noise measurement function, software will find the widest area in the chromatogram with the lowest noise level and measure the noise only in that area.
- **Smooth, Unsmooth Buttons**
  The **Smooth** button is used to manually apply the selected functions to the chromatograms of the current detector. The smoothing is applied as an overlay and may not be readily visible in some applications. All the selected functions are also applied automatically when a chromatogram is
  All the selected functions are also applied automatically when a chromatogram is analyzed using the analyze function.
  The **Unsmooth** button is used to undo the selected functions applied to the chromatograms.

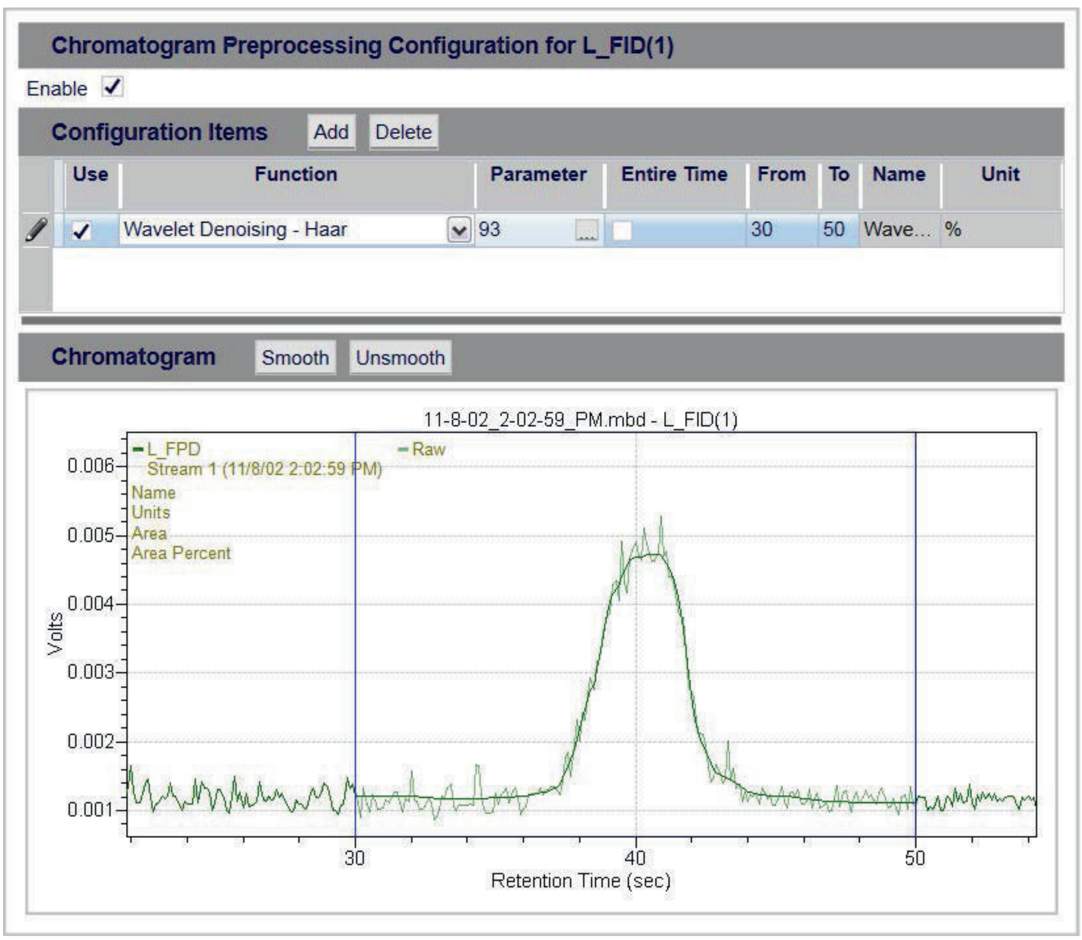


Figure 4-65 Wavelet smoothing between 30 and 50 seconds

In the preceding example the smoothed signal is overlaid with the raw signal. Notice how the smoothed signal is only displayed between 30 and 50 seconds and how it is aligned with an estimated average of the raw signal. When the smoothed signal is not in line with the raw signal this indicates possible excessive peak distortion.
Unsmooth: The Unsmooth button (illustrated above) is used to undo the selected functions applied to the chromatograms.

By default, the Maxum GCP saves a copy of the original chromatogram data before applying any smoothing functions. This allows the user to experiment with different smoothing functions and parameters without having to manually save and restore the original chromatogram.

Parameter graph windows

When Maxum GCP displays the recommended parameters along with a graph (as shown in figures 16, 17, and 18), the following functions are available:

- **Zoom in**
  Left-click and drag the mouse in the graph to define a zoom-in window, then release the left mouse button.
- **Zoom out**
  Double-click in the graph to go back to the previous zoom level.
- **Full unzoom**
  Right-click in the graph and select Full unzoom.
- **Print graph**
  Right-click in the graph and select **Print**.
- **Copy to clipboard**
  Right-click in the graph and select Copy to clipboard.
- **Add Text…**
  Move the mouse to a selected location on the graph, right-click in the graph and select Add Text. The Add Text Annotation window will open. Texts entered in the Text box will be displayed at the selected location.

Algorithms

Quantitative GC analysis relies on finding peaks in chromatograms and measuring their areas above the local baselines around peaks. The accuracy and precision of the peak finding and the area measurements for trace components are often compromised by the low S/N ratios commonly associated with these components. Therefore, reducing the noise in a chromatogram before the peak analysis is desirable to improve the detection limit and the repeatability of the quantitative analysis of trace components. Therefore, Maxum method software provides RMS and peak-to-peak noise calculations, moving-window smoothing functions, and the wavelet denoising function to assist in reaching these goals.

This section describes the algorithms used in Maxum for smoothing and noise measurement.

RMS noise

The root mean square (RMS) noise is calculated from the RMS deviation of data points from the linear least-square fit of the same data points:

$$\text{RMS noise} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}$$

where

- x_i is the deviation of a data point from the fit,
- $\overline{x}$ is the average deviation of all the data points from the fit, and
- n is the number of data points involved.

The linear least-square fit is used here to eliminate the effect of a chromatogram slope on the noise calculation.

Peak-to-peak noise

The peak-to-peak noise is simply calculated from the range of data points (x):

Peak-to-peak noise = max (x) - min (x)

Moving-window smoothing function

Moving-window smoothing uses the conventional approach of convoluting a set of 2m+1 filter coefficients, c_i with a sequence of 2m+1 original signal values, y_{i+j} to produce a filtered signal value, y_i^* at the center of the moving window:

$$y_i^* = \sum_{j=-m}^{j=m} c_j y_{i+j}$$

This convolution process is illustrated graphically below with a moving window of size five:

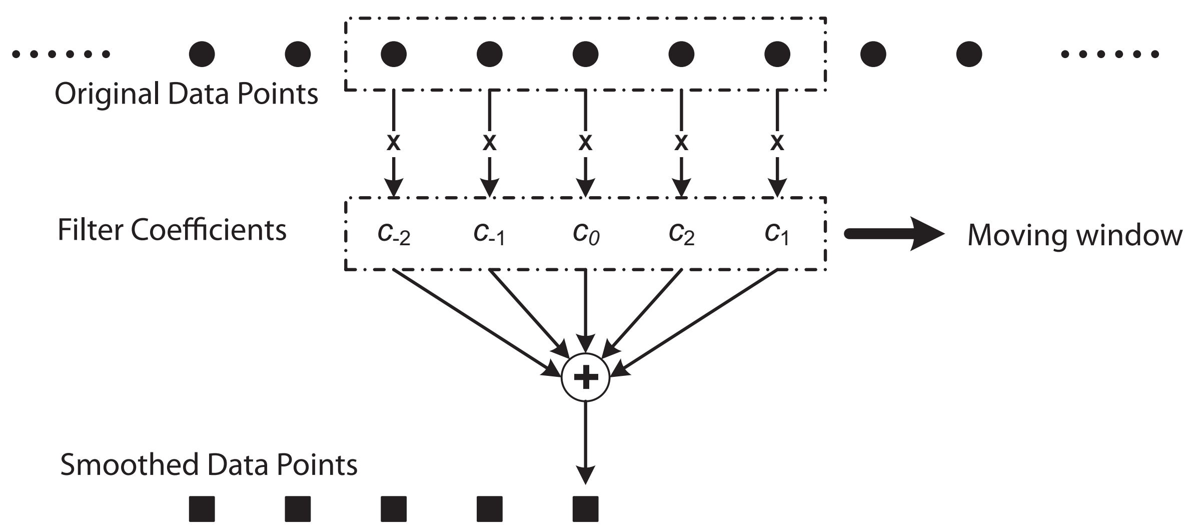


Figure 4-66 Convolution process used in moving-window smoothing functions

The preceding example shows the convolution process used in moving-window smoothing functions. A moving window slides across the original data points. At each window position, the values of all the original data points in the moving window are multiplied by the filter coefficients and the results are added together to produce the smoothed data point at the center of the window position.

Three types of filter coefficients have been implemented in the software: boxcar, Gaussian, and Savitzky-Golay. These filter coefficients will all smooth out some noise in the chromatogram, along with possible distortion of peak shapes when convoluted with a noisy chromatogram. The effects of smoothing and distortion are both enhanced if the filter width, *m*, is increased. Therefore, the filter type and width must be carefully selected based on the nature of the noise in a chromatogram to be smoothed.

Boxcar coefficients are all equal to

$$\frac{1}{2m+1},$$

producing a simple moving-average filter that treats every data point in the sequence with equal importance to the filtered value at the center. A boxcar filter is quite adequate for attenuating spike noises in the moving window when the window is away from a peak, but may cause too much peak distortion near the peak.

Gaussian coefficients are calculated based on a Gaussian function whose width is determined automatically based on the filter width selected, resulting a weighted moving-average filter that gives more importance to the data points that are closer to the center. The Gaussian filter may not seem to have much advantage over the boxcar filter when the moving window is away from a peak but smoothes much better with much less distortion near the peak.

Savitzky-Golay coefficients give the least-squares fits of a low-order polynomial to the data points inside the moving window (see illustration above). Fitting the data in this way models well the correlations in a generic bell-shaped peak while efficiently reducing the fluctuations of random noises with much less peak distortion.

Wavelet denoising function

It is often difficult to balance the amount of noise to be filtered and amount of peak distortion to be tolerated when using moving-window smoothing. Denoising in the wavelet domain offers much better performance when a deep noise-reduction is desired while maintaining original peak shapes as much as possible.

Wavelet denoising is based on wavelet transform of a chromatogram using a set of wavelet functions. These wavelet functions are localized in both time and frequency spaces, unlike the sine and cosine functions used in Fourier transform that are localized in frequency space but not in time space. This feature makes them more flexible to represent non-periodic signals, such as chromatograms.

Unlike the noise in a chromatogram that is spread over the whole chromatogram, the analytical peaks in the chromatogram are inherently localized in retention time and usually have different widths and shapes, causing different frequency components localized at different retention times. It is therefore difficult to use a Fourier transform to filter out the noise around the peaks of interest without severe distortion of the peak shapes and areas.

Wavelet transform decomposes a chromatogram onto a set of wavelet basis functions. It can be represented in matrix form (Reference /2))

$\mathbf{w} = \mathbf{W} \cdot \mathbf{y}$, where

- **y** is the vector of a raw chromatogram,
- **w** is the vector of the wavelet transform coefficients, and
- **W** is the matrix containing the wavelet basis functions.

Algorithmically, wavelet transform splits a chromatogram recursively into approximation and detail wavelet coefficients as shown in the following figure.

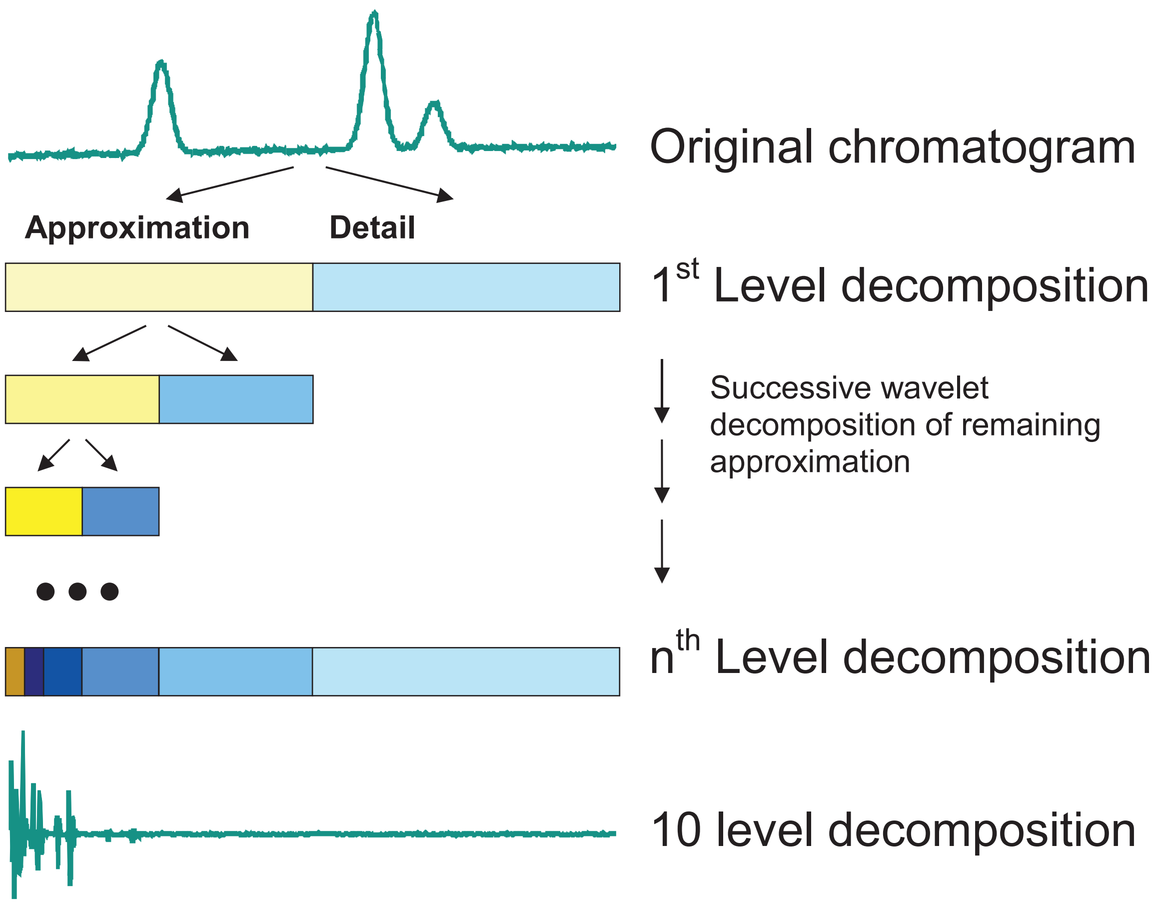


Figure 4-67 Wavelet transform algorithm

At each level of decomposition, approximation coefficients represent a smoothed signal in half resolution and detail coefficients contain fine details of the signal (the original chromatogram at the first level or approximation coefficients from the previous level of decomposition at other levels of decomposition). The smoothed signal is recursively decomposed until only one approximation coefficient remains. The original signal can be reconstructed by the inverse wavelet transform.

Because of the time-localization property of the wavelet functions, the important features of the localized analytical peaks are compressed into a small number of large wavelet coefficients, while the noise, being spread over the whole chromatogram, is instead represented by a large number of small wavelet coefficients. The wavelet denoising thus can be accomplished by removing those small wavelet coefficients before reconstructing the denoised chromatogram with the inverse wavelet transform as shown in the following figure.

In Maxum method software, the threshold for removing small coefficients is set automatically based on a user-specified percentage of total number of wavelet coefficients to be removed.

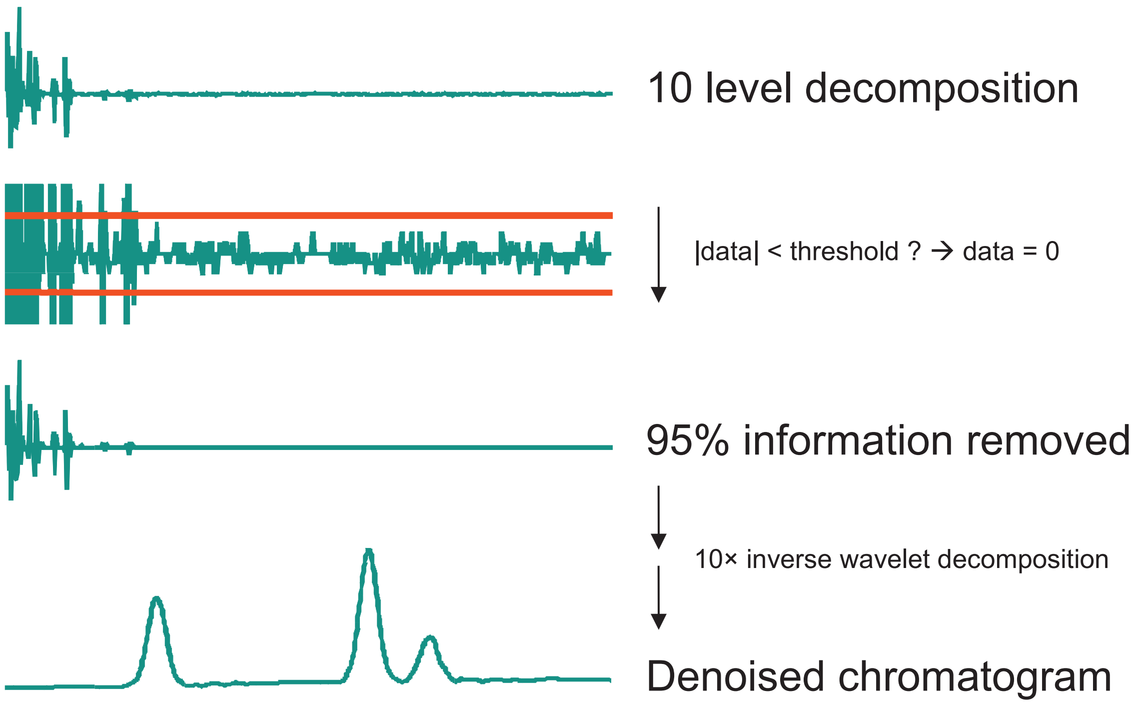


Figure 4-68 Reconstruction of the denoised chromatogram using inverse wavelet transform after thresholding

Because of unique shapes of wavelet functions and likely misalignment of sharp changes in a wavelet function and a chromatogram to be transformed, the reconstruction of the denoised chromatogram after thresholding can produce artifacts near sharp changes in the original chromatogram. To reduce such artifacts, the original chromatogram is shifted multiple times to obtain multiple shifted chromatograms. Each shifted chromatogram is denoised and back-shifted independently. The final denoised chromatogram is obtained by averaging all the denoised chromatograms.

Note

Only the Haar wavelet is provided with Maxum method software. It was found that this is the overall best wavelet for chromatogram denoising.

Segmented and sequential smoothing, noise measurement and method setup

To optimize smoothing and noise measurement functions, each function can be either applied to the entire chromatogram or to selected segments as needed. Smoothing functions can also be applied consecutively on top of each other. For example, when artificial spikes such as noise spikes and/or valve upsets exists in a chromatogram, it may be desirable to apply boxcar smoothing to remove spikes, followed by wavelet denoising, so that the spikes are preserved after wavelet denoising. Please note that noise measurements are done after all the smoothing functions have been applied.

The graphical user interface in Maxum GCP allows you to choose and optimize the functions and parameters for smoothing and noise measurement, chromatogram segments, and sequence of the functions to be applied. The parameters are all saved as part of the method that can be either executed on Maxum GCP for offline processing or downloaded to an analyzer enabling smoothing and noise measurement for an unattended online GC application.

During the method development phase, while the user needs to experiment with different smoothing functions and their parameters, the original chromatogram is kept to allow undoing previous smoothing functions before applying a new set of functions.

References

/1/ A. Savitzky, M.J.E. Golay,
Smoothing and Differentiation of Data by Simplified Least Square Procedures,
Anal. Chem., 1964, 36, 1627–1639.

/2/ C. Perrin, B. Walczak, D.L. Massart,
The Use of Wavelets for Signal Denoising in Capillary Electrophoresis,
Anal. Chem., 2001, 73, 4903-4917.

4.11.4.4 Peaks

The Peaks submenu allows the user to see and modify the settings for all chromatographic peaks configured within the method. The main Peaks screen (see below) shows all peaks for all detectors.

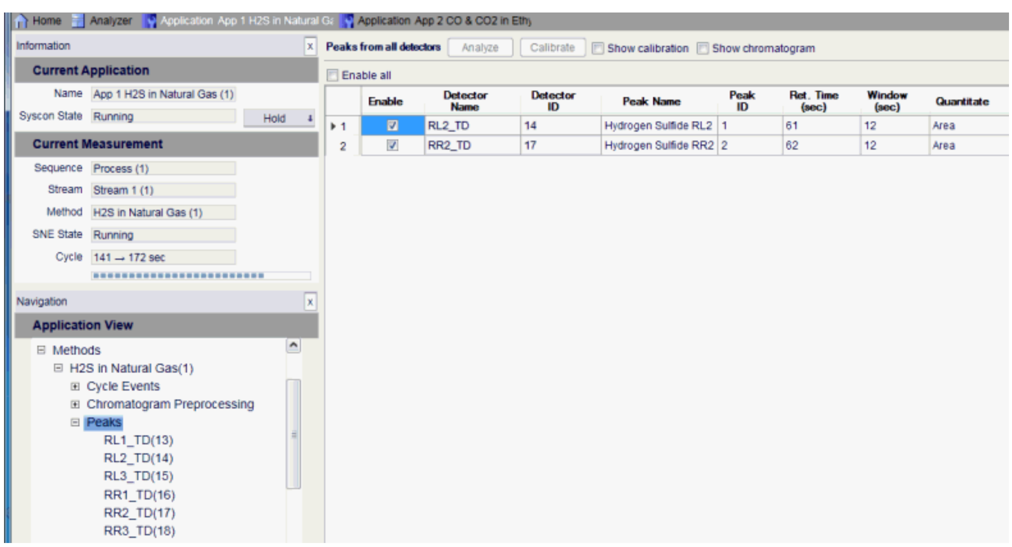


Figure 4-69 All Peaks

The available information is as follows:

Enable - Enables or disables the peak.

Detector Name - The detector that is associated with the peak.

Detector ID - The unique identification number of the detector.

Peak Name - The user-defined name of the peak.

Peak ID - The unique identification number of the peak, assigned automatically when the peak is created.

Ret. Time - The retention time is the expected amount of time it takes for the peak to elute from the column.

Window - This is the retention time window. It is the width, in seconds, of the peak, centered on the retention time.

Quantitate - Whether the calculation of response factors is based on area under the curve or height of the curve. Both are proportional to the concentration within the sample.

Detector Peak Screens

There are also selections for each detector which show the same information for the subset of peaks for that detector. Peaks can be added and deleted from the screens related to the detector (but not from the main Peaks screen). The buttons for adding and deleting screens can be seen in the image below. Other than the Add/Delete buttons, the information on the main and detector Peak screens are essentially the same.

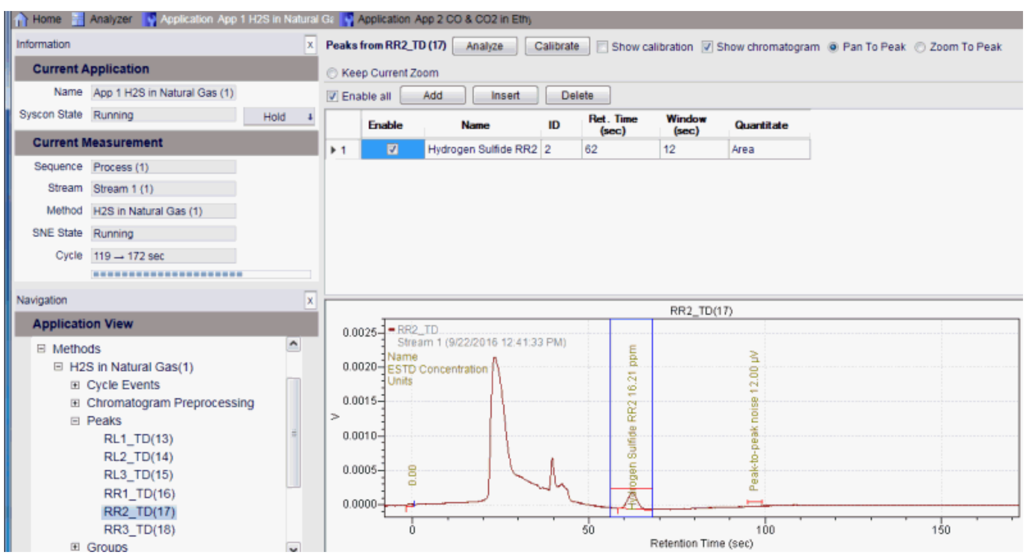


Figure 4-70 Screen for a Specific Detector

Chromatogram View Option

In the above image, the chromatogram for the selected detector is visible on the bottom of the screen. This useful feature is activated using the Chromatogram check box at the top of the window. The Chromatogram view allows the user to view peak settings as they appear on the chromatogram while the peak is being configured. Selecting a peak in the table will display blue lines on the chromatogram delineating the peak.

The Pan to Peak selection causes the entire chromatogram to be shown, as seen above. The Zoom to Peak selection is particularly useful, because it zooms in on the selected peak. With Zoom to Peak selected, selecting a different peak in the table zooms to the part of the chromatogram for that peak.

The chromatogram and zoom features make it very simple for a user to select the proper timing of a peak. Also, whenever a change is made to the timing in the table, the change is shown immediately on the graph.

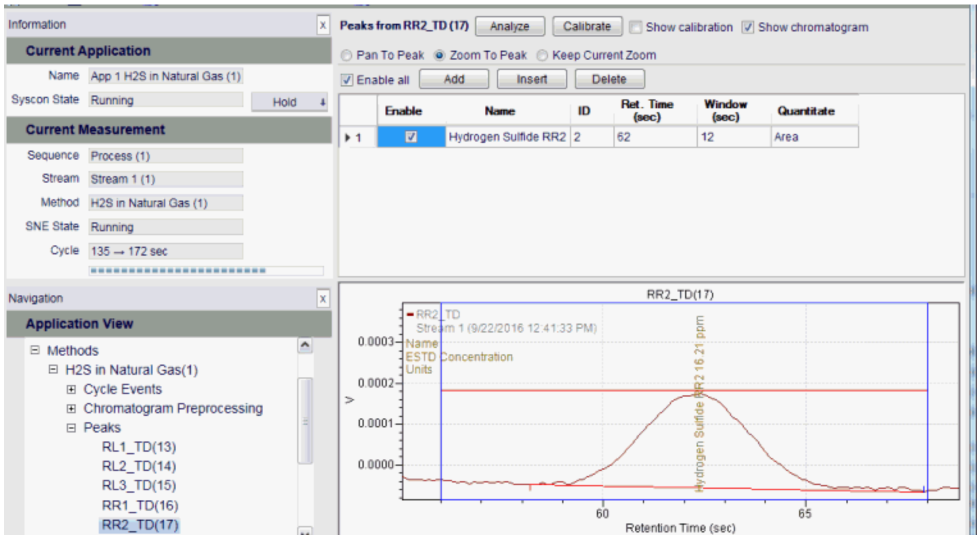


Figure 4-71 Chromatogram View Option - Zoom to Peak

Adding detected peaks: It is possible to have the software automatically detect a peak.

- Click the right mouse button while in the chromatogram area. This brings up a menu.
- Select the second menu item, Add Detected peaks.
- In the bottom left corner of the screen you will see "select start time". Click the point on the graph that you wish to start.
- In the bottom left corner, you will see "select stop time". Click the point on the graph that you wish to stop.
- A dialog box appears with the relevant information. Confirm settings and click OK. The software will detect any peaks in the range.
- It is also possible to add a peak using the mouse. To do this simply right click where you wish the center of the peak to be and then click "Add Peak at Mouse Position". A peak will be added at the desired location.

4.11.4.5 Groups

A group is a collection of peaks which are related in some way. Groups may be one of three types:

Uncalibrated Group - A group based on a time range.

Calibrated Group - Peaks are calibrated together as a group, creating a common response factor for the group. Peaks in the Calibrated Range will be reported as a single peak using the common response factor for the group as a basis for calculation of concentration.

Peak Groups - Peaks are selected individually, and do not need to be contiguous within the chromatogram.

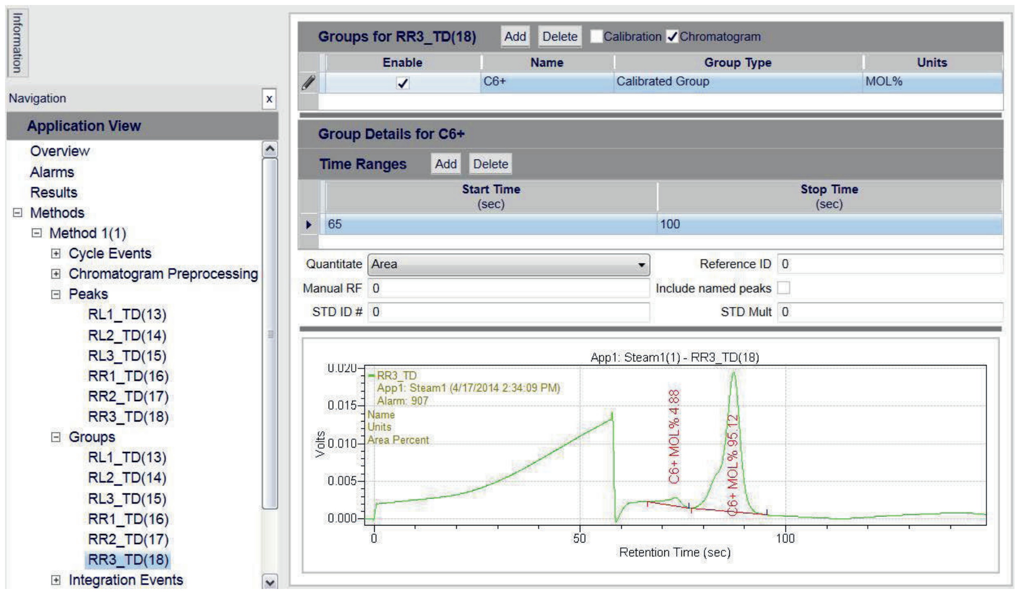


Figure 4-72 Peak Groups Screen

Chromatogram View

Clicking the Chromatogram check box in the Groups window displays the current chromatogram at the bottom of the window.

Adding groups: Groups can be added using the Add button or also by right clicking on the Chromatogram and then selecting the type of group to add.

4.11.4.6 Integration Events

Integration Timed Events are used to customize the integration of certain peaks or regions of the chromatogram. There is a separate screen for each detector channel. The Integration Events detector screens show all created integration events relating to the selected detector channel. From these screens events can be viewed, modified, added, and deleted.

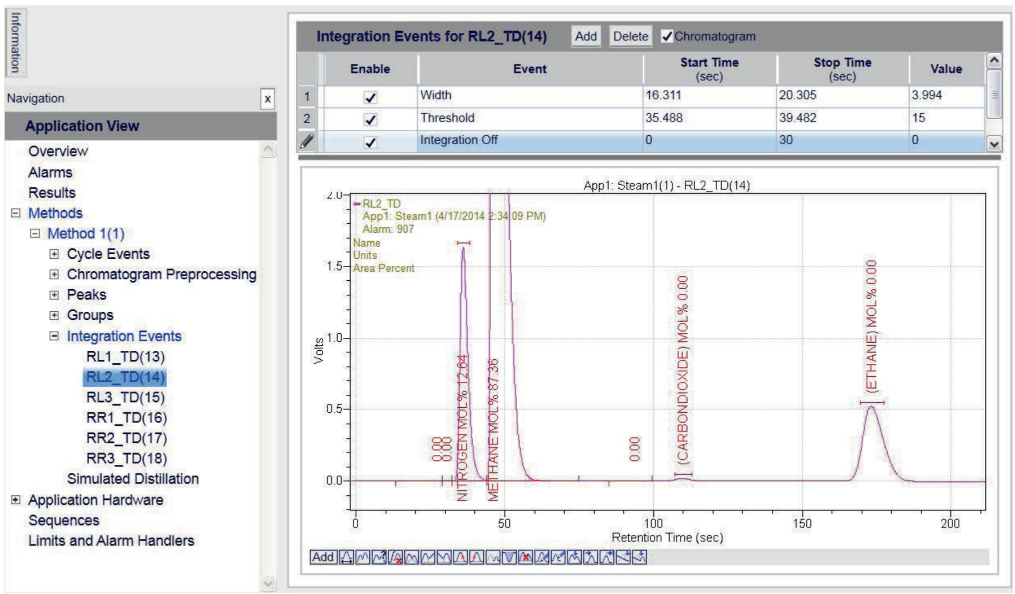


Figure 4-73 Integration Events

Information shown includes the event type (Event), the start time of the event in relation to the cycle clock, the stop time of the event, the numerical value, if applicable.

Chromatogram View:

Clicking the Chromatogram check box displays the chromatogram at the bottom of the window. The Chromatogram function is provided to allow the user to see the timing of events in relation to the cycle. The currently selected event from the table is represented on the Chromatogram by blue lines denoting the timing of the event.

Events can be added using the Add button or also by clicking one of the types of events from the menu bar at the bottom of the graph (hover the mouse pointer over the bar icons to see the purpose of each one).

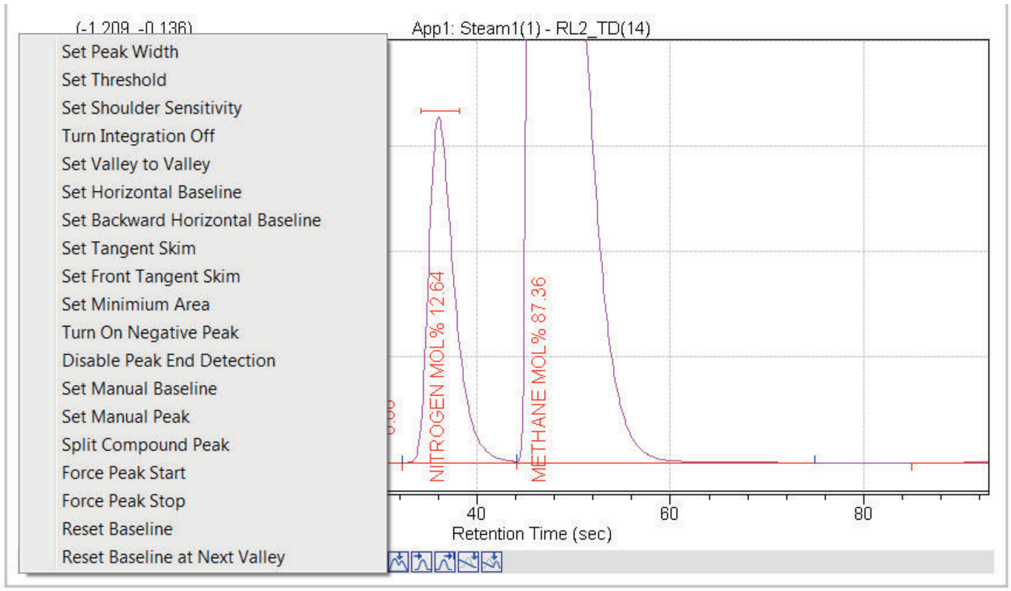


Figure 4-74 Integration Events - Chromatogram View

4.11.4.7 Column Performance

From the Application View, in the Navigation pane, click Column Performances to view a list of columns. Clik the indovodual column of interest to view perfomance values.

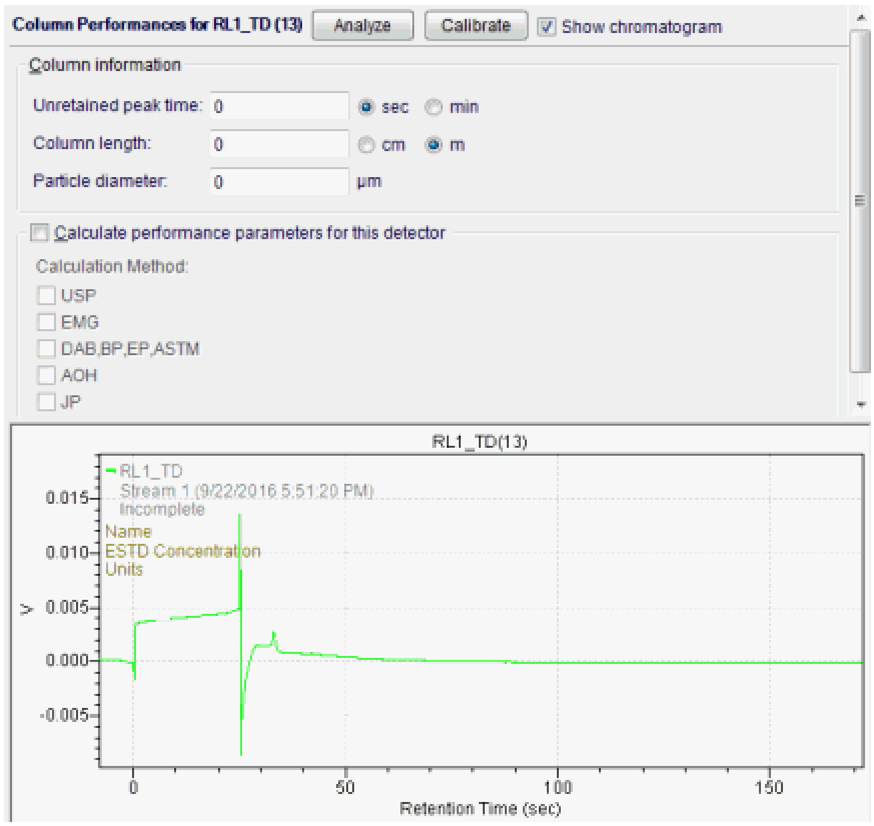


Figure 4-75 Column Performance Screen

4.11.4.8 Simulated Distillation

Simulated distillation ("SimDis") is a gas chromatographic method that emulates the distillation of mixtures, namely petroleum-based products, to establish their boiling point distribution in correlation to evaporated volume percent. See the Simulated Distillation Section.

4.11.5 Application Hardware

Applications in a Maxum family gas chromatograph (GC) utilize the hardware that is equipped within the GC. Multiple applications can run simultaneously on a Maxum family GC, with system hardware being shared between applications. The Application Hardware Screens available within GCP allow the user to view, add, delete, and modify hardware that is assigned in the application.

At the top of the display window for each type of hardware there is an image that indicates the relevant location in the Maxum Analyzer for the hardware. For example, the Detector Personality Module is highlighted for Detectors.

The available information on the Application Hardware screens includes

Trains - A chromatographic train, sometimes referred to as a column train, is the chain of hardware required to perform a chromatographic separation. The Gas Chromatograph Portal software give the user the ability to define the hardware related to a particular train, and to filter displays to show only information for hardware relating to the defined train.

Detectors - Information regarding the configuration, status, and assignment of each detector for the application. It is possible to view properties that are specific to the application or to the system or to the actual detector hardware. Only information that is accompanied by a white field can be changed.

Temperature - Information regarding the configuration, status, and assignment of each temperature controller for the application. It is possible to view properties that are specific to the application or to the system or to the actual temperature controller hardware. Only information that is accompanied by a white field can be changed.

Pressure Controllers - Information regarding the configuration, status, and assignment of each pressure controller for the application. It is possible to view properties that are specific to the application or to the system or to the actual pressure controller hardware. Only information that is accompanied by a white field can be changed.

Analog and Digital Inputs/Outputs - This series of screens allow the user to view and change various information relating to application inputs/outputs (I/O). The "Show All" selection box at the top of the screen toggles between showing just external I/O or both internal and external I/O.

4.11.5.1 Trains and Train Filtering

Description of Train Filtering

A chromatographic train, sometimes referred to as a column train, is the chain of hardware required to perform a chromatographic separation. A train consists of one or more columns, detectors, valve connections, and tubing. In the reference to the Maxum II Gas Chromatograph, the concept of a train is extended to also refer to other hardware that controls the separation, such as automatic temperature and pressure controllers.

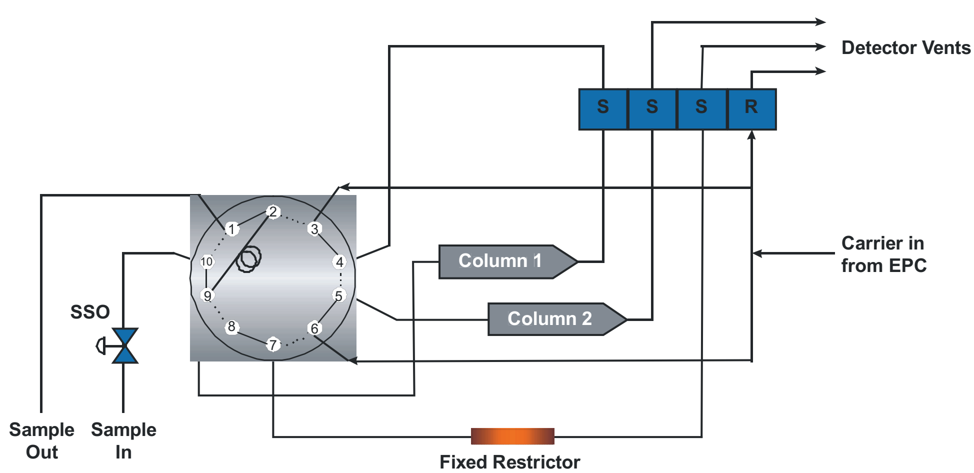


Figure 4-76 Train Hardware

The Maxum II gas chromatograph is capable of perfroming parallel chromatography, running muliple separations on multiple trains at the same time. This allows for great versatility in the instrument and also the ability to use one instrument when in the past multiple instruments may have been needed. Because a Maxum analyzer may have multiple applications each with multiple methods and also several trains, it is sometimes desirable for a user to be able to view only part of the overall configuration at a time. Using the Gas Chromatograph Portal (GCP), applications may be viewed using the Application tabs. Methods may be viewed from the Navigation menu on the Application tab. It is also possible to view individual trains on the analzer using the train filter feature.

Train filtering is a unique added functionality in GCP. It allows the user to define hardware in groups such that filtering by that group will display information specific to only that group. These groups, called trains, can be defined by the user as needed. Unlike configuration of Methods and Applications, train filtering does not affect the operation of the analyzer. It merely identifies hardware that the user has indicated as connected. For example, if the user decides that a particular detector output within a train is not necessary to see as part of the filter, then the user may choose not to include it as part of the filter. The function of that detector does not change.

See the following topics for more information:

Enabling Gas Chromatograph Portal for Train Filtering (Page 122)

Configuring a Train (Page 123)

Viewing Information Using Filtering (Page 124)

Enabling Gas Chromatograph Portal for Train Filtering

Train Filtering is a feature intended for experienced users. For this reason the Train Filtering feature is disabled by default in Gas Chromatograph Portal.

To enable the Train Filtering feature choose the "Tools" menu and then choose "Options". In the "Options" dialog box there will be a checkbox titled "Show Trains (Version ≥ 5.1)". Check the box and click OK to enable the feature.

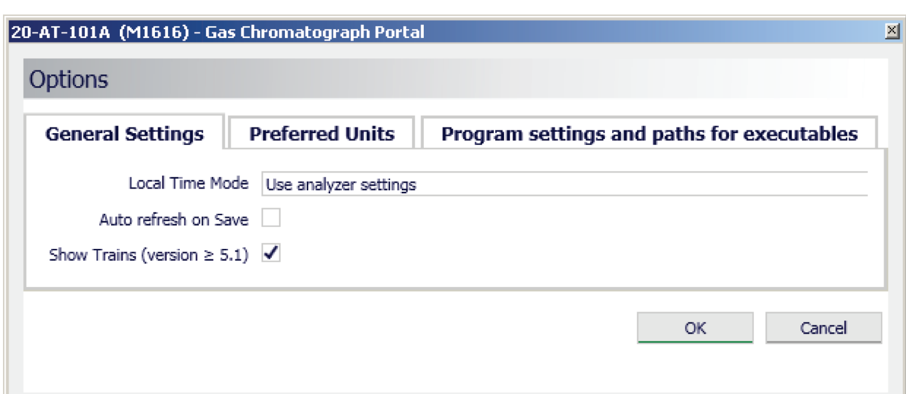


Figure 4-77 Tools Options Dialog Box

At this point in the top right corner of the GCP window the "Train Filter" selection box will appear. This box defaults to filtering "Off". If trains are configured then filtering can be done by selecting the drop-down Train Filter list. Once a train is selected then for many GCP screens and menu selections only hardware relating to the selected train is shown.

Figure 4-78 Toolbar with Train Filter Enabled

Note that trains can be configured whether the filtering feature is active or not.

Configuring a Train

Trains are created and configured by the user using GCP. Trains are used for filtering the way the user sees information. A train configuration by itself does not change operation of the analyzer. Because of this configuration of a train is at the discretion of the user. That is, hardware configured as part of a train are not necessarily physically connected as with a physical train.

Creating a Train:

Trains are created using the Trains navigation menu selection under Application Hardware.

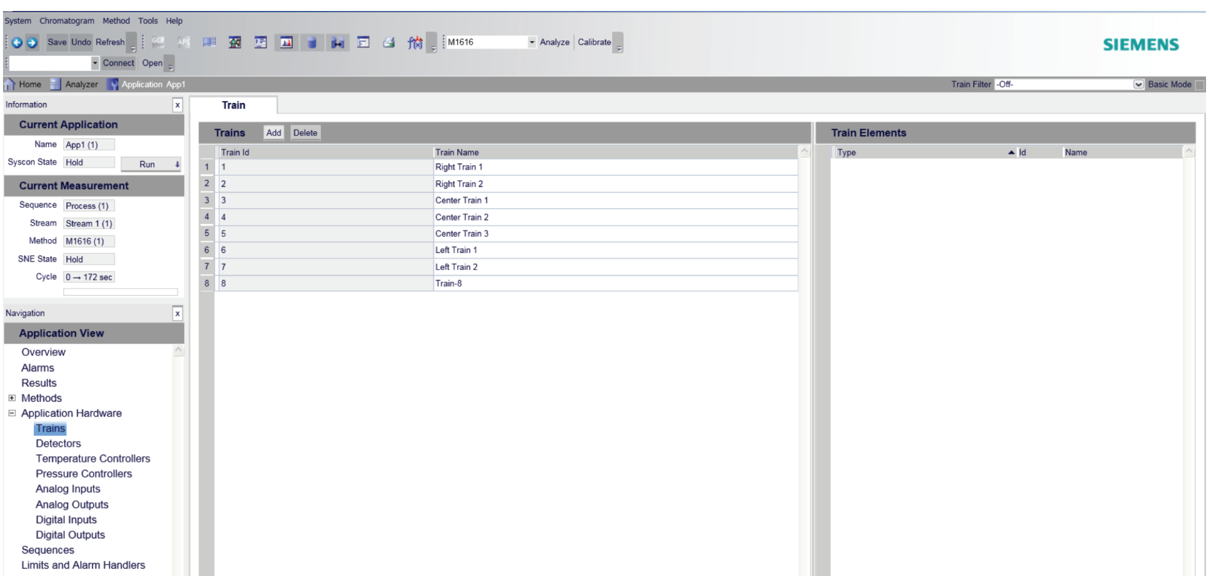


Figure 4-79 SS-Adding a Train

To add a train click the Add button in the information window. This will add a new train at the bottom of the list with a default name. Click on the train name to change the name of train

Configuring a Train:

The Train selection on the Navigation menu is used to create and delete trains and to view connected elements.

Configuring the elements that are to be connected to a train is done on the hardware assignment screens for the hardware. Detectors, pressure controllers, temperature controllers, and I/O can be configured. Below is the display for the Detector Assignment Screen. Note the

"Train Assignments" field onthe right hand side. If you click the "Train Assignments" field for a detector channel you can assign which trains the detector is connected to. More than one train can be selected. After entries have been completed, click Save on the toolbar to save changes.

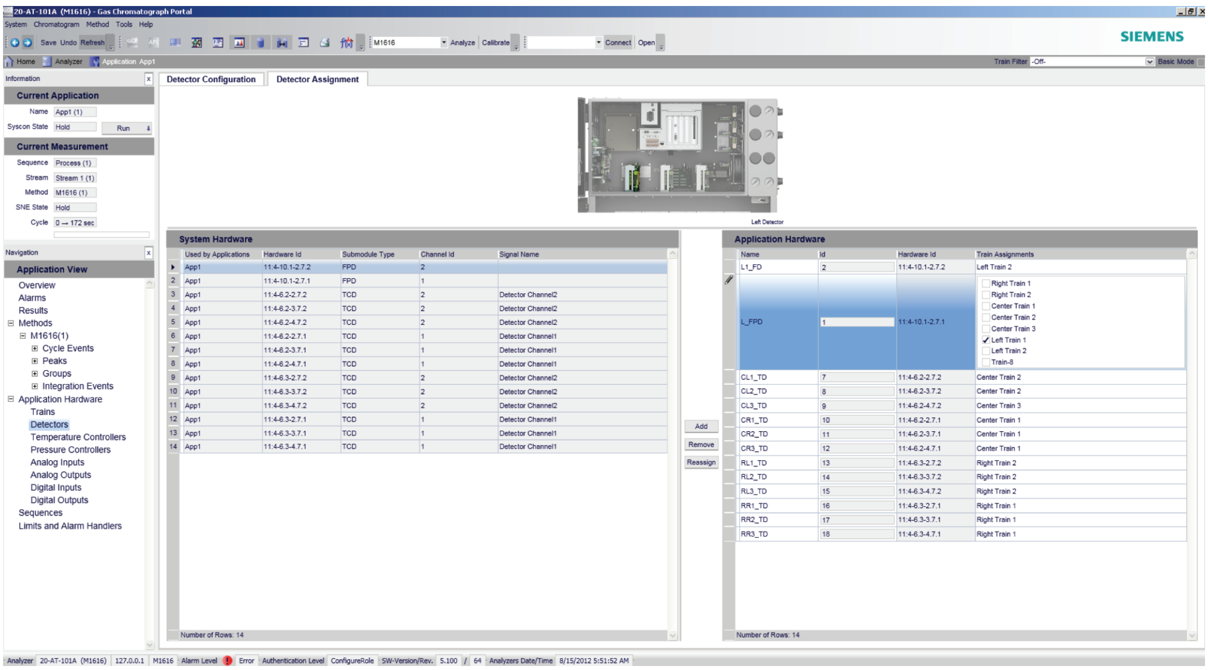


Figure 4-80 SS-Adding a Detector to a Train

The configuration screens for Temperature Controllers, Pressure Controllers, and I/O function in a manner similar to Detectors.

Viewing Information Using Filtering

The purpose of train filtering is to allow the user to limit the information displayed by the software to only that information relating to a set of specific hardware. The hardware that can be configured includes detector channels, temperature controller channels, and pressure controller channels. The image below shows the Detector Configuration screen. "Right Train 1" is selected. on the train filter. This causes the screen to display only detector channels that are assigned to"Right Train 1". All other detector channels are hidden.

To view all channels again, select "Off" from the filter menu.

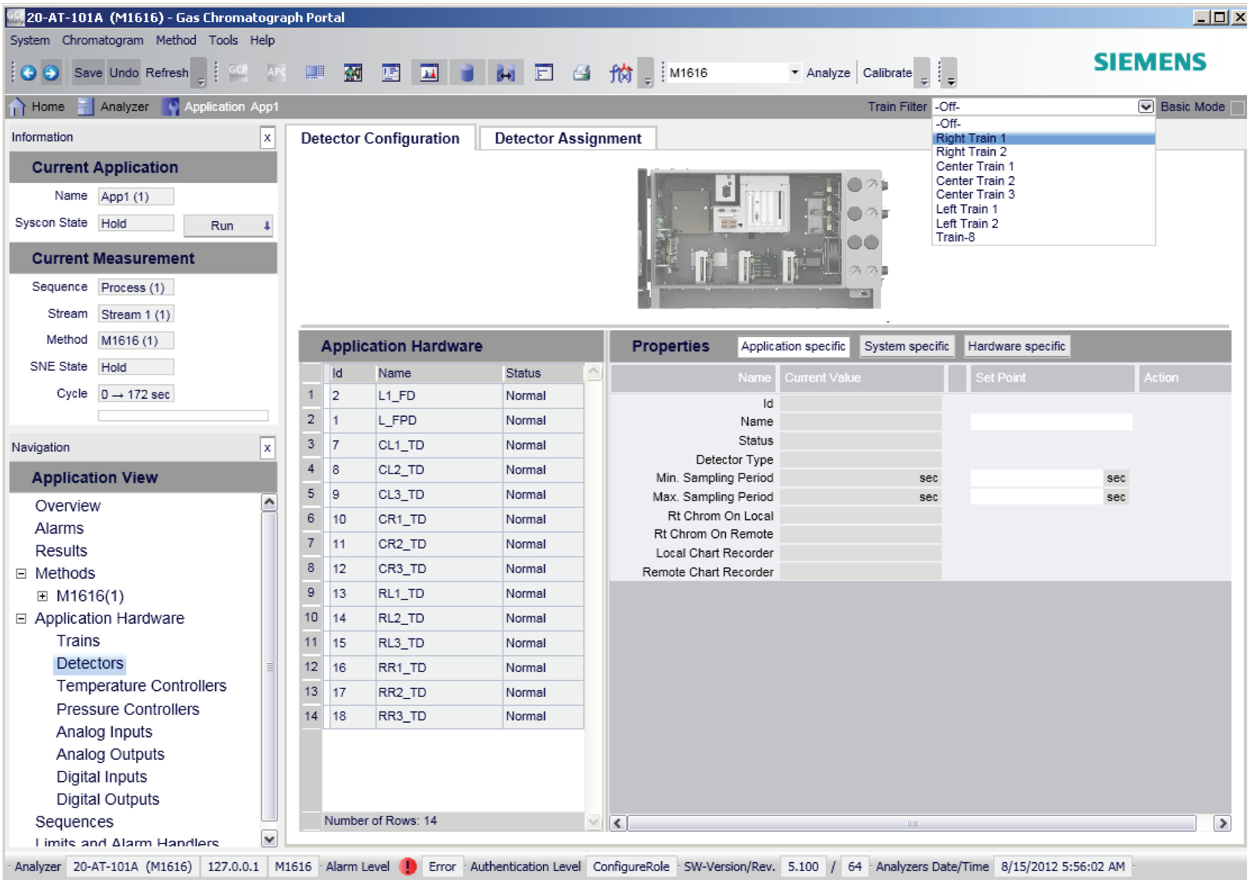


Figure 4-81 SS-Filtering by Train - Detector

Although hardware assinged to the train is limited to Detectors, Temperature Controllers, Pressure Controllers, and I/O, other information is also filtered when the feature is selected. This includes the method infomation. For example, Cycle event information is filtered as shown below. Note below that the Cycle Graph is also limited by the filter.

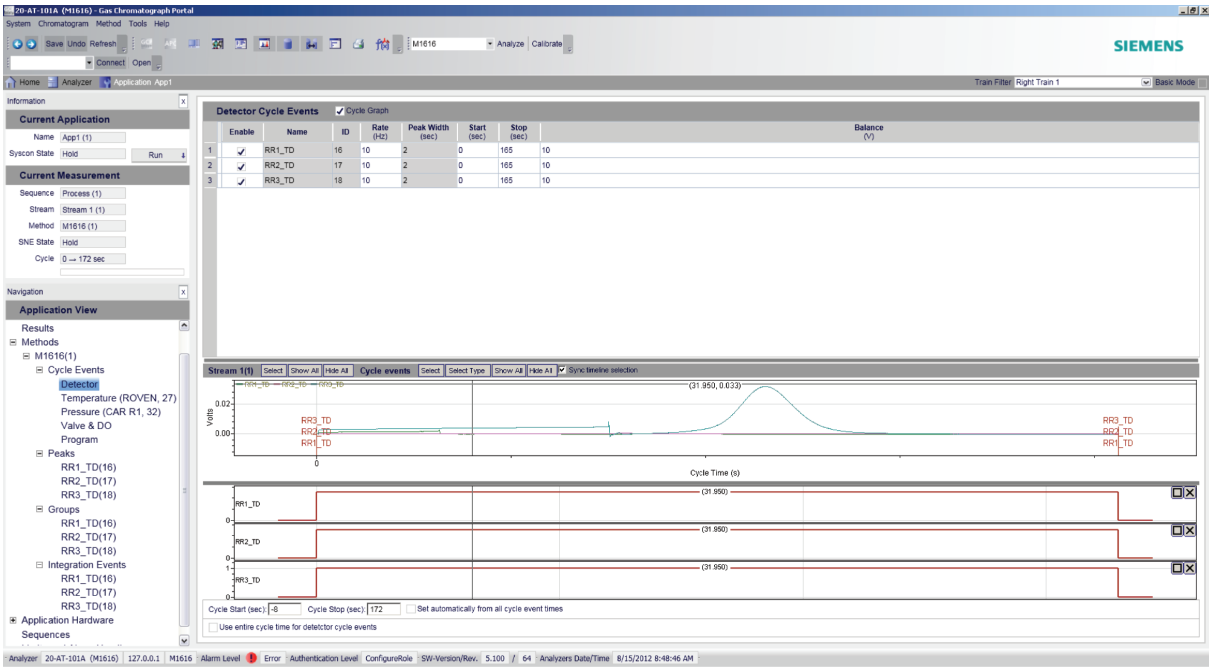


Figure 4-82 SS-Filtering by Train - Method

In a simiilar way to the examples above, the train filter can affect the display for all Method and Application Hardware menu items on the Application View.

4.11.5.2 Detectors

The Application Detector screen allows the user to assign detectors to an application as well as view settings and make changes. The user is also able to view hardware and system settings for the detector.

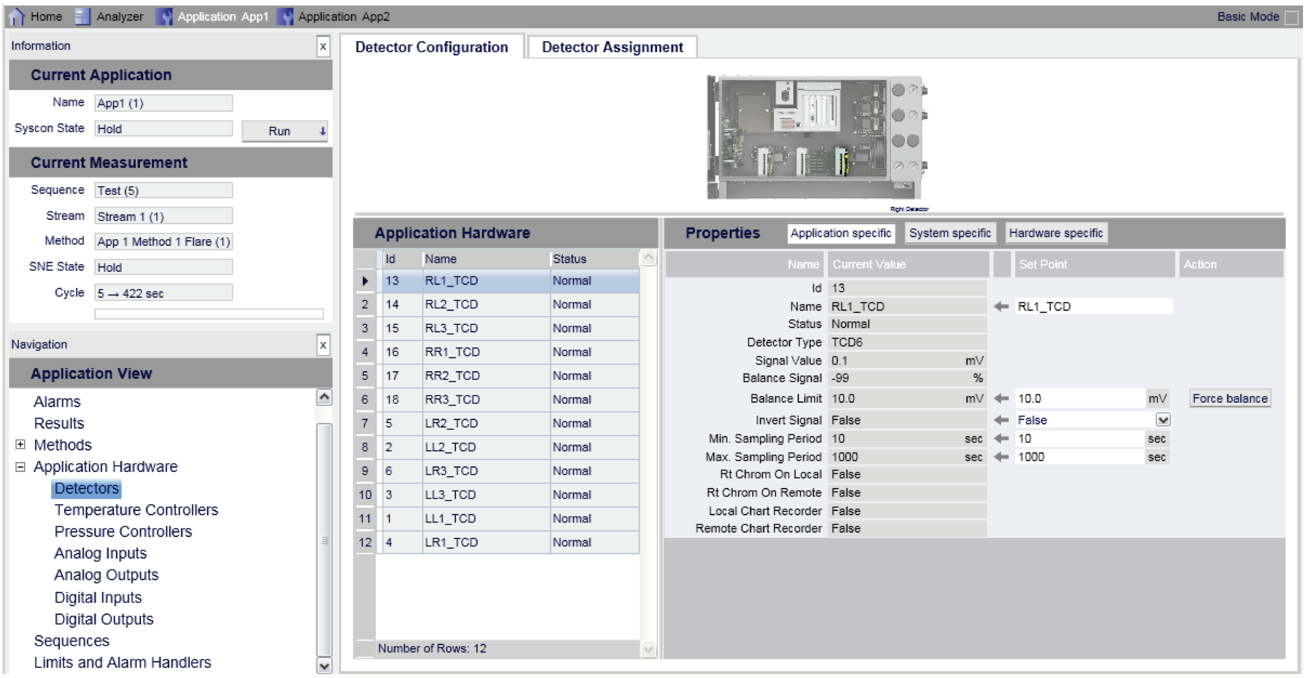


Figure 4-83 Application Hardware - Detector Configuration

Properties:

A short description of each property is available using the tool tip function (viewed by hovering the mouse pointer over the Value field for each property).

By default the Application Specific properties are displayed. Using the buttons at the top of the Properties pane, it is also possible to view the System Specific detector properties as well as the properties relating to the detector Hardware.

Detector Assignment:

The Detector Assignment tab allows the user to associate system detector hardware with the application and also to remove or reassign existing associations.

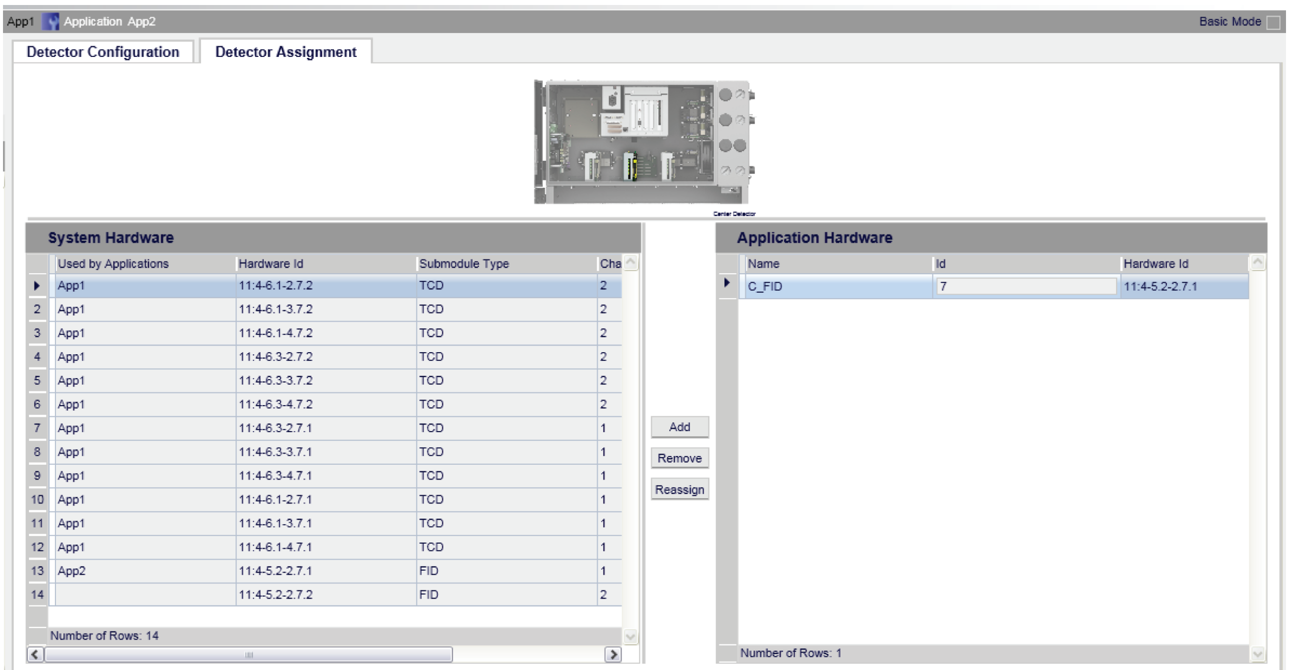


Figure 4-84 Application Hardware - Detector Assignment

Adding System Hardware to an Application:

The Assignment screen is organized with system hardware on the left and Application hardware on the right. To add a specific detector channel to the application, select the desired channel on the left and then click the Add button.

In the following image, the hardware ID 11:4-6.1-4.7.1 has been added to Application 2 (it is now associated with both application 1 and application 2). It is now LR3_TD with ID 6 in the Application.

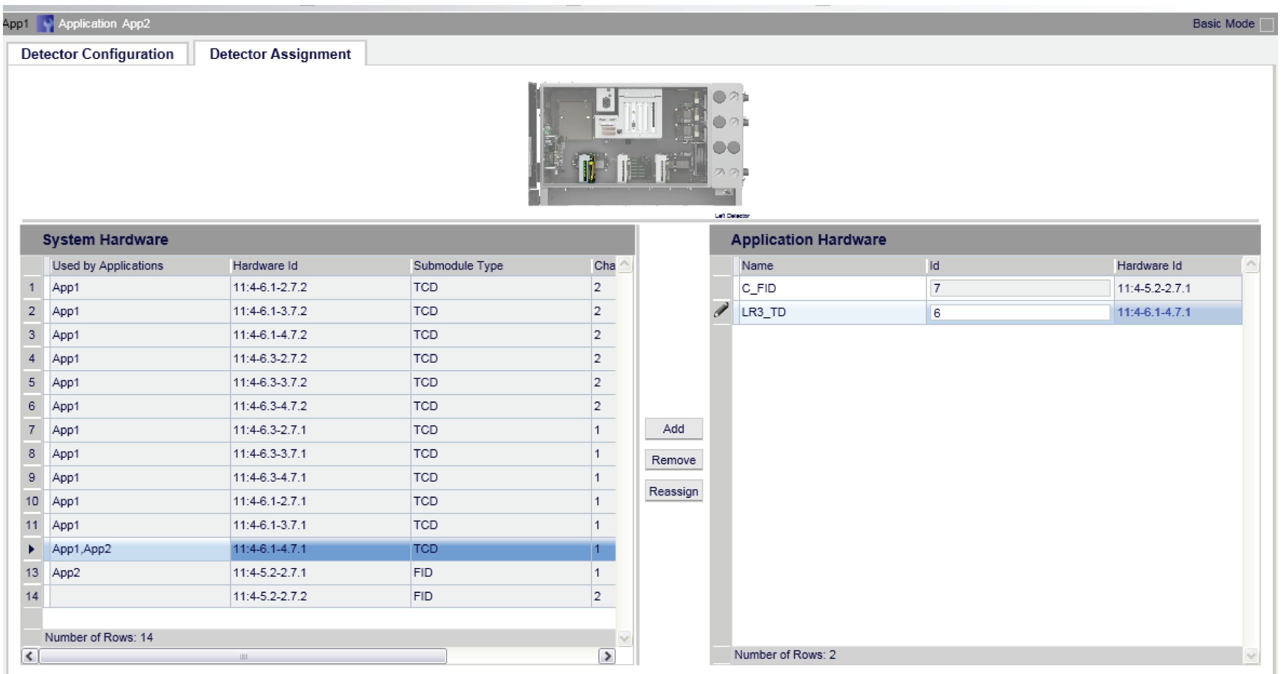


Figure 4-85 Assigning a Detector to an Application

Reassigning System Hardware for an Application

The Reassign button allows the user to modify the System Hardware that an Application hardware Detector is connected to. To reassign, make sure that the desired Application Hardware line on the right is selected and that the desired new System Hardware line is selected on the left. Then click Reassign. The association is changed, and the new System Hardware ID shows up in the Application Hardware table.

In the following image, the association created in the image above has been moved from hardware ID 11:4-6.1-4.7.1 to 11:4-6.1.3.7.1 by using the Reassign button.

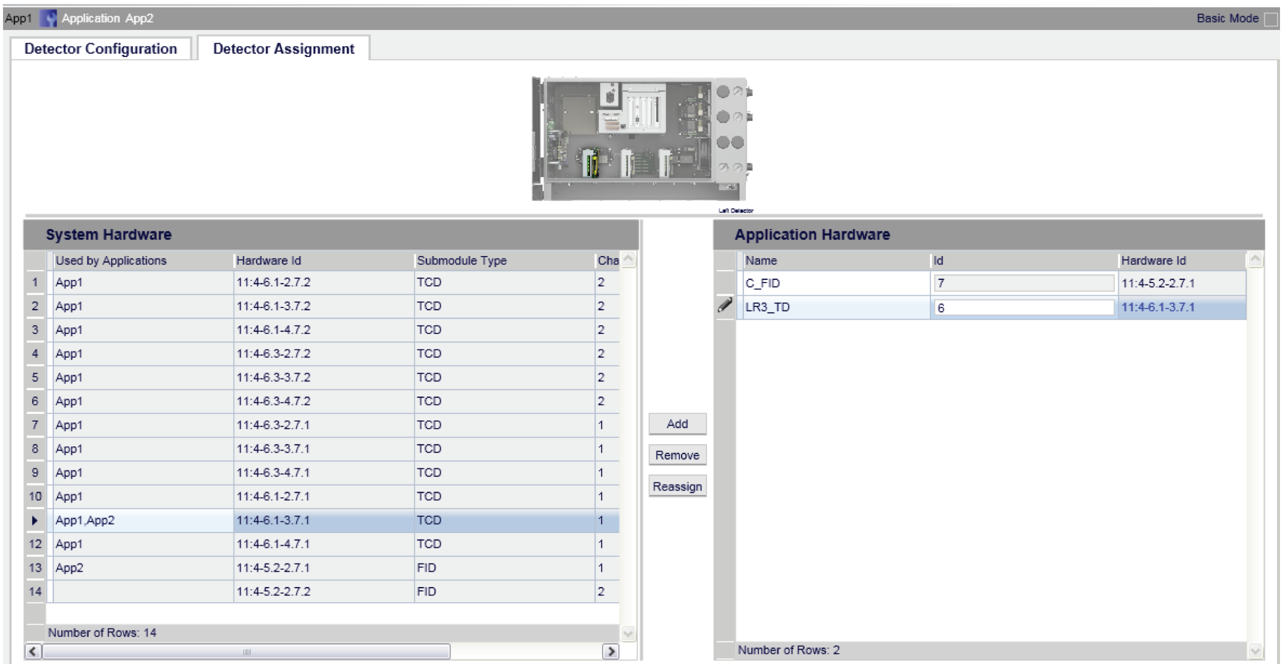


Figure 4-86 Reassigning an Application Detector Channel

4.11.5.3 Temperature Controller

The Application Temperature Controller screen allows the user to assign system Temperature Controllers to an application as well as view settings and make changes. The user is also able to view hardware and system settings for the Temperature Controller.

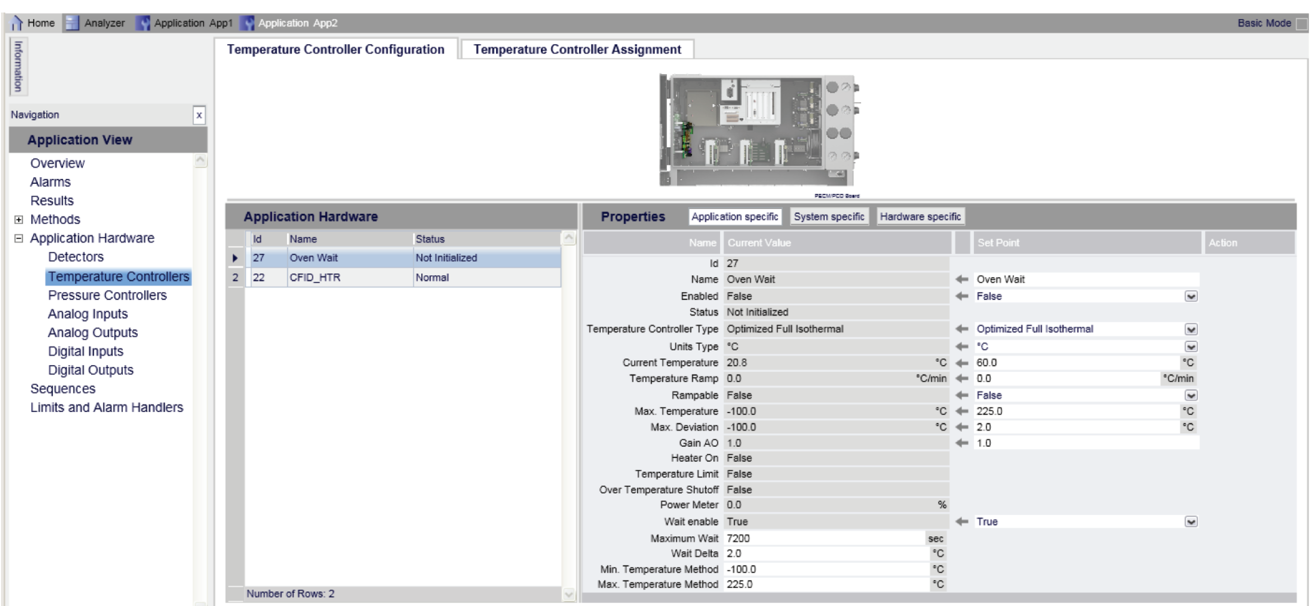


Figure 4-87 Application Hardware - Temperature Controller Configuration

Properties:

A short description of each property is available using the tool tip function (viewed by hovering the mouse pointer over the Value field for each property).

By default the Application Specific properties are displayed. Using the buttons at the top of the Properties pane, it is also possible to view the System Specific properties as well as the properties relating to the Hardware.

Temperature Controller Assignment:

The Assignment tab allows the user to associate system hardware with the application and also to remove or reassign existing associations.

The Assignment tab is similar for all Application Hardware. Refer to the help topic for Application Hardware Detectors for more information on using the functions of this tab.

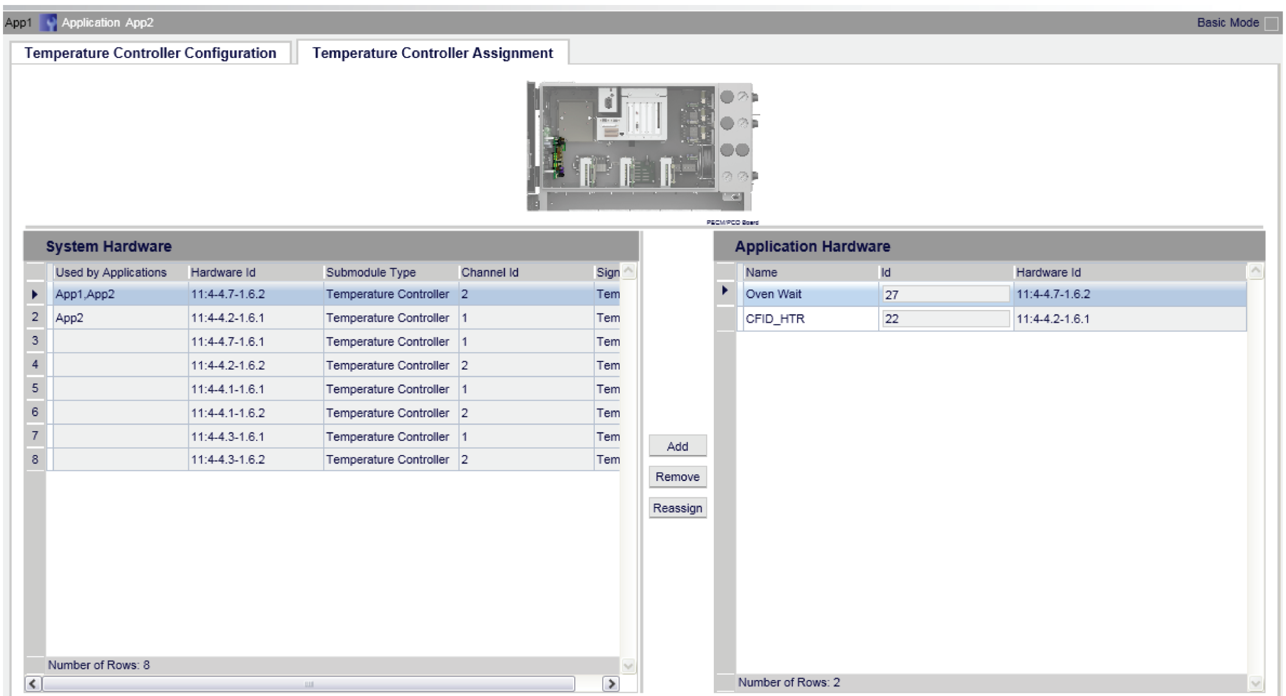


Figure 4-88 Application Hardware - Temperature Controller Assignment

4.11.5.4 Pressure Controller

The Application Pressure Controller screen allows the user to assign system Pressure Controllers to an application as well as view settings and make changes. The user is also able to view hardware and system settings for the Pressure Controller.

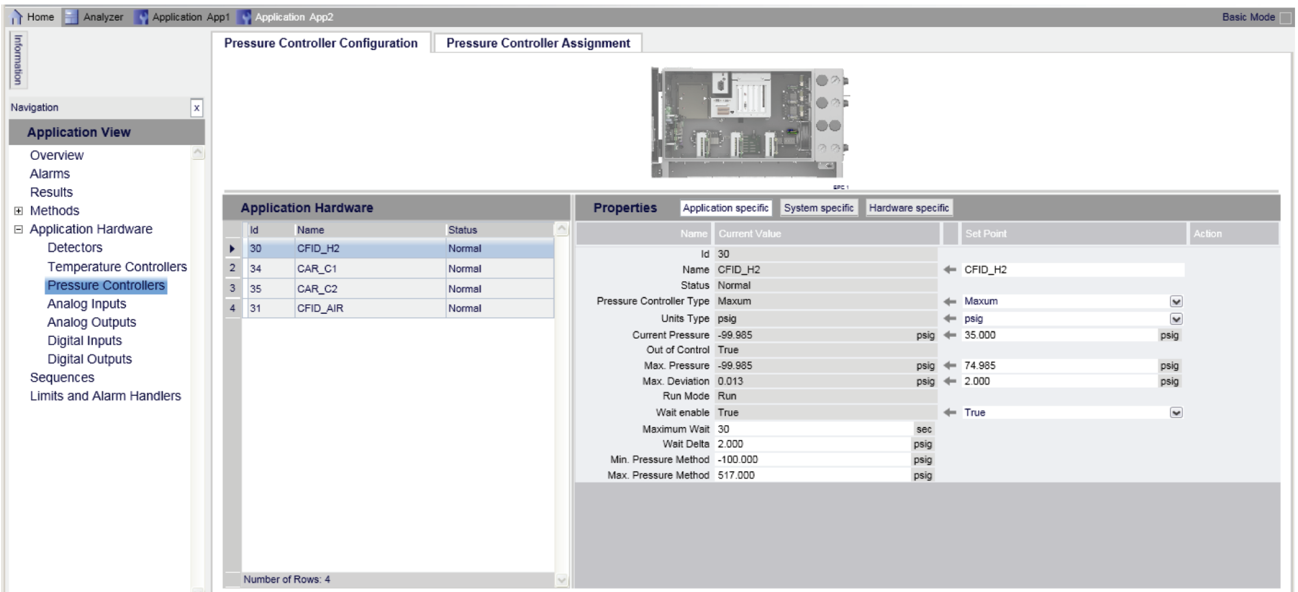


Figure 4-89 Application Hardware - Pressure Controller Configuration

Properties:

A short description of each property is available using the tool tip function (viewed by hovering the mouse pointer over the Value field for each property).

By default the Application Specific properties are displayed. Using the buttons at the top of the Properties pane, it is also possible to view the System Specific properties as well as the properties relating to the Hardware.

Pressure Controller Assignment:

The Assignment tab allows the user to associate system hardware with the application and also to remove or reassign existing associations.

The Assignment tab is similar for all Application Hardware. Refer to the help topic for Application Hardware Detectors for more information on using the functions of this tab.

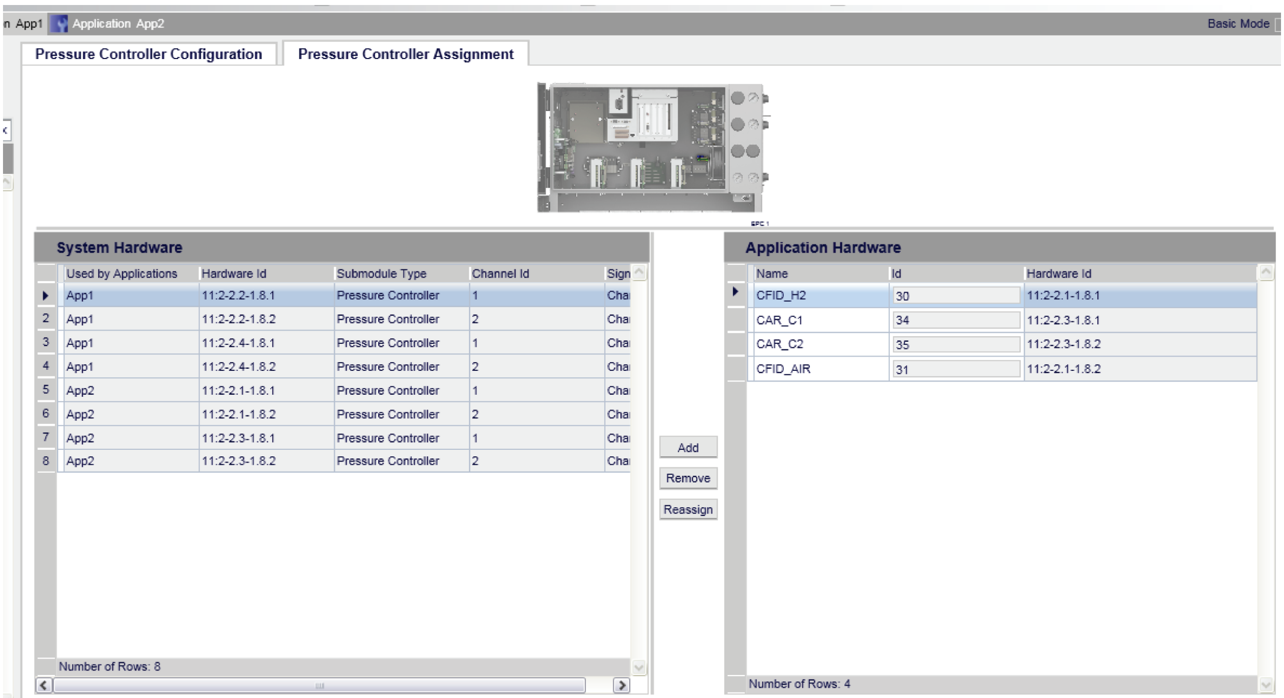


Figure 4-90 Application Hardware - Pressure Controller Assignment

4.11.5.5 Analog Input

The Application Analog Input (AI) screen allows the user to assign system AIs to an application as well as view settings and make changes. The user is also able to view hardware and system settings for the AI.

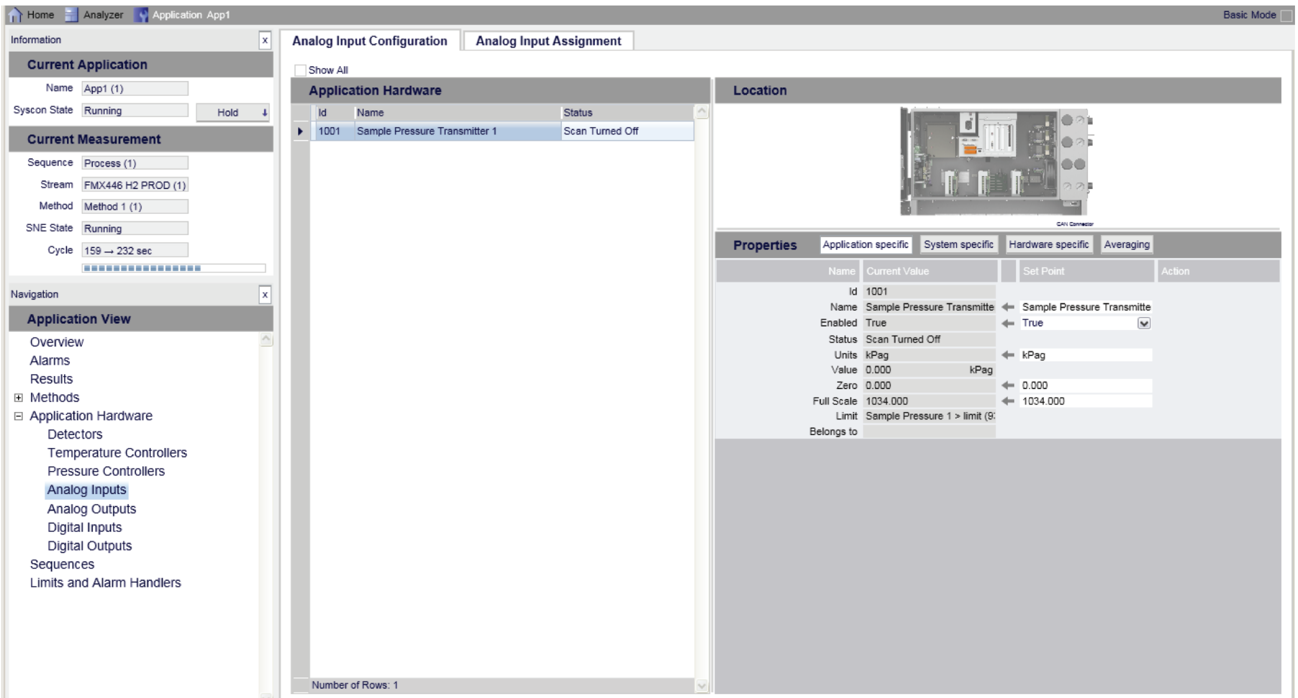


Figure 4-91 Application Hardware - Analog Input Configuration

Properties:

A short description of each property is available using the tool tip function (viewed by hovering the mouse pointer over the Value field for each property).

By default the Application Specific properties are displayed. Using the buttons at the top of the Properties pane, it is also possible to view the System Specific properties as well as the properties relating to the Hardware.

Show All:

The Show All check box at the top of the display window changes the display to show all system AIs instead of just those AIs that can be assigned to the Application.

Analog Input Assignment:

The Assignment tab allows the user to associate system hardware with the application and also to remove or reassign existing associations.

The Assignment tab is similar for all Application Hardware. Refer to the help topic for Application Hardware Detectors for more information on using the functions of this tab.

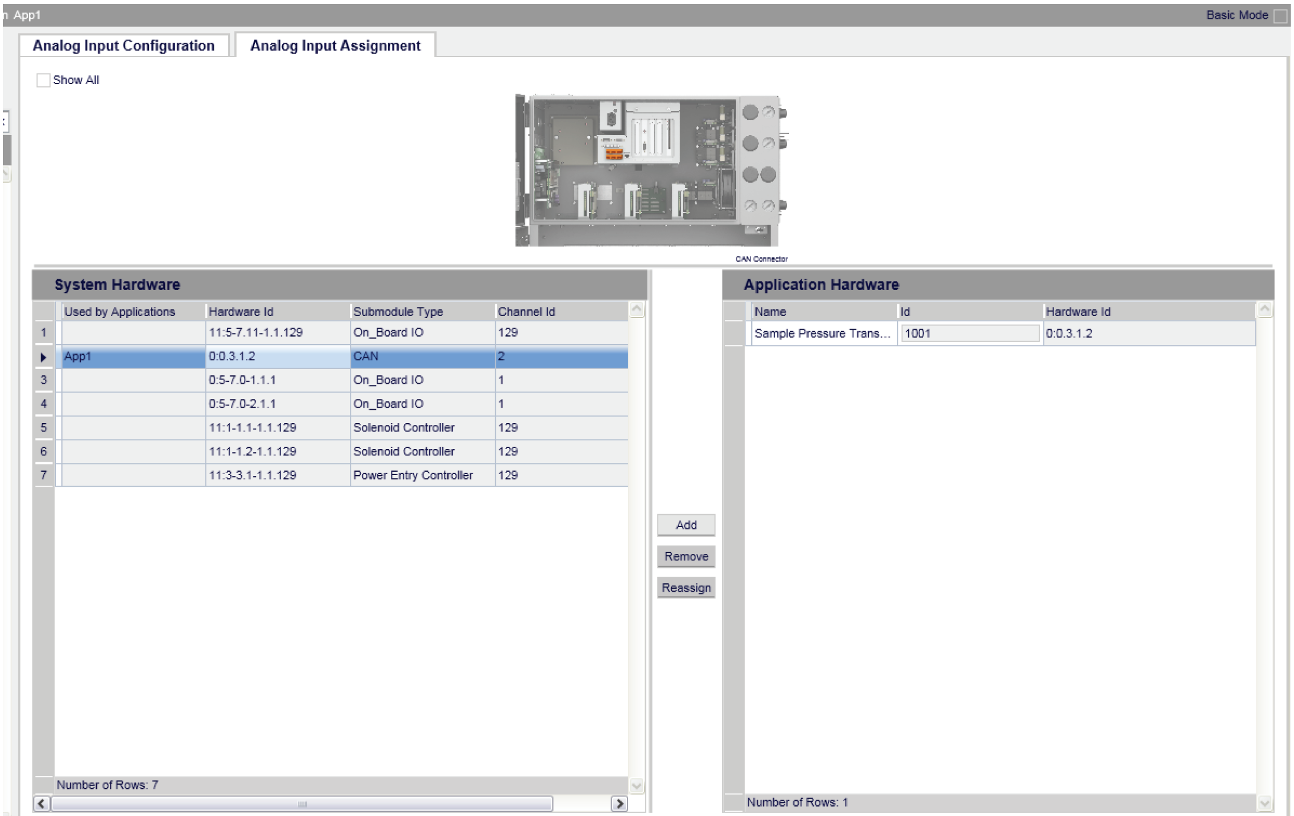


Figure 4-92 Application Hardware - Analog Input Assignment

4.11.5.6 Analog Output

The Application Analog Output (AO) screen allows the user to assign system AOs to an application as well as view settings and make changes. The user is also able to view hardware and system settings for the AO.

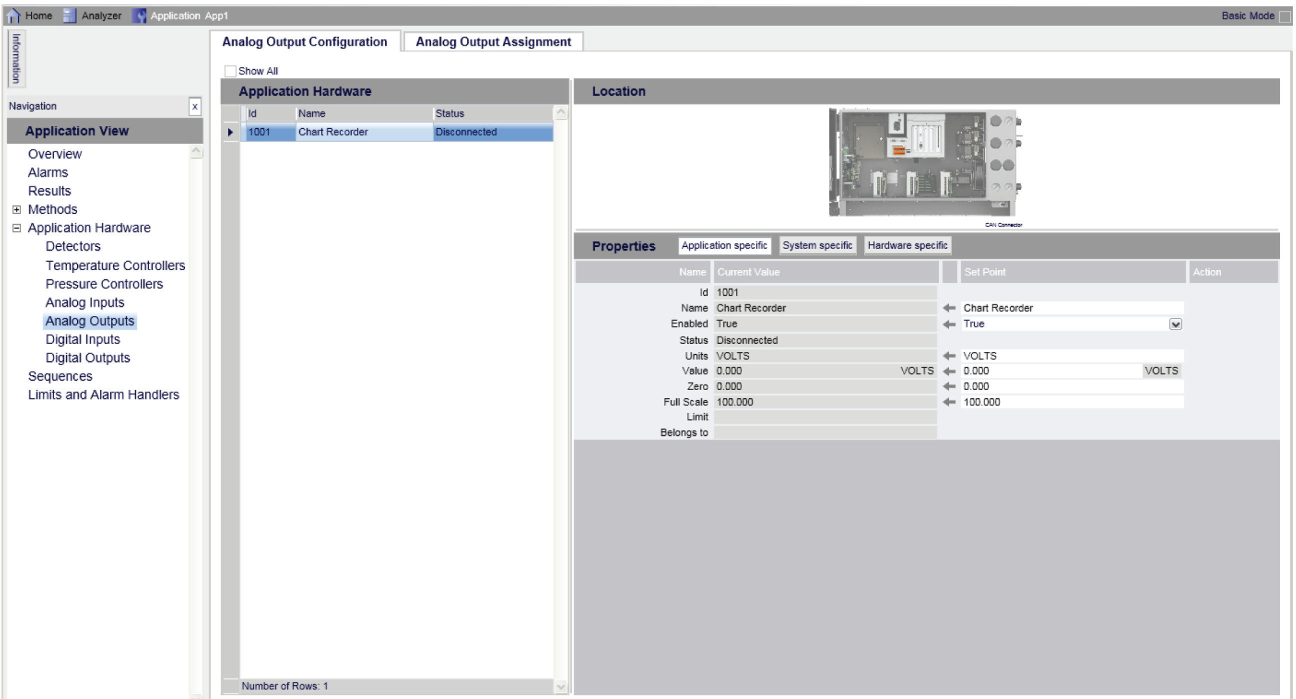


Figure 4-93 Application Hardware - Analog Output Configuration

Properties:

A short description of each property is available using the tool tip function (viewed by hovering the mouse pointer over the Value field for each property).

By default the Application Specific properties are displayed. Using the buttons at the top of the Properties pane, it is also possible to view the System Specific properties as well as the properties relating to the Hardware.

Show All:

The Show All check box at the top of the display window changes the display to show all system AOs instead of just those AOs that can be assigned to the Application.

Analog Output Assignment:

The Assignment tab allows the user to associate system hardware with the application and also to remove or reassign existing associations.

The Assignment tab is similar for all Application Hardware. Refer to the help topic for Application Hardware Detectors for more information on using the functions of this tab.

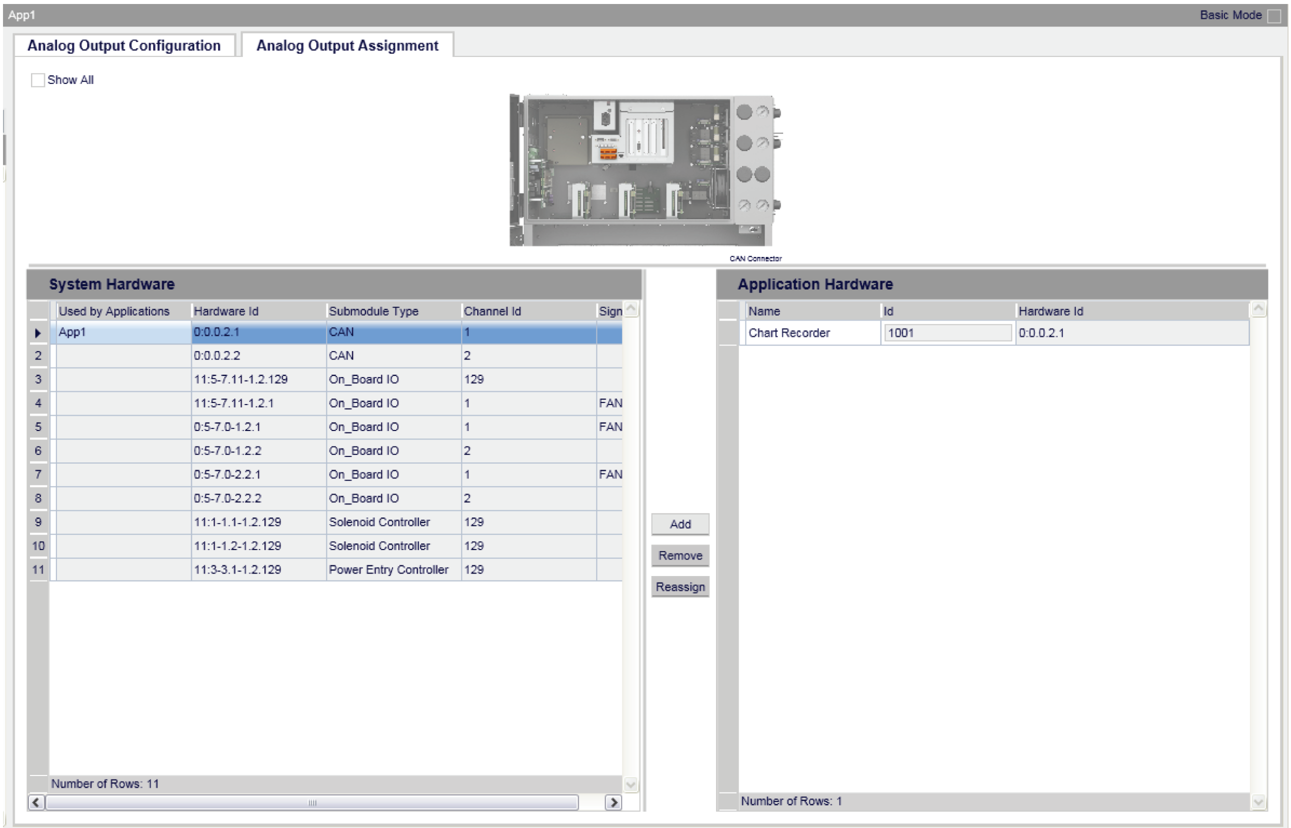


Figure 4-94 Application Hardware - Analog Output Assignment

4.11.5.7 Digital Input

The Application Digital Input (DI) screen allows the user to assign system DIs to an application as well as view settings and make changes. The user is also able to view hardware and system settings for the DI.

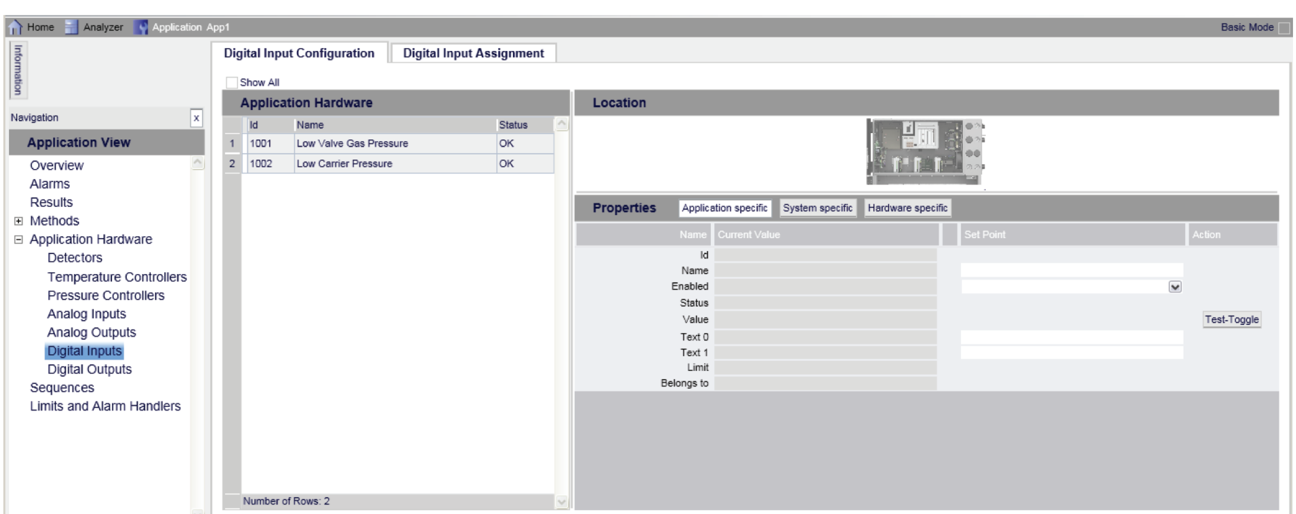


Figure 4-95 Application Hardware - Digital Input Configuration

Properties:

A short description of each property is available using the tool tip function (viewed by hovering the mouse pointer over the Value field for each property).

By default the Application Specific properties are displayed. Using the buttons at the top of the Properties pane, it is also possible to view the System Specific properties as well as the properties relating to the Hardware.

Show All:

The Show All check box at the top of the display window changes the display to show all system DIs instead of just those DIs that can be assigned to the Application.

Digital Input Assignment:

The Assignment tab allows the user to associate system hardware with the application and also to remove or reassign existing associations.

The Assignment tab is similar for all Application Hardware. Refer to the help topic for Application Hardware Detectors for more information on using the functions of this tab.

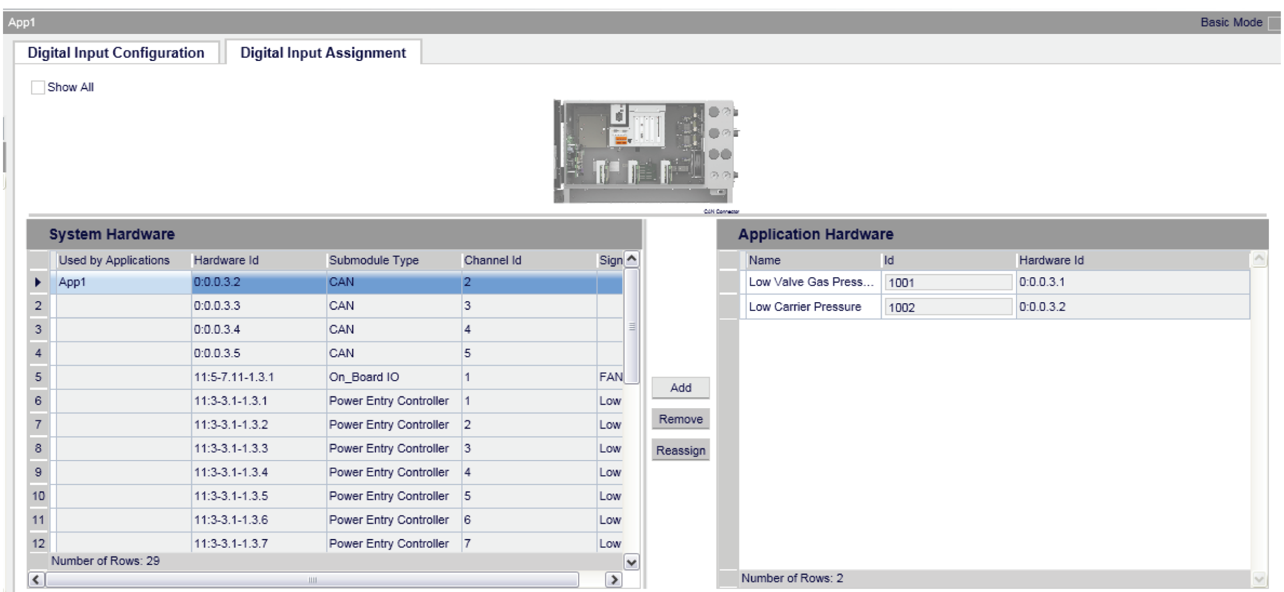


Figure 4-96 Application Hardware - Digital Input Assignment

4.11.5.8 Digital Output

The Application Digital Output (DO) screen allows the user to assign system DOs to an application as well as view settings and make changes. The user can also view hardware and system settings for the DO.

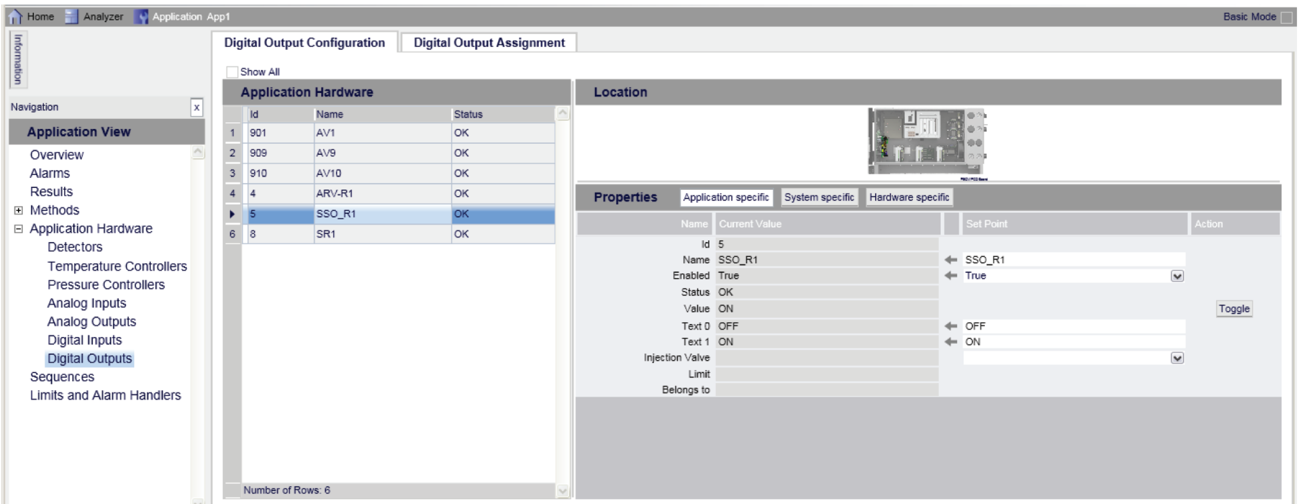


Figure 4-97 Application Hardware - Digital Output Configuration

Properties:

A short description of each property is available using the tool tip function (viewed by hovering the mouse pointer over the Value field for each property).

By default, the Application Specific properties are displayed. Using the buttons at the top of the Properties pane, it is also possible to view the System Specific properties as well as the properties relating to the Hardware.

Show All:

The Show All check box at the top of the display window changes the display to show all system DOs instead of only those DOs that can be assigned to the Application.

Digital Output Assignment:

The Assignment tab allows the user to associate system hardware with the application and also to remove or reassign existing associations.

The Assignment tab is similar for all Application Hardware. Refer to the help topic for Application Hardware Detectors for more information on using the functions of this tab.

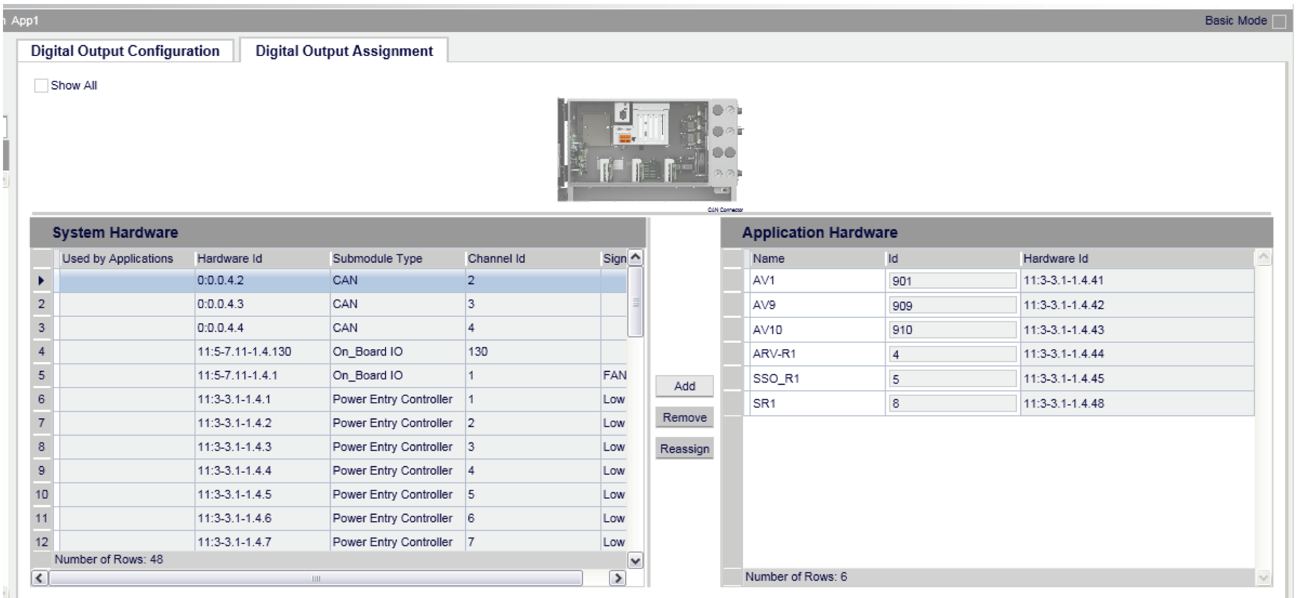


Figure 4-98 Application Hardware - Digital Output Assignment

4.11.6 Sequences (Streams and Sequences)

The Sequences Navigation menu item is used to view and modify the settings for process streams and sequences. From this menu the Sequences tab is used to view and administer Sequences of streams. The Stream Settings tab is used to view and administer streams. The Stream/Method Settings tab is for information that associates a particular stream with a method (a Stream/Method pair).

A Sequence is an ordered list of Stream/Method pairs. Each application has a set of sequences - by default, a normal process sequence, a default calibration sequence, and a default validation sequence. Sequences designate stream, method, and calibration run type in a certain order. As the GC runs an application, it cycles through the "steps" in the active sequence (by default this is the Normal process sequence).

As a sequence runs, each entry in the sequence will be indicated as Current, Next, or Curr,Next. Current means the one that the SNE is currently processing. The entry that is marked Next indicates the next one to be analyzed. If the active sequence is changed, the Next will move to that sequence.

Sequences Tab:

The Sequences tab is used for viewing and administering Sequences, including associating streams and methods together as sequence entries.

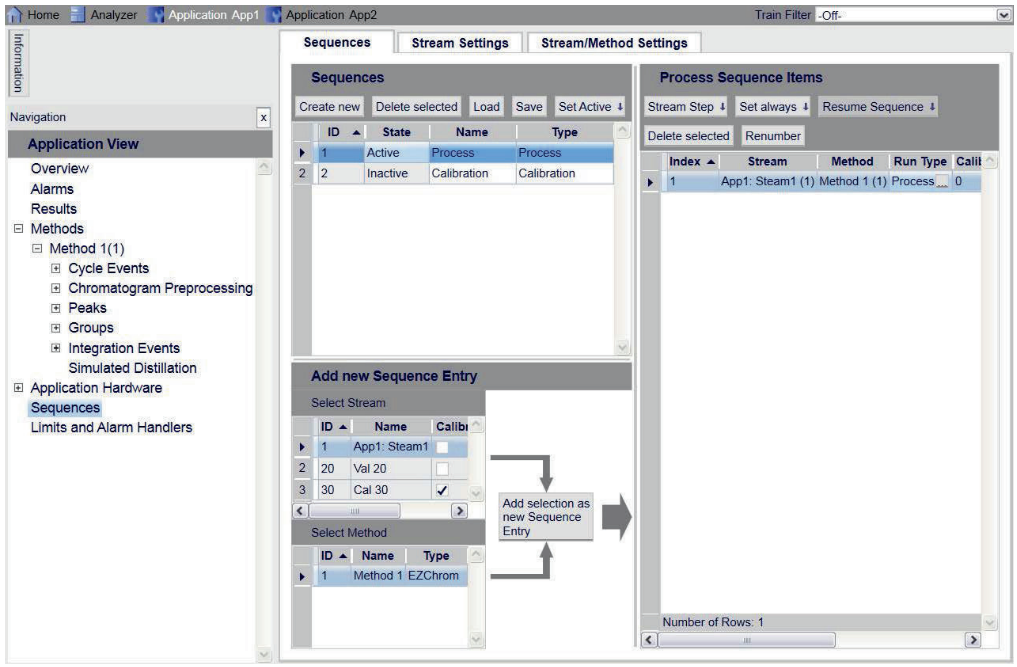


Figure 4-99 Sequences Tab

Sequences Settings Pane:

- ID - The numerical ID number of the sequence, automatically created
- State - The current state of the sequence
- Name - The user defined name of the sequence
- Type - The sequence type
- Create New (Button) - Creates a new sequence
- Delete Selected (Button) - Deletes the selected sequence
- Set Active (Button) - Sets the selected sequence to active
- Load (Button) – Loads a saved Sequence from the workstation hard drive
- Save (Button) – Saves a Sequence to the workstation hard drive

Add new Sequence Entry Settings Pane:

- Select Stream - List of available streams
- Select Method - List of available methods
- Add selection as new Sequence Entry (Button) - Associates the selected stream with the selected method and adds the stream/method pair to the currently selected sequence.

Sequence Items Pane (list of stream/method pairs for the selected sequence):

- Stream - The name of the stream associated with the entry
- Method - The name of the method associated with the entry
- Run Type - Process or Calibration
- Calibration Level - The level of calibration. Set from the method.

- Enabled - Whether the stream is disabled.
- Status - The sequence status of the stream/method pair.
- Stream Step (Button) - Advances the sequence.
- Set Always (Button) - Interrupts the step function of the sequence and sets the currently selected stream to run without stepping.
- Resume Sequence (Button) - Used to return to the normal sequence stepping after a stream has been set to always.
- Delete Selected - Removes the selected entry from the table

Stream Settings Tab:

The Stream Settings tab is used for viewing, creating, deleting, and modifying streams.

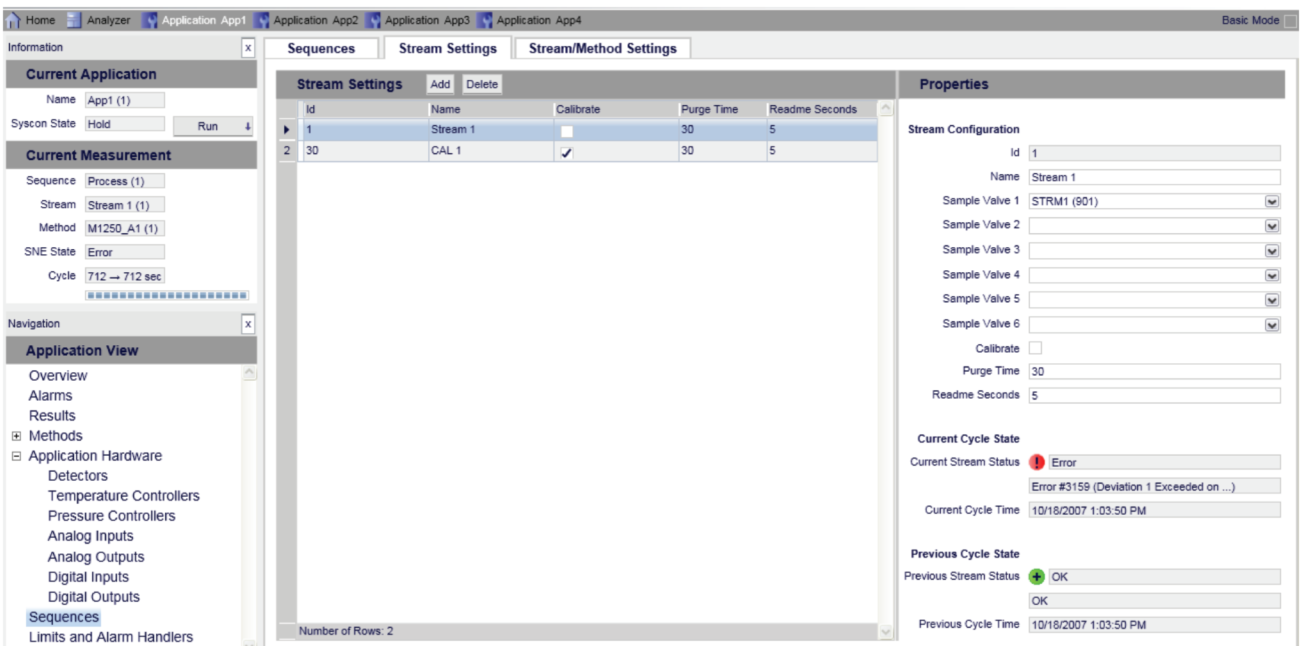


Figure 4-100 Stream Settings Tab

Stream Settings Pane:

- ID - The numerical ID number of the stream
- Name - The user defined name of the stream
- Calibrate - Indicates whether the stream is a calibration stream
- Purge Time - Time needed to purge for this stream
- Readme Seconds - Number of seconds for the readme flag to be set for external client applications.
- Add (Button) - Creates a new stream
- Delete (Button) - Deletes the selected stream

Properties Pane:

Used to display and change the properties for the selected stream. Information about specific fields can be viewed using the tooltip function (displayed by hovering the mouse pointer over the information area of the property).

Stream/Method Settings Tab:

The Stream/Method Settings tab is for viewing and changing information that associates a particular stream with a method (a Stream/Method pair). The Stream/Method pair is not created from the Stream/Method Settings tab. It is created when a new sequence entry is added.

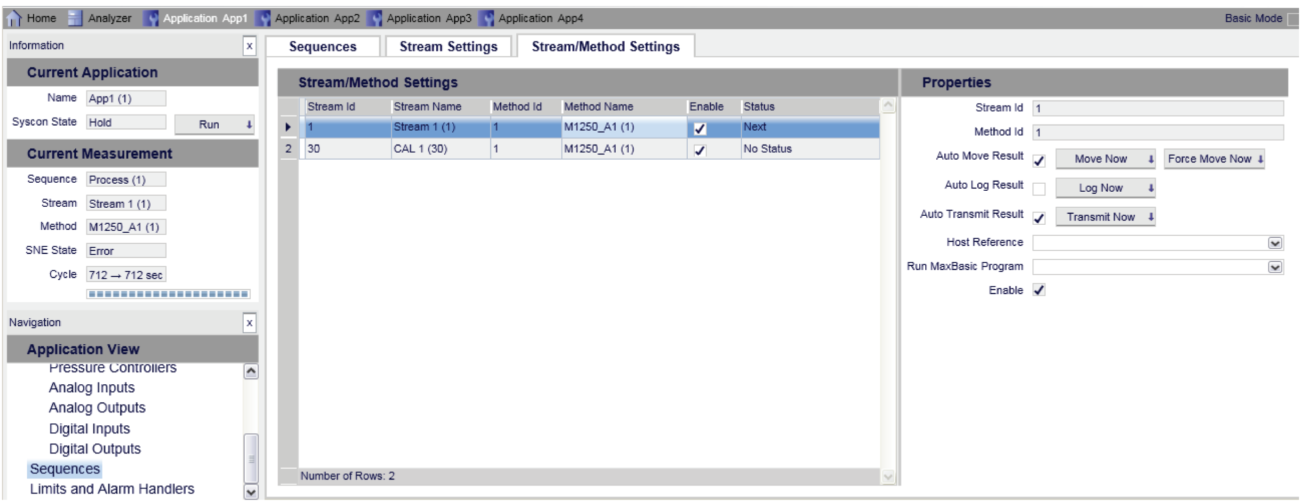


Figure 4-101 Stream/Method Settings Tab

Stream/Method Settings Pane:

- Stream ID - The numerical ID number of the stream
- Stream Name - The user defined name of the stream
- Method ID - The numerical ID number of the method
- Method Name - The user defined name of the method (defined when method is set up)
- Enable - Whether the Stream/Method pair is enabled or disabled
- Status - Status of the pair, if it is part of the active sequence (C = Current, N = Next).

Properties Pane:

- Auto Move Result - Automatically approve results if no alarm during this cycle
- Auto Log Result - Automatically log results at end of cycle
- Auto Transmit Result - Automatically transmit to hosts at end of cycle
- Host Reference - Reference to the host table. Indicates the host to send results (default is all hosts).
- Run MaxBasic Program - Event from the program table to run at the end of the cycle.
- Move Now (Button) - Move result from buffered to saved now if no fault exists
- Force Move Now (Button) - Force move result from buffered to saved regardless of faults
- Log Now (Button) - Log results immediately
- Transmit Now (Button) - Transmit results to hosts immediately

Setting up Sequences:

The general process for setting up a sequence includes creating the stream (or streams) using the Stream Settings tab and then creating the sequence using the Sequence tab, and then creating the stream/method pair (or pairs) using the "Add new Sequence Entry" pane on the Sequences Tab.

- To create a stream, go to the Stream Settings tab and click the Add button. Then fill out the desired Properties, such as the Name and associated Sample Valve.
- To create the Sequence, go to the Sequences tab and click Create New. Fill out the name and select the type of Sequence (Process, Calibration, Validation, or Mixed).
- Associate a Stream/Method pair with the Sequence by selecting the stream and method on the "Add new Sequence Entry" pane. Then click "Add selection as new Sequence Entry. This associates the stream and method with the currently selected sequence.
- The newly created stream and method pair can be modified using the Stream/Method Settings tab.

4.11.7 Limits and Alarm Handler

The Limits and Alarm Handler menu item is used to administer customer defined alarm information. A limit is used by the analyzer database detect certain conditions for I/O, results, or external results, and create certain outputs based on those conditions. An example is setting a limit to check for an abnormally high value on a result, and outputting an alarm in response. This limit can be associated with an alarm handler, which is a user-defined alarm.

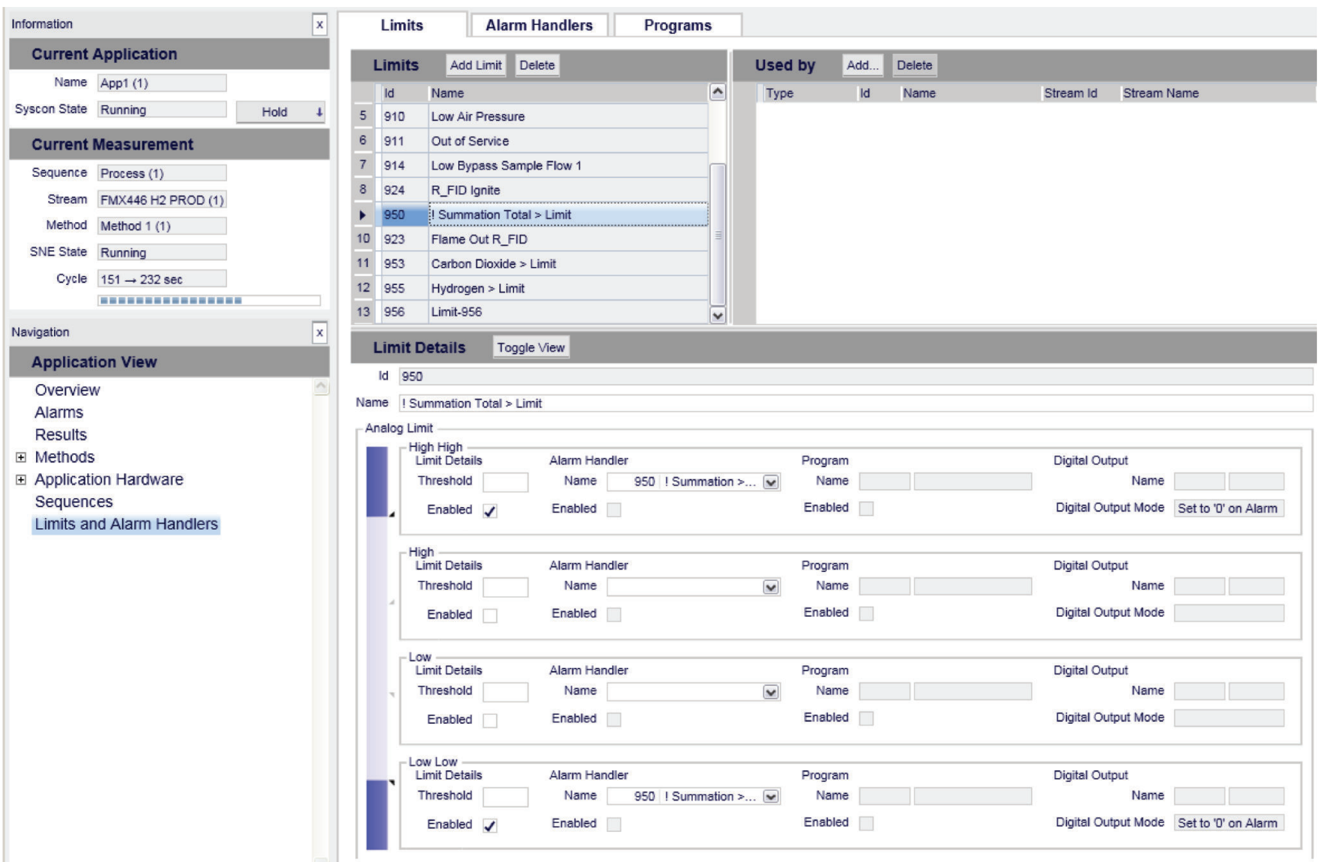


Figure 4-102 Limits and Alarm Handler Menu Screen

A detailed example describing how to use the Limits and Alarm Handler screens (including setting up a limit and user defined alarm) can be found in the help topic titled, "Example: Check Results and Create an Alarm Limit".

Programs Tab:

The Programs tab available from the Limits and Alarm Handler screen is the same as the main Programs tab found under on the Analyzer view (Systems submenu). This tab is provided on the Limits and Alarm Handlers screen to make it easier to associate a program with a limit/alarm.

FAQ 5

5.1 How are alarms handled in the analyzer?

Alarms are posted to the alarm_log table using an alarm code and a set of parameters. Static parameters are **appcontext**, **streamcontext**, **cycle_time**, **first_post_time**, and **latest_post_time**. There are also one or two variable parameters **param3** and **param4**. Param 5-param9 are not used. The alarm text comes from a different table that is loaded from the language files in System Manager. These could be changed at a customer site and reloaded, as needed. The language of the alarm text is chosen at display time only, by System manager or the HMI. If an alarm is posted more that once with the same parameters, it will only appear once, with a count of the number of times the alarm has occurred, **alarmcount**.

The Maxum Database has many built-in alarms as seen in the System Manager\Upgrade x.x \Language\alarm.001 file. The analyzer may have default handling associated with certain alarms, but it is also possible to add handling in the form of setting a DO, running a program, ignoring the alarm, or changing the severity of an alarm. These are all done through the **alarmhandler** table. Alarm handling is done on an application basis, so that in a GC with multiple applications, it will be necessary to define special handling for each application.

- To disable (ignore) an alarm, add a record to the alarmhandler table for the application/ alarm with the enable attribute set to false or null.
- To increase or decrease the severity of an alarm, redefine the text with ! (fault), ? (warning), + (note), or - (no alarm, but DO or program runs) and set enable to true.
- To set a DO or run a program, use the **doref** and **DO_setting** or **Programid**. These actions occur only when the alarm is enabled.
- To post the alarm to the stream that is currently flowing, instead of the stream being analyzed, use the **Stream_flag**.

Custom alarms can be created by using alarms in the 900-996 range. These alarms can be activated from limits or from MaxBasic or (version 5.1+) from a result formula.

5.2 Control from DCS: How does the DCS send signals to initiate calibraton or change to alternate process sequences?

For the Optichrom GC, specific bits are set that cause an ADH FUNCT command to calibrate for a certain stream. In the Maxum, this calibrate message is applied to the default ADH application, as indicated in the system_control table.

For Modbus, when a CALIBRATE address is set for an application, a message is sent to the designated analyzer/application to start calibration.

In the database, this causes the default calibration sequence (autocal_app, autocal_seq) to become active. Autocal or manual cal run based on the autocal flag in the application table. The database ignores the stream that may be part of the message.

Version 3.10+ database versions, from Modbus only, can run a MaxBasic program. Since MaxBasic programs can change the active sequence, this is the only way to change the sequence from a DCS.

5.3 What are Stream Sequence, Next Stream Control?

Each application has a set of sequences - by default, a normal process sequence default calibration sequence, and a default validation sequence. Sequences are more than stream sequences: they designate stream, method, and calibration run type in a certain order. Sequences are defined in EZChrom and can be modified in System Manager. As the GC runs an application, it cycles through the "steps" in the active sequence(by default this is the Normal process sequence). As it runs, each entry in the sequence will be indicated as Current, Next, or Curr,Next. Current means the one that the SNE is currently processing. The entry that is marked Next indicates the next one to be analyzed. If the active sequence is changed, the Next will move to that sequence.

If the sequence has been "interrupted" by the introduction of an ALWYS on the HMI, different actions occur, as expected. Manual intervention is also possible by doing repeated STREAM STEPs on the HMI.

Calibration and Validation sequences always begin on the first enabled step. The place in the process sequence is remembered and returned to after calibration or validation.

5.4 How can I run a program on a remote analyzer?

For Version 3.11+ there are 3 fields in the analyzer table that allow you to do this. These are only accessible from MaxBasic.

Example: By setting hae_app to 100, hae_stm to 3, and hae_evt to 30, where anlz_id = 141, you will cause event 30 for application 100, stream 3 to run on analyzer 141.

(Version 5.1) Use rempgm function of a result formula.

5.5 How do calibration and validation sequences differ from process sequences?

Calibration sequences and validation sequences are different in that when they are started, they always start with the first enabled step. At the end of the sequence, validation and autocalibration always return to the prior active sequence. A manual calibration remains in the calibration sequence until the calibration is stopped. During calibration, additional calibration information is sent from the SNE and stored in the calibration tables. When calibration is accepted, either manually or automatically, response factors are changed. Detailed instruction for calibration and validation are in the "Getting Started" section of the help.

5.6 How do host controls work from HCI-H to Maxum/NAU?

The HCI-H converts Modbus host requests into ADH FUNCT message calls to enable/disable streams run/hold/cal, or force stream. The DCS must communicate values to certain specific registers in order for the HCI-H to interpret its requests. Since the ADH commands do not include an application, a Maxum must supply the application by using the default ADH application in the system_control table for the run/hold/cal. Commands that involve streams are handled by ignoring the application, so streams on the Maxum must be uniquely numbered across applications.

5.7 How do host controls work from Modbus?

The database table modbus_addmap, along with the modbus driver software, takes the place of the HCI-H in the analyzer. The table also processes requests from the DCS and sends messages to itself and remote analyzers, or Advance Optichrom GCs.

Instead of relying on a fixed mapping of registers, it instead depends on information in the map to tell it what to do and where to send the message

5.8 How do SNE and Syscon communicate?

The SNE (analytical engine) and Syscon (database engine) communicate using TCP messages. For older Maxum GCs, NAU, and Advance Plus GCs these software engines exist on separate physical hardware. Newer Maxum II systems have a much more powerful Syscon that runs embedded SNE software (emSNE).

TCP is a transfer protocol - it defines a means of reliable transfer of information via an agreed upon connection. The Syscon's TCP server accepts a request for connection from the SNE and establishes a connection, over which messages may be exchanged. Both the SNE and Syscon have software that processes the messages. In addition to operational messages, there is a mutual heartbeat message that indicates to each one that the other is still there. Anytime this heartbeat is delayed or interfered with the Syscon tells the SNE to reset.

In the MicroSAM, the same messaging is used between the SAMSNE software and the MicroSAM database software, which exist on the same physical hardware.

5.9 How do the Autocal and Autovalidation programs work?

Autocalibration is the process of running a calibration sequence and automatically accepting response factors. When an application is placed in autocalibration from the HMI, from a **pgmfunction** in the program table, or from an external calibrate command(Modbus or OPC), it switches the active sequence to the default calibration sequence(application table **autocal_seq**). It always begins on the first entry in the sequence. During calibration, as with manual cal, the SNE sends calibration information at the end of cycle. New response factors are stored in the calibration_level table, but are not finalized until the end of the auto calibration sequence. At that time, peak margins are checked and response factors are accepted - all or none. The previous sequence is then automatically resumed. Autocalibration run from the program table using the pgmfunction can select a different sequence than the default calibration sequence by having the sequence id of the desired sequence in the **iargs**. Autocalibration scheduled with the program table or requested from an external command (Modbus, OPC) will not run if the application is in HOLD.

Autovalidation is a method for running a validation sequence. A sequence is marked as a verification/validation sequence in EZChrom (application table **autoval_seq**). This sequence is different in operation from a normal sequence in three ways:

1. It always begins on the first entry.
2. It always resumes the last sequence automatically.
3. If results for validation streams are configured with a **compare_margin** and **compare_value**, these results will be checked at the end of the validation sequence(not the cycle) and appropriate alarms will be generated.

Autovalidation run from the program table using the pgmfunction can select a specific sequence by having the sequence id of the desired sequence in the **iargs**.

5.10 How do you test for the Next Stream?

The Next_Stream attribute in the application table in DLExplorer gives this information. See DLExplorer (Page 473) and AUTOHOTSPOT (Table Refeence) sections.

5.11 How does the cycle clock work?

The cycle clock is not kept by the database, except for sim_clock applicaitons. For EZChrom methods, the SNE keeps track of the cycle clock. This means that depending on the load on the system, the clock may appear to miss cycle ticks. No processing should be dependent on the apparent (in the database or HMI) cycle clock being accurate.

5.12 Maxum to HCI-H or Modbus: How are results designated?

Results are marked for transmission using the **trtval** attribute of the result table. **Euhi** is set in the result table, also. The **trtval** numbers must be sequential, starting at 1. They do not need to match the **result_index**. To transmit at the end of cycle, use the **autotrt** attribute of the stream_method table.

5.13 Maxum to HCI-H: Where does the information come from?

Besides results from the result table, the HCI-H is sent:

- **Analyzer #:** the lid attribute of the system_control table
- **Number of streams:** count of the # of non-calibrate streams in all applications(checks calibrate attribute in stream table)
  # of peaks for streams 1-32, checks the result table to see if any trtval for that stream is designated. Uses the maximum # of peaks for a stream.
- **Stream #:** stream whose results are transmitting
- **Selected Stream:** always zero
- **Stream maskA:** checks stream_method table, sets bits for enable streams between 17 and 32, ignores any above 32
- **Stream maskB:** checks stream_method table, sets bits for enabled stream from 1 to 16
- **Report Timer:** longest cycle_time of all enabled methods on analyzer
- **Scaled Cycle Time:** longest cycle time+ purge time*(fracfs/9999.0)
- **Scaled analyzer Status:** status(fracfs/999.0)
- **Fractional Full Scale:** scale from host table
- **Next Stream:** always zero
- **Analyzer status:**
  - 50 = application in hold, not enabled, out of service
  - 6ss = manual cal
  - 7ss = autocal or validation
  - 9ss = warning alarm
  - 100= stream is in fault
  - 1000 = normal

5.14 What does the basic program debug output mean?

Every time a program runs you will see messages on the debug port. These occur regardless of debug settings.

For software version 3.11:

```
BS10: 13:39:07 Iargs: 50 4 7 13 0 60 1004 0 0 0
BS10: Rargs: 0.000000e+00 1.000000e+01
msg : Count= 14 Avg= 2.22
BS10: vb time=112.578s update program_execution set status=0 where
id=50
```

Explanation:

```
BS10: 13:39:07 Iargs: 50 4 7 13 0 60 1004 0 0 0
```

BS10 is the occurrence of the interpreter (there are 10 in 3.11)

13:39:07 is a timestamp

```
Iargs:50 4 7 13 0 60 1004 0 0 0
```

50 is a unique counter for the program execution table

4 appcontext of program

7 stream

13 program id

0 -errors or warnings

60 - max exec time from program table - this is not used

1004 0 0 0 -these are the values that are passed into the program as iArg0-iArg3, there could be up to 7 more

```
BS10: Rargs: 0.000000e+00 1.000000e+01
```

- these are 2 (rArg0, rArg1) of the 10 possible floating points arguments

```
msg : Count= 14 Avg= 2.22
```

- this is part of the program output using Msgbox.

```
BS10: vb time=112.578s update program_execution set status=0 where
id=50
```

-this tells you that the program executed 112.576 seconds and completed successfully(status=0)

You might see something like this, if there is an error:

```
BS08: vb time=2.037s update program_execution set status=91,msg_text
= 'OBJECT VARIABLE NOT SET' where id=16820
```

the msg_text is the text that will appear on the 511 alarm.

For software version 3.10

```
Iargs: 47727 1 1 4 0 60 10 1007
Rargs:
vb time=10.011s update program_execution set status=0 where id=47727
```

similar information, but a little less.

For software version 3.2+

Debug output is controlled by the Debug_Option in the program table.

For all versions of MicroSAM and Version 5.0+ of Maxum, the output from MaxBasic is quite different. These versions do not use the **debug_option** in the program table. Program debug options and Basic interpreter output in LogMonitor are used with these versions.

5.15 What happens at the end of a process cycle?

At the end of processing each channel the SNE transfers results to the Maxum database peak and group results and chromatograms. The database stores them first in the chromatogram and ezchrom_result tables and then in the result table(cycle_runtime and buffered value). When results post-processing is complete, the database then proceeds to the next stream unless it has been placed in Hold.

- Stop AI averaging, if avg_option = 2
- (Version 5.1+) If formulas are present, process formulas. The next cycle is delayed with PGM status.
- If MVRPGM is used, the next cycle is delayed with PGM status. When the program is complete it proceeds with the next steps.
- Alarms are cleared, if autoclear has been designated
- Limits are checked in the result table for buffered_value
- Validation check is done if at the end of a validation sequence
- Calibration check is done if at the end of a calibration sequence and autocal
- If there are no fault alarms in this cycle, regardless of whether the faults have been cleared, automvr is done
- autolog is done(standard printed reports)
- autotrt is done(transmission of results to Modbus)
- OPC results are processed
- Internal data archiving is performed(statmon table)
- datalogger flags are set
- Slave results are sent to a master
- (Version 4.4, 5.1+) Slave sends message to master when calibration or validation sequence is complete
- AO and DO are set from Result table
- The next cycle is started, unless in hold or is a slave or (Version 4.4, 5.1+)is a master waiting for slave to finish validation or calibration.

5.16 What happens at the start of a process cycle?

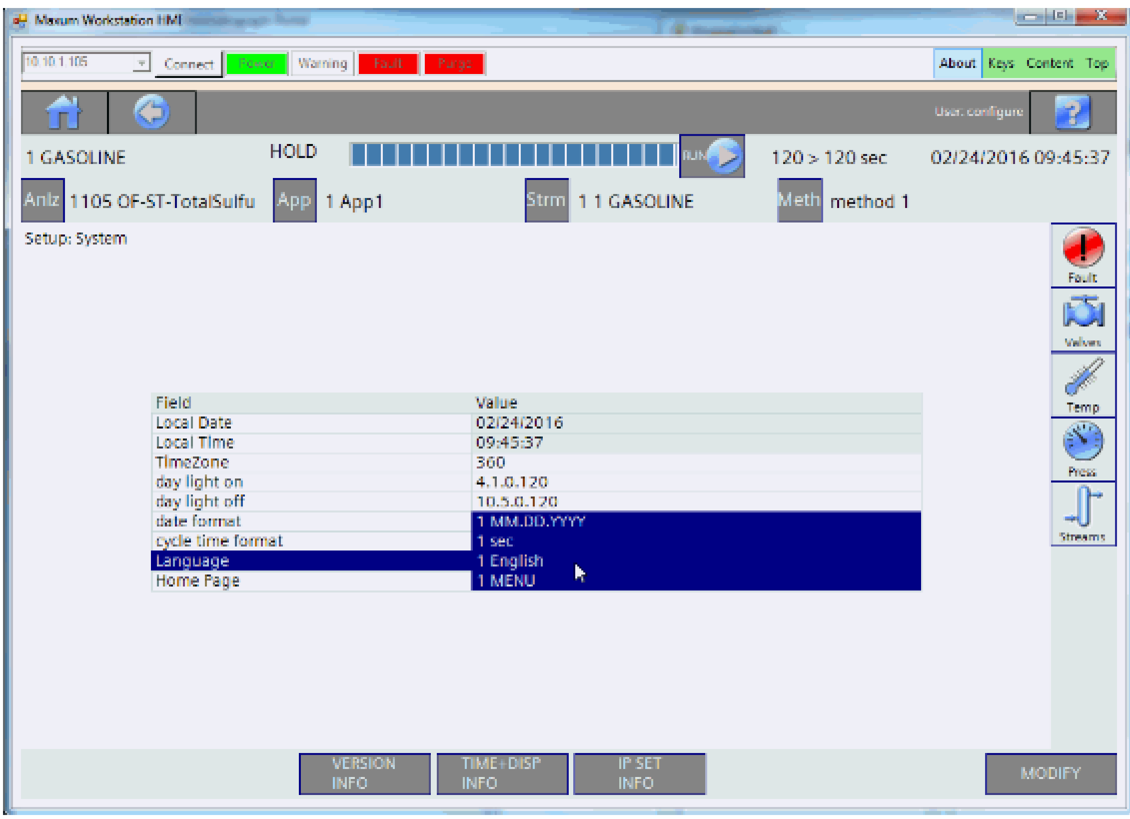
At the beginning of a cycle, the Maxum database determines what stream and method to run by looking at the active sequence, and figuring out which stream is the next to run. The database waits for stream purge or temp/pressure WAIT settings. If necessary, the database sends the method to the SNE. It then clears the error and warning attributes in the stream table and removes the intermediate results that reside in the ezchrom_result and chromatogram tables. In Version 4.0+, if appai averaging is used with avg_option =1 or 2, averaging is started. The SNE is now in control, until it the analysis is complete.

5.17 Why do I need to save to flash before making a backup of the database?

The save to flash operation, saves a permanent copy of the working database. This is the copy that the backup uses. If you do not save to flash, the backup will contain the database contents from the last save to flash.

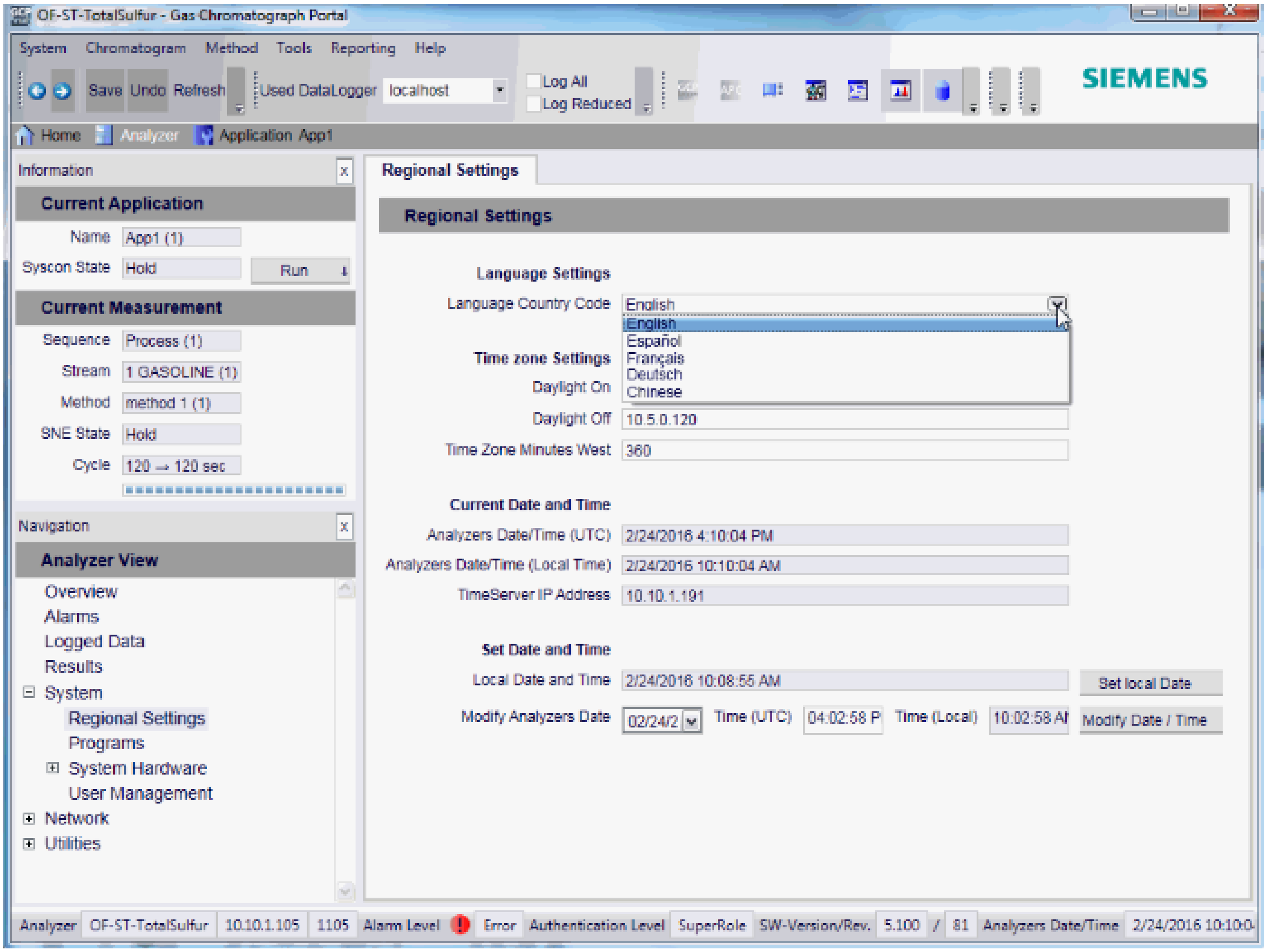
5.18 How do I set the language for the analyzer?

From the HMI



- Select Configure on the right side of the screen.
- Select 1. System Setup from the menu in the center.
- Select TIME+DISP INFO from the menu at the bottom.
- Select MODIFY.
- Select the desired language, then click ACCEPT CHANGE or CANCEL CHANGE.

From the GCP Workstation



- Open Gas Chromatograph Portal Analyzer and log in to the analyzer.
- Select Analyzer near the top left side of the screen.
- In the left pane under Analyzer View, select Regional Settings.
- Select the desired language from the available options.

How To 6

6.1 How To Interpret EPC Alarms

The alarms that are associated with the EPC are repeated here, along with some troubleshooting suggestions.

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
3117, 3118	!	Pressure [1 - 2] Out-Of-Control on %4	EPC (Electronic Pressure Controller) PIC: The measured pressure, on channel #n, has exceeded the absolute maximum allowed pressure and the corresponding channel was shutdown. The pressure controller is no longer working.	Confirm that the flow is greater than the minimum specification. Replace the EPC.

Investigate the entire flow path for an obstruction. Most often, the cause is not the EPC.

#		Text	Description	Action
3119, 3120	!	A/D [1 - 2] Failure on %4	EPC (Electronic Pressure Controller) PIC: The Analog to Digital Converter chip does not work properly. The flag will be set if the A/D internal calibration cycle is not completed within a pre-determined period of time or the A/D does not report any valid data within a pre-defined time-out period. **Note**: A firmware problem affecting the version 0.250 of the EPC PIC may cause an A/D failure flag to show-up occasionally following a PIC reset. This is not a sign of a defective A/D converter.	Cycle power. If the error repeats consistently, replace the module.

#		Text	Description	Action
3157, 3158	?	Low Supply Pressure [1 - 2] on %4	EPC (Electronic Pressure Controller) PIC: Set when the contact on the optional supply pressure sensor on [J5 or J6] is closed indicating that the supply pressure is getting low and that the bottle must be changed soon.	Check air supply. Replace supply bottle.

If bottle is OK, then the issue is a restriction in flow upstream of the EPC. Look for a closed valve or contamination in the line.

#		Text	Description	Action
3159, 3160	!	Deviation [1 - 2] Exceeded on %4	EPC (Electronic Pressure Controller) PIC: The measured pressure deviation has exceeded the corresponding MAX_DEVIATION value. The PID control was not successful in controlling the pressure with the desired precision on channel #n.	MAX_DEVIATION_x that is too small. An improper setting of TIME_LIMIT_DEVIATION_UP_x or TIME_LIMIT_DEVIATION_DN_x. Insufficient supply pressure. Flow too small or too large. Defective EPC.

This alarm can result from an EPC with insufficient back pressure downstream. The EPC requires backpressure in order to control the downstream pressure. The most likely cause is an extreme difference in settling time when going from high to low pressure as opposed to low to high pressure. Low-to-high changes are very efficient, and happen quickly. High-to-low changes require settling time for the pressure to leak out downstream. Settling time can vary widely between analyzers and applications.

Observe how fast the pressure drops; this will allow you to estimate settling time.

Try a smaller change in pressure; if this works, then the EPC is functioning properly.

#		Text	Description	Action
3161, 3162	?	Setpoint [1 - 2] changed following a change in Max Pressure	EPC (Electronic Pressure Controller) PIC: The SETPOINT_[n] AO value was modified internally as a result of the SETPOINT_MAX_[n] AO value set to a value lower than the SETPOINT_[n] value.	Set the SETPOINT_MAX_[n] value first and then set the setpoint.

#		Text	Description	Action
3163, 3164	!	EPC Shutdown on %4, Channel [1 - 2]	The [n] channel of the Electronic Pressure Control (EPC) was temporarily shut down. This happens when the EPC control valve is fully opened for more than 5s and is meant to prevent overheating of the valve. This situation typically happens when the input pressure is too low, as from an empty cylinder.	No action required. The shutdown is temporary and the operation will automatically resume after 15s.

#		Text	Description	Action
3203, 3204	!	EPC ramp has no origin on %4, Channel [1 - 2]	The starting point of the pressure ramp was set to the current measured pressure as the setpoint value was not previously set. When no prior setpoint is available, this alarm is issued and the current measured pressure is used as a substitute for setpoint #1.	Set a static setpoint first, and then set the ramp rate, followed by a new setpoint. With this sequence, the starting point of the ramp will be setpoint #1 and the ending point will be setpoint #2.

6.2 How To Troubleshoot Selected Detector Alarms

The alarms that are associated with detector overflows are repeated here, along with some troubleshooting suggestions.

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
395	?	%3 Detector overflows on channel %4 of module %5	Detector is reading above its maximum value and the signal is being clipped.	Reduce the amount of sample or, if possible, the detector gain.

First, verify that the alarm occurs on a peak that requires measurement. If that peak is not being measured, it can be ignored.

Next, verify if sampling is working as expected, any change in sample introduction can introduce too much sample to the system and cause this alarm. Then consider recommendations in table.

Once the cause of the alarm is understood, the alarm can be disabled if necessary.

#		Text	Description	Action
1041	?	AO Out Of Range on %4	All PICs: An AO was set to a value outside of the allowed range. The value was clipped to the allowed range. For example, an EPC has a 0 to 100 psi nominal range for the pressure setpoint. An attempt to set the setpoint to 150 psi results in an "AO out of range" and the setpoint is clipped to remain within the allowed range (100 psi).	Locate the problematic AO and change the AO value to a value within the proper range.
1042	?	Invalid Group Channel on %4	All PICs: The hardware I/O channel(s) requested does not exist on the module.	Check the 'Sys Hardware' table for invalid entries. Check that only detector channels are specified in the detector I/O table. Check that only EPC are defined in the pressure controller table. Check that only temperature controllers are defined in the temperature controller table.

With either of these alarms, verify that the database has not become corrupt.

If modifying a method or an application, re-check the settings to make sure they apply to the correct channels.

#		Text	Description	Action
2225	?	Glow Plug Bad on %4	FID DPM Detector PIC: The glow plug is not working correctly. The diagnostic is performed when the board is reset or when an attempt is made to ignite the flame. The hardware diagnostic verifies that a minimum current and voltage is present, checking for a short and open glow plug. This may also indicate that a spark igniter is not connected properly.	Confirm that the glow plug or spark igniter cable is securely inserted in the connector. Replace the glow plug. Replace the DPM.
2265	?	Flame Ignition Failure on %4	FID DPM Detector PIC: The FID flame could not be ignited within the predefined delay (25 or 60 sec). No other attempt will be made to automatically ignite the flame until the MANUAL IGNITION DO is activated.	If associated with an alarm 2225 (Glow plug failure), then diagnose and fix that alarm first. If a BASIC program is used to control the electronic pressure controller (EPC) to adjust the gas mixture for proper ignition, confirm that the poll rate of the 'IGNITE' DI is set to 2 sec. Verify adequate gas-supply pressure. Verify the proper operation of the EPC.
2305	!	Flame Out on %4	FID DPM Detector PIC: The flame is out; the data generated on the FID channel is invalid.	Verify adequate flame gas supply. Verify the operation of any associated EPC.

6.3 How To Configure TimeServer Access

In a typical facility, a number of analyzers may need to have their internal clocks synchronized from a single source. The Maxum II uses a simple RFC868 protocol to request time data from a specific IP address. This sequence is shown below.

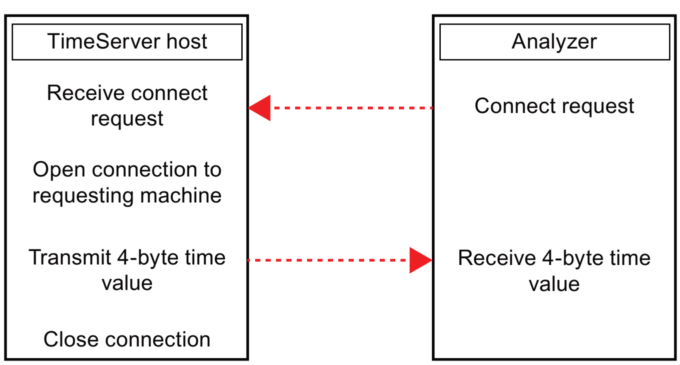


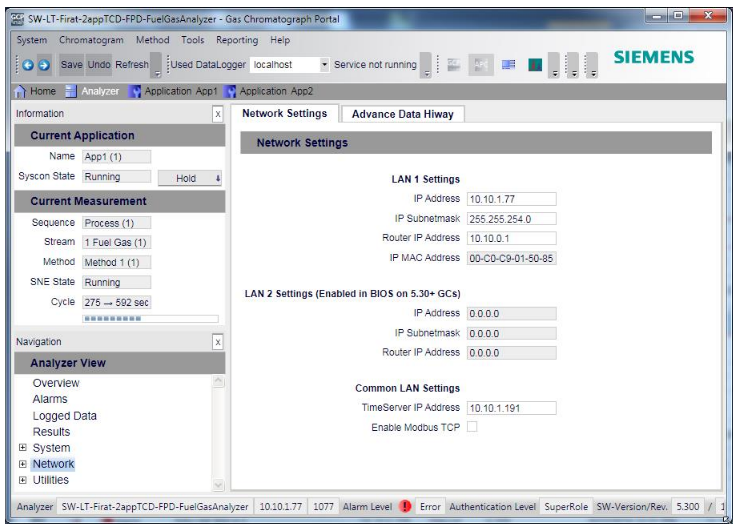
Figure 6-1 RFC868 TimeServer Operation

6.3.1 Designating the TimeServer on the Analyzer

Each analyzer can synchronize the internal clock with a central TimeServer. The IP address of the TimeServer is entered in the appropriate box under Analyzer View/Network Settings (Page 66), or from the HMI. This is the IP address of a computer running TimeServer software, or a Maxum on the same subnet.

Note

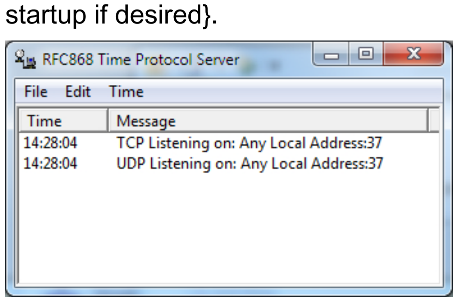
The computer running the TimeServer software must be on the same subnet as the analyzer.



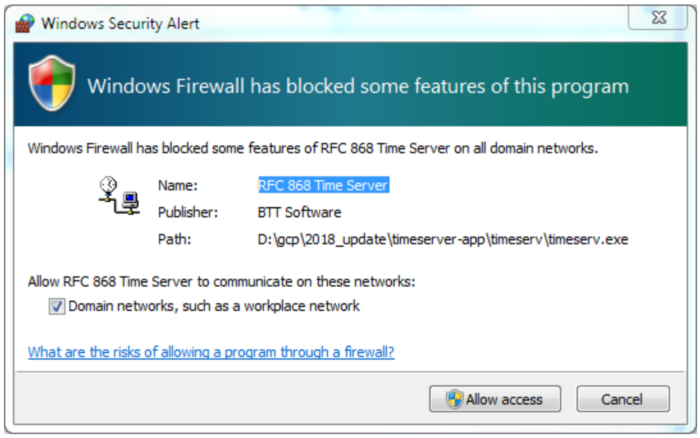
6.3.2 Running a TimeServer as an Application

A very simple way to implement a TimeServer is to run the software as an application.

1. Download the software from the following site: http://www.bttsoftware.co.uk/timeserv.html
2. Place the timeserv.exe and timeserv.inf files wherever you prefer in your directory structure.
3. Launch the exe file as an application. (This can be set up to start automatically on system startup if desired}.



4. This also triggers a message that some features are blocked by the firewall. Clicking Allow access on this window only creates an exception in the windows firewall for connections from a domain-registered source. To enable connections from the local subnet, follow the directions in the next section, Allowing the TimeServer Application Through the Firewall (Page 162).



5. Configure analyzers to use this computer as timeserver by entering the IP address as shown above.

See also

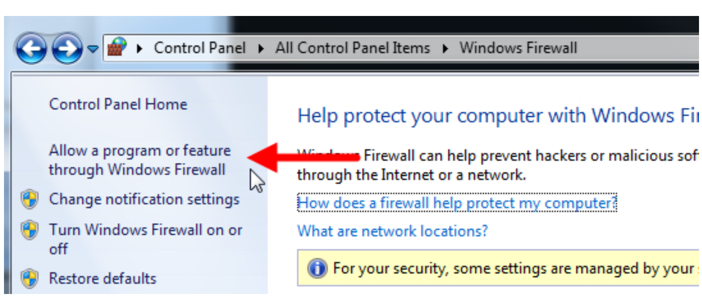
http://www.bttsoftware.co.uk/timeserv.html (http://www.bttsoftware.co.uk/timeserv.html)

6.3.3 Allowing the TimeServer Application Through the Firewall

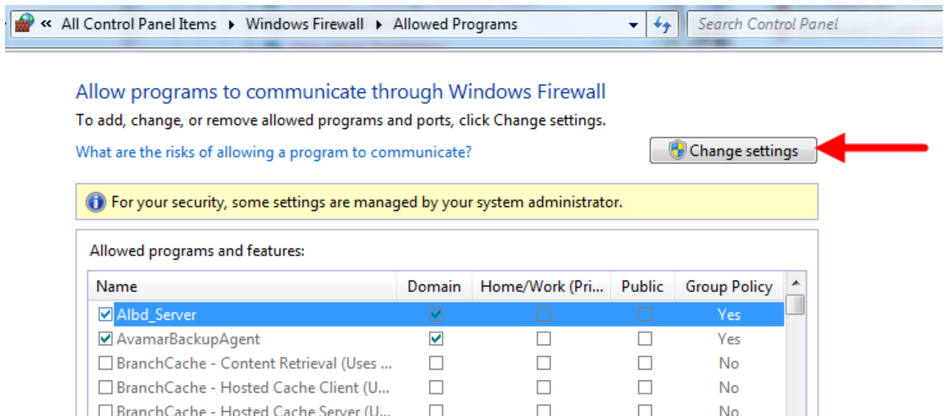
The computer that provides the TimeServer address may need to have an exception configured in its firewall.

To configure the exception, Open Windows Control Panel and click on Windows Firewall.

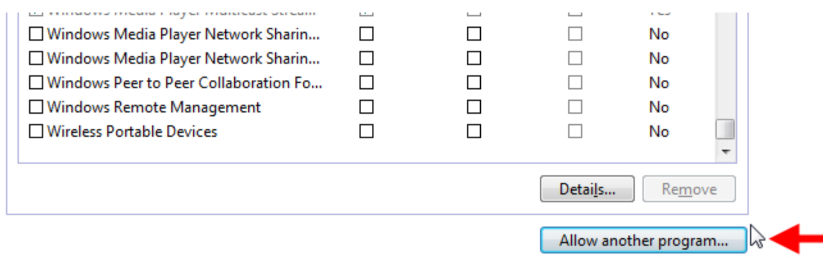
After the screen opens, click Allow a program or feature through Windows Firewall.



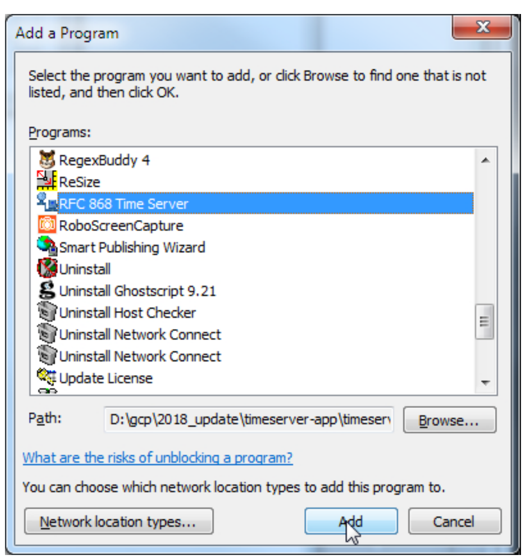
In the next screen, click Change settings.



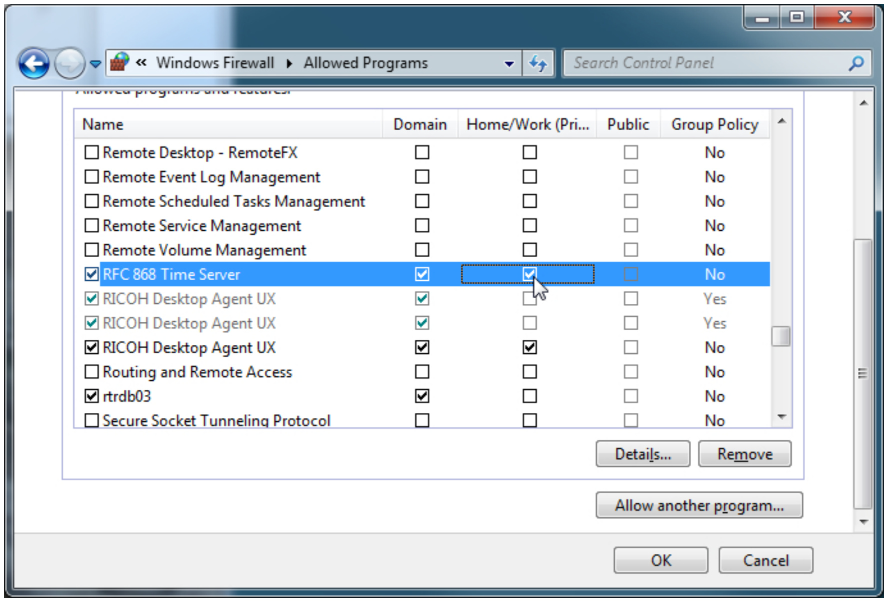
In the next screen, scroll to the bottom of the list and click Add another program.



If the RFC 868 Time Server program is not visible on the list, click Allow another program.



Select RFC 868 Time Server and click Add.

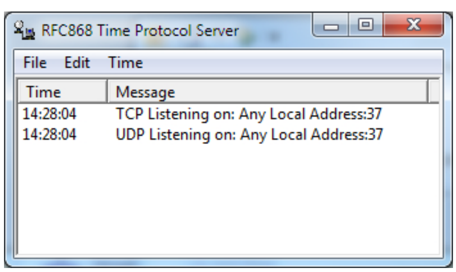


Click the checkbox for the RFC 868 Time Server.

For use with analyzers on the same subnet, also click the checkbox for Home/Work (Private).

Click OK to close.

The server should now be available.



The Maxum II uses only TCP communication.

6.3.4 TimeServer Service Under Windows 7

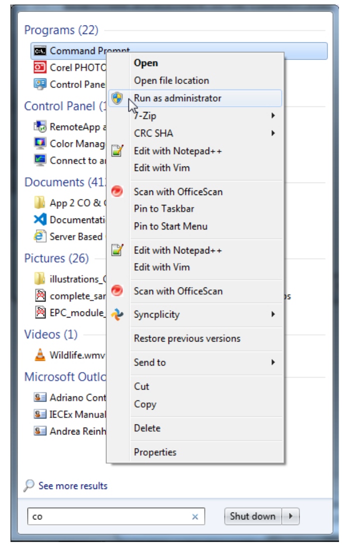
Download the software from the following site: http://unixwiz.net/tools/rfc868time.html

Place the rfc868time.exe file wherever you prefer in your directory structure.

Opening a command window as administrator

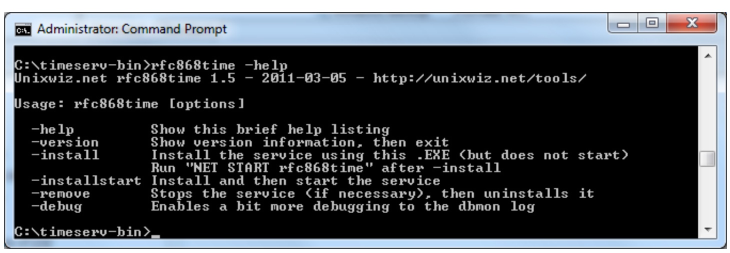
Click the Windows Start button.

- Type "command".
- Right-click the Command Prompt symbol and click Run as administrator
- The system will display the following dialog:
- Click Yes on the User Account Control dialog.

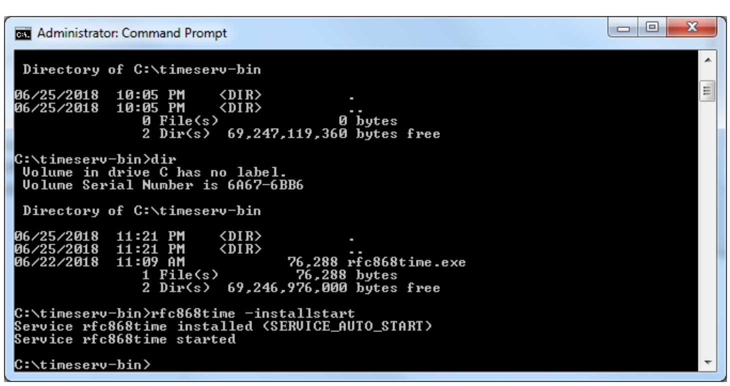


Commands within the command window

- The command window will typically open in c:WINDOWS\system32. Navigate to the directory containing the rfc868time.exe file.
- Enter the command "rfc868time -help" to display a list of commands.

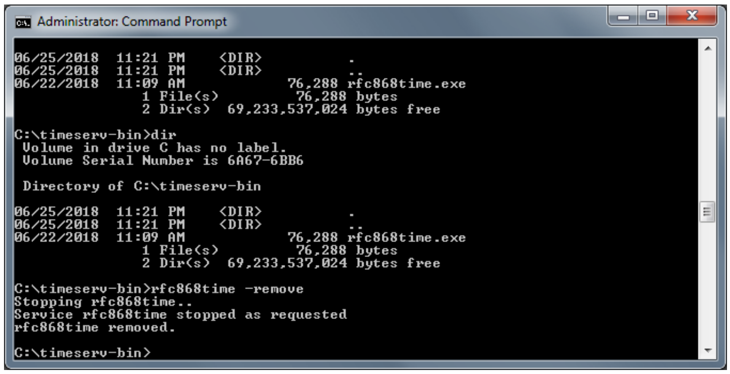


- Enter the command "rfc868time -installstart". This returns a message similar to this:



The service has now been installed in the services database and has started.

The command "rfc868time -remove" stops the service and deletes it from the services database.



See also

http://unixwiz.net/tools/rfc868time.html (http://unixwiz.net/tools/rfc868time.html)

6.3.5 TimeServer Service Under Windows 10

The installation procedure for Windows 10 is very similar to Windows 7. Using Windows 10, the user can choose between the command prompt or Windows PowerShell.

Using Windows PowerShell

1. Click Start
2. Type "powershell"
3. Right-click Run as administrator.
4. This opens a window that is very similar ot the command prompt. The main difference for this example is that the program name must be preceded by ".\" as shown below.

Administrator: Windows PowerShell

```
PS C:\timeserv-bin> dir


    Directory: C:\timeserv-bin


Mode                LastWriteTime         Length Name
----                -------------         ------ ----
-a----        6/22/2018  11:09 AM          76288 rfc868time.exe


PS C:\timeserv-bin> .\rfc868time -help
Unixwiz.net rfc868time 1.5 - 2011-03-05 - http://unixwiz.net/tools/

Usage: C:\timeserv-bin\rfc868time.exe [options]

  -help         Show this brief help listing
  -version      Show version information, then exit
  -install      Install the service using this .EXE (but does not start)
                Run "NET START rfc868time" after -install
  -installstart Install and then start the service
  -remove       Stops the service (if necessary), then uninstalls it
  -debug        Enables a bit more debugging to the dbmon log
PS C:\timeserv-bin> .\rfc868time -installstart
Service rfc868time installed (SERVICE_AUTO_START)
Service rfc868time started
PS C:\timeserv-bin>
```

To stop the service and remove it, the same "-remove" command is available.

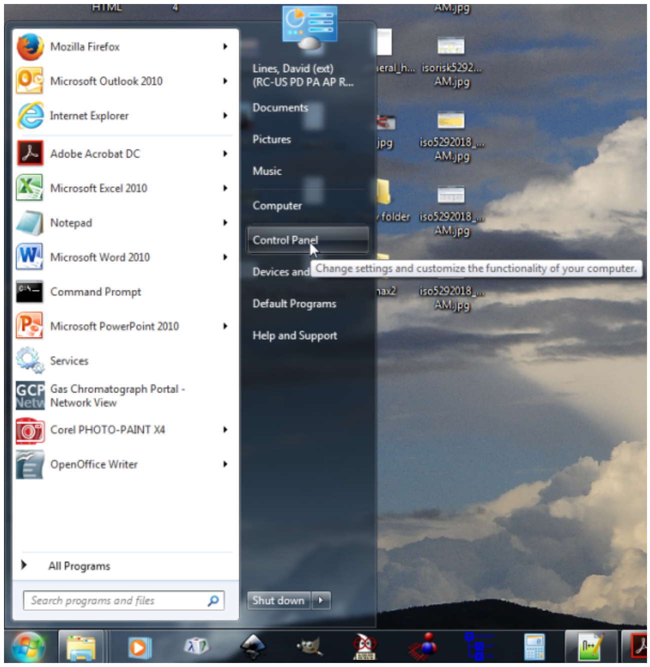
Administrator: Windows PowerShell

```
PS C:\timeserv-bin> .\rfc868time -remove
Stopping rfc868time..
Service rfc868time stopped as requested
rfc868time removed.
PS C:\timeserv-bin>
```

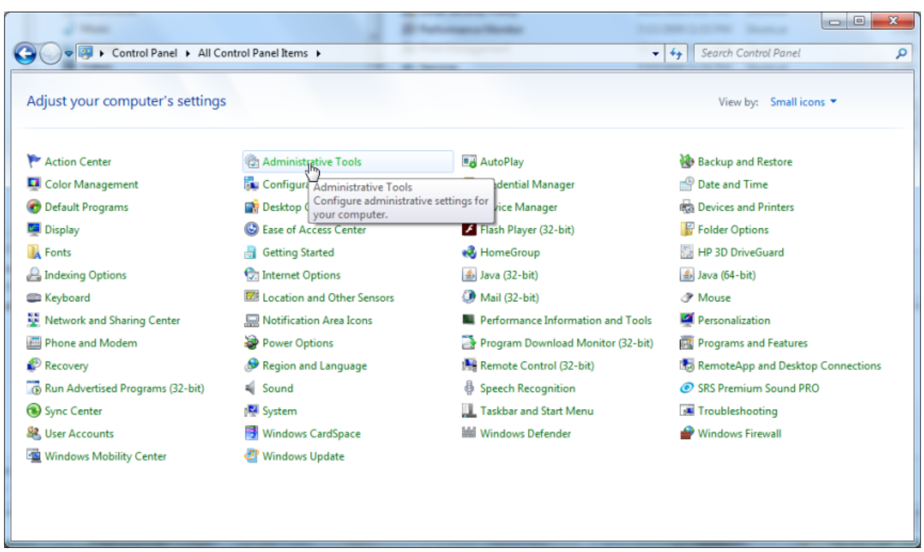
6.3.6 The Windows Services Viewer

To access the Windows Services Viewer:

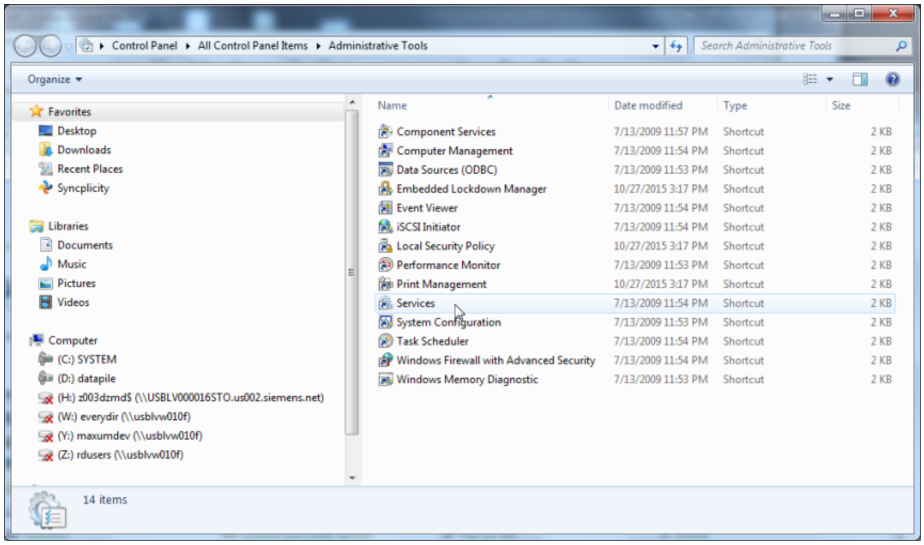
Click the Windows Start Button, and click Control Panel.



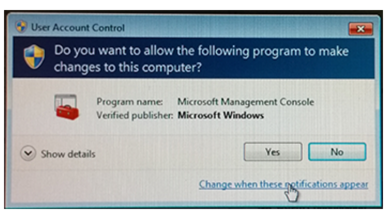
In the Control Panel, and click on Administrative Tools.



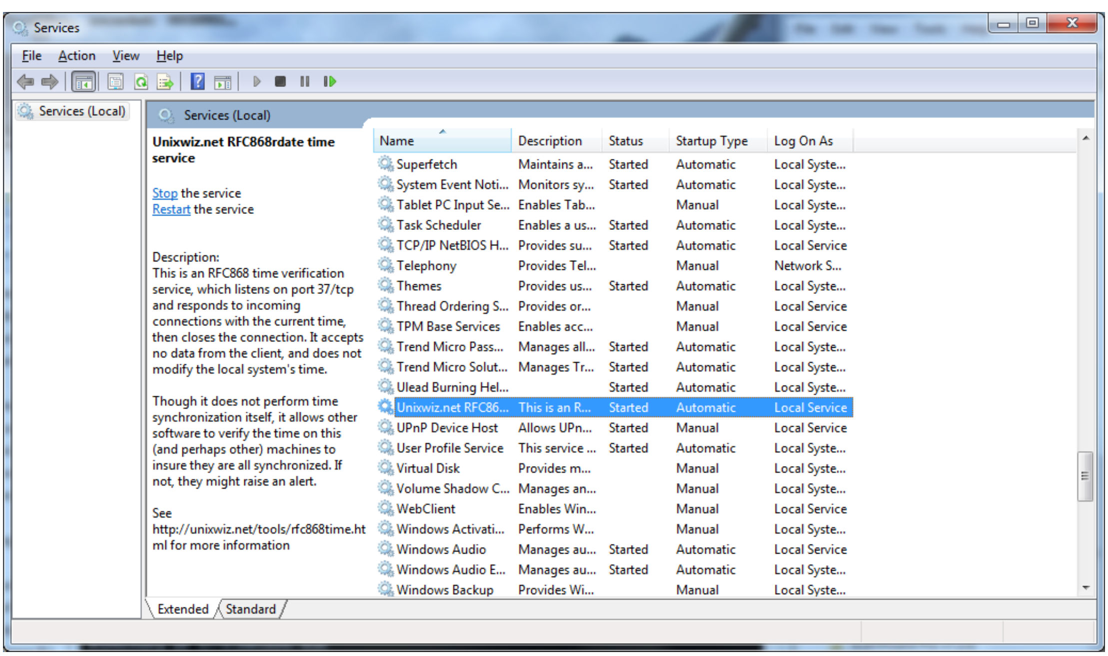
From the Administrative Tools window right-hand pane, double-click Services.



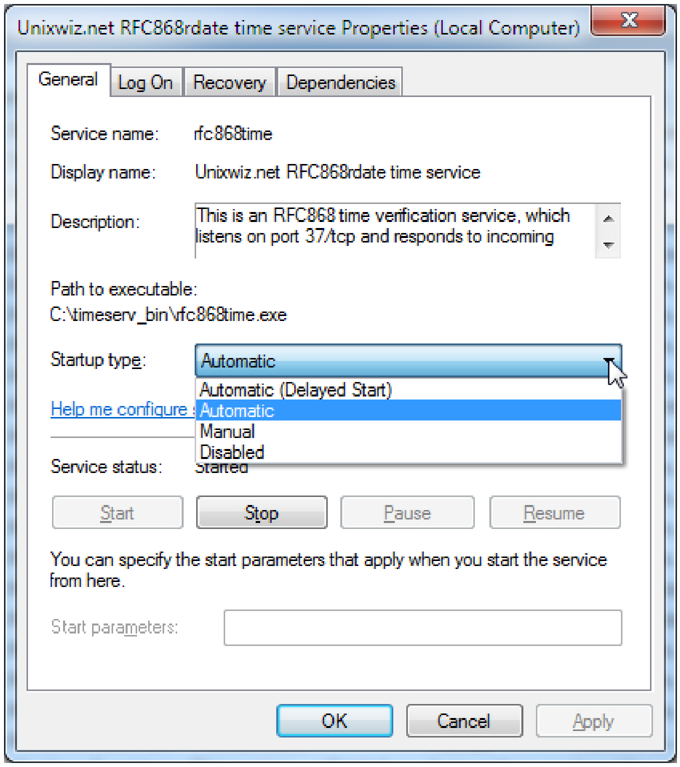
Click on Yes in the User Account Control dialog box.



The Services viewer shows all services, their state, startup type, and other information.



The properties such as startup type can be edited by right-clicking on a service and choosing Properties.



6.3.7 Firewall Considerations for the TimeServer Service

The computer that provides the TimeServer address may need to have an exception configured in its firewall. Below is a summary of rule configurations for Windows Firewall with Advanced Security. Other parameters will be required for specific situations.

The Maxum II only supports TCP, as reflected in the lists below.

Inbound rule

Enabled: Yes

Action: Allow

Program: c:\timeserv-bin\rfc868time.exe

Remote Address: Local subnet

Protocol: TCP

Local Port: 37

Remote Port: Any

Allowed Users: Any

Allowed Computers: Any

Outbound rule

Enabled: Yes

Action: Allow

Program: c:\timeserv-bin\rfc868time.exe

Remote Address: Local subnet

Protocol: TCP

Local Port: 37

Remote Port: Any

Allowed Computers: Any

6.4 How To Connect to an Analyzer

In the Gas Chromatograph Portal, there are two ways of connecting to an analyzer. These are connecting to an actual physical device or connecting to a virtual analyzer.

Physical Device - The GCP software downloads the database directly from a hardware device. This may be an Advance Maxum, Maxum II, MicroSAM, NAU, or Advance Plus. See the figure below.

To connect to a physical analyzer from the Analyzer View, select the desired analyzer from the drop down box on the toolbar and click Connect. You may also type in the IP address of the desired analyzer and click Connect.

Virtual Analyzer - With the virtual analyzer feature, the GCP software loads a database from an .amd file on the computer. In addition, the software launches a separate program that uses the database to create a simulation of an analyzer (virtual analyzer) in the computer memory. This virtual analyzer allows the user to implement and test the effects of changes without interrupting a working analyzer. To connect to a virtual analyzer, choose a file from disk by selecting the Open toolbar option. Alternatively, the user may also choose the Virtual Analyzer from the drop down box.

Refer to the Save a Database topic for more information concerning Virtual/Physical analyzers.

See also

How To Save a Database (Page 182)

6.5 Tool Tips Reference

This list describes the various tool tips that are configured in the GCControl software for Maxum II.

Toolbars		
	Tip Name	**Tip Contents**

Method Toolbar		
	Selection_List	List of application methods
	Analyze	Analyze currently opened chromatograms with selected method
	Calibrate	Calbrate selected method with currently opened chromatograms
Host Connection Toolbar		
	Selection_List	IP address
Window Selection Bar		
	Home	
	Analyzer	
	Application	
	Keep_It_Simple	
Information Subtab of Analyzer and Application Windows		
	Name	Name of current application
	State	Current cycle state
	Sequence	Name of current running sequence
	Stream	Name of current used stream
	Method	Name of current used method
	SNE State	Current cycle state
	Cycle	Current cycle: Position -> Length

Analyzer Tab - Navigation		
Analyzer Overview		
	Tip Name	**Tip Contents**
	Analyzer_Name	
	Type	
	IP_Address	
	Alarm_Level	(error text)
Alarm Log sub-window	(same as Alarm Log in Navigation - See Below)	
Installed Analytical Applications sub-window		
	Add	Create a new application
	Delete	Delete the selected applications
	Toggle Enable	A disabled application cannot be controlled locally or remotely and will not run cycles.
	Toggle In-Service	An application that is out of service will have invalidated results and will issue a fault alarm.

Analyzer Tab - Navigation		
	Tip Name	**Tip Contents**
Results tab of window		
	Show Connected Elements	
External Results tab of window		
	Add	
	Delete	

Analyzer Tab - Navigation		
Alarm Log		
	Tip Name	**Tip Contents**
	Acknowledge_selection	Acknowledge selected alarms
	Acknowledge_all	Acknowledge all alarms
	Clear_selection	Clear selected alarms
	Clear_all	Clear all alarms
	Ack	Acknowledges this alarm
	AlarmLevel_Icon_Error	Error
	AlarmLevel_Icon_Information	Information
	AlarmLevel_Icon_Warning	Warning

Analyzer Tab - Navigation		
Network		
	Tip Name	**Tip Contents**
Network Settings tab of window		
	IP_Address	
	IP_SubnetMask	
	IP_MAC_Address	
	Router_IP_Address	
	TimeServer_IP_Address	
Advance Data Hiway tab of window		
	Loop	
	Unit	
	Format	
	Default_Application_Id	

Analyzer Tab - Navigation		
Serial Settings (under network)		
	Tip Name	**Tip Contents**

	Baud_Rate	
	Parity	
	Data_Bits	
	Stop_Bits	
	Flow_Control	
	Communication_Standard	

Analyzer Tab - Navigation		
Hosts **(under network)**		
	Tip Name	**Tip Contents**
	Add	
	Delete	
	Id	User defined Id
	Name	User defined name
	Type	Type
	Analyzer_Id	Analyzer for Modbus and external results (Analyzer Id of NAU to receive results)
	Address	Address of gateway or Modbus unit
	Enabled	All hosts marked true will be sent result transmissions
	Log_Transmission	Print a log of the transmission to the first results printer

Analyzer Tab - Navigation		
Printers **(under network)**		
	Tip Name	**Tip Contents**
	Add	
	Delete	
	Id	User defined Id
	Name	User defined name
	Type	Type
	Loop	Required for printers on Advance DataHiway
	Unit	Required for printers on Advance DataHiway
	Receive_Alarms	Designates printer(s) to receive alarms
	Receive_Results	Designates printer(s) to receive results, parameters
	Receive_Calibration	Designates printer(s) to receive calibration reports

Analyzer Tab - Navigation		
Modbus Map (under System)		
	Tip Name	**Tip Contents**
	Modbus_Slave_Address	
	Add_Modbus_Item	
	Delete	
(Additional settings)	Scale_Factor	
(Additional settings)	Bad_Value	

6.6 How To Enable and Use the LAN2 Port

The LAN2 port can perform the same functions as the LAN1 port, except that a Software Upgrade can only be done through LAN1.

Use of the LAN2 port requires software version 5.3 to be running on the analyzer.

Note

This option cannot be used in analyzers that use a hardware SNECON module, or in analyzers that have both SYSCON and CIM boards.

The LAN2 port can only be enabled or disabled using the boot loader from the user interface physically located on front of the analyzer.

Physical Ethernet Connection

Maxum Airbath and Airless Oven (MAA) Models

The LAN port connectors for the MAA model are located inside the SYSCON enclosure on the system interface board (SIB) as shown in the photo below.

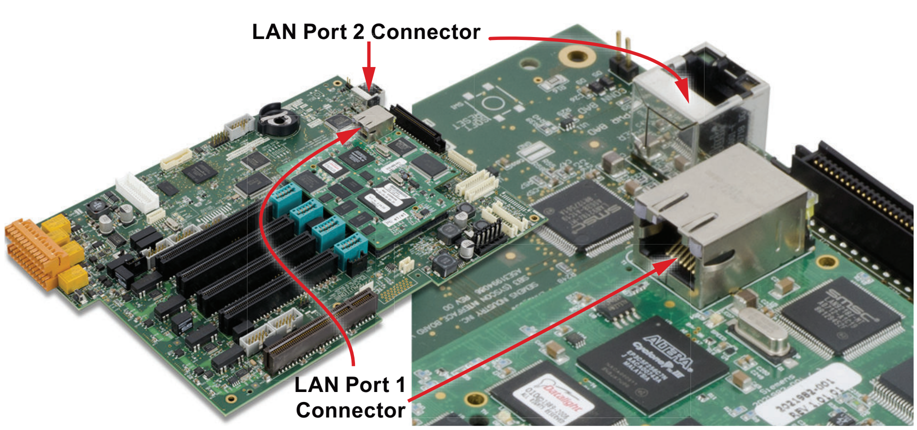


Figure 6-2 LAN Port Physical Connections

Maxum Modular Oven (MMO) Model

The LAN port connectors for the MMO model are located on the CIM mounted on the inside of the electronics cabinet door as shown in the photo below.

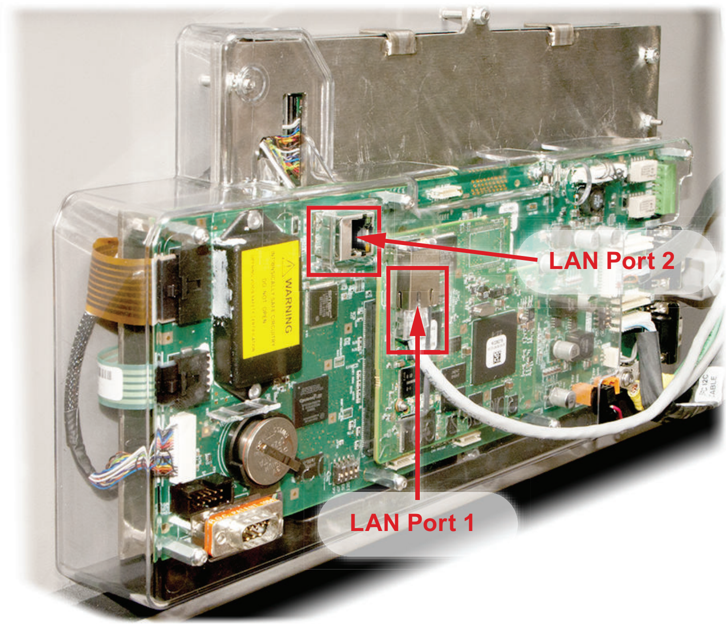


Figure 6-3 LAN Port Physical Connections (MMO)

Choosing IP Addresses for LAN2

A default gateway address that is reachable on the network (typically a router) must be set. This address cannot be the same as the LAN2 IP address, unlike some other devices. If there is no gateway device on the network, use the IP address of the Modbus Master. If there is no Modbus Master, the IP of another Maxum on the network may be used. Connect the LAN2 port to a **different** network segment (subnet) from the primary LAN1 port.

For example, the LAN1 port could be

- IP = 10.10.0.35
- Netmask = 255.255.254.0
- Gateway = 10.10.0.1

An appropriate LAN2 setting might be

- IP = 192.168.141.10
- Netmask = 255.255.255.0
- Gateway = 192.168.141.1

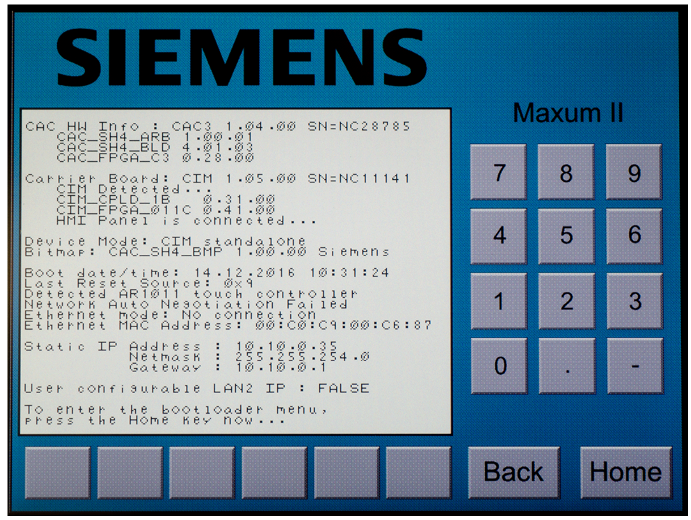
Configuring the LAN2 Port

The boot loader is required to enable or disable LAN2. When using the boot loader, the HOME key acts as an 'enter' key, and the BACK key acts as a 'backspace' key.

<table>
<tr>
<td>

- Enter the boot loader by resetting the analyzer and then pressing the "Home" key.

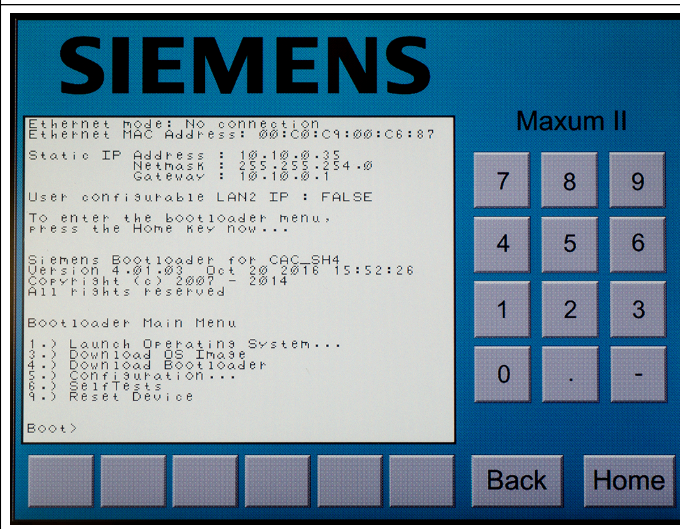
</td>
<td>



</td>
</tr>
<tr>
<td>

- Select "Configuration" by pressing "5".

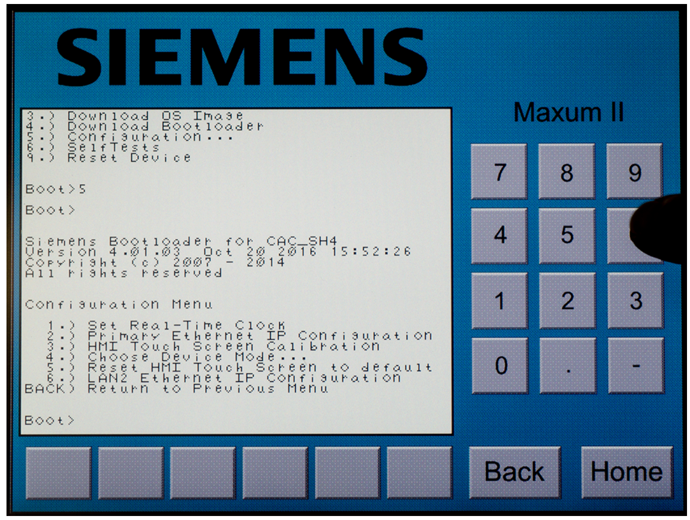
</td>
<td>



</td>
</tr>
</table>

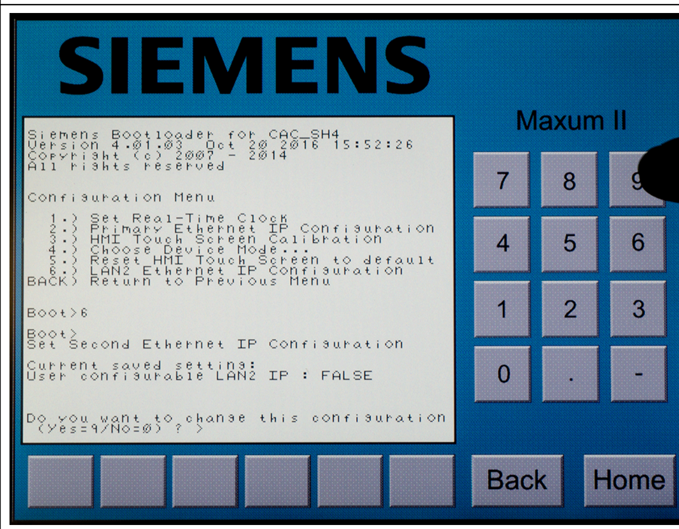
<table>
<tr>
<td>

- Select "LAN2 Ethernet IP Configuration" by pressing "6".

</td>
<td>


</td>
</tr>
<tr>
<td>

- Press "Yes" to enter the change-configuration screen.

</td>
<td>


</td>
</tr>
</table>

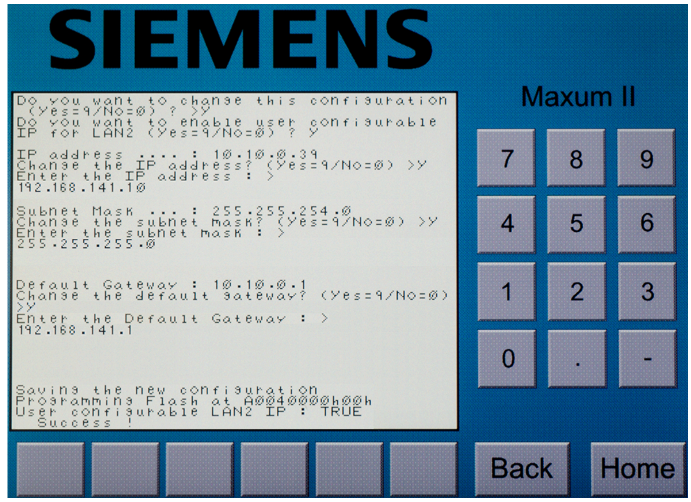
<table>
<tr>
<td>

- Enter "Yes" to "Do you want to enable user configurable IP for LAN2?"
- Enter "Yes" to "Change the IP address?"
- Enter the desired IP address
- Press the HOME key
- Enter "Yes" to "Change the subnet mask?"
- Enter the desired subnet mask.
- Press the HOME key.

Note: Connect the LAN2 port to a **different** network segment (subnet) from the primary LAN1 port.

- Enter "Yes" to "Change the default gateway?"
- Enter the default gateway address.
- Press the HOME key
- After the boot loader finishes, press a key to exit and start the software.

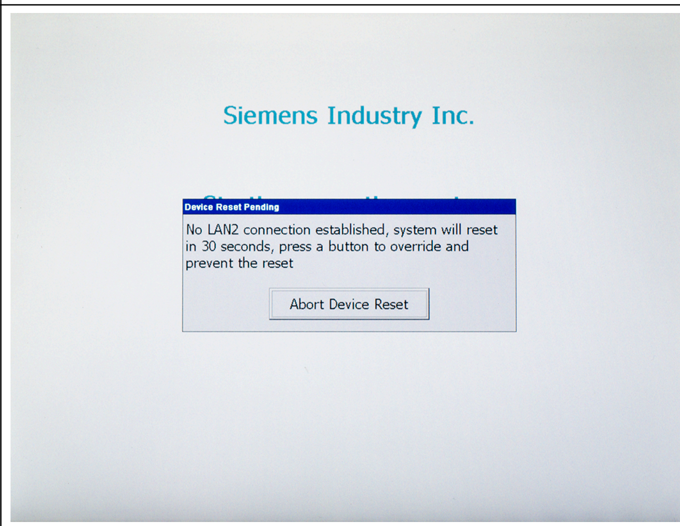
</td>
<td>



</td>
</tr>
<tr>
<td>

If the gateway address entered in the previous step is unreachable, the analyzer will reboot up to 4 times to attempt to connect. During each attempt, the screen displays a "Abort Device Reset" button to start the software without connecting.

</td>
<td>



</td>
</tr>
</table>

Accessing LAN2 Settings in GCP

After enabling the port, the IP settings are available in GCP in Analyzer view by clicking the Network entry.

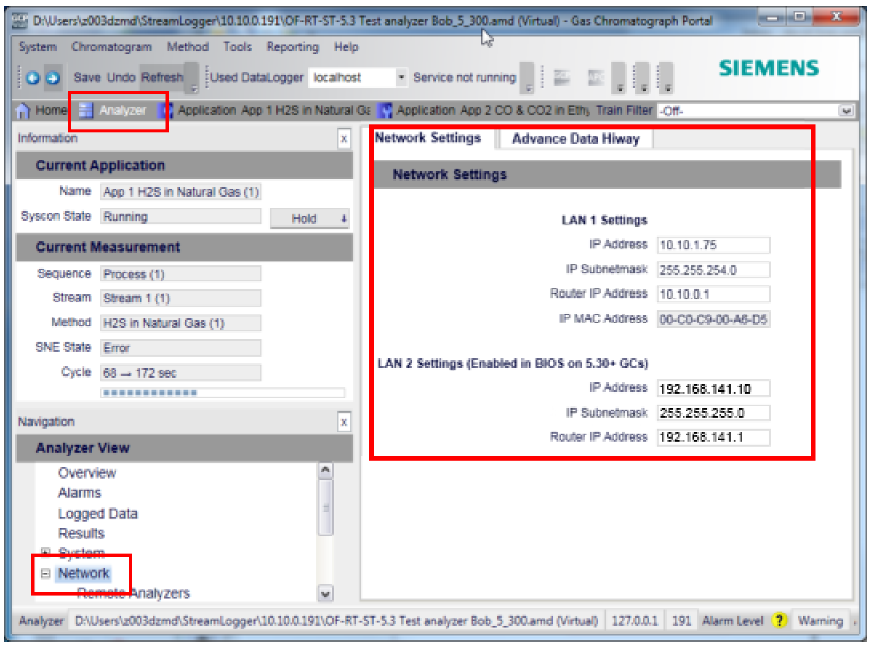
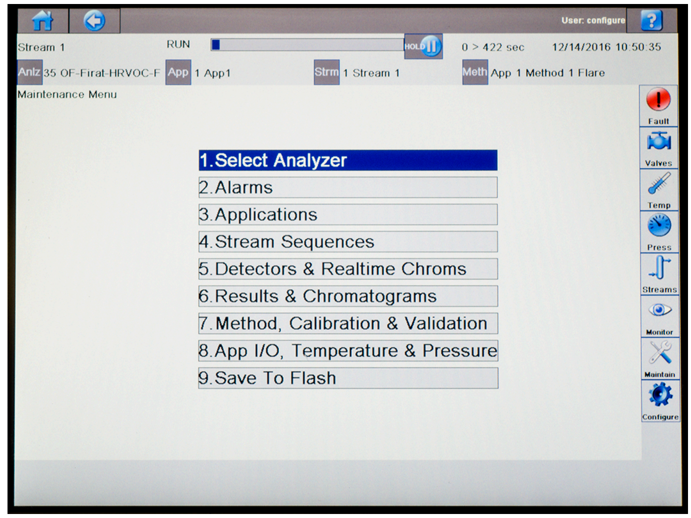


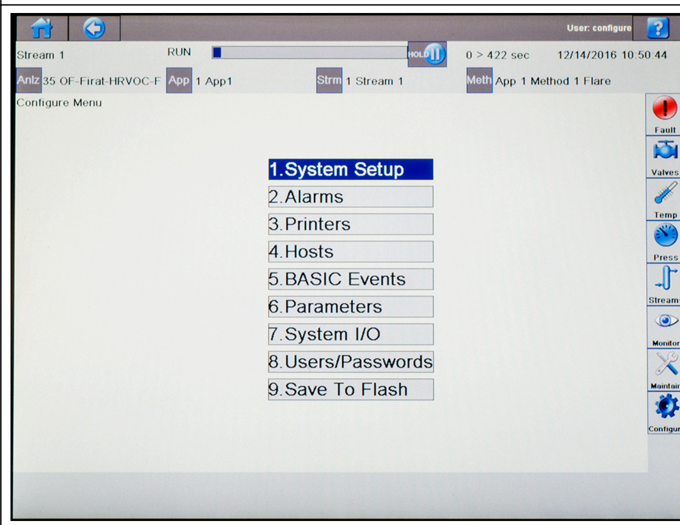
Figure 6-4 GCP LAN Port Window

Accessing LAN2 Settings in HMI

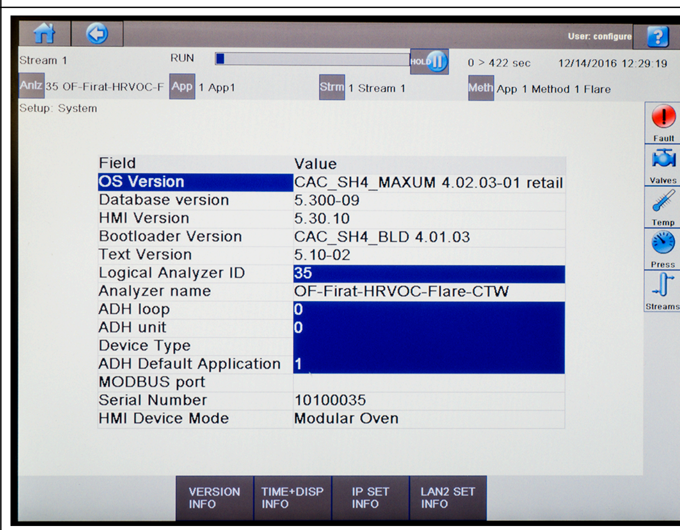
To access the LAN2 settings from the HMI, press "Configure" on the right-hand column of the Home screen.

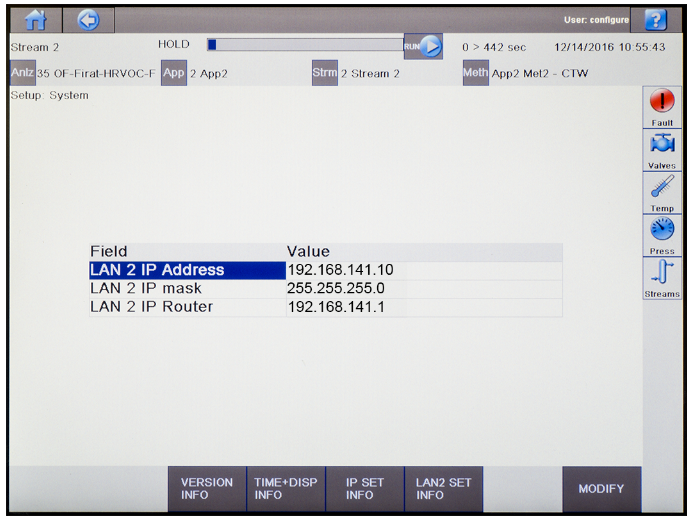
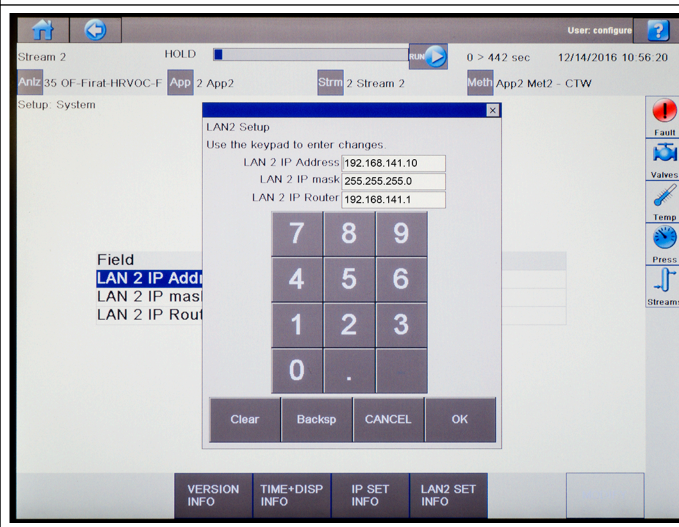


Press "1. System Setup"



At the bottom of the System Setup screen, press "LAN2 SET INFO".



<table>
<tr>
<td>Press the entry you want to change to select it, then press "MODIFY". A setup screen then appears.</td>
<td>
</td>
</tr>
<tr>
<td>Press the entry to be edited. The existing values can be changed, or the entire entry cleared and re-entered. Press "OK" to accept the new values and exit, or "CANCEL" to exit with no changes.</td>
<td>
</td>
</tr>
</table>

6.7 How To Save a Database

There are multiple save options in the Gas Chromatograph Portal. Where the information from a save operation is stored depends on which option is used and whether the GCP software is communicating with a virtual analyzer (Page 26) or an actual physical device.

Refer to the figure below for a visual representation of the various save operations, which are described in detail below.

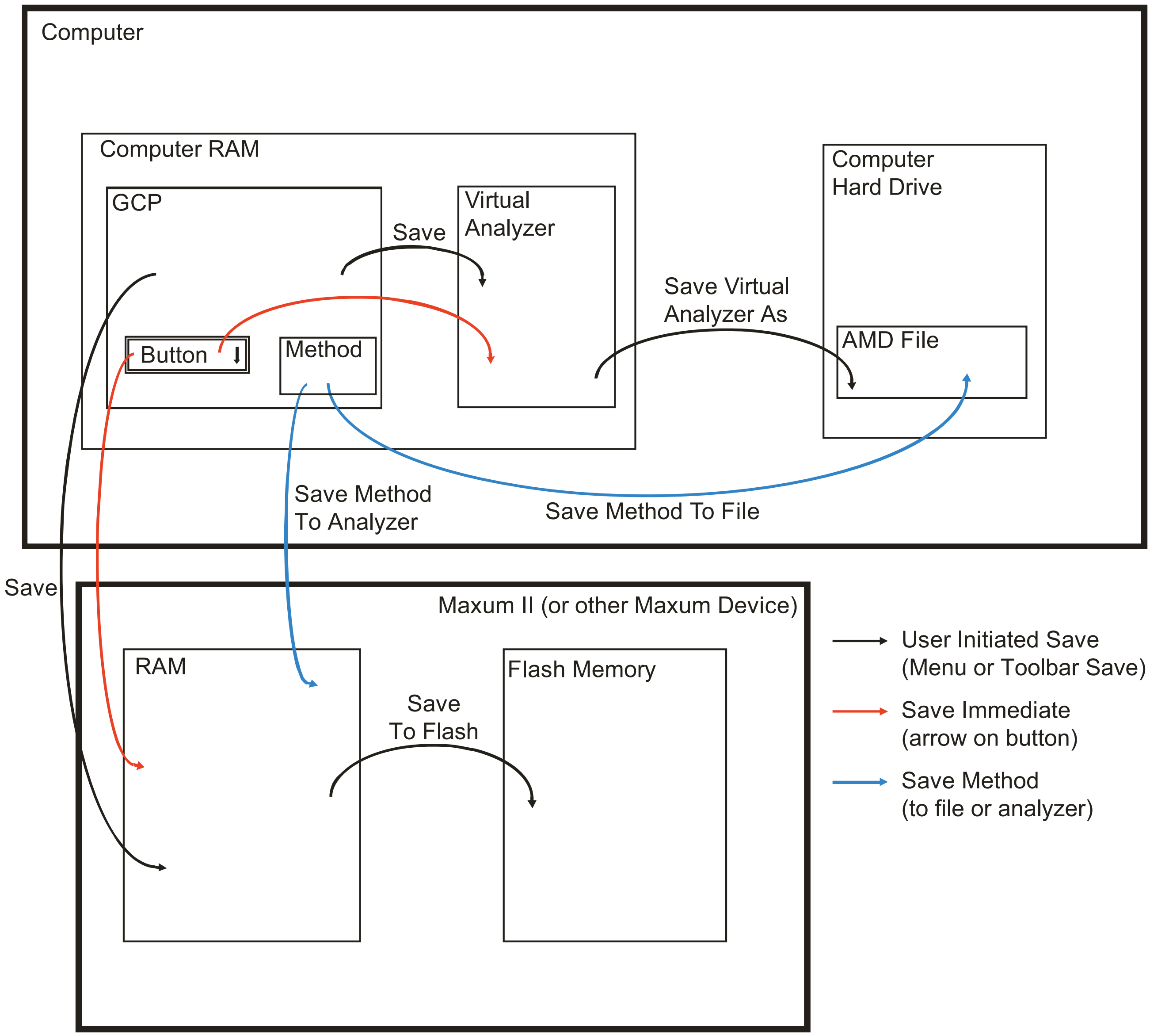


Figure 6-5 Saving Options for Gas Chromatograph Portal

NOTICE
Changes that are made and saved using Save or Save All are not yet permanent. If the change is to a virtual analyzer, the change is saved to the virtual analyzer in memory and not to disk. If the change is to a physical device, then the change has only been stored in the RAM of the analyzer and will be lost if the device loses power. See the figured below for more information.

Save/Save All - Whenever a field on a GCP screen is changed, the text changes from black to blue. As long as the text is blue, the change is temporary and is only located in the GCP version of the database. The Save button on the toolbar or Save All function under the System menu downloads recent changes like this to the database of the analyzer (either a physical device or a virtual analyzer). Changes can now affect analytical results of either the simulated analyzer or the physical analyzer

Immediate Saves (saves caused by clicking a button that has a blue arrow on it) - In the GCP software there are several functions that automatically initiate a change in the analyzer, without the need for the user to hit Save. These functions are identified by a blue arrow on the right side of the button. An example is the Run/Hold button that appears on the upper left side of the Analyzer View (other than on the Home screen). Clicking the Run/Hold button toggles the Run state of the analyzer.

NOTICE
Using the Save to Flash function permanently overwrites the database of the analyzer. It is strongly recommended that the database be saved to disk before attempting to Save to Flash

Save to Flash - When a change is saved to a physical analyzer, it is stored in the RAM of the device. This is volatile memory that will be lost if the analyzer loses power. To store these updates permanently, the Save to Flash function is used. This selection, found on the System menu, sends a command to the analyzer to save its current database to permanent Flash memory. Note that changes must first be sent from the GCP software to the Analyzer using the Save function. The Save to Flash function is only valid for a physical analyzer.

Save Virtual Analyzer As... - This is used for virtual analyzers and is equivalent to the Save to Flash function. This saves the virtual analyzer database to an .amd file on the computer. The user may select the existing file name or a new name.

Save Method to Analyzer - This function is used only for changes to a method. It allows the user to save recent method changes to the analyzer. This function is executed either from the Method menu or by right-clicking on the desired method in the Navigation menu. This function is only valid for physical analyzers. Note that the new method data is not permanent on the analyzer unless the Save to Flash function is used after saving the method to the analyzer.

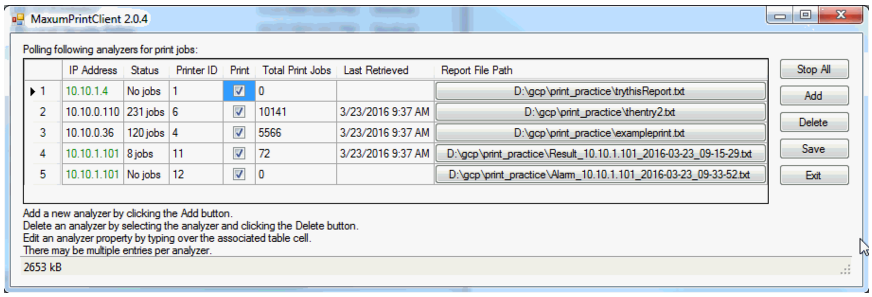
Save Method to File ... - This function allows the user to save method data to the hard disk. This may be either a method that had been downloaded from a physical analyzer or it may be part of a virtual analyzer database. The user has the option of saving the data as a standard MBM (binary) file, which may be read and loaded by Gas Chromatograph Portal and other Siemens chromatography software. The user may also choose to save the method as an XML file which can be read by other programs.

6.8 How To Use Print Client

The Print Client is a utility that allows information from multiple analyzers to be 'printed' to one or more text files on a GCP workstation PC.

Configure a printer

Click the Print Client icon in the Toolbar (Page 34). MaxumPrintClient opens with an empty table.

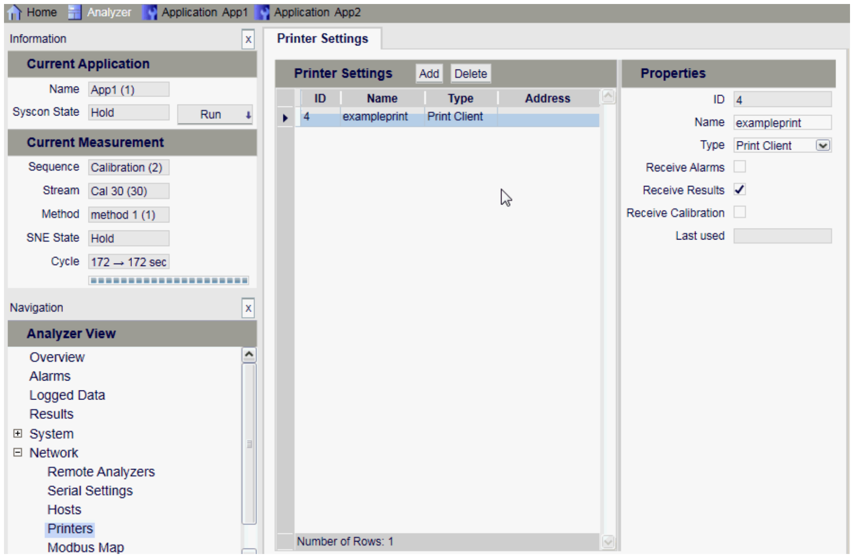


- Click the Add button.
- Set the IP of the target analyzer.
- Assign the Printer ID number.
- Enter the path and filename (default includes IP# and date) of the desired text file.

In the example above, two printers were configured for one analyzer; one for results, and one for alarms.

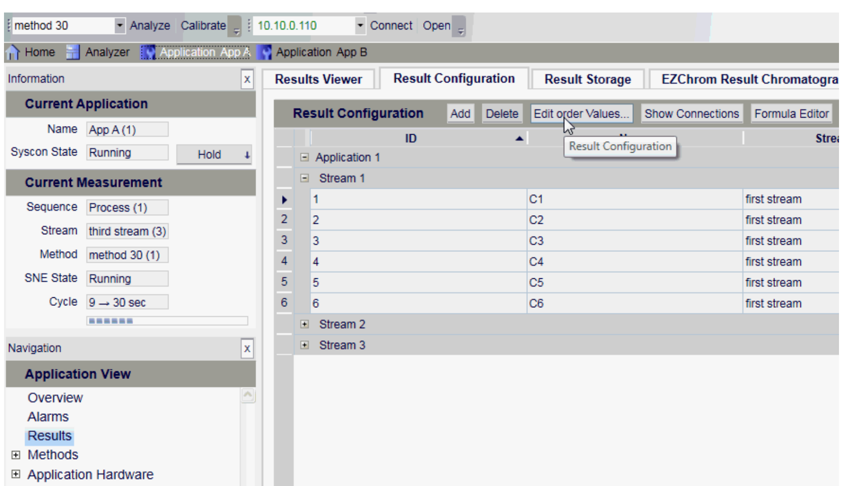
Configure the Analyzer to use the printer

- Click on Analyzer View in the View Selector bar.
- Navigate to Network/Printers.
- Enter ID for printer that was set up in Print Client
- Click Receive Results
  Available options include Alarms, Results, Calibration. If Alarms is checked, and alarm from this analyzer is printed to the printer in Print Settings.
- Click Save

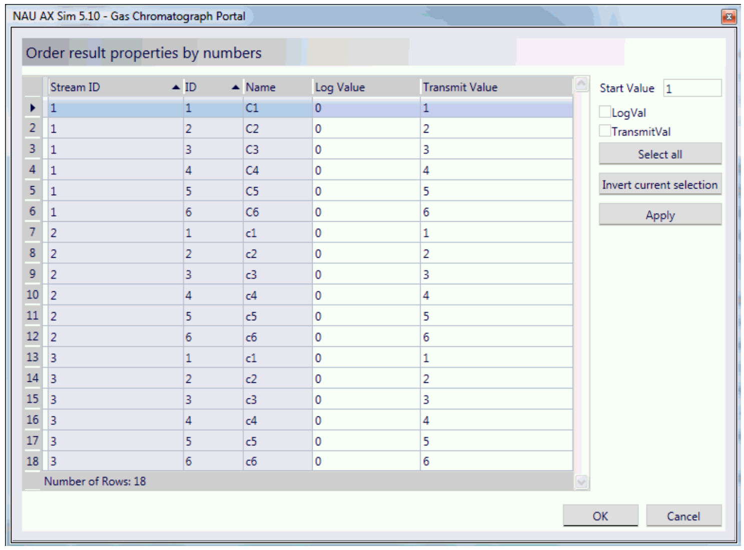


Select the Application to Print

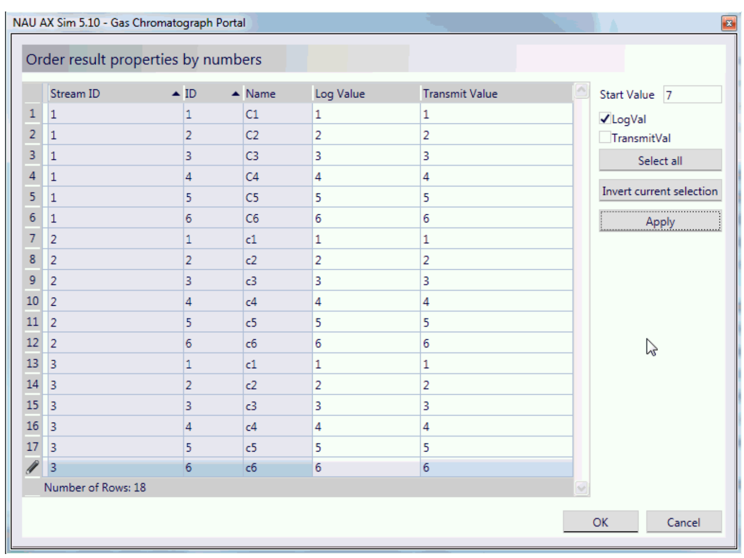
- Click on Application Tab
- Click on Application View/Results
- Click on Result Configuration Tab



- Click on Edit Order Values to open this window:



Notice that the Log Value column contains zeros or blank fields. To print the corresponding value to the text file, sequential Log Values are entered for each desired entry. The values for each stream must begin at 1.

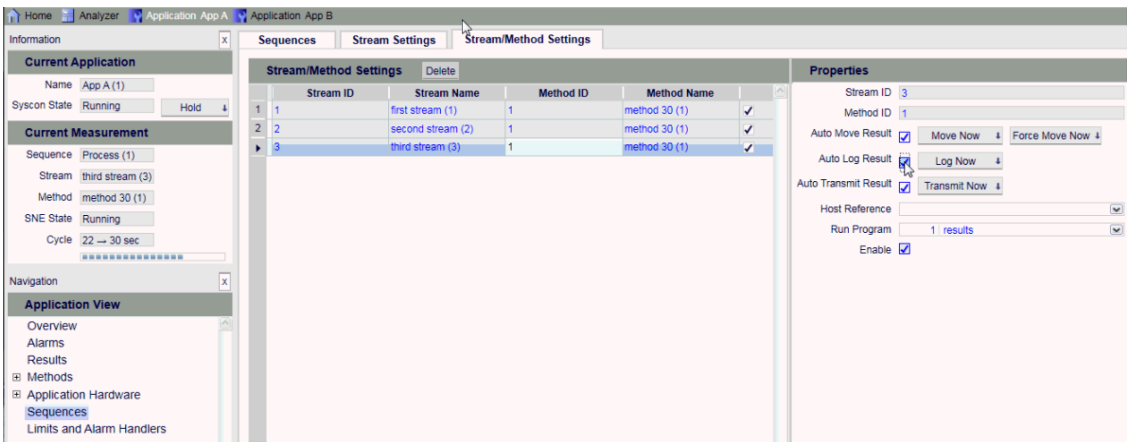


- When the Log Values are entered, click Apply, then OK
- Click Save
- Click Sequences
- Navigate to the Stream/Method Settings Tab
- Select a stream, then click to check the Auto Log Result box.

Note

Uncheck Auto Log Result box and the Receive Result, Receive Alarms and Receive Calibration boxes (shown above in the Analyzer Network/Printers screen) to stop printing.

- Repeat for each desired stream



- Click Save
- Repeat for any other desired Applications.

6.9 How To Use Cycle Event Linking

A cycle event link is used during method editing on workstation software to **enforce the time offsets between two linked cycle events.** Changing the time of one cycle event automatically sets the time of another cycle event that is linked to this cycle event, simplifying the method development process using the workstation software. For example, you may want to change EPC pressure when turning a valve on or off. However, during early stages of method development, you may need to iteratively change the valve time based on a cycle chromatogram, but often forget to change the EPC time as intended, which could slow down your method development process.

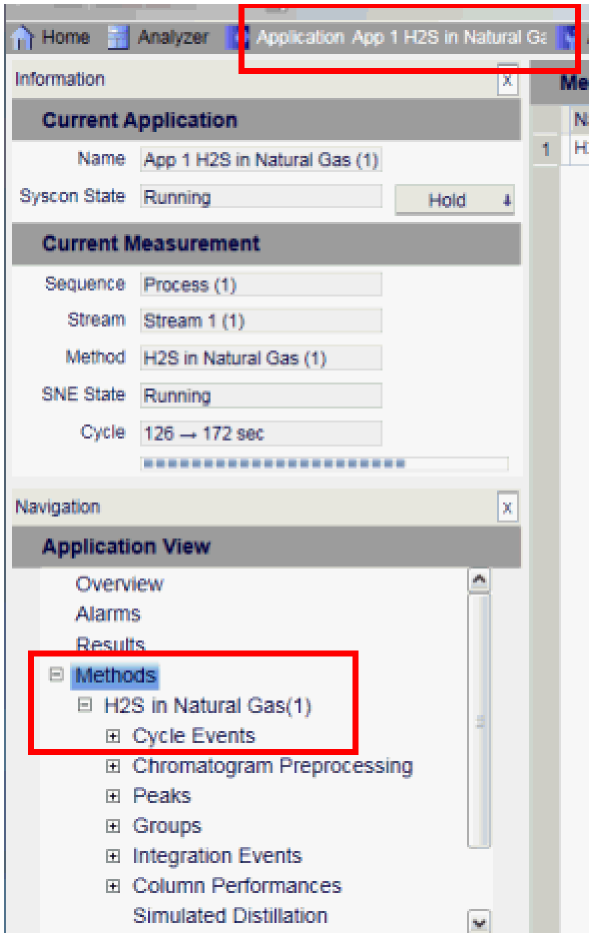
Only pressure, valve/DO, and and program cycle events can be linked. For a **valve/DO** or a **program** cycle event, it is the **start time** that is linked. For a **pressure** cycle event, it is the **stop time** that is linked. Since either hold times or stop times (configurable as described below) of all pressure cycle events for one controller are automatically enforced, **changing the stop time of one pressure cycle event either manually or by a linked cycle event automatically will always change the start time of the next pressure cycle event (if it exists) for the same controller.**

Linking or unlinking cycle events can only be changed in the **cycle event table** of GCP where all cycle events are displayed and the link column is also displayed. However, active cycle event links are effective in all supported cycle event pages and are saved/loaded as part of a method. To prevent creating an undesired cyclic link between multiple cycle events, **a cycle event cannot be involved in more than one cycle event link**.

Due to limitations of the analyzer database, **cycle event linking is not used by any local analyzer software. The cycle event links contained in a method that is saved to the analyzer may be removed automatically** if any properties of method cycle events, such as cycle start/stop times, cycle event start/stop times, or detector sampling rates, etc., are changed by local HMI or a MaxBasic program. Therefore, using method files saved in workstation software are recommended if iterative changes of method cycle events are expected.

To link cycle events

1. Navigate to Application View > Methods > Cycle Events.



2. Click on an unlinked event to select that row; selection is indicated by the arrow at the left of the row number.

3. Right-click in the checkbox for the desired target event in the link column. That cell background turns dark blue. After the links are made, clicking a checked cell in the Link column reveals which events are linked to that source event. If one of the target events is selected, the cell backgrounds of the linked event turn red. This provides a way to quickly verify the event links.

Changing the value of an editable start or stop time cell (with white background) of any linked cycle event will automatically change the time values of the other cycle event that is linked to this cycle event, based on the time offset between any two linked cycle events that is automatically calculated and fixed when the link is created.

The time relationships between all pressure cycle events of a controller are automatically enforced for the controller. Therefore, if a pressure cycle event of a controller is linked to another cycle event, the times of all other cycle events in the same controller are also indirectly linked.

All actives cycle event links are stored as part of a method when the method is saved to a file or to analyzer. Loading from a saved method will have the same cycle event links that are active when the method is saved.

All Cycle Events ☐ Show cycle graph

☑ Enable all ☐ Enable sort ☑ Update next T/P hold time on editing T/P stop time

	Enable	Name	ID	Event Type	Action	Start (sec)	Stop (sec)	Link
01	☑	LL1_TD	1	Detector	Acquire chromatogram	-8	170	
02	☑	LL2_TD	2	Detector	Acquire chromatogram	-8	169	
03	☑	LL3_TD	3	Detector	Acquire chromatogram	-8	168	
04	☑	LR1_TD	4	Detector	Acquire chromatogram	-8	[illegible]	
05	☑	LR2_TD	5	Detector	Acquire chromatogram	-8	169	
06	☑	LR3_TD	6	Detector	Acquire chromatogram	-8	168	
07	☑	LOVEN	26	Temperature	Hold at 60 °C	-8	0	
08	☑	Car L2-1	30	Pressure	Hold at 77.9108 kPa	-8	0	☐
09	☑	Car L2-1	30	Pressure	Hold at 93.7687 kPa	0	12.5	☑
10	☑	Car L2-1	30	Pressure	Hold at 77.9108 kPa	12.5	172	☐
11	☑	Car L2-2	31	Pressure	Hold at 29.6475 kPa	-8	0	☐
12	☑	Car L1-1	32	Pressure	Hold at 73.7739 kPa	-8	0	☐
13	☑	Car L1-1	32	Pressure	Hold at 91.7003 kPa	0	13.3	☐
14	☑	Car L1-1	32	Pressure	Hold at 73.7739 kPa	13.3	172	☐
15	☑	Car L1-2	33	Pressure	Hold at 26.8896 kPa	-8	0	☐
16	☑	SSO LR	12	Valve & DO	Off	-8		☐
17	☑	SSO LR	12	Valve & DO	On	8		☐
18	☑	CL1	16	Valve & DO	On	13		☐
19	☑	CL1	16	Valve & DO	Off	22		☐
20	☑	SL1	15	Valve & DO	On	0		☐
21	☑	SL1	15	Valve & DO	Off	13.3		☐
▶ 22	☑	CL2	14	Valve & DO	On	14		☑
23	☑	CL2	14	Valve & DO	Off	22		☐
24	☑	SL2	13	Valve & DO	On	0		☐
25	☑	SL2	13	Valve & DO	Off	12.5		☐
26	☑	SSO LL	11	Valve & DO	Off	-8		☐
27	☑	SSO LL	11	Valve & DO	On	8		☐
28	☑	Stream Step	-1	Program	Run	10		☐
29	☑	Balance Detector	-2	Program	Run	-2		☐

Cycle Start (sec) -8 Cycle Stop (sec) 172 ☐ Set automatically from all cycle event times

☐ Use entire cycle time for detector acquisition times

When Pressure Cycle Events are linked, the following table is generated.

Pressure Cycle Events (Car L2-1, 30) ☐ Show cycle graph

☑ Enable all ☐ Enable sort [Add] [Insert] [Delete] ☑ Recalculate next hold time on editing stop time

	Enable	Function	Hold (sec)	Ramp (kPa/min)	Setpoint (kPa)	Start (sec)	Stop (sec)	Use Max.Dev.	Max.Dev. (kPa)	Linked To
1	☑	Hold	8		77.9108	-8	0	☐	0	
2	☑	Hold	12.5		93.7687	0	12.5	☐	0	Valve & DO cycle event
3	☑	Hold	159.5		77.9108	12.5	172	☐	0	

Cycle Start (sec) -8 Cycle Stop (sec) 172 ☐ Set automatically from all cycle event times

☐ Use entire cycle time for detector acquisition times

Digital Output or Valve Events are displayed in this table.

Valve and DO Cycle Events ☐ Show cycle graph

☑ Enable all ☐ Enable sort [Add] [Insert] [Delete]

	Enable	Name	ID	Time (sec)	Switch	Duration (sec)	Activation Mode	Linked To
01	☑	SSO LR	12	-8	Off		(All)	
02	☑	SSO LR	12	8	On		(All)	
03	☑	CL1	16	13	On		(All)	
04	☑	CL1	16	22	Off		(All)	
05	☑	SL1	15	0	On		(All)	
06	☑	SL1	15	13.3	Off		(All)	
07	☑	CL2	14	14	On		(All)	Pressure cycle event
08	☑	CL2	14	22	Off		(All)	
09	☑	SL2	13	0	On		(All)	
10	☑	SL2	13	12.5	Off		(All)	
11	☑	SSO LL	11	-8	Off		(All)	
12	☑	SSO LL	11	8	On		(All)	

Cycle Start (sec) -8 Cycle Stop (sec) 172 ☐ Set automatically from all cycle event times

☐ Use entire cycle time for detector acquisition times

To unlink cycle events

1. Navigate to the Cycle Events page.
2. Click on the linked event row to select it and the linked events.
3. Right-click on the checked event. This clears the checkbox and unlinks the event.

6.10 How To Configure Automatic Reports

The reports that can be automatically generated from the Maxum are:

Result Logs

The anallyzer can generate two types of result log to ADH printers(Maxum and NAU only) and one type to TCP(or serial)printers. These are generated when the autolog is used or the lognow from the stream_method table. By designating which results are to print and what order in the logval attribute of the Result, you can print a standard report that is not customizable. These standard reports also use the decimal_places attribute of the result.

The type of report is designated in the setup for the printer.

Example:

```
RESULT LOG ANLZ:142 09-MAY-2000 16:16:14
APPLICATION: Six TCDs STREAM: Stream 1 METHOD: Synthetic
6.1222 16.0657 14.5377 10.2064 15.5602
gU1c gL2a
14.3700 7.5645
```

The ADH export report generates a comma separated list that is suitable to be captured and used by MS Excel. Results may be printed to multiple printers, indicated with the **results_def** attribute of the printer table.

Alarm printouts

Alarms are sent to both ADH and TCP printers as:

```
ALARM FOR ANLZ:142 17-MAY-2000 08:44:48
Application: Stream: Alarm Code: 999
! Fake Alarm
```

Alarms may be printed to multiple printers, indicated by the **Alarms_def** attribute in the printer table.

Calibration Logs

Calibration Reports are of two types: cycle and final.

Cycle Reports are generated every cycle and require that the **autolog** be set in the stream_method table:

```
CALIBRATION LOG ANLZ:142 17-MAY-2000 09:13:54
APPLICATION: Six TCDs METHOD: MetTest DETECTOR: TCD U3
COMPONENT OLD NEW % CHG MEASURED STANDARD MARGIN
NAME FACTOR FACTOR CONC CONC
C1-U3 127479 127186 -0.23 1 1 0
C2-U3 191017.6 187837.7 -1.66 9.83 10   0
```

Final reports are generated at the end of autocalibration or when calibration is manually accepted. In the case of autocalibration, the report shows whether any margins have been exceeded(margins are set in EZChrom) :

```
CALIBRATION LOG ANLZ:142 17-MAY-2000 09:18:06
APPLICATION: Six TCDs METHOD: MetTest DETECTOR: TCD U3
COMPONENT OLD NEW % CHG MEASURED STANDARD MARGIN
C1-U3 127479 131574 3.21 1.03 1 0
C2-U3 191017.6 195338.7 2.26 10.23 10 0
Calibration Accepted
```

Leave **autolog** off, if you want only the final report. In order to generate either calibration report, **calibration_def** must be indicated in the printer table Calibration reports are limited to a 3 printers.

Parameter Reports

Starting with Version 3.1, you can print a report from the parameter table, which can store large quantities of data generated from MaxBasic programs. All parameter streamcontexts must be the same for data to be printed together. Designate up to two header lines for the report. Create a print flag to control printing. An example parameter table:

	appcontext	streamcontext	parameter_id	parameter_name	value	qid	qtype
	100	41	-1	header 1	Header 1	NULL	NULL
	100	41	-2	header 2	Header 2	NULL	NULL
	100	41	-3	print flag	0	NULL	NULL
	100	41	1	Parameter 1	1.23	NULL	NULL
	100	41	2	Parameter 2	4.56	NULL	NULL
	100	41	3	Parameter 3	7.89	NULL	NULL

All of these parameters have the same appcontext, streamcontext. Parameter id %1 is used for the first heading, parameter %2 is the second heading, and parameter %3 is the print flag. A print to a properly set up printer will occur when the print flag value is changed to 1(it will automatically be reset). In this case, the report would look like:

```
DATA LOG ANLZ:141 10-FEB-2000 15:48:03
Header 1
Header 2
Parameter 1 1.23
Parameter 2 4.56
Parameter 3 7.89
```

MaxBasic Reports

Starting with Version 3.100, Custom reports can be generated from MaxBasic. This allows you to print virtually anything. Only tabs and newline formatting is available, but you have MaxBasics format$() function to format the data. Here is a program example, using specially written MaxPrint and EndPrint functions(Available from Customer Service).

```
Sub main()
Call MaxPrint(1,"This is a test report^n^n"
Call MaxPrint(1,"Result1^tResult2^tResult3^tResult4^n")
Call MaxPrint(1,"1.11^t2.22^t3.33^t4.44^n")
Call EndPrint(1)
End Sub
```

The report looks like:

```
Result1 Result2 Result3 Result4
1.11    2.22    3.33    4.44
```

6.11 Remote Master Slave

Starting in version 4.2 remote Master/Slave applications can be defined. These applications must be on a Maxum, NAU, Advance Plus, or MicroSAM.

Setup the Master application with the **rem_anlzref** of the slave. The **rem_master** remains blank.

Setup the Slave application with the **rem_anlzref** of the Master AND the **rem_master** is the **application_id** of the Master.

When the Master is placed in run, a network message is sent to the Slave to go into run (a slave that is out of service will not be run). The streams are automatically synchronized. When the Slave completes, it sends the results to the Master, as in local Master/Slave operation.The merging of results may be blocked by placing a -1 in the pgmval attribute of the result table.

Version 4.4 and 5.1have an added capability for masters to wait for calibration and validation of the slave.

6.12 Printing Reports to File on the Workstation

Starting in Version 4.3, you can direct your printed reports to be saved for later delivery to the workstation utility MaxumPrintClient. Designate your printer to be type 5. You must also have the MaxumPrintClient running on the workstation to receive the reports. If the workstation utility is not running, the reports will be stored for a limited amount of time and then deleted. The MaxumPrintClient is started under System Manager Tools.

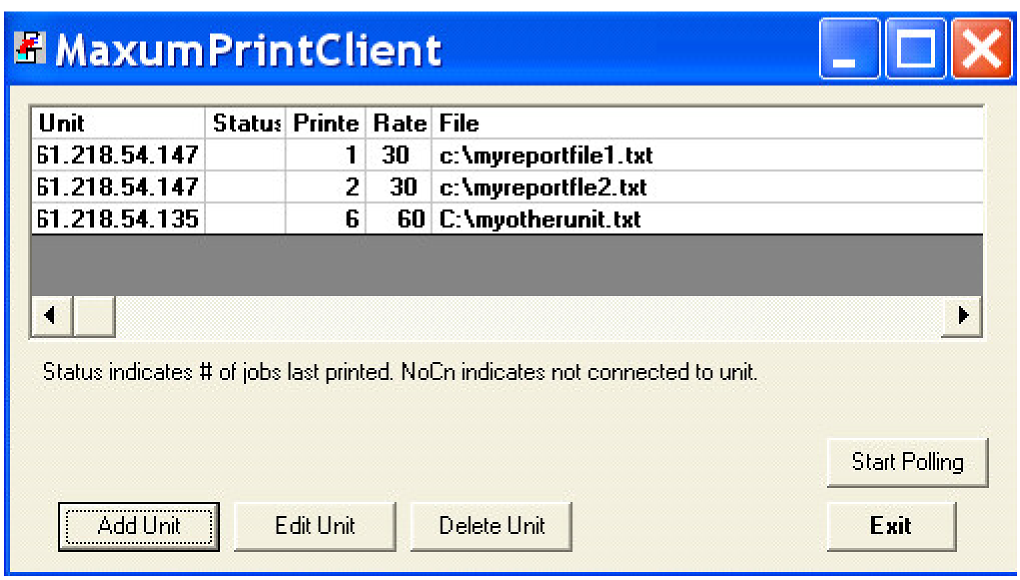


Figure 6-6 printclient1

Use Add Unit to add a new unit for receiving reports. The File Designated will be appended with new reports as the utility runs. Start Polling will tell the utility to extract the reports from the units designated at the rate specified. Multiple reports can be extracted at a time, so there is no need to time the rate to match the cycle time. Once the reports are extracted, they will be deleted from the GC. If the workstation utility is not getting the reports, the GC will alarm periodically.

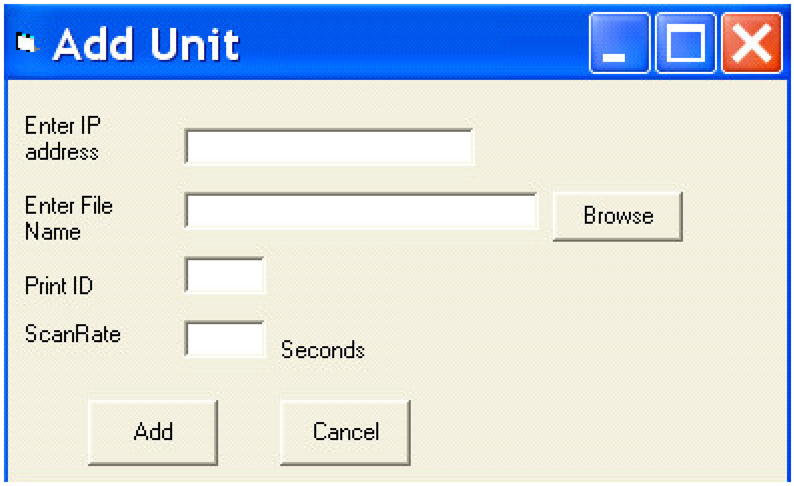


Figure 6-7 printclient2

6.13 Optimizing External Results

Prior to version 4.2, the mechanism for receiving external results (see extresult table in the Table reference) was not optimized. A large amount of results from the same remote analyzer/stream could cause a delay in processing.

For version 4.2+ a different mechanism is used to reduce the amount and frequency of messages to transfer the results.

To set up for optimized external results:

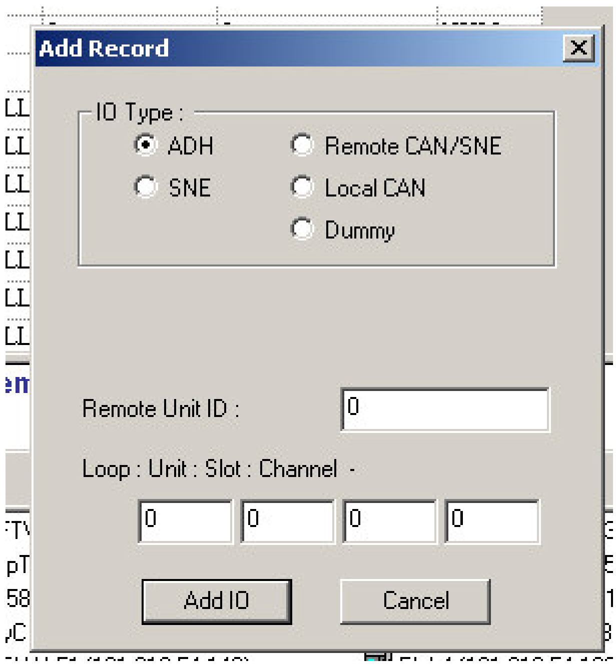
On the source analyzer, designate a host table entry with type set to 9. (it is not necessary to designate results with the **trtval** attribute, since all results are transmitted in a single message). On the target unit, define entries in the **extresult** table.

6.14 How can an application be required to wait until temperature or pressure is reached?

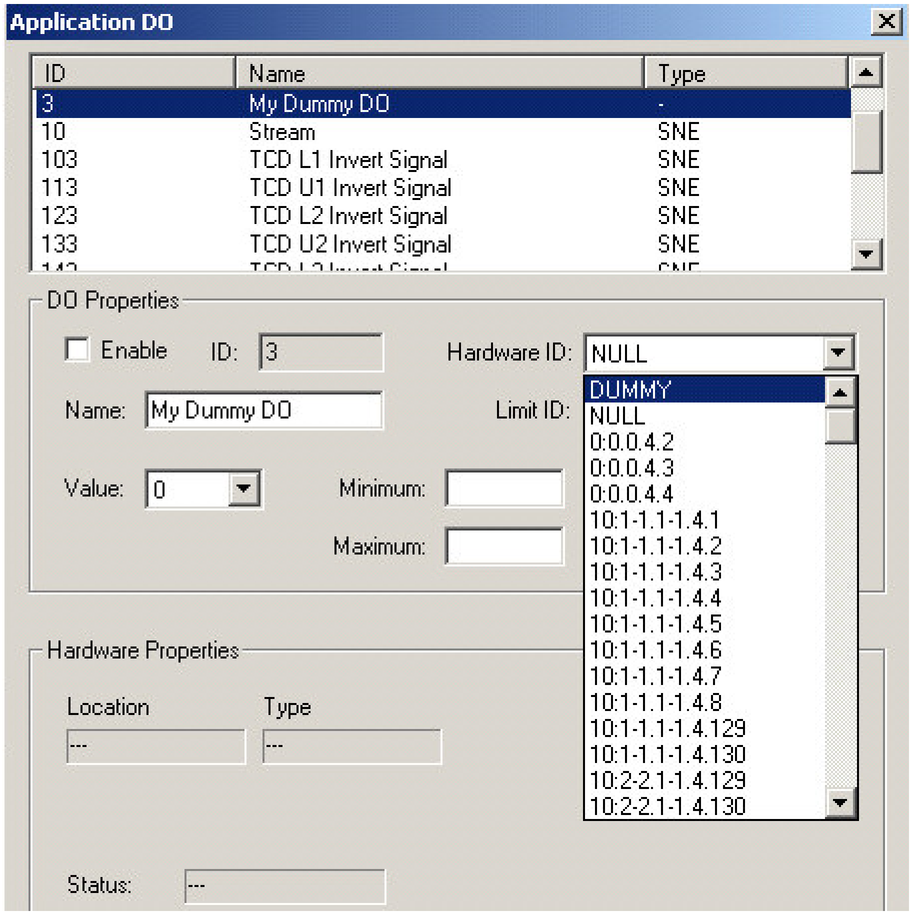
Causing the application to pause and keep the cycle from beginning is controlled by a temperature or pressure program entered into EZChrom. This became available in database version 3.0 and is independent of the temperature controller version. The app_tempctl and app_pressctl tables contain attributes **equilibrate**, **maxwait**, and **maxdelta**. Equilibrate must be true(false is default), maxwait indicates the number of seconds that the application will wait until going into hold and issuing an alarm. Maxdelta gives the closeness in degrees/pressure units that the temperature/pressure needs to be before the application is released to run. After equilibrate is set to true, the EZChrom instrument must be reconfigured. Add a temperature/pressure program entry for wait(the first step) with a setpoint. When the application is in the waiting state, it will appear as WAIT on the HMI.

6.15 Creating a Dummy IO

There are times when setting up an IO that is not tied to any hardware is required. This would allow for passing information to another unit on the network through remote IO. In Version 4.0 this can be done by adding a sys_io(in SM, displaying the sys_do table and adding a record):



Indicate Dummy. Then add an application DO record:



When Dummy is selected, the application DO can be used to store values from a program or valve event.

Note that in version 4.0 only one type of Dummy record is possible(AO, DO, AI, or DI)depending on the one that is defined first.

After version 4.2 the only requirement is for uniquely named Dummy IO.

6.16 Using the Built-in Programs Using Program Table DBFunction

From Version 4.2, a new feature is added to the Program table to run some common functions without using MaxBasic. These built-in functions are easily invoked (especially with the new value arguments) and are optimized for quick execution. The DBFunction attribute in the Program table is set to one of the following. Items in green are new to 4.3 and 5.0. The item in brown was added in 5.1.

dbfunction	New to 4.3/5.0	description	iargs	rargs	
1	OLD	Normalize	1=index of total result		requires pgmval in the result table to designate which results replaces the buffered_values of the original results
1	NEW	Normalize	1=index of total result 2=parameter id with list of results to normalize		uses a comma separated list in the parameter value to identify the result to normalize replaces the buffered_values of the original results
1	NEW	Normalize	1=index of total result 2=parameter id with list of results to normalize 3=parameter id with list of results for normalized values		uses a comma separated list in the parameter value to identify the result to normalize Use the 2nd list of results for the normalized values, preserving the originals
2	OLD	Enable DI	1=ID of application DI		
3	OLD	Disable DI	1=ID of application DI		
4	OLD	Application Inservice			
5	OLD	Application out of service			
6	OLD	Shutdown	1=application (optional)		
7	OLD	AO set from result	1=stream id of result 2=result index 3=ID of application AO		
8	NEW	I/O into result	1=type (see Statmon documentation) 2=ID of I/O 3=stream_id for result 4=Index of result		Place an I/O value into a result. Can be scheduled at any time in cycle.
9	NEW	Peak or Group value into result	1=Type (see Statmon documentation) 2=method 3=channel 4=peak or group id from ezchrom result table 5=result index of target result		Place a peak or group value into a result. Best done an end of cycle.
12	NEW	FlameSense (used with program 13)	1=detector ID 2=parameter ID for saved detector signal		These are patterned after the MaxBasic programs that we use in the US. The parameters work exactly the same as with the Maxbasic. These were tested and confirmed by Bob Bade.
13	NEW	FlameLight (used with program 12)	1=detector ID 2=Pressure AO ID 3=Parameter for saved signal ON 4=Parameter for saved signal OFF 5=Power DO ID	1=threshold 2=pressure	
14	NEW	FlameControl (used with programs 15,16,17)	1=DO id 2=program ID 3=Pressure AO ID	1=pressure	These are patterned after the MaxBasic program used in Khe. The parameters work just the same as the MaxBasic programs. These were test and confirmed by Adreas Fritz.
15	NEW	DI on	1=ID of application DI		
16	NEW	DI off	1=ID of application DI		
17	NEW	enable program	1=ID of program		
18	NEW	disable program	1=ID of program		
32	OLD	transmit results			

Figure 6-8 DBFunctions

Details

1: Normalization	The normalization function can be run 3 different ways: 1. With 1 Iarg, the function normalizes values in the result table that have the pgmval attribute set. The Iarg indicates the result_index of the unnormalized total. 2. With 2 Iargs, the function normalizes values that are stored in the parameter table in a comma delimited list. The first Iarg is the result_index of the unnormalized total. The second Iarg is the parameter ID of the result list. 3. With 3 Iargs, the function normalizes values that are stored in the parameter table in a comma delimited list. It stores the normalized values in a second list of results, retaining the original result values. The first Iarg is the result_index of the unnormalized total. The second Iarg is the parameter ID of the result list. The third Iarg is the parameter ID of the list for storing the normalized values.
2: Enable DI	Enables the DI that is designated in the first integer argument.
3: Disable DI	Disables the DI that is designated in the first integer argument.
4: Application In service	Places the Appcontext application in service.
5: Application Out of service	Places the Appcontext application out of service
6: Shutdown analyzer	Disables all temperature controllers, pressure controllers and puts Appcontext application in HOLD. Version 4.4/5.1: added optional iarg for applicaiton.
7: Set AO from result	For the appcontext application, sets AO value from the saved_value of the result. The Stream is the first integer argument, the result_index is the second integer argument and the AO id is the third integer argument.
8: IO to result. IO (added Version 4.3/5.0)	The first Iarg is the type of IO designated from the Statmon table list: • APPAI.VALUE = 400 • APPAI.AVERAGE = 401 • APPDI.VALUE = 410 • APPAO.READBACK = 420 • APPDO.READBACK = 430 The second Iarg is the ID of the IO. The third Iarg is the stream_id of the target result and the fourth Iarg is the result_index for the target result.
9: Peak or Group value to result (added Version 4.3/5.0)	
12 and 13: Flamesense and FlameIgnite (added Version 4.3/5.0)	Functions 12 and 13 work together and the GC must be configured in a similar fashion, but not exactly. Argument configuration can be confusing. Contact Customer Support for assistance.
14,15,16 17: FlameControl (TS 101) (added Version 4.3/5.0)	Functions 14, 15, 16, 17 work together the GC must be configure the same way as the MaxBasic versions of these programs. This configuration is complex. Contact Customer Support for assistance.
15: DI ON (added Version 4.3/5.0)	Sets the DI ON that is designated in the first integer argument.
16: DI OFF (added Version 4.3/5.0)	Sets the DI OFF that is designated in the first integer argument.
17: Enable Program (added Version 4.3/5.0)	Enables the Program that is designated in the first integer argument.

18: Disable Program (added Version 4.3/5.0)	Disables the Program that is designated in the first integer argument
32: transmit result	For the appcontext application and the running stream, transmit results.

6.17 User Examples

6.17.1 Examples Introduction

The examples in this section are intended to familiarize the user with navigating the Siemens Gas Chromatograph Portal and the way common tasks are completed using the Portal. The examples shown are representative examples and are not intended to instruct the user on all possible tasks. For more information on specific tasks and screens refer to the online help files included in the GCP Software.

6.17.2 Managing Alarms

Analyzer alarms are managed via the Alarm Log screen, which available from either the Analyzer tab or any Application tab in the GCP Analyzer view screen. The Alarm Log screen displays information regarding all errors, warnings, and informational messages that exist in the analyzer. The information on this screen is updated automatically when new information is received via broadcast message.

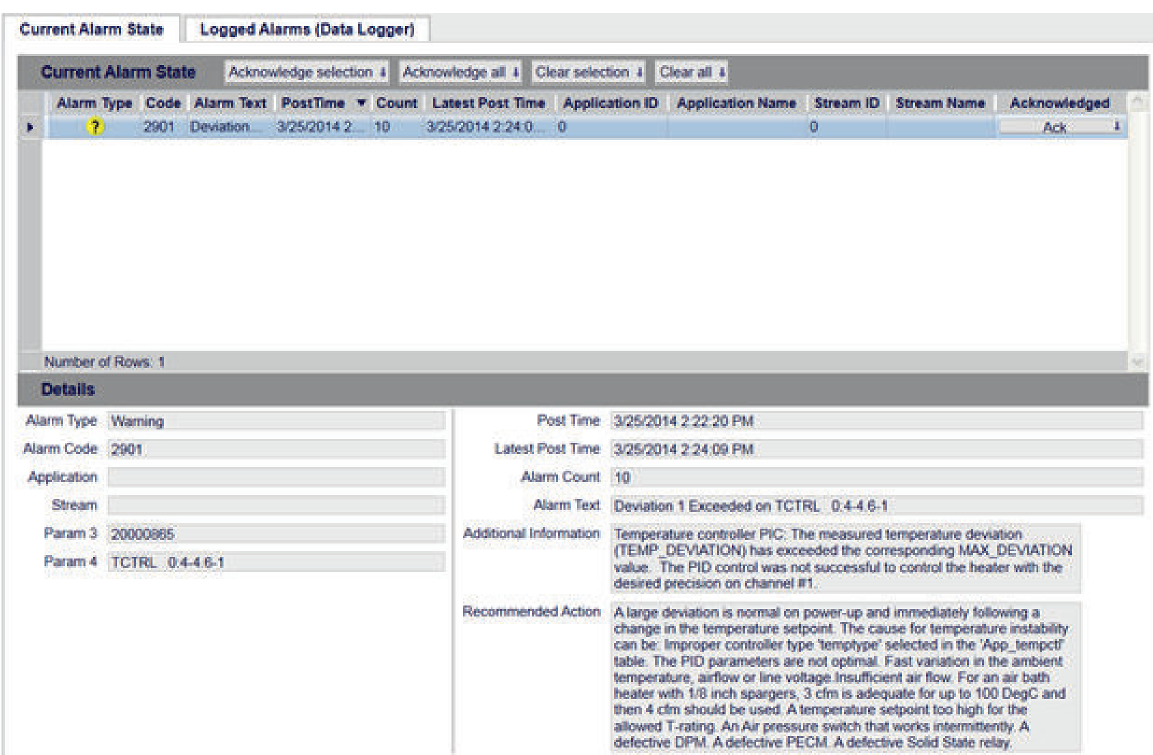


Figure 6-9 Alarm Log Screen

Interpreting the Display:

Alarm Table -

The top pane of the Alarm Log screen is a table of all alarms currently existing in the device. Included in each table line is information regarding the alarm, such as alarm level, time received, alarm text, etc. Alarms in this table may be sorted by clicking the desired column by which to sort. They may also be acknowledged or cleared, by using the relevant button (refer to the User Actions below).

Alarm Types - Different types of alarm status messages may be received from a device. Each message received must be assessed by the user to determine what, if any, further action is required.

Information - When a message is received from an analyzer that does not indicate a fault situation with that particular device, then it is typically classified as an informational message. Informational messages may be purely or information, such as noting that an application has been placed in service, or may indicate that an error situation exists other than in the device, such as a communication error on the network.

Warning - Warning messages typically indicate an abnormal situation with a device that does not usually affect analytical results. Depending on the message, this may be a minor error or a service affecting error.

Error - Error messages indicate faults with a device that are likely to affect analytical results.

Alarm Details -

The bottom pane of the Alarm Log screen includes detailed information regarding the alarm that is currently highlighted from the alarm table. The Gas Chromatograph Portal provides the user with a unique troubleshooting tool in its detailed explanation of alarms and suggestions for recommended actions.

On the left side of the Details pane are the information received from the analyzer. This includes the type, code, applicable application and stream (if any), and any relevant parameters. Parameters are variables that identify specific information about an alarm, such as which device is affected.

The information on the left side of the Details pane is used by Gas Chromatograph Portal to populate the right side of the Details pane. Gas Chromatograph Portal uses this information to build the Alarm Text as well as to populate the Additional Information and Recommended Action fields. The additional information is an extended description of the message. The recommended action provides the user with guidance for troubleshooting. Note that the recommended action is intended to be a brief suggestion to point the user to the most likely cause. It is not intended to be a detailed troubleshooting procedure. Refer to the relevant Maxum documentation for more details regarding troubleshooting, including relevant safety precautions.

Logged Alarms Tab -

Viewing logged alarms is covered in the Data Logger chapter of this manual.

Common User Functions:

Acknowledging Alarms - To acknowledge an alarm the user may click the "Ack" button on the far right of the alarm line (the Acknowledged column). Alternately, the user may select the line and click the Acknowledge Selection button at the top of the table. When an alarm is acknowledged, the "Acknowledged" column for that line changes from the "Ack" button to Yes. To acknowledge all alarms, click the Acknowledge All button.

Clearing Alarms - To clear an alarm, select it in the alarm table and click the Clear Selection button. The alarm should disappear from the list. To clear all alarms in the list click the Clear All button. An alarm that is permanently occurring (such as a purge alarm) may clear and then reappear immediately.

Note

Note that on the buttons to Acknowledge and Clear alarms, there are blue arrows pointing down. This arrow icon denotes changes that are sent immediately to the analyzer. If a button does not have a blue arrow, then it is used for a change or function that does not go immediately to the analyzer (although it might create a change to the database loaded in GCP).

Example of Managing an Alarm Using GCP:

In the image below, a message has been received in the Alarm Log.

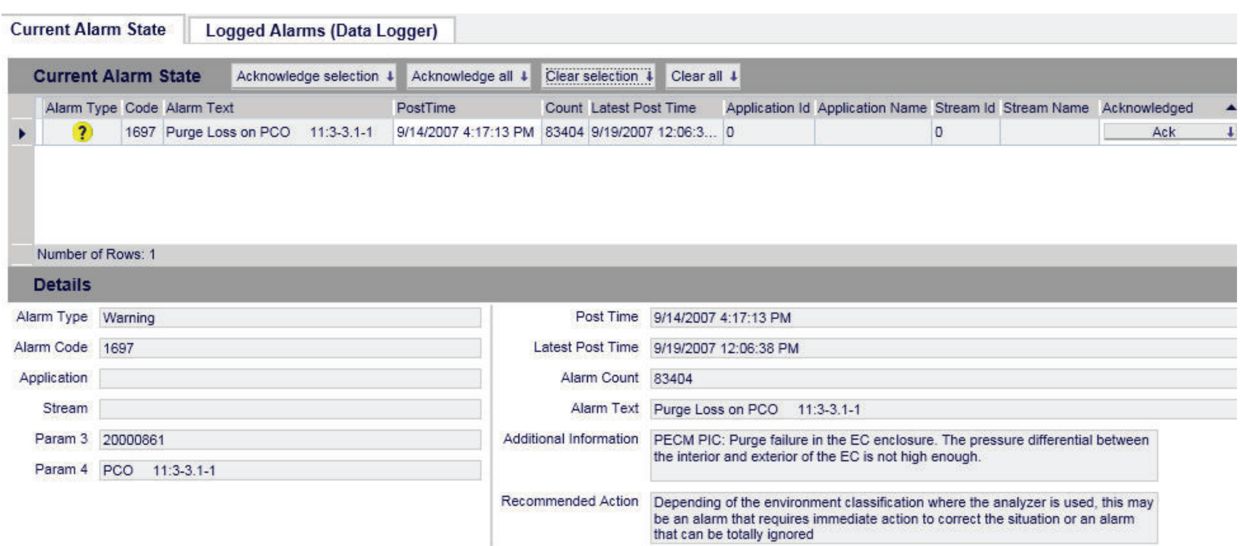


Figure 6-10 Alarm Log Example

From the image, we can see that the message is a Warning (yellow question mark). We can also see other information such as the time the message was reported and the alarm text of "Purge Loss on PCO". We can also see that the alarm is not acknowledged.

From the bottom Details pane, we can see the following extended description and recommended action.

- Additional Information - PECM PIC: Purge failure in the EC enclosure. The pressure differential between the interior and exterior of the EC is not high enough."
- Recommended Action - Depending of the environment classification where the analyzer is used, this may be an alarm that requires immediate action to correct the situation or an alarm that can be totally ignored.

From this we can tell that the Maxum Electronics Enclosure has experienced a loss of purge pressure. This may be due to an opened enclosure door, a failed seal, or some other cause. The urgency of this message depends on a number of factors, including the environmental classification where the analyzer is installed.

In this case, factors indicate that you need to check out the alarm immediately. However, first you choose to acknowledge the alarm by hitting the acknowledge button on the list. This tells other users that the alarm is being worked on.

Figure 6-11 Acknowledging Alarms

After correcting the fault (an open door), you return to the GCP computer. The original alarm still needs to be cleared. Select the alarm line and click the "Clear Selection" button (in this case with only one alarm "Clear All" would have the same effect). The alarm will disappear from the list.

6.17.3 Changing a Method

Method development and modification is a common maintenance function. For Gas Chromatograph Portal, method development is integrated into the analyzer interface for ease of use.

Overview of Changing a Method:

In GCP, methods are changed using the Application Tab for the analyzer. The Method selection on the navigation menu has several sub-topics. Changes can be made to a variety of Cycle Events as well as Peaks, Groups, and Integration Events for each configured detector.

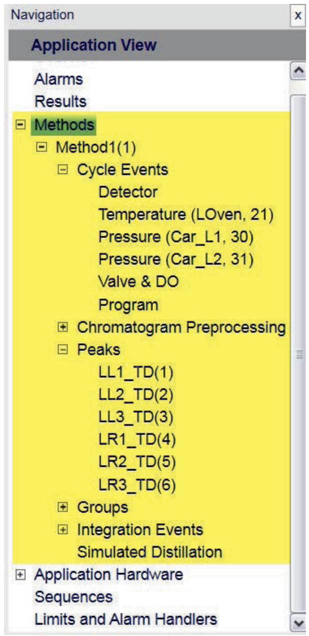


Figure 6-12 Method Tree on Navigation Menu

Methods can be changed and tested offline on the PC without affecting the live analyzer. When a particular setting is changed, the related tree topics turn blue to indicate unsaved information. Multiple changes can be made to the method without saving. After changes are made the user can run an offline analysis and then save, if ready.

The example below is intended to show the user how methods can be easily changed and tested offline and then incorporated into the analyzer.

Example Scenario:

A new column has been installed and minor changes to the method are needed to adjust for the change. You have already installed the hardware and adjusted flow rates by modifying pressure settings using the Maintenance Panel at the analyzer. The application is running and chromatograms are being acquired, but are shifted due to the new column.

You now need to tweak the peak retention times, valve timing, and integration events. To do this, you will connect to the analyzer, look at the current chromatograms, make changes, run an offline analysis and make sure it is correct, and then save the changes. These steps are detailed below.

Connect to Analyzer:

Use the GCP Network Window to connect to the desired analyzer. Select the analyzer and click "Connect".

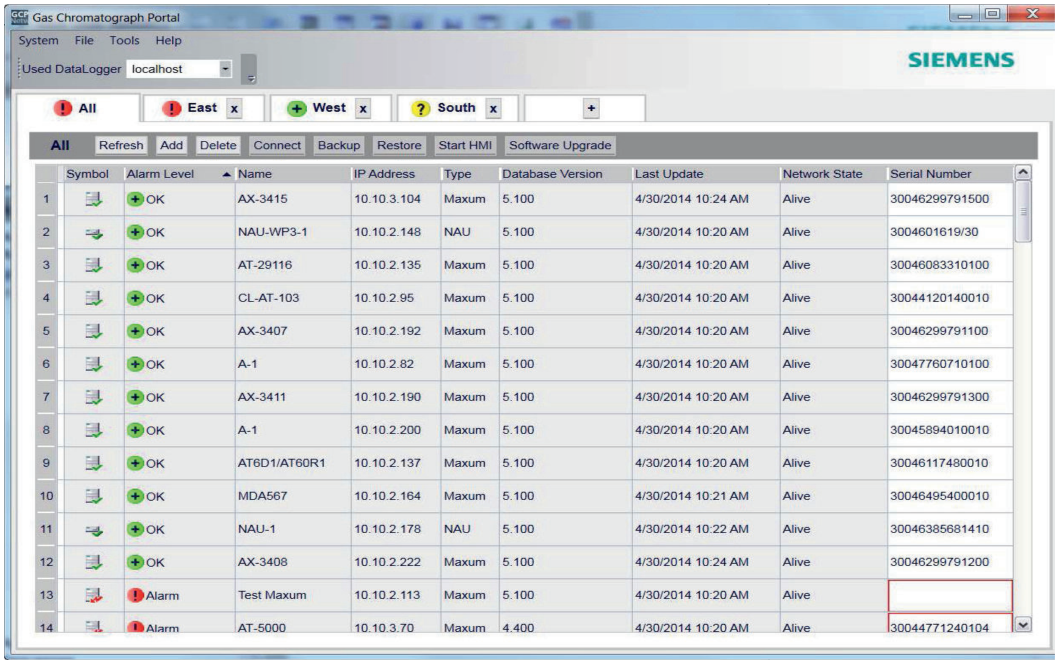


Figure 6-13 GCP Network View - Connecting to an Analyzer

Save Database:

Before attempting to make changes to a method, it is important to make a backup of the database. To backup the analyzer choose "Backup Unit" from the System menu. Enter a file name for the backup and hit "Save". The status window will show the progress until the save completes.

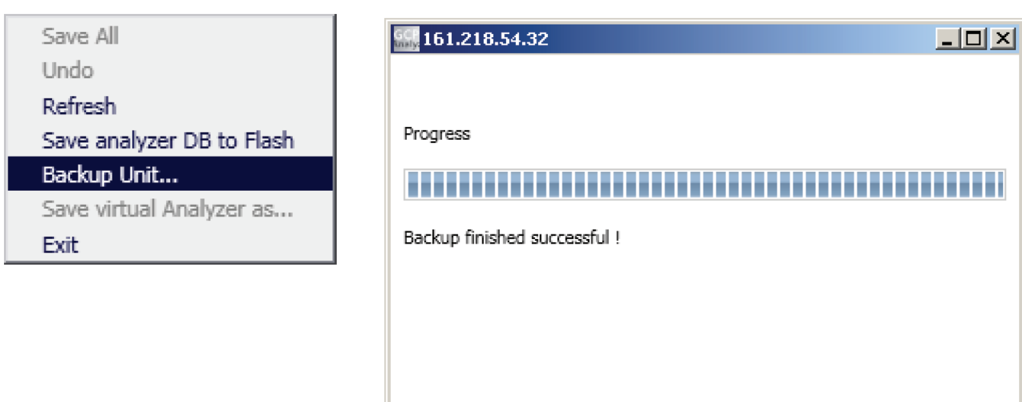


Figure 6-14 Saving an Analyzer Database

Load Chromatograms:

Chromatograms can be loaded using the Chromatogram menu. In this case, choose "Load from Analyzer" and then select the desired stream from the resulting menu.

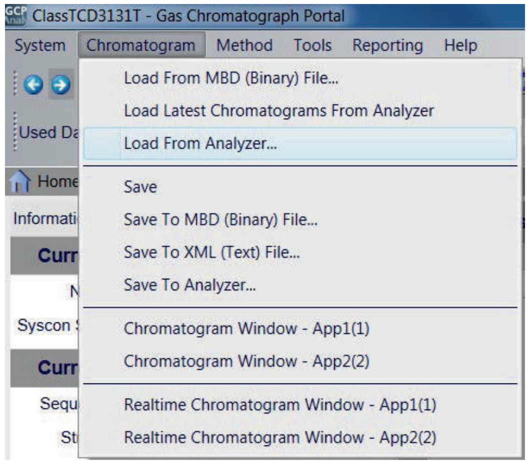


Figure 6-15 Load Chromatogram from Analyzer

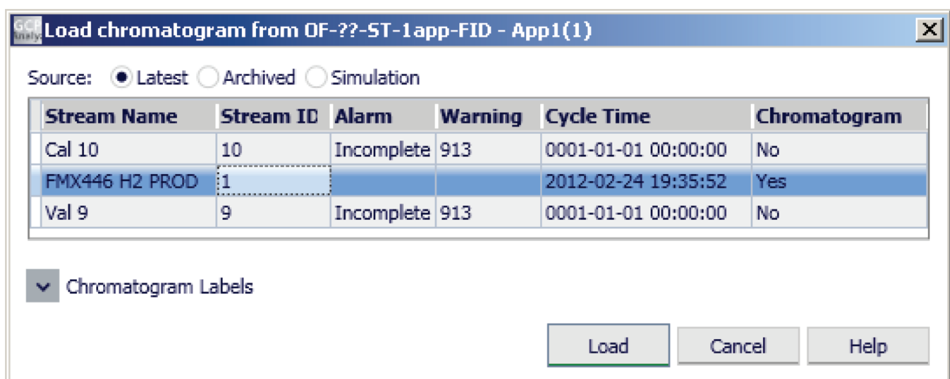


Figure 6-16 Select Chromatogram to Load

View Chromatogram:

When Chromatograms are loaded, the chromatogram viewer will open in a new window. Several functions are available. Some of these include:

- Expand specific chromatograms by clicking the box in the upper right corner of the chromatogram.
- Remove certain chromatograms from the view by clicking the X in the upper right corner of the chromatogram.

- Zoom by holding down the left mouse button and dragging to define the zoom area.
- Click the right mouse button to see multiple functions, including the Zoom Toolbar selection. Selecting the Zoom Toolbar displays several zoom function buttons at the top of the chromatogram.

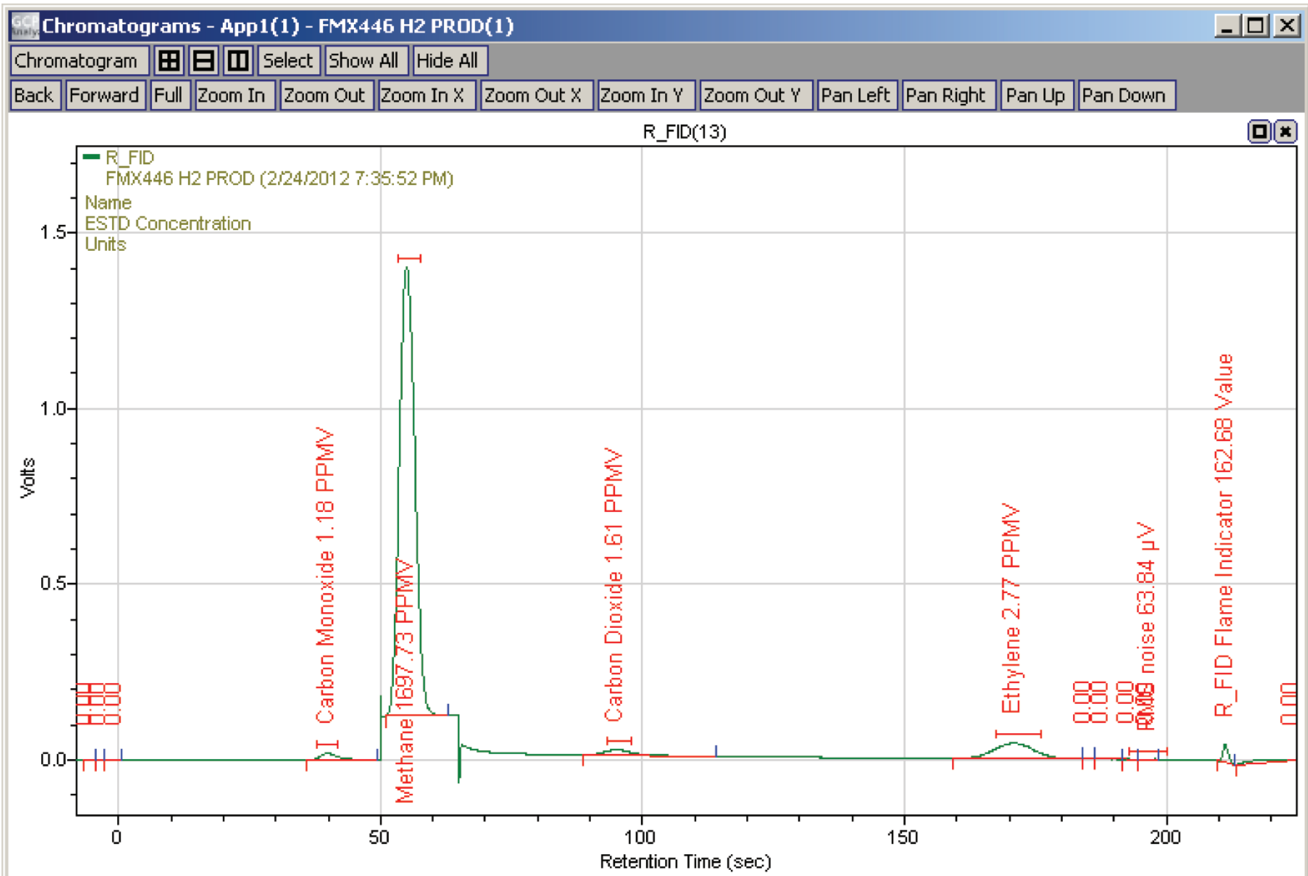


Figure 6-17 The Chromatogram Window

You can also view a chromatogram by selecting a specific detector on the Peaks screen on the navigation menu. To view the chromatogram for the detector, make sure that the chromatogram box at the top of the screen is checked. Clicking the right mouse button on this chromatogram results in a menu of several user functions.

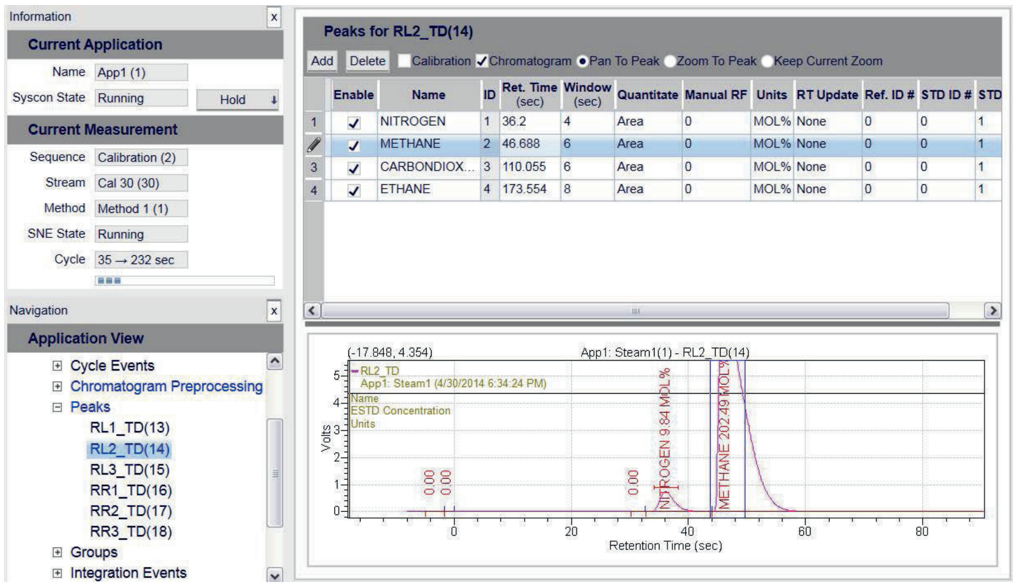


Figure 6-18 The Peak Screen - with Pan To Peak Selected

This way of viewing chromatograms has some advantages over the chromatogram window. Only the chromatogram for the selected detector is shown. There are also two special features that allow the user to view a particular peak. In the above image, the Methane peak is selected. The "Pan To Peak" circle is selected at the top of the window. This highlights the Methane peak on the chromatogram using blue bars.

There is also a "Zoom To Peak" feature. When Zoom To Peak is used, the chromatogram zooms in on the selected peak as shown below. For both Pan To Peak and Zoom to Peak, the blue bars represent the Retention Time and Window attributes

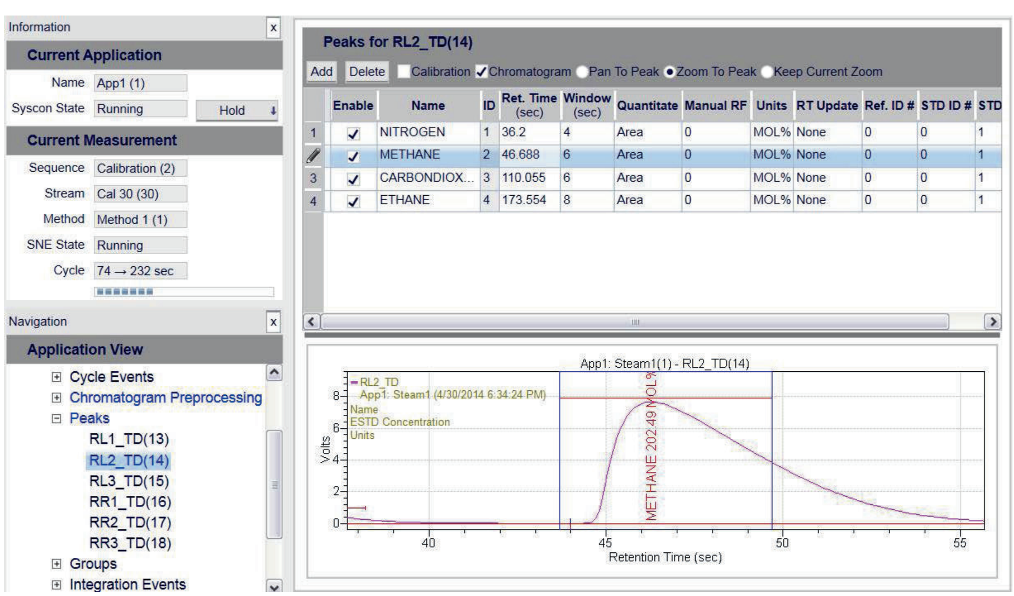


Figure 6-19 The Peak Screen - with Zoom To Peak Selected

Modifying a Peak

To change settings for a peak, simply click on the setting and make the desired change. As soon as a change is made, the blue bars in the chromatogram are updated.

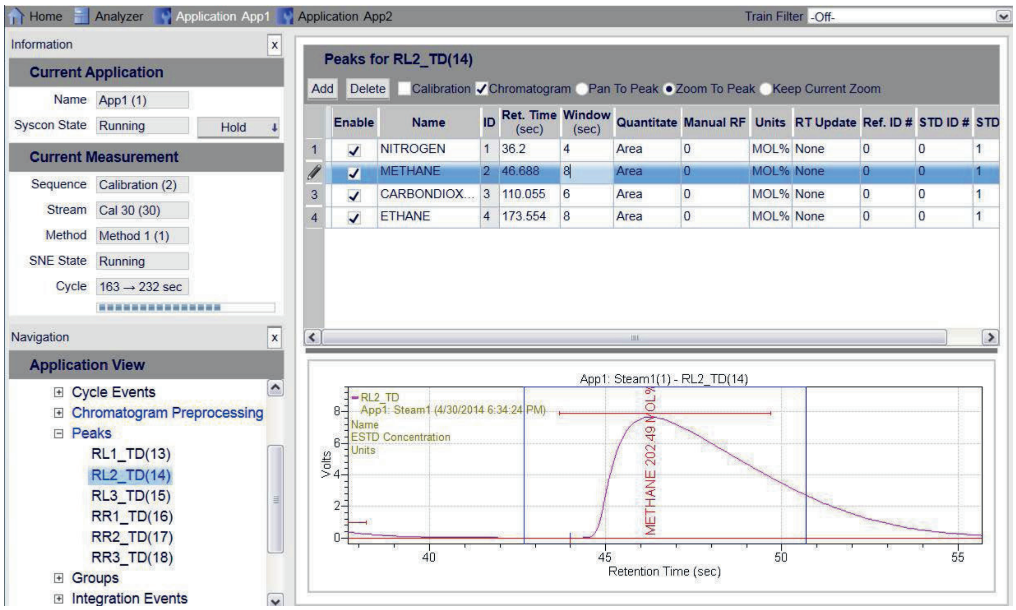


Figure 6-20 The Changed Peak

Modifying Valve Timing

To change valve timing, select the Valve & DO menu item under Cycle Events (you can also choose the main Cycle Events screen to see all events, including Valve timing). At the top of the Valve & DO screen there will be a "Cycle Graph" box. Check this box to see the cycle events in an overlay with the chromatograms. The cycle graph feature is useful to help visualize how valve timing (and other cycle events) will affect the chromatograms. In the Cycle Graph you can reduce the amount of information in the graph in different ways, such as using the Select buttons to select specific detectors or events.

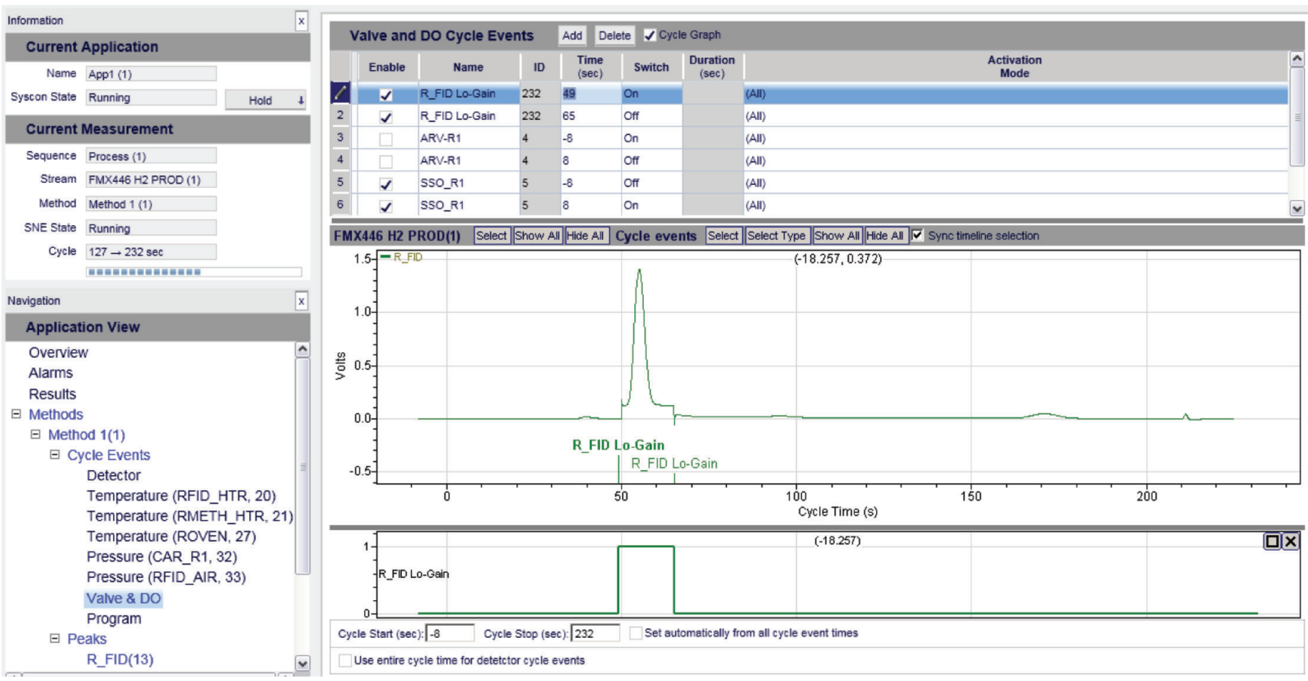


Figure 6-21 Changing a Valve Event - With Cycle Graph Shown

To change valve timing, select the setting and make the desired change. Modifying the valve timing (or other cycle event) immediately changes the cycle graph.

Modify Integration Events:

To change integration events click on Integration Events and the desired detector. As with the Peak screen, the Integration Events screen has a selection box to show the chromatogram at the bottom of the screen.

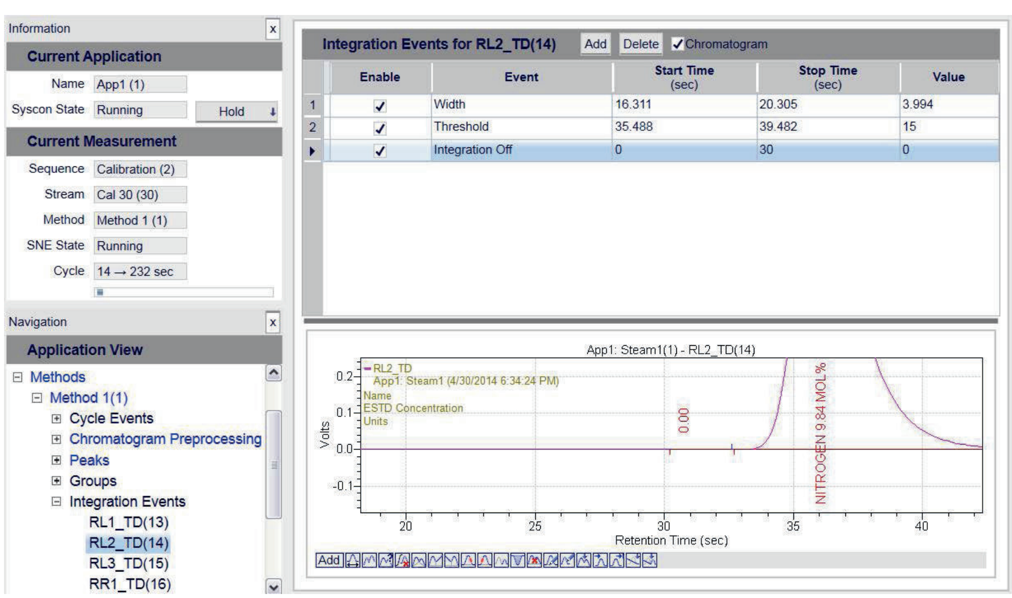


Figure 6-22 Changing Integration Events

When an integration event is selected, the timing for that event is noted by blue lines on the chromatogram. Changing timing for an event immediately changes the location for the bars.

Testing the Changes:

After all desired changes are complete, you can click the Analyze button on the toolbar to perform an offline analysis. Choose the "Chromatogram" menu and then "Chromatogram Window" to view the chromatogram that has now been analyzed with the new changes.

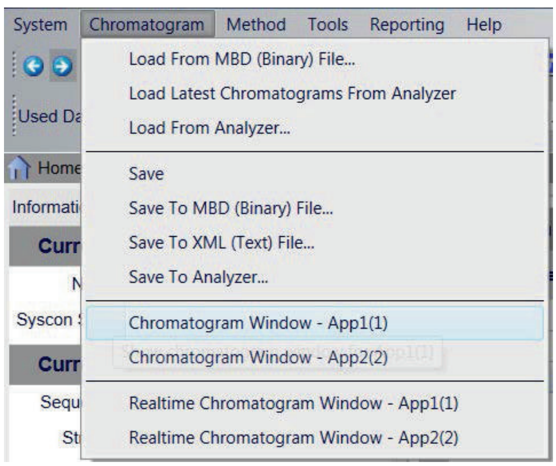


Figure 6-23 Opening the Chromatogram Window

Saving Changes to the Analyzer:

If the changes are satisfactory, then you can save by clicking the Method menu at the top of the GCP window and then "Save To Analyzer". This will save all method changes to the analyzer. After this, the changes will be live.

Note that saving the method to analyzer is a change to RAM. If the analyzer is rebooted, then changes will be lost. Perform Save To Flash, from the GCP System menu if you wish to make changes permanent.

6.17.4 Calibrating a Method

Overview:

Calibration is another change to the method similar in many ways to the changes described in the previous example for changing a method. Calibration is accessed from the Method Peaks screen described in the previous section. Calibration functions are accessed on this screen by clicking the box labeled "Calibration".

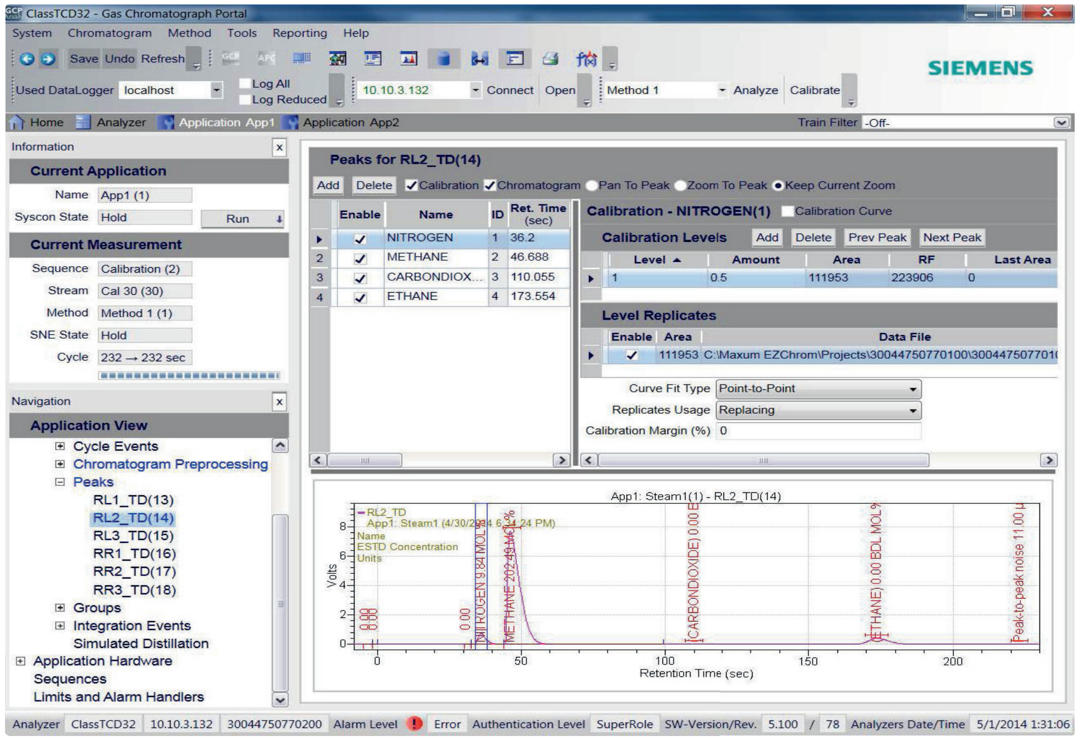


Figure 6-24 Peak Screen - Calibration

As each peak is selected on the left pane, the calibration settings for that peak are displayed on the right. The example below is designed to give the user a basic idea of modifying a calibration and performing an offline calibration based on the modified settings.

Example Scenario:

A new calibration standard has been installed with slightly different concentrations than the previous standard. You need to change the calibration levels and recalibrate the current method.

User Actions:

Perform the following actions to change the calibration levels:

- Select Peaks from the Method on the Navigation Menu and then select the first detector. This displays peaks for the first detector.
- Click the Calibration checkbox to see calibration settings.
- Select the first peak (in this case Carbon Monoxide).
- In the Calibration Level settings, change the Amount attribute to match the new calibration standard.

- Select the next peak for the detector and change the Amount attribute. Repeat for each peak.
- Select the next detector under the Method Peaks menu and change settings for each peak. Repeat for all detectors in the method.

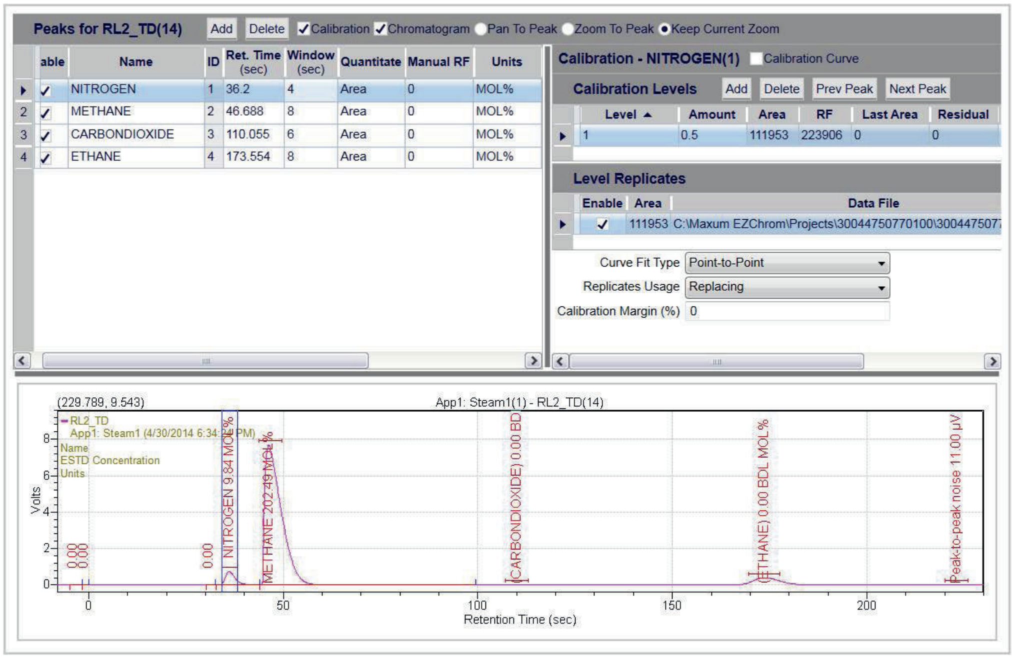


Figure 6-25 Changing Calibration Level Settings

- When all calibration level settings have been modified, then you can calibrate using the currently opened chromatograms.
- You can now save the method to the analyzer.

6.17.5 Checking Results and Creating an Alarm Limit

Results and Limits:

Chromatographic results can be viewed on the "Results" screen on the Navigation menu. It is possible to view and compare results in different ways. It is also possible to automatically monitor results in other ways, such as using a Limit associated with a user defined Alarm.

Results Overview:

Chromatographic results can be viewed on the "Results" screen on the Navigation menu. Results are available either from the Analyzer view or from the Application view, although the features available from these views are somewhat different.

Results from the Analyzer view - A table of all current results is shown. The information available on this screen is more limited than from the Application view. On this screen there are tabs for viewing external results and for viewing logged results from the Data Logger archive.

Results from the Application view - Only current results for the selected application are shown. This view has several extra tabs for displaying additional information and changing some information.

The example in this section will use the Application view results screen.

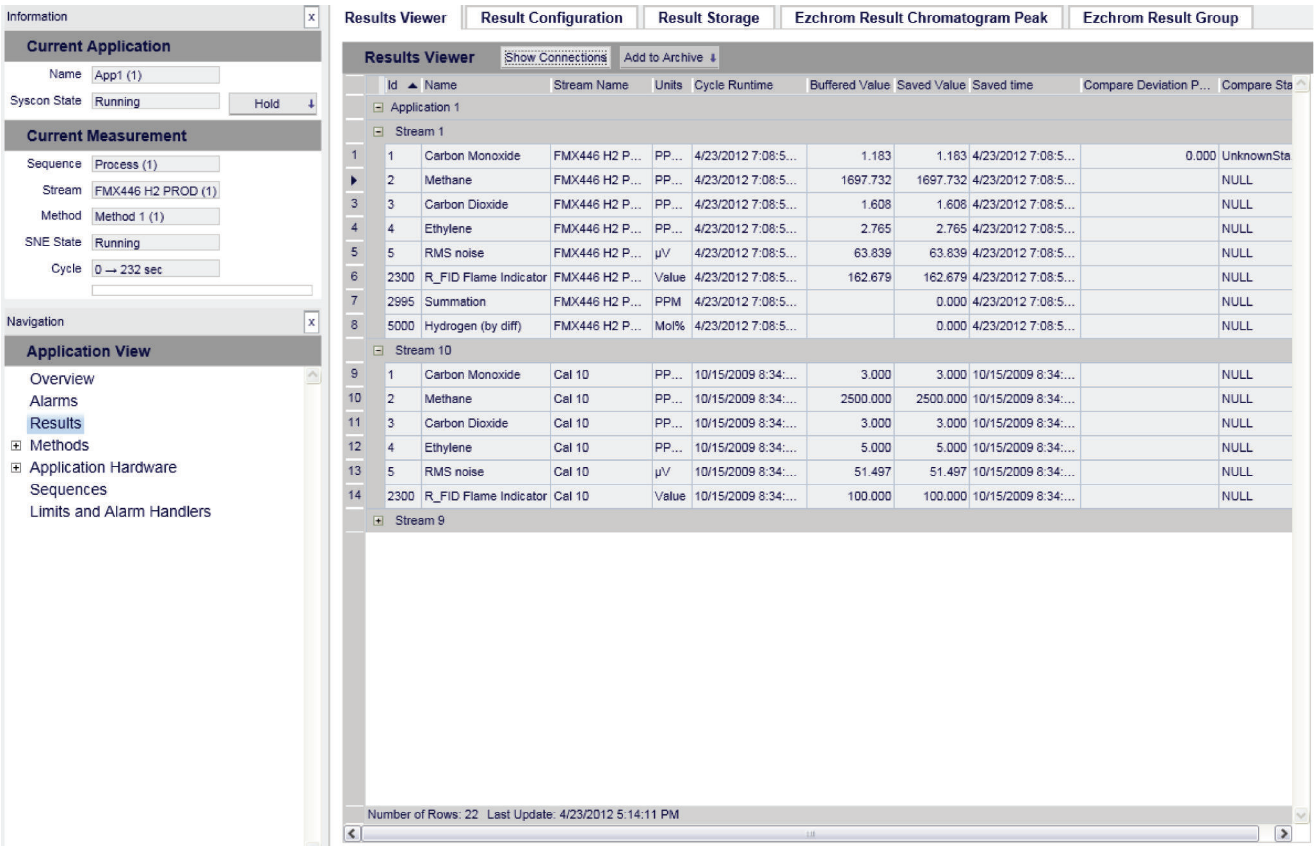


Figure 6-26 Result Viewer

Interpreting the Results Display:

Results Viewer Tab:

The display pane shows results for each stream. When first opened, the results for each stream are collapsed. Click the small "+" icon next to the stream to expand results for that stream. Click the "-" icon to collapse the list again. Various data relating to the results are shown in the table. Note that clicking on a column will sort results according to that column. Columns can also be resized by clicking and holding the left mouse button over the space between the column names and then dragging left or right to resize.

There are two buttons on the main Results Viewer screen.

- "Show Connections" - Displays a diagram of connected database elements, such as which detector the result relates to or whether the result is sent to Modbus. This is shown at the bottom of the display window.
- "Add to Archive" - This button adds the current results for the selected stream to the archive stored on the analyzer. The blue down-arrow indicates that this information is transmitted to the analyzer immediately.

Result Configuration Tab:

The second tab can be used for changing various properties related to the selected result. When a change is made the relevant fields turn blue. This indicates unsaved database information. If you wish to keep changes, then the database must be saved using the Save function. Navigating to a screen other than Results forces the user to either save or discard changes.

Result Storage Tab:

This tab accesses the archive on the analyzer. Results are added to the archive using the ""Add to Archive" button on the Results Viewer. Results are shown in a table similar to the Results Viewer. One useful feature of this table is the ability to sort by column (which can be done with most any screen). Sorting by Result Name allows the user to easily compare the same result as archived over time.

EZChrom Result Chromatogram Peak:

This tab is used to show detailed information related to the peaks that are defined within the method for the results.

EZChrom Result Group:

This tab is used to show result information for any groups that are defined within the method.

Limits and Alarm Handler Overview:

A limit is used by the analyzer database detect certain conditions for I/O, results, or external results, and create certain outputs based on those conditions. An example is setting a limit to check for an abnormally high value on a result, and outputting an alarm in response.

Limits are created and administered using the "Limits and Alarm Handlers" screen on the Navigation Menu for the Application view. To implement a limit, two database entries must be created. The first is the entry to the Limit table. The second is the Alarm Handler entry to the alarm table (creating the user alarm, setting the text, and setting other optional attributes for the alarm). After the Limit and Alarm Handler are created, then they must be attached to each other. To make the process as easy as possible, the GCP software integrates these changes all on one Navigation menu item, Limits and Alarm Handlers.

Interpreting the Limits and Alarm Handler Displays:

Limits Tab:

The upper left part of the display pane shows the limits that have been created and allows the user to create or delete limits. The upper right part of the display pane allows the user to attach a limit to a source (I/O, results, or external results). Adding an item to the "Used By" list causes a dialog box to be displayed. This dialog is described in the example later in this section.

The bottom half of the display pane is used to associate the created limit with an existing entry in the alarm handler table. Four types of alarm associations are available as shown below. The user may activate any combination of the four with a different threshold for each.

- High - Creates an alarm warning message when the value goes above the threshold specified.
- High High - Creates an alarm fault message when the value goes above the threshold specified.
- Low - Creates an alarm warning message when the value goes below the threshold specified.
- Low Low - Creates an alarm fault message when the value goes below the threshold specified.

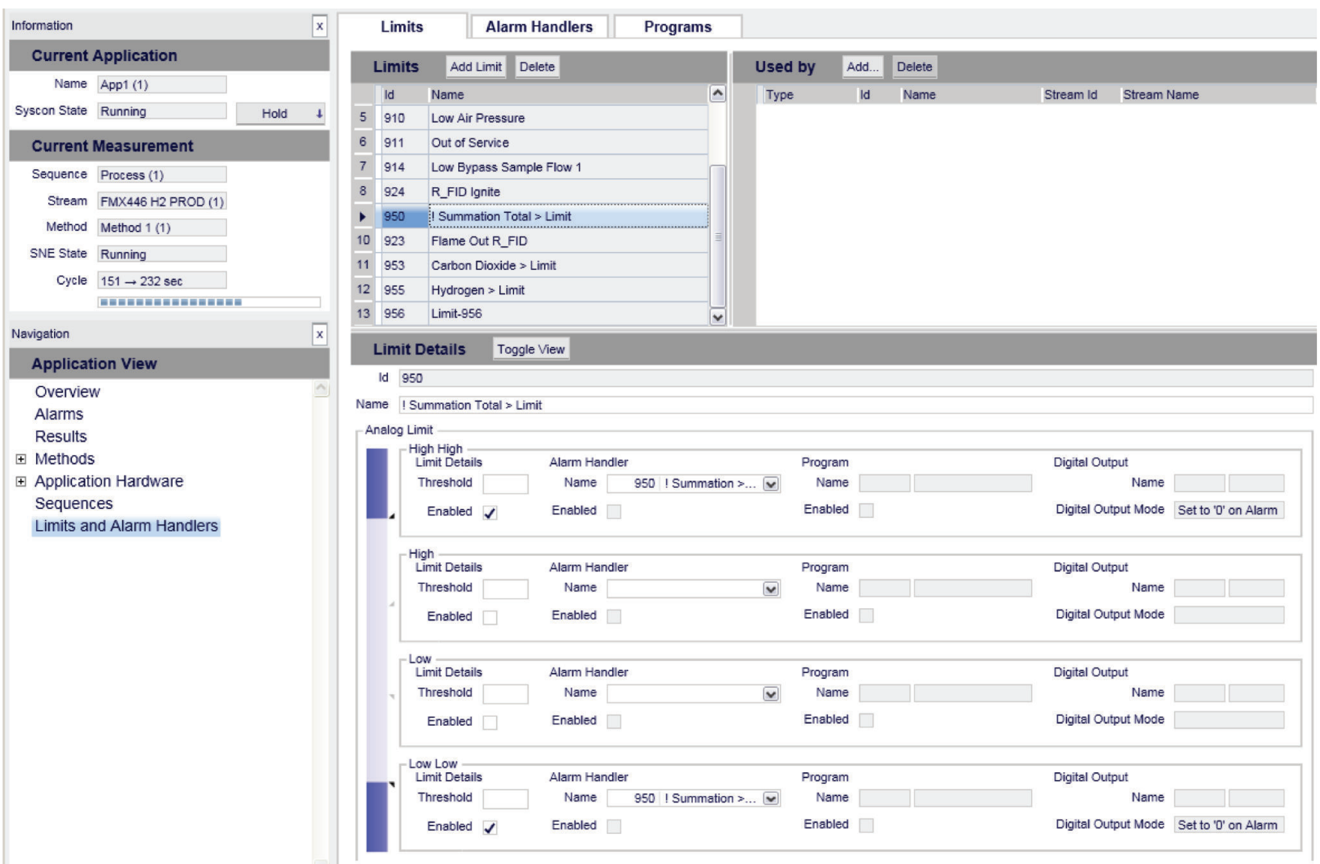


Figure 6-27 The Limits Screen

Alarm Handler Tab:

The alarm handler tab is for creating user defined alarm messages. This alarm information can be associated with a limit from the Limit table as described for the Limits tab.

The left part of the display pane shows the list of existing Alarm Handlers and allows the user to add and delete Alarm Handlers. The right part of the display pane shows the configuration details for the selected alarm handler.

Information in the Configuration is as follows:

- Alarm Code - This is the automatically assigned code. At the time of creation a new code can be selected. Alarm codes 900-996 are for user defined alarms.
- Text - This is the user defined alarm text.
- Enabled - Identifies whether the Alarm Handler is active or not.
- Digital Output - It is possible when the limit criteria is true, to have the alarm handler trigger a Digital Output (DO). The "Digital Output" box reveals a drop-down menu of available DOs. This works in addition to the alarm function.
- Digital Output Mode - This identifies whether the selected DO will be either 0 or 1 when the alarm is active.
- Program - It is possible when the limit criteria is true, to have the alarm handler trigger the execution of a program. The Program attribute is a drop-down menu of available programs.
- Program Enabled - This checkbox enables the Program attribute. It must be checked for the program to run when the limit is true.

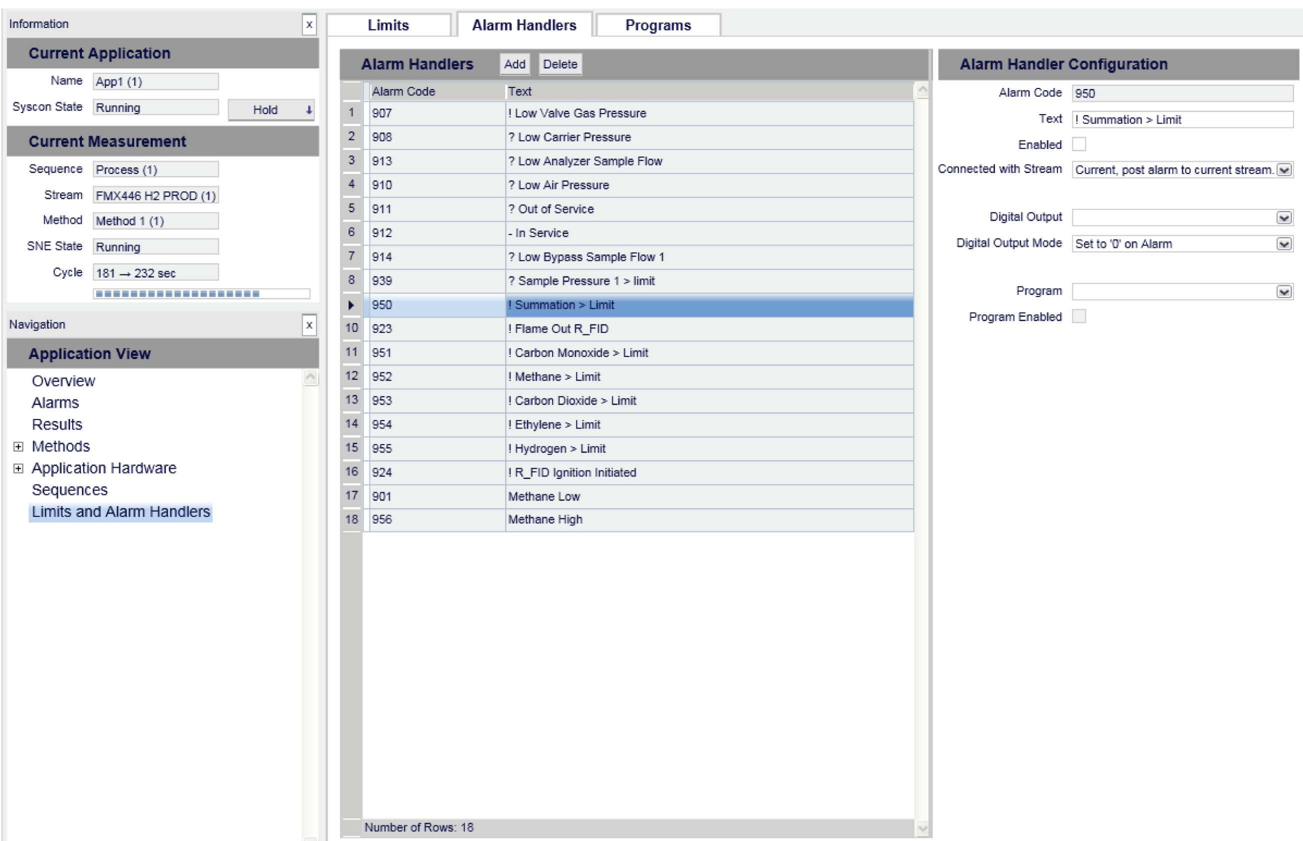


Figure 6-28 The Alarm Handler Screen

Programs Tab:

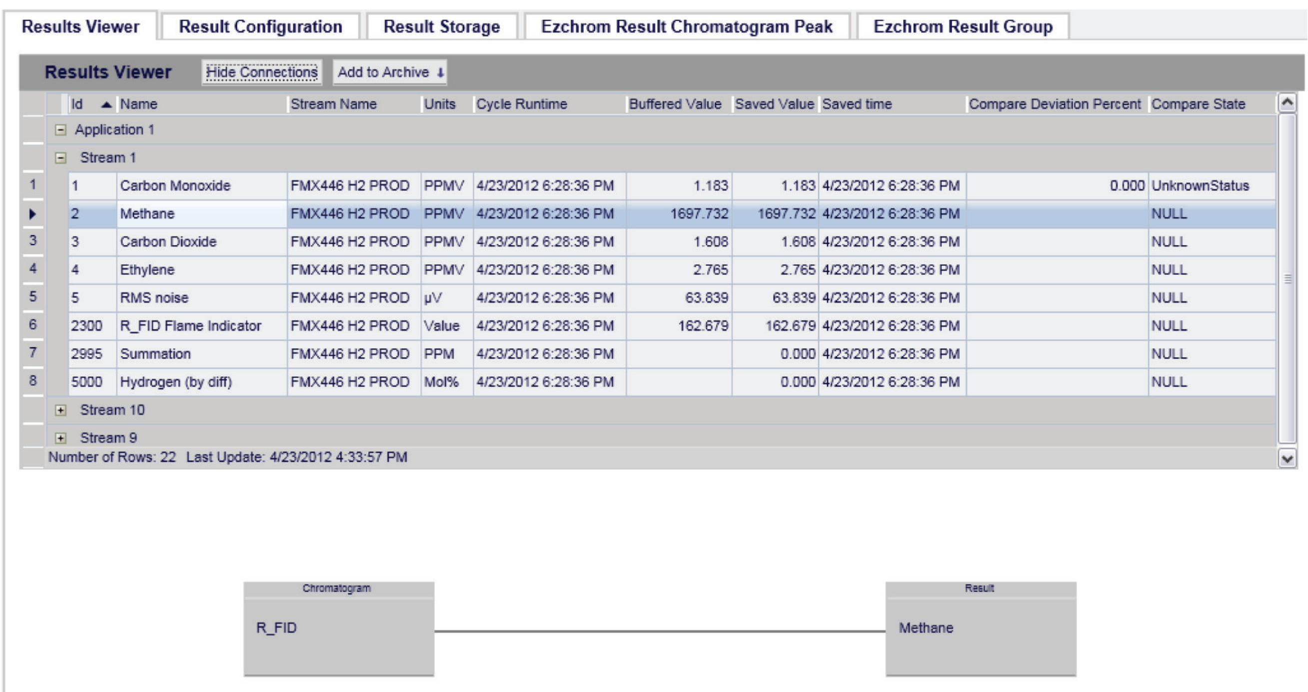
The Programs tab can be used for accessing functions related to user defined programs. This includes the ability to add and delete programs and edit programs using the MaxBasic editor. This tab is provided for easy access to programs that can be triggered by a limit. The main menu for programs, with more functions, is found under the System settings in the Analyzer view.

Example Scenario:

You wish to view details about the latest methane result from your process stream (stream 1) and compare it to archived data. You also wish to set up a function to detect when in the future this result exceeds an upper range.

User Actions (Results):

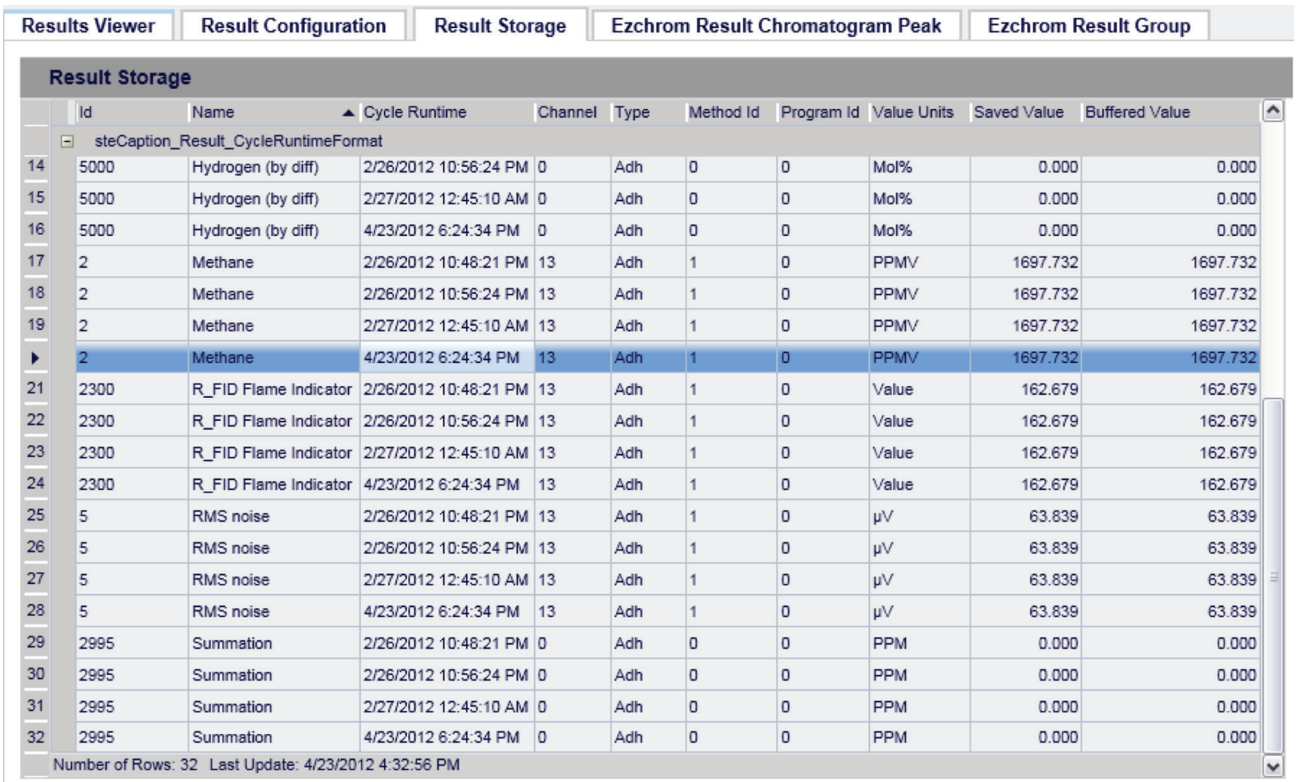
First, from the Results Viewer, select the line for methane. To see additional information, click the "Show Connections" button.



	Id	Name	Stream Name	Units	Cycle Runtime	Buffered Value	Saved Value	Saved time	Compare Deviation Percent	Compare State
1	1	Carbon Monoxide	FMX446 H2 PROD	PPMV	4/23/2012 6:28:36 PM	1.183	1.183	4/23/2012 6:28:36 PM	0.000	UnknownStatus
	2	Methane	FMX446 H2 PROD	PPMV	4/23/2012 6:28:36 PM	1697.732	1697.732	4/23/2012 6:28:36 PM		NULL
3	3	Carbon Dioxide	FMX446 H2 PROD	PPMV	4/23/2012 6:28:36 PM	1.608	1.608	4/23/2012 6:28:36 PM		NULL
4	4	Ethylene	FMX446 H2 PROD	PPMV	4/23/2012 6:28:36 PM	2.765	2.765	4/23/2012 6:28:36 PM		NULL
5	5	RMS noise	FMX446 H2 PROD	µV	4/23/2012 6:28:36 PM	63.839	63.839	4/23/2012 6:28:36 PM		NULL
6	2300	R_FID Flame Indicator	FMX446 H2 PROD	Value	4/23/2012 6:28:36 PM	162.679	162.679	4/23/2012 6:28:36 PM		NULL
7	2995	Summation	FMX446 H2 PROD	PPM	4/23/2012 6:28:36 PM		0.000	4/23/2012 6:28:36 PM		NULL
8	5000	Hydrogen (by diff)	FMX446 H2 PROD	Mol%	4/23/2012 6:28:36 PM		0.000	4/23/2012 6:28:36 PM		NULL

Figure 6-29 Result Viewer Showing Connected Elements

We can see that the value is 1697.732 and we an also see that the result comes from the R_FID detector. To compare to already archived data, add this data to the archive by clicking "Add to Archive". There is no confirmation message. However, going to the Result Storage tab shows that the data is now in the archive. Click the Name column to sort by name and see the Methane results that are stored.



	Id	Name	Cycle Runtime	Channel	Type	Method Id	Program Id	Value Units	Saved Value	Buffered Value
	steCaption_Result_CycleRuntimeFormat									
14	5000	Hydrogen (by diff)	2/26/2012 10:56:24 PM	0	Adh	0	0	Mol%	0.000	0.000
15	5000	Hydrogen (by diff)	2/27/2012 12:45:10 AM	0	Adh	0	0	Mol%	0.000	0.000
16	5000	Hydrogen (by diff)	4/23/2012 6:24:34 PM	0	Adh	0	0	Mol%	0.000	0.000
17	2	Methane	2/26/2012 10:48:21 PM	13	Adh	1	0	PPMV	1697.732	1697.732
18	2	Methane	2/26/2012 10:56:24 PM	13	Adh	1	0	PPMV	1697.732	1697.732
19	2	Methane	2/27/2012 12:45:10 AM	13	Adh	1	0	PPMV	1697.732	1697.732
▸	2	Methane	4/23/2012 6:24:34 PM	13	Adh	1	0	PPMV	1697.732	1697.732
21	2300	R_FID Flame Indicator	2/26/2012 10:48:21 PM	13	Adh	1	0	Value	162.679	162.679
22	2300	R_FID Flame Indicator	2/26/2012 10:56:24 PM	13	Adh	1	0	Value	162.679	162.679
23	2300	R_FID Flame Indicator	2/27/2012 12:45:10 AM	13	Adh	1	0	Value	162.679	162.679
24	2300	R_FID Flame Indicator	4/23/2012 6:24:34 PM	13	Adh	1	0	Value	162.679	162.679
25	5	RMS noise	2/26/2012 10:48:21 PM	13	Adh	1	0	µV	63.839	63.839
26	5	RMS noise	2/26/2012 10:56:24 PM	13	Adh	1	0	µV	63.839	63.839
27	5	RMS noise	2/27/2012 12:45:10 AM	13	Adh	1	0	µV	63.839	63.839
28	5	RMS noise	4/23/2012 6:24:34 PM	13	Adh	1	0	µV	63.839	63.839
29	2995	Summation	2/26/2012 10:48:21 PM	0	Adh	0	0	PPM	0.000	0.000
30	2995	Summation	2/26/2012 10:56:24 PM	0	Adh	0	0	PPM	0.000	0.000
31	2995	Summation	2/27/2012 12:45:10 AM	0	Adh	0	0	PPM	0.000	0.000
32	2995	Summation	4/23/2012 6:24:34 PM	0	Adh	0	0	PPM	0.000	0.000

Number of Rows: 32 Last Update: 4/23/2012 4:32:56 PM

Figure 6-30 Result Storage Viewer

You can see that the result value has not changed over time.

User Actions (Limits):

Rather than regularly comparing results, you wish to set up an automatic comparison to alert when the value is out side of the desired range. To accomplish this, you decide to create a limit for the methane result and associate it with an alarm.

To do this, you will create the limit and edit the "Used By" field to reference the limit to the Methane result. You will then create Alarm Handlers with text. After this is done, you will edit the Limit Details to set threshold values for high and low alarms and connect these to the Alarm Handlers.

First, go to the Limits and Alarm Handlers screen at the bottom of the Application View Navigator menu and then click the "Add Limit" button at the top left of the display screen. A new limit is created. Click the newly created limit line. Limits may be digital or analog. If the limit details are for a Digital Limit, click the Toggle View button to make the limit an Analog Limit.

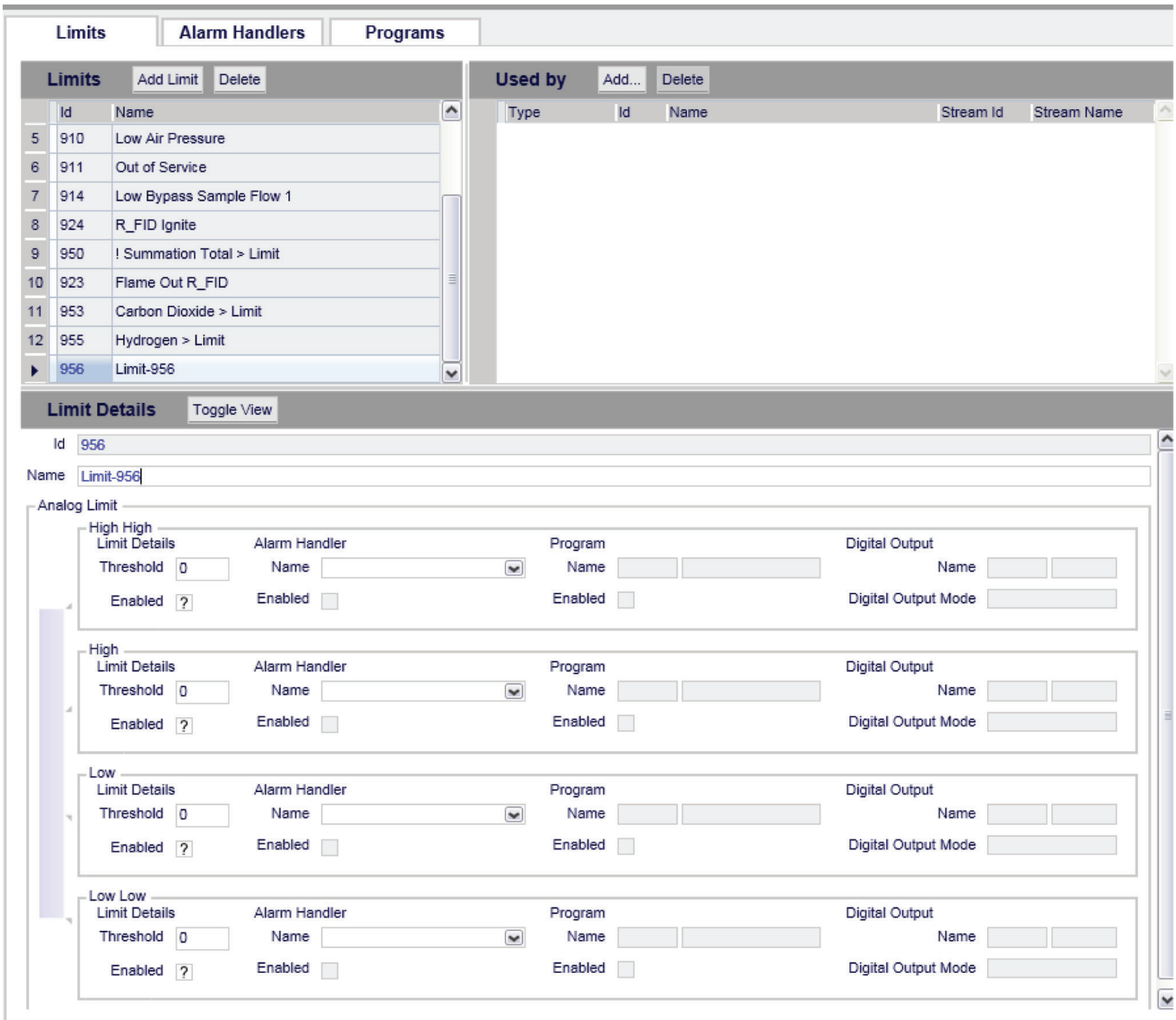


Figure 6-31 New Limit Created

You will change the name later. Click "Add" under the "Used By" pane. This will display a dialog box for selecting the Type and ID. You are associating to the Methane Result on Stream 1, so from the drop down menus select "Result" and then "Methane (Stream 1)". Then click OK.

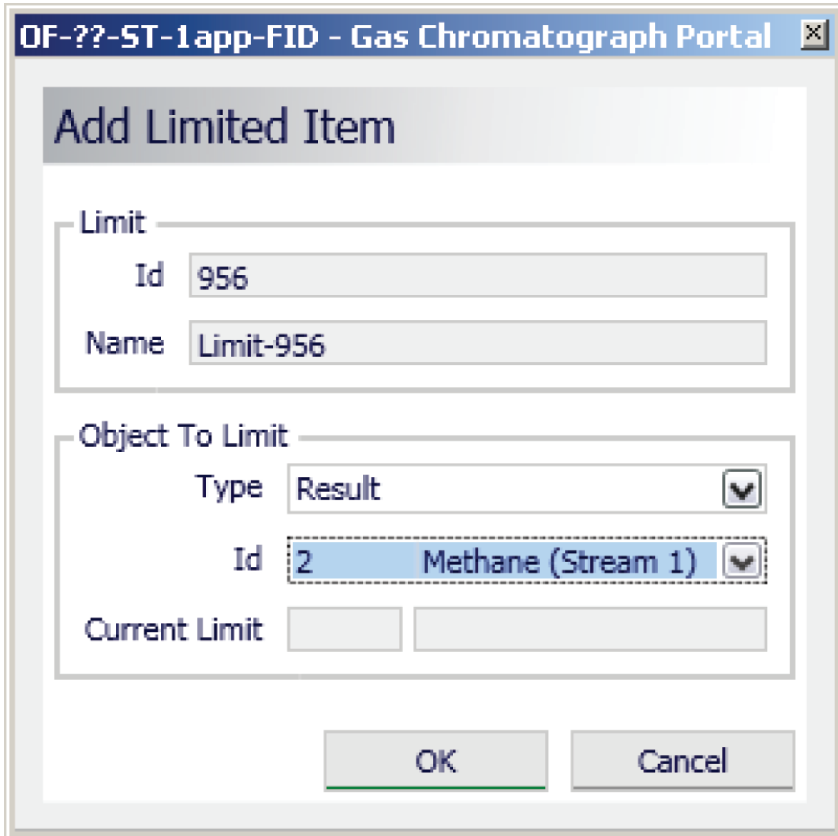


Figure 6-32 Add Limited Item Dialog Box

The Limit is now created. You now need to create the Alarm Handler. Use the following steps:

- Click the Alarm Handler tab
- Click the Add button on the Alarm Handler screen. This creates a blank Alarm Handler entry.
- Fill out the Alarm Text field (in this case, we use "Methane High").
- Click the Enable box for the Alarm Handler.

- Since this affects the stream, you may wish to click the drop down box to identify the alarm as being connected to the stream.
- Follow the same steps to create another alarm handler for "Methane Low".

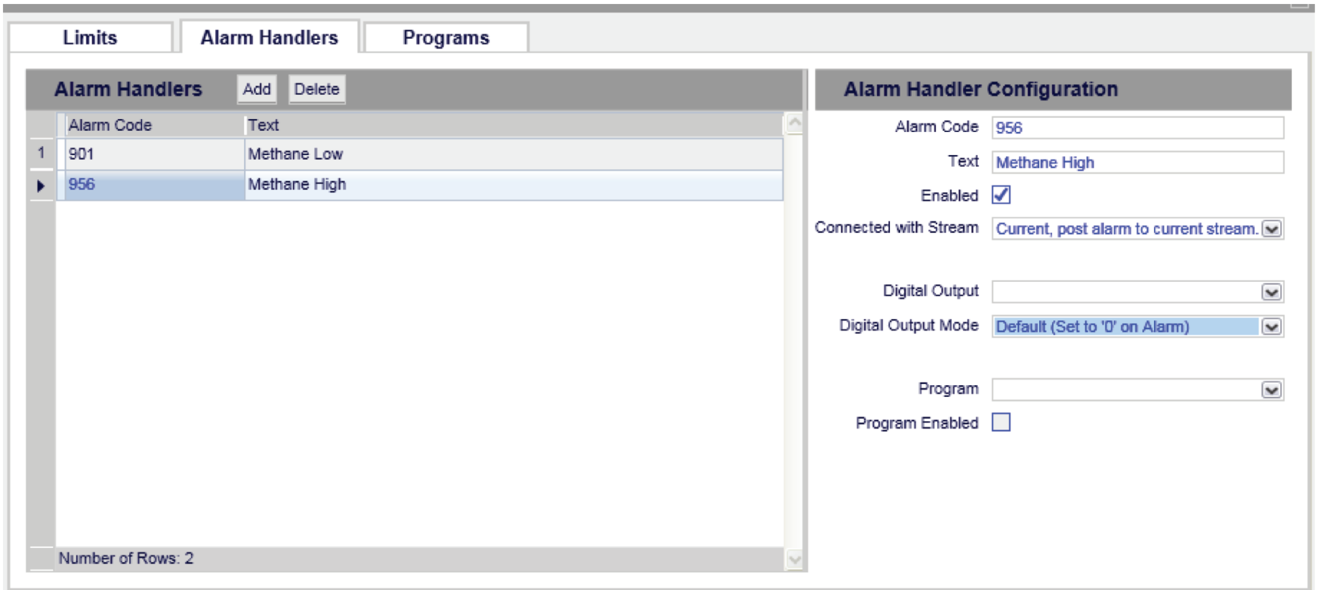


Figure 6-33 Alarm Handlers Created

Now that both the Limit and the Alarm Handlers are created, you can connect them so that the correct alarm will be associated with the correct limit. Use the following steps. The final result is shown below.

- First you need to save so that the new Alarm Handler will be seen by the Limits tab. Click the Save button in the toolbar. The blue entries, denoting modifications, will change to black.
- Next, return to the Limits tab. Under Limit Details, enter a name for the limit ("Methane Stream 1").
- You will now set the thresholds. In this case you want a Warning to be displayed so you use High and Low (High High and Low Low are used to create fault messages). Since the expected result value is 1697.732, you choose the low limit to be 1675 and the high value to be 1725. Values outside of this range will trigger a Warning message.
- Next, connect to the Alarm handlers. To do this, for both the High and Low limits click the drop-down menu for the Alarm Handler and choose "Methane High" and "Methane Low" handlers that were created.

- Finally, click Enabled for the High and Low limits. Note that as you enable the limits, the blue bar on the left side of the display window changes color. This denotes that the range is set.
- Click save again

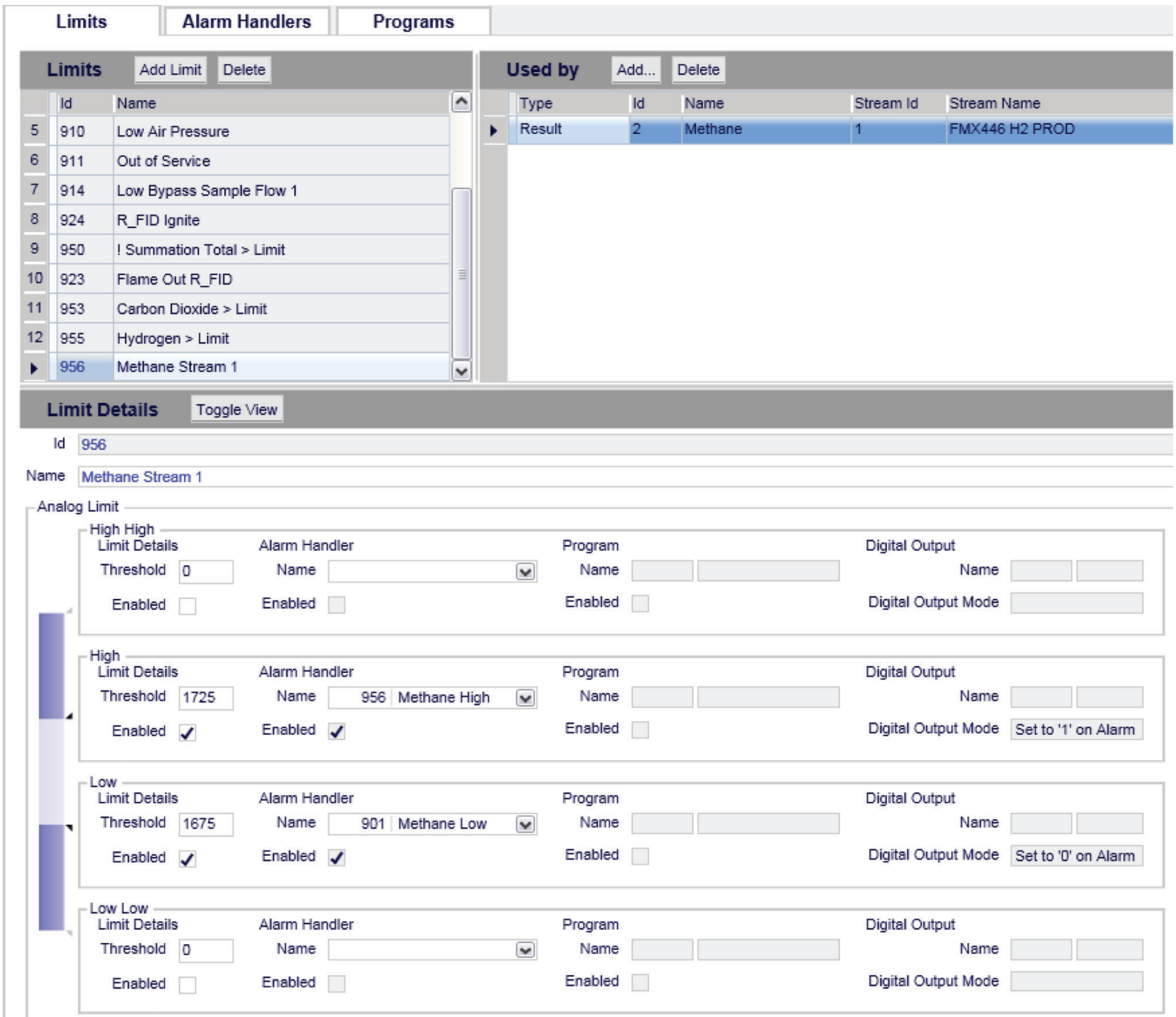


Figure 6-34 Alarm Limit Screen - Example Complete

The limit is now created and active. If a result value outside the range is detected, then the associated Warning message will be triggered in the Alarms table.

6.17.6 Modifying Hardware - I/O

System and Application Hardware:

Hardware in an analyzer can be modified in two different areas of the GCP software, System Hardware and Application Hardware. System Hardware is a system level listing of configured hardware including I/O, SNE Controllers, SNE PICs, and Advance+ Detectors. Application Hardware is hardware that is configured and used within an application including detectors, temperature and pressure controllers, and application I/O.

Hardware is accessed using the Navigation Menu on either the Analyzer tab (System Hardware) or the Application tab (Application Hardware). Several changes can be made depending on which type of hardware is selected. The example in this section shows how to create a new I/O board and assign an I/O on that board to an application.

Example Scenario:

In the previous section, an example was described of creating a limit on a result and then assigning an alarm handler to trigger if the limit on the result is exceeded. An additional step that a user may want is to assign a Digital Output to trigger if the limit is exceeded. This can be used, for example, to create an automatic external alert when a critical value is exceeded. This example shows the creation and assigning of new I/O to accomplish this task.

User Actions:

First, the hardware must be added. Using approved safe methods, a new DIO board is installed and plugged into the I^2C bus. This hardware is automatically detected and configured by the Maxum using the detected I^2C bus information and board ID switch settings. To see the updated hardware, click the Refresh button on the GCP toolbar. The System Hardware table for Digital Outputs, shown below, now displays the newly configured hardware.

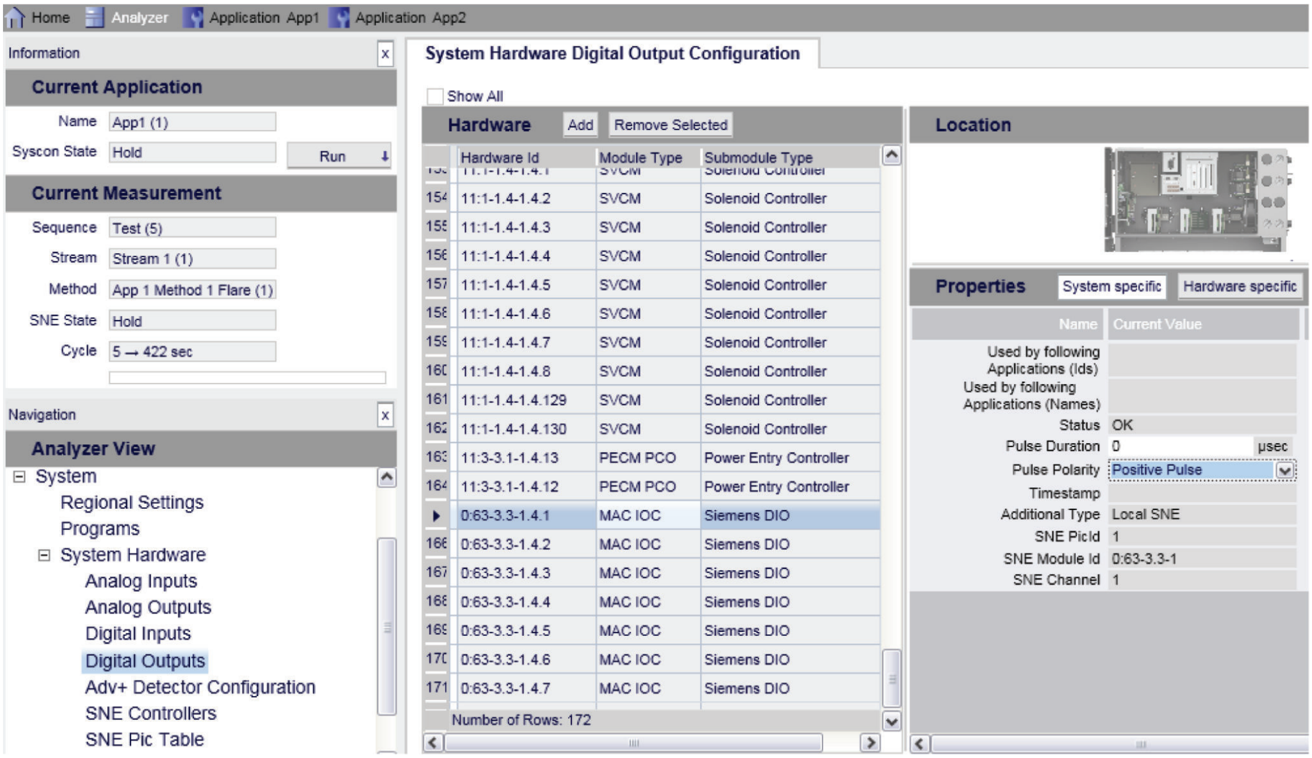


Figure 6-35 Digital Output System Hardware

This same I/O hardware will also appear on the Application Hardware assignment screen. To access this screen, click on the desired Application tab and then expand the Application Hardware menu selection by clicking the + symbol next to it. Next select Digital Output to see the DOs assigned to the application. To see the new hardware and assign it, click the Digital Output Assignment tab in the display window.

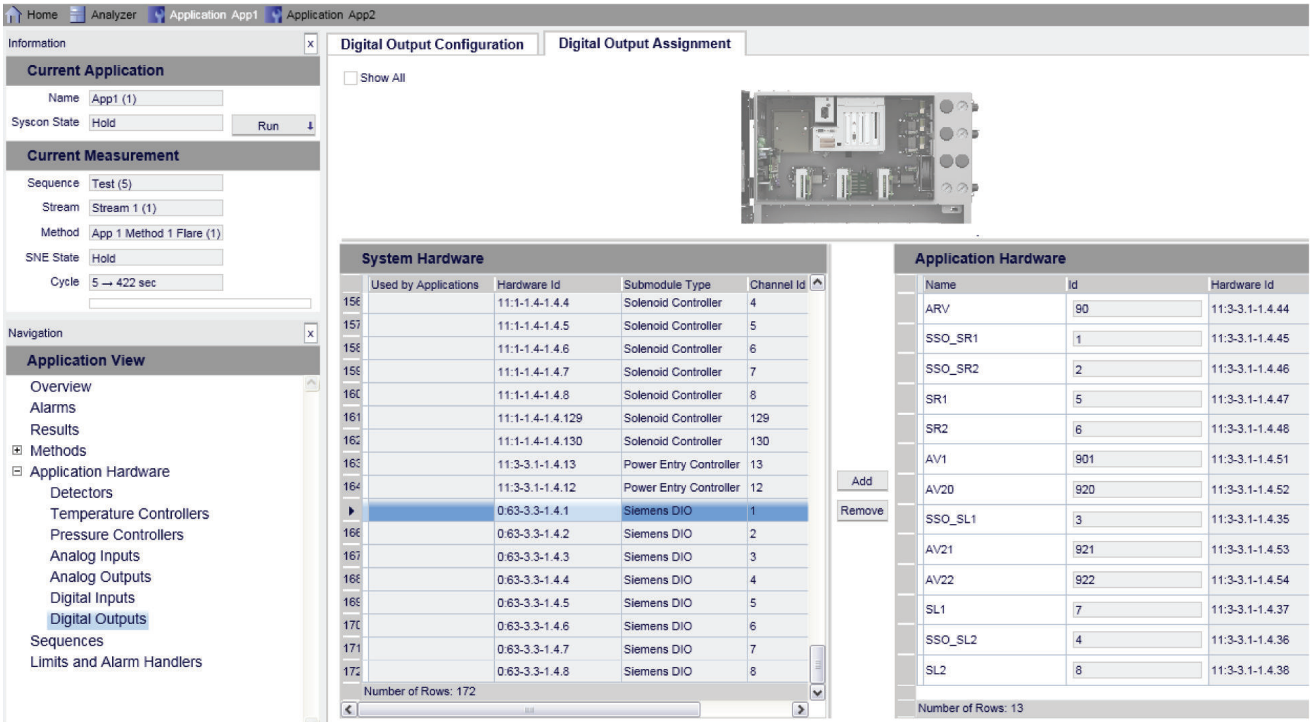


Figure 6-36 Assigning a Digital Output to the Application

The new hardware shows in the System Hardware window on the display pane. To assign the new DO to the application, select it and click the Add button. The DO is added to the Application Hardware window in the display pane and the entry under the System Hardware is modified to indicate that the hardware is now used by the application.

The name can be changed on Application Hardware line as shown below. Also, the automatically chosen reference ID can be changed if desired. Once the IO is assigned, the user can click Save in the toolbar to accept the change before completing the DO configuration.

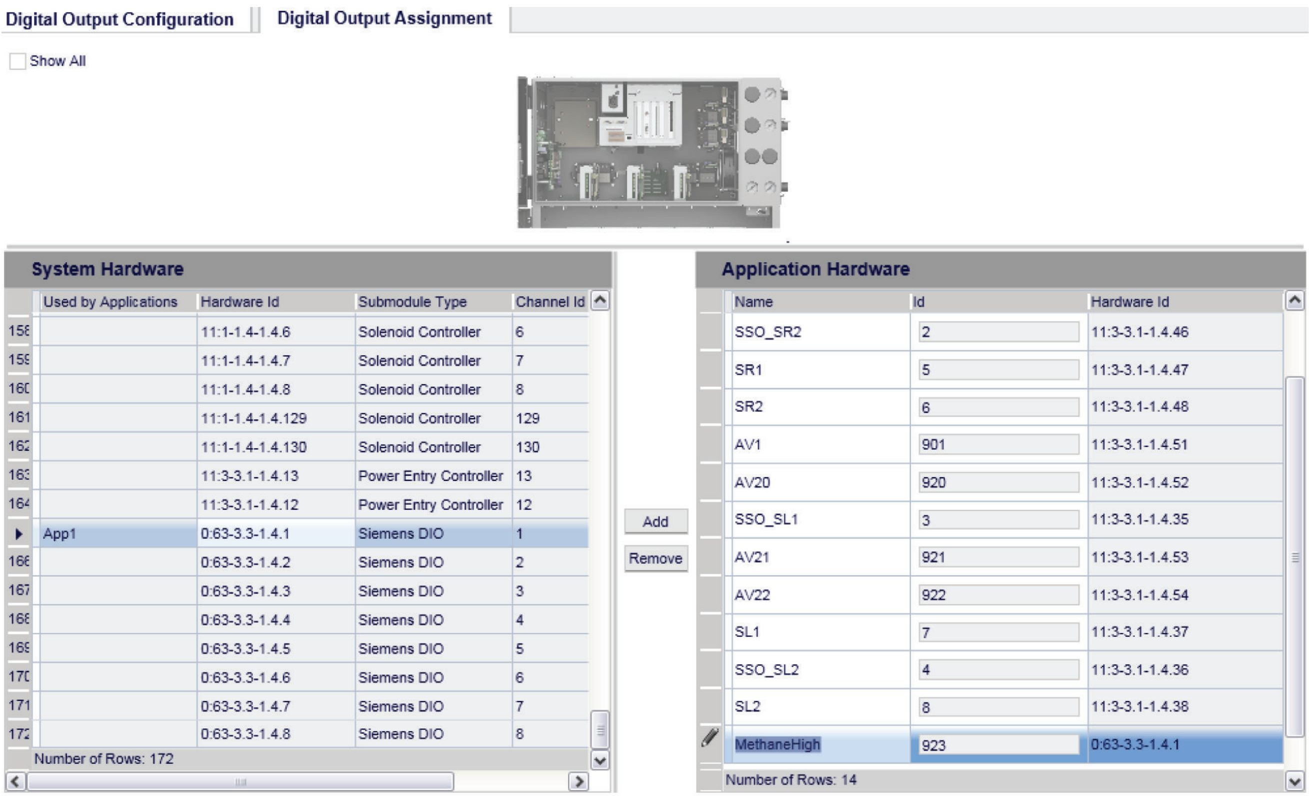


Figure 6-37 Assigning a Digital Output to the Application

After, saving the user may configure the by clicking the "Digital Output Configuration" tab and then clicking on the line for the new DO. The various properties can now be set. Hovering the mouse pointer over each property displays a tooltip to explain the use of that property. In the case of the DO the following are available.

- Name - The name was already set when the DO was created, but it can be changed here as well
- Enabled - Use to activate the created. The True/False value of the Enabled attribute is not to be confused with changing the value of the DO.
- Text 0/Text 1 - These are to determine the text that will display when the value of the DO is either 0 or 1. Common values are Off/On or False/True.
- Injection Valve - Used to indicate whether the DO is used to control

It is also possible to display system specific and hardware properties related to the DO by clicking on the relevant buttons for these properties. After editing the properties, the DO looks as below.

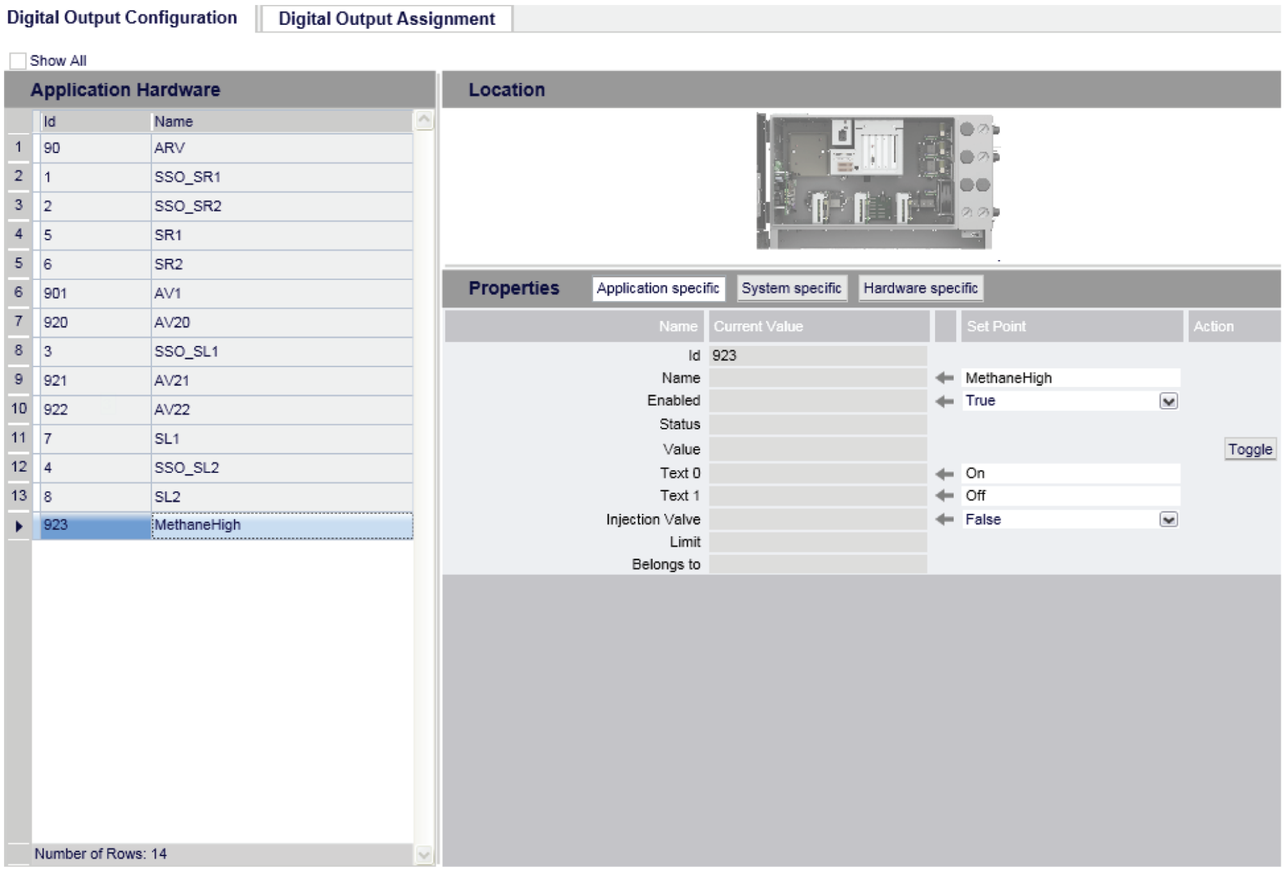


Figure 6-38 Configuring the Assigned Digital Output

It is now possible to associate the DO with the Alarm Handler that was mentioned previously.

Click on the "Limits and Alarm Handlers" menu item and then the Alarm Handlers tab.

Next, select the desired Alarm Handler and click the "Use Digital Output" checkbox. This causes a new field to appear for entering the desired Digital Output.

Click the drop-down menu and select the DO that was created above.

Click Save on the toolbar.

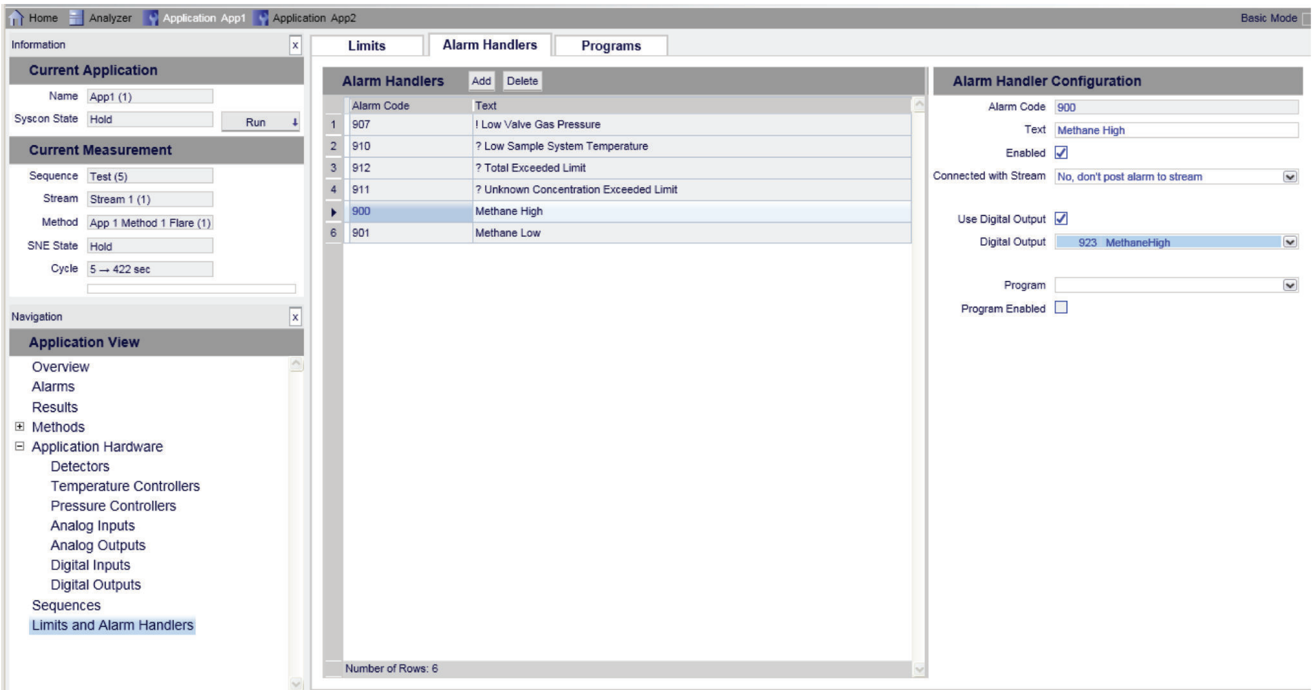


Figure 6-39 Assigning a Digital Output to the Alarm Handler

The DO is now associated with the alarm handler and as a result with alarm limits that use that alarm handler.

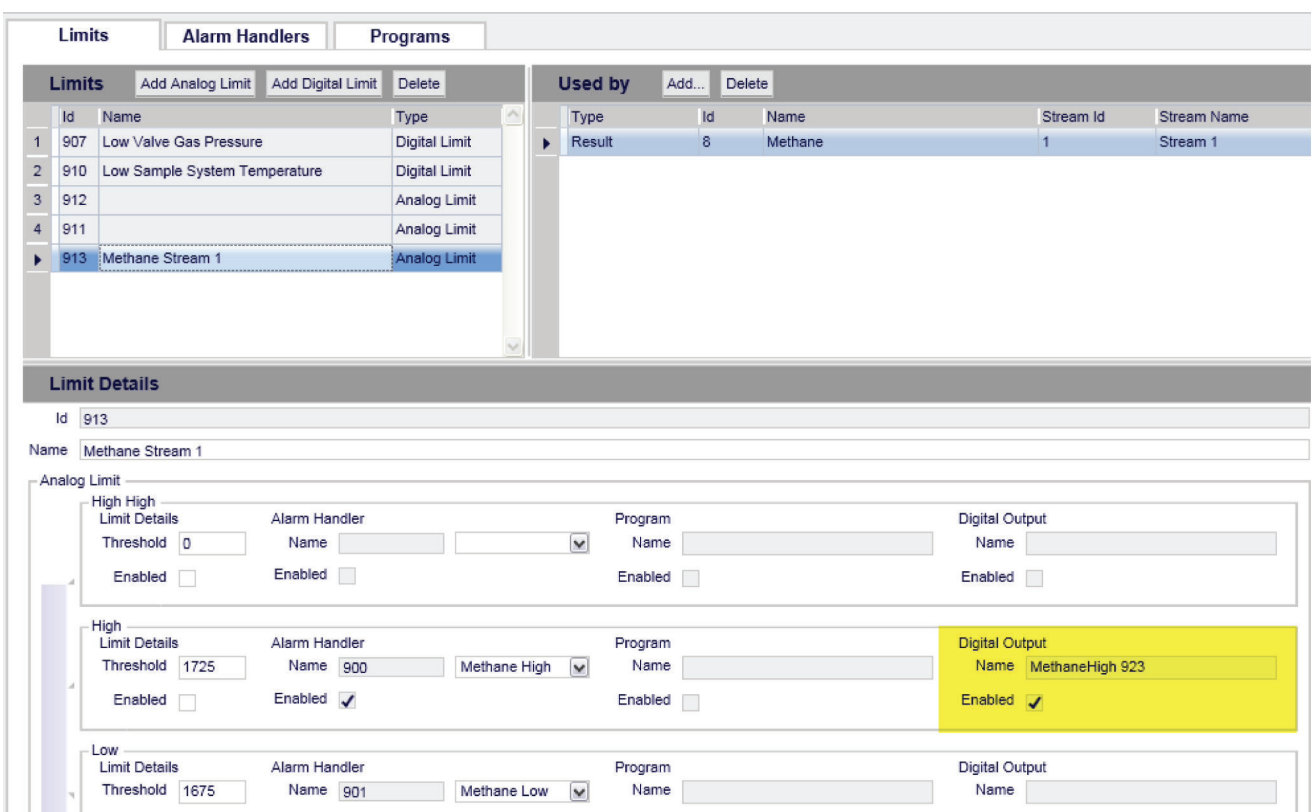


Figure 6-40 The Alarm Limit is Now Associated with the Digital Output

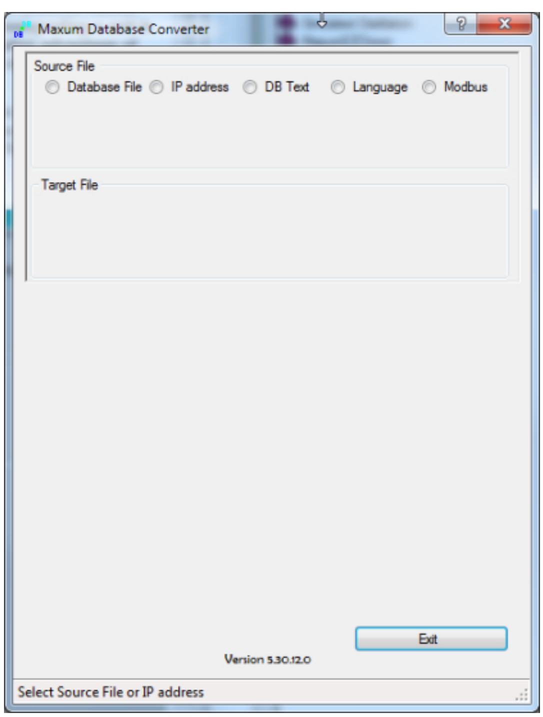
6.17.7 DBConverter Utility

6.17.7.1 Introduction to DBConverter

DBConverter is an application that handles multiple functions:

- Converting to or from one database file (offline or at an IP address) to another of the same or different version.
- Comparing 2 databases.
- Loading a DB text file into an empty or existing database.
- Loading a Modbus text file into an existing database.
- Unloading an existing database into a text file, with the ability to filter by table or application.
- Load a Language text file into an existing database (very rarely used).

DBConverter is accessible from the Loader menu in Maxum Utilities. Access to Maxum Utilities is via the Tools menu in the GCP Analyzer window. Help for DBConverter is available within the DBConverter program using tool tips (seen by hovering with the mouse pointer over a field).



6.17.7.2 Selecting a Source Database

The same Source selection dialog is used to select from five different source types:

- **Database FIle** - Selects a database file on the workstation as the source.
- **IP address** - Uses the last saved database from the analyzer at the specified address. The address can be keyed in or selected from a dropdown list.
- **DB Text** - Useful for loading a DB text file into a new analyzer.
- **Language** - Used for software versions prior to 5.0 to save language text files.
- **Modbus** - A Modbus map, often a .csv file, can be specified as the source. The output can be a database file (.amd) or loaded directly to an analyzer by entering the target IP address. This feature does not convert from one version to another, only from a Modbus to an analyzer database or database file.

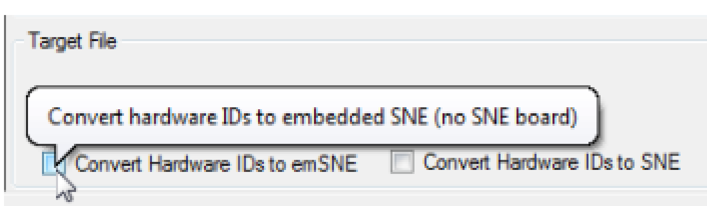
6.17.7.3 DB Converter Targets

The output from DB Converter can go to:

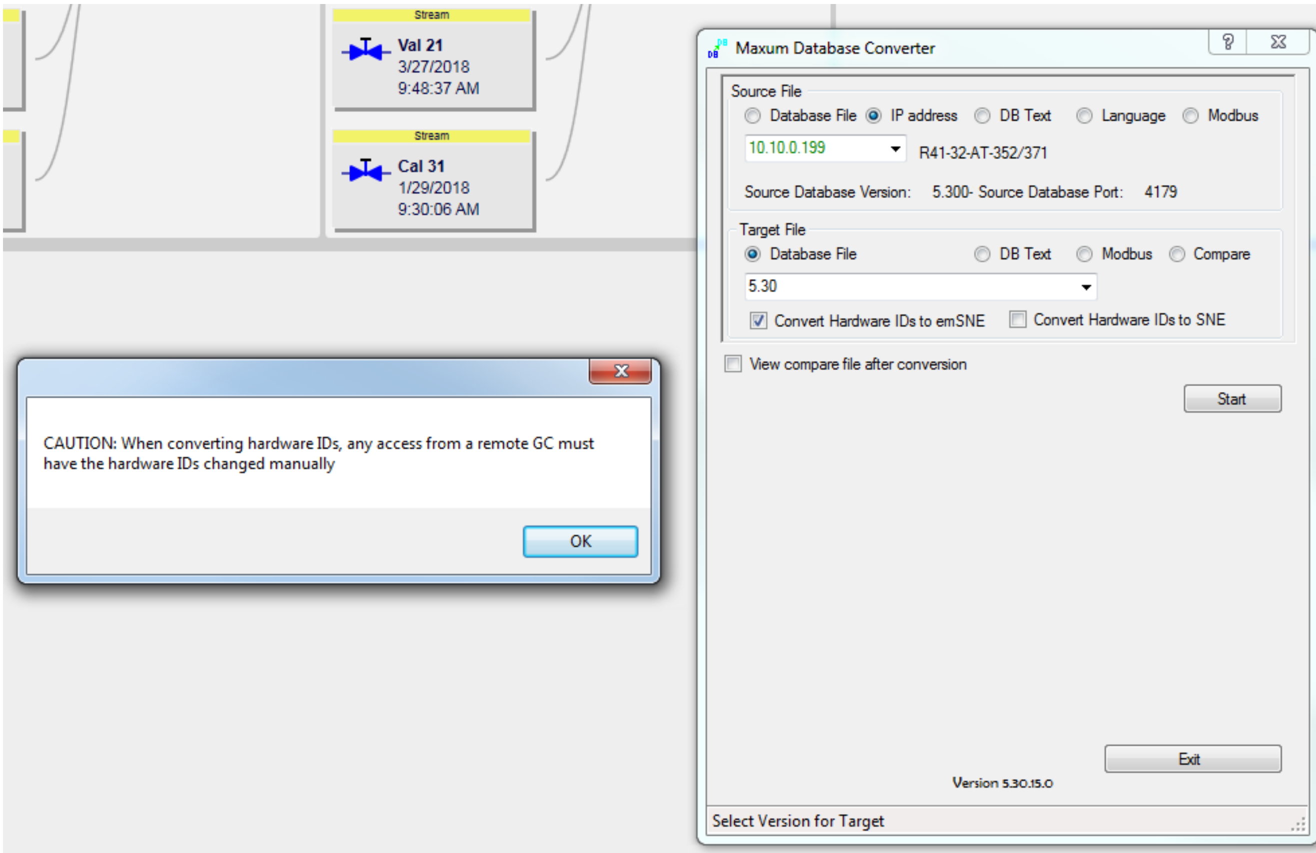
- A database file on the workstation
- Directly to an analyzer IP address
- An editable database text file
- A Modbus map
- A comparison with another database

6.17.7.4 Hardware IDs: SNE vs emSNE

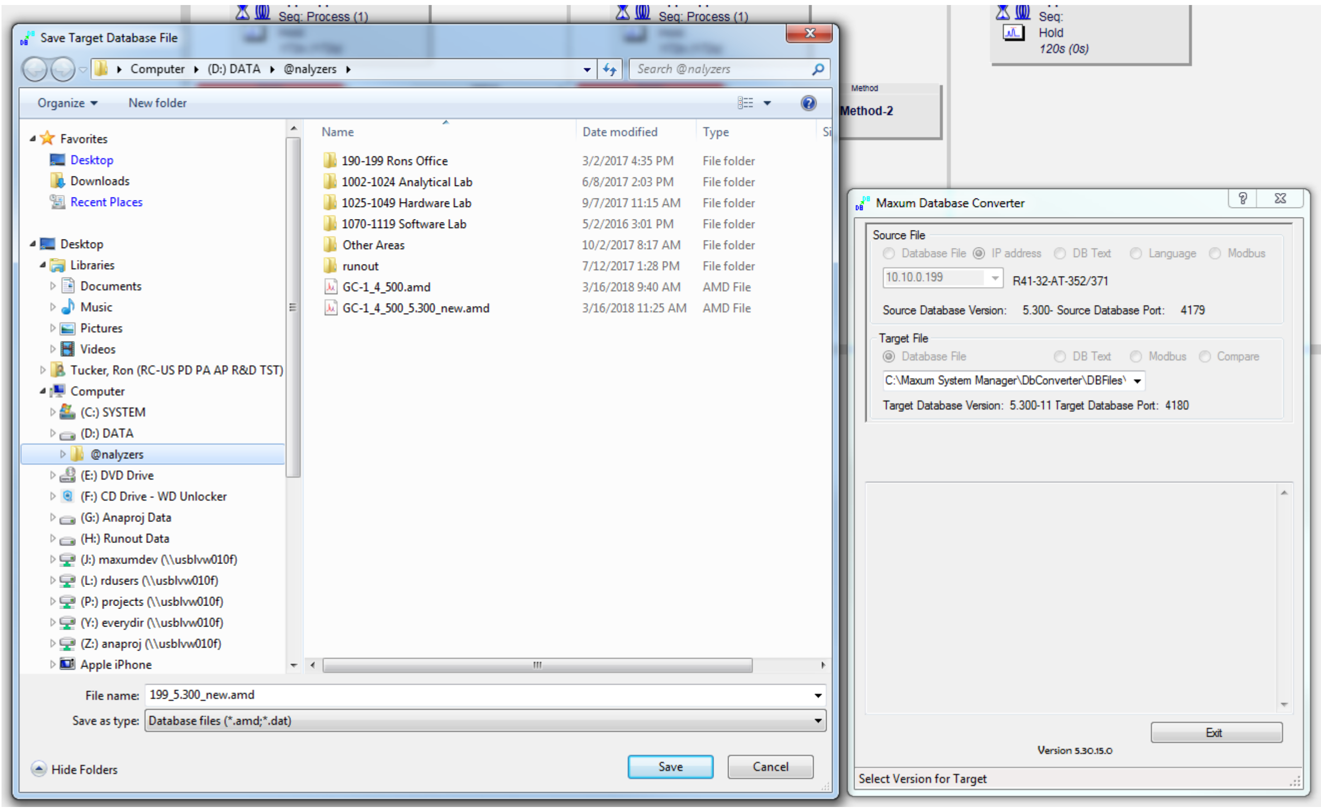
When upgrading analyzer hardware, it is sometimes desireable to remove the hardware SNE and use the software-based emSNE. The Database Converter has an option to convert the hardware IDs to be compatible with either configuration.



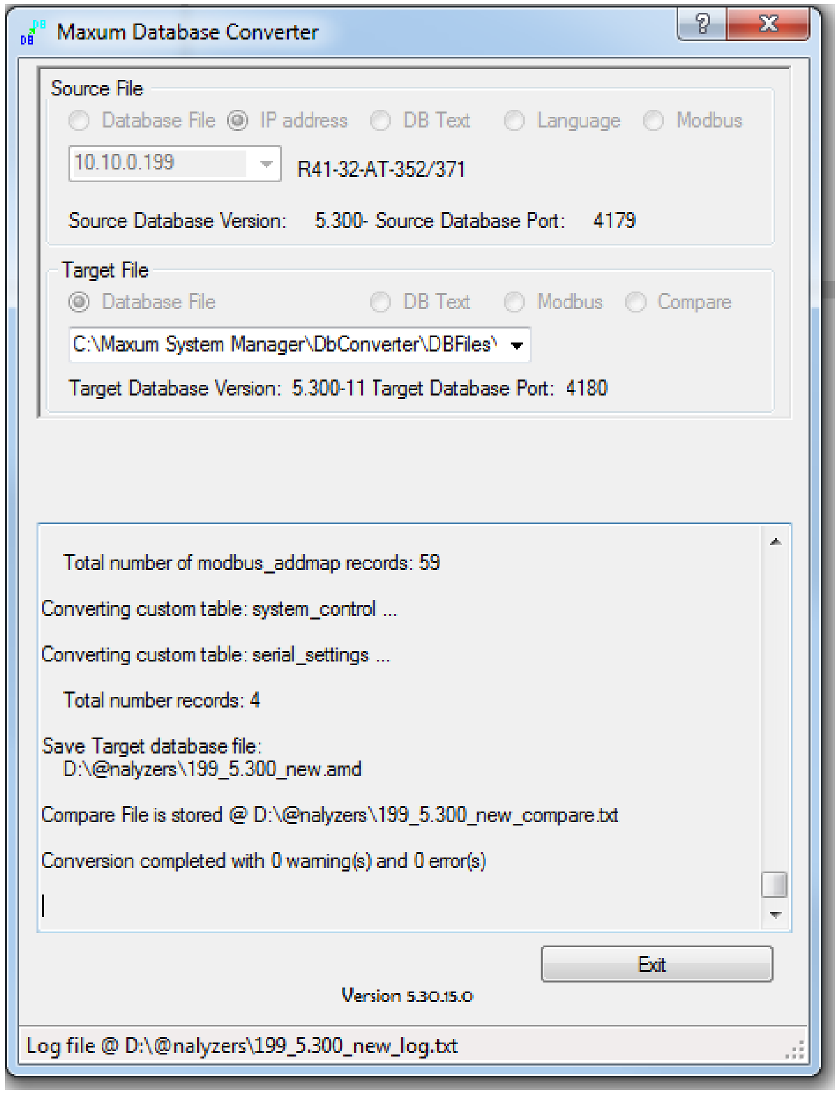
After selecting the source loacation, check the Convert Hardware IDs to emSNE box, then click Start.



Select location and file name for new AMD file and press Save.

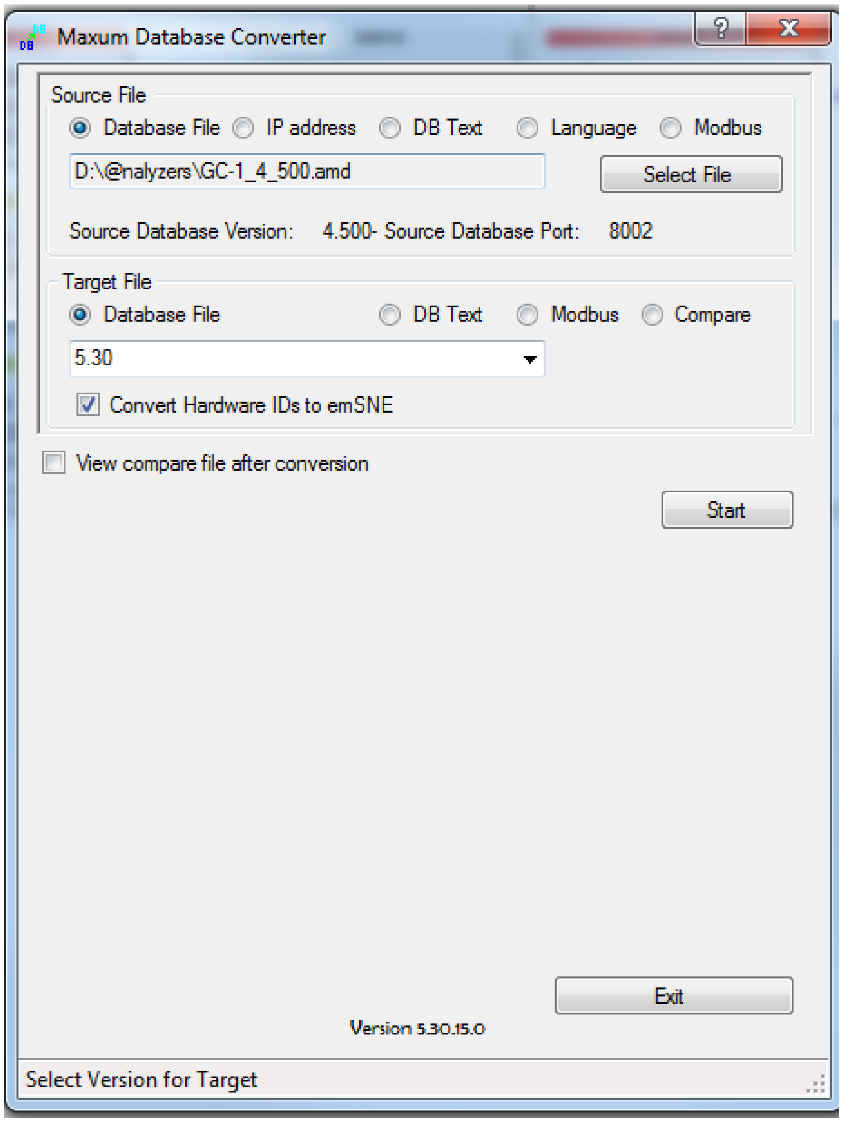


The new database file is created with converted hardware IDs. Check to see that no warnings or errors are reported.

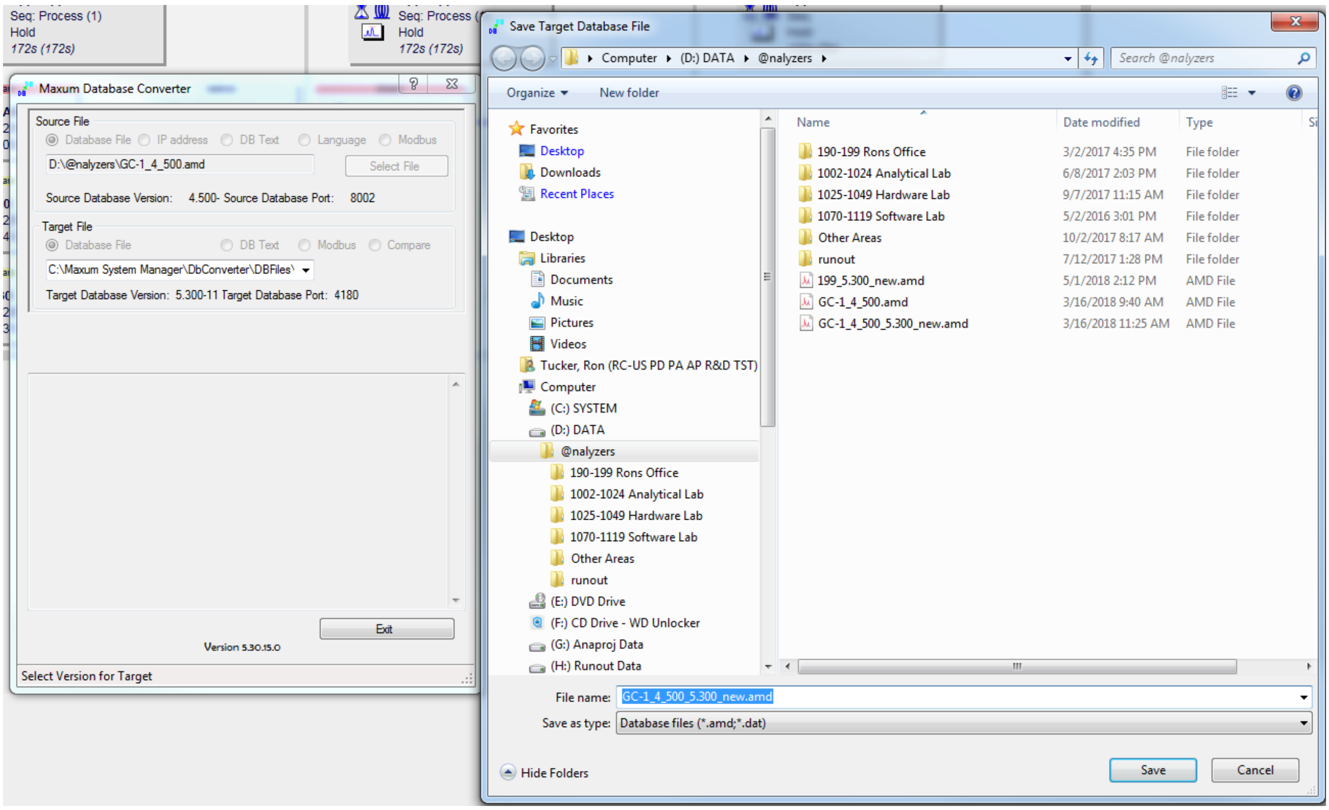

Maxum Database Converter
Source File
Database File
IP address
DB Text
Language
Modbus
10.10.0.199
R41-32-AT-352/371
Source Database Version: 5.300- Source Database Port: 4179
Target File
Database File
DB Text
Modbus
Compare
C:\Maxum System Manager\DbConverter\DBFiles\
Target Database Version: 5.300-11 Target Database Port: 4180
Total number of modbus_addmap records: 59
Converting custom table: system_control ...
Converting custom table: serial_settings ...
Total number records: 4
Save Target database file:
D:\@nalyzers\199_5.300_new.amd
Compare File is stored @ D:\@nalyzers\199_5.300_new_compare.txt
Conversion completed with 0 warning(s) and 0 error(s)
Exit
Version 5.30.15.0
Log file @ D:\@nalyzers\199_5.300_new_log.txt

6.17.7.5 Example: Converting a 4.x database to 5.3

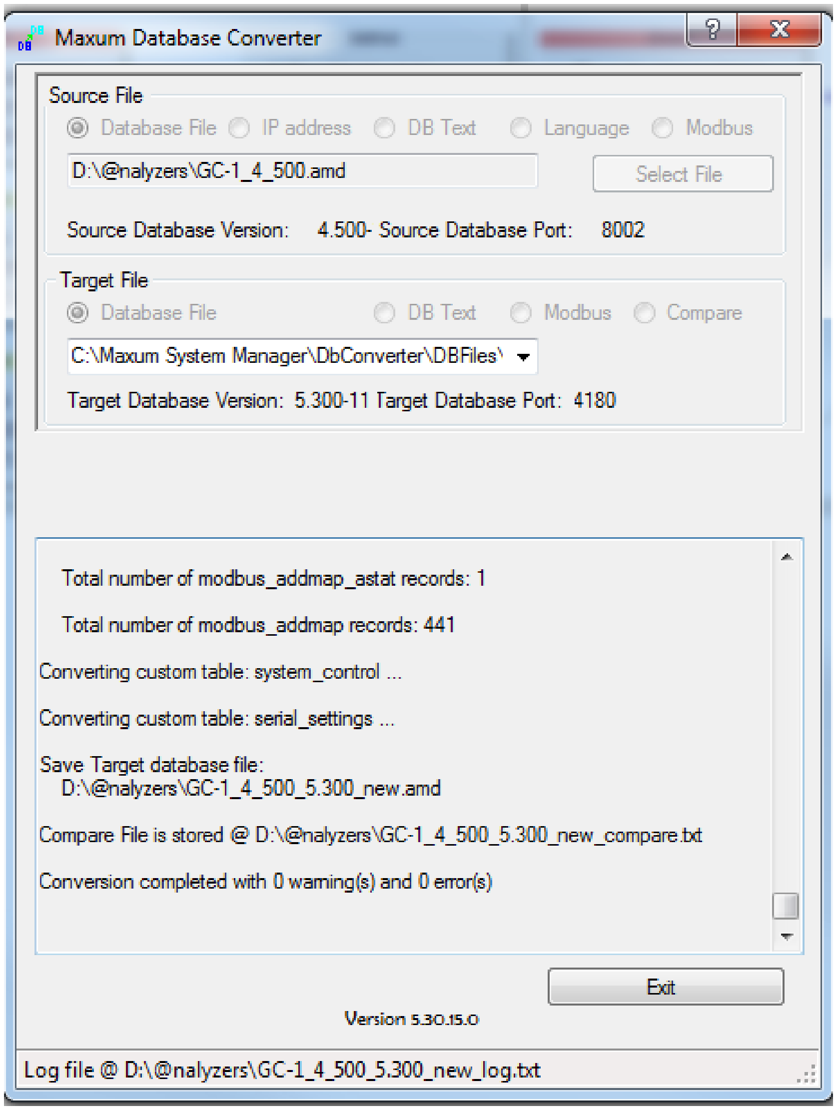
Select an older source database 4x to 5.2 and then a 5.3 target database. Select whether or not emSNE hardware-ID conversion is desired, then press start. In this example the option to convert hardware IDs to emSNE format is selected.



Select location and file name for new AMD file and press Save.

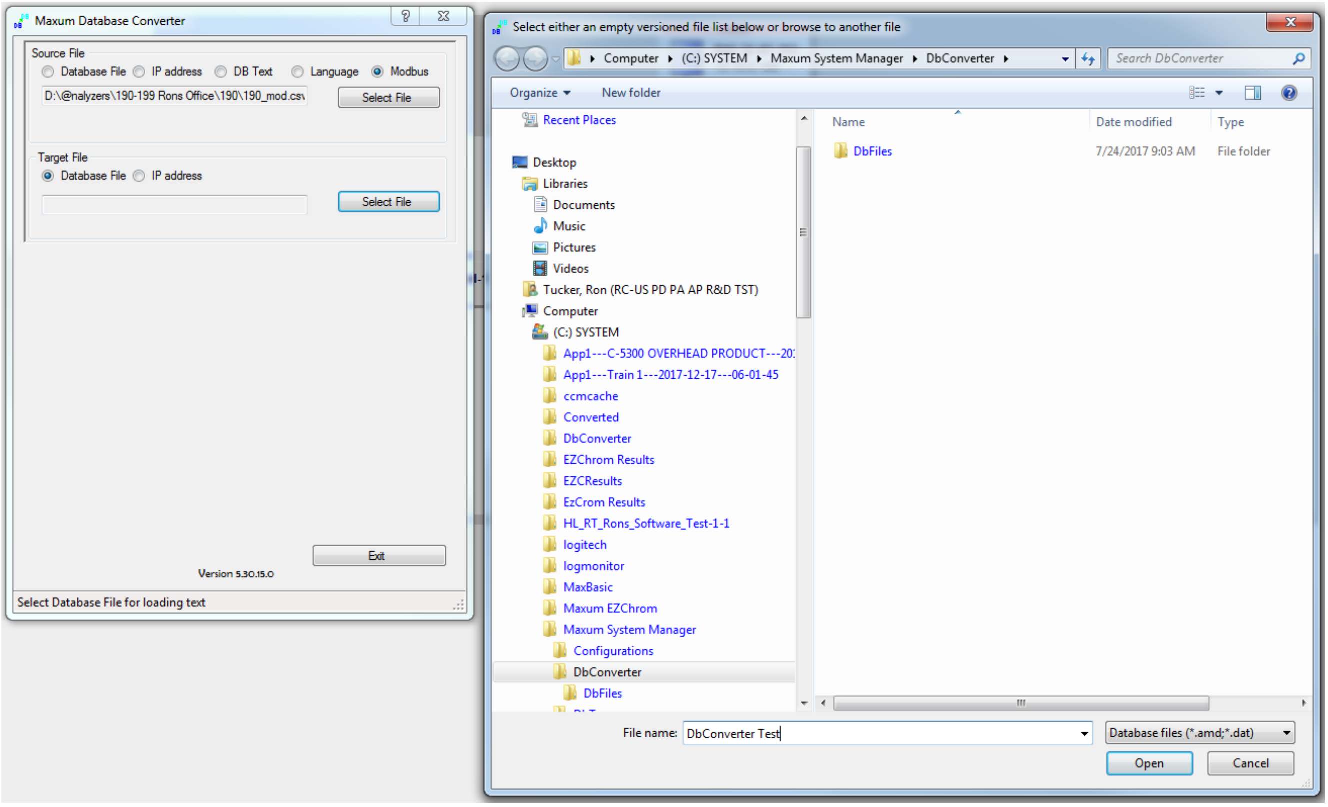


The new 5.3 database is created.



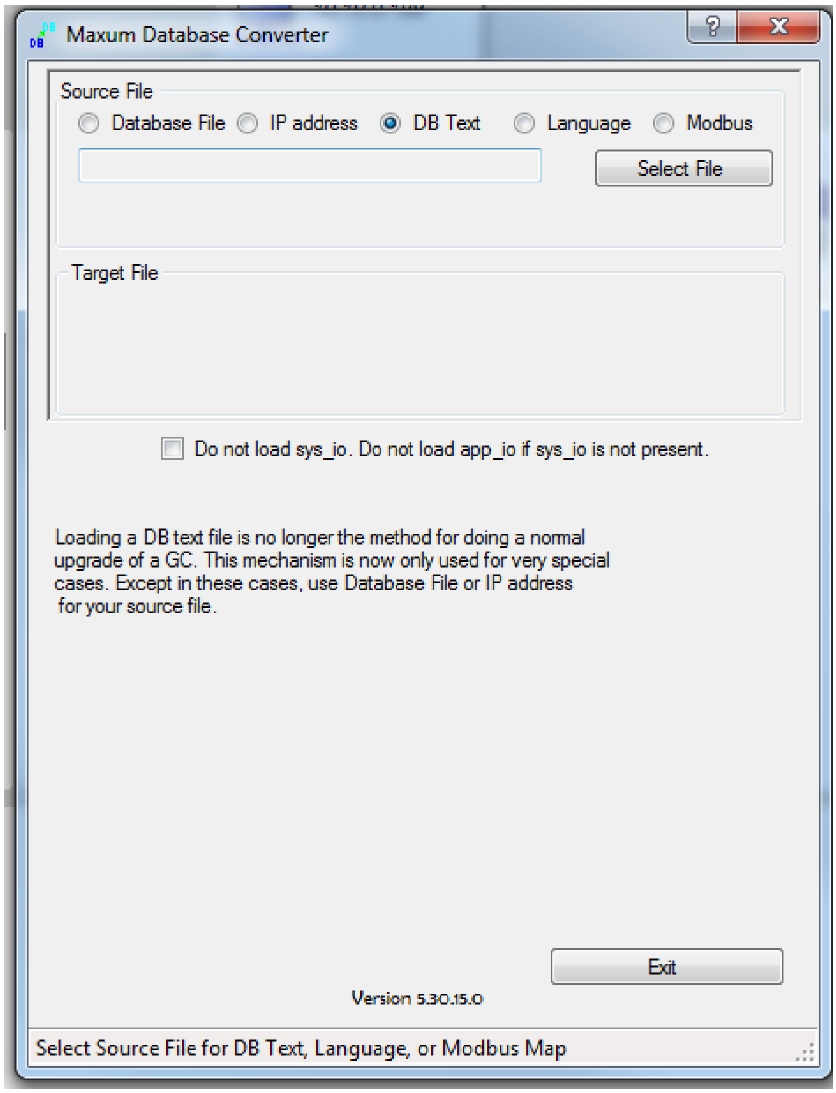
6.17.7.6 Example: Loading a Modbus file to a database file or analyzer

- Select Modbus in DB Converter, select whether to load to a database file or analyzer, then press start.
- Saving to a database file will give the option to select storage location and name.
- Selecting an I.P. address will load the Modbus map directly to the analyzer selected.


Maxum Database Converter
Source File
Database File
IP address
DB Text
Language
Modbus
D:\@nalyzers\190-199 Rons Office\190\190_mod.csv
Select File
Target File
Database File
IP address
Select File
Exit
Version 5.30.15.0
Select Database File for loading text
Select either an empty versioned file list below or browse to another file
Computer ▸ (C:) SYSTEM ▸ Maxum System Manager ▸ DbConverter ▸
Search DbConverter
Organize
New folder
Recent Places
Desktop
Libraries
Documents
Music
Pictures
Videos
Tucker, Ron (RC-US PD PA AP R&D TST)
Computer
(C:) SYSTEM
Appl---C-5300 OVERHEAD PRODUCT---20
Appl---Train 1---2017-12-17---06-01-45
ccmcache
Converted
DbConverter
EZChrom Results
EZCResults
EzCrom Results
HL_RT_Rons_Software_Test-1-1
logitech
logmonitor
MaxBasic
Maxum EZChrom
Maxum System Manager
Configurations
DbConverter
DbFiles
Name
Date modified
Type
DbFiles
7/24/2017 9:03 AM
File folder
File name:
DbConverter Test
Database files (*.amd;*.dat)
Open
Cancel

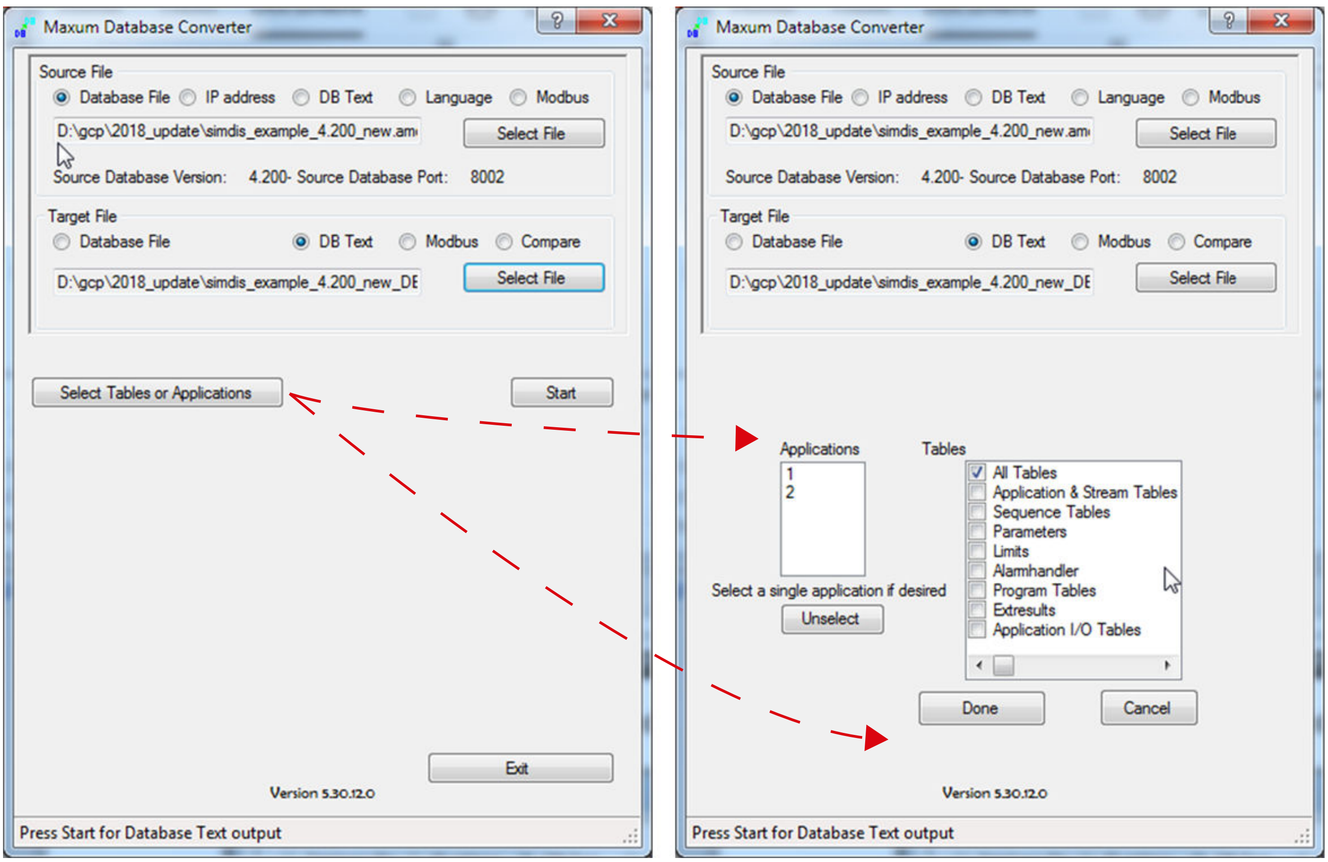
6.17.7.7 Loading a DB Text to an analyzer

This feature is normally only used to load a text file to a new analyzer. This process also works in reverse to create an editable text file (Page 241).

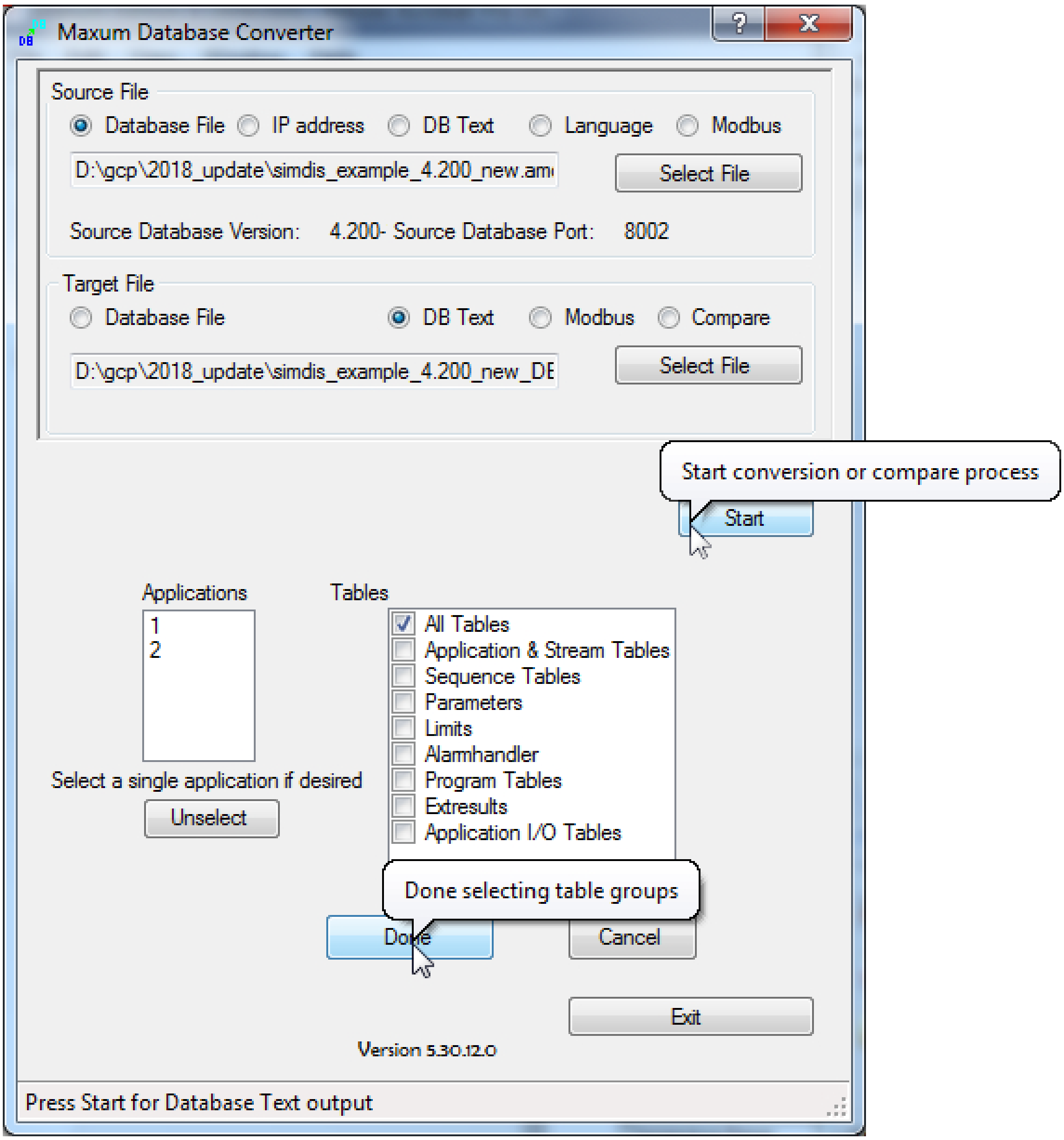


6.17.7.8 Creating an Editable Text File

If an aeditable text file of a database is desired, check the the DB Text button under Target File. When this is done, additional menus appear so that the output can limited to specific applications and tables of interest.



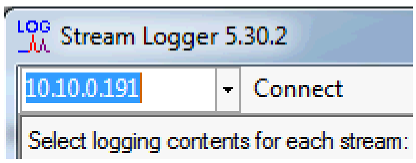
After choosing desired options, click Done, then Start to generate the text file.


Maxum Database Converter
Source File
Database File
IP address
DB Text
Language
Modbus
D:\gcp\2018_update\simdis_example_4.200_new.am
Select File
Source Database Version: 4.200- Source Database Port: 8002
Target File
Database File
DB Text
Modbus
Compare
D:\gcp\2018_update\simdis_example_4.200_new_DE
Select File
Start conversion or compare process
Start
Applications
1
2
Select a single application if desired
Unselect
Tables
All Tables
Application & Stream Tables
Sequence Tables
Parameters
Limits
Alarmhandler
Program Tables
Extresults
Application I/O Tables
Done selecting table groups
Done
Cancel
Exit
Version 5.30.12.0
Press Start for Database Text output

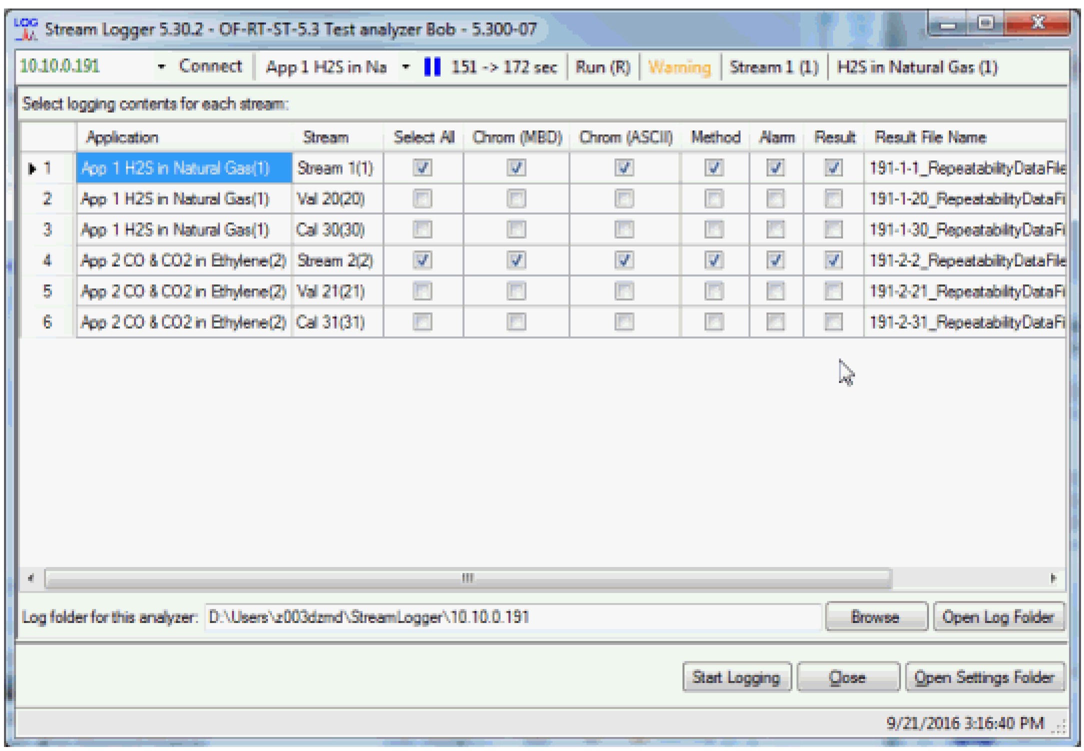
StreamLogger

7

This utility logs data as individual streams into files on the workstation. Launch StreamLogger from the Tools menu at the top of the Analyzer View.



To begin, enter the IP address for the desired analyzer, then click Connect.

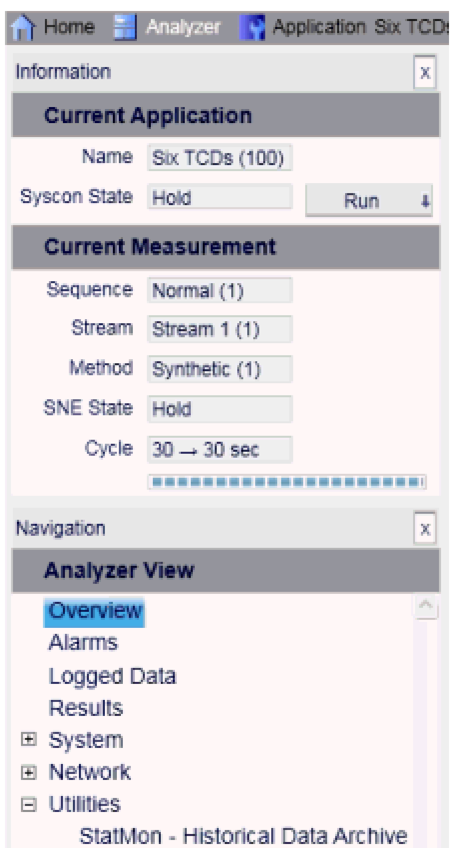


Choose a destination folder for the files, then click Start Logging to begin. Files are written at the end of each cycle.

StatMon - Storing Historical Data 8

Starting in version 4.2, the StatMon table in the database can be configured to store key database values over time. Because there is a limit to the amount of data that can be stored, this should be treated as temporary storage. The workstation interface in the Gas Chomatograph Portal provides configuration and viewing of StatMon values and the ability to export values to a file. Maxum Utilities Datalogger or GCP Datalogger provide more long-term storage of values. See the section on StatMon Table Limitations for important recommendations.

8.1 Configuring the StatMon Table

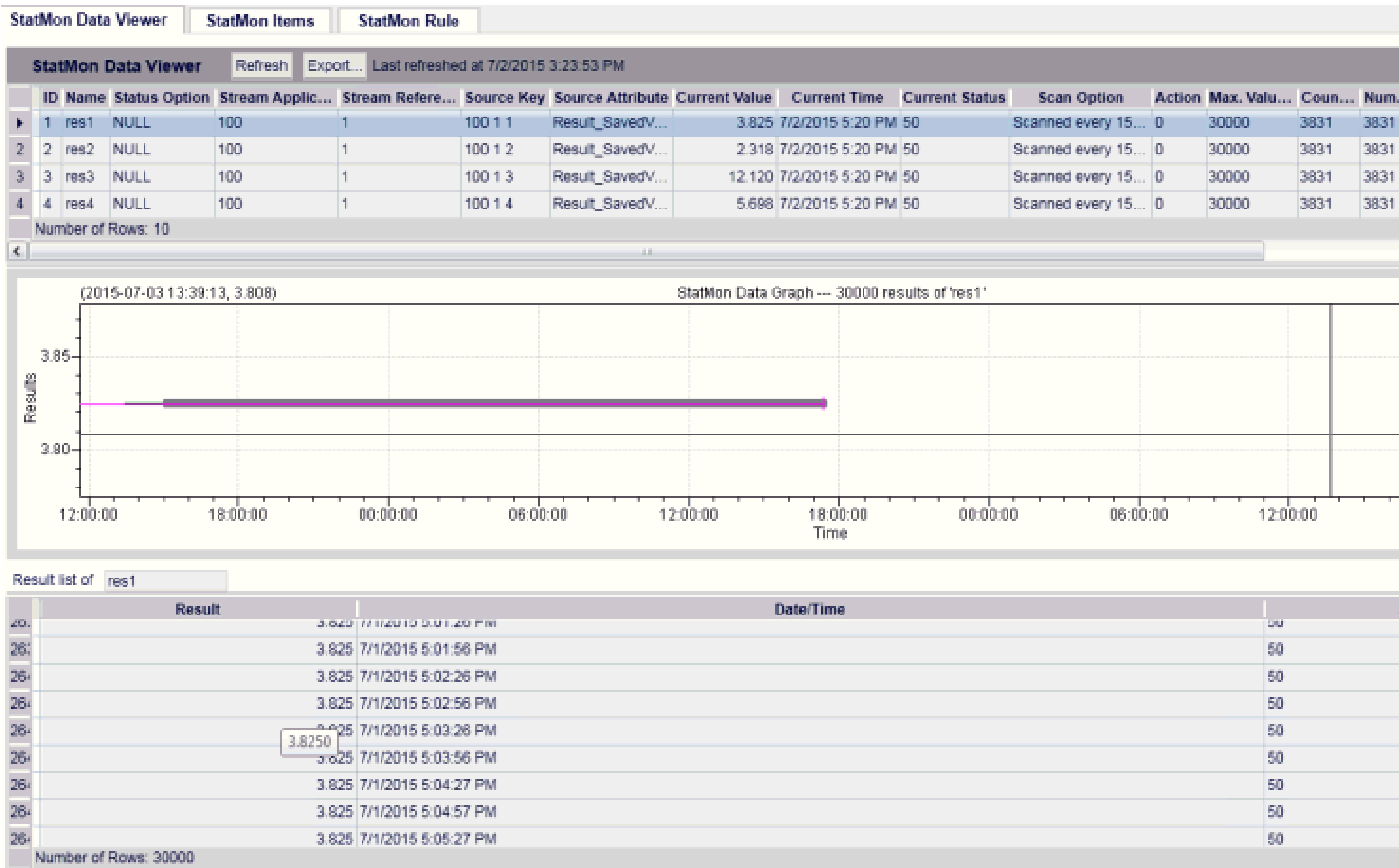


The configuration settings as well as the data (stored in binary format) are stored in the StatMon Table. Table attributes are listed at the end of this document.

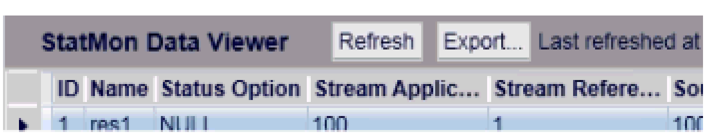
Open the Analyzer or offline database in GCP. Go to the Analyzer tab and select Utilities in the left hand pane.

Select StatMon - Historical Data Archive. You will see 3 tabs and the screen will be showing the StatMon Viewer. The viewer contains a list of configured items, a graph, and a table of stored values. By selecting items in the list, the details are shown in the bottom panes. The list contains some of the attributes in the table, but the labels are not always the same as the table attribute names. These are clarified in the table descriptions at the end of this document.

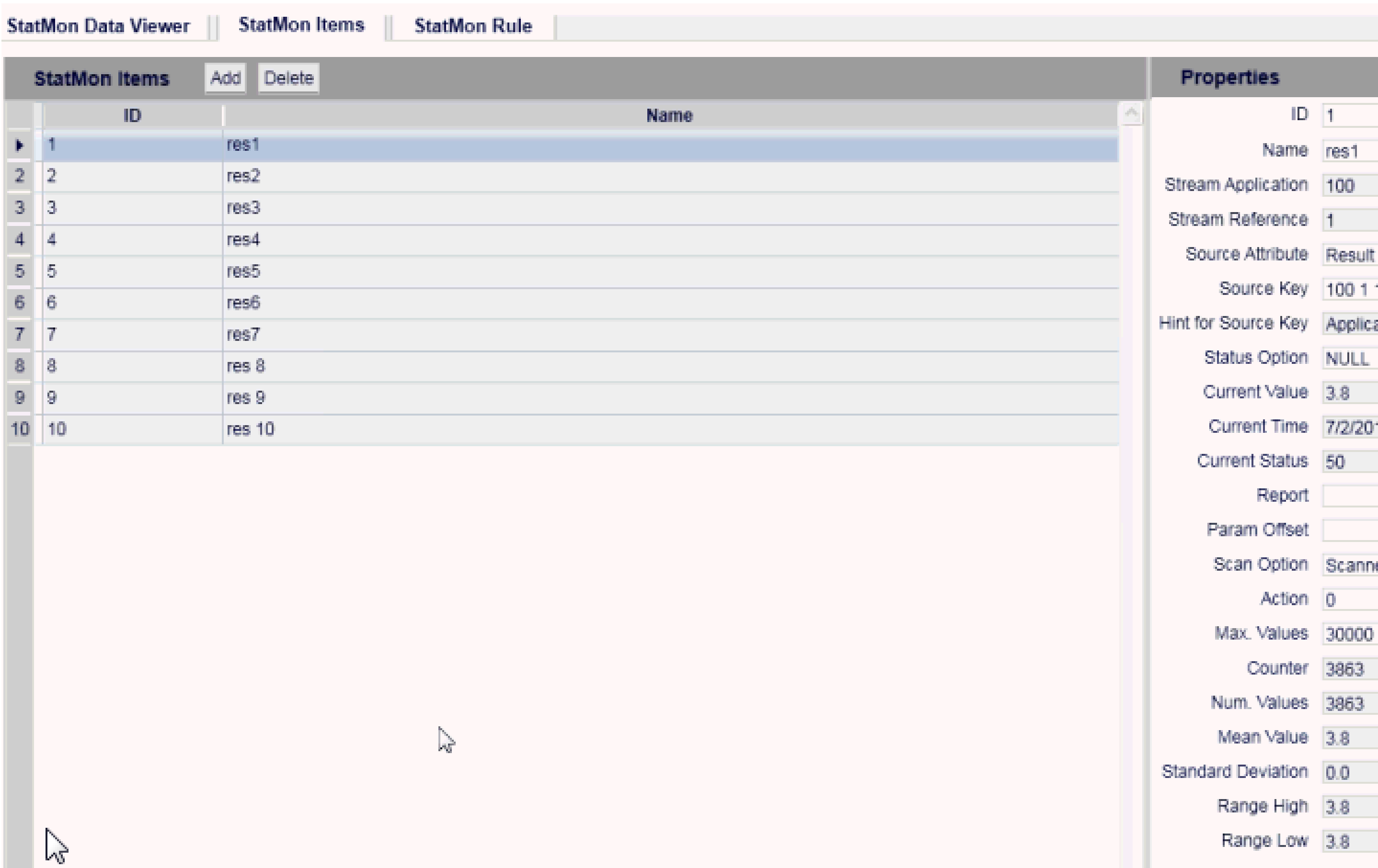
Open the Analyzer or offline database in GCP. Go to the Analyzer tab and select Utilities in the left hand pane.



Export the values in the bottom pane to a file with the Export button.



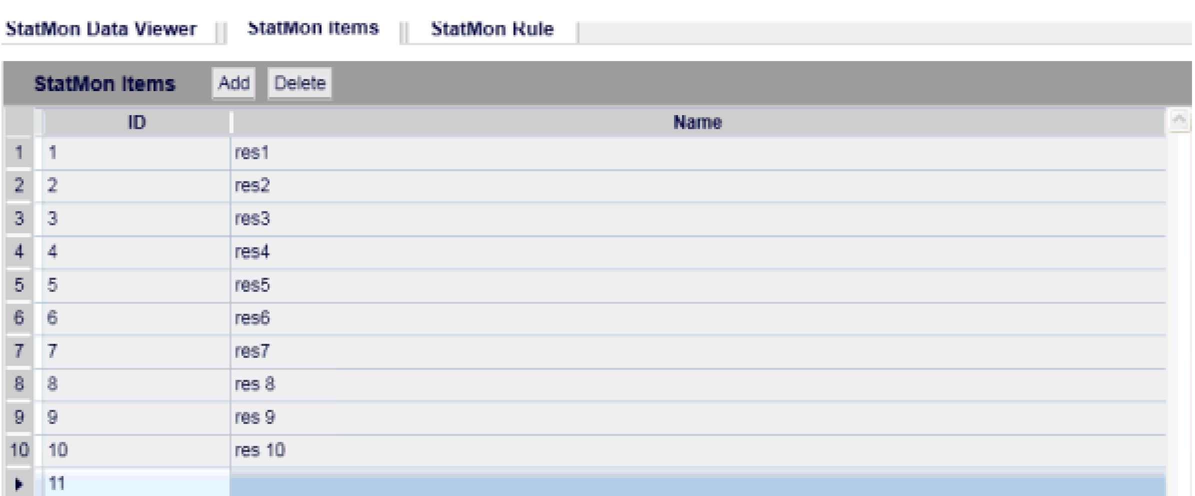
In order to add or edit a StatMon item, select the StatMon Items tab.



The current items are listed on the left, the details on the right.

Existing items can be edited, but in many cases, the data values will be lost when a change is made. Be sure to export values to file before making major changes.

Press the Add button to make a new entry. The ID is always assigned automatically.



Required Attributes

- **ID** – This is a unique identification number for the StatMon table entry.
- **SourceAttribute** –This is the type of data being archived. The available types of data are listed in the source attribute list (see the Attribute List later in this section).
- **Sourcekey** – This identifies which specific data to archive. For example, which Application, stream, method, channel, and group to collect the data from. The applicable Source Key is dependent on the Source Attribute that is chosen. Refer to the Attribute List later in this section. The SourceKey is a space separated list of primary key values referenced by the SourceAttribute.
- **Max_values** – Number of values to store in circular binaries (in general, max_values*cycle length = length, in the timing of the archive).

Optional Attributes

- **Scan_option** – default is zero (values stored at end of cycle). Greater than 0 indicates the rate for polling (5,10,15,30,60 seconds)
- **Status_option** – default is zero – use HCI-H status codes 1 = uses whatever is in the Current_status attribute (Set from a MaxBasic program)
- **Action** – default is zero (nothing happens), statistics are done every point collected -1 = empty out buffer and start collecting new archive. Any value greater than zero sets the rate of statistics computation. For example, 3 means to compute the mean, stdev, rangehi, rangelo every 3 values collected.
- **Name** – This is the name for displaying results (defaults to a system generated name, but may be changed). This name must be unique in the StatMon table.

Informational Attributes

- **Current_value** – last value stored in binvalues
- **Current_time** – last value stored in bintimes
- **Current_status** – last value stored in binstatus

- **Counter** – position in the archive of the last collected value
- **Num_values** – number of values currently in the archive
- **Mean** – arithmetic average of the values in the archive
- **Stdev** – standard deviation of the values in the archive
- **Rangehi** – largest value in the archive
- **Rangelo** – smallest value in the archive
- **Streamapp, Streamref** – Application and Stream that are indicated by the SourceKey. These are generally the first two fields of the SourceKey.

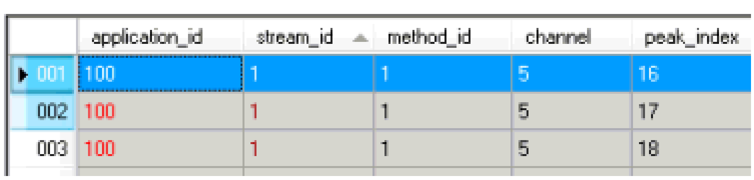
8.2 SourceAttribute and SourceKey

Each sourceattribute requires specific information to uniquely identify the value in the table. The primary key of the table is used, as it is the only unique way to request data from a table. The tables have different primary keys as indicated.

Ezchrom_result_chrompeak

Ezchrom_result_chrompeak has 5 integer values as primary key. These values go in the sourcekey as 5 integers separated by spaces. Sourcekey for the 2nd row in the table below would be "100 1 1 5 17"

From DBBrowser:



	application_id	stream_id	method_id	channel	peak_index
001	100	1	1	5	16
002	100	1	1	5	17
003	100	1	1	5	18

Table 8-1 Ezchrom_result_chrompeak Atributes and SourceAtribute codes

Attribute	SourceAttribute code	Attribute	SourceAttribute code
QUANTIZE	1	ASYM10	21
PEAK_WIDTH5	2	AREA_PERCENT	22
PEAK_WIDTH10	3	HEIGHT_PERCENT	23
PEAK_WIDTH50	4	FRONT_TIME	24
USP_PEAK_WIDTH	5	BACK_TIME	25
RELATIVE_RET_TIME	6	RETENTION_TIME	26
THEOR_PLATES	7	BASELINE_START	27
THEOR_PLATES_METER	8	BASELINE_START_HEIGHT	28
CAPACITY_FACTOR	9	BASELINE_STOP	29
RESOLUTION	10	BASELINE_STOP_HEIGHT	30
CONCENTRATION	11	RAW_AREA	31

Attribute	SourceAttribute code	Attribute	SourceAttribute code
NORM_CONC	12	CORRECTED_AREA	32
X_INT_AT_UP	13	ASYMMETRY	33
Y_INT_AT_UP	14	PEAK_HEIGHT	34
X_INT_AT_DWN	15	PEAK_BASE_WIDTH	35
Y_INT_AT_DWN	16	STRINDX_FRONT_INFL	36
X_SECT_INFL	17	STRINDX_BACK_INFL	37
Y_SECT_INFL	18	PEAK_NOISE	38
FIT_ERROR	19	PEAK_SIGNAL_TO_NOISE	39
CONC_ERROR	20	CURRENT_RF	40

Ezchrom_result_group

Ezchrom_result_group has 5 integer values as primary key. These values go in the sourcekey as 5 integers separated by spaces. Sourcekey for the 2nd row in this table would be “100 1 1 3 300”.

From DBBrowser:

	application_id	stream_id	method_id	channel	group_id
001	100	1	1	5	500
002	100	1	1	3	300
003	100	1	1	3	301

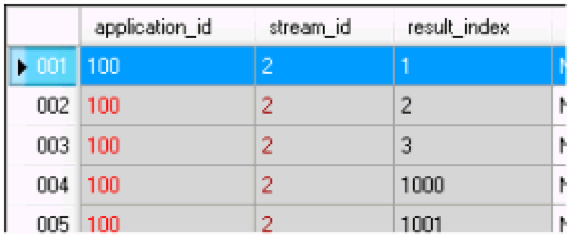
Table 8-2 Ezchrom_result_group Atributes and SourceAtribute codes

Attribute	SourceAttribute code	Attribute	SourceAttribute code
QUANTIZE	50	AREA_PERCENT	56
CONCENTRATION	51	HEIGHT_PERCENT	57
NORM_CONC	52	CORRECTED_AREA	58
GROUP_QVALUE	53	GROUP_HEIGHT	59
FIT_ERROR	54	CURRENT_RF	60
CONC_ERROR	55		

Result

Result has 3 integer values as primary key. These values go in the sourcekey as 3 integers separated by spaces. Sourcekey for the 2nd row in this table would be “100 2 2”

From DBBrowser:



	application_id	stream_id	result_index
001	100	2	1
002	100	2	2
003	100	2	3
004	100	2	1000
005	100	2	1001

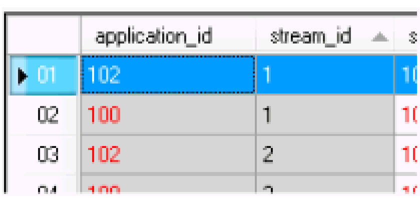
Table 8-3 Result Atributes and SourceAtribute codes

Attribute	SourceAttribute code
BUFFERED_VALUE	80
SAVED_VALUE	81

Stream

Stream has 2 integer values as primary key. These values go in the sourcekey as 2 integers separated by spaces. Sourcekey for the 2nd row in this table would be “100 1”.

From DBBrowser:



	application_id	stream_id
01	102	1
02	100	1
03	102	2

Table 8-4 Stream Atributes and SourceAtribute codes

Attribute	SourceAttribute code
CURR_ERROR	100
CURR_WARNING	101

alarm_log

The alarm_log has 3 integer values as primary key. These values go in the sourcekey as 3 integers separated by spaces. Sourcekey for the 1st row in this table would be “100 1 901”

From DBBrowser:

	appcontext	streamcontext	alarm_code
01	100	1	901

Table 8-5 alarm_log Atributes and SourceAtribute codes

Attribute	SourceAttribute code
ALARMCOUNT	300

calibration_level

The calibration_level section has 7 integer values as primary key. These values go in the sourcekey as 7 integers separated by spaces. This special case contains the stream ID in the 2nd position. Sourcekey for the 1st row in this table would be “100 1 1 1 0 4 0”.

From DBBrowser:

	application_id	method_id	channel	ref_type	cal_id	level	st
01	100	1	1	0	4	0	NL
02	100	1	1	0	5	0	NL
03	100	1	1	0	6	0	NL

Table 8-6 calibration_level Atributes and SourceAtribute codes

Attribute	SourceAttribute code
KNOWN_CONC	310
MEASURED_VALUE	311
NEW_RESPONSE_FACTOR	312
RESPONSE_FACTOR	313
RESIDUAL	314

appai, appao, appdi, and appdo

appai, appao, appdi, and appdo has 2 integer values as primary key. These values go in the sourcekey as 2 integers separated by spaces. Sourcekey for the 1st row in this table would be “100 100”.

From DBBrowser:

	application_id	id	
01	100	100	T
02	100	101	T
03	100	110	T

Table 8-7 appai, appao, appdi, and appdo Atributes and SourceAtribute codes

Attribute	SourceAttribute code
APPAI.VALUE	400
APPAI.AVERAGE	401
APPDI.VALUE	410
APPAO.READBACK	420
APPDO.READBACK	430

8.3 Placing Rules on the StatMon Table

Starting in version 4.3 it is possible to set rules for the data archive (StatMon table). Violation of these rules can be used to cause other actions to occur, such as activating an alarm.

Go to the StatMon Rule tab and press Add. Although GCP fills in suggested values, you may change them.

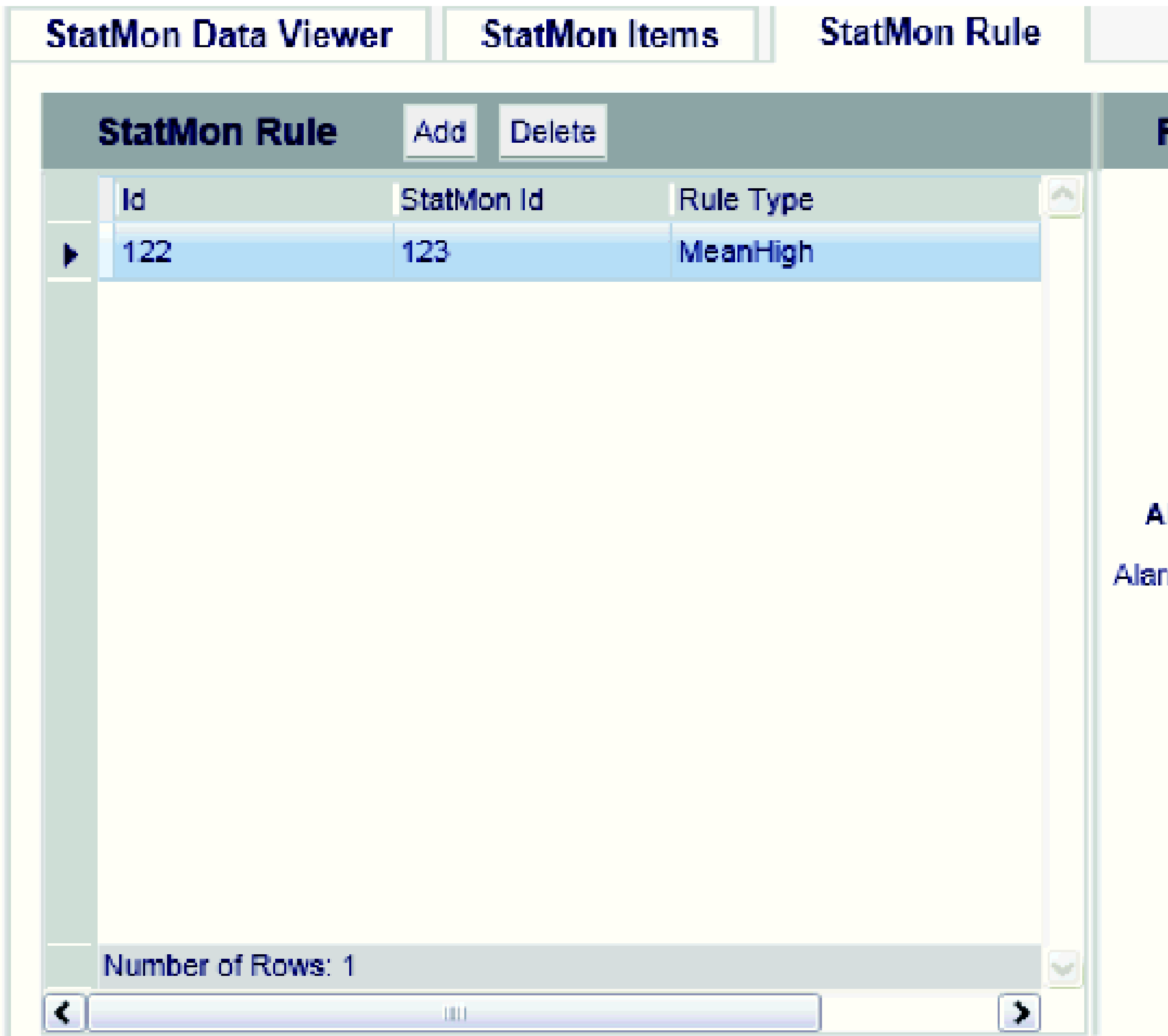


Figure 8-1 Statmon Rule Configuration

Statmon rules may be created by creating a rule in the StatMon Rule Tab and editing the Properties.

- **ID** - This is the unique ID for the rule. It is automatically set when the rule is created.
- **StatMon ID** – This is the StatMon entry ID from the StatMon Items tab.
- **Ruletype(I)**
  - **Mean High** means that the rule is true when the average of the entry is above the limit set by the attribute "Factor 1".
  - **Mean Low** means that the rule is true when the average of the entry is below the limit set by the attribute "Factor 1".
  - **Standard Deviation** means that the rule is true when the current value of the entry exceeds a certain number (set using attribute "Factor 1") of standard deviations from the average value.
  - **Limit** means to apply from the limit table to the current value of the entry.
- **Factor 1** - A numerical value that is used in combination with the Ruletype.
- **Alarm Application and Alarm ID** – Reference to the alarm handler table for ruletype 0,1,2 (ruletype 4 uses limit).

Example

In the example below rule 1 says that if the mean for StatMon ID 3 exceeds 3.0, that alarm 901 from the alarmhandler table will execute.

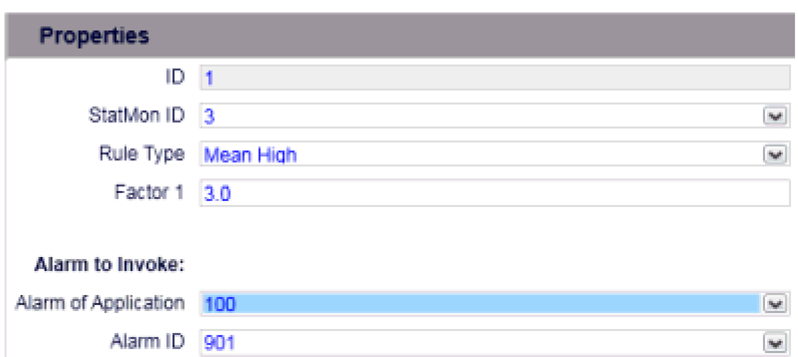


Figure 8-2 StatMon Rule Properties example

It is a challenge to sort out the labels that GCP uses for the actual table attributes.

From DBBrowser:

	id	rulenum	ruletype	factor1	factor2	factor3	factor4	almapp	almref
1	3	1	0	3	NULL	NULL	NULL	100	901
*2									

Example for Ruletype 4

StatMon id 10 will have the current_value checked against limit 901 in the limit table and whatever limit processing will happen.

From DBBrowser:

	id	rulenum	ruletype	factor1	factor2	factor3	factor4	almapp	almref
1	3	1	0	3	NULL	NULL	NULL	100	901
2	10	2	4	901	NULL	NULL	NULL	NULL	NULL
*3									

Ruletype(I)

- 0 = Mean is above factor1
- 1 = Mean is below factor1
- 2 = current_value exceeds factor1 Standard Deviations from mean
- 4 = Apply Limit to current_value

factor1(F)

- For ruletype 0 and 1, the value to check mean against
- For ruletype 2, number of standard deviations from the mean for current value
- For ruletype 4, limit ID to use to apply to current value

Almapp,Almref

Reference to alarmhandler table for rultype 0,1,2 (ruletype 4 uses limit)

Table 8-8 StatMon Table Attributes

Id(integer)	Integer unique ID . StatMon Viewer and Items (ID), StatMon Rule(StatMon ID)
status_option(integer)	StatMon Viewer and Items(Status Option) • zero(default) uses HCIH status codes for results • 1 = use whatever is in the current_status(Set from MaxBasic only)
streamapp(i),streamref	reference to stream table if applicable. Set automatically. Stream Viewer and Items(Stream Application and Stream Reference)
sourcekey(String)	space separated list of primary key to table(depends on sourceattribute). StatMon Viewer and Items(Source Key)
sourceattribute(integer)	Source of value being archived StatMon Viewer and Items(Source Attribute)
name(String)	Name for displaying results(has a default value, but may be changed) (should be unique) StatMon Viewer and Items(Name)
current_value(Float)	Last value stored in binvalues. StatMon Viewer and Items(Current Value)
current_time(Datetime)	Last time stored in bintimes.- local time. StatMon Viewer and Items(Current Time)
current_status(integer)	Last status stored binstatu.s StatMon Viewer and Items(Current Status)

scan_option(integer)	StatMon Viewer and Items(Scan Option) • 0 (zero) = end of cycle • >0 = rate for polling(5,10,15,30 seconds)
action(integer)	StatMon Viewer and Items(Action) • -1 = empty binvalues, bintimes,binstatus • 0 = no action • >0 = interval for computing mean, standard deviation and range
max_values(integer)	Number of values to store in circular binaries StatMon Viewer and Items(Max. Values)
binvalues(Binary)	Values. Only viewable in the table in the StatMon Viewer as Result
bintimes(Binary)	Times. Only viewable in the table in the StatMon Viewer as Date/Time
binstatus(Binary)	Status. Only viewable in the table in the StatMon Viewer as Status
counter(integer)	Position in binary for next value. StatMon Viewer and Items(Action)
num_values(integer)	Number of values in binaries. StatMon Viewer and Items(Num. Values)
mean(Float)	Arithmetic mean of all values in binary binvalues. StatMon Viewer and Items(Mean Value)
StDev (Float)	Standard deviation of all values in binary binvalues. StatMon Viewer and Items(Standard Deviation)
Rangehi(Float)	High value in binary binvalues StatMon Viewer and Items(Range High)
Rangelo(Float)	Low value in binary binvalues. StatMon Viewer and Items(Range Low)
Report(String)	Used to print standard reports. StatMon Items(Report)
Paramoffset(Integer)	Offset in the parameter table for storing daily averages. StatMon Viewer and Items(Param Offset)

Table 8-9 StatMon_rule Table Attributes

Id(integer)	S row in the StatMon table. StatMon Rule (StatMon ID)
Rulenum(Integer)	Unique number(each StatMon table entry can have multiple rules) . StatMon Rule (ID)
Ruletype(Integer)	StatMon Rule (Rule Type) • 0 = Mean High • 1 = Mean Low • 2 = Standard Deviation • 4 = Limit
factor1(Float)	StatMon Rule (Factor 1) • For ruletype 0 and 1, value to check mean • For ruletype 2, number of standard deviations from the mean for current value • For ruletype 4, limit ID to use to apply to current value

factor2(Float)	Not used
factor3(Float)	
factor4(Float)	
almapp,almref	A row in the alarmhandler table. alarm to issue if rule is violated . StatMon Rule (Alarm of Application, Alarm ID)

8.4 StatMon Table Limitations

There are 2 important types of limitations for using the StatMon table: memory limitations and processing limitations.

Memory Limitations

The database of the Maxum is loaded into memory as it executes. Each process on the unit has a maximum allowable process memory. Each value in each row of the StatMon table occupies 16 bytes of memory. Entries in the StatMon table must not exceed 3 MB of memory. A row that stores 30000 values will use .48MB, 50000 values use .8MB, etc

(Number of values * 16)/1000000 = MB of memory required for the value binary data.

For Version 5.2, internal checks are done to keep the memory usage less than 3 MB. There is a setting in the Maxum config file that can be changed to increase or decrease this amount, but this change should only be made by Customer Service.

Processing Limitations

When using the scan_option to store values polled from a timer (5,10,15, or 30 seconds), note the following:

- Many times these entries are used to scan AI values. If the AI is only scanning every 15 seconds from the hardware, it makes no sense to poll from the StatMon table every 5 seconds. Be sure the scan rate of the IO makes sense between the two tables.
- Timer polling with scan_option > 0 can impact the database and its ability to function and save to flash under maximum memory usage. These are the limits on timer usage:
  - Maximum of 10 timers
  - Up to 5 of the timers scanning at 5 second rates, with the rest at lower rates
  - Maximum values for all 10 timers: 1440

Simulated Distillation 9

9.1 Overview

Simulated distillation ("SimDis") is a gas chromatographic method that emulates the distillation of mixtures, namely petroleum-based products, to establish their boiling point distribution in correlation to evaporated volume percent. Such a correlation can be used to monitor and optimize the manufacturing process of gasoline, kerosene, and diesel. SimDis yields such results in 10-60 minutes, whereas actual laboratory distillation is much more time consuming, labor intensive and error prone. Even though SimDis methods yield answers close to the "true" results, they often have to be correlated to laboratory one-plate distillation methods such as ASTM D86 to enable comparisons with these cruder methods.

ASTM Method Compliance

This simulated distillation modules performs almost all operations as defined in the following ASTM methods:

- **D2887-97a:** *Boiling range distribution of petroleum fractions by gas chromatography*
- **D3710-95:** *Boiling range distribution of gasoline and gasoline fractions by gas chromatography*
- **D4814-99:** *Standard specification for automotive spark-ignition engine fuel*, Appendix 2.

There are a few optional ASTM method specifications that are not performed by the simulated distillation module implementation. These exceptions--mostly suitability calculations--are described below.

ASTM D2887

Calculation of resolution R between n-Hexadecane and n-Octadecane. The resolution must be between R ≥ 3.0 and R ≤ 10.0 for a suitable method and instrument.

Calculation of relative response factors f in a calibration mixture (relative to n-Decane). The relative response factors must be between f ≥ 0.900 and f ≤ 1.100 for a suitable method and instrument.

Optional automatic detection of the 100% point, when the rate of change is < 0.01% of the total area count. (This Simdis module employs a threshold instead.) ≥ 0.900 and f ≤ 1.100 for a suitable method and instrument. Optional automatic detection of the 100% point, when the rate of change is < 0.01% of the total area count. (This Simdis module employs a threshold instead.)

ASTM D3710

Determination of a 5% valley of iso-Pentane and lighter peaks. For a suitable method and instrument, adjacent peaks must be separated so that the height of the valley above the baseline is not more that 5% of the height of the smaller of the two peaks forming the valley.

Calculation of resolution R between n-Dodecane and n-Tridecane. The resolution must be between R ≥ 2.0 and R ≤ 4.0 for a suitable method and instrument. Calculation of the area-to-noise ratio (A/N) of n-Hexane. For a suitable method and instrument, A/N Calculation of resolution R between n-Dodecane and n-Tridecane. The resolution must be between R ≥ 2.0 and R ≤ 4.0 for a suitable method and instrument. Calculation of the area-to-noise ratio (A/N) of n-Hexane. For a suitable method and instrument, A/N must be ≥ 10.0 for each 0.05 LV% of n-Hexane. For a nominal calibration mixture concentration of 5% n-Hexane, A/N must be ≥ 1000.0. -Hexane. For a nominal calibration mixture concentration of 5% n-Hexane, A/N must be ≥ 1000.0.

Drift determination of a blank run. For a suitable method and instrument, the drift must be ≤ 2.0% total area of the blank run versus the total area of the calibration mixture. Calculation of peak asymmetry A at 5% height for all 19 peaks in the calibration mixture. The asymmetry must be between A ≥ 0.50 and A ≤ 2.00 for a suitable method and instrument.

Retention time repeatability r for isopentane and lighter components. The repeatability must be r ≤ 3.0 sec, and the retention time of Propane must be ≥ 15 sec for a suitable method and instrument.

The repeatability of calculated boiling points for n-Pentane and heavier components must be ≤ 2.0°C for a suitable method and instrument. The boiling points BP calculated at the measured retention times of all normal paraffins in the calibration mixture must deviate by less than 6.0°C from their true boiling points for a suitable method and instrument.

Repeatability of the area of all calibration mixture components must be within 0.1% for a suitable method and instrument.

The calculated normalized liquid volume percentages of all components heavier than n-Butane must be within 0.5% of their known percentages for a suitable method and instrument. Suppression of peaks with a signal-to-noise ratio > 3.0 from a blank run when performing a baseline subtraction. Optional determination of the end of integration when the rate of change is < 50µV/min or 0.001% of the total area. (This Simdis module employs a threshold instead.)

License Error (Simulated Distillation)

Simulated Distillation operates under a separate license from Gas Chromatograph Portal. A license error has occurred. The Simulated Distillation module is now running in demo mode and can connect only to simulation databases.

The following license errors can occur:

- Simultaneous use of this license detected on xx.xx.xx.xx The same single license has been installed elsewhere on the network and that application has started before this one (xx.xx.xx.xx is the IP address of the computer where the same single license is currently running). Shut down the application both on this and the other machine, and then restart the application on this machine.
- This trial version expired on [Date] A trial version has expired.
- Invalid license key found. Invalid licensing information stored for this application on this computer.
- Installation of a demo version detected. Application was originally installed as a demo version, or the licensing information for this application can no longer be retrieved on this computer.

Please contact Siemens to obtain additional or replacement licenses for this application.

9.2 Setup Tab

Setup Tab Options

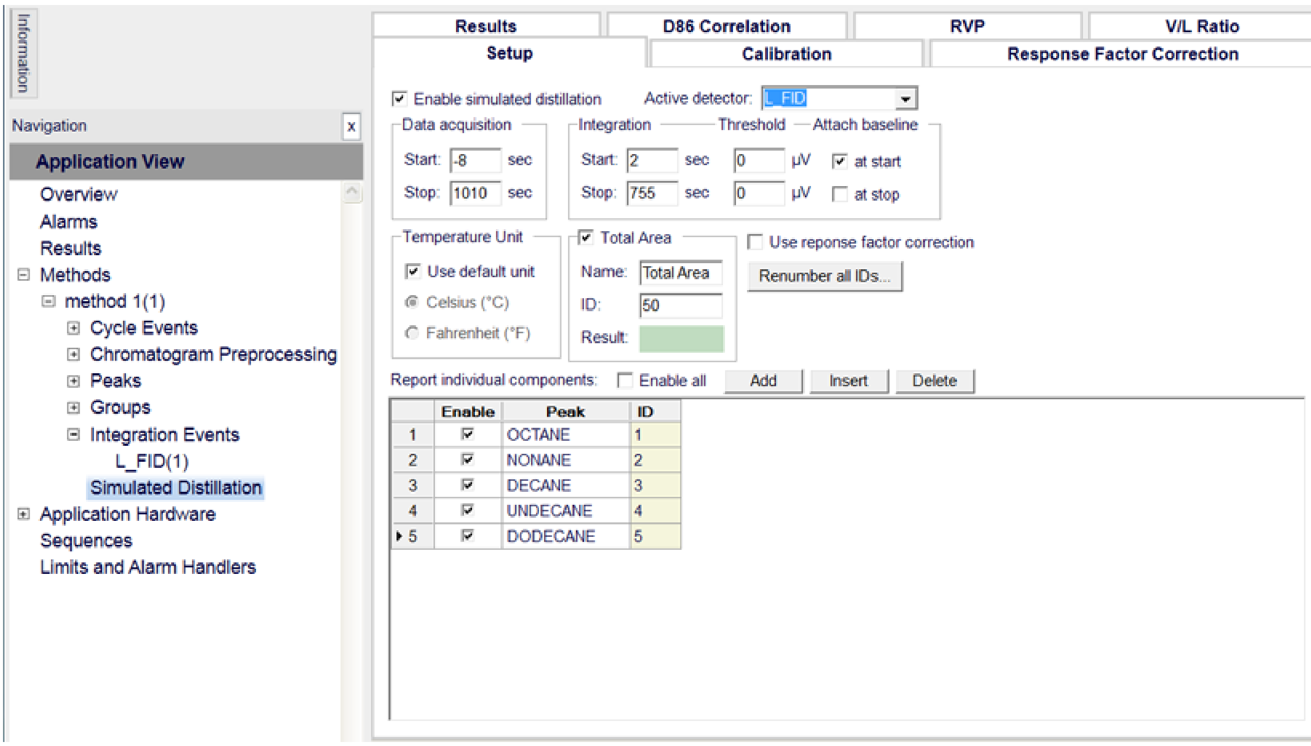
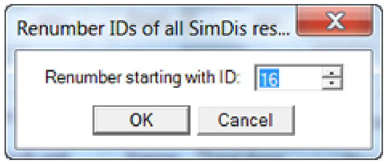


Figure 9-1 Setup Method for Simulated Distillation

In this section, the overall method is set up for simulated distillation.

Enable Simulated Distillation	Uncheck this box if Simdis should be disabled for this method.
Active Detector	This selection determines the detector signal for which the Simdis module will carry out the Simdis calculations. Only one detector signal per method can be analyzed with Simdis.
Data Acquisition	Enter the start and stop times for the chromatogram data acquisition here. These entries will automatically synchronize with the detector setup in the Cycle Events table.
Integration	Begin and end times to calculate the total area for Simdis. These times must be inside the data acquisition start and stop times. Between the start and end of the integration, the Method software will calculate a straight horizontal baseline, anchored at the start time.
Threshold	Both the start and end integration times can be made sensitive to rising/falling baselines (0 = no threshold). For example, with a start threshold of 100 µV, the Method software will start integrating only when the baseline rises by at least 100 µV between data points. Once this point is found, the preceding valley point (flat baseline) becomes the starting integration point.
Attach Baseline	Normally, Simdis attaches a straight forward horizontal baseline to the starting point of the integration. For certain situations, it may be necessary to attach a straight backward horizontal baseline to the end point of the integration, or to have a straight rising/falling baseline attached to both the start and stop of the integration. If no baseline chromatogram is used, and the straight baseline is attached either to the start or the stop of the integration (but not both), Simdis also clips any data points below the baseline; negative-area segments are ignored.

Temperature Units	Simdis uses the Methods default settings for time, temperature, and pressure (go to the Cycle Events tables to view settings). For temperature numbers, this dependency can be decoupled by unchecking USE DEFAULT UNITS and choosing between degrees Celsius or Fahrenheit as the Simdis temperature unit.
Total Area	The total area can be reported as a result in Simdis. Check this box to include it as a result value. The name of the total area and the result ID can be specified as well. A green number after "Result:" shows the current value of the total area in µV-sec.
Use Baseline Chromatogram	In certain situations, it may be necessary to record and use a baseline chromatogram to subtract from the measurement chromatogram to compensate for sharply rising baselines at high oven temperature. There are two different ways to use a baseline chromatogram: • If a baseline chromatogram file is available, go to METHOD | ADVANCED | FILES, check the Baseline file box, and open the baseline chromatogram file. Then check the appropriate detector name below the baseline file name to enable baseline subtraction. Baseline subtraction will then occur the next time a chromatogram file is opened. • If a baseline chromatogram is not yet available, but will be acquired in the analyzer, check this box Use baseline chromatogram and set up an online sequence entry that can acquire a baseline chromatogram (see help for Online Sequence Run Type).
Use Response Factor Correction	When Simdis is calibrated with a calibration mixture, e.g., for an ASTM D3710 analysis, response factor corrections are usually made. Check or uncheck this box to enable or disable all response factor corrections. See Response Factor Correction tab section for more information.
Renumber All IDs	Here, all result IDs can be renumbered consecutively throughout all sections. Simdis will look for any peaks defined for this detector and offer the highest peak ID plus 1 as the starting number for renumbering peaks. For example, in a D3710 method, 19 peaks with IDs 1 through 19 are normally defined. Simdis will start with 20 as the lowest possible ID and renumber the result IDs in this order: 1. Setup: total area 2. Results: boiling points 3. Results: cut volume 4. Results: summed volume 5. D86 correlation: Ford et al. 6. D86 correlation: Bird & Kimball 7. RVP 8. V/L 4, 20, 45 (computer method) 9. V/L 20 (linear equation method)
Report Individual Components	Simdis can also report individual components as part of the Simdis results. Select these components from the list of method peaks.
Enable all	Uncheck this box to remove all peaks from the result list. Check to enable all peaks in the result list.
Enable	Uncheck a peak to remove it from the result list while keeping it on the setup list.
Peak	The name of the peak to be reported is listed here. The selection list for new peaks always contains only those peaks that haven’t already been entered here.

<table>
<tr><td>ID</td><td>The peak or result ID.</td></tr>
<tr><td>Renumber Result IDs</td><td>

Setup, Renumber starting with ID window
Renumber starting with ID: window
Result IDs can be sequentially renumbered starting with the ID entered here. Normally, this affects only the currently displayed result setup table, unless this function was started from the Setup page. In that case, Simdis renumbers all result IDs throughout the module in this order:

Total area
Boiling points
Cut volume
Summed volume
D86 correlation (Ford et al.)
D86 correlation (Bird & Kimball)
Reid vapor pressure
V/L (computer method)
V/L (linear equation method)

For global renumbering, Simdis will suggest the first ID to be the highest peak ID plus 1. </td></tr>
</table>

Errors in Simulated Distillation Setup

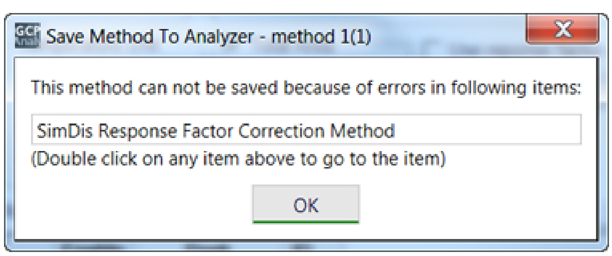


Figure 9-2 Setup, Errors in Method setup

If any data entry errors exist in the simulated distillation module setup, Simdis will show this error dialog when the Method is saved. Double-clicking on any of the entries will go directly to the table.

9.3 Callibration Tab

Overview

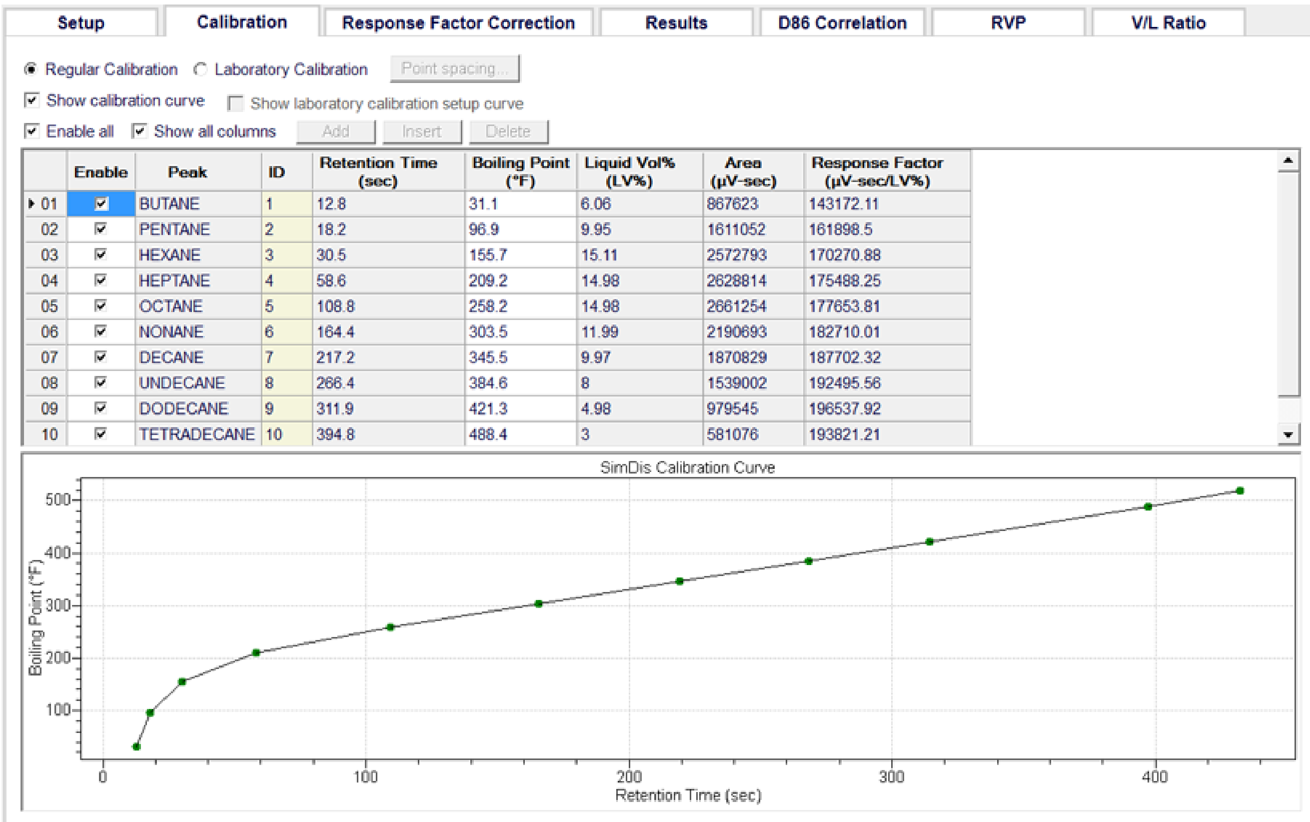


Figure 9-3 Simdis Calibration Tab with Regular Calibration selected

Simdis methods can be calibrated using Regular Calibration or Laboratory Calibration:

- Regular Calibration, to show all columns in this table, or select
- Laboratory Calibration to show a limited set of columns in this table.

9.3.1 Regular Calibration Option

Regular Calibration

Check this box to enter values from a regular calibration. The typical Simdis application is calibrated with a test mixture of known composition. This mixture is run to establish the correlation between retention time and boiling point for a given column configuration and separation method. An example for such a chromatogram is given below (an ASTM D3710 calibration):

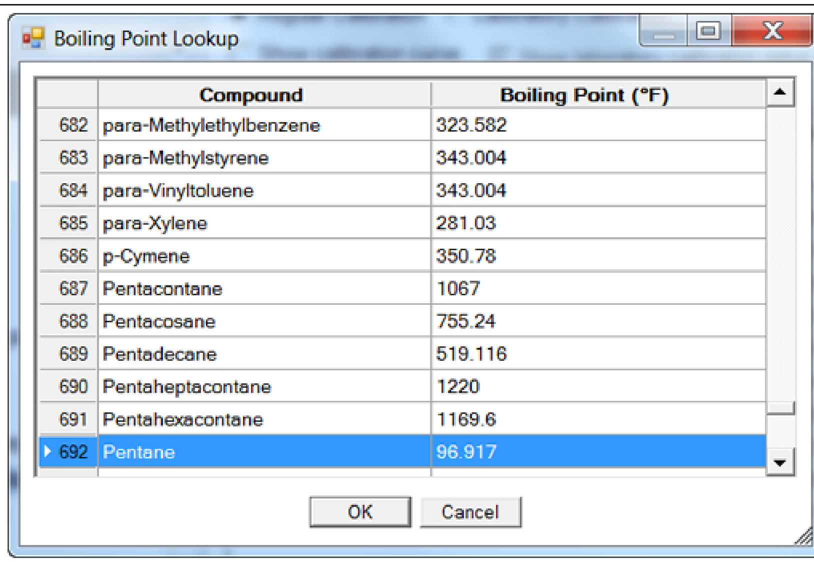
Show Calibration Curve	Click on this button to view and print a graphical representation of the calibration curve for both regular and laboratory calibration.
Enable all	Check to enable all peaks in the table, click to uncheck and disable all peaks. Click Enable on each row to toggle enable/disable for specific peaks.
Show All Columns	(Not available for laboratory calibration.) Check this box to have Simdis show all columns with supporting information. Unchecked will not display Retention Time and Response Factor columns.

Regular Calibration Table

The boiling point of each of these 19 components and their volume percent in the test mixture is known. In an ASTM D3710 calibration mixture, these components are:

	Component	Retention Time (s)	Boiling Point (°C)	Liquid Vol % (LV%)
1	Propane	39.0	-42.07	1.0
2	iso-Butane	75.5	-11.73	3.0
3	n-Butane	104.5	-0.495	10.0
4	iso-Pentane	179.0	27.85	9.0
5	n-Pentane	204.0	36.065	7.0
6	2-Methylpentane	244.0	60.27	5.0
7	n-Hexane	256.5	68.736	5.0
8	Benzene	286.0	80.10	5.0
9	n-Heptane	316.0	98.424	9.0
10	Toluene	360.5	110.62	10.0
11	n-Octane	392.0	125.673	5.0
12	p-Xylene	440.0	138.35	12.0
13	n-Propylbenzene	497.0	159.22	4.0
14	n-Decane	529.0	174.155	3.0
15	n-Butylbenzene	559.0	183.27	3.0
16	n-Dodecane	636.0	216.28	3.0
17	n-Tridecane	684.0	235.43	2.0
18	n-Tetradecane	730.5	253.57	2.0
19	n-Pentadecane	778.5	270.62	2.0

With this information, a calibration curve of retention time vs. boiling point can be established. This calibration curve is to be treated like a multi-level calibration lookup table: For a retention time between two calibration points, the appropriate boiling point value is calculated via interpolation. For retention times outside the calibration curve, the boiling point has to be calculated using extrapolation of the nearest calibration curve segment.

<table>
<tr><td>Enable</td><td>Uncheck a peak to remove it from the calibration.</td></tr>
<tr><td>Peak</td><td>The name of the peak from the Method Peaks table.</td></tr>
<tr><td>ID</td><td>The peak ID from the Method Peaks table.</td></tr>
<tr><td>Retention Time</td><td>The retention time for this peak from the Method Peaks table table. The time can be viewed in minutes or seconds, depending on the Prefered Units setting in the menu item Tools and Options. Note that the retention times displayed in this column are from the peak table. The retention times displayed in the calibration curve are the actual peak retention times that Simdis found during calibration.</td></tr>
<tr><td>Boiling Point</td><td>This column lists the boiling points of each peak either in °C or in °F, depending on the Prefered Units setting in the menu item Tools and Options. For new peaks, Simdis performs an automatic lookup and fills in the boiling point for each peak. This cell will be empty if Simdis is unable to find the boiling point of a peak. In this case, you can either run the lookup yourself by clicking on the small arrow in the cell, or by entering the value manually. Once the value has changed, Simdis will display it in blue instead of black.</td></tr>
<tr><td>Lookup Boiling Point</td><td>


Simdis Boiling Point Lookup Table

Simdis comes with a database of physical properties for over 300 components with more than 400 additional synonyms. Most of the components have entries for boiling point, relative density, molecular weight, and whether the component is a normal paraffin. This database is stored as the text file PhysicalProperty.txt in the Gas Chromatography Portal directory, which can be edited by following the directions inside that file.

All physical property lookups are performed in this dialog box, which lists all components and their synonyms in alphabetical order.</td></tr>
<tr><td>Liquid Vol%</td><td>The standard concentration from the first "Level x" column in the Advance EZChrom peak table. For a D3710 calibration, this number must be in "Liquid Vol%" units.</td></tr>
<tr><td>Area</td><td>The calibration area for this peak.</td></tr>
<tr><td>Response Factor</td><td>The response factor for this peak. Response Factor = Area/Liquid Vol%</td></tr>
</table>

9.3.2 Laboratory Calibration Option

Laboratory Calibration Option

Check this box to enter values from a laboratory calibration.

If a calibration mixture is not available or a known correlation between boiling point and percent evaporated ("%Off") already exists, a manual calibration curve of a different kind can be established using a "%Off" vs. "Boiling Point" list:

%Off (LV%)	Boiling Point (°C)	%Off (LV%)	Boiling Point (°C)
0.5	-9.4	65	82.8
5	2.9	70	97.4
10	4.8	75	110.5
20	31.5	80	112.6
30	32.2	85	135.1
40	39.7	90	152.7
50	44.4	95	173.9
60	69.3	99.5	221.4

Using a sample of an unknown mixture, a chromatogram is collected with the established temperature program. Using the Simdis calculations described for regular calibration, a relationship can be established between the data points for percent evaporated in the table above and the corresponding retention time. From this relationship, the usual retention time vs. boiling point calibration curve can be constructed.

Point Spacing

A list of evenly spaced %Off values can be generated with this dialog, including the initial boiling point (IBP, or 0.5%Off) and final boiling point (FBP, or 99.5%Off). Any spacing between 0.1% and 50% is allowed. This action overwrites the existing Laboratory Calibration table.

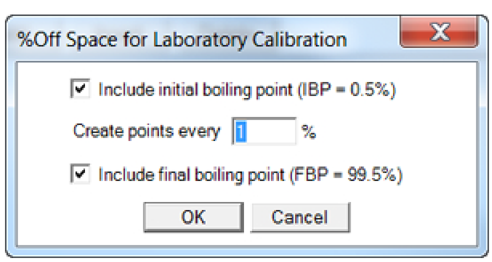


Figure 9-4 %-Off Point Spacing for Laboratory Calibration

Examples:

IBP 10% FBP	10%	IBP 0.4% FBP	0.4%	IBP 0.1% FBP	0.1%	IBP 30% FBP
0.5	10	0.5	0.4	0.5	0.1	0.5
10	20	0.9	0.8	0.6	0.2	30
20	30	1.3	1.2	0.7	0.3	60
30	40	1.7	1.6	0.8	0.4	90
...	...	...	...	...	...	99.5

IBP 10% FBP	10%	IBP 0.4% FBP	0.4%	IBP 0.1% FBP	0.1%	IBP 30% FBP
80	70	98.9	98.8	99.3	99.7	
90	80	99.3	99.2	99.4	99.8	
99.5	90	99.5	99.6	99.5	99.9	

Show Calibration Curve	Click on this button to view and print a graphical representation of the calibration curve for both regular and laboratory calibration.
Show Laboratory Calibration Setup Curve	(Not available for regular calibration.) This graph shows the laboratory calibration values in a graphical representation. See Graph Display Functions for a detailed description of all functions in this window.
Enable all	Check to enable all peaks in the table, click to uncheck and disable all peaks. Click Enable on each row to toggle enable/disable for specific peaks.
Add, Inset and Delete Buttons	(Not available for regular calibration.) These buttons will add a point to the end of the table with the next logical %OFF value midpoint between the last point and 100 with a calculated Boiling Point temperature. Insert a point above the selected row with the logical %OFF value midpoint between the previous point and the current point with a calculated Boiling Point temperature. Delete the selected point.

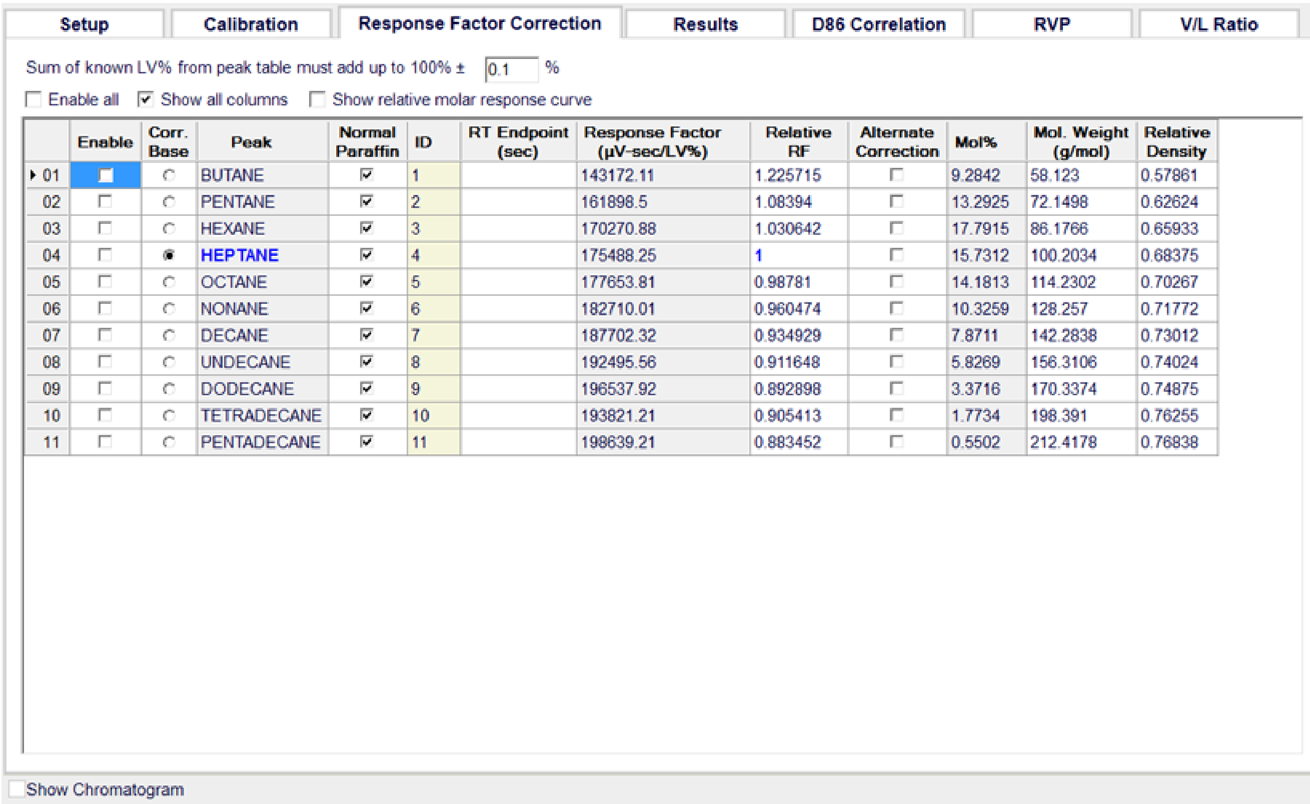
Laboratory Calibration Table

Enable	Uncheck an entry to remove a point from the calibration.
%Off (LV%)	The "%Off" value in Liquid Vol% for the laboratory calibration.
Boiling Point (°C)	The corresponding boiling point value, which can be displayed either in °C or in °F, depending on the Prefered Units setting in the menu item Tools and Options, depending on the Prefered Units setting in the menu item Tools and Options.

9.4 Response Factor Correction Tab

Response Factor Correction Tab

For ASTM D3710 calculations, response factor correction is required for all Simdis calculations. This can be done only if the Simdis application has been calibrated with a calibration mixture for regular calibration.



	Enable	Corr. Base	Peak	Normal Paraffin	ID	RT Endpoint (sec)	Response Factor (µV-sec/LV%)	Relative RF	Alternate Correction	Mol%	Mol. Weight (g/mol)	Relative Density
01	☐	○	BUTANE	☑	1		143172.11	1.225715	☐	9.2842	58.123	0.57861
02	☐	○	PENTANE	☑	2		161898.5	1.08394	☐	13.2925	72.1498	0.62624
03	☐	○	HEXANE	☑	3		170270.88	1.030642	☐	17.7915	86.1766	0.65933
04	☐	●	HEPTANE	☑	4		175488.25	1	☐	15.7312	100.2034	0.68375
05	☐	○	OCTANE	☑	5		177653.81	0.98781	☐	14.1813	114.2302	0.70267
06	☐	○	NONANE	☑	6		182710.01	0.960474	☐	10.3259	128.257	0.71772
07	☐	○	DECANE	☑	7		187702.32	0.934929	☐	7.8711	142.2838	0.73012
08	☐	○	UNDECANE	☑	8		192495.56	0.911648	☐	5.8269	156.3106	0.74024
09	☐	○	DODECANE	☑	9		196537.92	0.892898	☐	3.3716	170.3374	0.74875
10	☐	○	TETRADECANE	☑	10		193821.21	0.905413	☐	1.7734	198.391	0.76255
11	☐	○	PENTADECANE	☑	11		198639.21	0.883452	☐	0.5502	212.4178	0.76838

Figure 9-5 Response Factor Correction Tab

The response factor corrections are applied around the calibration peak apex to the "halfway points" between neighboring peaks:

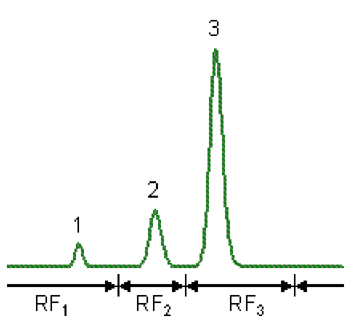


Figure 9-6 Response Factor Corrections

For example, the response factor RF_2 in the picture above is applied from the point halfway between apex 1 and 2 to the point halfway between apex 2 and 3. The first response factor correction is applied from the first data point to the point halfway between apex 1 and 2, and the last response factor correction is treated similarly.

9.4.1 Calculations

Calculations

1. Locate the response factor RF_0 for n-Heptane. If this factor is not available, find the minimum response factor RF_{min}.
2. Divide RF_0 or RF_{min} by all response factors RF_1 through RF_{19} to yield relative response factors RC_1 through RC_{19}. For example, if RF_1 = 100,000, and RF_0 = 50,000, all responses in the range of RF_1 are twice as large as compared to the responses in the range of RF_0 for the same LV%. Thus, all data points in the range of RF_1 need to be multiplied by RC_1 = RF_0 / RF_1 = 0.5 to give the same response for the same LV%.
3. Multiply each data point in each retention time range with its corresponding relative response factor RC_i. This will likely lead to a chromatogram with a different maximum point.
4. Determine the minimum and maximum responses in the chromatogram before and after the correction to obtain a correction factor cf: 0 or RF_{min} by all response factors RF_1 through RF_{19} to yield relative response factors RC_1 through RC_{19}. For example, if RF_1 = 100,000, and RF_0 = 50,000, all responses in the range of maximum responses in the chromatogram before and after the correction to obtain a correction factor C_f:

   $$c_f = \frac{Max_{old} - Min_{old}}{Max_{new} - Min_{new}}$$

5. Multiply all data points with this correction factor to get a chromatogram with similar intensities as before and store the final result as temporary chromatogram.

9.4.2 Alternate Response Factor Correction

Alternate Response Factor Correction

If response factor correction is applied, individual components from the calibration mixture may be treated differently to correct for loss of lighter components (see ASTM method D3710). This is normally not necessary for a Simdis analysis with Siemens Maxum gas chromatographs. The alternate calculation of relative response factors RC_i needs to be specified for each individual component in the calibration mixture. Otherwise, the regular calculation of relative response factors is carried out.

Alternate relative response factors are calculated using these steps:

1. Calculate relative molar responses RMR_i for all normal paraffin peaks from C5 and higher, except for the ones that require alternate calculation of relative response factors.

   $$RMR_i = \frac{A_i - mol_0}{mol_i - A_0}$$

   where

   – A_i is the area of peak i, and A_0 is the area of the reference peak, normally n-Heptane.

   – Mol_0 and mol_i are the calibration mixture mol% compositions of the reference peak and the peak of interest, respectively.

2. From the values of RMR_i calculated in the previous step, run a linear fit with least squares to form the equation

   $$RMR_i = a \times MW + b$$

   where

   – MW is the molecular weight for the component

   – a and b are the factors of the linear equation

3. Using the linear equation established in the previous step, calculate RMR for all components that require alternate calculation of relative response factors, usually Propane, iso-Butane, and n-Butane.
   Calculate the relative response factor RC_i for all necessary components:

   $$RC_i = \frac{MW_i}{RMR_i \times D_i} \times \frac{RMR_0 \times D_0}{MW_0}$$

   where

   – D_0 is the relative density of the reference component

   – D_i the relative density of the component of interest.

   If RC_i for n-Butane has been calculated, and iso-Butane needs an alternate correction, set RC_i of iso-Butane to the same value as the one for n-Butane.

Show All Columns	Check this box to also show columns with supporting information Corr. Base, ID and Response Factor.
Enable All	Check or uncheck this box to operate on all Enable boxes as a group, i.e., checking this box will check all boxes in the Enable column.
Show Relative Molar Response Curve	Click on this button to show the current relative molar response (RMR) calculation as a graph.
Sum of known LV % from peak table must add up to 100% ± ______ %	Often, standard concentrations for a Simdis calibration mixture don't add up to exactly 100.00%. This field specifies the tolerance, or reports the current tolerance, if the Simdis method is being set up for the first time.
Enable	Check or uncheck to manually include/remove this peak from the response factor correction. Note that this will affect the value in the RT Endpoint column.

Corr. Base	Only a single row in this column can have a check box to indicate which component serves as the correction base. This is usually n-heptane. The correction-base component is also shown in blue and can be changed by checking another box in this column.
Peak	The name of the peak from the Method Peaks table.
Normal Paraffin	If this box is checked, this peak is a normal paraffin. For new peaks, Simdis performs an automatic lookup and fills in the value for each peak.
ID	The peak ID from the Method Peaks table.
RT Endpoint	Response factor correction for this peak is carried out between this and the preceding entry in this column. (If there is no preceding entry, this response factor correction starts at the beginning.) Normally, this value is calculated automatically from the retention time of the individual peaks, and whether they are included in the response factor correction. However, Simdis accepts manual overrides in this column.
Response Factor	The response factor for this peak.
Relative RF	The currently calculated relative response factor, which can be overridden except for the correction-base peak.
Alternate Correction	Check or uncheck this box to toggle between regular and alternate response factor correction. ASTM method D3710 calls for this correction to compensate for the loss of lighter components n-Propane, iso-Butane, and n-Butane, but for a Simdis analysis with Siemens Maxum gas chromatographs, no alternate correction is necessary. Alternate correction cannot be applied if one of the Mol% values is missing. This could be due to a missing entry in the Mol. Weight or Relative Density column, or if the tolerance in SUM OF KNOWN LV% FROM PEAK TABLE is too tight.
Mol%	Currently calculated value for Mol%. This cannot be overridden and is updated automatically when standard concentration, molecular weight, or relative density value change.
Mol. Weight	The molecular weight in g/mol of this component. For new peaks, Simdis performs an automatic lookup and fills in the molecular weight for each peak. This cell is empty if Simdis is unable to find the molecular weight of a peak. In this case, the user can either run the lookup by clicking on the small arrow in the cell, or by entering the value manually. Once the value has changed, Simdis will display it in blue instead of black.
Relative Density	The relative density of the liquid at 20°C relative to water at 4°C (if available). For new peaks, Simdis performs an automatic lookup and fills in the relative density for each peak. If Simdis is unable to find the relative density of a peak, this cell will be empty. In this case, the user can either run the lookup by clicking on the small arrow in the cell, or by entering the value manually. Once the value has changed, Simdis will display it in blue instead of black.

9.5 Simulated Distillation Calculations

Overview

This section describes the calculations for all Simulated Distillation (Simdis) analysis operations. An example of a Simdis chromatogram is given below:

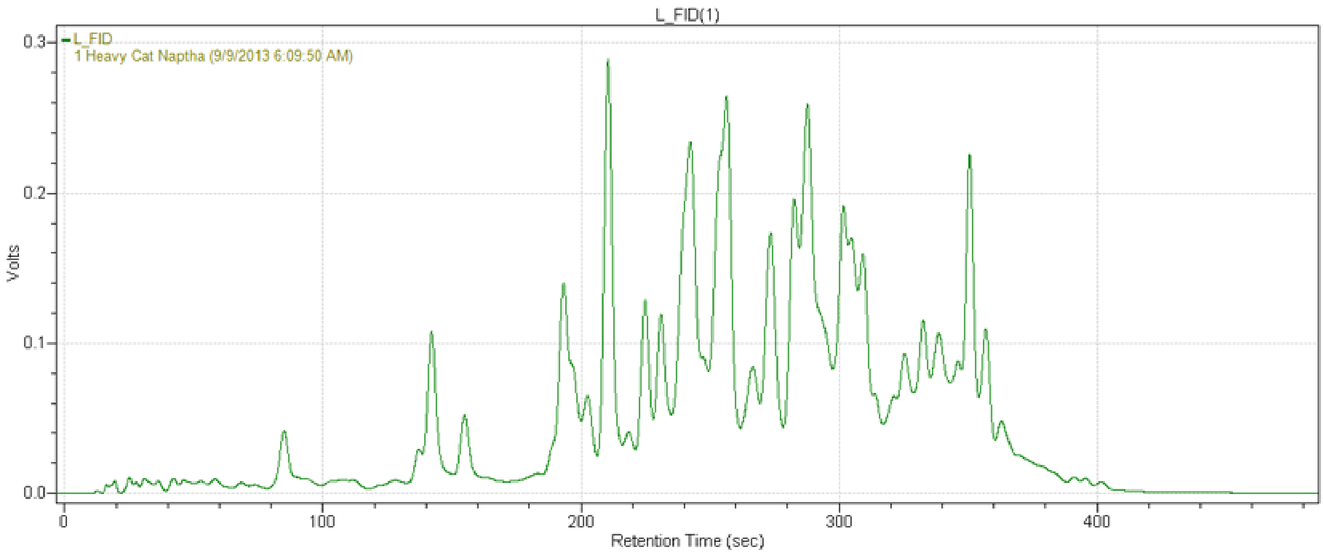


Figure 9-7 Simdis Chromatogram

Total Area Calculation

The area for the entire chromatogram is determined in order to calculate values for "%Off". Because it is difficult to automatically determine a single baseline for such a chromatogram, start and stop of the integration is set by the user (see Setup). At the start of the integration, the start of a horizontal baseline is assumed. The total area is given in "µV-sec" units.

Determination of Boiling Points

For example, the retention time t needs to be determined for the target percentage V = 11%. In a chromatogram with data points between 0 and 754.5 seconds (2 points/s), the starting and ending times t_s and t_e of the integration are set to be 10 s and 740 s, respectively (start index Is = 21; end index I_e = 1481), and the response R_s at the starting point is -24 µV. The total area A_T between these points is calculated using the response R_i for each i between 21 and 1481:

$$A_T = \sum_{i=I_s}^{I_e} (R_i - R_s)$$

For this example, A_T calculates to be 56,253,197 µV-s. The target percentage V is now calculated by running the same summation and stop once $A/A_T \geq V$:

$$A = \sum_{i=I_s}^{A/A_T < V} (R_i - R_s)$$

At this point, the retention time t+ found at the point where A/A_T first exceeds V could be used to look up the appropriate boiling point in the calibration table. A more accurate answer can be obtained by interpolating a retention time between the points t_+ where $A/A_T \geq V$, and the previous t_- where $A/A_T < V$ (V_+ and V_- are the percent responses at these points) to obtain t_V for $A/A_T = V$:

$$t_V = \frac{t_+ - t_-}{V_+ - V_-}(V - V_-) + t_-$$

For example, between t_- = 118.0 and t_+ = 118.5 s, the value for A/A_T goes from 10.887% to 11.098%, so that t_V for V = 11.000% has to lie between these points:

$$t_V = \frac{118.5 - 118.0}{11.098 - 10.887}(11 - 10.887) + 118 = 118.27\,\text{s}$$

Looking up 118.27 s in the calibration table yields an interpolated boiling point of 5.5°C.

Determination of Volume Percent

For gasoline characterization, a boiling point range vs. percent volume report is often required to obtain results for further processing. A lookup can be performed in the Simdis calibration table to find retention times t_1 and t_2 for two given boiling points T_1 and T_2. The area between t_1 and t_2 is then summed and divided by A_T to yield the volume percent for that temperature segment.

9.6 Results Tab

Overview

The normal Simdis calculation results are set up in this tab. For more result calculations, see *D86 Correlation*, *RVP* (Reid Vapor Pressure), and *V/L* (Vapor-to-Liquid) *Ratio.* Three general segments exist for Simdis; *Boiling Point, Cut Volume and Summed Volume*. Click on any one of these buttons located on the left side of the header area to display and manipulate the corresponding spreadsheet:

9.6.1 Boiling Point

Boiling Point

The primary results of the Simdis calculation is a list of **%Off (LV%)** vs**. Boiling Point (°C)** values. A boiling point report contains the most basic results of a Simdis application, correlating the evaporated volume (%Off) to the boiling point through the retention time. A new Simdis method always contains a list of these 16 %Off values:

0.5, 5, 10, 20, 30, 40, 50, 60, 65, 70, 75, 80, 85, 90, 95, 99.5 %Off

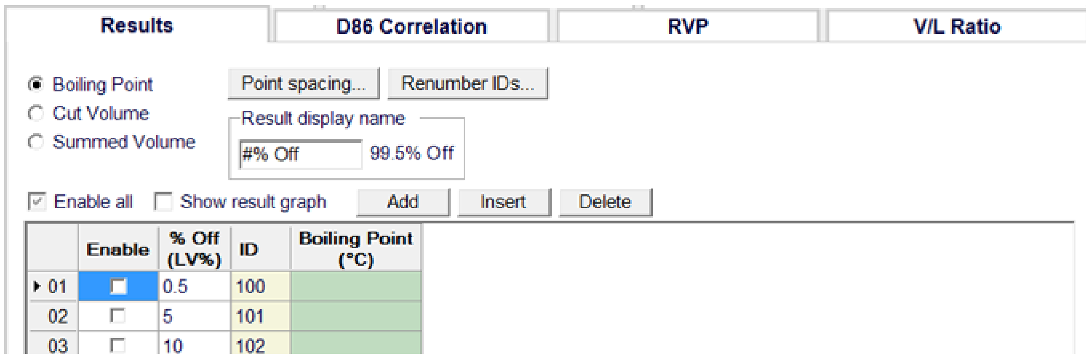


Figure 9-8 Results Tab, Boiling Point

Enable	Check or uncheck this box to include or exclude this result from the result report.
%Off (LV%)	Requested %Off value in liquid volume percent
ID	The ID of this result used in the final result report.
Boiling Point	This column displays the current result value in °C or in °F, depending on the Preferred Temperature Units setting in the Tools Options setting in the Tools Options.

9.6.2 Cut Volume

Cut Volume

The inverse view of the Simdis calculation, a temperature segment or "cut" associated with a Volume% number for that cut. The sum of all results for this kind must add up to 100%.

Cut volume is the volume of a simulated distillation between two temperature points in liquid volume percent. The list is contiguous between the begin and end of cycle and cannot contain gaps. A new Simdis method always contains a list of these 27 temperature points:

From: begin of cycle:

-31.7°C	-10.6°C	10°C	30.6°C	38.9°C	52.2°C	57.8°C	62.8°C	69.4°C
79.4°C	87.8°C	92.2°C	97.8°C	104.4°C	113.9°C	122.2°C	132.2°C	140.6°C
148.9°C	155.6°C	167.2°C	178.9°C	191.1°C	201.7°C	212.2°C	225.6°C	236.7°C

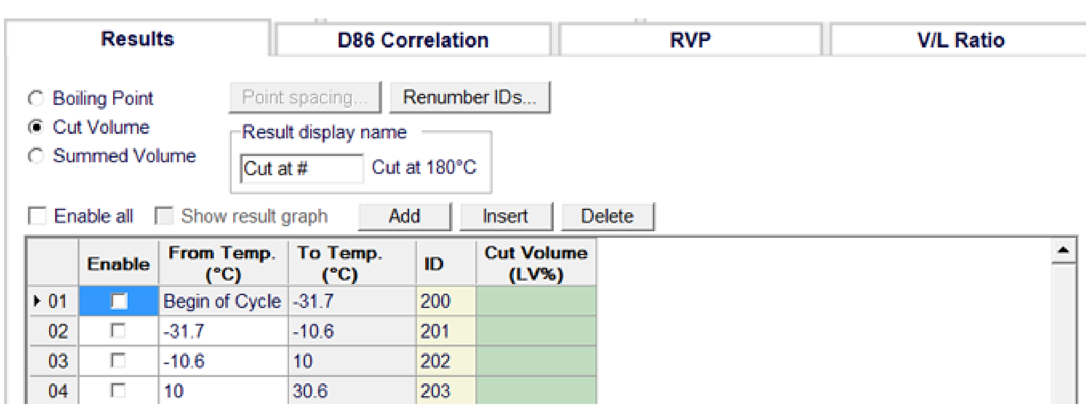


Figure 9-9 Results Tab, Cut Volume

Enable	Check or uncheck this box to include or exclude this result from the result report.
From Temp (°C)	The lower temperature point of the cut—or "Begin of cycle" for the first entry in the list—displayed in °C or in °F, depending on the Preferred Temperature Units setting in Tools Options.
To Temp (°C)	The higher temperature point of the cut—or "End of cycle" for the last entry in the list. This is the same as the next starting temperature.
ID	The ID of this result in the final result report.
Cut Volume (LV%)	Displays the current result in liquid volume percent.

9.6.3 Summed Volume

Summed Volume

This table is the same as the cut volume, except that the Volume% is reported as the sum up to that point instead of individual volume number. The summed volume is the %Off value of a simulated distillation up to a certain temperature point in liquid volume percent. The list is contiguous between the begin and end of cycle and cannot contain gaps. A new Simdis method always contains a list of these 27 temperature points:

-31.7°C	-10.6°C	10°C	30.6°C	38.9°C	52.2°C	57.8°C	62.8°C	69.4°C
79.4°C	87.8°C	92.2°C	97.8°C	104.4°C	113.9°C	122.2°C	132.2°C	140.6°C
148.9°C	155.6°C	167.2°C	178.9°C	191.1°C	201.7°C	212.2°C	225.6°C	236.7°C

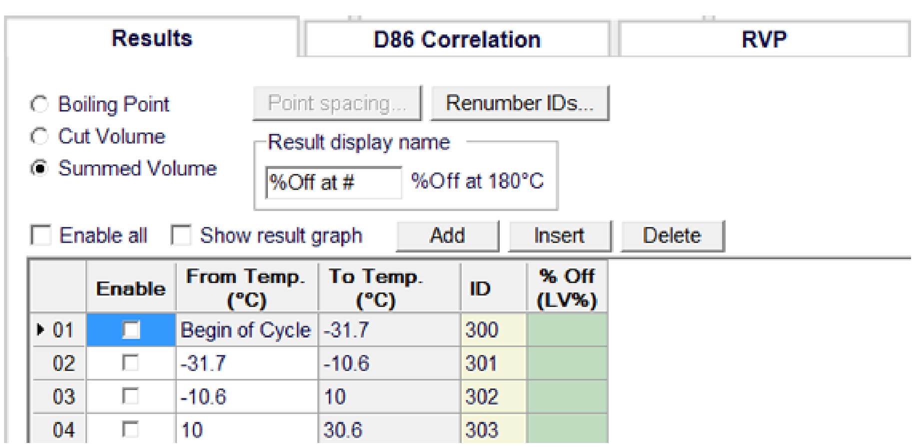


Figure 9-10 Results Tab, Summed Volume

Enable	Check or uncheck this box to include or exclude this result from the result report.
From Temp (°C)	The lower temperature point of the cut—or "Begin of cycle" for the first entry in the list—displayed in °C or in °F, depending on the Preferred Temperature Units setting in Tools Options.
To Temp (°C)	The higher temperature point of the cut—or "End of cycle" for the last entry in the list. This is the same as the next starting temperature.

ID	The ID of this result in the final result report.
%Off (LV%)	Displays the current result in liquid volume percent.

9.6.4 Common Results Tab Options

Common Results Tab Options

Point Spacing	Generate a list of evenly-spaced result points, e.g., every 1% between 1 and 99%, including IBP and FBP for the currently-displayed result set. See *Generate List of %Off values* for more information.
Renumber IDs	Result IDs in the currently-displayed spreadsheet can be renumbered by clicking on this button. In order to renumber all result IDs for the entire Simdis module, go to SETUP and click on the same button there.
Result Display Name	Definition of the result display template for the currently displayed result set. Use the '#' sign in this template to place the value from the white spreadsheet column. The text to the right of the edit box gives a preview of one of the result names as it will appear in all result reports for the currently displayed result set. Use the '#' sign in this template to place the value from the white spreadsheet column. The text to the right of the edit box gives a preview of one of the result names as it will appear in all result reports.
Enable All, check box, check box	Check or uncheck this box to include or exclude all values in the currently displayed spread sheet from the result report.
Show Result Graph, check box	Click on this button to view the currently displayed result set in graphical representation (not available for Cut Volume results).
Add, Inset and Delete Buttons	These buttons will add a point to the end of the table with the next logical %OFF value midpoint between the last point and 100 with a calculated Boiling Point temperature. Insert a point above the selected row with the logical %OFF value midpoint between the previous point and the current point with a calculated Boiling Point temperature. Delete the selected point.

9.7 D86 Correlation Tab

9.7.1 Correlation with ASTM D86 Method

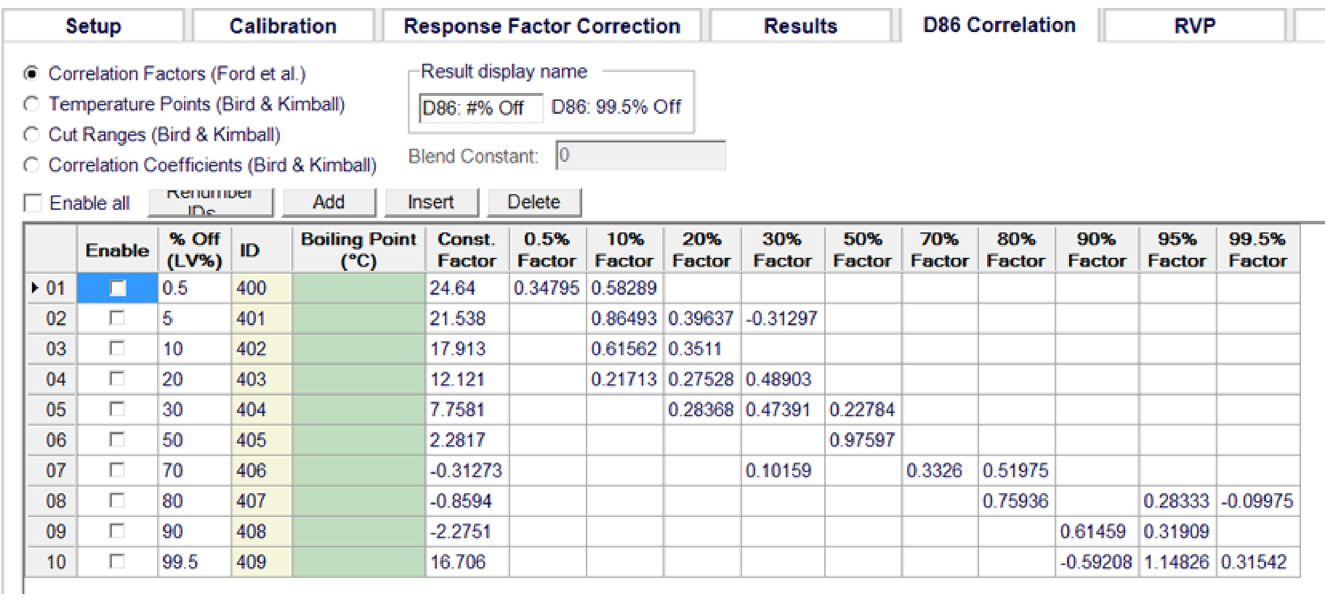
Correlation with ASTM D86 Method

The Simdis module offers two different methods to approximate ASTM D86 distillation results from the regular Simdis results: Ford et al. and Bird & Kimball. There are three tables to setup with Bird & Kimball: Temperature Points, Cut Ranges and Correlation Coefficients.

9.7.2 Ford et al. Correlation Factors

Ford et al. Correlation Factors

Click on this field to display the D86 correlation factors (Ford et al.) for editing and viewing.



	Enable	% Off (LV%)	ID	Boiling Point (°C)	Const. Factor	0.5% Factor	10% Factor	20% Factor	30% Factor	50% Factor	70% Factor	80% Factor	90% Factor	95% Factor	99.5% Factor
01		0.5	400		24.64	0.34795	0.58289								
02		5	401		21.538		0.86493	0.39637	-0.31297						
03		10	402		17.913		0.61562	0.3511							
04		20	403		12.121		0.21713	0.27528	0.48903						
05		30	404		7.7581			0.28368	0.47391	0.22784					
06		50	405		2.2817					0.97597					
07		70	406		-0.31273				0.10159		0.3326	0.51975			
08		80	407		-0.8594							0.75936		0.28333	-0.09975
09		90	408		-2.2751								0.61459	0.31909	
10		99.5	409		16.706								-0.59208	1.14826	0.31542

Figure 9-11 D86 Correlation Factors

This correlation technique is described by D.C. Ford, W.H. Miller, R.C. Thren, R. Wertzler in *Correlation of ASTM Method D 2887-73 Boiling Range Distribution Data with ASTM Method D 86-67 Distillation Data, Calculation of Physical Properties of Petroleum Products from Gas Chromatography Analyses*, ASTM STP 577, American Society for Testing and Materials, 1975, pp. 20-30.

This correlation technique is sometimes also known as the "Arco method", because the authors devised this procedure at the Atlantic Richfield Company, this method numerically calculates results similar to the ASTM D86 distillation method.

This correlation uses a pre-computed set of linear equations and coefficients.

D86: %Off (LV %)	Linear equations with Simdis results
0.5	= 24.640 + 0.34795 × [0.5%] + 0.58289 × [10%]
5	= 21.538 + 0.86493 × [10%] + 0.39637 × [20%] – 0.31297 × [30%]
10	= 17.913 + 0.61562 × [10%] + 0.35110 × [20%]
20	= 12.121 + 0.21713 × [10%] + 0.27528 × [20%] + 0.48903 × [30%]
30	= 7.7581 + 0.28368 × [20%] + 0.47391 × [30%] + 0.22784 × [50%]
50	= 2.2817 + 0.97597 × [50%]
70	= –0.31273 + 0.10159 × [30%] + 0.33260 × [70%] + 0.51975 × [80%]
80	= –0.85940 + 0.75936 × [80%] + 0.28333 × [95%] – 0.09975 × [99.5%]
90	= –2.2751 + 0.61459 × [90%] + 0.31909 × [95%]
99.5	= 16.706 – 0.59208 × [90%] + 1.14826 × [95%] + 0.31542 × [99.5%]

For example, the D86 value for 30% Off is calculated using the Simdis values for 20%, 30%, and 50% Off. These coefficients can be changed within this spreadsheet.

Option Descriptions

Renumber IDs	Result IDs in the currently displayed spread sheet can be renumbered by clicking on this button. In order to renumber all result IDs for the entire Simdis module, go to SETUP and click on the same button there.
Result Display Name	Definition of the result display template for the currently displayed result set. Use the '#' sign in this template to place the value from the white spreadsheet column. The text to the right of the edit box gives a preview of one of the result names as it will appear in all result reports. right of the edit box gives a preview of one of the result names as it will appear in all result reports.
Enable All	Check or uncheck this box to include or exclude all D86 values (Ford et al.) from the result report. This also displays the spreadsheet with the D86 correlation factors.
Add, Inset and Delete Buttons	These buttons will add a point to the end of the table with the next logical %OFF value midpoint between the last point and 100 with a calculated Boiling Point temperature. Insert a point above the selected row with the logical %OFF value midpoint between the previous point and the current point with a calculated Boiling Point temperature. Delete the selected point.

Spreadsheet Columns

Enable	Check or uncheck this box to include or exclude this result from the result report.
%Off (LV%)	The requested %Off value in liquid volume percent. This value can be changed, or other values can be added or deleted, as long as suitable factors are provided in the spreadsheet.
ID	The ID of this result in the final result report.
Boiling Point	This column displays the current result value in °C or in °F, depending on the Preferred Temperature Units setting in the Tools Options. isplays the current result value in °C or in °F, depending on the Preferred Temperature Units setting in the Tools Options.
Const. Factor	The first constant is for calculations based on degrees Celsius (the X% Factor multiplication factors are the same for both °C and °F based calculations). If a constant based on calculations for degrees Fahrenheit is to be entered here, use this equation to convert it for calculations based on degrees Celsius:l;'jnbk'jnbkcation factors are the same for both °C and °F based calculations). If a constant based on calculations for degrees Fahrenheit is to be entered here, use this equation to convert it for calculations based on degrees Celsius: $F_{^\circ C,const} = \left(F_{^\circ F,const} - 32 + \sum\left(F_{^\circ F,n}\right) \times 32\right) \div 1.8$ Each line must have an entry in this column.
X% Factor	The count and value of these columns is fixed. You may change as many factors as necessary, or delete them altogether by pressing DELETE on the keyboard.

9.7.3 Bird & Kimball

Bird & Kimball

This technique was described by W.L. Bird, J.L. Kimball in "Application of Gas Chromatographic Distillation to Motor Gasoline Blending", *Calculation of Physical Properties of Petroleum Products from Gas Chromatography Analyses*, ASTM STP 577, American Society for Testing and Materials, 1975, pp. 51-64.

This technique is sometimes also known as the "Mogas method" or "Exxon method", because the authors devised this procedure at the Exxon Company, this method numerically calculates %Off values for fixed temperature points as well as Reid vapor pressure and vapor-to-liquid ratios from regular Simdis results.

There are three tables to set up with Bird & Kimball:

- Temperature Points
- Cut Ranges
- Correlation Coefficients.

Temperature Points (Bird & Kimball)

Click on this field to display and edit the Temperature Points (Bird & Kimball).

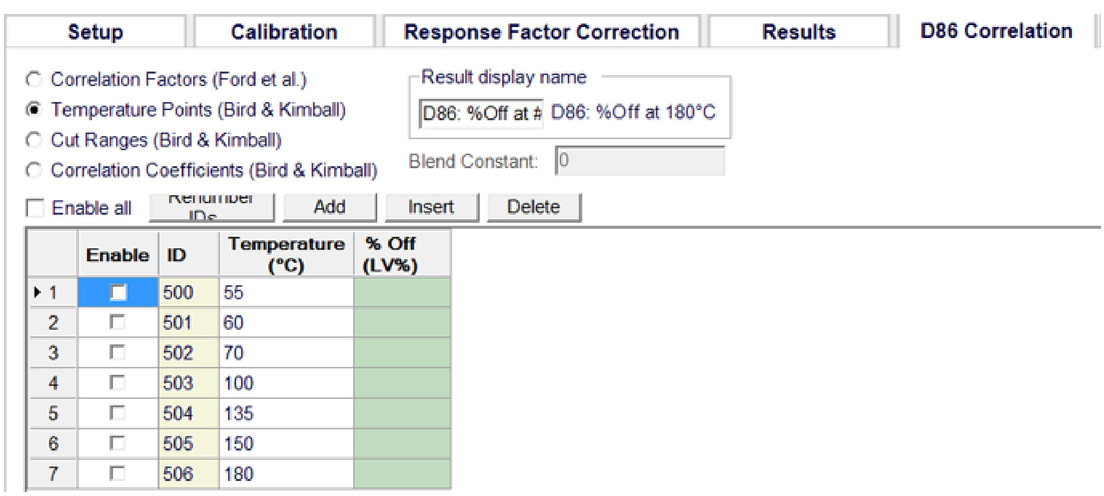


Figure 9-12 D86 Correlation Temperature Points

This procedure does not calculate boiling points for percent volume, but provides 7 fixed temperature points that need to be correlated with a %Off number Ai. These temperatures points are:

55, 60, 70, 100, 135, 150, and 180°C.

For this computation, 15 fixed temperature ranges similar to the ones for result volumes are used:

CUT	TemperatureRange (°C)
1	< -10.6
2	-10.6 to 10.0

CUT	TemperatureRange (°C)
3	10.0 to 30.6
4	30.6 to 52.2
5	52.2 to 62.8
6	62.8 to 79.4
7	79.4 to 92.2
8	92.2 to 104.4
9	104.4 to 113.9
10	113.9 to 140.6
11	140.6 to 148.9
12	148.9 to 167.2
13	167.2 to 191.1
14	191.1 to 212.2
15	> 212.2

These temperature ranges yield volume percentages V_i in the same way cut volumes for results are calculated.

In order to calculate %Off numbers A_i for the 7 fixed temperature points, A_i are computed with predetermined coefficients b_i and contributions from each volume percent V_i. The coefficients for b_i are different for each temperature point and listed in the table below:

CUT	b_i 55°C	b_i 60°C	bi 70°C	bi 100°C	bi 135°C	bi 150°C	b_i 180°C
1	1.79	1.59	1.32	1.03	1.02	1.02	1
2	1.63	1.55	1.39	1.04	1.02	1.02	1
3	0.74	0.87	1.09	1.18	1.02	1.02	1
4	0.5	0.64	0.91	1.25	1.02	1.02	1
5	0.16	0.26	0.49	1.15	1.05	1.02	1
6	0.01	0.09	0.27	0.97	1.1	1.03	1
7	-0.11	-0.06	0.07	0.68	1.17	1.08	1
8	-0.14	-0.1	-0.02	0.41	1.12	1.11	1
9	-0.18	-0.15	-0.09	0.2	1.03	1.14	1
10	-0.18	-0.17	-0.14	-0.06	0.65	1.01	1.03
11	-0.25	-0.24	-0.22	-0.25	0.25	0.72	1.08
12	-0.2	-0.19	-0.18	-0.26	-0.03	0.36	1.05
13	-0.19	-0.18	-0.18	-0.32	-0.29	-0.1	0.8
14	-0.18	-0.18	-0.18	-0.34	-0.48	-0.47	0.09
15	-0.17	-0.17	-0.17	-0.34	-0.55	-0.63	-0.52

The contribution of each cut to the %Off number at a given temperature point is calculated and summed to yield A_i:

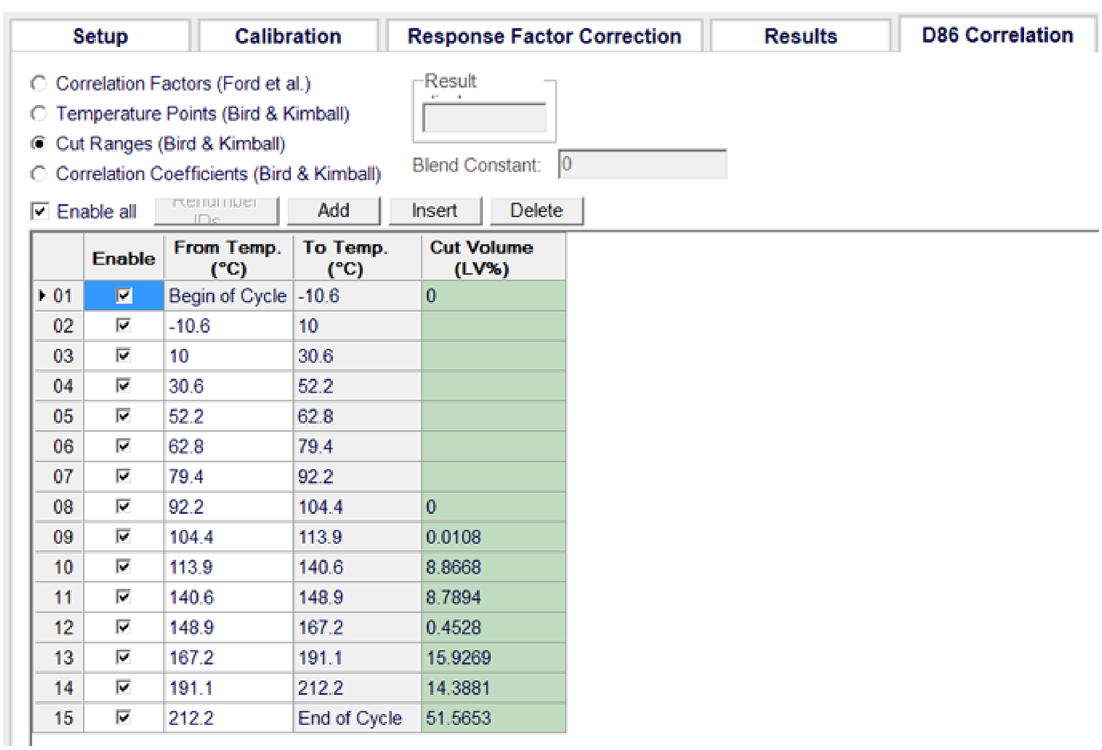
$$A_i = \sum_{i=1}^{15} (b_i \times V_i) + K_g$$

K_g is a periodically revised constant based on blending experience that directionally corrects for model bias between different gasoline grades.

Enable	Check or uncheck this box to include or exclude this result from the result report.
ID	The ID of this result in the final result report.
Temperature (°C)	This column is the requested temperature point in °C or in °F, depending on the Preferred Temperature Units setting in the Tools Options. The value of this temperature point can be altered, or different temperature points added or removed, as long as the correct coefficients are provided.
%Off (LV%)	This column displays the current result in liquid volume percent.
Result Display Name	Definition of the result display template for the currently displayed result set. Use the '#' sign in this template to place the value from the white spreadsheet column. The text to the right of the edit box gives a preview of one of the result names as it will appear in all result reports.
Enable All	Check or uncheck this box to include or exclude all D86 values (Ford et al.) from the result report. This also displays the spreadsheet with the D86 correlation factors.
Renumber IDs	Result IDs in the currently displayed spread sheet can be renumbered by clicking on this button. In order to renumber all result IDs for the entire Simdis module, go to SETUP and click on the same button there.
Add, Inset and Delete Buttons	These buttons will add a point to the end of the table with the next logical %OFF value midpoint between the last point and 100 with a calculated Boiling Point temperature. Insert a point above the selected row with the logical %OFF value midpoint between the previous point and the current point with a calculated Boiling Point temperature. Delete the selected point.

Cut Ranges

Click on this field to display and edit the cut range table (Bird & Kimball).



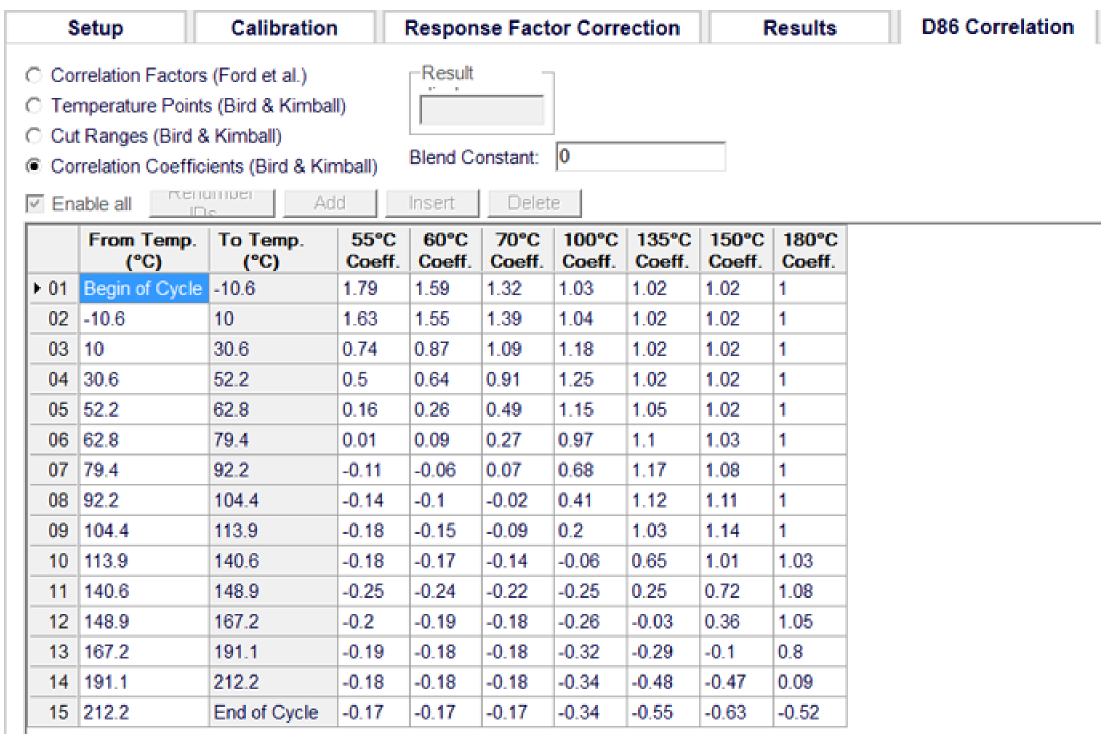
	Enable	From Temp. (°C)	To Temp. (°C)	Cut Volume (LV%)
01	☑	Begin of Cycle	-10.6	0
02	☑	-10.6	10	
03	☑	10	30.6	
04	☑	30.6	52.2	
05	☑	52.2	62.8	
06	☑	62.8	79.4	
07	☑	79.4	92.2	
08	☑	92.2	104.4	0
09	☑	104.4	113.9	0.0108
10	☑	113.9	140.6	8.8668
11	☑	140.6	148.9	8.7894
12	☑	148.9	167.2	0.4528
13	☑	167.2	191.1	15.9269
14	☑	191.1	212.2	14.3881
15	☑	212.2	End of Cycle	51.5653

Figure 9-13   D86 Correlation, Cut Ranges

Enable	Check or uncheck this box to include or exclude this range from the calculation.
From Temp. (°C)	The lower temperature point of the cut—or "Begin of cycle" for the first entry in the list—displayed in °C or in °F, depending on the Preferred Temperature Units setting in the Tools Options. The value of this temperature point can be changed, or different temperature ranges added or removed, as long as the correct coefficients are provided.
To Temp. (°C)	This is the higher temperature point of the cut—or "End of cycle" for the last entry in the list. This is the same as the next starting temperature.
Cut Volume (LV%)	The calculated volume for this cut in liquid volume percent. This is an intermediate result and cannot be included in the final result report.

Correlation Coefficients (Bird & Kimball)

Click on this field to display the coefficient setup (Bird & Kimball) for editing and viewing.



	From Temp. (°C)	To Temp. (°C)	55°C Coeff.	60°C Coeff.	70°C Coeff.	100°C Coeff.	135°C Coeff.	150°C Coeff.	180°C Coeff.
01	Begin of Cycle	-10.6	1.79	1.59	1.32	1.03	1.02	1.02	1
02	-10.6	10	1.63	1.55	1.39	1.04	1.02	1.02	1
03	10	30.6	0.74	0.87	1.09	1.18	1.02	1.02	1
04	30.6	52.2	0.5	0.64	0.91	1.25	1.02	1.02	1
05	52.2	62.8	0.16	0.26	0.49	1.15	1.05	1.02	1
06	62.8	79.4	0.01	0.09	0.27	0.97	1.1	1.03	1
07	79.4	92.2	-0.11	-0.06	0.07	0.68	1.17	1.08	1
08	92.2	104.4	-0.14	-0.1	-0.02	0.41	1.12	1.11	1
09	104.4	113.9	-0.18	-0.15	-0.09	0.2	1.03	1.14	1
10	113.9	140.6	-0.18	-0.17	-0.14	-0.06	0.65	1.01	1.03
11	140.6	148.9	-0.25	-0.24	-0.22	-0.25	0.25	0.72	1.08
12	148.9	167.2	-0.2	-0.19	-0.18	-0.26	-0.03	0.36	1.05
13	167.2	191.1	-0.19	-0.18	-0.18	-0.32	-0.29	-0.1	0.8
14	191.1	212.2	-0.18	-0.18	-0.18	-0.34	-0.48	-0.47	0.09
15	212.2	End of Cycle	-0.17	-0.17	-0.17	-0.34	-0.55	-0.63	-0.52

Figure 9-14 D86 Correlation Coefficients

This table shows the correlation coefficients between all current cut ranges (rows) and temperature points (columns). The size of this table changes when the number of temperature points or cut ranges changes. The temperature is displayed in °C or in °F, depending on the Preferred Temperature Units setting in the Tools Options.

Blend Constant	Enter the season-dependent blend constant for the Bird & Kimball method here.
From Temp. (°C)	The lower temperature point of the cut—or "Begin of cycle" for the first entry in the list—displayed in °C or in °F, depending on the Preferred Temperature Units setting in the Tools Options. The value of this temperature point can be changed, or different temperature ranges added or removed, as long as the correct coefficients are provided.

To Temp. (°C)	This is the higher temperature point of the cut—or "End of cycle" for the last entry in the list. This is the same as the next starting temperature.
X °C Coeff(icients)	In order to calculate %Off numbers A_i for the 7 fixed temperature points, A_i are computed with predetermined coefficients b_i and contributions from each volume percent V_i. The coefficients for b_i are different for each temperature point.

9.7.4 Reid Vapor Pressure Tab

Reid Vapor Pressure Tab

The calculation of the Reid vapor pressure (RVP) is based on Bird & Kimball's method for ASTM D86 correlation as well (for reference, see Correlation with ASTM D86 Method). The RVP calculation uses 28 cut volumes as its basis:

Cut	Temperature Range [°C]	Avg. Temp.Ti [°C]	Remarks(BP = boiling point)
1	< -31.7	-42.2	Ti = BP of Propane
2	-31.7 to -10.6	-11.7	Ti = BP of iso-Butane
3	-10.6 to 10.0	-0.6	Ti = BP of n-Butane
4	10.0 to 30.6	27.8	Ti = BP of iso-Pentane
5	30.6 to 38.9	36.1	Ti = BP of Pentane mix
6	38.9 to 52.2	45.6	
7	52.2 to 57.8	55.0	
8	57.8 to 62.8	60.3	
9	62.8 to 69.4	66.1	
10	69.4 to 79.4	74.4	
11	79.4 to 87.8	83.6	
12	87.8 to 92.2	90.0	
13	92.2 to 97.8	95.0	
14	97.8 to 104.4	101.1	
15	104.4 to 113.9	109.2	
16	113.9 to 122.2	118.1	
17	122.2 to 132.2	127.2	
18	132.2 to 140.6	136.4	
19	140.6 to 148.9	144.7	
20	148.9 to 155.6	152.2	
21	155.6 to 167.2	161.4	
22	167.2 to 178.9	173.1	
23	178.9 to 191.1	185.0	
24	191.1 to 201.7	196.4	
25	201.7 to 212.2	206.9	
26	212.2 to 225.6	218.9	
27	225.6 to 236.7	231.1	
28	> 236.7	242.2	Ti = assigned

As for the cut volume results, the RVP calculation computes cut volumes Vi. In addition, an average (or assigned) temperature Ti is used to calculate each cut's contribution bi to the RVP:

$$b_i = 417e^{-0.03402\,T_i}$$

The predicted contribution bi of each cut Vi to RVP is summed to give a total preliminary value Pa for RVP:

$$P_a = \sum_{i=1}^{28} b_i \times V_i$$

The average temperature T from all cut average temperatures T_i

$$\overline{T} = \sum_{i=1}^{28} T_i \times V_i$$

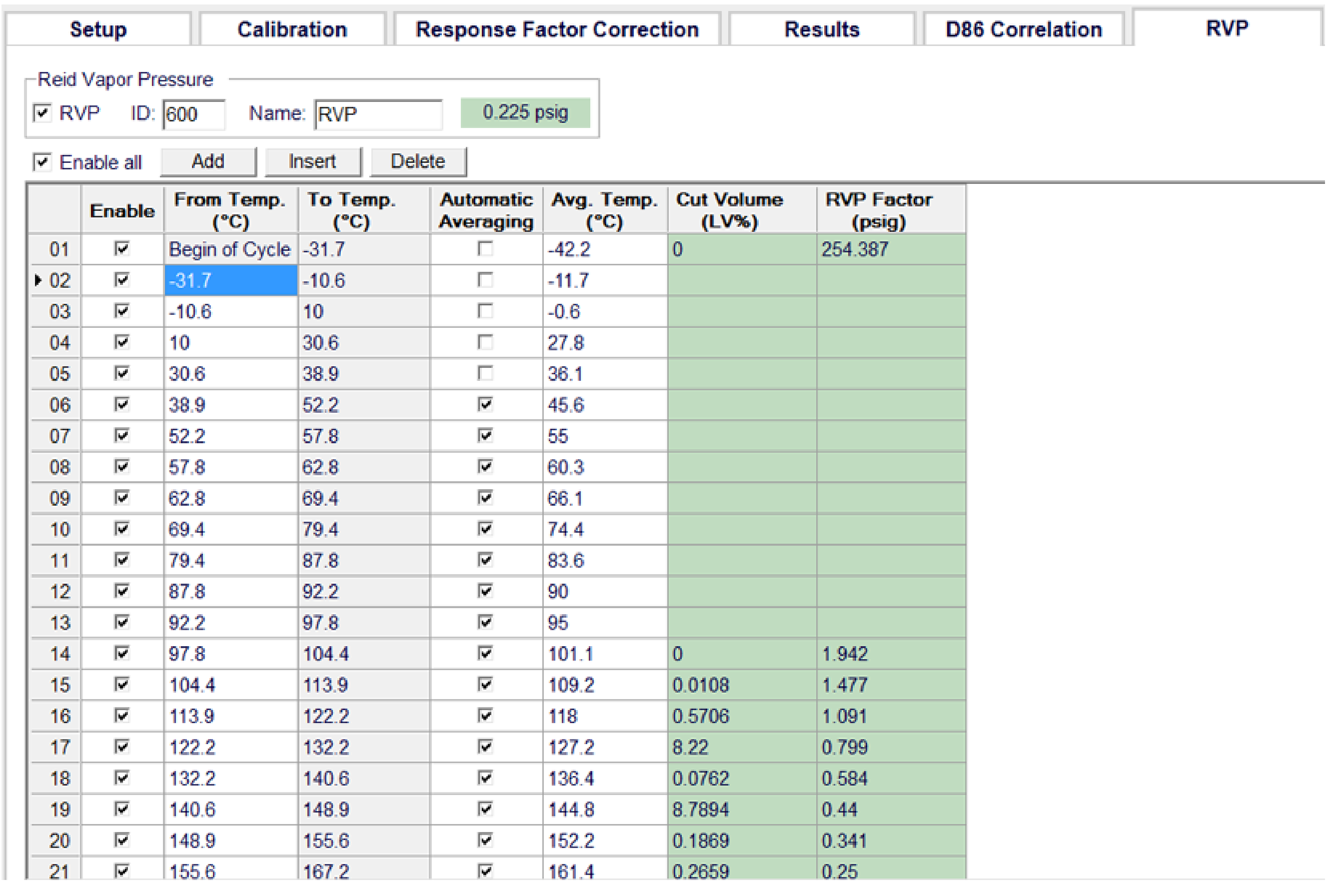
is then used to arrive at a correction factor f for the preliminary RVP value P_a

$$f = 1.0 + 0.003744 \times \left(\overline{T} - 93.33\right)$$

before calculating the final value for RVP.

$$RVP = f \times P_a$$

Reid Vapor Pressure Setup



	Enable	From Temp. (°C)	To Temp. (°C)	Automatic Averaging	Avg. Temp. (°C)	Cut Volume (LV%)	RVP Factor (psig)
01	☑	Begin of Cycle	-31.7	☐	-42.2	0	254.387
02	☑	-31.7	-10.6	☐	-11.7		
03	☑	-10.6	10	☐	-0.6		
04	☑	10	30.6	☐	27.8		
05	☑	30.6	38.9	☐	36.1		
06	☑	38.9	52.2	☑	45.6		
07	☑	52.2	57.8	☑	55		
08	☑	57.8	62.8	☑	60.3		
09	☑	62.8	69.4	☑	66.1		
10	☑	69.4	79.4	☑	74.4		
11	☑	79.4	87.8	☑	83.6		
12	☑	87.8	92.2	☑	90		
13	☑	92.2	97.8	☑	95		
14	☑	97.8	104.4	☑	101.1	0	1.942
15	☑	104.4	113.9	☑	109.2	0.0108	1.477
16	☑	113.9	122.2	☑	118	0.5706	1.091
17	☑	122.2	132.2	☑	127.2	8.22	0.799
18	☑	132.2	140.6	☑	136.4	0.0762	0.584
19	☑	140.6	148.9	☑	144.8	8.7894	0.44
20	☑	148.9	155.6	☑	152.2	0.1869	0.341
21	☑	155.6	167.2	☑	161.4	0.2659	0.25

Figure 9-15 Reid Vapor Pressure (RVP) Tab

Table 9-1 RVP Tab Options

RVP	Check or uncheck this box to include or exclude RVP from the final result report. The current RVP result is displayed at the far right of the Reid Vapor Pressure box in green. The units of the RVP result depending on the Preferred Pressure Units setting in the Tools Options.
ID	ID of the RVP result in the final result report
Name	The name of the RVP result in the final result report. Highlighted in Green is the calculated RVP.
Enable All	Check or uncheck this box to include or exclude all D86 values (Ford et al.) from the result report. This also displays the spreadsheet with the D86 correlation factors.
Add, Inset and Delete Buttons	These buttons will add a point to the end of the table with the next logical %OFF value midpoint between the last point and 100 with a calculated Boiling Point temperature. Insert a point above the selected row with the logical %OFF value midpoint between the previous point and the current point with a calculated Boiling Point temperature. Delete the selected point.

Table 9-2 RVP Tab Columns

Enable	Check or uncheck this box to include or exclude this range from the calculation.
From Temp (°C)	The lower temperature point of the cut—or "Begin of cycle" for the first entry in the list—displayed in °C or in °F, depending on the Preferred Temperature Units setting in the Tools Options. The value of this cut can be changed, or different cuts added or removed. However, this may render the empirical calculation coefficients invalid (see equations above).
To Temp (°C)	This is the higher temperature point of the cut—or "End of cycle" for the last entry in the list. This is the same as the next starting temperature.
Automatic Averaging	Check or uncheck this box to enable/disable automatic averaging of the temperature start/end points for use as the Avg. Temp.
Avg. Temp. (°C)	The average temperature of the start/end points of the cut displayed in °C or in °F, or an assigned value, if Automatic Averaging is not checked.
Cut Volume (LV%)	This is the currently calculated volume (liquid volume percent) of this cut. This is an intermediate value and cannot be included in the final result report.
RVP Factor (psig)	This is the currently calculated RVP contribution bi of this cut displayed in one of the available pressure units, depending on the Preferred Temperature Units setting in the Tools Options. This is an intermediate value and cannot be included in the final result report.

9.7.5 V/L Ratio

Vapor-to-Liquid (V/L) Ratio

The vapor-to-liquid ratio (V/L) is one of the numbers that characterize the volatility of gasoline. This is important for the production of season-dependent blends. The calculation of the temperature for V/L=4, V/L=20, and V/L=45 is based on numbers obtained from the D86 correlation in °C and the Reid vapor pressure computation in kPa.

Simdis calculates the V/L numbers according to ASTM method D4814, which defines two different ways to arrive at the results: the "computer method" and the "linear equation method". Both are described below, and they base their calculations on these variables:

P = RVP [kPa]

E = D86, 10% [°C]

F = D86, 20% [°C]

G = D86, 50% [°C]

Computer Method

A series of convoluted empirical equations are used to calculate vapor-to-liquid ratios with this method:

$$H = G - E$$

$$Q = F - E$$

$$R = \begin{cases} H/Q & H/Q \leq 6.7 \\ 6.7 & \end{cases}$$

$$A = 102.859 - 1.36599P + 0.009617P^2 - 0.000028281P^3 + 207.0097P^{-1}$$

$$B = 5.36868 + 0.9105040Q - 0.040187Q^2 + 0.00057774Q^3 + 0.254183Q^{-1}$$

$$S = -0.00525449 - \frac{0.3671362}{P - 9.65} - \frac{0.812419}{(P - 9.65)^2} + 0.0009677R - 0.0000195828R^2 - 3.3502318R \times P^{-2}$$
$$+ 1241.1531R \times P^{-4} - 0.06630129R^2 \times P^{-1} + 00627839R^3 \times P^{-1} + 0.0969193R^3 \times P^{-2}$$

$$C = 0.34205P + 0.55556S^{-1}$$

$$D = 0.62478 - 0.68964R + 0.132708R^2 - 0.0070417R^3 = 5.8485R^{-1}$$

$$VL_4 = A + B$$

$$VL_{45} = F + 0.125H + C$$

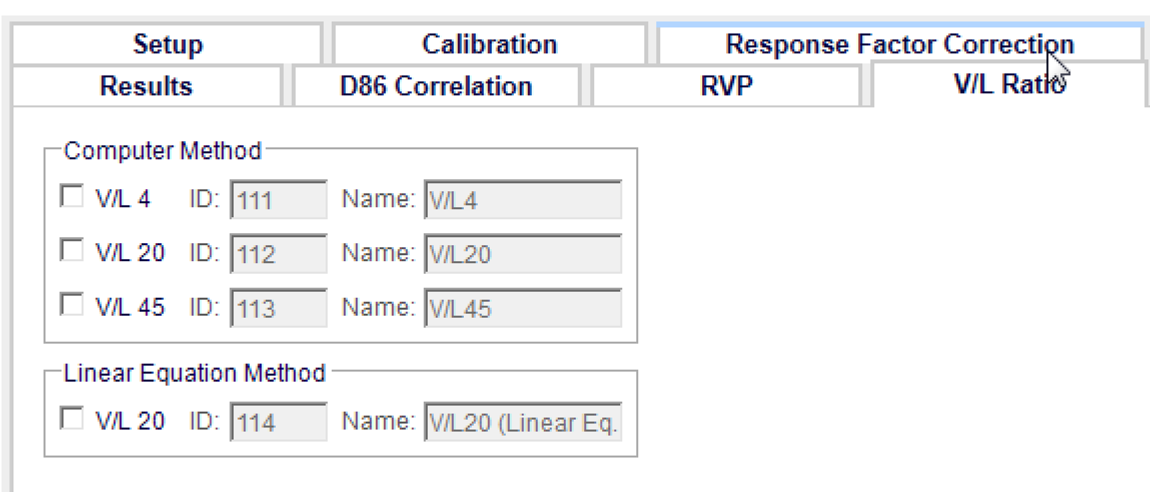
$$VL_{20} = VL_4 + 0.390244(VL_{45} - VL_4) + 1.46519D$$

Linear Equation Method

Much simpler than the previous list of equations, this method uses only a single equation to compute a value for V/L=20:

$$VL_{20} = 52.47 - 0.33P + 0.20E + 0.17G$$

V/L Ratio Tab Options



V/L X	Check or uncheck this box to include or exclude this V/L value from the final result report. The current V/L X result is displayed at the far right either in °C or °F, depending on the Preferred Temperature Units setting in the Tools Options.
ID	ID of the V/L result in the final result report
Name	Name of the V/L result in the final result report

Training

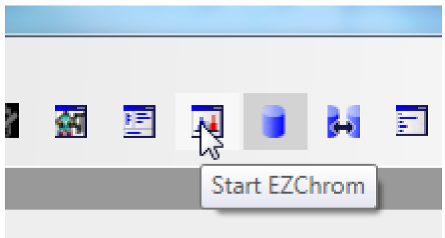
Siemens offers an On-line Instructor Led course on Simulated Distillation. The details of this and other Process Analytics instructor led and on-line courses can be found on our web site at;

www.usa.siemens.com/sitrain.

Accessing Maxum EZChrom Help

10

The Maxum EZChrom utility is launched from a toolbar button in the Analyzer Window.



When EZChrom opens, click the Help buttom to open a separate help file dedicated to EZChrom.

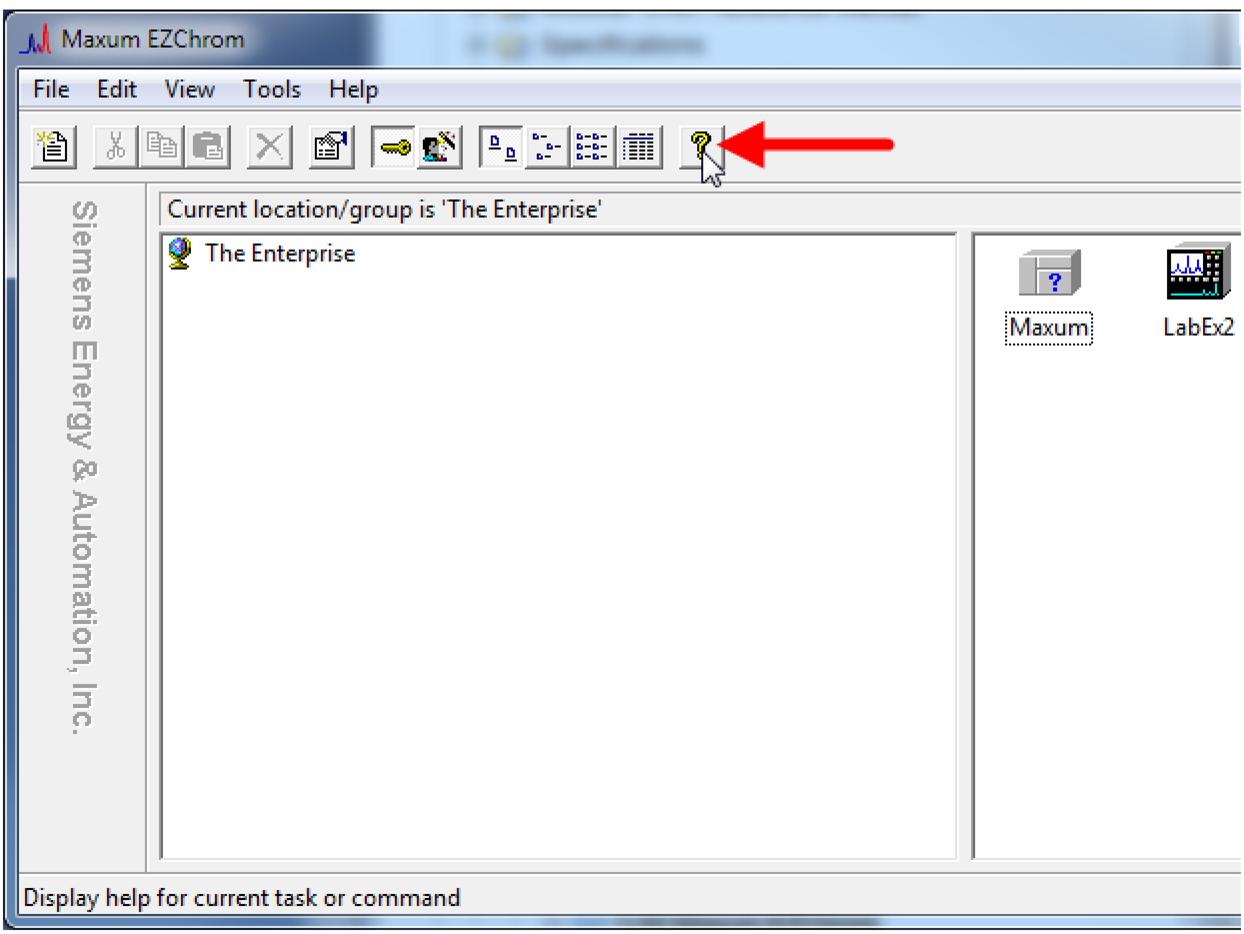


Table Reference 11

11.1 Introduction

The tables described here are part of the database for the Siemens Maxum gas chromatograph, Siemens Maxum Network Access Unit(NAU), and the Siemens MicroSAM gas chromatograph. This is not a complete listing of the tables.

The Maxum System Control unit (SYSCON) or MicroSAM contains a real-time relational database that provides persistent storage for all hardware, system, and application data. It acts as the interface between the customer's method, developed on a workstation using Gas Chromatograph Portal (GCP), and the analytical engine, that acquires and processes data. It also acts as a data server for workstation applications – those that are part of the system and those that the customer might develop.

Local and Workstation versions of the HMI (Human Machine Interface) give access to data, applications, programs, and results. Additional workstation interfaces are available through the Gas Chromatograph Portal (GCP).

Within the GCP, access to the tables is via screens that translate the tables into more easily readable formats. Because of this the names of some attributes in the tables may be slightly different than the actual table entries described in this table reference.

The NAU contains all the tables of the GC, but usually carries on different types of tasks. Maxum tables are classified, as follows:

Application Tables:
These are tables that store customer specified methods for data acquisition, compositional analysis and result generation along with stream sequencing and links to hardware specifications.

Result Tables:
These are tables that support chromatogram and result storage and realtime chromatogram display on an MMI or chart recorder.

Calibration Tables:
These are tables used in single and multi-level calibration. Expected peaks and known concentrations are entered into EZChrom. Calibration results, response factors that are used in compositional analysis of unknown samples, are generated by the SNE software and uploaded to these tables.

System Configuration Tables:
These are tables that contain system configuration and monitoring information of interest to the customer

System Control Tables:
These tables are used for a variety of support functions.

System I/O Tables:
These tables encapsulate the data and functions needed to provide applications with I/O from various sources, while hiding from the applications the actual mechanics.

11.2 Table Descriptions

This help file includes a description of the most common tables in the Siemens Maxum or MicroSAM database. A list of the table attributes is included.

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

11.3 Application Tables

11.3.1 Application

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Applications are configured in the Gas Chromatography Portal. This table controls the running and monitoring of the application.

Application_id (I) - Primary Key (999 is reserved for special Modbus features)

Application_name(S) - name given to the application

Application_type(i) - (Version 4.0+) (not used)
0 Maxum

Mode(**I**) - Indicates the application's operating mode:
0 = hold

1 = running
4 = flow(stream purge)
6 = waiting for temp or pressure
7 = set to run
8 = Program Wait
9 = Halt
10 = Reprocess
11 = Results Finished
12 = Reprocess and Hold
By setting this status to 7 or 0, the customer can cause an application to go into run (7) or hold (0) state.

SNE_mode(I) - Indicates the state of the SNE(analytical engine) or method:
0 = hold
1 = run
2 = load
5 = error
9 = Halt

Active_app, active_sequence (I,I) - Foreign key to the sequence table. Indicates the sequence that is "active."(not necessarily current). These attributes can be set to change the active sequence.

Paused_app, paused sequence(I,I) - Foreign key to the sequence table. Indicates the sequence that is "waiting for return" from a calibration or validation.

Curr_app,curr_seq, curr_seq_pos(I,I,I) - Foreign key to the sequence_entry table. Indicates the current position in the sequence that is being analyzed.

Next_app, next_seq, next_seq_pos(I,I,I) - Foreign key to the sequence_entry table. Indicates the next position in the sequence that will run, if it has not been forcibly changed with a Set Always.

Int_app,int_seq, int_seq_pos(I,I,I) - foreign key to the sequence_entry table. Indicates a forced position in the sequence caused by Set Always.

Curr_stream_id(I) - Indicates the current stream that is being analyzed

Cm_app,curr_method_id(I,I) - Foreign Key to the Method Table. Indicates the current method being used.

Stream_purge_clock(F) - number that is set to the Stream_Purge_Time at stream step. It counts down to zero. If the Method attempts to run before zero is reached, the application will be put in mode FLOW until it has reached zero.

Watclock(F) - When temperature or pressure programming (as part of the method) is used, this number will be set to the maxwait value from the app_tempctl or app_pressctl tables. It will count down and if the temperature or pressure is not reached (within maxdelta), it will place the application in hold.

Total_cycle(F) - Comes from the method. Total Cycle in seconds.

Injection_lag(F) - Comes from the method. Injection Lag in seconds

Clock_time(F) - Indicates the time in the current cycle.

Curr_error(I) - Indicates the last unacknowledged fault for the application. It is maintained by the alarm_log table.

Fault_DO(S) - Alternate DO for indicating fault, references the sys_do table (Version 4.0+).

Curr_warning(I) - Indicates the last unacknowledged warning alarm for the application. It is maintained by the alarm_log.

Warning_DO(S) - Alternate DO for indicating Warning (can be the same as Fault_DO), references sys_do table (Version 4.0+).

Curr_error_type(S) -
! indicates that the alarm log contains an unacknowledged fault
? indicates that the alarm log contains an unacknowledged warning (no faults)
+ indicates that the alarm log contains an unacknowledged note (no warnings or faults)
This value is displayed on the MMI at the top of the screen.

Manualcalrun(B) - Indicates that the application is in manual cal mode, or that the last calibration run was manual

Autocal(B) - Indicates whether the application is allowed to do autocalibration.

Autocal_app, autocal_seq(I,I) - Foreign key reference to the sequence table. This must contain the reference to the sequence for autocal, if autocal is to run.

Autoval_app, autoval_seq(I,I) - Foreign key reference to the sequence table. This must contain the reference to the sequence for running a validation

Max_cal_reps(I) - Not used

Autoclear(B) - Indicates whether alarms from a previous cycle are automatically acknowledged when a "good" cycle runs

Inservice(B) - Indicates whether the application is inservice. An out of service application will not move or transmit results and will generate a fault alarm.

Enable(B) - Indicates whether an application can be placed in run.

Master(I) - Foreign key reference to the Application Table. Is set to the application that will synchronize the cycle clocks and contain merged results. For the Master, this is set to its own application_id.

Rem_anlzref(I) - (Version 4.2+) Foreign key reference to the analyzer Table. If Rem_Master is zero, this indicate that this application is the master and contains the analyzer for the slave application(s). When this application is set to run, it sends a run request to all appropriate slaves on the remote analyzer. If this is the slave application, it contains the reference to the master’s analyzer.

Rem_Master(I) - (Version 4.2+) Used in conjunction with Rem_anlzref.
Zero indicates that this is the master
> 0 , application_id of the remote master application

MasterSlave_Delay(I) - (Version 4.2+) delay is entered into the local or remote SLAVE. Slave receives a run requests and delays to this many seconds before going into run.

Ms_Waitclock(I) - (Version 4.2+) clock for counting down master/slave delay (used internally)

Sim_Clock(B) - Indicates whether application is to simulate the cycle clock. It requires an entry into the method table for the cycle_length and entries in the stream and sequence_entry tables.

Synch_sec(I) - Will synchronize the sim_clock cycle on seconds after the minute. Use 60 to synchronize on the minute. Zero indicates no synchronization.(4.0)

Continuouscycle(B) - Will cause sim_clock cycles to run continuously, without waiting for a mvrpgm to complete. Could cause problems used with datalogger or transmit of results to a host using OPC or Modbus. (4.0)

App_status(I) - (OPC, external client applications) Indicates the presence of uncleared, unacknowledged alarms in the alarm_log. This is not cleared at the beginning of a cycle and is set during end of cycle processing. (4.0)
0 = no faults or warnings
1 = warnings
2 = faults
3 = faults and warnings

App_status_msg(S) - (OPC, external client applications) the alarm code and message of the first, most severe alarm. Set during end of cycle processing. (4.0)

Next_stream_id(I) - indicates the flowing stream (next to be analyzed). (Version 4.0+)

Cal_status(i) - (Version 4.2+) indicates status of calibration
0 = unknown
1 = calibration successful
2 = calibration failed

Val_status(I) - (Version 4.2+) indicates status of validation
0 = unknown
1 = Validation successful
2 = Validation failed

Streamstep_flag - 1 = stream step has occurred in the current cycle(used interally)

Enable_trt(B) - (Version 4.2+) Allows disable of TRT for entire application
Impacts Modbus, OPC, external results

11.3.2 Stream

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Streams are configured in the Gas Chromatography Portal. The purpose of this table is to control and monitor the stream in the application.

Application_id, stream_id(I,I) - Primary key. Application_id is a foreign key to the application table. Stream_id is an integer that will be used to refer to the stream from other tables.

Sv_app,sv_id(I,I) - Foreign key reference to the Appdo table. It indicates the valve that is used at stream step. It may be set to NULL.

Sv_2app,sv_2id(I,I) - Foreign key reference to the Appdo table. It indicates the valve that is used at stream step. It may be set to NULL.(4.0)

Sv_3app,sv_3id(I,I) - Foreign key reference to the Appdo table. It indicates the valve that is used at stream step. It may be set to NULL.(4.0)

Sv_4app,sv_4id(I,I) - Foreign key reference to the Appdo table. It indicates the valve that is used at stream step. It may be set to NULL.(4.0)

Sv_5app,sv_5id(I,I) - Foreign key reference to the Appdo table. It indicates the valve that is used at stream step. It may be set to NULL.(4.0)

Sv_6app,sv_6id(I,I) - Foreign key reference to the Appdo table. It indicates the valve that is used at stream step. It may be set to NULL.(4.0)

Stream_name(S) - Name used for reports

Calibrate(B) - Indicates whether the stream is a calibration stream. Only used for transmiting to HCI-H.

Purge_time(I) - Used to set the stream_purge_clock in the application table.

Curr_error(I) - Integer that indicates the last fault alarm for the current or most recent cycle. It is set to zero at the beginning of a new cycle. This value is used to determine whether the cycle is "good" and whether results are moved from buffered to saved. It should not be modifed except under special circumstances.

Prev_error(I) - Fault indicator from the previous cycle.

Curr_warning(I) - indicates the last warning alarm during the current or most recent cycle. It is used for generation of status for transmission of results to a host.

Prev_warning(I) - Integer that indicates the warning from the previous cycle.

Curr_error_type(S) - Indicates the severity of the alarms for the current cycle.
! indicates fault
? indicates warning
+ indicates note

Prev_error_type(S) - Indicates the severity of the alarms for the previous cycle.
! indicates fault
? indicates warning
+ indicates note

Clear_results(B) - Used internally.

Current_cyctime(D) - Time of current cycle

Previous_cyctime(D) - Time of previous cycle

Bin_hdr(Bin) - comes from EZChrom

Complete_time(D) - Cycle time for last set of completed results received from the SNE. This is set when all results have been received.

Complete_flag(B) - value is set to false when results are being received from the SNE and is set to true when results are complete. Used by Datalogger to determine when to pick up results.

Stream_status (I) - (Version 4.0+) indicates the presence of uncleared, unacknowledged alarms in the alarm_log for the last cycle for this stream. This is cleared at the beginning of a cycle and is set during end of cycle processing.
0 = no faults or warnings
1 = warnings
2 = faults
3 = faults and warnings

stream_status_msg (S) - (Version 4.0+) the alarm code and message of the first, most severe alarm. Set during end of cycle processing

eoc_readme(B) - (Version 4.0+) (external client applications) read-me flag used for external polling of results. Is set at end if end cycle processing and is reset after readme_sec seconds

readme_sec(I) - (Version 4.0+) (external client applications) seconds before eoc_readme is reset.

runevent(I) - (Version 4.0+) (OPC, external client applications) program id used to run a program event for this stream (4.0)

setalarm(I) - (Version 4.0+) (OPC, external client applications) alarm code used to cause an alarm for this stream.

11.3.3 Stream Sequencing

11.3.3.1 SEQUENCE

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table contains the control information for an online sequence, which is created and maintained in EZChrom.

Application_id, Id(I,I) - Primary key. Ids are usually:
1 = normal, created automatically
2 = calibration, created automatically
3 = user defined
4 = validation (created automatically in Version 4.2+)

Name(S) - Name for the sequence. Can be set in EZChrom or System Manager.

Type(I) - Type of sequence. This type will control special behavior for the end of the sequence.
1 = normal
2 = calibrate
3 = mixed
4 = validation

Stopatend(B) - Boolean value that indicates whether the application goes into hold at the end of the sequence.

Return_app, Return_sequence(I,I) - Used internally to control return from calibration and validation (for future use)

Default_flag(I) - Used to indicate the default calibration or validation sequence(for future use)

11.3.3.2 SEQUENCE_ENTRY

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table contains each step in an online sequence.

application_id, id, sqid (I,I,I) - primary key indicates position in sequence

enable(B) - enabled? set from the stream_method table or on the MMI under setup/streams or from EZChrom.

method_id(I) - Method _id from method table

interrupt(I) -
0 = none
1 = forced
2 = step
3 = reset value (transient)

state(I)-
1 = current
3 = current and next

Stream_state(I) -
0 = none
1 = flowing

Screenstatus(S) - Created for display as a summary of the state, interrupt, and stream_state
F = Indicates stream is flowing

Curr = Indicates the SNE is currently processing
Step = Indicates that this would be the next if it is in the active sequence

C,S = Curr and next(after the flowing one finishes)
---- = No status
Alwy = Will run always, if the sequence is active
Once = Will run once, if the sequence is active
(Note: Status display on the HMI is less complex, indicating Curr and Next)

Curr_cal (I) - Calibration level (0=unknown) set from Method

Run_type(I) - set from Method

stream_app.stream_id(I,I) - Foreign key reference to the stream table

Smapp,smstream, Smmethod(I,I,I) - Foreign key to the stream_method table

11.3.3.3 STREAM_METHOD

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table is a summary table for the sequence entries.

application_id, stream_id, method_id(I,I,I) - primary key

enable(B) - enabled? This is for summary only.

Automvr(B) - automatically approve(qualify) results if no alarm this cycle?

Autolog(B) - automatically log results at end of cycle?

Mvrpgm(I) - event from the program table that runs at the end of the cycle.A
Runs before automvr, autolog, autotrt and other end of cycle processing

Status(S) - status if in the active Sequence. Built from the screenstatus in the sequence_entry table.

Autotrt(B) - automatically transmit to hosts at end of cycle?

Lognow(B) - Print standard log. Automatically resets to false.

Mvrnow(I) - Move results from buffered to saved. Automatically resets to 0.
1 = normal fault processing
2 = forced, regardless of faults

Trtnow(B) - Transmits results when set to true. Automatically resets to false.

Hostref(I) - Foreign key reference to the host table. Indicates the host to send results (default is all hosts).

11.3.4 Special Programming

11.3.4.1 PROGRAM

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Programs are created in the Maxum Gas Chromatography Portal or MaxBasic.

Appcontext, Id, Instance(I,I) - Primary key. There can be multiple instances of a program for the purpose of differentiating code because of stream or arguments.

Streamcontext(S) - Indicates valid stream context for this program. Entry of -1 will allow the program to be run for all streams. Entry of "1,3,5" will allow it to run for streams 1,3, and 5. (dash notation is not allowed)

Runstream(I) - This is the stream context(stream argument) for programs that run from the MMI or scheduled in the program_schedule table. Normally programs will use the current running stream, but this will override that.

Name(S) - Program name enforced to be the same for all programs with the same ID within an application.

Iargs(S) - comma delimited list of parameter ids from the parameter table to be passed as integers to the executing program. Also used with autocalibration and autovalidation to indicate a specific sequence to run.

(Version 4.2+) Constant values are indicated by a V in the first character of each item in the list.

Rargs(S) - Comma delimited list of parameter IDs from the parameter table to be passed as decimal numbers to the executing program.
(Version 4.2+) Constant values are indicated by a V in the first character of each item in the list

Pcode(Bin) - Program pseudocode. This is the executable (.exe) file generated from MaxBasic. It can be entered from MaxBasic or System Manager.

Scode(Bin) - Program source code. This is the contents of the .bas file from MaxBasic. This file can be saved and viewed using a text editor. It can be modified from MaxBasic or System Manager.

Enable(B) -
Prior to Version 3.11: True enables frequency scheduling. False disables frequency scheduling. False does not disable any other program execution.
After Version 3.11: True enables frequency, alarmhandler, and cycle event execution. False disables frequency, alarmhandler, and cycle event execution. It does not disable running the program from an external source or MMI.

Status(I) - Indicates the status of the program execution.
-1= ready
-2 = running
0 = success
1 = failed
2 = cancelled
4 = incomplete(program was cancelled)

Pgmfunction(I) - Integer that indicates special programming that does not require MaxBasic.

0 = none
1 = autocalibrate
2 = autovalidate
99 = end of cycle release for mvrpgm
> 100 = program id of next program to run (+100). i.e.:130 means run program 30.

Dbfunction(I) - (Version 4.2+) Integer that indicates internal functions

0 = none
1 = Normalize
2 = Enable DI
3 = Disable DI
4 =Put application in service
5 = Put application out of service
6 = Analyzer shutdown
7 = AO set from result saved_value
32 = Transmit Results(TRTNOW)
(Version 4.3+)
8 = I/O to Result buffered_value
9 = Peak or Group results to Result buffered_value
12 = Flame Sense
13 = Flame Ignite
14 = Flame Control (TS 101)
15 = Di on
16 = Di off

17 = Program enable
18 = Program disable

Max_exec_time(I) - Interpreter will cancel program if it runs beyond this time. –1 means do not use.

Debug_option(I) - Option for debugging, passed as argument to program and also used by the interpreter.
Interpreter debug output:
0 = none
8 = display execution time and error status
16 = display arguments and start time
32 = trace SQL statements
-1 = all of the above

Overrun_option - If the program is run while another occurrence of the same program is still running:
0 = run anyway
1 = Fault alarm and do not run
2 = warning alarm and run anyway

Runmethod(I) - (Version 4.0+) This is the method context(method argument) for programs that run from the MMI or scheduled in the program_schedule table. Normally programs will use the current running method, but this will override that.

11.3.4.2 PROGRAM_SCHEDULE

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table contains scheduling information for the program table.

Appcontext, Id, Programref, Sched_num (I,I,I) - Primary key. Appcontext, Id, Programref is Foreign key to the program table. Multiple scheduling can be entered for the same program.

Schedule_time(S) - Contains the character representation of the time. It can be entered with dot or colon notation. (10:00 or 14.00). When using freq_amt and freq_unit, this can be used to synchronize the starting of the program on the hour(set schedule_time to "1:00:00"). This synchronization occurs only on the first time the program runs.

Schedule_day(I) - Is used to select a day of the month(add 200) or day of the week(as a bit mask).

0-127for day of week
bit 6 = Sunday
bit 5 = Monday
bit 4 = Tuesday
bit 3 = Wednesday
bit 2 = Thursday
bit 1 = Friday
bit 0 = Saturday
127 = every day
64 = Sunday only
...
200-231 for day of month

Freq_unit(I) -
1 = hour
2 = minute
3 = day
4 = seconds

Freq_amt(I) - Freq_amt: number of units. The system will not allow a frequency less that 5 seconds.

Nextruntime(D) - The next time the program is scheduled to run. This is used internally by the system for time and day scheduling only.

Timerref(I) - References timer that handles frequency scheduling.(for internal use)

11.3.4.3 PARAMETER

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table contains scheduling information for the program table.

Parameters are used primarily to get information to programs, or other built in functions

Appcontext(I) - An application here means that this parameter is specific to this application, -1 is reserved for all applications

Streamcontext(I) - Stream id from application .-1 is reserved to indicate all streams.

Parameter_id(I) - Unique id – used in iargs and rargs for program table (-1,-2, -3 used for parameter reports)

Parameter_name(S) - Name for parameter

Value(S) - Value used as a constant, if Qtype is null or 0. Otherwise, is the last evaluated value that was passed to a program.

Qid(I) - ID in queried table – used to make execution time queries to table

Qtype(I) - Table for query: Used to make execution time queries
null = use parameter value as a constant
0=none
1 = AI
2 = DI
3 = buffered result
4 = saved result
5 = external result
6 = stream current error
7 = stream current warning
8 = application current error
9 = application current warning
10 = flowing stream
11 = application mode
12 = active sequence id
13 = next sequence id
14 = DO

11.3.5 Method

11.3.5.1 METHOD

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Comes from EZChrom. The table attributes are taken from the EZChrom binary attributes. See the EZChrom documentation for a detailed explanation of these attributes *application_id, method_id(I,I)* - Primary key

method_type(I) - To distinguish between Quantra (4),sim_clock (8), or Ezchrom (0) method (4.0)

cycle_length(F) - Entire cycle time (seconds) Can be set for sim_clock applications or when artificially setting up a dummy method to lengthen the timeout for Modbus.

injection_lag(F) - injection lag

method_name(S) - customer defined, should be unique

Flagged_for_download(B) - Tells the application whether to send the method to the SNE

Amount_area(B) - True: use amount/area

acq_all_chan(B) - acquire on all channels?

auto_update(B) - see EZChrom documentation

Curr_cal(I) - Calibration level (0=unknown)

run_type(I) - see EZChrom documentation

Bin_run(Bin) - from Maxum EZChrom

Bin_cyc(Bin) - from Maxum EZChrom

Enable(B) - indicates whether a method is valid

Local_change(B) - used internally

Bin_blf(Bin) - for SimDis

Bin_blh(Bin) - for SimDis

Sne_ctrl_ref(I) - used for Quantra (4.0)

Cycle_length_timeout(F) - used for Quantra (4.0)

11.3.5.2 CHANNEL

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table contains scheduling information for the program table.

Comes from EZChrom. The table attributes are taken from the EZChrom binary attributes. See the EZChrom documentation for a detailed explanation of these attributes

Application_id, Method_id, Channel(I,I,I) - Primary key

Detectorapp,detectorref(I,I) - Foreign key reference to the detector

Trace_id (I) - Assigned by Ezchrom – used internally only

Enable(B) - not used

Sample_rate(F) - SamplePeriod (seconds)

Acquisition_delay(F) - Detector acquisition delay (seconds)

Meas_units(S) - Amplitude axis name

Multiplier(F) - Multiplier to get microvolts

run_duration(F) - Detector run time (seconds)

balance_limit(F) - balance limit

Bin_int(Bin)Maxum - EZChrom integration events

Bin_mif(Bin)Maxum - EZChrom Manual integration fixes

Bin_prf(Bin)Maxum - EZChrom Performance parameters

Bin_npk(Bin)Maxum - EZChrom Named peak

Bin_grp(Bin)Maxum - EZChrom Group

Bin_map(Bin)Maxum - EZChrom map for storing results

Bin_npk_cal(Bin) - SNE EZChrom peak calibration

Bin_grp_cal(Bin) SNE EZChrom group calibration

Devtype(S) -

xmit_enable(I) -
1 = transmit chrom and results
0 = don't send chrom

Full_unzip(I) -
1 = populate calibration tables from binary data
0 = used for performance enhancement

Full_results(I) -
0 = compact results
1 = populate ezchrom result tables from binary data
2 = compact results(extended set for OPC)

New_blends(B) - A new blend has been entered by the user and is to be used in the next calibration

Unzip_needed(B) - Calibration tables are not current

Bin_bln(Bin) - for SimDis

Bin_sds(Bin) - for SimDis

Bin_sds_cal(Bin) - for SimDis

Apply_baseline(B) - for SimDis

Bin_smo(Bin) - smoothing binary

Local_change(B) - used internally

11.3.5.3 CYCLE_EVENT

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table lists the cycle events for the method as created in EZChrom. Sim_clock application can have cycle_events that are created in Maxum System Manager.

application_id, method_id, id(I,I,I) - primary key

ezid(I) - ezchrom id

name(S) - user defined

type(I) -
1 = I/O
3 = Other

enable(B) - used to enable/disable event

start_time(F) - cycle start time (seconds)

Appdo(I) - id of appdo for DO set event

Program(I) - id in the program table for a program event

Cycdelay(F) - delay

Slope(F) - slope (may be integer)

Limit(F) - limit

Slopedetect(B) - slope detect

Valveon(B) - valve on/off

Comparetype(I) -
0 : =

1 : >

2 : <

3 : >=

4 : <=

5 : <>

channel(I) - channel

detname(S) - for EZChrom internal use

traceid(I) - for EZChrom internal use only

duration(F) - pulse duration. Zero means none. (Version 4.0+)

mode(I) - used to indicate whether done during process, calibration, validation, baseline (see EZChrom documentation) (Version 4.0+)

11.3.5.4 INTEGRATION_EVENT

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table lists the integration events for the method as created in EZChrom.

Application_id, Method_id, Channel, Intevent_id(I,I,I,I) - primary key

Enable(B) - not used

start_time(F) - cycle start time (seconds)

stop_time(F) - cycle stop time (seconds)

Value(F) - value associated with event

Event_type - See EZChrom documentation

11.3.5.5 TEMPERATURE_PROGRAM

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table is a list of temperature program steps as created in EZChrom.

Application_id, Method_id, Tempctlid, step_id(I,I,I,I) - Primary key

Mode(I) -
1 = setpoint
2 = ramp
3 = start

start_time(F) - sec

ramp_rate(F) - C/sec

setpoint(F) - C

limit(F) - C

parameters(Bin) - binary containing additional parameter settings for the TC

enable(B) - for EZChrom internal use

hold_time(F) - for EZChrom internal use

stop_time(F) - for EZChrom internal use

devtype(S) -

ezid(I) -

Usemaxdev(B) - indicates whether to used the Maxdev or the value of the Max Deviation AO. (4.0)

MaxDev(F) - value for max deviation. (4.0)

11.3.5.6 PRESSURE_PROGRAM

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table is a list of temperature program steps as created in EZChrom.

Application_id, Method_id, Tempctlid, step_id(I,I,I,I) - Primary key

Mode(I) -
1 = setpoint
2 = ramp
3 = start

start_time(F) - sec

ramp_rate(F) - C/sec

setpoint(F) - C

limit(F) - C

parameters(Bin) - binary containing additional parameter settings for the TC

enable(B) - for EZChrom internal use

hold_time(F) - for EZChrom internal use

stop_time(F) - for EZChrom internal use

devtype(S) -

ezid(I) -

Usemaxdev(B) - indicates whether to used the Maxdev or the value of the Max Deviation AO. (4.0)

MaxDev(F) - value for max deviation. (3.3)

11.3.6 Limits and Alarms

11.3.6.1 ALARM_LOG

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Appcontext(I) - 0 indicates no application

Streamcontext(I) - 0 indicates no stream

Alarm_code(I) - The number of the message – used to access the text from the text or alarmhandler tables

Post_time(D) - The time the alarm first occurred

Latest_Post_time(D) - most recent time

Alarm_type(S) -
+ = informational
? = warning, maintenance
! = error, fault

User_id(S) - not used

Cycle_time(I) - Time in cycle that alarm occurred(seconds)

Maint_type(I) -
1 = in current cycle and unacknowledged
0 = acknowledged

Status(I) - not used

Alarmcount(I) - count for multiple occurrences

Appref - foreign key reference to application table

Streamapp,streamref - foreign key reference to stream table

Check_time(D) - The time the message was acknowledged

Param3 – param4 - Parameters for filling in message

Param5- param9 - not used

11.3.6.2 LIMIT

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table controls special handling for results and I/O.

application_id, Limit_id(I,I) - primary key

Name(S) - for information purposes(4.0+)

usehihi(B) - use the hihi limit?

Hihivalue(F) - analog value that triggers hihi limit

Hihialarmapp,hihialarmref(I,I) - Foreign key to alarmhandler table . If null, fault alarm 673

Usehi(B) - use the hi limit?

Hivalue(F) - analog value that triggers hi limit

Hialarmapp,hialarmref(I,I) - Foreign key to alarmhandler table. if null, warning alarm 694

Uselo(B) - use the lo limit?

Lovalue(F) - analog value that triggers lo limit

Loalarmapp,loalarmref(I,I) - Foreign key to alarmhandler table. If null, warning alarm 695

Uselolo(B) - use thelolo limit?

Lolovalue(F) - analog value that triggers lolo limit

Loloalarmapp,loloalarmref(I,I) - Foreign key to alarmhandler table. If null, warning alarm 695

11.3.6.3 ALARMHANDLER

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table controls special alarm handling: alarm redefinition, alarm disable, alarm actions, custom alarms.

application_id, Alarm_code(I,I) - primary key

Enable(B) - is alarm enabled? Can disable system alarms here. If alarm is disabled, DO will not be set, Program will not run

Programid(I) - program to run when alarm occurs

Text(S) - Text begins with
! for fault
? for warning
+ for note, or
– for no alarm(DO and Program actions only)

text will embed special symbols for parameter substitution
first character is alarm type(!,?,+)followed by a blank
%1 – application_id
%2 – stream_id
%3-%4 param3-param4

dosetting(B) - value setting for do

Doapp,doref(I,I) - do to set when alarm occurs

Stream_flag(I) - indicates whether to post the alarm to the current or flowing stream (4.0)
0 = current
1 = flowing

11.3.7 Application I/O

11.3.7.1 APPAI

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table contains analog inputs as they relate to the application.

Application_id, Id(I,I) - Primary key

Name(S) -

Io_status(I) - set by system(see io_status under System I/O Tables

Enable(B) - if not enabled, the value can be set, but the device value is not

Hrdwr_id(S) - Foreign key reference to the the system I/O tables. .

Unittext(S) - Text to display for units.

Value(F) - Floating point value in engineering units.

Zero(F) - zero to be used in engineering unit calculation.

Fullscale(F) - floating point fullscale value to be used in engineering unit calculation.

Limtiapp, Limitref(I,I) - Foreign key reference to the limit table. Used to define special actions or alarms based on the value of the I/O.

Hrdwrapp, Hrdwrref(I,I) - Foreign key reference to the detector, pressure controller, or temperature controller table. Used for keeping data current in those tables.

Average(B) - Indicates whether the AI is being averaged

Avg_option(I) -
0 = non-cycle, usually set to average from a MaxBasic program. Values are sent to the specific result which is updated each time a value is read.
1 = averaging done during a cycle using the current stream for placing result(updated at end of cycle only)
2 = averaging done during a cycle using the specific result and stream specified(updated at the end of the cycleonly)

Avg_rate(I) - 5, 10, or 15 seconds

Avgresapp, Avgresstr, Avgresref(I,I,I) - Foreign Key reference to the Result table

Avg_value(F) - Accumulated value

Numpoints(I) - Number of values averaged

Avgtimerref(I) - Foreign Key reference to IOPolltimer table.

11.3.7.2 APPAO

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table contains analog outputs as they relate to the application.

Application_id, Id(I,I) - Primary key

Name(S) -

Io_status(I) - set by system(see io_status under System I/O Tables

Enable(B) - if not enabled, the value can be set, but the device value is not

Hrdwr_id(S) - Foreign key reference to the system I/O tables.

Unittext(S) - Text to display for units.

Value(F) - Floating point value in engineering units.

Zero(F) - zero to be used in engineering unit calculation.

Fullscale(F) - floating point fullscale value to be used in engineering unit calculation.

Limitapp, Limitref(I,I) - Foreign key reference to the limit table. Used to define special actions or alarms based on the value of the I/O.

Hrdwrapp, Hrdwrref(I,I) - Foreign key reference to the detector, pressure controller, or temperature controller table. Used for keeping data current in those tables.

11.3.7.3 APPDI

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table contains digital inputs as they relate to the application.

Application_id, Id(I,I) - Primary key

Name(S) -

Io_status(I) - set by system(see io_status under System I/O Tables

Enable(B) - if not enabled, the value can be set, but the device value is not

Hrdwr_id(S) - Foreign key reference to the the system I/O tables.

Value(B) - Boolean value

Text0(S) - Text to display if value is false

Text1(S) - Text to display if value is true

Limitapp, Limitref(I,I) - Foreign key reference to the limit table. Used to define special actions or alarms based on the value of the I/O.

Hrdwrapp, Hrdwrref(I,I) - Foreign key reference to the detector, pressure controller, or temperature controller table. Used for keeping data current in those tables.

11.3.7.4 APPDO

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table contains digital outputs as they relate to the application.

Application_id, Id(I,I) - Primary key

Name(S) -

Io_status(I) - set by system(see io_status under System I/O Tables

Enable(B) - if not enabled, the value can be set, but the device value is not

Hrdwr_id(S) - Foreign key reference to the the system I/O tables.

Value(B) - Boolean value

Text0(S) - Text to display if value is false

Text1(S) - Text to display if value is true

Auto_offtime(I) - (obsolete as of version 4.0; see pulse duration in the sys_do table)

Limtiapp, Limitref(I,I) - Foreign key reference to the limit table. Used to define special actions or alarms based on the value of the I/O.

Hrdwrapp, Hrdwrref(I,I) - Foreign key reference to the detector, pressure controller, or temperature controller table. Used for keeping data current in those tables.

Injection(B) - If true, this will not inject during baseline chromatogram acquisition.

11.3.7.5 APP_DETECTOR

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table is the list of detectors for an application.

application_id, Id(I,I) - Primary key

Ezid(I) - EZChrom id

Hrdwr_id(S) - Foreign key reference to the sys_hardware table

Name(S) - name used for detector

DetType - corresponds to the submodule type (4.0)
-1 = Unknown
0 = TCD
1 = FID
5 = FID
6 = TCD
9 = FIL
10 = FPD
11 = UNIV
65 = TCD (MicroSAM)
255 = Configured TCD
256 = Configured FID

Type(I) -
6 = Temperature Controller
7 = Detector
8 = Pressure Controller

ezname(S) - EZChrom name

meas(F) - current AI value

Measapp,measref(I,I) - Foreign key reference to AI table

Status(I) - set by system (see io_status under System I/O Tables)

Minsamp(F) - Minimum sampling period (seconds)

maxsamp(F) - Maximum sampling period (seconds)

chrom_status(I) - used for realtime chrom display

chrom_running(B) - used for realtime chrom display

yunits(S) - from ezchrom

ymult(F) - from ezchrom

dobalance(B) - send a balance event to this detector

dobalancelimit(F) - balance limit to send flame(B) - flame indicator for FID detector

Flaimediapp,flamediref(I,I) - Foreign key reference to DI table

manigwrite(B) - manual ignition activate for FID

manigread(B) - manual ignition read value for FID

Mandoapp,mandoref(I,I) - Foreign key reference to DO table

disablewrite(B) - activate disable bias for FID

disableread(B) - read value

Disdoapp,disdoref(I,I) - Foreign key reference to DO table

balance_sig(F) - balance signal

Balaiapp,balairef(I,I) - Foreign key reference to AI table

balancewrite(F) - Advance Plus only

balanceread(F) - read value

balaoapp,balaoref(I,I) - Foreign key reference to AO table

gainwrite(B) - Advance Plus only

gainread(B) - read value

gaindoapp,gaindoref(I,I) - Foreign key reference to DO table

invertwrite - Invert peaksDO

invertread - invert peaks read back

invertdoapp,invertdoref(I,I) - Foreign key reference to DO table

gain_di_app,gain_di_ref(I,I) - Foreign key reference to DI table

gain_en(B) - Gain feature DI (rev3.2)

gain_en_di_app, gain_en_di_ref(I,I) - Foreign key reference to DI table

flame_en(B) - Flame feature DI (rev3.2)

flame_en_di_app, flame_en_di_ref(I,I) - Foreign key reference to DI table

bias_en(B) - Bias feature DI (rev3.2) (not used)

bias_en_di_app, bias_en_di_ref(I,I) - Foreign key reference to DI table

Bridge_volt_write - Bridge Voltage AO(4.0)

Bridge_current_aiapp - Bridge Current AI(4.0)

Bridge_enable_write - Bridge Voltage enable DO(4.0)

bridge_gain_read(F) - Bridge Gain AO

bridge_volt_aiapp(I) - Bridge Voltage AI

bridge_power_aiapp (I) - Bridge Power AI

Bridge_Carrier(I) - (Version 4.2+) MicroSAM

Bridge_setcarrier(B) - (Version 4.2+) MicroSAM

11.3.7.6 APP_TEMPCTL

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table is a list of temperature controllers to be controlled by an application.

application_id, Id(I,I) - Primary key

Ezid(I) - EZChrom id

Hrdwr_id(S) - Foreign key reference to the sys_hardware table

Name(S) - Name to use on I/O

Type(I) -
6 = Temperature Controller
7 = Detector
8 = Pressure Controller

ezname(S) - EZChrom name

meas(F) - current AI value

Measapp,measref(I,I) - Foreign key reference to AI table

Status(I) - set by system(see io_status under System I/O Tables

Unitstype(I) - type of units for I/O:
0 = Degrees C
1 = Degrees F

Temptype(I) - type of temperature controller:
1 = full isothermal
2 =Maxum methanator
3 = fid block
4 = half isothermal
5 = ptgc
6 = SLIV
7 = generic
8 = Maxum Methanator (no longer used)
9 = Airless
10 = MaxumII Methanator
11 = MicroSAM
33 = Adv+ (no longer used)

99=Custom
155 = Adv+ TC3
156 = Adv+ TC4

setread(F) - setpoint readback

setwrite(F) - setpoint

Setaoapp,setaoref(I,I) - Foreign key reference to AO table

Rampread(F) - ramp rate readback

Rampwrite(F) - ramprate

Rampaoapp, rampaoref(I.I) - Foreign key reference to AO table

Devread(F) - deviation readback

Devwrite(F) - max deviation

Devaoapp, devaoref(I,I) - Foreign key reference to AO table

Gainread(F) - gainreadback

Gainwrite(F) - RTD calibration gain

Gainaoapp, gainaoref(I.I) - Foreign key reference to AO table

Runread(B) - run enable readback

Enable(B) - run enable

Rundoapp, rundoref(I,I) - Foreign key reference to DO table

Maxread(F) - max temp readback

Maxwrite(F) - maximum temperature

Maxaoapp, maxaoref(I,I) - Foreign key reference to AO table

Pwm(F) - pwm

Pwmaiapp, pwmairef(I,I) - Foreign key reference to AI table

Targetai(F) - target temp

Targetaiapp, targetairef(I,I) - Foreign key reference to AI table

Dev(F) - temp deviation

Devaiapp, devairef(I) - Foreign key reference to AI table

heater_on(B) - heater on?

Ondiapp, ondiref(I,I) - Foreign key reference to DI table

Tlimit(B) - temperature limit reached?

Limitiapp, limitairef(I,I) - Foreign key reference to AI table

Ots(B) - Overtemp shutdown?

Otsdiapp, otsdiref(I,I) - Foreign key reference to DI table

Rampable(B) - Rampable?

Equilibrate(B) - put method on hold until start temp reached?

Devicemin(F) - defaults –100

Devicemax(F) - defaults to 900

Maxwait(I) - maximum waiting time for holding application for start temp
Note: The application uses the largest wait time for all defined temperature/pressure controllers

Waitdelta(F) - limit for testing if temperature is close enough to set point

params(Bin) - set by system based on temptype

11.3.7.7 APP_PRESSCTL

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table is a list of pressure controllers to be controlled by an application.

application_id, Id(I,I) - Primary key

Ezid(I) - EZChrom id

Hrdwr_id(S) - Foreign key reference to the sys_hardware table

Name(S) - Name to use on I/O

Status(I) - set by system(see io_status under System I/O Tables

Type(I) -
6= Temperature Controller
7= Detector
8= Pressure Controller

ezname(S) - EZChrom name

meas(F) - current AI value

Measapp,measref(I,I) - Foreign key reference to AI table

EpcType(I) -
0 = Maxum
1 = MicroSAM

Unitstype(I) - Type of units for I/O:
0 = PSIG
1 = KPA

2 = Bar
3 = Kg

outofcontrol(B) - pressure out of control?

Outdiapp, outdiref(I,I) - set automatically

Pwmenread(B) - enable readback

Pwmenwrite(B) - enable pressure controller?

Pwmendoapp, pwmendoref(I,I) - set automatically

Setread(F) - setpt readback

Setwrite(F) - setpt for pressure

Setaoapp, setaoref(I,I) - set automatically

Devread(F) - max deviation readback

Devwrite(F) - maximum deviation

Devaoapp, devaoref(I,I) - set automatically

Maxread(F) - max pressure readback

Maxwrite(F) - maximum pressure

Maxaoapp, maxaoref(I,I) - set automatically

Rampable(B) - Rampable?

Equilibrate(B) - put method on hold until start temp reached?

Devicemin(F) - defaults to –100

Devicemax(F) - defaults to 900

Maxwait(I) - maximum waiting time for holding application for start temp
Note: The application uses the largest wait time for all defined temperature/pressure controllers

Waitdelta(F) - limit for testing if pressure is close enough to set point

Pwmaiapp - PWM AI (Rev 4.0)

11.4 Results Tables

11.4.1 RESULT

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Final results that come from EZChrom, MaxBasic, or an external source.

Application_id, Stream_id, Result_index(I,I,I) - primary key

Peakid(i) - from EZChrom

Status(I) - not used

Method_id(I) - method associated with result

Channel(I) - channel associated with result

Result_name(S) - name for result

Value_units (S) - text for value units

Cycle_runtime(D) - end of data acquistion – matches chromatogram table

Buffered_value(F) - preliminary value

Saved_time(D) - timestamp for saved_value

Saved_value(F) - approved value(qualified]. Buffered value is moved to saved value when automvr or mvrnow from the stream_method table are used.

Limitapp, limitref(I,I) - Foreign key to limit table. limit high/low for buffered_value

Aoapp, aoref(I,I) - Foreign key to appao table. AO to set at end of cycle

Logval(I) - value indicates the order for standard report logging.

PGMval(I) - value is used by MaxBasic and dbfunctions for sorting. Used to indicate results NOT to be merged from a slave application into a master.

Trtval(I) - value indicates the order for transmission of results to a host computer card (HCI-H, HCI-A, HCI-C01, HCI-CO4). When transmitting to Modbus, the value corresponds to the result attribute in the Modbus_addmap table.

host_euhi(F) - EUHI value for transmission of scaled values. For HCI-C04, when the scale factor in the host table is zero, this value is used as a scaling factor.

decimal_places(I) - decimal places to use for reporting; default 4.

doapp, doref(I,I) - Foreign key to the appdo table. DO to set at end of cycle

Compare_value - used in validation to compute a difference between the buffered_value(4.0)

Compare_margin - used in validation to determine if the validation is successful(4.0)

Compare_state - Cal/Val; State information (Pass/Fail/manually)(4.0)

Compare_dev_percent - Cal/Val; % deviation of "buffered_value" vs "compare_value"(4.0)

Compare_ref_comp_name - Not used

Compare_max_drift - Not used

Formula(S) - not used

11.4.2 CHROMATOGRAM

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Created from EZChrom. See EZChrom documentation for attribute descriptions.

application_id, stream_id, channel(I,I,I) - primary key

cycle_runtime(D)

method_id(I) - method that generated

automvr(B) - auto approve results? – set at end of cycle from stream_method table

autolog(B) - auto log results? – set at end of cycle from stream_method table

sample_interval(F) - Sampling period in seconds (Hz = 1/SamplePeriod)

Sample_Delay(F) - Delay (pos. or neg.) in seconds

injection_lag(F) - from Method

conversion_factor(F)

base_freq(F) - SamplePeriod (seconds)

X_axis_mult(F) - Multiplier to produce seconds (0.0166667 for "Minutes")

Y_axis_mult(F) - Multiplier to produce microvolts (1E-6 for "Volts")

X_axis_title(S) - For display purposes, from detector DUI

Y_axis_title(S) - Title for display

Point_count(I) - Number of data points

Markers(Bin)

bin_pkr(Bin) - SNE EZChrom peak results

bin_grr(Bin) - SNE EZChrom group results

bin_npk(Bin) - Maxum EZChrom expected peaks

bin_grp(Bin) - Maxum Ezchrom expected groups

bin_trc(Bin) - SNE EZChrom chromatogram

name(S)

bin_sdr(Bin) - for SimDis

bin_usm(Bin) - for smoothing

11.4.3 EXTRESULT

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Results that all polled for or transmitted from another analyzer

Anlz_id(I) - Analyzer to access remote data

Remapp(I) - primary key. Application on remote or local database

Remstr(I) - primary key. Remote Stream

Resnum(I) - primary key. Remote result number

Result_type(I) -
0 = Advance Optichrom
1 = remote Analyzer
2 = local

Status(I) -
-2 = error
-1 = not initialized
0 = ok

Result_name(S) - name for result

Limitapp, limitref(I,I) - Foreign key to limit table. Alarm handler of limit high/low

Scanrate(I) - Use as in the i/o tables :valid values are 5,10, 15 Zero = Version 4.2 analyzers transmit results from Host table

Saved_value(F) - value

Resapp,resstrm,resref(I,I,I) - Foreign key to result table. When updated, the saved value is transferred to the buffered_value and saved_value in the result table.

11.4.4 EZCHROM_RESULT_GROUP

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Temporary location of EZChrom group results. Only that last set of results for a stream are saved. Attributes are described in EZChrom documentation.

application_id, stream_id, method_id, channel, Group_id (I,I,I,I,I) - primary key

Cycle_runtime(D) - date, time that cycle ran

Group_name(S) - From group table

Group_type(I) - See EZCHROM documentation

conc_units (S)

Quantize(I) - See EZCHROM documentation

Conc_flags(I) - See EZCHROM documentation

concentration(F) - Externally calibrated result

Norm_conc(F) - Normalized result

Group_qvalue(F) - Quantization value (height or area)

Fit_error(I) - See EZCHROM documentation

Conc_error(I) - See EZCHROM documentation

area_percent(F) - Percent area

height_percent(F) - Percent height

corrected_area(F) - Corrected group area

group_height(F) - Max. peak height

current_rf(F)

11.4.5 EZCHROM_RESULT_CHROMPEAK

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Temporary location of EZChrom peak results. Only that last set of results for a stream are saved. Attributes are described in EZChrom documentation.

application_id, stream_id, Method_id, Channel, Peak_index (I,I,I,I,I) - primary key

Cycle_runtime(D) - date, time that cycle ran

Detected(I) - 0 = not detected; 1 = detected

Peak_name(S) - From peak table

Conc_units (S)

Quantize(I) - See EZCHROM documentation

peak_width5(F) - Peak width at 5% height

peak_width10(F) - Peak width at 10% height

peak_width50(F) - Peak width at 50% height

usp_peak_width(F) - Peak USP width (U.S. Pharmacopeia)

relative_ret_time(F) - Relative retention time (RT)

theor_plates(F) - Theoretical plates

theor_plates_meter(F) - Theoretical plates per meter

capacity_factor(F) - Peak capacity

resolution(F) - Resolution relative to previous peak

Conc_flags(I) - See EZCHROM documentation

Concentration(F) - Externally calibrated result

Norm_conc(F) - Normalized result

x_int_at_up (F) - Intersection of baseline with tangent at up inflexion point, RT

y_int_at_up(F) - Intersection …, amplitude

x_int_at_dwn(F) - Intersection of baseline with tangent at down inflexion point, RT y_int_at_dwn(F) - Intersection …, amplitude

x_sect_infl(F) - Intersection of tangents at up and down inflection points, RT

y_sect_infl(F) - Intersection …, amplitude

Fit_error(I) - See EZCHROM documentation

Conc_error(I) - See EZCHROM documentation

usp_validity(B) - When True: items with I are valid

Asym10(F) - Asymmetry at 10% height

area_percent(F) - Percent area

height_percent(F) - Percent height

Front_time(F) - Retention time at start of peak

Back_time(F) - Retention time at end of peak

Retention_time(F) - Retention time at peak apex

Baseline_start(F) - Baseline start RT

base_start_height(F) - Baseline start amplitude

Baseline_stop(F) - Baseline end RT

base_stop_height(F) - Baseline end amplitude

raw_area(F) - Raw peak area

Corrected_area(F) - Corrected peak area

Asymmetry(F) - Peak asymmetry

peak_height(F) - Max. peak height

peak_base_width(F) - Peak width at base

strindx_front_infl (F) - Stream index at front inflection point

strindx_back_infl(F) - Stream index at back inflection point

peak_type(S) - See EZCHROM document

Stop_flag(S) - See EZCHROM document

Start_flag(S) - See EZCHROM document

Peak_noise(F)

Peak_signal_to_noise(F)

current_rf(F)

11.4.6 REALTIME_BUFFER

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Used for real time chromatogram display.

buffer_id(I) - primary key
1 = local HMI
2 = remote HMI
3 = local chart
4 = remote chart
(additional entries are present when EZChrom is displaying realtime chromatograms)

Detectorapp, detectorref(I,I) - foreign key to app_detector table.

sample_interval(F) - For future use to define coarseness of display

points(Bin) - compressed data points

markers(Bin) - markers for chrom

In_ptr(I)

Out_ptr(I)

startup_delay(I)

x_full_scale(I)

x_offset(I)

y_full_scale(I)

y_offset(I)

11.4.7 ARCHIVE

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

The archive table allows longterm storage of chromatograms and results

application_id, cycle_runtime(I,D) - primary key

stream_id(I) - stream_id associated with this item

method_id(I) - method_id associated with this item

Bin_hdr(Bin) - Maxum EZChrom header

Bin_run(Bin) - Maxum EZChrom Run

Bin_cyc(Bin) - Maxum EZChrom Cycle events

11.4.8 CHROMATOGRAM_STORAGE

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

application_id, cycle_runtime, channel - Primary key. References archive table.

stream_id(I) - stream

method_id(I) - method

markers(Bin) - markers for chrom

sample_interval(F) - sample interval

Point_count(I) - Number of data points

sample_Delay(F) - Delay (pos. or neg.) in seconds

X_axis_mult(F) - Multiplier to produce seconds (0.0166667 for "Minutes")

Y_axis_mult(F) - Multiplier to produce microvolts (1E-6 for "Volts")

X_axis_title(S) - For display purposes, from detector DUI

Y_axis_title(S) - Title for display

Bin_int(Bin) - Maxum EZChrom Integration event

Bin_mif(Bin) - Maxum EZChrom Manual integration fixes

Bin_npk(Bin) - Maxum EZChrom Named peak

Bin_grp(Bin) - Maxum EZChrom Group

Bin_prf(Bin) - Maxum EZChrom Performance parameters

Bin_map(Bin) - Maxum EZChrom map for storing results

Bin_trc(Bin) - SNE EZChrom trace

Bin_pkr(Bin) - SNE EZChrom peak results

Bin_grr(Bin) - SNE EZChrom group results

detr_name(S) - EZChrom detector name

Bin_bln(Bin) - for SimDis

Bin_sds(Bin) - for SimDis

Bin_sdr(Bin) - for simDis

11.4.9 RESULT_STORAGE

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Application_id, Cycle_runtime, Result_index - Primary key. References archive table.

Channel(I)channel - detector

Stream_id(I) - stream

Method_id(I) - method

Result_name(S) - name

Value_units(S) - value units

Saved_value(F) - approved (qualified)value

Buffered_value(F) - preliminary value

11.5 Calibration Tables

11.5.1 CALPEAK

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

application_id , method_id, channel, - primary key

ref_type - Peak = 0; group = 1

Cal_id(I) - Peak Id

Name(S) - Customer defined name for group or peak

Ref_peak(I) - Reference peak #

Quantize(I) - 0 = area; 1 = height

manual_rf_used(B) - TRUE: use manual response factor (RF)

manual_rf(F) - user supplied manual RF

Margin(F) - Max. % difference between cal. and meas. area/height for retention time update to execute

Scale(I) - See EZCHROM documentation

calibration_curve_type(I) -
0 = point_to_point
1 = linear
2 = quadratic
3 = cubic
4 = average RF

Force_zero(B) - True: force curve fit through zero

valid_fit (B)True: curve fit is valid

Inverted_fit(B) - True: inverted fit

cal_weight(F) - Weighting for weighted average

Conc_units(S) - Units of known amount (e.g. vol%)

Meas_units(S) - Units of measurement (e.g. microvolts)

Low_conc(F) - Trigger value for low concentration

High_conc(F) - Trigger value for high concentration

Check_stdconc(Bin) - amount/%deviation

Rep_process(I) - 0 = replace; 1 = weighted average

Result_index(I) - not used

curve_fit(Bin) - curve fit data for EZChrom

exp_ret_time(F) - expected retention time (seconds)

meas_ret_time(F) - measured retention time (seconds)

ret_time_win(F) - expected retention time window (seconds)

ret_time_tolerance(F) - expected retention time tolerance %

Ret_time_update(I) - See EZCHROM documentation

Window_mode(I) - Default = 0; see EZCHROM documentation for values

11.5.2 CALGROUP

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

application_id , method_id, channel, - primary key

ref_type - Peak = 0; group = 1

Cal_id(I) - Group Id

Name(S) - Customer defined name for group or peak

Ref_peak(I) - Reference peak #

Quantize(I) - 0=area; 1=height

manual_rf_used(B) - TRUE: use manual response factor (RF)

manual_rf(F) - user supplied manual RF

Margin(F) - Max. % difference between cal. and meas. area/height for retention time update to execute

Scale(I) - See EZCHROM documentation

calibration_curve_type(I) -
0 = point_to_point
1 = linear
2 = quadratic
3 = cubic
4 = average RF

Force_zero(B) - True: force curve fit through zero

valid_fit (B) - True: curve fit is valid

Inverted_fit(B) - True: inverted fit

cal_weight(F) - Weighting for weighted average

Conc_units(S) - Units of known amount (e.g. vol%)

Meas_units(S) - Units of measurement (e.g. microvolts)

Low_conc(F) - Trigger value for low concentration

High_conc(F) - Trigger value for high concentration

Check_stdconc(Bin) - amount/%deviation

Rep_process(I) - 0 = replace; 1 = weighted average

Result_index(I) - not used

curve_fit(Bin) - curve fit data for EZChrom

Include_npk(B) - True: include peak in calibrated range results

Group_type (I) -
0= none
1= peak
2 = time ranges

Num_elements(I) - Number of group element items

Group_elements(Bin) - Binary describing peaks or time ranges

11.5.3 CALIBRATION_LEVEL

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

application_id, method_id, Channel

ref_type - Peak=0; group=1

Cal_id - foreign key reference to calpeak or calgroup

Level(I,I,I,I,I,I) - primary key

stream_id(I) - stream

known_conc(F) - known concentration

Setsource(I) - for internal use
0 = none
1 = set by user modify
2 = set by user delete
3 = set by replicates

measured_value(F) - value based on replicate values

new_response_factor(F)

response_factor(F)

New_blend(F) - New blend to be used for the next calibration

Residual(F) - Difference between user defined concentration and value read back from the calibration curve

ResidualCalc(B) - TRUE = calculate residual value

Markforaccept(B) - not used(4.0)

Old_Measured_Value(F) - used to store the measured value from the previous accepted calibration(4.0)

11.5.4 CALIBRATION_REPLICATE

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

application_id, method_id,

channel, ref_type, cal_id, level - references calibration_level table

replicate(I,I,I,I,I,I,I) - Primary key

Enable(B) - True = use replicate

Value(F) - measured value

calibration_date(D) - date of replicate

sample_id(I)

11.6 System Configuration Tables

11.6.1 ANALYZER

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Populated automatically by broadcast messages. If the local analyzer has a loop and unit defined in the system_control table, Maxum DataHiway broadcast messages will also be used.

Anlz_id(I) - logical analyzer id. Primary key.

Anlz_name(S) - analyzer name set by broadcast (or the name in the system_control table)

Type(I) -
0 = unknown

16 = Ethernet attached Maxum
32 = ADH attached analyzer (Optichrom or Maxum)
64 = Ethernet attached NAU
96 = MicroSAM
128 = Quantra

Ip_address(S) - IP address or gateway – comes from broadcast or the system_control Table

Loop(I) - loop for ADH; comes from broadcast or system_control table

Unit(I) - unit for ADH; comes from broadcast or system control table

Status(I) -
0 = force broadcast of local analyzer
1 = normal
2=In fault

Local_ip(I) - (shared) Reference to local anlz_id set from the lid in the system_control table

Hae_app(I) - \ If something is placed here, an ADH HAE message or

hae_strm(I) - | SQL is sent to run an event, either on the local or remote

hae_evt(I) - / analyzer

Version(S) - Database version – is set automatically

last_broadcast(D) - last time this record was updated (used for cleaning out table)

11.6.2 HOST

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Host_id(I) - primary key

Host_name(S) - customer defined

Loop(I) - ADH loop(not required for NAU)

Unit(I) - ADH unit(not required for NAU)

Address(S) - Gateway or NAU ip address, automatically maintained

Type(I) -
1 = ADH HCI-CO1
2 = ADH HCI-CO4
3 = ADH HCI-H
4=ADH HCI-A
5=ADH custom (results only)
6 = Modbus for analyzer
7 = Modbus for NAU free format
8 = HCI-A with cycle length
9 = Transmit external results to remote analyzer

host_def(B) - Transmit to this host. The hostref in the Stream_method table is a way to designate streams' results for a certain host.

scale_factor(F) - scale factor for HCI-H and HCI-C04 TRT formats(not NAU). For HCI-C04, if the scale factor is zero, host_euhi in the result table is used as a scale factor.

Anlzref(I) - Analyzer ID of NAU to receive results. Foreign key to analyzer table.

status(I) - not used

11.6.3 MODBUS_ADDMAP

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

This table maps remote and local analyzer result data to Modbus addresses. An address map is loaded through Maxum Utilities. A number of "child" tables exist that have additional attributes. In order to access these attributes, the "child" table must be queried. An additional qualifier has been added to indicate the appropriate table. (ASTAT) means that the table is modbus_addmap_astat, (RESULT means the table is modbus_addmap_result.

modbus_address(I) - Unique address that host will use when reading or writing values

Slave_address(I) - 1 to 255

Slave_address2(I) - Do not use

ref_index(I) - reference from load file

Host_tagname(S) - identifies data to host, when using the text file for host configuration

Host_desc(S) - identifies data to host, when using the text file for host configuration

Data_type(S) -
S for scaled fraction (positive only)
E for EUHI float (16 bit)
B for Boolean
R for real (IEEE 32 bit float)
Q for real (IEEE 32 bit float) registers swapped
I for integer(16 bit)
D for Datetime (Version 5.0)

Anlz(I) - analyzer ID to which data refers

Application(I) - application to which data refers

Stream(I) - stream to which data refers

Result(I) - result to which data refers

Scale_factor(I) - Shared. Used to scale data_type S values.

Bad_value(I) - Shared. If zero, no "bad value processing" occurs. If non-zero, results are initialized to it.

Value(S) - setting the value will cause the host to read a changed value. Setting the value will not cause any actions that setting the value from the host would do.

Value_type(S) -
RESULT = analyzer component value
CYCLELENGTH = longest cycle length for application
EUHI = euhi
RDME = readme flag (set from analyzer, will be reset automatically)
SKIPSTREAM = stream enable flag (set from analyzer or host)
SELECTSTREAM = stream force flag (set from analyzer or host)
DEDICATEDSTREAM = forced stream set from analyzer
CURRENTSTREAM = current stream
ANALYZERSTATUS = analyzer status
DCHG = database change flag (set from NAU, must be reset by host)
ECHG = euhi change flag (set from analyzer, must be reset by host)
STANDBY = run/hold flag set from analyzer or host
CALIBRATE = calibration flag set from analyzer or host
SCSEC,SCMIN,SCHR,SCDAY,SCMON,SCYR,SCDOW = set clock
PROGRAMRUN = run program for a unit/application/stream
DIREAD = polls a DI in local database(application 999)
DOSET = sets a DO on a remote analyzer
ALARM = last alarm number for anlz, app, stream
CLEARALARM = clear alarms for anlz, app, stream
DOREAD = polls a DO from a remote analyzer – application 999
AIREAD (Version 4.2+) = polls a AI from a remote analyzer – application 999
DATE (Version 4.2+, obsolete in 5.0+) = cycle date. Can be set by Host to set analyzer time
TIME (Version 4.2+, obsolete in 5.0+) = cycle time. Can be set by Host to set analyzer time
Datetime (Version 5.0+) = cycletime or used to set the date and time

Initvalue(S) - initialization value, used only when the map is loaded (not for results)

Configure(B) - Flag to limit actions while address map is being loaded bin_ref(I) - reference to Modbus driver table where host reads are processed

write_offset(I) - Shared. Used to hold readme reset rate (default is 20 seconds)

euhi_address(I)(RESULT) - Loaded from text file

Time_left(I)(ASTAT) - Used for checking time from last transmission from analyzer

Status_type(I) - 0 = HCIH; Used to distinguish between HCIH and other ADH transmissions of results. Only HCIH will cause time expiration or other processing of "bad values" based on the status value. (Version 4.0)

11.6.4 OPC

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Anlz(I) - analyzer id for Optichrom or zero for local analyzer

Application(I) - application for local analyzer

Stream(I) - stream id

Streamname(S) - name of stream, if available

Enable(B) - Status of stream from transmission. Can be set to true of false to cause a stream to be enabled/disabled.

Force(B) - Tells whether stream is "selected" or "Always". Can be set by setting to true or false.

Nextstream(I) - tells from the transmission what the next stream will be

Cyclelength(I) - tells the cycle length from the transmission; used for Optichrom to "timeout" and set the runstatus to communication failure

Settime(D) - used to set the time on the local analyzer and send a ADH TAD message

Runstatus(I) -
0 = Hold
1 = Run
2 = Calibration
3 = Validation
4 = communication failure detected (can be disabled using a parameter)

Alarmstatus(I) - information for stream
0 = no faults or warnings
1 = warnings only
2 = faults only
3 = faults and warnings

Alarmmsg(S) - current streams most current alarm;

Sysalmstatus(I) - information for analyzer
0 = no faults or warnings
1 = warnings only
2 = faults only
3 = faults and warnings

Sysmsg(S) - analyzers alarm

Binversion(I) - Version of results binary

Numresults(I) - number of results in binary

Results(Bin) - binary data for results

Lastreceived(D) - time of last received results

Runevent(I) - used to run an event

Setalarm(I) - used to post an alarm

Changeflag(B) - readme flag

Localset(B) - used to tell if set from remote or local; used internally

Comm._time(I) - countdown time for communication failure

Xmit_count - running count of # of results transmissions received

11.6.5 PRINTER

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

printer_id(I) - primary key

printer_name(S) - customer defined

Loop(I) - ADH loop

Unit(I) - ADH unit

Address(S) - For ADH, this will automatically be maintained from broadcast messages. For TCP printer, IP address of printer and queue name must be entered. For serial printer, IP address of local or remote analyzer with :P for RS-232 port :D for debug port. For email, use the email address, with the format jane.doe@ssc.com

Type(I) - type of standard output
1 = ADH standard result and alarm log
2 = ADH comma delimited result list
3 = TCP or serial connected printer
4 = Email
5 = printclient (Version 4.3+)

alarms_def(B) - print alarms to this printer

results_def(B) - print results to this printer

calibration_def(B) - print calibration to this printer (only one printer allowed to receive)

status(I) - not used

11.6.6 SNE_CTRL

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

id(I) - Primary key. IP of sne_tcp_conn

sne_name(S)

sne_type(I)

serial_number(S)

sne_version(S)

os_version(S)

enable(B)

status(I)

bus_master(I) - 1=master, 0=slave, 2=unknown

sne_config(I) - RAM, Version, actual simulation

simulation(I) - simulation requested to real SNE

load_option(I)

load_status(I)

boot_cnt(I)

boot_date(D) - Started at DateTime

down_date(D) - Power fail at indicated DateTime

sim_method(B)

sne_conn_ref(I) - references sneconnection(id)

11.7 System I/O Tables

11.7.1 CAN_MODULE

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Node(I) - 1-20

serial_number(S) - serial number of the board

status - board status

status_di - not used

moduleref - reference to sne_module for CAN bridge

iorefs - not used

11.7.2 SERIAL_SETTINGS

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Portnum(I) - unique port number

default_use(S) - M=modbus; P=printer

configuration(S) - configuration string

11.7.3 System I/O Tables

System I/O tables contain the links between the hardware I/O channels and the applications on the local analyzer. An application can only use I/O that is defined in the system I/O tables. These tables are either automatically populated by the system at startup from SNE messages or I/O tables or are added through the Gas Chromatography Portal.

These tables use a complex method of derived functionality. The Sys_DI table can be thought of as four different tables: sys_sne_di, sys_adh_di, sys_dvi_di, and sys_rem_di. These correspond to the four types: local SNE, remote Optichrom, local CAN, and remote SNE or CAN. Likewise for the Sys_AI, Sys_AO, and Sys_DO tables.

Tables with local SNE are created automatically. Tables for Optichrom and remote SNE and CAN must be created by hand using a text load file or Gas Chromatography Portal Tables. Each table contains the specialized functions necessary to perform the I/O defined. In order to access the special attributes, it is necessary to access the specific table using that attribute. These attributes are marked with an additional qualifier (SNE, REM, ADH, DVI) to indicate which table to use.

In version 5.0+ the CAN tables are part of the SNE I/O. Although the DVI tables still exist, they are not used.

Tables include:
Digital Inputs
Digital Outputs
Analog Inputs
Analog Outputs

11.7.4 SYS_AI

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

hrdwr_id(S) - Primary key. A value of "DUMMY" may be used to indicate a dummy entry for the purpose of creating an application AI that has no hardware AI.

status(I) - set by system (see io_status under System I/O Tables)

exclusive(B) - not used

Type(I) -
0 = local SNE (or CAN for version 5.0+)
1 = local CAN (not used in Version 5.0+)
2 = Optichrom
3 = remote analyzer (CAN or SNE)

fracfs_value(F) - fraction of full scale

Rawvalue(I) - device raw value

Datatype(I) -
1 = 0 to 20 ma
2 = 4 to 20 ma
3 = obsolete
4 = obsolete
5 = NAMUR 4 to 20 ma(version 5.0+)
6 = NAMUR 4 to 20 ma with lower failsafe(version 5.0+)
7 = NAMUR 4 to 20 ma with upper failsafe(version 5.0+)
8 = NAMUR 4 to 20 ma with unrestricted failsafe(version 5.0+)

Scanenable(B) - Scanning is enabled, if true. This is usually set from the appdi table (enable)

Scanrate(I) - The rate of scanning the I/O, in seconds. 5, 10, 15, or 30 seconds for ADH or REM.

Devicemin(F) - used for clamping the value

Devicemax(F) - used for clamping the value

Failsafe_value(F) - failsafe value

Use_failsafe(B) - is failsafe value to be used?

rem_name(I)(REM) - foreign key to analyzer table. Indicates remote analyzer rem_hrdwr_id(S)(REM) - hrdwr id on remote analyzer

Module_id(S)(SNE) - reference to the sne_module table

pic_id(**I**)(SNE)

Channel(**I**)(SNE)

Loop(**I**)(ADH) - ADH loop

Unit(I)(ADH) - ADH unit

Slot(**I**)(ADH) - ADH slot

Channel(**I**)(ADH) - ADH channel

11.7.5 SYS_AO

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

hrdwr_id(S) - Primary key. A value of "DUMMY" may be used to indicate a dummy entry for the purpose of creating an application AO that has no hardware AO.

status(**I**) - set by system (see io_status under System I/O Tables)

exclusive(B) - not used

Type(**I**) -
0 = local SNE (or CAN for version 5.0+)
1= local CAN (not used in Version 5.0+)
2= Optichrom
3= remote analyzer (CAN or SNE)

fracfs_value(F) - fraction of full scale set from APPAO table

Rawvalue(I) - device raw value

Datatype(I) -
0 to 20 ma
2 = 4 to 20 ma
3 = obsolete
4 = obsolete

5 = NAMUR 4 to 20 ma(version 5.0+)
6 = NAMUR 4 to 20 ma with lower failsafe(version 5.0+)
7 = NAMUR 4 to 20 ma with upper failsafe(version 5.0+)
8 = NAMUR 4 to 20 ma with unrestricted failsafe(version 5.0+)

Devicemin(F) - used for clamping the value

Devicemax(F) - used for clamping the value

Failsafe_value(F) - failsafe value

Use_failsafe(B) - Is failsafe value to be used?

rem_name(I)(REM) - foreign key to analyzer table. Indicates remote analyzer

rem_hrdwr_id(S)(REM) - hrdwr id on remote analyzer

Module_id(S)(SNE) - reference to the sne_module table

pic_id(I)(SNE)

Channel(I)(SNE)

Loop(I)(ADH) - ADH loop

Unit(I)(ADH) - ADH unit

Slot(I)(ADH) - ADH slot

Channel(I)(ADH) - ADH channel

Use_failsafe(B) - For future use(4.0)

Failsafe_Value(F) - For future use. Fractional fullscale value for safety.(4.0)

Scanrate(I) - Rate of scanning the I/O, in seconds. 5, 10, 15, or 30 seconds for REM.

11.7.6 SYS_DI

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

hrdwr_id(S) - Primary key. A value of "DUMMY" may be used to indicate a dummy entry for the purpose of creating an application DI that has no hardware DI.

status(I) - set by system(see io_status under System I/O Tables)

exclusive(B) - not used

Type(I) -
0 = local SNE (or CAN for version 5.0+)
1= local CAN (not used in Version 5.0+)
2= Optichrom
3= remote analyzer (CAN or SNE)

chanformat(I) - channel data format from SNE

value(B) - value from device – when this changes through a poll, SNE, CAN, or ADH poll, appdi table is updated, if the appdi is enabled. If the appdi is not enabled, the appdi and sys_di values may be different. This allows the user to control the DI value used by the application, independent of the "real" value.

Scanenable(B) - scanning is enable, if true. This is usually set from the appdi table (enable)

Scanrate(I) - The rate of scanning the I/O, in seconds. 5, 10, 15, or 30 seconds for ADH or REM.

Failsafe_value(B) - failsafe value

Use_failsafe(B) - The rate of scanning the I/O, in seconds. is failsafe value to be used?

rem_name(I)(REM) - foreign key to analyzer table. Indicates remote analyzer

rem_hrdwr_id(S)(REM) - hrdwr id on remote analyzer

Module_id(S)(SNE) - reference to the sne_module table

pic_id(I)(SNE)

Channel(I)(SNE)

Loop(I) (ADH) - ADH loop

Unit(I) (ADH) - ADH unit

Slot(I) (ADH) - ADH slot

Channel(I) (ADH) - ADH channel

11.7.7 SYS_DO

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

hrdwr_id(S) - primary key . A value of "DUMMY" may be used to indicate a dummy entry for the purpose of creating an application AI that has no hardware AI.

status(I) - set by system (see io_status under System I/O Tables

exclusive(B) - not used

Type(I) -
0 = local SNE (or CAN for version 5.0+)
1= local CAN (not used in Version 5.0+)
2= Optichrom
3= remote analyzer (CAN or SNE)

Value(B) - set value for device – when this change, the appdo s listed in appref are updated. If pulse duration >0, setting the value to true initiates the pulse.

dvi_id(I)(DVI)

rem_name(I)(REM) - foreign key to analyzer table. Indicates remote analyzer

rem_hrdwr_id(S)(REM) - hrdwr id on remote analyzer

Module_id(S)(SNE) - reference to the sne_module table

pic_id(I)(SNE)

Channel(I)(SNE)

Loop(I) (ADH) - ADH loop

Unit(I) (ADH) - ADH unit

Slot(I) (ADH) - ADH slot

Channel(I) (ADH) - ADH channel

Pulse_duration(I) - in US, disabled if <=0 (4.0)

Pulse_polarity_neg(I) - 0: positive pulse; 1: negative pulse (4.0)

Failsafe_value(B) - failsafe value

Use_failsafe(B) - is failsafe value to be used?

Scanrate(i) - Used for remote DO scanning at 5, 10, or 15 seconds (4.0)

11.7.8 I/O Status Codes

The following Status Codes are available for Inputs/Outputs:

0 = normal

-1 = not initialized

-2 = general error

-3 = comm error

-4 = open error

-5 = overscale error

-6 = not scanning

-7= no hrdwr_id

-8 = remote not responding

-9 = Under scale

-10 = disabled

-11 = disconnected

-12 = Calibrating

-13 = invalid

-14 = configured detector error

-15 = not implemented

11.8 System Control Tables

11.8.1 DVI_SYSCON_INFO

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Note: This table is not available in the MicroSAM and becomes obsolete in Version 5.0. This information is included for legacy systems. Refer to System_Info table.

software_version(S) - read only

software_date(S) - read only

options(I)

daylighton(S) - mm.ww.dd.nn mm=month, ww=week (5=last)

daylightoff(S) - dd=day of week (0=sun), nn=minutes of change (120=2am) tzminuteswest(I) - minutes west of UTC (GMT) (360=CST)

hostname(S) - from bootp

ip_address(S) - i.e, 172.16.9.160

ip_address_mask(S) - i.e, 255.255.0.0

ip_address_gateway(S) - i.e., 172.16.0.23

ethernet_type(S) - 10 base T or 10 base5

syslog(S) - i.e, 172.16.9.160

timeserver(S) - i.e, 172.16.9.160

ip_lan2(S) - i.e, 192.

ip_lan2_mask(S) - i.e, 255.255.255.0

ip_address_bios(S) - for compatability

ip_address_mask_bios(S) - for compatability

ip_address_gateway_bios(S) - for compatability

ethernet_type_bios(S) - for compatability

ethernet_address (S) - MAC address i.e, 00-60-0D-10-12-C5

boot(I) - enter 21930 (0x55aa) to reset

system_special(S) - password

cmd_file(S) - i.e., /tftpboot/update.cmd

host_ip(S) - TFTP server, i.e, 172.16.8.8

start_mode(I) - 1=start app, 2=burn flash always

date(S) - write only to set date mm/dd/yyyy

time(S) - write only to set time hh.mm.ss

datetime - not used

Ip_email - IP address for email server

Ip_dns - IP for DNS server

11.8.2 SYSTEM_CONTROL

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute’s data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Version(S) - database schema version

Revision(S) - CL revision

Boot_date(D) - datetime started

Down_date(D) - System time

Boot_count(I) - Number of times the database has been booted

Status_type(I)

Errors(I) - Most recent unacknowledged fault

Fault_do(S) - DO for indicating fault (4.0)

Warnings(I) - Most recent unacknowledged warning

Warning_DO(S) - DO for indicating warning (can be the same as fault_do) (4.0)

Notes(I) - Most recent unacknowledged note

DB_ready(B) - rtrdb is complete

Mask_DM(B) - no dm available

DM_ready(B) - dm is ready

DB_needs_save(B) - needs to be saved to flash

DB_last_save(D) - last saved to flash

db_save_int(D) - flash save interval

loop(I) - loop for communicating on Advance DataHiway

unit(I) - unit for communicating on Advance DataHiway

name(I) - name to be used in broadcasts

lid(I) - analyzer id to be used in broadcast

language_cc(I) - Language to use for alarms and HMI

ADH_application(I) - default application for Optichrom commands

device_type(I) - 16=Maxum Ethernet; 64=NAU Ethernet

debug_option(Bin) - set from HMI debug screen

sne_file_ip(S) - used for loading SNEsoftware

sne_app_file(S) - used for loading SNE software

sne_os_file(S) - used for loading SNE software

sne_simulation(I) - used for development

Modbus_setting(S) - Serial port configuration

Serial_number(S)

OpcFlag(B) - True=OPC processing (4.0); The existence of a Modbus Map will allow Modbus processing. These can co-exist.

ADH_TRTformat(I) - indicates format for incoming Optichrom results. (4.0)
0 = HCI-H
1 = HCI-C01
2 = HCI-C04
3 = HCI-A

system_status(I) - (OPC, external client applications) indicates the presence of uncleared, unacknowledged alarms in the alarm_log. This is not cleared at the beginning of a cycle and is set during end of cycle processing. (4.0)
0 = no faults or warnings
1 = warnings
2 = faults
3 = faults and warnings

system_status_msg(S) - alarm code and alarm message of the first, most severe alarm. (4.0)

Startup_Delay - seconds to delay running applications after power up (4.0)

11.8.3 SYSTEM_INFO

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

ID(I) - Primary key, matches system_control

os_version(S) - Set from analyzer operating system

Bios_version(S) - Set from analyzer operating system

os_date(S) - Set from analyzer operating system

daylighton(S) - Format is mm.ww.dd.nn.bb;
mm=month
ww=week (5=last)
dd=day of week (0=sun)
nn=minutes of change (120=2am)
bb=bias (defaults to -60)

daylightoff(S) - mm.ww.dd.nn.bb bias defaults to zero

tzminuteswest(I) - minutes west of UTC (GMT) (360=CST)

hostname - Set from analyzer operating system

ip_address(S)

IP_useDHCP(I) - 1=use DHCP, 0=use fixed address

ip_address_mask S)

ip_address_gateway(S)

ethernet_type (S) - 10 base T or 10 base5

syslog(S) - enter 255.0.1.1 to log debug files for Compact Flash(not used for version 5.0+)

syslog_useDHCP(S) - not used

timeserver(S) - IP address of timeserver

timeserver_useDHCP - 1=use DHCP, 0=use fixed address

ethernet_address(S) - MAC address set by analyzer operating system

flash_status(I) - used internally to determine whether a save to flash if complete

date(S) - write only to set date mm.dd.yyyy

time(S) - write only to set time hh.mm.ss

ip_email(S) - Email server IP

ip_dns(S) - DNS server IP --not used

dns_flag(I) - not used

ip_lan2(S)

ip_lan2_mask(S)

cmd_file(S) - see dvi_syscon_info table

host_ip(S)

start_mode(I)

options(I)

local_change(B) - used to determine if update needs to be acted on

db_save_options - (Required for Compact Flash). xx for interval save (I 60 means save every 60 minutes) minimum is 6 minutes

Flash_status -
0 is initial
1 is save to flash complete
3 is save to flash in progress

11.8.4 STATMON

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Historical archiving of results and other important information

Id(i) - integer unique ID

status_option(I) - zero(default) uses HCIH status codes for results. 1 = use whatever is in the current_status (Set from MaxBasic only)

streamapp(I),streamref(I) - reference to stream table if applicable

sourcekey(S) - space separated list of primary key to table(depends on sourceattribute)

sourceattribute(I) - Source of value being archived

name(S) - Name for displaying results (has a default value, but may be changed)

current_value(F) - Last value stored in binvalues

current_time(D) - Last time stored in bintimes

current_status(I) - Last status stored binstatus

scan_option(I) - Zero indicates end of cycle. > 0 indicates rate for polling(5,10,15,30 seconds)

action(I) - 0 is no action; -1 empty binvalues, bintimes,binstatus; >0 indicates interval for computing mean, standard deviation and range

max_values(I) - Number of values to store in circular binaries

binvalues(B) - Values

bintimes(B) - Times

binstatus(B) - Status

counter(I) - position in binary for next value

num_values(I) - number of values in binaries

mean(F) - arithmetic mean of all values in binary binvalues

StDev (F) - Standard deviation of all values in binary binvalues

Rangehi(F) - High value in binary binvalues

Rangelo(F) - Low value in binary binvalues

Polltimer(I) - timer for timed scanning(see scan_option)

Report(S) - Used to print standard reports

Paramoffset(I) - offset in the parameter table for storing daily averages

11.8.5 STATMON_RULE

Entries that are in *italics* indicate the primary key to the table.

Entries in **Bold** are those that can be modified.

The Attribute names are followed by an indicator for the attribute's data type

I - for integer

S - for character string

F - for floating point number

B - for boolean

Bin - for binary

D - for Datetime

Table for assigning rules for control of Statmon table

Id(I) - Foreign key reference to Statmon table

Rulenum(I) - Unique number

Ruletype(I) -
0 = Mean High
1 = Mean Low
2 = Standard Deviation
4 = Limit

factor1(F) -
for ruletype 0 and 1, value to check mean
for ruletype 2, number of standard deviations from the mean for current value
for ruletype 4, limit ID to use to apply to current value

factor2(F) - not used

factor3(F) - not used

factor4(F) - not used

alarmapp,almref(I,I) - references alarmhandler table – alarm to issue if rule is violated

Modbus Reference 12

12.1 Introduction

12.1.1 Definitions

Term	Definition
Analyzer	Any of the following units that support the Modbus slave protocol: Maxum I, Maxum II, NAU, Advance Plus, MicroSAM
Coil	Modicon term for a Boolean value, also described as a flag
Float	A data element representing an Analog value using IEEE standard 32-bit floating point format
DCS	Host computer that is the Master
HCI-H	(Host Computer Communications Interface – HIWAY) The Advance Optichrom system's Modbus protocol interface
Host	An external computer system which acts as the Modbus master and requests data from the Slave analyzer.
Master	Modbus systems require one master device (host) which sends requests to one or more slave devices
Modbus	Communications protocol, defined in 1979 for Modicon Programmable Logic Controllers, that has become a de facto standard for data communications.
Modbus TCP	Modbus variant used for communications over TCP/IP networks (different from Modbus over TCP). Supported for software versions 5.0.7 and higher.
NAU	(Network Access Unit) Provides general purpose I/O for Siemens GC systems. Any analyzer can be configured for this purpose, but it is recommended that it be done on a dedicated unit.
Optichrom	Siemens Advance Optichrom product line of gas analyzers and network devices, the predecessor to the Siemens Maxum product line
Register	term for a 16-bit 2's complement integer value, also described as a Word
RTU	(Remote Terminal Unit) Modbus RTU is a format where values are transmitted in binary form using serial communication links.
Slave	Modbus device that passively waits for requests from a Modbus master device

12.1.2 Modbus Operation

From GC

The following steps are illustrated in the figure below.

- The analyzer sends sql commands or Optichrom units send Advance Data Hiway messages to the NAU database at the end of a cycle or after a manual transmit.
- The NAU updates the Modbus_addmap table. The correct address is identified and updated with the value received from the analyzer. Identification is based on the value_type, anlz, application, stream, and result.
- The Modbus_Addmap table sends the value to the MODBUS communication software..

From the DCS

- The DCS sends a message to the MODBUS communication software
- The MODBUS communication software processes a read request and returns a message to the DCS or sends the value to the modbus_addmap table.
- The MODBUS_addmap table determines the correct message to send to a specific analyzer based on the address value_type, anlz, application, stream, and result.

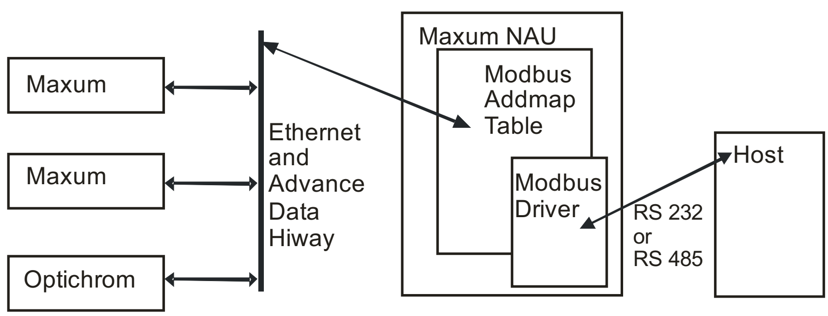


Figure 12-1 Modbus Operation

12.1.3 Hardware Configuration

To configure hardware, have:

- GCs and a Network Access Unit (NAU) attached to the same ethernet or Advance DataNET network. Small systems, like MicroSAMs, can allow the analyzer to do its own Modbus communications. In addition, Modbus TCP allows an analyzer to do its own Modbus communications.
- Host DCS computer, setup to be a MODBUS master using Modbus RTU messages and/ or Modbus TCP messages. Host connects to the NAU/Analyzer using the RS-232 or RS-485 serial ports for Modbus RTU, or using Ethernet ports when using Modbus TCP.

12.1.4 Serial Communication

To set up serial communication:

These settings can be changed at any time prior to or during MODBUS communication. MicroSAM requires a reset after changing any settings.

For MicroSAM, the unit must be configured for Modbus serial communication at startup. Consult MicroSAM documentation for details.

Using Gas Chromatograph Portal, for all versions:

In the Analyzer View of the Analyzer Portal, choose Network on the Naviation menu and then Serial Settings.

The serial ports will be displayed. These are hard coded depending on the type of hardware installed.

SYSCON1 - Port 1 is dedicated to Modbus

SYSCON2 - Ports 1, 3, and 4 are dedicated to Modbus

CIM - Port 1 is dedicated to Modbus

On the far right side of the display pane, set the details as needed for each serial port to be used for serial Modbus communications. The drop-down menus for each attribute show the possible values.

Using System Manager:

For versions prior to 5.0.7:

Using System Manager, enter a value in the modbus_setting attribute of the System_Control table:

Y:Baud,Parity,Data bits,Stop bits,Flow control,RS

Baud: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200
Parity: n, o, or e (none, odd, or even)
Data bits: 7 or 8
Stop bits: 1 or 2
Flow control: n or h (none or hardware)
RS: 232 or 485

Default: 1:19200,n,8,1,n,232

For versions 5.0.7 and above:

Use the Serial_Settings table to configure 4 port or 2 port units.

a,b,c,d,e,f (example--1:19200,n,8,1,n,232)

where
a = baud rate (50, 75, 110, 134, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200,

38400, 57600 or 115200)
b = parity (e for even, o or odd, or n for none)
c = data bits (7 or 8)
d = stop bits(1 or 2)
e = flow control(h for hardware, n for none)
f = 232 for RS-232, 485 for RS-485

12.1.5 Modbus TCP Configuration

Modbus TCP Configuration
Modbus TCP communication is enabled by placing "TCP" in the modbus_settings attribute of the System_Control table. This can be done by editing the System_Control table in Maxum System Manager. It can also be accomplished by checking the "Enable Modbus TCP" checkbox in GCP software (to access this checkbox, under the Analyzer tab choose the Network selection on the Navigation Menu).

When using MobbusTCP, the master(s) must be configured to use port 502 and the IP address of the unit containing the Modbus tables. The slave address is not used for Modbus TCP. Multiple masters can access the Modbus data on a single GC/NAU. The Maximum number of Modbus TCP masters (connections) is 16.

12.1.6 Unit/Stream/Component Limits

(Software Version 4.0 and above)

There are no limits on the number of GCs/units. Streams must have stream numbers <=100. Results must have result # < 500. There are no requirements for GC numbering.

Component numbers should be consecutive integers. Component numbers are assigned in the order transmitted for Optichrom Advance or correspond to the trtval setting in the result table for GCs.

12.1.7 Component Values

Result values (any component or other value stored in the Analyzer's result table) can be sent to the Host as either:

- scaled integers, or
- 32-bit floating point numbers.

12.1.8 Scaled Results

Scaled results are stored in a single register as:

scaled result = Round(ScaleFactor * ResultValue / EUHI)

Note: EUHI must be >= 1.0

12.1.9 Floating Point Results

A floating point result is stored in a pair of registers. Only the first register in the pair is defined in the address map. The floating point format for Modbus addresses in the 70000s is the 754 standard IEEE 32-bit float. The format for addresses in the 20000s is IEEE 32-bit float with the words swapped. The format for addresses in the 40000s is either swapped or unswapped based on the data_type setting (R or Q). Addresses for floating point results must be numbered as odd numbers.

Floating point values can be transmitted from Advance Optichrom by using a fractional full scale of 1.0 and an EUHI of 1.0.

12.1.10 Status Information

Each analyzer transmits status information at the end of the application cycle, along with the results. This information is made available to the Host to ascertain the following:

- Whether the application is in normal state, reporting data on schedule
- Whether the application is calibrating, in hold, out of service, or has not reported data on schedule
- Whether the application has an error in the current cycle
- Whether the application is operating with a dedicated stream
- The enable/disable state of every stream in an application
- The current and next stream to be analyzed
- Whether specific database or EUHI values have changed

12.1.11 Analyzer Alarms

Analyzer alarms are defined as any alarms that may occur on the GCs. Most alarms that are associated with Modbus communications will appear on the Network Access Unit (NAU).

Alarm	Meaning
698	The NAU is unreachable or refuses connection. Results will not be transmitted.

12.1.12 NAU Alarms

NAU alarms are defined as any alarms that may occur on the Slave unit.

Alarm	Meaning
699	The analyzer tried to transmit a result or analyzer status that was not defined in the address map.
700	The analyzer is not reachable or refuses connection. It will not receive a command from the Host.
701	Scale factor or EUHI is missing.
703	The Host attempted to set an address that was not defined in the address map.
704	The Host has attempted a write to an address that is read-only.
705	Host command could not be directed to an address in the address map.
706	Can’t locate EUHI.
709	The Data_type does not match the value_type. Correction has been taken.

12.2 Modbus Address Map

12.2.1 Address Map Description

To have working communication among the GC(s), Modbus, and Host, you must have an address map customized to user specifications. The Modbus Address Map is a text file used for loading the Maxum Network Access Unit (NAU) with details for processing the following:

- GC results to be placed at certain addresses so the host computer can read them.
- Control requests sent from the DCS to be directed to analyzers.

The map contains details about all addresses configured to send and receive data. Since no assumptions are made about what is contained at an certain address, the data type and a value type indicate what kind of information is stored at an address and any actions to be taken. For example, a RDME flag is set to "True" from the analyzer and reset to "False" automatically. The value column in the Modbus_addmap table in the Gas Chromatography Portal contains information in readable format, not the format the Modbus Driver sends to the Host. A scaled result will be in the pre-scaled format, as it appears in the result table.

An address map may be configured by Siemens. according to customer requirements or configured by the customer – either by using a general default map or by editing that map to meet specific requirements. Microsoft Excel is used as the configuration tool for Version 3.0, by editing the map and saving it in comma delimited (.CSV) format. The resulting text file can be loaded onto the NAU by using System Manager/Tools/Utilities/Loader/MODBUS Load, or DBConverter can be used in software version 4.3 and higher. An unload utility is also available.

12.2.2 General Address Map Rules

Each transmitted result must be defined in the address map, and each transmitting application must have a status in the map.

For every result that the system needs to handle, have the following available:

- The analyzer number
- Application number
- Stream number
- Result number (trtval value)

In addition, have on hand the specific customer requirements for host computer controls and information.

(Software Version 4.0 and Above) As the map is loaded onto the analyzer using Maxum Utilities/ Loader/Modbus Load, duplicate addresses that contain the same information will be removed. That is, two addresses for result 1/ analyzer 14/application 1/stream 2 are not allowed and will be removed during loading of the map.

12.2.3 Address Map Limits

The address map is limited to 4000-4500 addresses. This will be sufficient to handle an old-style Optichrom HCI-H map for 18 applications/ 9 streams/ 9 results. A custom address map may have any combination of types of values, with the only requirement being a result or result plus EUHI for every component transmitted to the NAU and an Analyzer status for every application tagged to transmit results. A much larger map may be successfully loaded, but, when the NAU goes through a reset, the database cannot be rebuilt.

12.2.4 Creating and Loading an Address Map

Use a text editor or Microsoft Excel to create a map.

Load the map onto the NAU.

Use the following to configure an analyzer to transmit results:

1. Mark results for transmit using the trtval and EUHI attributes of the result table.
2. Mark stream for transmission using the autotrt attribute in the stream_method table.
3. Designate NAU to receive results, using the host table

   type:6, anlzref:NAU's anlz_id

   Or

   Version 3.1and Above: The following format was developed for use by NAUs that are used to gather results from 3rd party analyzers and transmit them to a host. This will allow for running a MaxBasic program that transmits by frequency using the trtnow attribute in the stream_method table. An application and streams will need to be created to create the results in the result table. Store AI or other values in result table. Set up additional results with these specific result names:
   Analyzerstatus – set to status as in HCI-H (required)
   Currentstream – set saved_value to the next stream
   Standby - set to 1 for running, 0 for hold
   Alarmstream - set for stream alarm
   Alarmanlz – set to anlz alarm
   Alarmapp – set ot application alarm
   Dedicatedstream – set to dedicated stream
   Cyclelength – set to cycle length
   Skipstream – set saved value to stream that is enabled(positive)
   or disabled(negative)
   Calibrate – set to 1 if in calibration

   Do NOT mark these for transmit, only mark the result' s trtvals. Set values in these results.

   Use type 7 for the host. This is a new free format used for Modbus, which allows you to be free of entries in the actual tables. Example:

1&&2	1	analyzerstatus	NULL	NULL	NULL	NULL	NULL	1000.000000
1&&2	2	currentstream	NULL	NULL	NULL	NULL	NULL	4.000000
1&&2	3	standby	NULL	NULL	NULL	NULL	NULL	0.000000
1&&2	4	alarmstream	NULL	NULL	NULL	NULL	NULL	362.000000
1&&2	5	result1	NULL	1	NULL	NULL	NULL	0.234000
1&&2	6	result2	NULL	2	NULL	NULL	NULL	5.678000
1&&2	7	alarmapp	NULL	NULL	NULL	NULL	NULL	562.000000
1&&2	8	alamranlz	NULL	NULL	NULL	NULL	NULL	444.000000
1&&2	9	enablestream	NULL	NULL	NULL	NULL	NULL	1.000000
1&&2	10	skipstream	NULL	NULL	NULL	NULL	NULL	1.000000
1&&2	11	skipstream	NULL	NULL	NULL	NULL	NULL	2.000000
1&&2	12	skipstream	NULL	NULL	NULL	NULL	NULL	-3.000000
1&&2	13	skipstream	NULL	NULL	NULL	NULL	NULL	-4.000000
1&&2	14	skipstream	NULL	NULL	NULL	NULL	NULL	-5.000000
1&&2	15	skipstream	NULL	NULL	NULL	NULL	NULL	-6.000000
1&&2	16	skipstream	NULL	NULL	NULL	NULL	NULL	-7.000000

Figure 12-2 Address Map Spreadsheet

This will transmit 2 results, along with supporting information to the host.

12.2.5 Address Map Entries

The entries in the address map are detailed in the following table:

Field Name	Type	Range/Description
Ref_Index	Integer	Arbitrary,suggest using sequential integers, from 1 up, as line numbers
Host_Tag Name	Character	Arbitrary, for use in referencing host database. This is the label assigned by the host to the data item
Description	Character	If blank, will be set by the load routine. As results transmit, this will contain the name from the result table.
result_name	Character	(not used)
Data_Type	Character	S for scaled fraction (only positive values) E for 16-bit EUHI float B for boolean R for real number (IEEE 32-bit float) Q same R words swapped I for an integer that can be positive or negative D floating point 64 bit date
Modbus_address	Integer	For digital: 00001 to 9999 10001 to 19999 For integer or float: 20001 TO 29999 30001 to 39999 40001 to 49999 70001 to 79999 A pair of addresses (numbered as odd numbers) are required for each 32-bit floating point number. All addresses must be unique within each of the four tables (0, 1, 3, and 4). The first digit of the address specifies the table. Addresses in the 20000s, 40000s and 70000s share the same memory locations. These address ranges allow the host to format the data into swapped 32-bit, 16-bit integer, or 32-bit float, respectively.
Anlz	Integer	Analyzer id/unit
Application	Integer	Must be a valid application id for the given analyzer.
Stream	Integer	Must be a valid stream id for the given application.
Result	Integer	Must be a valid result.

Value_type	Character	(in many cases, only the first 2 characters are required, see **bold** – Values are not case sensitive) **HO**STALIVE = host alive flag **RE**SULT = analyzer result value **CY**CLELENGTH = length of cycle **EU**HI = Euhi **RD**ME = readme flag **SE**LECTSTREAM = stream force flag **SKI**PSTREAM = stream skip flag **DE**DICATEDSTREAM = dedicated stream **CU**RRENTSTREAM = current stream flag **AN**ALYZERSTATUS = analyzer status **DC**HG = database change flag **EC**HG = euhi change flag **ST**ANDBY = standby flag **CA**LIBRATE = calibration flag **PR**OGRAMRUN = execute event **DO**SET = set a DO on the NAU **DI**READ = read a DI on the NAU **DO**READ = read a DO on the NAU **AL**ARM = fault alarm code **CL**EARALARM = clear Maxum alams Clock settings: **SCMIN, SCHR, SCDAY, SCMON, SCYR** **DA**TETIME – replaces DATE and TIME in Version 5.0.
Initvalue	Character	Initial value (not for results or EUHI)
Slave_address	Integer	Modbus Slave address
Euhi_address	Integer	Modbus address for EUHI

There are two special entries in the address map that set the "bad value" and the scale factor. The scale factor will be used to calculate all scaled values (data_type S) in the address map. These can be results, cycle_length, and analyzer status. The "bad value" is used when certain conditions exist, as in the HCI-H. If the "bad value" is set to zero, no "bad value" processing is done.

12.2.6 Sample Address Entries

Some sample lines from an address map (the first line is always ignored by the loader):

Ref_index, host, tag, desc, data_type, address, anlz, app, stream, res, value_type, initvalue, euhi_address

```
1, , , , , , , , , sf, 9999        <- scale factor( required)
2, , , , , , , , , bv, 65535       <- "bad value" (required)
3, , ,B,10, , , , ,DCHG,0,1, ,
```

```
 4, , ,B,1001,1,1,1, ,SKIP,0,1, ,
 5, , ,B,1002,2,1,1, ,SKIP,0,1, ,
 6, , ,B,1051,1,1,1, ,SEL,0,1, ,
 7, , ,B,1052,2,1,1, ,SEL,0,1, ,
 8, , ,B,1101,1,1,1, ,CU,0,1, ,
 9, , ,B,1102,2,1,1, ,CU,0,1, ,
10, , ,B,1151,1,1,1, ,ECHG,0,1, ,
11, , ,B,1152,2,1,1, ,ECHG,0,1, ,
12, , ,B,1201,1,1,1, ,DCHG,0,1, ,
13, , ,B,1202,2,1,1, ,DCHG,0,1, ,
14, , ,B,1351,1,1,1, ,CAL,0,1, ,
15, , ,B,1352,2,1,1, ,CAL,0,1, ,
16, , ,B,1667,1,1, , ,SBY,0,1, ,
17, , ,B,1668,2,1, , ,SBY,0,1, ,
18, , ,B,11001,1,1,1, ,RDME,0,1, ,
19, , ,B,11002,2,1,1, ,RDME,0,1, ,
20, , ,S,30001,1,1, , ,AN,0,1, ,
21, , ,S,30002,2,1, , ,AN,0,1, ,
22, , ,S,30255,1,1, , ,CY,0,1, ,
23, , ,S,30256,2,1, , ,CY,0,1, ,
24, , ,S,30509,1,1, , ,DED,0,1, ,
25, , ,S,30510,2,1, , ,DED,0,1, ,
26, , ,S,41001,1,1,1,1,RES, ,1, ,31255
27, , ,S,41002,2,1,1,1,RES, ,1, ,31256
28, , ,E,41255,1,1,1,1,EUHI,1, ,
29, , ,E,41256,2,1,1,1,EUHI,1, ,
30, , ,Q,20001,1,1,1,2,RES, ,1, ,
31, , ,R,70003,2,1,1,2,RES, ,1, ,
```

12.2.7 Example Address Map Configuration

Analyzer 124 has 3 applications:

- Application 1 has stream 1, results 1-3
- Application 2 has stream 4, results 1-3
- Application 3 has stream 1, results 1-3

No control from host is required. The only information from analyzers that is needed by the Host is results and analyzer status.

These addresses do not conform with the HCI-H.

Example Map

host	Data_Type	Address	Anlz	App	Stream	Res	value_type	Init value	Slave1	EUHI
1							sf	9999	1	
2							bv	65535	1	

3	R	40001	124	1	1	1	RES	1	0
4	R	70003	124	1	1	2	RES	1	0
5	Q	20005	124	1	1	3	RES	1	0
6	R	40007	124	2	4	1	RES	1	0
7	R	40009	124	2	4	2	RES	1	0
8	R	40011	124	2	4	3	RES	1	0
9	R	40013	124	3	1	1	RES	1	0
10	R	40015	124	3	1	2	RES	1	0
11	R	40017	124	3	1	3	RES	1	0
21	I	30001	124	1			AN	1	
22	I	30002	124	2			AN	1	
23	I	30003	124	3			AN	1	

Note: The results are designated here as 32-bit floating point numbers (data_type Q or R). The second addresses (40002, 70004,..) are not defined in the map, but are present in the driver tables.

12.2.8 Viewing and Editing the Address Map

Once the address map has been loaded onto the NAU, it may be viewed and edited with the Gas Chromatography Portal from the Analyzer screen under the navigation menu selection Network/Modbus Map or viewed with HMI/Select Analyzer/View Modbus.

The value attribute for GC results can be changed in the table for testing. It contains the pre-scaled version of scaled results and character representations of Boolean values (True or False). Testing for Host commands to the NAU cannot be done by editing the value in the table.

12.2.9 Configure Analyzers to Transmit Results

For Maxum and MicroSAM analyzers:

1. Use the Gas Chromatograph Portal to add the NAU to the host table of the "sending" analyzers. Use Type "Modbus" and set the Analyzer Id property to the NAU’s analyzer id. If the NAU does not appear in the list box, wait until it broadcasts (10-15 minutes).
2. Use the Gas Chromatograph Portal to make entries in the "sending analyzer" result table to indicate which component values to send. Indicate the result values to send by placing an integer value in the TRTVAL to indicate the result # in the address map. EUHI values are set in the result table. The NAU’s address map will direct the result to a specific MODBUS address using the anlz, application, stream, and result attributes in the address map table (modbus_addmap).

For Optichrom Analyzers:

1. Set up the results and events for the Optichrom Advance exactly as done for transmitting to an HCI-H.
2. The NAU will need to have a loop, unit defined in order to receive Advance Data Hiway messages. Define the loop and unit in the Gas Chromatograph Portal by selecting the Analyzer View and then the Network menu selection on the Navigation menu. The ADH setup is the "Advance Data Hiway" tab under the Network View. Alternatively, the loop and unit may be set using the HMI/Configure Menu/System Setup screen.

12.2.10 Special Instructions

Special instructions for Modbus Address Maps:

- Do not duplicate data in the address map. There should be only one address defined for analyzer 1, application 1, Stream 1, result 1. (This differs from the HCIH address map.)
- The address map must contain an ANALYZER STATUS for every transmitting analyzer/ application.
- The address map must contain a RESULT for every transmitted component (with EUHI if required).
- If the bad_value is > 0 there will be the normal process of setting values "bad." Otherwise, the component values will be stored as is.
- Prior to Version 3.11, messages from the host must be alternated.
- EUHI values must be >= 1.0.
- Addresses in the 40000s, 20000s, and 70000s all map to the same registers. Do not overlap the addresses. i.e., do not use 40001 and 70001 in the same map.

12.3 Host/Analyzer Messages

12.3.1 Summary of Host/Analyzer Communication

This table summarizes the information types and availability. The topics in this heading provide details for each information type.

Always available to the Host
Result values (Value_type: RESULT)
EUHI values (Value_type:EUHI)
Analyzer/Application status (Value_type: ANALYZERSTATUS)

Available to the Host when defined in the address map
Readme flags (Value_type: rdme)
Database change flags (Value_type: DCHG) (obsolete)
EUHI change flags (Value_type: ECHG) (obsolete)
Stream skip flags(Value_type: SKIPSTREAM)

Dedicated Stream (Value_type: DEDICATEDSTREAM)
Stream active flags (Value_type: CURRENTSTREAM)
Analyzer standby (Value_type: STANDBY)
MapCalibration (Value_type: CALIBRATE)
Cycle Length(Value_type: CYCLELENGTH)
Diread(Value_type: DIREAD)
Airead(value_type: AIREAD)
Alarm(Value_type: ALARM)
Time(Value_type: TIME)
Date(value_type: DATE)
Datetime(value_type: DATETIME)(Version 5.0 replacement for DATE and TIME)

Host Controls sent to Analyzers when addresses are defined
Analyzer control (Value_type: STANDBY)
Calibration control (Value_type: CALIBRATE)
Stream control (Value_type: SELECTSTREAM. SKIPSTREAM)
EUHI change (Value_type: EUHI)
Set clock (Value_types: SCMIN, SCSEC, SCHR, SCDAY, SCMON, SCYR)
Clear Alarms(Value_type:CLEARALARM)
Program Run(Value_type: PROGRAMRUN)
DO set (Value_type: DOSET)
Date(value_type: DATE)
Time (value_type: TIME)
Datetime(value_type: DATETIME)(Version 5.0 replacement for DATE and TIME)

12.3.2 AIREAD

AIREAD - Valid Addresses: 20001-49999, 70001-79999

AIREADs can be defined for each Application AI that is defined in the NAU's application 999. It is polled according to the Application AI setup. The value in the result designates the ID from the APPAI table.

Values may be R or Q type. These require 2 consecutive registers (prior to Version 5.0 these were not allowed to cross block boundaries, which are every 1000 registers):

Examples registers of consecutive AIREAD values:

40001, 40003

41999, 42000 (Not allowed prior to Version 5.0, since it crosses the block boundary).

12.3.3 ALARM

ALARM -

Valid Addresses: 30001-49999
The integer (data_type I) can be defined for each analyzer, analyzer/application, and analyzer/application/stream. It contains the first alarm code for fault alarms.

Valid Addresses: 00001-19999
The boolean (data_type B) can be defined for each analyzer, analyzer/application, and analyzer/application/stream. It contains the presence of alarms on the GC.

It is not possible to define a boolean and an integer with the same analyzer, analyzer/application, and analyzer/application/stream.

Note that the ALARM defined for the analyzer corresponds directly with the red LED on the front of the HMI. An integer type value will reflect the contents of the system_control table errors and warnings attributes. This will be the last fault alarm that occurs or warning alarm, if there are no faults.

An ALARM defined for the stream or application will reflect the contents of the curr_error attribute in the stream and application table. These can only be cleared by the completion of a cycle without alarms. This means that the analyzer ALARM can be zero, but the stream and application can reflect an alarm condition.

12.3.4 ANALYZERSTATUS

ANALYZERSTATUS - Valid Addresses: 30001-49999

This integer or scaled integer (data_type I or S) value is defined for each application and contains the stream status at the end of cycle. The status values can range from 0 to 1000, as follows:

1000 normal, error free operation
9ss warning alarm on stream ss
7ss auto cal or validation running on stream ss
6ss manual cal running on stream ss
5ss Optichrom Advance change test exceeded on stream ss
4ss Optichrom Advance database change on stream ss
3ss Optichrom Advance excessive rate of change test failed on stream ss
2ss Optichrom Advance minimum rate of change test failed on stream ss
100 application has fault alarm this cycle
50 application is out of service, disabled, or in hold
0 application is not transmitting results(timed out)

12.3.5 CALIBRATE

CALIBRATE -

For Status: Valid Addresses: 0001-9999
This boolean (data_type B) can be defined for each analyzer/application/stream and is set by the analyzer when the application is in manual or auto calibration. See Host operations in the next section for a discussion of Host calibration control.

For Host Control: Valid Addresses: 0001-9999
The Host can direct an application to calibrate or stop calibrate by setting the calibrate flag, defined on each analyzer/application/stream, for any stream in an application. If set by the Host, a message is sent to the analyzer to place the application in auto calibration (1 or True) or stop calibration (0 or False). In either case, if the analyzer is in hold, the command will be ignored. If auto calibration is not enabled for the application, it will be placed in manual calibration. Although each stream can be defined, it is recommended for only one stream (any

stream in the application). There may be operational differences for calibration when the MODBUS interface is implemented for Advance Optichrom analyzers.

12.3.6 CLEARALARM

CLEARALARM - Valid Addresses: 0001-9999

This boolean (data_type B) can be defined for each analyzer, analyzer/application, and analyzer/application/stream. The Analyzer will clear all alarms for the specified analyzer, application, or stream. This flag is not operational for Advance Optichrom. . Note that clearing alarms operates under the same constraints as clearing the alarms directly on the analyzer. If stream or application alarms are cleared, record of them is still kept by the application and stream until a cycle without alarms completes.

12.3.7 CURRENTSTREAM

CURRENTSTREAM -

Valid Addresses: 0001-9999

This boolean (data_type B) can be defined for each analyzer/application/stream and is set by the analyzer. The flag tells the Host which stream will be the next to report.

Valid Addresses: 30001-49999

In Version 5.0+, CURRENTSTREAM can be defined as Integer type (I). In that case, the stream is zero and the stream number is in the Value.

12.3.8 CYCLELENGTH

CYCLELENGTH - Valid Addresses: 30001-49999

This integer (data_type S or I) is set by the analyzer/application to be the longest cycletime in the method table for an application, even unused methods. The longest cycle time is the stream purge time + injection_lag + cycle length.

12.3.9 DATE and Time

DATE, TIME - (Replaced in version 5.0 with DATETIME, see below)

From the Analyzer: Valid Addresses: 20001-49999, 70001-79999

Date and Time values are transmitted from the analyzer and designate the timestamp of the inject time for most analyzer types. It can be designated for analyzer,application,stream or analyzer,application.

Values may be R or Q type. These require 2 consecutive registers and may not cross block boundaries(which are every 1000 registers):

Examples registers of consecutive TIME and DATE values:

40001, 40003
41999, 42000 is not allowed, since it crosses the block boundary.

From the Host: When a DATE or TIME address is set from the Host, it is a command to set the date. It will not appear changed in the Modbus map. Time and Date must be set together.

Values may be R or Q type. These require 2 consecutive registers and may not cross block boundaries(which are every 1000 registers). TIME must come before DATE.addresses.

Examples registers of consecutive TIME and DATE values:
40001, 40003
41999, 42000 is not allowed, since it crosses the block boundary.

DATE is in the format mmddyyyy

TIME is in the format

Version 5.0:

DATETIME is a unique type that designates a character string.

A Datetime may be defined by analyzer,application,stream or analyzer,application. When being used to set the datetime from the Host, it is recommended to use an address with the stream designated as zero so that it does not interfere with the datetimes coming from the stream cycles. You may use a single Datetime for all streams and for the Host to set the datetime.

12.3.10 DCHG

DCHG - Valid Addresses: 0001-9999

This boolean (data_type B) can be defined with or without analyzer/application/stream and is set when the scale factor changes. The flag is not reset when read by the Host. If defined for stream 0, it is a summary flag for all streams. If stream 0 entry is set to 0, the flag will set all stream DCHG flags for the application to 0.

12.3.11 DEDICATEDSTREAM

DEDICATEDSTREAM - Valid Addresses: 30001-49999

This integer (data_type S or I) can be defined for an analyzer/application and is set by the analyzer. It tells the Host if a stream is running on a dedicated basis (Always). If the value is 0, there is no dedicated stream.

12.3.12 DIREAD

DIREAD - Valid Addresses: 0001-19999

This boolean (data_type B) can be defined for each Application DI that is defined in the NAU's application 999. It is polled according to the Application DI setup. The value in the result field designates the ID from the APPDI table.

12.3.13 DOREAD

DOREAD - Valid Addresses: 0001-19999

This boolean (data_type B) can be defined for each Application DO that is defined in the NAU's application 999. It is polled according to the Application DO setup(sys_do table has the scanrate). The value in the result field designates the ID from the APPDO table.

12.3.14 DOSET

DOSET - Valid Addresses: 0001-9999

This boolean (data_type B) can be defined for each Application DO that is defined in the NAU's application 999. It can be set by the host to set the DO in the "on" position for the analyzer.

12.3.15 ECHG

ECHG - Valid Addresses: 0001-9999

This boolean (data_type B) can be defined for each analyzer/application/stream and is set when the EUHI is changed from the analyzer or from host. Resetting is similar to the RDME. If defined for stream 0, it is a summary flag for all streams in the application. If stream 0 entry is set to 0, the flag will set all stream ECHG flags for the application to 0.

12.3.16 EUHI

EUHI -

From analyzer: Valid Addresses: 30001-49999
This is the full scale value for each scaled result. It is set for each transmitted result in the analyzer's result table. The default value is 100. It is sent to the Host as a 16-bit floating point number, as in the HCI-H. The value is useful to the host to verify the full scale value used. Additionally, the EUHI can be set by the Host to force synchronization and override any EUHI set manually on the analyzer. EUHI values must be >= 1.0.

From Host: Valid Addresses: 40001-49999
The EUHI value for any result can be set by the Host in 16-bit floating point format. See the section on the EUHI format. Version 3.0 requires that EUHI values be greater that 1.0.

12.3.17 PROGRAMRUN

PROGRAMRUN - Valid Addresses: 40001-49999

Registers can be defined for each analyzer/application/stream. The Analyzer runs the event number that is indicated in the register for the designated stream

12.3.18 RDME

RDME - Valid Addresses: 0001-19999

This boolean (data_type B) can be defined for each analyzer/application/stream. It is set when the analyzer transmits results for a stream. The flag tells the Host that there is new result data available. For versions before 3.11, the flag automatically resets to zero after being read by the Host after 3 seconds. These flags are stored in blocks of 1000 (1-1000, 1001-2000….). The flag is reset after 20 seconds, regardless of host read. Each flag is reset independently. The 20 second default may be changed by setting the write_offset value in the Modbus_addmap table.

Zeroes for stream and application are allowed. This would allow all streams to share the same RDME.

12.3.19 RESULT

RESULT - Valid Addresses: 20001-49999, 70001-79999

Expressed as a fraction of full scale (data_type S) or as a 32-bit float (data_type R). Designated for transmission by the analyzer from the result table or from the Optichrom Advance analyzer. A "bad value" is used, when defined in the map, when a condition on the analyzer suggests that the values are not current or good. These conditions are:

- the result exceeds the EUHI
- the EUHI has changed
- analyzer status is < 500 (in fault alarm, out of service, or application time limit has expired)
- the stream is disabled.

Values may be R or Q type. These require 2 consecutive registers and, prior to Version 5.0, may not cross block boundaries (which are every 1000 registers):

Examples registers of consecutive RESULT values:

40001, 40003

41999, 42000 is not allowed prior to Version 5.0, since it crosses the block boundary.

Zeroes for stream and application are allowed. This would allow all streams to share the same RESULT addresses.

12.3.20 SCMIN, SCSEC, SCHR, SCDAY, SCMON, SCYR

SCMIN, SCSEC, SCHR, SCDAY, SCMON, SCYR - Valid Addresses: 40001-49999

By writing to the appropriate locations, the Host can set the date and time of day on the Maxum Network Access Unit (NAU). Note: The SCYR address must be the last address written to. These addresses are not kept current by the NAU.

If the NAU has designated another system as its time server, setting from the Host has no long term effect and will be overwritten by the time server. If there is no time server for the NAU, this date and time will be allowed to remain but will have no effect on the analyzers unless each analyzer has its time server set to the NAU's IP address.

12.3.21 SELECTSTREAM

SELECTSTREAM - Valid Addresses: 0001-9999

This boolean (data_type B), defined on each analyzer/application/stream, can be set by the Host to cause a Force Always condition (1 or True) or a Resume sequence (0 or False) on the stream. The skipstream flag can be set to control stream enable/disable, as described in the help topic for skipstream.

12.3.22 SKIPSTREAM

SKIPSTREAM - Valid Addresses: 0001-9999

This boolean (data_type B) can be defined for each analyzer/application/stream. It is set by the analyzer and tells the Host if the stream is enabled (0 or False) or disabled (1 or True). If set by the Host, this flag causes a message to be sent to the analyzer to disable or enable the stream.

12.3.23 STANDBY

STANDBY -

From Analyzer: Valid Addresses: 0001-9999

This boolean (data_type B) can be defined for each analyzer/application and is set by the analyzer. The flag tells the host if the application is in hold, out of service, or disabled.

From DCS: Valid Addresses: 0001-9999

The Host can direct an application to start or stop running. If set by the Host, a message is sent to the analyzer to place the application in hold (1 or True) or run (0 or False).

12.4 Modbus Protocol Reference

12.4.1 Protocol Formats

In the Modbus protocol there are two formats for sending messages, Modbus RTU and Modbus ASCII (not supported). The message content is the same in each format. Both formats have checksums, but the checksum methods are different. All of the Modbus devices on a communications link must use the same message format and the same communication parameters (e.g. baud rate).

12.4.2 RTU vs. ASCII vs. TCP

Modbus RTU is more efficient than Modbus ASCII, but has stringent timing restrictions that are difficult to comply with when implemented on a multitasking computer, especially using languages such as FORTRAN. For this reason, many Modbus interfaces either deviates from the Modicon specifications regarding Modbus RTU timeouts or else implement the Modbus ASCII format. The Maxum family of products do not support Modbus ASCII.

Modbus TCP utilizes standard TCP/IP messaging to transmit Modbus data. Modbus TCP is distinct from Modbus over TCP. Modbus over TCP takes an entire Modbus RTU message and encapsulates it within a TCP/IP message. Modbus TCP encapsulates only the data portion of the Modbus message. Starting in software version 5.0.7, the Maxum family of products support Modbus TCP. The Maxum family of products do not support Modbus over TCP.

12.4.3 Modicon Types

In some of the Modicon programming languages, data is viewed as being one of seven types:

- Type 0 digital output (can be read and written)
- Type 1 digital input (can only be read)
- Type 2 digital value representing internal PLC status (exception)
- Type 3 analog input (can only be read)
- Type 4 analog output (can be read or written)
- Type 5 analog value representing internal PLC value (event)
- Type 6 file of 16-bit registers

In Modbus terminology, types 0, 1, 3, 4, and 6 are general-purpose, but type 6 is implemented less frequently than types 0, 1, 3, and 4. Types 2 and 5 are not referred too directly. The type 2 and type 5 data varies between PLC models and can be accessed only through Modbus functions that are often specific to certain PLC models.

Although the Modbus standard, defined by Modicon, does not specify how to send values other than digitals or 16-bit 2’s complement integers, a frequent practice is to use the Modbus protocol to other 16-bit values or to send 32-bit and 64-bit values as pairs and quadruples of registers. For 32-bit and 64-bit values, the most significant 16-bit portion is sent as the first register and the least significant 16-bit portion is sent as the last register. 32-bit IEEE floating point format values are the most common deviation from the Modicon standard but sometimes the values of 32-bit integers and 64-bit IEEE floats are transmitted this way.

The Modbus data model views each type of data as belonging to a separate data table. The conventional notation for addresses specifies which table and the offset within the table. The original ranges of the four main data types are:

- 00001 to 09999 for digital outputs (read and write) meaning table 0 with offsets 1 to 9999
- 10001 to 19999 for digital inputs (read only) meaning table 1 with offsets 1 to 9999
- 30001 to 39999 for analog inputs (read only) meaning table 3 with offsets 1 to 9999
- 40001 to 49999 for analog outputs (read and write) meaning table 4 with offsets 1 to 9999

Extended addresses may be supported in the future.

12.4.4 IEEE 32 Bit Float Format

The Institute of Electrical and Electronics Engineers has published a standard for floating point formats on computers. The 32-bit version will be supported by the Modbus. The 32-bit values will be packed into pairs of consecutive Modbus registers (16-bit words). The most significant 16 of the 32 bits will be placed into the first register (lower address) and the less significant 16 bits will be placed into the second register (higher address). The most significant bit of the 32 bits will be the most significant bit of the first register. The least significant bit of the 32 bits will be the least significant bit of the second register. The host computer (Modbus master) must extract the 32-bit floating point value from the registers in the Modbus message. 32-bit floating point values may be mixed with 16-bit values in the same Modbus message. The Modbus Address Map defines which Modbus registers hold which type of data. The Modbus supports two floating point formats, one is the standard(data_type R), as described below, and the other is the same format with the words swapped(data_type Q).

NOTE: sending 32-bit IEEE floats using pairs of Modbus registers has become fairly common.

The most significant bit of the IEEE 32-bit float is the sign bit, 0 for a positive number and 1 for a negative number. The next 8 bits are the exponent. If the exponent is 0 (zero), the mantissa represents either zero or a special type of value called Not A Number (NAN) indicating values that cannot be properly represented in the format. NAN numbers are a special case that should not occur in the Siemens system. If the exponent, mantissa, and sign bit are all zero, the value is zero. If the exponent is not zero, the exponent represents a power of two with a bias of 127 and the mantissa represents the fractional part of a value between 1.0 inclusive and 2.0 exclusive. If the exponent is not zero, the value is given as:

Value = (-1)SIGN * (2.0)(EXPONENT – 127) * (1.0 + (MANTISSA / 8388608))

S	Exponent								Mantissa																						
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Byte 0 (Most Significant)	Byte 1	Byte 2	Byte 3 (Least Significant)
More Significant 16-Bit Word (Word 0)		Less Significant 16-Bit Word (Word 1)	

For example, the Master reads two floating point values from the registers 48601 through 48604, where the slave is identified as slave 65 (0x41). Translating this into a Modbus command, this would be a request to read 4 registers starting at offset 8600 in table 4 of slave 65:

Slave#	Function Code	Data Start		Quantity	
		High	Low	High	Low
41	03	21	98	00	04

The Modbus will respond with a message sending the 4 16-bit words which contain the 2 32-bit values:

Slave#	Function Code	Byte Count	Word 0		Word 1		Word 2		Word 3	
			High	Low	High	Low	High	Low	High	Low
41	03	08	43	1D	66	66	BF	63	D7	0A

In this example, the first value is 157.4 (0x431D6666) and the second value is –0.89 (0xBF63D70A).

12.4.5 EUHI 16 Bit Float Format

Description

The Optichrom Advance systems HOST Computer Communications Interface – HIWAY (HCI-H) used 16-bit integers to represent the values from analyzer data as scaled fractions of the maximum expected value. The maximum expected value is called the Engineering Unit High (EUHI). The content of the 16-bit integer word is given by:

Scaled Result = Round(ScaleFactor * Result value/ EUHI)

For example, if the scaling factor is 9999 and the current value is 35.0% of an expected maximum of 50.0%, 9999 * 35.0 / 50.0 = 6999.3 which would be rounded to 6999 (nearest integer) and stored in the 16-bit word.

The ScaleFactor is normally 999, 4095, 9999, or 65534 but can be configured to any other value between 1 and 65534. A ScaleFactor of 65535 is not allowed because 65535 is the BAD_VALUE (bad quality) indicator. The ScaleFactor must be configured in both the host system and the NAU.

The host system obtains the current value by making this conversion:

ResultValue = EUHI * Scaled Result/ ScaleFactor

The EUHI is represented using a special 16-bit floating point format derived from the IEEE 32-bit floating point format. The sign bit is still the significant bit (0 for positive, 1 for negative). A 6-bit exponent (bias 31) follows the sign bit. The mantissa occupies the 9 least significant bits. The value 0x0000 represents 0.0. An exponent value of zero with a nonzero mantissa is similar to the Not A Number (NAN) values of the IEEE 32-bit floating point format. Otherwise, the exponent should have a value between 1 and 62, representing powers of 2 between –30 and

31 inclusive. An exponent value of 63 is reserved as an indicator of a ‘Bad Value’. The EUHI format is only used to represent EUHI values (maximum values):

EUHI = (-1)SIGN * (2.0)(EXPONENT – 31) * (1.0 + (MANTISSA / 512))

<table>
<tr><th>S</th><th colspan="6">Exponent</th><th colspan="9">Mantissa</th></tr>
<tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td colspan="8">Byte 0 (Most Significant)</td><td colspan="8">Byte 1 (Less Significant)</td></tr>
<tr><td colspan="16">16-Bit Word</td></tr>
</table>

12.4.6 16-Bit Conversion Routines

The following are conversion routines for this format, written in C. The information can be used by host computer software engineers for setting the EUHI from the host or translating the EUHI reported by the NAU. These routines are valid for EUHI values greater than 1.0.

```
int to_euhi(float input);
{
    int output;
    int man;
    int exp;
    float temp;
    for (exp = 0; ;++exp)
        {
        if ((1 << exp) > input)
            break;
        }
    --exp;     /* -1 to compensate for going too far */
    temp = input - (1 << exp);
    man  = (int)(temp * (512 / (1 << exp)));
    output = ((exp + 31) << 9) + man;
    return output;
}
/* Convert number from EUHI */
float from_euhi(int input)
{
    float output;
    int man;
    int exp;
    float temp;
    exp = (input >> 9) - 31;
    man = input & 0x1FF;
    temp =  man;
    output = temp / (float)(1 << (9 - exp));
    output += 1 << exp;
    return output;
}
```

12.4.7 Communication Errors

In both message formats, the message will be discarded if one of these communication errors is detected:

- Received checksum differs from the checksum computed for the message;
- Length of received message differs from length determined for that function;
- If a slave receives a message with a function code of 0 (zero) or between 128 and 255;
- If the master receives a message with a function code of 0;
- Character parity error if either odd or even parity is configured.

As a diagnostic tool, Modbus devices usually maintain message counters that record the number of messages received and the number discarded due to communication errors.

If a slave detects a communication error in a command, the slave discards the message and does not respond to the master. If the master detects a communication error in a response, the master discards the message and retries sending the command. The master will also retry sending a command if an expected response is not received within a configured timeout interval. Master devices may be configured to alert an operator or execute a diagnostic sequence if sending a command fails after a number of retries.

12.4.8 Implementation of Modbus Protocol

Supported Functions

The Siemens GCs will support the Modbus RTU message format and a subset of Modbus functions and error codes. The Siemens Modbus will extend this subset in two ways:

1. Use of the IEEE 32-bit floating point format (with or without swapped words), packing values into pairs of consecutive Modbus registers;
2. Use of a 16-bit floating point format (EUHI), placing values into Modbus registers for HCI-H compatibility;

Function Codes

These Modbus functions will be supported:

Function Code	Description (not in MODBUS Terminology)
1 (0x01)	Read N booleans from Table 0
2 (0x02)	Read N booleans from Table 1
3 (0x03)	Read N registers from Table 4
4 (0x04)	Read N registers from Table 3
5 (0x05)	Write 1 boolean to Table 0
6 (0x06)	Write 1 register to Table 4
8 (0x08)	Loopback Diagnostic Test (Diagnostic Codes 0, 10, 11, 12, 13)
15 (0x0f)	Write N booleans to Table 0
16 (0x10)	Write N registers to Table 4

Exception Codes

The Modbus will send the following exception response codes:

Exception Code	Cause
01	ILLEGAL FUNCTION (for Function Codes 00, 07, 09 to 14, 17 to 101, 102, and 103 to 127)
02	ILLEGAL DATA ADDRESS (possible for Function Codes 01 to 06, 15, and 16)
03	ILLEGAL DATA VALUE (possible for Function Codes 05 and 08)

12.4.9 Modbus Message Format

The Modbus protocol is based on polling. One master device polls one or more slave devices. The master sends commands (queries) to the slaves. The slaves wait for commands from the master. If a command is directed to a particular Modbus slave, the slave sends a response. Some commands can also be broadcast to all slaves at once. The Modbus implementation does not support broadcast messages.

12.4.10 Message Length

The message lengths are specified for the bytes in the message and ignore checksum. Modbus RTU requires 2 additional bytes for the checksum.

Function Code	Length of Command	Length of Response
0	Communication Error	
1	6	3 + value of third byte
2	6	3 + value of third byte
3	6	3 + value of third byte
4	6	3 + value of third byte
5	6	6
6	6	6
7	2	3
8	6	6
9	2 + value of fifth byte	2 + value of fifth byte
10	2	2 + value of fifth byte
11	2	3 + value of third byte
12	2	3 + value of third byte
13	3 + value of third byte	3 + value of third byte
14	2	3 + value of third byte
15	7 + value of seventh byte	6
16	7 + value of seventh byte	6
17	2	3 + value of third byte
18	3 + value of third byte	3 + value of third byte
19	3 + value of third byte	3 + value of third byte

20	2 + value of third byte	2 + value of third byte
21	2 + value of third byte	2 + value of third byte
22-126	3 + value of third byte	3 + value of third byte
127	2	2
128-255	Communication Error	3

12.4.11 Message Content

The message content is always:

Slave#	Function Code	String_of_Data_Bytes
1 byte	1 byte	N bytes

Each message begins with a one byte slave identifier (Slave#). Slaves are configured with identifiers between 1 and 255 inclusive. Slave identifier 0 (zero) is used in the commands broadcast to all slaves. Broadcast messages are not supported in the Modbus. Note: Modicon documentation specifies 1 to 247 for slave identifiers, reserving 248 through 255 for special equipment, but other vendors frequently allow 1 to 255 for slave identifiers.

The second byte of the message indicates the function code (FunctionCode). For commands, this byte has a value between 0 and 127 inclusive. For responses, the function code values range from 1 to 127 if there was no error and from 128 to 255 if there was an error. Slaves indicate errors by sending a response with 128 added to the function code and sending an error code as the String_Of_Data_Bytes.

The String_Of_Data_Bytes has a length that depends upon the function code and whether the Modbus Master is sending the message (Command) or a Modbus Slave is sending the message (Response). For some function codes, the length of the String_Of_Data_Bytes can vary. If the length can vary, there is always one byte, which indicates the number of bytes, 1 to 255, in the variable portion.

12.4.12 Digitial Values

Modbus messages that transmit a string of digital values pack these into a sequence of bytes. The first 8 digitals are packed into the first byte, the next 8 digitals are packed into the second byte, and so on. Digital values are packed into a byte using the least significant available bit. The value of the first digital value is given by the least significant bit of the first byte. If there are not enough digital values to fill the last data byte, the unused bits of that byte will be in the most significant bit positions and have a value of 0.

For an example of packing bits into bytes, assume the following sequence of 19 digital values will be packed into 3 consecutive bytes:

0, 0, 1, 0, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, and 1,

Then: the first eight bits (0,0,1,0,1,1,1,1) would be packed into the first byte which would have the value 0xF4 (11110100), the next eight bits (1,0,0,0,0,0,1,0) would be packed into the second byte which would have the value 0x41 (01000001), and the last three bits (1,0,1) would be packed into the third byte which would have the value 0x05 (00000101) because the most significant 5 bits of the third byte would be set to zero (bit positions shown below)

Data Byte 0								Data Byte 1								Data Byte 2							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
1	1	1	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1

One Modbus function sets the value of a single digital (Function 05 – Force Single Coil). This particular function represents the value of ON by 0xFF00 (65023 decimal) and the value of OFF by 0x0000 (zero).

Within a Modbus message, the values of 16-bit quantities are sent with the more significant byte transmitted before the less significant byte. Note that this is opposite of the way Modbus RTU transmits the CRC-16 checksum.

12.4.13 RTU Checksum

Modbus RTU uses a CRC-16 (cyclic redundancy check) checksum, an equivalent to doing a polynomial division of the message in modulo-65536 (i.e., keep the remainder and discard the quotient). The algorithm usually does this one bit at a time. However, modulo arithmetic allows this to be done one byte at a time, by precomputing a table of all 256 of the possible CRC-16 checksums for a single-byte message.

To compute the 16-bit CRC-16 checksum for a message:

1. Initialize the checksum to 0xFFFF (65535 in decimal);
2. For each byte in the message, starting with the first, do:
   – Exclusive OR the message byte with the less significant byte of the checksum;
   – Use the result of (2.a) as an index into the precomputed CRC-16 lookup table;
   – Exclusive OR the result of (2.b) with the more significant byte of the checksum;
   – Replace the current checksum with the result of (2.c);

12.4.14 Basic Data Types

The Modbus protocol has two basic data types, digital and analog. Digital values are either 0 (zero) or 1 (one). Analog values are usually 16-bit 2's complement integers, giving a range from –32768 to 32767. The Modbus protocol also uses 16-bit positive integers with a range of 0 to 65535 (for example, Modbus addresses). Digital values are often referred to as coils. Analog values and other 16-bit values are often referred to as registers.

12.4.15 Checksum and Communication Errors

When a message is received, the CRC-16 checksum of the message is computed and compared with the received CRC-16 checksum. If the two checksums match, there was probably no communication error.

12.4.16 CRC Lookup Table

Use the following steps to create the CRC-16 lookup table. This is only one of many ways to compute CRC-16 checksums.

(1) For each of the values 0 to 255, do:

(1.a) Initialize the checksum to 0xFFFF (65535 in decimal);

(1.b) Exclusive OR the less significant byte of the checksum with the value between 0 and 255;

(1.c) Replace the less significant byte of the checksum with the result of (1.b);

(1.d) Do the following 8 times:

- (1.d-1) If the least significant bit of (1.c) is 1 then:
  - (1.d-1.a) Right shift the checksum one bit;
  - (1.d-1.b) Exclusive OR the result of (1.d-1) with 0xA001 (40961 in decimal);
  - (1.d-1.c) Replace the checksum with result of (1.d-2);
- (1.d-2) Else:
  - (1.d-2.a) Right shift the checksum one bit;
  - (1.d-2.b) Replace the checksum with the result of (1.e-1);

(1.e)Place the result of (1.d) in the table at the index specified by the value between 0 and 255.

12.4.17 Character Transmission

Modbus protocol uses normal RS-232C, RS-422 (not supported), and RS-485 asynchronous character transmission. A start bit is sent before the data bits, then the data bits are transmitted with the least significant bit first, then an optional parity bit may be sent, and finally one or two stop bits are sent.

In Modbus RTU, the binary values of the message and checksum are transmitted as characters. The checksum requires two bytes, which are transmitted with less significant byte first, immediately after the last byte of the message is transmitted. Characters must be transmitted as 8 data bits. Character parity can be odd, even, or none. Either 1 or 2 stop bits can be used.

In Modbus RTU, a pause is inserted between messages to indicate the start and end of a message. Modicon's Modbus specification requires a pause equal to or greater than the time required to transmit 3.5 characters at the configured baud rate. Shorter pauses are accepted between characters in the same message. However, many Modbus RTU interfaces are implemented on multiprocessing computers and are unable to detect such a small time interval, especially at higher baud rates. For these systems, a larger pause is specified (for example, minimum of 500ms inserted between consecutive messages).

The following table assumes: 8-bit data, 1 start bit, 1 stop bit, and no parity.

Baud Rate (bits per second)	3.5 Character Pause (milliseconds)
110	318.2
300	116.7
1200	29.2
4800	7.29
9600	3.65
19200	1.823
38400	0.911
57600	0.608
112500	0.304

12.4.18 Function Codes

Modicon has defined many Modbus Function Codes, most of which are specialized for PLC configuration and some are only used with specific models of PLC's. Most vendors only implement a subset of the Modbus functions.

The following functions are almost always supported:

Function 01	Read Coil Status	reads a string of digital outputs (table 0)
Function 02	Read Input Status	reads a string of digital inputs (table 1)
Function 03	Read Holding Registers	reads a string of analog outputs (table 4)
Function 04	Read Input Registers	reads a string of analog inputs (table 3)

The following functions are almost as common:

Function 05	Force Single Coil	writes a value to a single digital output (table 0)
Function 06	Preset Single Register	writes a value to a single analog output (table 4)

The following functions are also very common:

Function 15	Force Multiple Coils	writes values to a string of digital outputs (table 0)
Function 16	Preset Multiple Registers	writes values to a string of analog outputs (table 4)

Note: At least one of Function 05 and Function 15 will be implemented. Usually both are. At least one of Function 06 and Function 16 will be implemented. Usually both are.

Less common functions are:

Function 08	Loopback Diagnostic Test	diagnostic test message sent to test communications
Function 11	Fetch Event Counter Communications	check slave's communications counter

The other Modbus functions tend to be specific to models of Modicon PLC's and are not described here.

These Modbus functions will be supported in the Maxum/MicroSAM:

Function Code	Description (not in MODBUS Terminology)
1 (0x01)	Read N booleans from Table 0
2 (0x02)	Read N booleans from Table 1
3 (0x03)	Read N registers from Table 4
4 (0x04)	Read N registers from Table 3
5 (0x05)	Write 1 boolean to Table 0
6 (0x06)	Write 1 register to Table 4
8 (0x08)	Loopback Diagnostic Test (Diagnostic Codes 0, 10, 11, 12, 13)
15 (0x0f)	Write N booleans to Table 0
16 (0x10)	Write N registers to Table 4

12.4.19 Exception Response Codes

The Modbus slave can send the following exception response codes:

Exception Code	Cause
01	ILLEGAL FUNCTION (for Function Codes 00, 07, 09 to 14, 17 to 101, 102, and 103 to 127)
02	ILLEGAL DATA ADDRESS (possible for Function Codes 01 to 08, 15, and 16)
03	ILLEGAL DATA VALUE (possible for Function Codes 05 and 08)

12.4.20 Error Responses

If a slave receives a command with the slave's identifier and with a function code that the slave doesn't support, the slave will send an error response indicating that an ILLEGAL FUNCTION was received. The slave will send a 3-byte error response with its identity, the function code summed with 128, and the ILLEGAL FUNCTION error code.

For example, if slave 17 (0x11) receives a request for function 98 (0x62), slave 17 will respond with identity 0x11, function code 0xE2 (128+98), and error code 0x01 (ILLEGAL FUNCTION):

Slave#	Function Code	Error Code
11	E2	01

12.4.21 Function Reference

12.4.21.1 Function 01 - Read Coil

Master Command

The master sends a command requesting the values of a number of digital outputs (table 0), specifying the initial address to read and the number of locations to read. For example, the master might request a read of the 37 coils 00020 through 00056 from slave 17. Translating the values into hexadecimal, this is a request that slave 0x11 read 0x0025 digitals starting at address 0x0013 (corresponds to table offset 0020 of table 0):

Slave#	Function Code	Data Start		Quantity	
		High	Low	High	Low
11	01	00	13	00	25

Slave Response

If the slave can process the command without error, the slave will respond with its identifier, the function code, a count specifying the number of data bytes required to pack the digitals, and the string of data bytes. For example:

Slave#	Function Code	Byte Count	Data Byte 0	Data Byte 1	Data Byte 2	Data Byte 3	Data Byte 4
11	01	05	CD	6B	B2	0E	1B

In this example,

- 0xCD (11001101) indicates that coils 00020, 00022, 00023, 00026, and 00027 are on.
- 0x6B (01101011) indicates that coils 00028, 00029, 00031, 00033, and 00034 are on.
- 0xB2 (10110010) indicates that coils 00037, 00040, 00041, and 00043 are on.
- 0x0E (00001110) indicates that coils 00045, 00046, and 00047 are on.
- 0x1B (00011011) indicates that coils 00052, 00053, 00055, and 00056 are on.
- All of the other coils are off (value of zero).

Note: the three most significant bits of data byte 4 (fifth byte) are all unused and are therefore set to zero.

Possible Errors

Possible errors that could occur are:

- The specified starting address is outside of the configured range for table 0.
- The combination of specified starting address and number of digitals (quantity) would result in an address outside of the configured range for table 0.
- The specified number of digitals (quantity) is too large to fit into a response. (A response can hold a maximum of 255 data bytes or 2040 digitals.)

Error Response

Some devices limit the response length to 250 data bytes (2000 digitals). If one of the first two errors occurs, an error response will be sent indicating that there is an ILLEGAL DATA ADDRESS. If the third error occurs, an error response will be sent indicating that there is an ILLEGAL DATA VALUE.

Using the example above slave 17 would respond to a command which had an illegal address or an illegal combination of address and number of digitals (quantity) with:

Slave#	Function Code	Error Code
11	81	02

Slave 17 would respond to a command specifying more than the allowable number of digitals (quantity) with:

Slave#	Function Code	Error Code
11	81	03

12.4.21.2 Function 02 - Read Input

Master Command

The master sends a command requesting the values of a number of digital inputs (table 1) that specifies the initial address to read and the number of locations to read. For example, the master might request a read of the 22 inputs 10197 through 10218 from slave 17. Translating the values into hexadecimal, this is a request that slave 0x11 read 0x0016 digitals starting at address 0x00C4 (corresponds to table offset 0197 of table 1):

Slave#	Function Code	Data Start		Quantity	
		High	Low	High	Low
11	02	00	C4	00	16

Slave Response

If the slave can process the command without error, the slave will respond with its identifier, the function code, a count specifying the number of data bytes required to pack the digitals, and the string of data bytes. For example:

Slave#	Function Code	Byte Count	Data Byte 0	Data Byte 1	Data Byte 2
11	02	03	AC	DB	35

In this example,

- 0xAC (10101100) indicates that inputs 10199, 10200, 10202, and 10204 are on.
- 0xDB (11011011) indicates that inputs 10205, 10206, 10208, 10209, 10211, and 10212 are on.
- 0x35 (00110101) indicates that inputs 10213, 10215, 10217, and 10218 are on.
- All of the other inputs are off (value of zero).

Note: the two most significant bits of data byte 2 (third byte) are all unused and are therefore set to zero.

Error Response

Similar to a Function Code 01, an ILLEGAL DATA ADDRESS error response will be sent if the starting address or combination of starting address and number of digitals exceeds the configured range of table 1 (digital inputs).

An ILLEGAL DATA VALUE error response will be sent if the number of digitals exceeds 2040, the limit that can be packed into 255 data bytes for a response.

Note: some devices will limit the response length to 250 data bytes (2000 digitals). However, the function code in the error response, will be 130 (0x82) indicating that the error occurred on a command with Function Code 02.

12.4.21.3 Function 03 - Read Output

Master Command

The master sends a command requesting the values of a number of output registers (table 4), specifying the initial address to read and the number of locations to read. For example, the master might request a read of the 3 registers 40108 through 40110 from slave 17. Translating the values into hexadecimal, this is a request that slave 0x11 read 0x0003 analogs starting at address 0x006B (corresponds to table offset 0108 of table 4):

Slave#	Function Code	Data Start		Quantity	
		High	Low	High	Low
11	03	00	6B	00	03

Slave Response

If the slave can process the command without error, the slave will respond with its identifier, the function code, a count specifying the number of data bytes required for the analogs, and the string of data bytes. For example:

Slave#	Function Code	Byte Count	Word 0		Word 1		Word 2	
			High	Low	High	Low	High	Low
11	03	06	02	2B	00	00	00	64

In this example, registers 40108, 40109, and 40110 have the values 555 (0x022B), 0 (0x0000), and 100 (0x0064) respectively.

Error Response

Similar to Function Code 01, an ILLEGAL DATA ADDRESS error response will be sent if the starting address or combination of starting address and number of analogs exceeds the configured range of analog outputs (table 4).

An ILLEGAL DATA VALUE error response will be sent if the number of registers exceeds 127 which is the limit that can be packed into 254 data bytes for a response.

Note: Some devices limit the response length to 250 data bytes (125 registers). However, the function code in the error response will be 131 (0x83), indicating that the error occurred on a command with Function Code 03.

12.4.21.4 Function 04 - Read Input

Master Command

The master sends a command requesting the values of a number of input registers (table 3), specifying the initial address to read and the number of locations to read.

For example, the master might request a read of the register 30009 from slave 17. Translating the values into hexadecimal, this is a request that slave 0x11 read 0x0001 analogs starting at address 0x0008 (corresponds to table offset 0009 of table 3):

Slave#	Function Code	Data Start		Quantity	
		High	Low	High	Low
11	04	00	08	00	01

Slave Response

If the slave can process the command without error, the slave will respond with its identifier, the function code, a count specifying the number of data bytes required for the analogs, and the string of data bytes. For example:

Slave#	Function Code	Byte Count	Word 0	
			High	Low
11	03	02	00	00

In this example, register 30009 has the value zero (0x0000).

Error Response

Similar to Function Code 01, an ILLEGAL DATA ADDRESS error response will be sent if the starting address or combination of starting address and number of analogs exceeds the configured range of table 3 (analog inputs).

An ILLEGAL DATA VALUE error response will be sent if the number of registers exceeds 127, the limit that can be packed into 254 data bytes for a response.

Note: Some devices limit the response length to 250 data bytes (125 registers). However, the function code in the error response will be 132 (0x84), indicating that the error occurred on a command with Function Code 04.

12.4.21.5 Function 05 - Set Single Coil

Master Command

The master sends a command writing the value of one output digital (table 0), specifying the digital's address and the value to write. For example, the master might request that slave 17 turn ON coil 00173. Translating the values into hexadecimal, this is a request that slave 0x11 write 0xFF00 to the coil at 0x00AC (corresponds to table offset 0173 of table 0):

Slave#	Function Code	Data Start		Digital Value	
		High	Low	High	Low
11	05	00	AC	FF	00

Slave Response

If the slave can process the command without error, the slave will echo the command as a response:

Slave#	Function Code	Data Start		Digital Value	
		High	Low	High	Low
11	05	00	AC	FF	00

Possible Error

A possible error that might occur is that, although the address and data value are valid, there is some internal error that prevents the digital value from being written to the specified digital. For instance, the value may be on another device connected over an internal network. If the other device is offline or has security features, which can block writing to that device's digital, this would cause a FAILURE IN ASSOCIATED DEVICE error response.

For example, if slave 17 had not been able to carry out the command because of an internal system problem, the response would have been:

Slave#	Function Code	Error Code
11	85	04

Similar to Function Code 01, an ILLEGAL DATA ADDRESS error response will be sent if the coil's address is outside the configured range of table 0 (digital outputs).

An ILLEGAL DATA VALUE error response will be sent if the digital value specified is neither 0xFF00 (ON) nor 0x0000 (OFF). However, the function code in the error response will be 133 (0x85) indicating that the error occurred on a command with Function Code 05.

12.4.21.6 Function 08 - Loopback Diagnostic

Master Command

The master sends the Loopback Diagnostics Test command to test communications with a slave device. A 2-byte diagnostic code tells the slave what action is required. Modicon has specified a number of diagnostic codes and reserves some additional codes for proprietary use. Most of the diagnostic codes tell the slave to return a value from an internal communications event counter (e.g., Diagnostic Code 12 requests the Checksum Error Count). The 2-byte data code is followed by a two byte (16-bit) data value.

Diagnostic Codes

Diagnostic Code	Action of Modbus Slave Device
0	Respond by echoing command
1	Reinitialize Modbus interface
10	Clear event counters (reset to zero)
11	Respond with the number of received messages (bus message events)
12	Respond with the number of received checksum errors (checksum error events)
13	Respond with the number of error responses sent (exception events)
14	Respond with the number of responses sent (response events)
15	Respond with the number of commands not responded to (nonresponse events)
16	Respond with the number of NAK responses from attached devices (NAK events)
17	Respond with the number of busy responses from attached devices (busy events)

Diagnostic Codes

Diagnostic Code   Action of Modbus Slave Device

Diagnostic Codes 16 and 17, NAK, and busy event counters respectively are a diagnostic for Modbus slave interfaces that forward values to attached devices perhaps over a proprietary network.

Full definitions of these codes are shown below.

Diagnostic Code 0

Return Query Data, is the most useful. This allows the host system (Modbus master) to test loop communications and verify that the slave device can correctly generate checksum values (CRC-16 for Modbus RTU and LRC for Modbus ASCII). Verifying the checksum requires sending a series of Loopback Diagnostics Test messages with different 16-bit data values. The addressed slave will send a response to this diagnostic code. The response should match the message sent by the master, but a checksum will be generated by the slave and is not just an echo of the command's checksum.

Diagnostic Code 1

Restart Communications Option, tells the slave to reinitialize all serial communications including clearing all event counters (message and error counters). After initialization, the slave will resume waiting to be polled by the master. The slave does not send a response to this diagnostic code. Modicon specifies two data values for this diagnostic code indicating whether the slave should halt or continue when a communications error is detected. A data value of

0x0000 specifies the slave should halt on communications error. A value of 0xFF00 says the slave should continue on communications error (but increment error event counters).

Note: For diagnostics on remote devices in SCADA systems, it is useful to halt the slave device when an error occurs and then read a communications log (Function Code 12). Otherwise, the Modbus implementation should ignore the data values for Diagnostic Code 1 (i.e., accept all values).

Diagnostic Code 10

Clear Counters and Diagnostic Register, is useful if Function Code 11, Fetch Communications Event Counter, is implemented. A Modbus slave increments the event counter for every successful command from the Modbus master (i.e., commands that caused no errors). A Modbus master can send a series of commands and then check the event counter to verify that all were successful. This can be useful in testing a new configuration. The slave sends a response that echoes the command from the master.

Diagnostic Codes 11 through 17

Diagnostic Codes 11, 12, 13, 14, 15, 16, and 17 are useful to allow a host computer system (Modbus master) to track communication statistics on Modbus slaves. The slaves respond with the values of event counters.

Note: For Diagnostic Codes 10 through 17, the master should send a data value of 0 (zero). Unless there is reason to do otherwise, the slave device should ignore the data value (i.e., accept every data value) for these diagnostic codes. For Diagnostic Codes 11 through 17, the slave should respond with the value of the specified event counter. For Diagnostic Code 10, the slave should respond by echoing the command (similar to the response for Diagnostic Code 0).

Error Response

The only error that should occur is that a command with an unsupported diagnostic code is sent. If the slave does not recognize the diagnostic code, it should send an ILLEGAL DATA VALUE error response (see Function Code 01 on page 43) with the Function Code set to 136 (0x88) to indicate that the error occurred on a command with Function Code 08.

Error Example 1

The master sends Diagnostic Code 0 with data value 42295 (0xA537) to slave 17:

Slave#	Function Code	Diagnostic Code		Data Value	
		High	Low	High	Low
11	08	00	00	A5	37

The slave will echo the command as a response:

Slave#	Function Code	Diagnostic Code		Data Value	
		High	Low	High	Low
11	08	00	00	A5	37

Error Example 2

The master sends Diagnostic Code 12 with data value 0 (zero) to slave 17:

Slave#	Function Code	Diagnostic Code		Data Value	
		High	Low	High	Low
11	08	00	0C	00	00

The slave will respond with its identity, the function code, the diagnostic code, and the value of the event counter (count of checksum errors), a value of 3 in this example:

Slave#	Function Code	Diagnostic Code		Data Value	
		High	Low	High	Low
11	08	00	0C	00	03

12.4.21.7 Function 15 - Set Multiple Coils

Master Command

The master sends a command writing the values to a string of digital outputs (table 0), specifying the starting address, the number of digitals, and the values. The values are packed into bytes. The first byte contains the values of the first eight digitals, the second byte contains the values of the next eight digitals, and so on. The values are packed into the bytes, beginning with the least significant bit of a byte and finishing with the most significant bit of the byte. If there are not enough digitals to fully use all of the bits of the last data byte, the unused bits should be set to zero. There should be at least one digital value in the last data byte.

For example, the master might set the values of the 10 coils 00014 through 00023, turning ON (one) coils 00014, 00016, 00017, 00020, and 00021 while turning OFF (zero) coils 00015, 00018, 00019, 00022, and 00023:

Slave#	Function Code	Data Start		Quantity		Byte Count	Data Byte 0	Data Byte 1
		High	Low	High	Low			
11	0F	00	13	00	0A	02	CD	00

Slave Response

If the slave can process the command without error, the slave will send a response with its identity, the function code, the starting address, and the number of digitals (quantity) whose values were set:

Slave#	Function Code	Data Start		Quantity	
		High	Low	High	Low
11	0F	00	13	00	0A

Error Response

Similar to Function Code 05, an ILLEGAL DATA ADDRESS error response will be sent if the register's address is outside the configured range of table 0 (digital outputs) or if the combination of starting address and quantity results in an address outside of the configured range.

A FAILURE IN ASSOCIATED DEVICE error response will be sent if an internal error prevented the command from being carried out.

Normally there would not be an ILLEGAL DATA VALUE response because all values should be acceptable. The function code in the error response will be 143 (0x8F) indicating that the error occurred on a command with Function Code 15.

12.4.21.8 Function 16 - Set Multiple Registers

Master Command

The master sends a command writing the values to a string of analog outputs (table 4), specifying the starting address, the number of analog values, and the 16-bit values. The values are sent with the more significant byte before the less significant byte.

For example, the master might set the values of the 2 registers 40136 and 40137 to 10 (0x000A) and 258 (0x0102) respectively in slave 17:

Slave#	Function Code	Data Start		Quantity		Byte Count	Word 0		Word 1	
		High	Low	High	Low		High	Low	High	Low
11	10	00	87	00	02	04	00	0A	01	02

Slave Response

If the slave can process the command without error, the slave will send a response with its identity, the function code, the starting address, and the number of analogs (quantity) whose values were set:

Slave#	Function Code	Data Start		Quantity	
		High	Low	High	Low
11	10	00	87	00	02

Error Response

Similar to Function Code 05, an ILLEGAL DATA ADDRESS error response will be sent if the register's address is outside the configured range of table 4 (analog outputs) or if the combination of starting address and quantity results in an address outside of the configured range.

A FAILURE IN ASSOCIATED DEVICE error response will be sent if an internal error prevented the command from being carried out.

Normally there would not be an ILLEGAL DATA VALUE response because all values should be acceptable. The function code in the error response will be 144 (0x90) indicating that the error occurred on a command with Function Code 16.

Alarm Reference 13

13.1 Alarms 301 - 324

GCP Alarm Descriptions 301 - 324

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
301	?	External Message: send failure %3	A message was received by the device from itself; or source of message can't be identified; or Gateway is too busy or communication was disrupted between the GC and the message handler.	Reset Gateway or SYSCON.
302	?	External Message: server lost	System Error	Contact Customer Support.
303	+	External Message: Rec'd invalid communication from unit %3	Message was received from Advance DataHiway unit that had previously broadcast with no slots or slot is out of range.	Reset Advance DataHiway unit.
304	+	External Message: Orphan message received from %3	An Advance DataHiway external PANDSP message was received with no matching PANKEY; or an ATTACH was received with no matching RATCH; or an internal timeout was generated for non-existent message.	Ignore or reset SYSCON.
305	?	External Message: Invalid Message Length for %3	Advance DataHiway Results, print, HAE, or Service Panel messages received from GC that have no length.	Check database set up for these messages.
306	+	External Message: Send invalid communication to unit %3	Message from GC is directed to an Advance DataHiway unit that has no slots, an invalid range of slots, or no UID has ever been received.	Check Advance DataHiway unit.
307	?	External Message: Duplicate anlz_id %3 detected ; setting to zero	An Advance DataHiway ZIP message was received from another Advance DataHiway unit, or another GC has broadcast with the same analyzer number.Check other units on network.	Check other units on network.
308	?	External Message: Duplicate UNIT %3 detected; setting loop/unit to zero	An Advance DataHiway SLEEP message has been received. Another Advance DataHiway unit has broadcast with the same loop/unit.	Check other units on Advance DataHiway and correct loop/unit of GC.
309	?	External Message: RUD:Unit does not respond; loop/unit %3	Occurs when Advance DataHiway loop/unit does not respond to a RUD message - originates from I/O, Host, or Printer table in GC.	Remove extraneous references to non-existent units. Check Advance DataHiway connection.

#		Text	Description	Action
310	?	External Message: Unit not known for %3	GC is trying to communicate with an unknown unit on the Advance DataHiway.	Wait 10 minutes to see if this condition will correct itself. If it does not, verify that the Gateway is communicating with the GC.
311	?	External Message: Error for Activation of EVT on %3	Bad Advance DataHiway Host Activation Event message was sent by GC to message handler.	Check MaxBasic programs for invalid setting of attributes on the analyzer table.
312	?	External Message: Send error for %3	Send failure for UDP outgoing message sequences.	This is a general failure that indicates a network fault.
313	?	External Message: Invalid TOR sequence on %	An Advance DataHiway SEND message was received from external unit when there are no results to send.	Check result transmit, # of results.
314	?	External Message: Anlz: %3 & Anlz: %4 have loop/unit conflict	Two Advance GCs have duplicate Advance DataHiway addresses (loop,unit).	Check for duplicate loop,unit addresses on the two analyzers and correct the duplication.
315	?	External Message: Anlz id exceeds allowable limit for ADH	FUNCT 88 Advance DataHiway Alarm message received from HCI-H; or GC attempted a broadcast with an analyzer_id greater than 255.	Check analyzer ID.
316	?	External Message: Host: Anlz 1 to 50 config conflict	FUNCT 89 Advance DataHiway Alarm message received from HCI-H.	Check # results and # streams against HCI-H limitations.
317	?	External Message: Host: for anlz 51-254 stream>1 or # of components>9	FUNCT 90 Advance DataHiway Alarm message received from HCI-H.	Check # results and # streams against HCI-H limitations.
318	?	External Message: Host: invalid data received from anlz	Advance DataHiway H card is sending alarm back to GC.	Check trtval in result table.
319	?	External Message: no results marked to transmit for stream %3	No results are marked for transmission. Comes from GC prior to transmission.	Check trtval in result table.
320	?	External Message: %3 Timeout for %4	Advance DataHiway message timeout for ADREQ, REXD, results, HAE, Print, FUNCT.	Reset SYSCON. If the alarm occurs again, contact Customer Support.
321	+	External Message connection opened on: %3	Normal message from reset.	No action necessary.
322	?	No ADH connection detected %3 failed	No message handler. This means that that certain software components are not working.	Contact Customer Support.
323	?	External Message: Invalid LOOP %3 detected ; setting loop/unit to zero	An Advance DataHiway WRLP message has been received.	Check Loop of GC.
324	!	Error processing database command %3	An error has occured in SQL messaging to a remote or local database table for Modbus or remote I/O.	Check network communication and contact Customer Support.

13.2 Alarms 330 through 359 SNE Communication

GCP Alarm Descriptions 330 - 359

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
331	!	Run Method: No SNE found or bad status on module: %3	The connection between the GC and the SNE is invalid.	Check cable between the SNE and SYSCON. Check the LEDs on the SNE to see if it is running.
332	!	Run Method: No module found for detr: %3	The SNE has not reported the detector, pressure controller, or temperature controller.	Check hardware connections to SNE. The GC can contain references to invalid hardware channels. Check the pressure, temperature, and detector channels defined in the application for correct assignments.
333	!	Run Method: No Detr found or bad status for method.channel: %3	Realtime chromatogram attempt on invalid detector, or bad status on detector.	Check hrdwr_id, module for app_detector. The GC can contain references to invalid hardware channels. Check the detector channels defined in the application for correct assignments.
334	!	Run Method: No Channel found for method: %3	No channels are present or can't find detector for channel.	Check app_detector, EZChrom method for proper hardware channel assignments.
335	+	SNE connection opened on %3	System error	Contact Customer Support.
336	!	SNE connection closed on %3 error: %4	SNE connection closed due to timeout or error.	If IP address specified is not a 192.168.144.# network address, check for appropriate grounding of system. Otherwise check SNE for appropriate connections and software versions.
337	!	SNE connection replaced on %3	System error	Contact Customer Support.
338	?	SNE %3 Method %4 Cannot Store Chrom	Results received from SNE for unknown stream.	Check stream table. It is possible to delete streams during the run of a cycle. If that is done, then this alarm may occur.
339	?	SNE %3 Method %4 Application %5 not found	Can't find application or method to match SNE results. This indicates that messages between the SNE and SYSCON are corrupted.	Reset SNE to sychronize messages. It is possible to delete applications during the run of a cycle. If that is attempted, then this alarm may occur.
340	!	SNE %3 Method %4 Load - Invalid Method	SNE has sent a status message that the method is invalid. No other information is available.	Download method from EZChrom again.
341	!	SNE %3 Method %4 Inactive	SNE sent message that method is inactive. No other information is available.	Restart the application.
342	!	SNE %3 Method %4 Load - Max Method exceeded	SNE sent message that maximum methods has been exceeded.	Reduce number of methods, reset SYSCON.

#		Text	Description	Action
343	!	SNE %3 Method %4 Load - Invalid Mode	Invalid run/hold sent to SNE.	Reset SYSCON or try placing application in run.
344	!	SNE %3 Method %4 status - unknown error %5	Unknown error from SNE method status.	Reset SNE/SYSCON.
345	!	Stream Valve does not exist	Can't find appdo or sys_do for DO set in cycle_events. Digital Output on cycle_event may not be valid.	Check DO on application I/O tables to see if the DO exists for this application and has a normal status.
346	!	SNE %3 Write IO %4 does not exist %5	IO write was sent to SNE, where I/O does not exist.	Reset SNE/SYSCON. Check the sys_hardware table for normal I/O status. If any I/O is not normal, investigate the cause.
347	!	SNE %3 Read IO %4 does not exist	IO read was sent to SNE where the I/O does not exist.	Reset SNE/SYSCON Check the sys_hardware table for normal I/O status. If any I/O is not normal, investigate the cause.
348	?	SNE %3 RT chrom %4 does not exist	Realtime chromatogram request to non-existent SNE.	Reset SNE/SYSCON Check the sys_hardware table for normal I/O status. If any I/O is not normal, investigate the cause.
349	?	SNE %3 Method %4 - Write attempted on active method		Ignore: Alarm was removed from Versions 4.3 and later.
350	!	SNE Module I/O error 0x %3 on %4	An operation attempted on an attached SNE module failed.	Report the error number and the module to Customer Support.
351	!	SNE pSOS error 0x %3 on %4	System Software Failure.	Report the error number and the module to Customer Support.
352	!	SNE pSOS Driver error 0x %3 on %4	Driver Software Failure.	Report the error number and the module to Customer Support.
353	!	SNE AAI Driver error 0x %3 on %4	AAI custom driver failure.	Report the error number and the module to Customer Support.
354	?	SNE TFTP load Error on %3 : %4	TFTP load failure during download of SNE software.	Verify that TFTP server is running Verify correct IP address Verify correct file location Retry TFTP load
355	?	SNE FLASH Driver Error on %3 : %4	Flash Memory Failure.	If persistent, replace SNE.
356	!	SNE %3 Stream/Method %4 / %5 does not exist	Results received from SNE: Can't locate stream/method. Deleting streams and methods or downloading methods while a cycle is running can cause this error.	Check sequence. Place application in hold and then run again.
357	!	SNE Method %3 - Invalid message argument	This indicates that the SNE has an obsolete software version or the messages between the SNE and SYSCON have been corrupted.	Check the SNE and SYSCON software versions with the upgrade tool. Reset the SYSCON and SNE.

#		Text	Description	Action
358	!	SNE Invalid I/O Write from SNE on %4 , command %5	This should only occur if the SNE has an old software version or the messages between the SNE and SYSCON have been corrupted.	Check the SNE and SYSCON software versions with the upgrade tool. Reset the SYSCON and SNE.
359	!	SNE I/O not found on I/O Write from SNE: %4	This should only occur if the SNE has an old software version or the messages between the SNE and SYSCON have been corrupted.	Check the SNE and SYSCON software versions with the upgrade tool. Reset the SYSCON and SNE.

13.3 Alarms 360 - 399

GCP Alarm Descriptions 360 - 399

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
360	!	%!3 %4	General SNE Fault.	Contact Customer Support.
361	?	%3 %4	General SNE warning.	Contact Customer Support.
362	+	%3 %4	General SNE note.	Contact Customer Support.
363	!	Invalid function request %3 from SYSCON	This indicates that the SNE has an obsolete software version, or that the messages between the SNE and SYSCON have been corrupted.	Check the SNE and SYSCON software versions with the upgrade tool. Reset the SYSCON and SNE.
364	?	No real-time buffer exists for detector %3 on DPM %4	Detector data is being collected for a detector that wasn't properly enabled.	If received during a load sequence, it is an artifact of the shutdown sequence. Otherwise, record occurrence and DPM information and report to Customer Support.
365	!	Incomplete Analysis on channel %3	EZChrom analysis was not completed on channel.	Modify integration events in method. Send method to Customer Support.
366	!	Data Corruption Error	Major Data corruption on SNE	Reset SNE Report error to Customer Support.
367	!	System Error %3 in File %4 line %5	System Software Failure.	Record sequence of events leading to occurrence and report error, along with the complete contents of the alarm message, to Customer Support.
368	!	Unable to find %3 number %4	Hardware specified in method is not in analyzer.	Verify that the method is correct.
369	!	Unsupported channel type %3	Hardware channel operation requested for an invalid channel type.	Inspect for current version of SNE software. May require a reload or rebuild of corrupted SYSCON database.
370	?	No channel %3 on DPM %4 for realtime display	Realtime display requested for a detector channel that doesn't exist. Indicates database corruption.	Restore an older version of the database.

#		Text	Description	Action
371	!	Invalid channel acquisition overlap on %3	Two channels referencing the same hardware detector are scheduled to acquire at the same time.	If multiple application detector channels are assigned to the same hardware detector, do not allow their times to overlap.
372	!	Scheduling error %3 scanning %4 # %5 channel %6	Unable to schedule all event and polling routines. May indicate a memory or hardware failure.	If method schedules many events as well as all 18 detectors, try removing some of the events or deleting some of the detectors, then resetting the SNE.
373	!	Module I/O error %3 on %4 # %5 channel %6	Error between module and channel. Indicates obsolete anayler.	Consider upgrading analyzer.
374	!	Internal communication error %3	Software modules inside SNE are failing to communicate. Usually happens with out of memory condition resulting from SYSCON timeout.	Reduce processing requirements on SYSCON.
375	!	End of cycle missed; stopping cycle	The message that coordinates the end of a method around the SNE tasks was lost.	Reset SNE. Reduce the complexity of the SNE setup. Replace SNE.
376	+	Adjusting cycle clock master	Obsolete software version.	Contact Customer Support.
377	!	Error %3 scheduling cycle clock master adjustment	Resource not found for scheduling adjustment of event clock. SNE may be overloaded.	Reduce complexity of tasks for SNE.Reset SNE to prevent event clock overflow.
378	+	%3 samples adjusted on chrom from channel %4	An excessive number of samples required adjustment on chromatogram. Occurs in conjunction with DPM alarms.	Replace affected DPM.
379	!	Error %3 preparing analysis for channel %4	EZChrom processing error.	Check integration events; modify events that may cause problems.
380	!	Error %3 finding chrom peaks for channel %4	EZChrom processing error.	Check integration events and peak table; modify events that may cause problems.
381	!	Error %3 generating results for channel %4	EZChrom processing error. Example error: Setting the threshold value too low, causing many peaks to be detected in the noise of the chromatogram.	Check method for problems that could affect results.
382	!	EZChrom server failed error %3 on channel %4	Resource problem on SNE.	Reduce SNE workload. Replace SNE.
383	?	Software Watchdog Timeout	SNE is running out of processing capacity.	Reduce SNE workload. Replace SNE.
384	!	Method Modification Failed	An attempt to modify a running method failed, most likely due to invalid data.	Verify that modification was valid.
385	?	Event occurred before modification request	Before a modification of a running method was completed, the event occurred.	Contact Customer Support.
386	!	Invalid Cycle Length %3	A cycle length larger than the maximum size was specified in a method. Usually caused by a corrupt method. Maximum cycle length is approximately 2 days.	Verify correct values in method.
387	!	Invalid Sample Rate %3 on channel %4	Invalid sample rate value chosen for channel in method.	Verify the methods and use only a supported detector sample rate.

#		Text	Description	Action
388	!	Acquisition time greater than cycle length on channel %3	Start and stop acquisition times for a detector exceeded the method cycle length.	Decrease acquisition time or increase cycle method time.
389	!	Invalid Event Type %3 for event %4	Invalid event downloaded with method.	Check for proper SNE version. Rebuild method.
390	!	Invalid Start Time %3 for event %4	Event time specified that is outside the cycle start and stop times.	Correct the method using EZChrom.
391	?	%3 messages not sent to SYSCON from SNE	Some messages that the SNE attempted to send to SYSCON were lost. Results may be unpredictable.	Reset the device.
392	?	%3 Detector underflows detected on channel %4 of module %5	Detector is reading a raw value of 0. It is potentially clipping the signal at the low value.	Check the method.
393	?	%3 Detector opens detected on channel %4 of module %5	Detector channel is not connected.	Verify the detector hardware to ensure that it is properly connected and that the detector is not damaged.
394	?	%3 Unexpected Calibration points on channel %4 of module %5	Detector channel unexpectedly went into calibration mode.	Replace DPM if persistent.
395	?	%3 Detector overflows on channel %4 of module %5	Detector is reading above its maximum value and the signal is being clipped.	Reduce the amount of sample or, if possible, the detector gain. Verify that the alarm occurs on a peak that requires measurement. If that peak is not being measured, it can be ignored. Next, verify if sampling is working as expected; any change in sample introduction can introduce too much sample to the system and cause this alarm. Once the cause of the alarm is understood, the alarm can be disabled if necessary.
396	!	SNE out of memory at %3 line %4	SNE is out of memory.	Reduce SNE workload. Report to Customer Support.
397	!	Invalid Trace from channel %3	System error	Contact Customer Support.
398	!	Invalid Number of Temperature or Pressure Program Segments	The number of temperature program setpoints was different from the number sent.	Rebuild temperature events for method.
399	+	Results not calculated for Channel %3	System error	Contact Customer Support.

13.4 Alarms 400 - 562

GCP Alarm Descriptions 400 - 478

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
400	!	Sync Bus Failure %3	Sync Bus Test failed.	Replace SNE.
401	!	No detector present for configured detector %3	On Advance Plus unit, configured detector is invalid.	Check sys_detector_cfg configuration.
402	+	SNE reset requested	SYSCON requested a reset from the SNE. Usually means that the communications between the SNE and SYSCON timed out. This is can happen when SYSCON is overloaded.	Reset SNE. Reduce processing demands on SYSCON.
403	!	Configured Detector %3 Balance Failure	Balance Failure from an Advance+ detector.	Check sys_detector_cfg configuration.
404	?	All Methods must be in Hold before Configuring Detectors	All methods must be in hold while changing the configuration of any configured detectors.	Set all application in hold and wait for cycles to complete. Then reconfigure Advance Plus configured detector.
405	!	Method not on tracking list: Count = %3 Track ID = %4	SNE processing error.	Contact Customer Support.
406	!	Error %3 Monitoring Purge Signal	SNE or I2C error.	Reset unit.
407	?	SYSCON-SNE Communications Overload Detected	SNE or I2C messaging error.	Contact Customer Support.
408	?	Spurious detector acquisition	SNE error.	Contact Customer Support.
409	?	SNE low on Memory	SNE error.	Reduce the memory consumption. Some examples of how to do this include: Reduce the number of peaks detected by increasing the threshold. Reduce the length of cycles. Reduce the detector sampling rate.
420	!	Heartbeat timeout	MicroSAM: error	Contact MicroSAM support for assistance.
421	!	Heartbeat lost	MicroSAM: error	Contact MicroSAM support for assistance.
422	!	Cannot connect to RSP	MicroSAM: error	Contact MicroSAM support for assistance.
423	!	Method %3 has more than 8 simultaneous events	MicroSAM: error	Contact MicroSAM support for assistance.
424	!	Method %3 has more than 255 events	MicroSAM: error	Contact MicroSAM support for assistance.

#		Text	Description	Action
425	!	EZChrom Method Verification failed, code %3	The method was successfully downloaded from the SYSCON to the EMSNE but failed an integrity verification test. The method is likely corrupted or may contain a feature which is not supported. Code values are listed below: 0: Unknown error, the method is likely corrupt. 1: Invalid Method Binary, the method is likely corrupt. 10: Invalid Cycle Lag time. The Cycle Start value must be <= 0 sec. 11: Invalid Cycle Length. The Cycle Stop value must be greater than the Cycle Start. 20: Invalid Event List Binary. The method is likely corrupt. 21: Invalid Event List Binary. The method is likely corrupt. 22: Pulse DO duration too short for a pulse DO event started at the time indicated by alarm Cycle Time. 23: Pulse DO extends beyond the end of cycle, for a pulse DO event started at the time indicated by alarm Cycle Time. 24: Invalid Pulse Polarity for a Pulse DO event started at the time indicated by alarm Cycle Time. 25: Pulse DO overlapping another DO event, on the same channel, started at the time indicated by alarm Cycle Time. 26: Multiple DO events at the same time and on the same channel, at the time indicated by alarm Cycle Time. 40: The start time of a detector channel is invalid. 41: Invalid Run Duration for a detector channel. 50: Invalid Temperature Program segment. The start time of the segment is not within the cycle and was requested to start at the time indicated by alarm Cycle Time. 51: Invalid Pressure Program segment. The start time of the segment is not within the cycle and was requested to start at the time indicated by alarm Cycle Time.	The action to be taken is determined by the code value in the alarm message, as follow: 0: Replace the method. 1: Replace the method. 10: Change the Cycle Start value to be smaller or equal to 0 sec. 11: Change the Cycle Stop value to be greater than the Cycle Start. 20: Replace the method. 21: Replace the method. 22: Extend the pulse DO duration to at least 1 ms. 23: The Cycle Stop value must be increased or the pulse duration must be reduced to fit within the cycle. 24: The pulse polarity must be set to positive or negative. 25: One affected event must be deleted or moved to another time in the cycle, in order to eliminate the overlap. 26: One affected event must be deleted or moved to another time in the cycle. 40: The detector start time must be changed to be within the cycle (between Cycle Start and Cycle Stop). 41: The detector stop time must be changed to be greater than the detector start time. 50: The start time of the temperature segment must be changed to be within the cycle. 51: The start time of the pressure segment must be changed to be within the cycle.
426	!	SIMDIS not supported	The EZChrom method contains the simulated distillation analysis option which is not supported by the EMSNE.	Remove the SIMDIS option from the method or use a separate SNECON if SIMDIS is needed for this application.

#		Text	Description	Action
427	+	Detector simulation activated	The detector data reported by the DPM is from a simulation chromatogram read from the EZChrom trace binary and not from actual data acquired by the DPM. This is normal when running a simulation.	If simulation is not desired, the trace (TRC) binary must be removed from the EZChrom method for non-simulated chromatogram data to be collected.
428	!	Invalid configuration for smoothing noise measurement	The method contains a channel with smoothing noise measurement and the time range used for noise measurement is outside of the time range of the chromatogram. The analysis was aborted and the results for this channel could not be calculated.	Correct the method (on the workstation) so that the time range used for noise measurement falls within the time range of the chromatogram.
460	!	Invalid Method Write	System error	Not applicable
461	!	Argument %3 , Invalid Type %4	System error	Not applicable
462	!	Invalid Method Section %3	System error	Not applicable
463	!	Unable to Run Method, Hardware Initializing	System error	Not applicable
464	!	Unable to Run Method, Instrument Busy	System error	Not applicable
465	!	Error Running Method	An I/O error was detected while executing a cycle event associated with a running method. This is probably caused by a missing or invalid I/O module or by reusing the same detector channel in more than one application.	Verify the status of all I/O modules and correct as needed. To identify the I/O module associated with this alarm, read the alarm cycle time information and use while looking up the list of cycle events in the method. The problematic I/O is one of the events with the cycle time matching the cycle time reported with the alarm.
466	!	Error Installing Method	System error	Not applicable
467	!	Error Retrieving Method	System error	Not applicable
468	!	Unable to Run Method, Not on Method List	System error	Not applicable
469	!	Invalid component results	System error	Not applicable
470	!	Invalid Spectrum results	System error	Not applicable
471	!	Invalid calibration file %3 line %4	System error	Not applicable
472	?	Unknown method status %3	System error	Not applicable
473	?	Multiple component sets not allowed	System error	Not applicable
474	?	Multiple component scans not allowed	System error	Not applicable
475	!	Component report invalid	System error	Not applicable
476	!	Arguments do not match script	System error	Not applicable
477	!	Component report with no associated method	System error	Not applicable
478	!	Internal reset commanded	System error	Not applicable

#		Text	Description	Action
511	!	Program Failed event # %3 %4	Error running MaxBasic program.	Check message and program. If this program was written by Siemens, contact Customer Support.
512	?	Program execution cancelled: event # %3	Cancellation requested from HMI or CIM Display.	Informational. No action necessary.
513	!	Program Failed: Run requested on running event # %3	Occurs when overrun_option is set to 2 and event is run while event is still running from a previous request.	Check event timing or change overrun option.
514	!	Program Invalid frequency; disabling event # %3	Invalid program frequency.	Check program_schedule setup.
515	?	Program Overrun for event # %3	Occurs when overrun_option is set to 1 and warns that a program is running when a previous run of the same program has not finished.	Check cycle event timing or frequency of program or ignore.
516	!	Formula Failure: %3	The condition given in the alarm text prevented the formula from returning a result.	Investigate the condition given in the alarm text.
561	+	EZChrom download	Informational message.	No action necessary.
562	+	EZChrom upload for app %1 method %3	Informational message.	No action necessary.

13.5 Alarms 671 - 699

GCP Alarm Descriptions 671 - 699

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
671	!	Database: Failure: %3	1. Cannot find method; 2. Cannot find MaxBasic program; 3. Invalid stream for program; 4. Bad status on external result.	Check methods and sequences. Check program table. Check program streamcontext. Verify extresult table entries.
672	!	Database: Remote Service lost on %3	A connection for remote I/O or result transmission has been closed. This alarm is normal when the remote unit becomes unavailable.	Check the status of the remote unit.
673	!	Database:value > limit: %3	Limit exceeded.	See Alarm Text. See the Limits and Alarm Handlers tables under the GCP Application View.
674	!	Database value < limit: %3	Limit exceeded.	See Alarm Text. See the Limits and Alarm Handlers tables under the GCP Application View.
675	!	Database: No Stream at cycle start on applicaton %1	Cannot locate stream to start.	Check sequence to make sure that the entries are enabled.

#		Text	Description	Action
676	!	Database: delay limit exceeded on stream %3	Temperature or pressure wait set in the method has been exceeded.	Check temp or press controller. Check wait_delta and maxwait in temperature or pressure controller table.
677	?	Next Stream Error	Cannot locate next stream in sequence after a stream step.	Check sequence to ensure that there is an enabled stream.
678	!	End of Cycle occurred before events completed	System error	Contact Customer Support.
679	!	Application is out of service	Attempt was made to move (approve) results for an out-of-service application.	Put application in service.
680	?	Print job failed: %3 for Printer: %4	Print failure.	Check printer.
681	!	Application is disabled	Attempt was made to set disabled application to run.	Enable application.
682	!	Database: I/O failure: %3	Bad status on AO, DO write.	Check I/O channels.
683	?	Database: no normal sequence for application: %3	No active sequence.	Check sequences.
684	?	Database: no enabled entries in sequence	Cannot find enabled entry in sequence.	Check sequence.
685	?	Printer: TCP connection or queue failed	Printer connection failed.	Check address in printer table.
686	?	Printer: TCP Print failed	Communication failure with TCP printer.	Try printing again.
687	!	Results for cycle %3 lost due to SNE reset	This alarm marks results as uncertain until a cycle has been completed after resetting unit.	Automatic repair: No action necessary.
688	!	Method is corrupt: %3 reload from EZChrom	Method is corrupt.	Download method from EZChrom.
689	!	Database: Fault on Slave Application %3	A fault is being transferred from the slave to the master to invalidate the master's results.	Check fault in slave application.
690	!	Database: Slave Application not Complete %3	Master application is trying to run when slave is not in hold. The slave must complete before the master.	Check cycle length of slave application; should be shorter than master. Also could occur if autocalibration sequence for master is shorter than for the slave.
691	?	Database: Warning: %3	System error	Contact Customer Support.
692	!	Database: Divide by zero in %3	Peak measured value is zero during calibration for an autocalibration, so margin-checking cannot occur.	Check method.
693	?	Database: I/O warning: %3	System error	Contact Customer Support.
694	?	Database:value > limit: %3	Limit exceeded. Message should contain sufficient information.	See the Limits and Alarm Handlers tables under the GCP Application View.
695	?	Database value < limit: %3	Limit exceeded. Message should contain sufficient information.	See the Limits and Alarm Handlers tables under the GCP Application View.
696	?	DB: Screen access denied	System error	Contact Customer Support.
697	!	DB: Run requested on disabled program: %3	System error	Contact Customer Support.

#		Text	Description	Action
698	?	NAU %3 not available for communication	1. No analyzer reference in host table for Maxum Modbus 2. Cannot open connection to remote analyzer for Maxum Modbus or remote I/O. This is a sometimes-temporary error that indicates a problem in the host table or a network problem.	Check the cables at the sending and receiving ends.
699	?	MODBUS: result is not in address map %3	Cannot find address in map for result or analyzerstatus that came from an analyzer.	Check modbus_addmap for an incorrect anlz attribute.

13.6 Alarms 700 - 737

GCP Alarm Descriptions 700 - 736

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
700	?	Network: Analyzer %3 not available	Analyzer cannot be opened from NAU to receive message from the DCS.	Check network. Reset SYSCON.
701	?	MODBUS: scale factor or euhi absent for %3	Scale factor or EUHI is absent for scaled results.	Check contents of modbus_addmap.
702	?	MODBUS: host command for %3 invalid; undefined database location	A DCS command has been received for an undefined address.	Check contents of modbus_addmap.
703	?	MODBUS: host command for undefined address: %3	DCS message received that is for an unknown address.	Check contents of modbus_addmap.
704	?	MODBUS: host cannot write to this address: %3	The address written to by the DCS is not defined with a value_type that the host can send messages to.	Check value_type of address in modbus_addmap.
705	?	MODBUS: modbus_msg_buffer cannot be processed: %3	1. Invalid DCS command was sent to an Optichrom or 2. EUHI, calibrate, stream select, skip stream, run/hold, doset set from host that cannot be located in analyzer table.	1. Cannot clear alarms on optichrom or 2. Check analyzer table to see if entry occurs or wait until analyzer broadcasts.
706	?	MODBUS: cannot locate euhi %3	Cannot find EUHI for result.	Check EUHI address in modbus_addmap_result table.
707	?	Calibration rejected: margin exceeded for %3	Peak or group margins exceeded on auto calibration.	Check peak or group margins in EZChrom.
708	?	MODBUS: Data type failure for address: %3	Data_type mismatch with value_type.	Check modbus_addmap. This is usually self-correcting, but changes should be checked.
709	!	DB: AI averaging %3	Averaging is occurring on an AI with no result designated to receive the average.	Check configuration of AI averaging.
710	?	DB: AI averaging %3	Averaging is occurring on an AI with no result designated to receive the average.	Check configuration of AI averaging.

#		Text	Description	Action
711	+	Database: %3	System error	Contact Customer Support.
712	!	%6 Start Ver: %3 - %4 on %5	SYSCON has been reset. Informational message.	No action necessary.
713	+	System backed up	System error	Contact Customer Support.
714	+	All alarms cleared	System error	Contact Customer Support.
715	+	Database Build	System error	Contact Customer Support.
716	?	DB: Invalid Sourcekey or SourceAttribute for StatMon table: ID %3	Occurs when StatMon table is not properly configured.	Consult documentation.
717	?	DB: Calibration : margin check/reports are invalid for curve type	Occurs when a margin is set in EZChrom for a curve type that does not support margin checking.	Remove margin or change curve type.
718	?	Validation failed for %3	Validation has failed.	Check report or validation results screen on the HMI or CIM Display.
719	+	Database: SNE reset requested	SNE is indicating that it has been reset from a database request.	May indicate a communication overload.
720	?	Database: Reprocess during Run not allowed	Reprocess button pushed while application in run.	Only push reprocess button when application is in hold.
721	+	Application is in service	Informational message.	No action is necessary.
722	?	Reference Component not found; Component %3 , Reference %4	Quantra alarm.	Contact Customer Support
723	!	Database: Method ID %3 not found	Method ID is in sequence, but not in method table.	Check method table.
724	?	Calibration or Validation failed; application in hold	Calibration or validation was requested while one was already running.	Check timing of calibration or validation events.
725	?	DB: Method %3 halted	Application was halted from the HMI, CIM display, or a MaxBasic program. Informational message.	No action necessary.
726	!	DB: Slave application stream is invalid %3	A stream ID in slave does not line up with master application stream ID (new requirement for version 4.0).	Check master and slave sequences.
727	?	DB: Master app autocalibration completed before Slave app %3	Master autocalibration sequence is finishing before slave autocalibration.	Check length of sequences. Master autocalibration sequence must finish after slave autocalibration.
728	?	DB: application cannot autocalibrate	Autocalibration was requested on application that is not defined for autocalibration.	Check autocal attribute in application table.
729	!	DB: message processing timeout for message %3; attempting recovery	System error	Contact Customer Support.
730	!	DB: Unnamed peak processing exceeded (2000) for channel %3	Processing for unnamed peaks must not exceed 2000 peaks for a channel. Excess peaks were discarded.	Increase the EZChrom threshold value to reduce the number of peaks.
731	!	CAN initialization failure for application %3	Application does not start until CAN cards required by the application are initialized. The application starts regardless of the error after 30 seconds.	Verify that all application I/Os are properly initialized. Remove any I/O that depends on a CAN card that is not present.

#		Text	Description	Action
732	!	IO: underflow or lower fail-safe condition detected for %3	The firmware is reporting an under-range error for analog NAMUR data types 6 or 8.	Check the wiring for the secondary device being used. Verify proper ranges for the I/O.
733	!	IO: overflow or upper fail-safe condition detected for %3	The firmware is reporting an under-range error for analog NAMUR data types 7 or 8.	Check the wiring for the secondary device being used. Verify proper ranges for the I/O.
734	!	%3 Process not communicating	Occurs when ADHMaxumD or I2CDB connection is not present.	Contact Customer Support.
735	?	IO: AO value was clamped for %3 to %4	Indicates clamping of AO value. Informational message.	No action necessary.
736	?	Untrusted Connection Refused from %3	A connection was refused from an external client due to the trusted-connection function.	Trusted Connections are defined on the HMI. Please contact your site's administrator or Siemens Customer Service.
737	?	System Time is Incorrect	System Time is Incorrect	Set Analyzer Time or set TimeServer IP Address as described in “Regional Settings” Help in GCP.

13.7 Alarms 801 - 999

GCP Alarm Descriptions 801 - 999

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
801	?	System Error %3 in File %4 line %5	System Error	Contact Customer Support.
802	?	Error %3 opening Flash File %4	System Error	Reset the device. If the error persists, replace the Flash/SRAM module.
803	?	Error %3 closing Flash File	System Error	Reset the device. If the error persists, replace the Flash/SRAM module.
804	?	Error %3 reading Flash File	System Error	Reset the device. If the error persists, replace the Flash/SRAM module.
805	?	Error %3 writing Flash File	System Error	Reset the device. If the error persists, replace the Flash/SRAM module.

#		Text	Description	Action
806	?	Memory Corruption Error from Task %3	An attempt to free a block of memory was unsuccessful because the header was overwritten. The block of memory was not returned to the free pool.	1. Save a fresh copy of the database to your Maxum Workstation. 2. Connect to the SYSCON Debug port with hyperterminal or equivalent with 'save to file' turned on. 3. Type the login and password individually when prompted (maxum, maxum) 4. Type each of the diagnostic commands one at a time from the following list: ps, id, fr, st a, ck netstat, ifstatus, uptime. 5. Send the debug file and the .amd file to Customer Support.
807	+	Region 0 Memory Low: %3	The amount of free memory in the SYSCON is low.	Verify the amount of memory installed in the SYSCON. Contact Customer Support.
808	+	Excessive Network Communications	The internal network communication buffers (PNA buffers) are abnormally low. This indicates that the network traffic to the analyzer is abnormally high.	Investigate the cause of the high network traffic.
809	+	System is excessively busy	This is an overload situation, the processor cannot keep up with the requests.	To reduce processor load: • Reduce the size of the Modbus table. • Reduce the number and poll rate of AIs and DIs. • Reduce the number of concurrent applications running. • Reduce the communication burden with Optichrom analyzers.
810	?	Invalid dbdat file	The db.dat file, containing the 'cold' database on a Compact flash system, is missing or invalid. This may happen if the system was reset or powered down during a user initiated save to flash (initiated from the HMI, CIM display, or the workstation).	Perform a manual save to flash as soon as possible in order to have a valid db.dat file.
811	+	Excessive Maxum broadcasts were dropped	Other analyzers on the network are generating network broadcast messages at an abnormal rate (greater than 200/min). The excessive traffic is ignored. As a result, the status of the analyzers in the analyzer table may not be up to date.	Investigate the network traffic. Contact Customer Support for assistance.
812	?	Network communication overload	The internal network communication buffers (PNA buffers) are full; the system may not function normally.	Reset the device. Contact Customer Support.
813	+	SYSCON-SNE Comm Debug: %3	Debugging information, for internal use.	No action necessary.
814	?	Invalid CMOS time, check the battery	The built-in SYSCON clock has an invalid time.	Check SYSCON clock battery and replace if needed.

#		Text	Description	Action
997	+	%3	General alarm used for information. Used most often by MaxBasic programs.	No action necessary.
998	?	%3	General warning alarm used for information. Used most often by MaxBasic programs.	Immediately report runtime errors to Customer Support (please make careful note of the alarm message).
999	!	%3	General fault alarm used for information. Used most often by MaxBasic programs.	Immediately report runtime errors to Customer Support (please make careful note of the alarm message).

13.8 Alarms 1002 - 1128

GCP Alarm Descriptions 1002 - 1128 SNE Common Module Errors

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
1002	!	ID Key Not Connected on %4	All PICs: The module location ID connector is disconnected or set to 0. This is an abnormal condition; the module may not be operational.	Verify that the location ID connector is in good condition and connected properly.
1003	!	ID Key Change on %4	All PICs: The module location ID value was changed while the module was operating. This is a transient error that causes the module to automatically reset. The module can then be addressed and operated at the new location ID.	Verify that the location ID connector is in good condition and connected properly. Check for intermittent connection.
1004	!	EEPROM Bad Checksum on %4	All PICs: A checksum error was detected in the module EEPROM. The firmware will still use all the information that it can read from the EEPROM. However, the module may not operate normally.	Cycle power. If the error repeats, replace the module.
1005	?	Temp Diag Error on %4	All PICs: The on-board temperature sensor (LM-75) diagnostic failed. This alarm indicates that the ability of the board to detect a module overheat (alarm #1044) may be compromised. This alarm is may happen occasionally following a board reset. This alarm is in no way related to and should not be confused with the Overtemp Shutdown related to heater temperature controls.	No action is required unless the error happens every time the board is reset. For these repetitive errors replace the module.

#		Text	Description	Action
1007	!	Firmware Fault on %4	All PICs: A 'run-time' error was detected in the PIC firmware. For example, a timer is turned off at a point where the firmware expects it to be on. The firmware will attempt to recover. Usually an additional specific flag will be set to provide more information about the cause of the fault.	Contact Customer Support.
1008	!	EEPROM Bad Value on %4	All PICs: A value read from EEPROM is out of range or invalid. This may happen if a board's EEPROM was incorrectly initialized during manufacturing.	Cycle power. If the error repeats, replace the module.
1009	!	Local I2C error on %4	All PICs: A fatal error was detected while accessing the internal, on-board I2C bus (not the private bus between a SNE and a DPM). The communication with the on-board EEPROM or the LM75 (on board temperature sensor) is not working normally.	Cycle power. If the error repeats, replace the module.
1010	!	Fatal error on %4	All PICs: An error or an invalid operational condition was detected by the PIC firmware. The board is shut down to a failsafe mode.	Contact Customer Support.
1041	?	AO Out Of Range on %4	All PICs: An AO was set to a value outside of the allowed range. The value was clipped to the allowed range. For example, an EPC has a 0 to 100 psi nominal range for the pressure setpoint. An attempt to set the setpoint to 150 psi results in an "AO out of range" and the setpoint is clipped to remain within the allowed range (100 psi).	Locate the problematic AO and change the AO value to a value within the proper range. **Note**: With alarm 1041 or 1042, verify that the database has not become corrupt. If modifying a method or an application, re-check the settings to make sure they apply to the correct channels.
1042	?	Invalid Group Channel on %4	All PICs: The hardware I/O channel(s) requested does not exist on the module.	Check the 'Sys Hardware' table for invalid entries. Check that only detector channels are specified in the detector I/O table. Check that only EPC are defined in the pressure controller table. Check that only temperature controllers are defined in the temperature controller table.
1043	?	Invalid EEPROM Address on %4	All PICs: The on-board EEPROM addresses requested do not exist or cannot be accessed within a single command.	Report to Customer Support for further investigation.

#		Text	Description	Action
1044	?	Board overheating on %4	All PICs: A module temperature greater than the defined maximum operating temperature (default 65°C) has been detected.Overheating must be corrected as soon as possible to avoid permanent damage to the analyzer electronics, including reduced module life expectancy or other board failures. Note: This alarm can occur together with alarm 1005 (Temp Diag Error) in which case the board may not actually be overheating. This alarm concerns the temperature in the electronics enclosure. This alarm is not related to the Overtemp Shutdown related to heater temperature controls.	If the overheating condition is real, determine and correct the cause of high operating temperature. Possible causes include ambient temperature higher than specification or an inoperative fan in the electronics enclosure (restricted air flow inside the EC).
1045	?	Output Locked on %4	All PICs: The state of the DO or the value of the AO are locked and cannot be changed. The AO or DO command was ignored. Some DO and AO are locked during a board self-test.	When performing a board self-test, suspend all other operations affecting the board.
1047	?	PIC firmware diagnostic 47 on %4	System error	Contact Customer Support.
1048	?	PIC firmware diagnostic 48 on %4	System error	Contact Customer Support.
1049	?	PIC firmware diagnostic 49 on %4	System error	Contact Customer Support.
1050	?	PIC firmware diagnostic 50 on %4	System error	Contact Customer Support.
1051	?	PIC firmware diagnostic 51 on %4	System error	Contact Customer Support.
1052	?	PIC firmware diagnostic 52 on %4	System error	Contact Customer Support.
1053	?	PIC firmware diagnostic 53 on %4	System error	Contact Customer Support.
1054	?	PIC firmware diagnostic 54 on %4	System error	Contact Customer Support.
1055	?	PIC firmware diagnostic 55 on %4	System error	Contact Customer Support.
1056	?	PIC firmware diagnostic 56 on %4	System error	Contact Customer Support.
1081	+	Data Not Ready on %4	All PICs: The data requested is not available.	Contact Customer Support.
1082	+	Reset Detect on %4 %5	All PICs: A reset was detected. Normal indication that the PIC was reset.	No action necessary.
1083	+	Power Up on %4 %5	All PICs: A power-up cycle was detected. Normal indication that the PIC was powered up.	No action necessary.

#		Text	Description	Action
1084	+	I2C Timeout on %4	All PICs: An I2C communication timeout timer has expired. The timer is reset after each successful character processed. Only an addressed module may generate a timeout. The timeout can occur on incoming and outgoing characters.	Contact Customer Support.
1085	+	I2C Read Past End on %4	All PICs: The I2C communication master did not stop reading after the complete response had been sent.	Contact Customer Support.
1086	+	I2C Buffer Overflow on %4	All PICs: The combination of the transmit and receive I2C message was too large, causing a buffer overflow. (With kernel revision 1: SSP_READ_UNEXPECTED_STOP, a stop condition occurred before the end of the response).	Contact Customer Support.
1087	+	I2C Write Past End on %4	All PICs: In an I2C message, more than the number of bytes specified by the length was written. The extra bytes are ignored.	Contact Customer Support.
1088	+	I2C Resync Error on %4	All PICs: Severe I2C error, causing the current message to be dropped. Communication will re-synchronize after the next START or STOP condition. Usually associated with alarm 1092.	Contact Customer Support.
1089	+	I2C Write Unexpected Stop on %4	All PICs: A new I2C message was received in the middle of a write. The old message was discarded and the new message is served (this message may be out of sequence and therefore cause other flags to be set).[With kernel revision 1: SSP_WRITE_UNEXPECTED_STOP, during a slave write a stop condition occurred before the message was completed. The message is ignored.]	Contact Customer Support.
1090	+	I2C Write Unexpected Start on %4	All PICs: A new I2C message was received in the middle of a read. The old message was discarded and the new message is served (this message may be out of sequence and therefore cause other flags to be set). [With kernel revision 1: SSP_WRITE_UNEXPECTED_START, during a slave write a Start or Repeat Start (RS) condition was detected before the entire message was received (according to the length field). The message is ignored and processing resumes following the Start or Repeat Start.]	Contact Customer Support.

#		Text	Description	Action
1091	+	I2C Write Before Read on %4	All PICs: An attempt was made to write an I2C message before reading the response from a previous message. This indicates that an attempt was made to do a Slave Write - RepeatStart - Slave Write combination.	Contact Customer Support.
1092	+	I2C Read Unexpected on %4	All PICs: An I2C read from the peripheral was attempted before a slave write loaded a command.	Contact Customer Support.
1093	+	I2C Invalid Checksum on %4	All PICs: An I2C message with an invalid checksum was received. The message was ignored.	Contact Customer Support.
1094	!	Data not available on %4	All PICs: Some data was lost and is no longer available. For a detector channel it means that a 'Detector Read' command was received with an invalid index. This can happen when a request to retransmit detector data came too late when the data was already gone from the buffer. This situation may also happen while accessing the I/O related to the LM75 (BOARD_TEMPERATURE and OVERTEMP_SETPOINT). It indicates that the local I2C bus was not available to perform the desired action.	Cycle power. If the error repeats, replace the module or the SNECON.
1095	+	Invalid Message on %4	All PICs: An I2C message with a valid checksum was not recognized or had an invalid op-code.	Cycle power. If the error repeats, replace the module or the SNECON.
1096	+	Diagnostic mode enabled on %4	Informational message.	No action Necessary.
1121	!	Firmware Math error on %4	All PICs: An unexpected math operation error was detected by the PIC. It can be an un-handled overflow, underflow, etc. This flag is always associated with a FIRMWARE_FAULT flag.	Cycle power. If the error repeats, replace the module.
1122	!	Firmware Mem error on %4	All PICs: A jump or a call was made to an invalid PIC memory location causing the PIC to be reset. This flag is always associated with a FIRMWARE_FAULT flag.	Cycle power. If the error repeats, replace the module.
1123	!	Firmware Table error on %4	All PICs: An error was detected when addressing an internal PIC firmware table. The index in the table is likely to be invalid. This flag is always associated with a FIRMWARE_FAULT flag.	Cycle power. If the error repeats, replace the module.

#		Text	Description	Action
1124	!	Firmware Watchdog on %4	All PICs: The PIC watch dog timer has expired causing a module reset. This flag is always associated with a FIRMWARE_FAULT flag. It can be an indication that the I2C clock or data line was held low for more than the timeout duration (nominally 30 ms). It can also indicate that the PIC oscillator is not working normally.	Cycle power. If the error repeats, replace the module.
1125	!	Firmware System Monitor on %4	All PICs: The background system monitoring task has discovered a problem causing the PIC to be reset. It can be that the interrupt or timer were disabled when they should have been enabled, or some similar error. This flag is always associated with a FIRMWARE_FAULT flag.	Cycle power. If the error repeats, replace the module.
1126	!	Firmware Application on %4	All PICs: A general PIC firmware error was encountered causing a board reset.	Cycle power. If the error repeats, replace the module.
1127	!	Firmware Stack Overflow on %4	An abnormal condition was detected in the firmware of a specified module.	Reset the device. If the condition persists, replace the affected module.
1128	!	Firmware Unknown Reset on %4	An abnormal condition was detected in the firmware of a specified module.	Reset the device. If the condition persists, replace the affected module.

13.9 Alarms 1317 - 1319

GCP Alarm Descriptions 1317 - 1319

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#	!	Text	Description	Action
1317	!	Valve Switch Error on %4	SVCM PIC: The SVCM firmware has detected an invalid condition in the circuit driving the solenoid valves. One or more valves is likely to be malfunctioning.	Replace the module.
1318	!	J10 Disconnected on %4	SVCM PIC: The SVCM J10 connector is not properly connected and the corresponding bank of solenoids may not work.	Check the J10 connection.
1319	!	J11 Disconnected on %4	SVCM PIC: The SVCM J11 connector is not properly connected and the corresponding bank of solenoids may not work.	Check the J11 connection.

13.10 Alarms 1617 - 1697 Pecm Errors

GCP Alarm Descriptions 1617 - 1697 PECM Errors

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
1617 - 1624	!	[LWH1; LWH2; LWH3; LWH4; LWH5a; LWH5b; LWH6a; LWH6b] Output Fault on %4	PECM PIC: On-board diagnostic indicating that a LWH is not working correctly. This diagnostic is active only when a SSR output is configured for PECM self-control, when the loop-back connector is present. The diagnostic is not active when the control is from a temperature controller. If this happens when the output is controlled by a temperature controller, it indicates a defective harness between the DPM and the PECM. (The PLUG_DETECT pin (#5) is not grounded and the output is turned on).	If associated with an 'Invalid configuration alarm' (1659), then check the J connector on the PECM associated with the specified LWH. Otherwise, replace the PECM or the cable between the DPM and PECM.
1625, 1626	!	ABH [1 - 2] Output Fault on %4	PECM PIC: On-board diagnostic indicating that an ABH is not working correctly. This diagnostic is active only when a SSR output is configured for PECM self-control, when the loop-back connector is present. The diagnostic is not active when the control is from a temperature controller. If this happens when the output is controlled by a temperature controller, it indicates a defective harness between the DPM and the PECM. (The PLUG_DETECT pin (#5) is not grounded and the output is turned on).	If associated with an 'Invalid configuration alarm' (1659), then check the J connector on the PECM associated with the specificed ABH. Otherwise, replace the PECM or the cable between the DPM and PECM.
1627	!	ABH Ctrl Plug Missing on %4	PECM PIC: The air bath heater control cable is missing in J9 and at least one of the air-bath heaters is non-disabled. If the cable is missing, the NO_AIR_ABH_x flag will also be set on the non-disabled air-bath heater channels.	If the air bath heater is not used, then disconnect J91 and J92 on PECM in order to eliminate the alarm. Otherwise check J9.
1628	!	ABH Air Plug Missing on %4	PECM PIC: The air-bath heater air-sensor connector is missing and at least one of the air bath heaters is non-disabled.	Check J10 on PECM.
1629	!	Purge Indicator not available on %4	PECM PIC: Neither the SYSCON nor the HMI level 1 LED panel is connected. It indicates that there is no purge indicator connected, the PECM has nowhere to report the purge information.	Check J1302 and J101 on PECM. Verify the cable connected into J1302.
1630	!	The low wattage relay board is missing	PECM PIC: The low wattage relay board is not connected properly to the PECM electronics.	Confirm that the relay board is connected properly. Replace the relay board and/or the PECM electronics.

#		Text	Description	Action
1633 - 1638	!	Output error on solenoid valve, [left location, left group; left location, right group; right location, left group; right location, right group; upper location, left group; upper location, right group]	PECM PIC: The solenoid output status read-back value is incorrect for at least one valve in the group. This can happen when a solenoid cable is disconnected, even momentarily. Note that the read-back check can only be accomplished when the state of the output to a solenoid is OFF (no verification can be done on an output when it is ON).	Verify the cable connections. Replace the solenoid group cable. Replace the solenoid group. Replace the PECM board.
1657 - 1658	?	ABH[1 - 2] No Air on %4	PECM PIC: The air bath heater #n is turned off, as the air pressure is too low for a safe operation of the heater. This flag is set only if the corresponding air bath heater is in use. The PECM considers the air bath heater in use if a loopback connector or a cable from a temperature controller is connected.	If the channel is not in use, disconnect the loopback connector or temperature controller cable. Check the air pressure on the corresponding air bath heater. Make sure that it is 10 psi or above. Electrically disconnect the pressure switch: 1. Verify that it operates normally by measuring the contact resistance with a multimeter at 0 and 10 psi. 2. Verify with a multimeter that there is no continuity to ground. Verify the harness with a multimeter. Replace the PECM.
1659	?	Invalid Configuration on %4	PECM PIC: An attempt was made to control a heater output with a DO command while the corresponding loopback is not installed.	Install or verify the corresponding PECM loopback plug.
1665 - 1670	?	Solenoid valve disconnected, [left location, left group; left location, right group; right location, left group; right location, right group; upper location, left group; upper location, right group]	This alarm can be generated as a result of either of the following: 1. The cable to the corresponding valve group was disconnected since the last time the PECM board was reset. As a result, all valves in that group may not work properly. 2 A digital output was invoked to a disconnected valve group. The output cannot be controlled.	Verify that the solenoid valve cable is properly seated in the connector and reset the device. Verify the configuration of the DOs in all applications to ensure that no DO is referencing a valve in a non-connected group.
1697	?	Purge Loss on %4	PECM PIC: Purge failure in the EC enclosure. The pressure differential between the interior and exterior of the EC is not high enough. Depending on the environment classification where the analyzer is installed, this alarm may indicate an unsafe condition that requires immediate action to correct.Check supply-air pressure.	Verify that door is closed. Check for damaged door gaskets. Verify that all cables and tubes entering the EC are sealed properly.

13.11 Alarms 1917 - 2005 DPM TCD

GCP Alarm Descriptions 1917 - 1999 DPM Errors

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
1917	!	Balance Hardware Failure TCD L %5 on %4	System error	Contact Customer Support.
1918	!	Balance Hardware Failure TCD U %5 on %4	System error	Contact Customer Support.
1919, 1920	!	A/D Failure TCD [L; U] %5 on %4	TCD DPM Detector PIC: Set when the corresponding Analog to Digital Converter hardware does not work properly. The flag will be set if the A/D internal calibration cycle is not completed within a predetermined period of time or the A/D does not report any valid data within a pre-defined timeout period. Note: A firmware problem affecting the version 1.000 of the TCD detector PIC may cause an A/D failure flag to show-up occasionally following a PIC reset. This is not a sign of a defective A/D converter.	Cycle power. If the error repeats consistently, replace the module.
1921	!	PIC Timeout on %4	System error	Contact Customer Support.
1922	!	Incompatible Hardware on %4	TCD DPM Detector PIC: The PIC firmware is not compatible with the DPM board.	Replace the module.
1925	?	Glow Plug bad	FID DPM Detector PIC: The glow plug is not working correctly. The diagnostic is performed when the board is reset or when an attempt is made to light the flame. The hardware diagnostic verifies that a minimum current and voltage is present, checking for a short and open glow plug. This may also indicate that a spark igniter that is not connected properly.	Confirm that the glow plug or spark igniter cable is securely inserted in the corresponding connector. Replace the glow plug. Replace the DPM.
1926	!	Invalid PIC index	DPM Detector PIC: The PIC index is not valid, the DPM board is not working normally.	Replace the module.
1927	!	Mezzanine module disconnected	FID DPM Detector PIC: The mezzanine-module ID value is 0 or 15 indicating that no module is present or is malfunctioning.	Verify that the mezzanine module is properly connected. Replace the module on the DPM. Replace the DPM.
1928	!	Mezzanine-module ID changed	FID DPM Detector PIC: The mezzanine-module ID value has changed since the last time the board was reset. Indicates a bad contact or a bad component.	Verify that the mezzanine module is properly connected. Replace the module on the DPM. Replace the DPM.

#		Text	Description	Action
1929	!	Mezzanine-module ID invalid	FID DPM Detector PIC: The mezzanine-module ID value is not supported by this DPM board. More specifically, the module value is pointing to a non-initialized EEPROM region on the DPM. This may indicate an invalid mezzanine module or an older revision of the DPM that was manufactured before the mezzanine module was defined.	Verify the DPM revision level and replace as needed. Replace the mezzanine module on the DPM.
1930	!	Mezzanine-module ID reserved	FID DPM Detector PIC: The mezzanine-module ID value is set to a value reserved for future expansion.	Verify the DPM revision level and replace as needed. Replace the mezzanine module on the DPM.
1957, 1958	!	Balance Failure TCD [L; U] %5 on %4	TCD DPM Detector PIC: For Rev 1 TCD DPM: A detector balance sequence failed because of a hardware failure, an improper configuration, or sequence of events. Some possible causes include: The detector beads are too unbalanced to be 'balance-able'. The detector signal is not stable enough and proper balance could not be obtained before the maximum number of iterations was reached. The A/D or D/A do not work properly. The detector is not configured for acquisition or turned off. SIMULATE_TCD_x is set to ‘1’ (the detector cannot be balanced in detector simulation mode).The balance is disabled (DISABLE_BALANCE_TCD_x is set to ‘1’). The sampling period was changed during the balance sequence.	Contact Customer Support.
1959, 1960	?	Balance Out Of Limit TCD [L; U] %5 on %4	TCD DPM Detector PIC: For Rev 1 TCD DPM: A detector balance value is above the normal limits. The balance may still work as this is an early warning.	If associated with a balance failure (alarm 1957), then the source of the balance failure must be corrected. If not associated with a balance failure and the balance limits are normal (greater than 9 Volts or 90%) then schedule maintenance to replace the detector beads. If using Rev 2 TCD DPM or FID DPM, contact Customer Support.
1961, 1962	!	The ADC missed a sample on channel [1 - 2] on %4	A transient error was detected by the Analog-to-Digital Converter of the DPM, channel #n. The missing or invalid data point was replaced by a point with a value of zero.	Reset the DPM. If the error repeats, replace the DPM.

#		Text	Description	Action
1965	?	Flame ignition failure	TCD DPM Detector PIC: The FID flame could not be lit within the predefined delay (25 or 60 sec). No other attempt will be made to automatically light the flame until the MANUAL IGNITION DO is activated.	If associated with an alarm 2225 (Glow plug failure), then diagnose and fix this other alarm first. If a BASIC program is used to control the electronic pressure controller (EPC) to adjust the gas mixture for proper ignition, confirm that the poll rate of the 'IGNITE' DI is set to 2 sec. Check that the gas supply pressure is adequate. Verify the proper operation of the EPC.
1966	?	Gain override	TCD DPM Detector PIC: An external signal is applied to the DPM, overriding the DPM gain control. This is a normal situation if a signal is connected to the external gain-select connector.	If no external signal is connected, replace the DPM.
1967	?	Gain select not supported	TCD DPM Detector PIC: An attempt was made to change the gain on a configuration that does not support the dual gain feature. The request was ignored.	Remove access to the GAIN_ALT_SELECT DO.
1968	?	Igniter type changed	TCD DPM Detector PIC: The spark igniter was connected or disconnected during an ignition sequence, causing the ignition sequence to be aborted.	Verify that the igniter is properly connected. Replace the igniter. Replace the DPM.
1997, 1998	!	Buffer Overflow TCD [L; U] %5 on %4	DPM Detector PIC: The PIC detector data buffer filled up before an I2C command was received to retrieve the data. Some data was lost. The SNECON was not fast enough to retrieve the points or the SNECON stopped polling without turning off the corresponding detector channel. This may happen with a combination of a very high speed detector with a large burst of I/O commands.	Stagger the balance events and valve switching events by approximately 10-20 ms to distribute the load on the I2C bus. Disconnect the SNECON debug cable (if connected) and reset. Reload the SNECON OS and APP software.
2005	!	Firmware error	Firmware error	Contact Customer Support.
2006	!	Bias off	FID DPM Detector PIC: The detector is used while the 300 Volts bias is disabled. The data validity is unknown.	Set the 'disable bias' DO to ‘0’.

13.12 Alarms 2217 - 2306 DPM FID

GCP Alarm Descriptions 2217 - 2306 DPM Errors

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
2217	!	Balance Hardware Failure FID L %5 on %4	System error	Contact Customer Support.
2218	!	Balance Hardware Failure FID U %5 on %4	System error	Contact Customer Support.
2219, 2220	!	A/D Failure [FID; TCD] %5 on %4	DPM Detector PIC: Set when the corresponding Analog to Digital Converter hardware does not work properly. The flag will be set if the A/D internal calibration cycle is not completed within a predetermined period of time or the A/D does not report any valid data within a pre-defined timeout period.	Cycle power. If the error repeats consistently, replace the module.
2221	!	PIC Timeout on %4	System error	Contact Customer Support.
2222	!	Incompatible Hardware on %4	The firmware has detected an invalid condition indicating that the hardware is not compatible with the firmware.	Replace the module.
2225	?	Glow Plug Bad on %4	FID DPM Detector PIC: The glow plug is not working correctly. The diagnostic is performed when the board is reset or when an attempt is made to ignite the flame. The hardware diagnostic verifies that a minimum current and voltage is present, checking for a short and open glow plug. This may also indicate that a spark igniter is not connected properly.	Confirm that the glow plug or spark igniter cable is securely inserted in the connector. Replace the glow plug. Replace the DPM.
2226	!	Invalid PIC index	DPM Detector PIC: The PIC index is not valid; the DPM board is not working normally.	Replace the module.
2227	!	Mezzanine module disconnected	FID DPM Detector PIC: The mezzanine-module ID value is 0 or 15 indicating that no module is present or is malfunctioning.	Verify that the mezzanine module is properly connected. Replace the module on the DPM. Replace the DPM.
2228	!	Mezzanine-module ID changed	FID DPM Detector PIC: The mezzanine-module ID value has changed since the last time the board was reset. Indicates a bad contact or a bad component.	Verify that the mezzanine module is properly connected. Replace the module on the DPM. Replace the DPM.

#		Text	Description	Action
2229	!	Mezzanine-module ID invalid	FID DPM Detector PIC: The mezzanine-module ID value is not supported by this DPM board. More specifically, the module value is pointing to a non-initialized EEPROM region on the DPM. This may indicate an invalid mezzanine module or an older revision of the DPM that was manufactured before the mezzanine module was defined.	Verify the DPM revision level and replace as needed. Replace the mezzanine module on the DPM.
2230	!	Mezzanine-module ID reserved	FID DPM Detector PIC: The mezzanine-module ID value is set to a value reserved for future expansion.	Verify the DPM revision level and replace as needed. Replace the mezzanine module on the DPM.
2257	!	Balance Failure FID on %4	FID DPM Detector PIC: A detector balance sequence failed because of a hardware failure or because of an improper configuration or sequence of events. Some possible causes are: The detector signal is not stable enough and proper balance could not be obtained before the maximum number of iterations was reached. The A/D or D/A do not work properly. The detector is not configured for acquisition or turned off. SIMULATE_FID is set to 1 (the balance cannot be done in detector simulation mode). The balance is disabled (DISABLE_BALANCE_FID is set to 1). The sampling period was changed during the balance sequence.	Contact Customer Support.

#		Text	Description	Action
2258	!	Balance Failure TCD %5 on %4	FID DPM Detector PIC: A detector balance sequence failed because of a hardware failure or because of an improper configuration or sequence of events. Some possible causes are: The detector beads are too mismatched to be balance corrected. The detector signal is not stable enough and proper balance could not be obtained before the maximum number of iterations was reached. The A/D or D/A do not work properly. The detector is not configured for acquisition or turned off. SIMULATE_TCD is set to ‘1’ (the balance cannot be done in detector simulation mode). The balance is disabled (DISABLE_BALANCE_TCD is set to ‘1’). The sampling period was changed during the balance sequence.	Contact Customer Support.
2259	?	Balance Out Of Limit FID on %4	FID DPM Detector PIC: A detector balance value is above the normal limits. The balance may still work as this is an early warning.	If associated with a balance failure (alarm 2257), then the source of the balance failure must be corrected. If not associated with a balance failure and the balance limits are normal (greater than 9 Volts or 90%), schedule maintenance to clean or replace the FID detector.
2260	?	Balance Out Of Limit TCD %5 on %4	TCD DPM Detector PIC: A detector balance value is above the normal limits. The balance may still work as this is an early warning.	If associated with a balance failure (alarm 2258), then the source of the balance failure must be corrected. If not associated with a balance failure and the balance limits are normal (greater than 9 Volts or 90%) then maintenance should be scheduled to replace the detector beads.
2261, 2622	!	The ADC missed a sample on channel [1 - 2] on %4	A transient error was detected by the Analog-to-Digital Converter of the DPM, channel #n. The missing or invalid data point was replaced by a point with a value of zero.	Reset the DPM. If the error repeats, replace the DPM.
2265	?	Flame Ignition Failure on %4	FID DPM Detector PIC: The FID flame could not be ignited within the predefined delay (25 or 60 sec). No other attempt will be made to automatically ignite the flame until the MANUAL IGNITION DO is activated.	If associated with an alarm 2225 (Glow plug failure), then diagnose and fix that alarm first. If a BASIC program is used to control the electronic pressure controller (EPC) to adjust the gas mixture for proper ignition, confirm that the poll rate of the 'IGNITE' DI is set to 2 sec. Verify adequate gas-supply pressure. Verify the proper operation of the EPC.

#		Text	Description	Action
2266	?	Gain override	FID DPM Detector PIC: An external signal is applied to the DPM, overriding the DPM gain control. This is a normal situation if a signal is connected to the external gain-select connector.	If no external signal is connected, replace the DPM.
2267	?	Gain select not supported	FID DPM Detector PIC: An attempt was made to change the gain on a configuration that does not support the dual gain feature. The request was ignored.	Remove access to the GAIN_ALT_SELECT DO.
2268	?	Igniter type changed	FID DPM Detector PIC: The spark igniter was connected or disconnected during an ignition sequence, causing the ignition sequence to be aborted.	Verify that the igniter is properly connected. Replace the igniter. Replace the DPM.
2297, 2298	!	Buffer Overflow [FID; TCD] on %4	FID DPM Detector PIC: The PIC detector data buffer filled up before an I2C command was received to retrieve the data. Some data was lost. The SNECON was not fast enough to retrieve the points or the SNECON stopped polling without turning off the corresponding detector channel. This may happen with a combination of a very high speed detector with a large burst of I/O commands.	Stagger the balance events and valve switching events by approximately 10-20 ms to distribute the load on the I2C bus. Disconnect the SNECON debug cable (if connected) and reset. Reload SNECON OS and APP software.
2299	!	Detector Disabled on %4	FID DPM Detector PIC: An attempt was made to read detector information from a disabled detector.	Cycle power. If the error repeats replace the module.
2305	!	Flame Out on %4	FID DPM Detector PIC: The flame is out; the data generated on the FID channel is invalid.	Verify adequate flame gas supply. Verify the operation of any associated EPC.
2306	!	FID Bias off on %4	FID DPM Detector PIC: The detector is used while the 300 Volts bias is disabled. The data validity is unknown.	Set the 'disable bias' DO to ‘0’.

13.13 Alarms 2500 - 2577 Access Bus Driver Errors

GCP Alarm Descriptions 2500 - 2577 Access Bus Driver Errors

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
2500	?	I2C Premature Stop on %4	SNECON I2C driver: A stop condition was detected in the middle of a transfer (SNECON hardware revision 2.x).	Contact Customer Support.
2501	?	I2C No Acknowledge (Module Disconnected?) on %4	SNECON I2C driver: No module responding to the I2C address. A module was disconnected or is no longer responding. This can also happen if the PIC-index is erroneously set to 0 as this is a way to bypass the I2C address resolution table and directly address the I2C bus.	Reset the analyzer.
2502	?	I2C NS486 Timeout Overflow on %4	SNECON I2C driver: An I2C communication timeout condition was detected (SNECON hardware revision 2.x).	Contact Customer Support.
2503	?	I2C Address is Odd on %4	SNECON I2C driver: Illegal I2C address.	Reset the analyzer. Reload SNECON OS software.
2505	?	I2C Driver Not Initialized	SNECON I2C driver: An attempt was made to communicate to the I2C driver before it was initialized.	Reset the analyzer. Reload SNECON OS and APP software.
2508	?	I2C Improper Acknowledge on %4	SNECON I2C driver: No module responding to the I2C address. A module was disconnected or is no longer responding (SNECON hardware revision 2.x).	Contact Customer Support.
2509	?	I2C Invalid Message Checksum Received on %4	SNECON I2C driver: A message was received with an invalid checksum.	(SNECON hardware revision 2.x): Verify that the application does not use a hardware address that does not exist.
2510	?	I2C Module Not Found: %4	SNECON I2C driver: No module of this 'module type' and 'location id' is listed in the address table.	Reset the analyzer. Verify that the application does not use a hardware address that does not exist.
2511	?	I2C Invalid Opcode Received from %4	SNECON I2C driver: The message received corresponds to an unrecognized opcode.	Reset the analyzer. Reload SNECON OS and APP software. Replace the SNECON.
2512	?	I2C Error Reading ISR Queue	SNECON I2C driver: An error was detected reading a communication queue (SNECON hardware revision 2.x).	Reset the analyzer.
2513	?	I2C Message Too Big on %4	SNECON I2C driver: The I2C message received is too large and is not valid.	Contact Customer Support.
2515	!	I2C Address Table Full	SNECON I2C driver: No free addresses on the I2C bus. There is a limit of 120 addresses per bus (each PIC occupies one address).	Reset the analyzer.

#		Text	Description	Action
2516	?	I2C Invalid Bus on %4	SNECON I2C driver: Invalid I2C bus identification number.	Reset the analyzer.
2518	?	I2C Unknown Address Received on %4	SNECON I2C driver: SNECON firmware internal error.	Reset the analyzer.
2519	?	I2C Invalid Data Type on %4	SNECON I2C driver: SNECON firmware internal error.	Reset the analyzer.
2520	?	I2C Invalid Number of I/O Channels on %4	SNECON I2C driver: SNECON firmware internal error.	Reset the analyzer.
2521	?	I2C Bus Conflict; Lost Arbitration on %4	SNECON I2C driver: An I2C communication error was detected (SNECON hardware revision 2.x).	Confirm that only one SNECON is present on the bus; a revision 2 SNECON cannot share the I2C bus.
2522	?	I2C Using a Free Message Buffer on %4	SNECON I2C driver: SNECON firmware internal error.	Reset the analyzer.
2523	?	I2C NS486SXF-C0 Patch Timeout on %4	SNECON I2C driver: SNECON firmware internal error.	Reset the analyzer. Replace the SNECON.
2525	?	I2C Invalid Driver Control Command on %4	SNECON I2C driver: SNECON firmware internal error.	Reset the analyzer Reload the SNECON OS and APP software. Replace the SNECON.
2526	?	I2C Capability Information Too Big on %4	SNECON I2C driver: SNECON firmware internal error.	Reset the analyzer.
2527	?	I2C Message Lost in a Controller Reset: %4	SNECON I2C driver: A pending I2C message could not be sent and was lost as a result of a reset of the I2C interface. The cause of the reset is usually a recurring communication error.	Contact Customer Support.
2529	?	I2C Invalid Capability Version; Incompatible Firmware on %4	SNECON I2C driver: An I2C module has provided an invalid device capability information message. The associated 'Sys_Hardware' table may be invalid.	Replace the module Reload newer SNECON OS and APP software.
2530	?	I2C Internal Error; Invalid Daemon Function on %4	System error	Contact Customer Support.
2531	?	I2C Internal Error; Invalid Info on %4	SNECON I2C driver: SNECON firmware internal error.	Reset the analyzer.
2532	?	I2C Invalid Device ID Version; Incompatible Firmware on %4	SNECON I2C driver: An I2C module has provided an invalid device ID information message. The module type and location ID information may be invalid.	Replace the module. Reload SNECON OS and APP software.
2534	?	I2C Internal Error; Bus Manager Invalid Command on %4	System error	Contact Customer Support.
2537	?	I2C Address Table not initialized on %4	SNECON I2C driver: SNECON firmware internal error.	Reset the analyzer.
2538	?	I2C ISR Lockup	SNECON I2C driver: The SNECON message receive indicator is stuck (SNECON revision 3.0 hardware only).	Reset the analyzer. Replace the SNECON.
2539	?	I2C Invalid Message Status Size on %4	SNECON I2C driver: SNECON firmware internal error.	Reset the analyzer. Replace the SNECON.

#		Text	Description	Action
2540	?	I2C Message Too Short on %4	SNECON I2C driver: An I2C message received by the SNECON is too short to be valid.	Contact Customer Support.
2541	+	I2C FPGA Queue Full on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Replace the SNECON.
2542	?	I2C FPGA Write Before End on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Replace the SNECON.
2543	?	I2C FPGA Write After End on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Replace the SNECON.
2544	?	I2C FPGA Message Too Short on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Replace the SNECON.
2545	?	I2C FPGA Invalid Checksum on %4	SNECON I2C driver: SNECON on-board communication error. Known to happen very infrequently with SNECON I2C FPGA rev 23 or lower (SNECON revision 3.0 hardware only).	Ignore the alarm. If occurring frequently, replace the SNECON.
2546	?	I2C FPGA Invalid Size on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2547	!	I2C Heartbeat Timeout Expired; Resetting Controller	SNECON I2C driver: A SNECON PIC was not responding and was reset (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2549	?	I2C Heartbeat Counter Mismatch on %4	SNECON I2C driver: One or more messages were lost on the on-board communication (SNECON rev 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2550	?	I2C Invalid Message Status on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2551	?	I2C Internal Error; Invalid Block Structure ID on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2552	?	I2C Internal Error; Invalid Block Offset on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2553	?	I2C Internal Error; Invalid Block ID on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2554	?	I2C Internal Error; New Block Offset Non-Zero on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.

#		Text	Description	Action
2555	?	I2C Internal Error; Block Table full	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2556	?	I2C Not Enough Memory	SNECON I2C driver: SNECON firmware internal error.	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2557	?	I2C Internal Error; Block Too Large on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2558	?	I2C Internal Error; Block Not Found on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2559	?	I2C Internal Error; Invalid Block Size on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2560	!	I2C Driver OS and Application version mismatch	SNECON I2C driver: The version number of the SNECON OS is incompatible with the SNECON APP version.	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2562	?	I2C Internal Error; Bad state on %4	SNECON I2C driver: SNECON firmware internal error.	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2563	!	I2C FPGA bad version	SNECON I2C driver: The SNECON I2C FPGA is incompatible or broken.	Reload the SNECON OS with the newest version. Replace the SNECON.
2564	!	I2C Temperature Block Version Invalid	SNECON I2C driver: The temperature controller PID parameter data block supplied by the SYSCON is incompatible.	Reload the SNECON OS and APP software to the corresponding SYSCON version.
2565	?	I2C Opcode not expected in current state on %4	SNECON I2C driver: Unexpected I2C message opcode received by the SNECON from a module.I2C communication error.	Contact Customer Support.
2566	!	I2C Modules were reset following multiple errors	SNECON I2C driver: A fatal error or multiple consecutive retries have forced the I2C controller to reset.	Contact Customer Support.
2567	!	I2C Header Index Mismatch; Message Lost	System error	Contact Customer Support.
2568	?	I2C Internal Error; Invalid Block Index on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software.
2569	?	I2C FPGA Queue Full on %4	SNECON I2C driver: The SNECON I2C FPGA queue is full, the PIC is no longer processing I2C messages.	Reset the analyzer. Reload the SNECON OS software.
2570	?	I2C FPGA Packet Too Big on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.

#		Text	Description	Action
2571	?	I2C FPGA Recovery Failed on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2572	?	I2C FPGA Read in progress not set after header on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2573	?	I2C Not enough memory in ISR on %4	SNECON I2C driver: SNECON firmware internal error (SNECON revision 3.0 hardware only).	Reset the analyzer. Reload the SNECON OS software. Replace the SNECON.
2574	!	I2C PIC Reset Detected on %4	SNECON I2C driver: A problem was detected by a SNECON PIC and it went through a reset. Can also be caused by an I2C communication error.	If occurring frequently, replace the SNECON.
2575	?	I2C General AO error on %4	SNECON I2C driver: A channel specific error was detected while an AO command was processed (Example AO out of range) . A more specific alarm will be reported by the module on the next poll.	Provides the channel information for an alarm reported on the same module.
2576	?	I2C General DO error on %4	SNECON I2C driver: A channel specific error was detected while an DO command was processed (Example DO out of range) . A more specific alarm will be reported by the module on the next poll.	Provides the channel information for an alarm reported on the same module.
2577	?	I2C bus configuration changed	The configuration between internal I2C (5V I2C) and external, SSSI (10V I2C) was changed. The configuration change is ignored until the next reset.	If the configuration was changed intentionally, simply reset the device. Otherwise, verify that the cable in J3 and J13 on SNECON V4 or J1 and J3 on the SIB are properly inserted.

13.14 Alarms 2817 - 2904 DPM Temperature

GCP Alarm Descriptions 2817 - 2904 - DPM Temperature

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#	!	Text	Description	Action
2817	!	12V Error on %4	Temperature controller PIC: The 12 volt supply is not working normally.	Disconnect the RTDs and feedthrough connector. If the error does not go away, replace the DPM. If the error goes away, confirm that there is no continuity between any RTD lead and ground.
2818	!	Setpoint Board Missing on %4	Temperature controller PIC: The OTS and temperature limit configuration board (t-rating configurator) is not detected on J10. The temperature controller is non-functional.	Install or replace the TLIM-OTS T-rating configuration board.
2819, 2820	!	RTD Failure [1 - 2] on %4	Temperature controller PIC: An attempt was made use a temperature channel that has an invalid RTD signal. The RTD is shorted or open circuit. The temperature controller cannot function.	Verify the 4-wire temperature sense RTD on channel #1. The RTD resistance must be between 81 and 269 ohms. Confirm that none of the leads have any continuity with ground.
2823, 2824	!	SSR Cable [1 - 2] Missing on %4	System error	Contact Customer Support.
2825	!	A/D Failure on %4	Temperature controller PIC: An Analog to Digital Converter chip does not work properly. The flag will be set if the A/D internal calibration cycle is not completed within a pre-determined period of time or the A/D does not report any valid data within a pre-defined timeout period. Note: A firmware problem affecting the version 1.002 of the Temperature controller PIC may cause an A/D failure flag to show-up occasionally following a PIC reset. This is not a sign of a defective A/D converter.	Cycle power. If the error repeats consistently, replace the module.
2899, 2900	!	Over Temp Shutdown [1 - 2] on %4	Temperature controller PIC: The Over-Temp Shutdown function is active on channel #1. The heater cannot be turned on. The overtemp shutdown condition indicates that the temperature reached the absolute limit..	Check for: A disconnected TLIM-OTS configuration board. A temperature setpoint too high for the allowed T-rating. A defective OTS or T-limit temperature probe. A defective DPM A defective (shorted) SSR.

#	!	Text	Description	Action
2901, 2902	?	Deviation [1 - 2] Exceeded on %4	Temperature controller PIC: The measured temperature deviation (TEMP_DEVIATION) has exceeded the corresponding MAX_DEVIATION value. The PID control was not successful to control the heater with the desired precision on channel #1. A large deviation is normal on power-up and immediately following a change in the temperature setpoint.	Check for: Improper controller type 'temptype' selected in the 'App_tempctl' table. The PID parameters are not optimal. Fast variation in the ambient temperature, airflow or line voltage.Insufficient air flow. For an air bath heater with 1/8 inch spargers, 3 cfm is adequate for up to 100 DegC and then 4 cfm should be used. A temperature setpoint too high for the allowed T-rating. An Air pressure switch that works intermittently. A defective DPM. A defective PECM. A defective Solid State relay.
2903, 2904	?	Ramp has no origin [1 - 2] on %4	Temperature controller PIC: A ramp rate was set without a prior temperature setpoint on channel #1. A ramp must have an initial temperature defined by the previous setpoint value.	Set the power-up default ramp value to 0.

13.15 Alarms 3117 - 3204 EPC

GCP Alarm Descriptions 3117 - 3204 EPC

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
3117, 3118	!	Pressure [1 - 2] Out-Of-Control on %4	EPC (Electronic Pressure Controller) PIC: The measured pressure, on channel #n, has exceeded the absolute maximum allowed pressure and the corresponding channel was shutdown. The pressure controller is no longer working.	Confirm that the flow is greater than the minimum specification. Investigate the entire flow path for an obstruction. Most often, the cause is not the EPC. Replace the EPC if flow path is verified.
3119, 3120	!	A/D [1 - 2] Failure on %4	EPC (Electronic Pressure Controller) PIC: The Analog to Digital Converter chip does not work properly. The flag will be set if the A/D internal calibration cycle is not completed within a pre-determined period of time or the A/D does not report any valid data within a pre-defined time-out period. A firmware problem affecting the version 0.250 of the EPC PIC may cause an A/D failure flag to show-up occasionally following a PIC reset. This is not a sign of a defective A/D converter.	Cycle power. If the error repeats consistently, replace the module.
3157, 3158	?	Low Supply Pressure [1 - 2] on %4	EPC (Electronic Pressure Controller) PIC: Set when the contact on the optional supply pressure sensor on [J5 or J6] is closed indicating that the supply pressure is getting low and that the bottle must be changed soon.	Check supply bottle. If bottle is OK, then the issue is a restriction in flow upstream of the EPC. Look for a closed valve or contamination in the line.

#		Text	Description	Action
3159, 3160	!	Deviation [1 - 2] Exceeded on %4	EPC (Electronic Pressure Controller) PIC: The measured pressure deviation has exceeded the corresponding MAX_DEVIATION value. The PID control was not successful in controlling the pressure with the desired precision on channel #n.	The MAX DEVIATION value is too small. Insufficient supply pressure. Flow too small or too large. Defective EPC. This alarm can result from an EPC with insufficient back pressure downstream. The EPC requires backpressure in order to control the downstream pressure. The most likely cause is an extreme difference in settling time when going from high to low pressure as opposed to low to high pressure. Low-to-high changes are very efficient, and happen quickly. High-to-low changes require settling time for the pressure to leak out downstream. Settling time can vary widely between analyzers and applications. Observe how fast the pressure drops; this will allow you to estimate settling time. Try a smaller change in pressure; if this works, then the EPC is functioning properly.
3161, 3162	?	Setpoint [1 - 2] changed following a change in Max Pressure	EPC (Electronic Pressure Controller) PIC: The SETPOINT_[n] AO value was modified internally as a result of the SETPOINT_MAX_[n] AO value set to a value lower than the SETPOINT_[n] value.	Set the SETPOINT_MAX_[n] value first and then set the setpoint.
3163, 3164	!	EPC Shutdown on %4, Channel [1 - 2]	The [n] channel of the Electronic Pressure Control (EPC) was temporarily shut down. This happens when the EPC control valve is fully opened for more than 5s and is meant to prevent overheating of the valve. This situation typically happens when the input pressure is too low, as from an empty cylinder.	No action required. The shutdown is temporary and the operation will automatically resume after 15s.
3203, 3204	!	EPC ramp has no origin on %4, Channel [1 - 2]	The starting point of the pressure ramp was set to the current measured pressure as the setpoint value was not previously set. When no prior setpoint is available, this alarm is issued and the current measured pressure is used as a substitute for setpoint #1.	Set a static setpoint first, and then set the ramp rate, followed by a new setpoint. With this sequence, the starting point of the ramp will be setpoint #1 and the ending point will be setpoint #2.

13.16 Alarms 3401 - 3454 TFTP

GCP Alarm Descriptions 3401 - 3454 TFTP

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
3401	?	TFTP Protocol Error	Protocol error detected, such as receipt of a non-DATA packet or lack of an expected message acknowledgment. Most likely the gateway settings on the SNE are wrong.	Power up the SNE connected to a serial terminal and change the settings in the startup dialog.
3402	?	TFTP Timeout	The TFTP client didn't receive a response from the server.	Verify that the TFTP server is running on the host computer, and that the host computer is connected to the SNE through the network.
3403	?	TFTP Server out of Sync	The data packets requested by the TFTP client to not match those sent by the TFTP server. Either the TFTP client or TFTP server is not working properly.	Reset the SNE. Restart the TFTP server on the host computer.
3404	?	TFTP Server out of Sockets	TFTP server cannot create a portal from which to communicate. SNE or host computer is low on resources.	Wait for problem to clear. Contact Customer Support.
3405	?	TFTP Max Channels exceeded	Too many TFTP load requests have been commanded.	Only request one TFTP load at a time.
3406	?	TFTP Driver Not Initialized	TFTP driver was not successfully initialized. Usually a problem of resource.	Verify that the SNE has sufficient memory. Upgrade SNE. Reset SNE.
3450	?	TFTP Client Out of Memory	Client ran out of memory loading file.	Verify that the SNE has 16Mb SIMM. Reset SNE.
3451	?	TFTP Client Checksum Error	File loaded had invalid checksum.	Verify that loadfile is correct and uncorrupted.
3452	?	TFTP Client Missing End of File	Attempt to load truncated file.	Verify that loadfile is correct and uncorrupted.
3453	?	TFTP Client Invalid OS File	Attempt to load OS with invalid address range.	Verify that loadfile is correct and uncorrupted.
3454	?	TFTP Client Invalid App File	Attempt to load App with invalid address range. Loadfile may be OS file or corrupt.	Verify that loadfile is correct and uncorrupted.

13.17 Alarms 3500 - 3528 Advance

GCP Alarm Descriptions 3500 - 3528 Advance

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
3500	?	Reserved	System error	Contact Customer Support.
3501	!	Advance Adapter Initialization Failure	Advance Adapter detected, but responding improperly.	Repair or replace adapter.
3502	?	Invalid Channel for Advance Adapter %4	Reference to invalid channel on Advance Adapter.	Check reference to I/O channels in application tables.
3503	?	Advance Adapter Backplane Timeout on %4	The referenced I/O on backplane board did not respond.	Reseat or replace board corresponding to hardware ID.
3504	?	Advance Adapter Backplane Error on %4	The referenced I/O on backplane responded improperly.	Reseat or replace board corresponding to hardware ID.
3505	?	Resource for %4 not available on Advance Adapter	Memory or operating system object not available for hardware access.	Verify that SNE has sufficient memory. Upgrade SNE. Reset SNE.
3516	!	No Advance Adapter detected	System error	Contact Customer Support.
3517	!	Advance Adapter Driver Out of Memory	Driver initialization failure due to lack of memory.	Verify that SNE has sufficient memory. Upgrade SNE. Reset SNE.
3518	!	Invalid Advance Adapter Driver Command	Application requested invalid command from Adapter Driver. Most likely a mismatch between the SNECON OS and application.	Reload SNECON software.

13.18 Alarms 3718 - 3804 SNE I/O

GCP Alarm Descriptions 3718 - 3804 SNE I/O

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
3718	!	FPGA Error Full on %4	SNECON PICs: The FPGA queue to the NS486 was full and a packet could not be sent. A best attempt is made to continue but one or more packets were lost.	Reset the SNECON. Replace the SNECON.
3719	?	FPGA error reset_W on %4	SNECON PICs: A FPGA reset was detected during a packet write from the PIC. The packet and any packet still in the FPGA queues were lost.	Reset the SNECON. Replace the SNECON.

#		Text	Description	Action
3720	?	FPGA error reset_R on %4	SNECON PICs: A FPGA reset was detected during a packet read by the PIC. The packet and any packet still in the FPGA queues were lost.	Reset the SNECON. Replace the SNECON.
3721	?	FPGA error_W on %4	SNECON PICs: An error was detected while writing the packet header or data to the FPGA. A best attempt is made to continue but one or more packets may be lost.	Reset the SNECON. Replace the SNECON.
3722	?	FPGA error_R on %4	SNECON PICs: An error was detected when reading the packet header or data from the FPGA. A best attempt is made to continue but one or more packets may be lost.	Reset the SNECON. Replace the SNECON.
3725	!	Error SCL on %4	SNECON PICs: An abnormal situation was detected on the I2C 'Serial Clock' line. This is an indication that the WDB is broken, a cable harness is broken or one board connected to the I2C bus is malfunctioning, pulling the I2C data signal to a logical low.	Contact Customer Support.
3726	!	Error SDA on %4	SNECON PICs: An abnormal situation was detected on the I2C 'Serial Data' line. This is an indication that the WDB is broken, a cable harness is broken or one board connected to the I2C bus is malfunctioning, pulling the I2C data signal to a logical low.	Contact Customer Support.
3727	!	I2C will not align on %4	SNECON PICs: I2C communication error.	Contact Customer Support.
3728	?	I2C msg not allowed on %4	SNECON PICs: A packet containing an I2C message was received by the PIC (from the NS486 through the FPGA) at a time when it is not allowed but after a valid configuration message was received. The message was discarded.	Reset the SNECON. Reload the OS for the SNECON. Replace the SNECON.
3757	?	NACK address on %4	SNECON PICs: An I2C message transaction failed after the required number of retries. A cause of this failure was a unacknowledged destination address byte (first byte in the message). This may happen if a module was disconnected from the bus after its address has been reassigned.	Reset the analyzer.
3758	?	NACK Byte on %4	SNECON PICs: An I2C message transaction failed after the required number of retries. A cause of this failure was a unacknowledged byte that is not the first byte in the message (any byte other than the destination address was not acknowledged). This may happen if a module is seriously corrupted or the I2C signal integrity is a problem (noise, etc…).	Contact Customer Support.

#		Text	Description	Action
3759	?	NACK Message on %4	SNECON PICs: An I2C message transaction failed after the required number of retries. A cause of this failure was a NACK message with a non-zero flag. This may happen if the firmware of the peripheral module is not responding properly.Reset the analyzer.	Replace the module being addressed.
3760	?	Invalid Checksum on %4	SNECON PICs: An I2C message transaction failed after the required number of retries. A cause of this failure was an invalid checksum in the reply message. This may happen if the firmware of the peripheral module is not working properly or the electrical properties of the I2C signals are marginal.	Contact Customer Support.
3761	?	Invalid Opcode on %4	SNECON PICs: An invalid private opcode was received from the NS486. The message was ignored. This may happen if the PIC firmware is out-of-date relative to the SNE software.	Reload the OS and APP software for the SNECON. Replace the SNECON.
3762	?	Invalid Message on %4	SNECON PICs: An I2C message transaction failed after the required number of retries. A cause of this failure was a reply message that had a valid checksum and valid opcode but was invalid in any other way. This may happen if the firmware of the peripheral module is not working properly or the SNECON software is too old.	Reload the OS and APP software for the SNECON. Replace the module being addressed. Replace the SNECON.
3763	!	Arbitration Loss on %4	SNECON PICs: An I2C message transaction failed after the required number of retries and a cause of this failure was that the PIC could not successfully arbitrate its way to the bus. Other bus-master devices are using all the I2C bus bandwidth.	Contact Customer Support.
3764	?	Timeout SCL on %4	SNECON PICs: An I2C message transaction failed because the I2C clock was stretched beyond the allowed timeout period specified in the configuration. A module may be malfunctioning.	Contact Customer Support.
3765	?	Timeout SDA on %4	SNECON PICs: An I2C message transaction failed because the I2C data line was held beyond the allowed timeout period specified in the configuration. A module may be malfunctioning.	Contact Customer Support.
3766	?	Bus Not Sync on %4	SNECON PICs: The master-mode operation generated a start condition that was not detected by the FPGA.	Reset the SNECON. Replace the SNECON.

#		Text	Description	Action
3767	?	Timeout Buffer on %4	SNECON PICs: A master-mode message has not been processed within a timeout period. This is a broad alarm with multiple possible causes. The PIC will discard the message and attempt to recover.	Contact Customer Support.
3768	?	Invalid Handle on %4	SNECON PICs: The received header handle was not sequential. One or more I2C messages were lost.	Reset the SNECON. Replace the SNECON.
3769	?	High I2C traffic on %4	The amount of traffic on the I2C bus has exceeded a configurable threshold. A heavy traffic may delay the I/O activity which ultimately can affect the operation (accuracy, repeatability) of the analyzer.	Check the methods to ensure that the I/O activity is distributed in time and not all at the same exact cycle time (Detector balance event, valve events, temperature and pressure setpoint, etc).
3797	+	Invalid Checksum Slave on %4	SNECON PICs: An unsolicited I2C message was received with a bad checksum. The message was discarded and it is expected that the master will retry the message. This is a communication error that can be ignored if not frequent.	Reset the SNECON. Replace the SNECON.
3798	+	Invalid Message Slave on %4	SNECON PICs: An unsolicited I2C message was received with an invalid message size, invalid opcode or invalid data. The message was discarded. There may be a firmware version conflict.	Reload the OS and APP software to all SNECONs.
3799	?	Invalid Status Summary on %4	SNECON PICs: A packet was received by the PIC from the NS486 and the packet had an undefined bit set in the Status_summary field of the packet. The packet was processed normally.	Reload the OS and APP software for the SNECON. Replace the SNECON.
3800	?	Module Not Ready on %4	SNECON PICs: An I2C message transaction failed after the required number of retries and the cause of the failure was a series of consecutive message NACKs, all with a 0 flag. This may happen if the firmware of the peripheral module is not responding properly.	Reload the OS and APP software for the SNECON. Replace the module being addressed. Replace the SNECON.
3801	?	Invalid Status Data on %4	SNECON PICs: The content of the status buffer, 'Status_data', was invalid and not recognized by the PIC. This may happen if the PIC firmware is out of date relative to the NS486 software.	Reload the OS and APP software for the SNECON. Replace the SNECON.
3802	?	Invalid Status Type on %4	SNECON PICs: The value of the status_type was invalid and not recognized by the PIC. This may happen if the PIC firmware is out of date relative to the NS486 software.	Reload the OS and APP software for the SNECON. Replace the SNECON.

#		Text	Description	Action
3803	+	Invalid Msg Size on %4	SNECON PICs: A packet was received with an invalid I2C message size or no I2C message at all. The packet was discarded.	Reload the OS and APP software to all SNECONs.
3804	+	Arbitration Loss Slave on %4	SNECON PICs: The PIC lost a slave read arbitration. It indicates that at least one other module responded to the same message request.	If sporadic, no action is necessary. If repeating frequently, reset the analyzer.

13.19 Alarms 4001 - 4124 EZChrom

GCP Alarm Descriptions 4001 - 4124 EZChrom

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
4001	?	TFTP cannot load with active method %3	Method currently running when software load was commanded.	Put method on hold and wait for it to complete before loading SNE software.
4003	!	Zero Correction Out of Limits on %4	System error.	Contact Customer Support.
4022	?	I/O channel not found on %4	Hardware resource requested not present.	Reload and or repair SYSCON database.
4024	?	Slope check failure on channel %4	Slope check commanded with invalid parameters.	Check method for slope check events and review data.
4025	?	Detector channel underflow occurred on %4	A/D converter for detector reading lowest possible value. This error may also be a secondary error caused by an overflow on an FID DPM.	Check A/D inputs, potentially replace referenced DPM.
4026	?	Detector channel open occurred on %4	Open connection detected on A/D detector input. This error may also be a secondary error caused by an overflow on an FID DPM.	Verify proper operation of the DPM.
4027	?	Detector channel overflow occurred on %4	A/D converter for detector reading maximum value possible.	Check A/D inputs, potentially replace referenced DPM.
4028	?	Detector channel unknown error occurred on %4	Undeterminable error occurred on detector channel circuit. This error may also be a secondary error caused by an overflow on an FID DPM.	Reset. If error repeats, replace DPM.
4029, 4030	?	Zero Correction failure on [first/lower/right; second/lower/left] channel of %4	Should occur only with a revision 2 TCD DPM or revision 3 baseboard (PIC firmware revision 2.006 and up). Or, the zero correction value exceeded the maximum allowed value for that particular board. This is a balance failure situation.	Eliminate the cause of the balance failure: On TCD detector, replace the detector bead or filament. On FID detector, clean or replace the FID.
4031	!	Flame out on %4	Flame out detected on an Advance+ FID or FPD Board.	Ignite flame on unit. If flame is burning, board may be defective.

#		Text	Description	Action
4032	?	Purge Loss on %4	Loss of purge pressure has been detected. Possible causes include low pressure for supply air, open door, and failed gaskets. Depending on the environment classification where the analyzer is installed, this alarm may indicate an unsafe condition that requires immediate action to correct.	Investigate and correct cause of pressure loss.
4033	!	Zero Correction Out of Limits on %4	The value of the zero correction (software balance of the detector) has exceeded the balance limits.	Confirm that the corresponding balance limit values are not too small. See the maintenance instructions for the specific detector type.
4120	?	Pulse DO Within a Pulse DO is Not Allowed on %4	A pulse DO was requested by the SYSCON while a pulse DO was already in progress. The latest requested pulse DO was ignored.	Wait until the on-going pulse has completed before requesting another pulse DO.
4121	+	Pulse DO Aborted on %4	A pulse DO was aborted as a result of a standard (non-pulsed) DO command. The non-pulsed DO command has precedence.	Informational message. No action necessary.
4122	!	Method Conflict: Concurrent Chromatogram Channel Acquisition on %4	It is not allowed to use the same detector channel for more than one chromatogram acquisition at a time, whether within a method or across methods. The newest request was cancelled.	Verify that the method does not contain 2 concurrent uses of the same detector channel hardware. Verify that the methods running in separate applications are not erroneously reusing the same detector channels.
4123	!	Unsupported detector sampling rate on %4	A request was made to run the specified detector channel at a standard rate but the DPM hardware does not support that rate. The method file is likely corrupt. It may be necessary to rebuild the method.	Contact Customer Support for assistance.
4124	!	Run-time Operational Conflict on %4	An operation was requested at a time when it is not allowed. e.g.: GainSelect VDO: A gain select was initiated before the previous GainSelect sequence was completed.	Revise the method to remove the conflicting events.

13.20 Alarms 4217 - 4320 CAN Bridge

GCP Alarm Descriptions 4217 - 4320 CAN Bridge

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
4217	!	CAN:Underflow %4	System error	Contact Customer Support.
4218	!	CAN: Overflow %4	System error	Contact Customer Support.

#		Text	Description	Action
4220	!	CAN: External AO uncalibrated	The EEPROM does not contain valid factory calibration information for a local AO channel. Default calibration values are used. The module is operational.	Replace the SIB to eliminate the alarm.
4257	?	CAN: Underflow	System error	Contact Customer Support.
4258	?	CAN: Overflow	System error	Contact Customer Support.
4259	?	CAN: Node init failure	Indicates that at least one CAN node failed during the initialization process. No I/O operations are allowed on the node.	Reset the device. If the problem persists, replace the CAN card.
4260	?	CAN: Node failure	Indicates that at least one CAN node failed during normal operation. This flag is generated only if the node worked properly during initialization but failed at a later time. No further I/O operations are allowed on the node. The communication with the card will be stopped and the card will set itself to failsafe output.	Reset the device. If the problem persists, replace the CAN card.
4261	?	CAN: Bus HW init failure	Indicates a failure of the CAN bus detected during the CAN bus initialization. No communication is possible with any node. This can be as a result of either: a) No CAN card is present, but yet at least one card is defined in the database b) The CAN hardware cannot communicate with a CAN device as a result of a hardware error (e.g. broken or shorted cable) and the PIC CAN module is reporting a transmitter error.	Check the Database CAN node list for a stray card. Check data cable and power to CAN Extension Unit (CEU).
4262	?	CAN: Bus HW Failure	Indicates a fatal failure of the CAN bus detected during the normal operation. This flag is generated only if the CAN system worked properly during initialization but failed at a later time. No communication is possible with any node.	Check power to CAN Extension Unit (CEU).
4263	?	CAN: Invalid channel %4	A read or a write was attempted to a channel that does not exist.	Verify the hardware ID of the I/O for valid addresses.
4264	?	CAN: Node changed	Indicates that at least one serial number has changed and that, as a result, the CAN bridge PIC will soon reset. This is normal as a result of a CAN node list configuration change.	No action necessary.
4265	?	CAN: Receive Init Buffer Overflow	The CAN bus receive buffer that processes messages from uninitialized CAN cards has overflowed. Initialization will likely fail.	Contact Customer Support.
4266	?	CAN: Receive Heartbeat Buffer Overflow	CAN card heartbeat replies have overflowed the heartbeat buffer. The heartbeat buffer is large enough to hold replies from all 20 cards. Overflow would indicate a serious loading problem.	Contact Customer Support.

#		Text	Description	Action
4267	?	CAN: Receive I/O Buffer Overflow	CAN card I/O replies/updates are not processing fast enough. This indicates that some received CAN messages have been lost because the CAN bridge cannot process them fast enough. Since CAN messages take longer to transmit on the CAN bus than it takes to process them this flag is unlikely to occur. If it ever occurs, the likely cause is very heavy I2C traffic combined with a large number of ADIO boards which add considerable CAN traffic to the bus.	Reset the device. If the problem persists, the I2C traffic to the CAN bridge or the number of ADIO boards in the system must be reduced.
4268	?	CAN: Transmit Buffer Overflow	There are too many pending CAN messages and the transmit buffer is full. This indicates that the SYSCON is performing I/O operations faster than they can be transmitted on the CAN bus. The most likely cause would be heavy DO traffic since the I2C protocol can update many DO bits per transaction but it takes one CAN message for EACH DO bit.	Contact Customer Support.
4269	?	CAN: Channel not responding	Indicates that one or more channels have not properly communicated and recovery efforts have failed. For outputs, this flag is set after several retries writing to a channel without proper confirmation from the CAN card that the message was received and handled. For inputs, this flag is set after enough time passes without getting an update from the channel.	Reset the device. If the problem persists, replace the CAN card.
4270	?	CAN: Hardware FIFO Overflow	The PICs hardware CAN message buffer has overflowed.	Contact Customer Support.
4297	+	CAN: init complete	The initialization of the CAN card has completed. Informational message.	No action necessary.
4300	+	CAN: Unrecognized card	This flag is set when an uninitialized card is detected on the bus after the init sequence is complete. The most common cause of this condition is a Node/SN list that does not precisely match the card mix on the bus either due to missing entries or typographical errors.	Verify the node list in the database for an exact match of all serial numbers. Make sure that no unused CAN card is present in the system. If this is associated with a 'CAN: Node x abnormal' error, replace the corresponding card.
4301 - 4320	+	CAN: Node [1 - 20] abnormal	CAN card I/O malfunction that causes initialization failure, loss of heartbeat responses from a CAN card or loss of communication with one or more channels of the node.	Verify the node list in the database for an exact match of all serial numbers. If this is associated with a 'CAN: Node x abnormal' error, replace the corresponding card.

13.21 Alarms 4525 - 5220 Advance TC

GCP Alarm Descriptions 4525 - 5220 Advance TC

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
4525	!	AD Failure on %4	Advance Adapter Temperature Controller PIC: The Advance Adapter temperature A/D converter is not generating data points within the prescribed time interval.	Reset the analyzer. Replace the Advance Adapter.
4526	!	Over Temp Shutdown Power Supply Failure on %4	Advance Adapter Temperature Controller PIC: The power supply used for over-temp shutdown is not working properly.	Replace the Advance Adapter.
4557	?	Setpoint Changed following a change of Max Temp %4	Advance Adapter Temperature Controller PIC: The SETPOINT AO value was modified internally as a result of the SETPOINT_MAX AO value set to a value lower than the SETPOINT value.	Set the SETPOINT_MAX value first, then set the setpoint value.
4599	!	Over Temp Shutdown on %4	Advance Adapter Temperature Controller PIC: The Over-Temp Shutdown function is active, the heater cannot be turned on. The overtemp shutdown condition indicates that the temperature reached the absolute limit.	Check for: A temperature setpoint too high for the allowed T-rating. A defective temperature probe. A defective Advance Adapter. A defective (shorted) SSR.
4601	?	Temperature Deviation Exceeded on %4	Advance Adapter Temperature Controller PIC: The measured temperature deviation (TEMP_DEVIATION) has exceeded the corresponding MAX_DEVIATION value. The PID control did not successfully control the heater with the desired precision. A large deviation is normal on power-up and immediately following a change in the temperature setpoint. Only small deviations are expected during normal operation.	Check for these causes of temperature instability: Fast variation in the ambient temperature, airflow or line voltage. Insufficient air flow. A temperature setpoint too high for the allowed T-rating. A defective DPM. A defective Solid State relay.
4817	!	AI Underflow Fault on %4	One or more AIs on the module has encountered a voltage or current underflow situation.	Make sure that the signal going to all AIs is within the range of the inputs.
4818	!	AI Overflow Fault on %4	One or more AIs on the module has encountered a voltage or current underflow situation.	Make sure that the signal going to all AIs is within the range of the inputs.
4819	!	External ADC HW is not responding on %4	Timeout or communication error with an Analog to Digital Converter.	Reset the device. If the problem recurs, replace the module.
4820	!	External AO is not calibrated on %4	One or more AO channel has an invalid calibration record in the EEPROM of the module.	Reset the device. If the problem recurs, replace the module.

#		Text	Description	Action
4821	!	External AI is not calibrated on %4	One or more AI channel has an invalid calibration record in the EEPROM of the module.	Reset the device. If the problem recurs, replace the module.
4857	?	External AI underflow on %4	One or more AIs on the module has encountered a voltage or current underflow situation.	Make sure that the signal going to all AIs is within the range of the inputs.
4858	?	External AI overflow on %4	One or more AIs on the module has encountered a voltage or current overflow situation.	Make sure that the signal going to all AIs is within the range of the inputs.
5117 - 5140	!	Alarm [5117 - 5140] on %4	A fault alarm was generated on an unrecognized I2C module.	Update to the latest software version. Make sure that the latest text files are loaded.
5157 - 5199	?	Warning [5157 - 5199] on %4	A warning alarm was generated on an unrecognized I2C module.	Update to the latest software version. Make sure that the latest text files are loaded.
5200 - 5220	+	Note [5200 - 5220] on %4	A note alarm was generated on an unrecognized I2C	Update to the latest software version. Make sure that the latest text files are loaded.

13.22 Alarms 10000 - 11536 MicroSAM

GCP Alarm Descriptions - 10000 - 11536 MicroSAM

The following tables list the alarm number (#), type (+ information, ? warning, ! error) alarm text, description, and actions.

#		Text	Description	Action
10000	!	Temperature control failure on %4	MicroSAM alarm	Contact MicroSAM Support.
10001	!	Temperature sensor (RTD) of %4 defective	MicroSAM alarm	Contact MicroSAM Support.
10002	!	Temperature deviation on %4 exceeds limits	MicroSAM alarm	Contact MicroSAM Support.
10003	!	Temperature controller %4 disabled	MicroSAM alarm	Contact MicroSAM Support.
10004	!	Carrier gas pressure low on %4	MicroSAM alarm	Contact MicroSAM Support.
10256	!	Detector %4 disabled	MicroSAM alarm	Contact MicroSAM Support.
10257	!	Detector %4 shorted	MicroSAM alarm	Contact MicroSAM Support.
10258	!	Detector %4 not connected	MicroSAM alarm	Contact MicroSAM Support.
10259	!	Carrier gas pressure low on %4	MicroSAM alarm	Contact MicroSAM Support.
10512	!	Pressure controller %4 disabled	MicroSAM alarm	Contact MicroSAM Support.
10513	!	A/D converter failure on %4	MicroSAM alarm	Contact MicroSAM Support.

#		Text	Description	Action
10514	?	Operating pressure low on %4	MicroSAM alarm	Contact MicroSAM Support.
10515	!	Pressure exceeds limits on %4	MicroSAM alarm	Contact MicroSAM Support.
10516	!	Setpoint exceeds limits on %4	MicroSAM alarm	Contact MicroSAM Support.
10517	!	Pressure out of control on %4	MicroSAM alarm	Contact MicroSAM Support.
10518	!	Voltage exceeds limits on %4	MicroSAM alarm	Contact MicroSAM Support.
10519	!	Operating pressure low	MicroSAM alarm	Contact MicroSAM Support.
10768 - 10775	!	Valve [1 – 8] operation failure on %4	MicroSAM alarm	Contact MicroSAM Support.
11536	!	General RSP communication error on %4	MicroSAM alarm	Contact MicroSAM Support.

Data Logger

14

Overview:

The Data Logger is a part of the Gas Chromatograph Portal (GCP) Software that is used to poll and store data for multiple Maxum/MicroSAM analyzers on a network. The user may choose to store alarms, results, or chromatograms. Retrieval of the stored information is integrated into the GCP software.

The Data Logger is designed to run as a separate service on the workstation computer, regardless of whether the GCP Network or GCP Analyzer executable programs are running. Data is stored in an SQL database for later access via GCP screens.

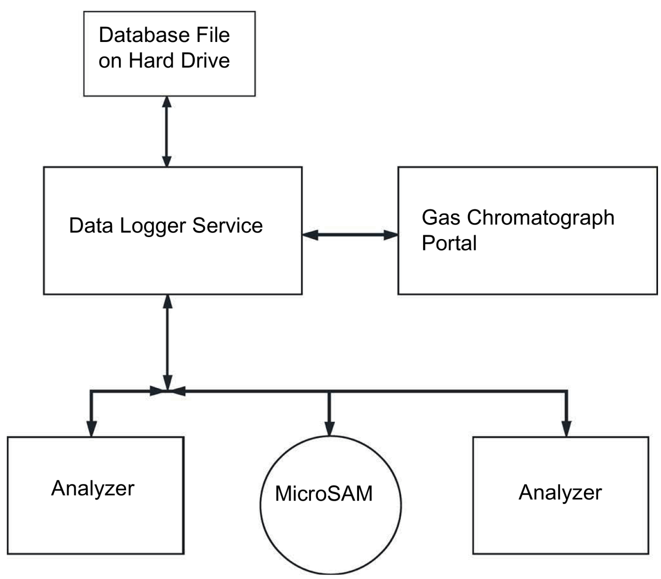


Figure 14-1 Flow of Data Logger Information

Data Logger Basics:

Since, by default, the Data Logger runs as a service, this allows for the most reliable logging of results. For example, if the computer is rebooted the service restarts and continues to log data as before, even if the Windows account is not logged in.

The Data Logger service collects data as specified by the user during configuration. For each analyzer on a network, the user may choose to log alarms, results, chromatograms, or a combination of the three. For chromatograms, the user may choose to always log chromatograms, or only on alarm.

When the user configures the Data Logger to log information from a particular analyzer, a query is set up to automatically transmit the desired data from the analyzer whenever new data is available.

Once transmitted, data is stored in an SQL database file. The maximum file size is 3.5 gigabytes. Once the maximum size has been reached, the current database file is closed out and a new one is opened. The name of each file is automatically selected based on the timestamp of the first data stored in the file.

Once data has been stored, the user may retrieve it by accessing the various GCP screens related to the stored data for a particular analyzer. See more information under "Accessing Logged Data" below.

Results and alarm data can be further filtered by date and time. Chromatograms can be selected from a list of available stored data. Finally, stored data that has been accessed via GCP screen can be exported to a text file for use/analysis outside of GCP.

Note

Although Data Logger runs as a separate service, it is configured and accessed via the Analyzer Tab on the GCP Analyzer window. Note that this tab is not available unless the GCP Analyzer window is connected to an analyzer. For configuration of the Data Logger this can be any analyzer.
Although Data Logger configuration information as well as stored data are accessed while connected to an analyzer, this information is not part of an analyzer database. Data Logger configuration information is stored separately and does not change when a new analyzer is connected. The stored data that is available from related GCP screens is the information from the data archive file which is specific to the selected analyzer.

Depending on customer needs, multiple computers within the same network can be configured with Data Logger. For example, this can be for redundancy of data or split up a large network by functional area.

Accessing Logged Data:

Many analyzers can be logged at one time, and the database file stores all of this. However, using GCP, only data for the current connected analyzer can be accessed. Access of this data is integrated into the program. For example, the Results screen has a tab labeled "Logged Results (Data Logger)". Accessing this tab will query the results from the archive file which are specific to the current analyzer.

The serial number of the analyzer is the unique identifier used by Data Logger to access data for the connected analyzer. For this reason, a virtual analyzer that is loaded from a file with the same serial number as a physical analyzer will give access to any stored data for that physical analyzer.

Also, because the serial number is used to retrieve data, then old data for that analyzer can no longer be retrieved if the serial number for an analyzer is changed. For this reason it is not recommended to change the serial number, even though it is possible to do so under the System screen on the Navigation Menu.

14.1 Installing/Configuring the Data Logger as a Windows Service

By default, the Data Logger service installs as part of the Gas Chromatograph Portal installation. Installation as a service is preferable because it allows data to be logged regardless of whether the GCP software is running. In addition, if the computer is rebooted, the Data Logger service will be restarted even if the Windows account is not logged in.

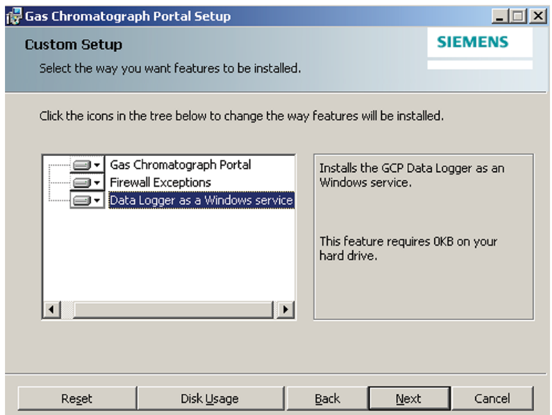


Figure 14-2 GCP Installation Setup Screen

It is also possible choose not to install the service or to install the Data Logger service separately. To deselect installation of Data Logger in the installation wizard, click the small down-arrow next to the menu item labeled "Data Logger as a Windows service". This will display a menu from which the user can choose an "X" to prevent installation of the feature.

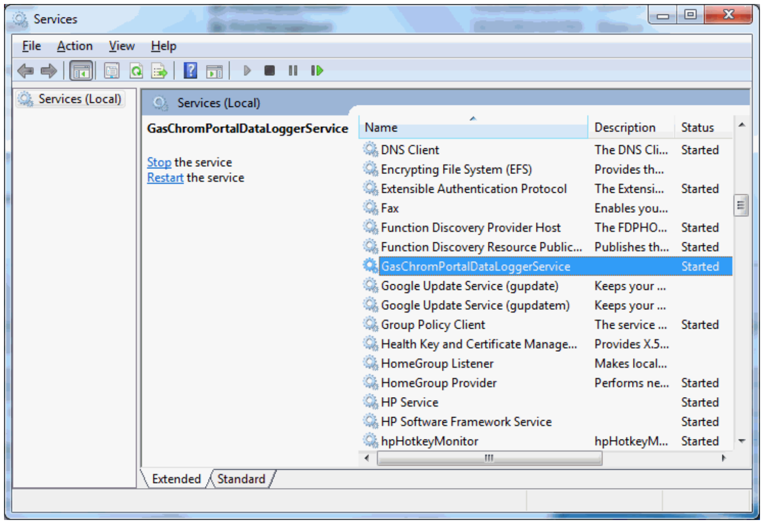
If installation of Data Logger as a Windows service was skipped, it is always possible to reinstall it at a later date by running the setup again. To do so, go to the Windows Control Panel and choose Add/Remove Programs. From the list, select "Gas Chromatograph Portal" and then click "Change". This will bring up the GCP Installation Setup wizard.

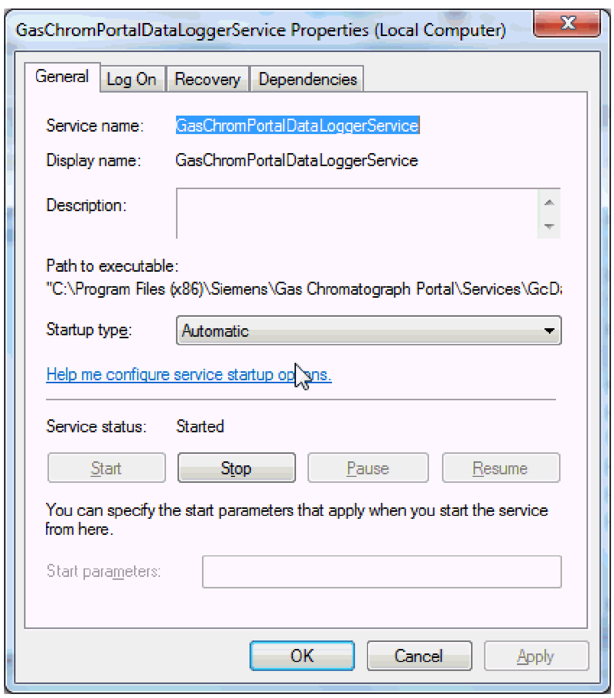
Stopping the Data Logger Service

If needed, it is possible to deactivate the Data Logger service manually. To do so, go to the Windows Control Panel (view by Small icons) and choose Administrative Tools and then Services. Under the list of services there will be GasChromPortalDataLoggerService. Right-click on the service choose Stop or Right-click and open the edit properties window to Stop, Restart, and other property settings for this service.

Note

Use caution when making changes to Windows services. Careless actions can adversely affect the operation of either GCP or the computer.



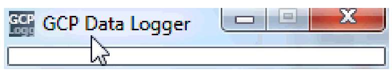


Uninstalling the Data Logger Service

The Data Logger service cannot be uninstalled without uninstalling the GCP software. If necessary, a complete uninstall can be done and then just the GCP software can be reinstalled. To uninstall go to Windows Control Panel and choose Add/Remove Programs. From the list, select "Gas Chromatograph Portal" and then click "Remove".

14.2 Using the Data Logger as a Windows Application

If the Data Logger service is not installed as part of the GCP installation, then it can still be run manually as a Windows application. This is done by choosing "Start Data Logger" from the Tools menu of either the GCP Network window or the GCP Analyzer window. When opened manually from GCP, a small GCP Data Logger window (see below) will appear in the bottom right corner of the screen. As long as this window is open, the Data Logger will collect information if it is configured to do so.



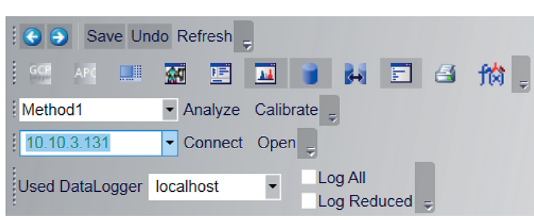
To stop logging data in this manner, close the small window by clicking the X on the right-hand side.

Setting the Datalogger Location

Any computer that is loaded with the Data Logger can serve as a Data Logger host. More than one computer in a network can be configured. If more than one Data Logger is configured, then each runs independently. When configuring a Data Logger using GCP, the first step is to connect to the correct Data Logger software. It is possible to connect to the Data Logger on the local computer or to one on a remote computer.

Used Datalogger

The IP address of the Datalogger workstation used with this device is defined in the Used Datalogger window in the action bar of either the GCP Network window or the GCP Analyzer window. Select ‘localhost’ in the pull down menu to have the Datalogger database saved on the local computer. Select or enter the IP address of the remote computer if the Datalogger database is saved on a remote computer. For a remote connection, it may be necessary to configure the firewall to allow communication between the two computers (allowing TCP traffic on port 8004 as described in the section titled "Enabling Access to Remote Data Logger with Firewall").



Datalogger Configuration (Log All, Log Reduced)

In the Used DataLogger area on the action bar or the Datalogger Configureation Column in GCP Network window there are two check boxes Log All and Log Reduced. No check in the Log All or Log Reduced check boxes will disable Data Logger for this device. Select Log All to log results, chromatograms and stream related alarms for each cycle. The current method is also logged if the method has changed since the last cycle. Select Log Reduced to stop logging chromatogram and continue all other log activities. In the Log Reduced mode chromatograms will be logged on cycles where a stream alarm occurs. Configure the Data Logger (Set File Location)

To configure Data Logger open GCP Network view, select Tools and Configure Data Logger. The Network View Settings window will open. Enter the path where the Data Logger database file will be saved and click the OK button. The Apply Default Values button will reset the path to the default path originally defined for the database location.

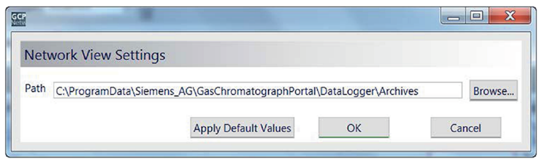


Figure 14-3 Configure Data Logger Network View Settings

Datalogger and Analyzer Serial Numbers

The serial number of the analyzer is the unique identifier used by Data Logger to access data for the connected analyzer. For this reason, a virtual analyzer that is loaded from a file with the same serial number as a physical analyzer will give access to any stored data for that physical analyzer.

Also, because the serial number is used to retrieve data, then old data for that analyzer can no longer be retrieved if the serial number for an analyzer is changed. For this reason it is not recommended to change the serial number, even though it is possible to do so under the System screen on the Navigation Menu.

Enabling Access to Remote Data Logger with Firewall

It is possible to configure the data logger running on one computer to be accessed as a server for other computers running GCP. The administrator can grant access to an individual computer or all computers in a network by defining appropriate firewall rules.

When a firewall exists, it is necessary to allow incoming connections for TCP traffic on port 8004 on the server running the GCP Data Logger and allow corresponding outgoing traffic on the computer that needs to access this GCP Data Logger remotely. In addition, ICMP messages must not be blocked on the respective computers. Refer to the following screen images for examples of Windows settings.

Note

Changes to firewall security settings could compromise the network security. Any changes must only be done with the approval of relevant IT support.

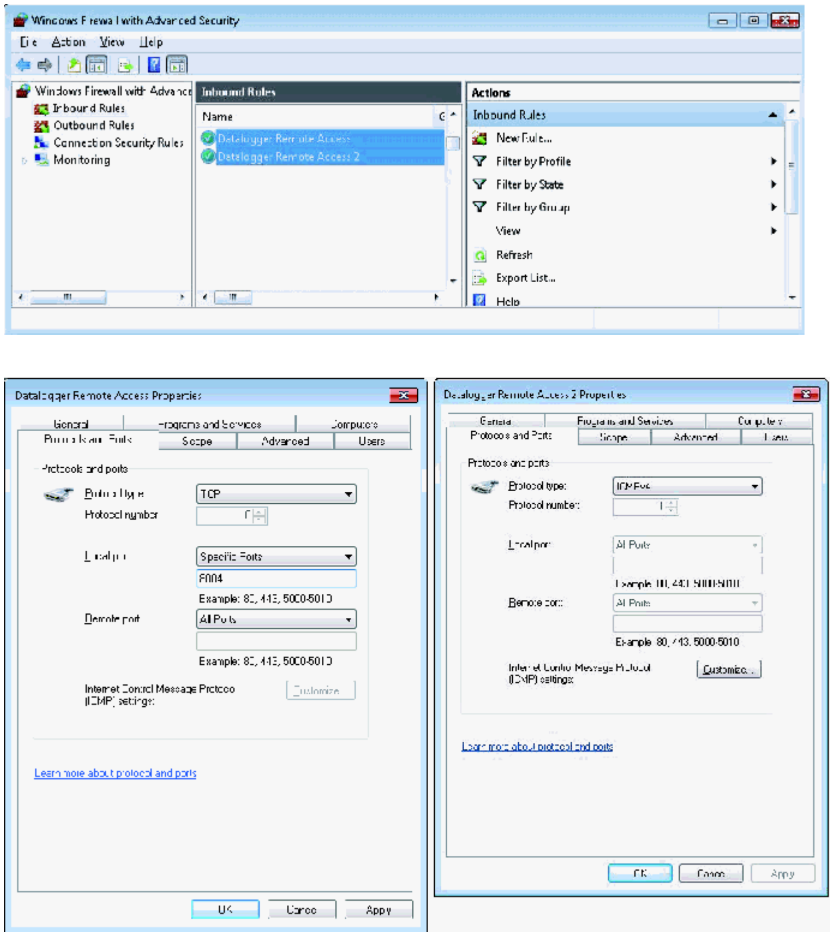


Figure 14-4 Windows Settings for Remote Access

Once firewall settings have been confirmed, it should be possible to access data on a remote computer using GCP on a different computer. To do this, set the data logger location to "Remote" and enter IP Address of computer running GCP data logger. After the IP Address is entered, the window will display the configuration of monitored analyzers on the remote data logger.

If the connection status shows disconnected, then there may still be a network configuration issue.

14.3 Configuring the Data Logger Using GCP

Data Logger is configured using the "Data Logger Configuration" screen in the GCP Analyzer window. This screen is on the Analyzer View tab at the bottom of the Navigation menu under Utilities. See the image below. For this screen to be available, the GCP window must be connected to an analyzer (either a physical or virtual analyzer).

Note that even though it requires connection to an analyzer in order to use the "Data Logger Configuration" screen, this screen is not related to the analyzer. It is a direct connection to the Data Logger software.

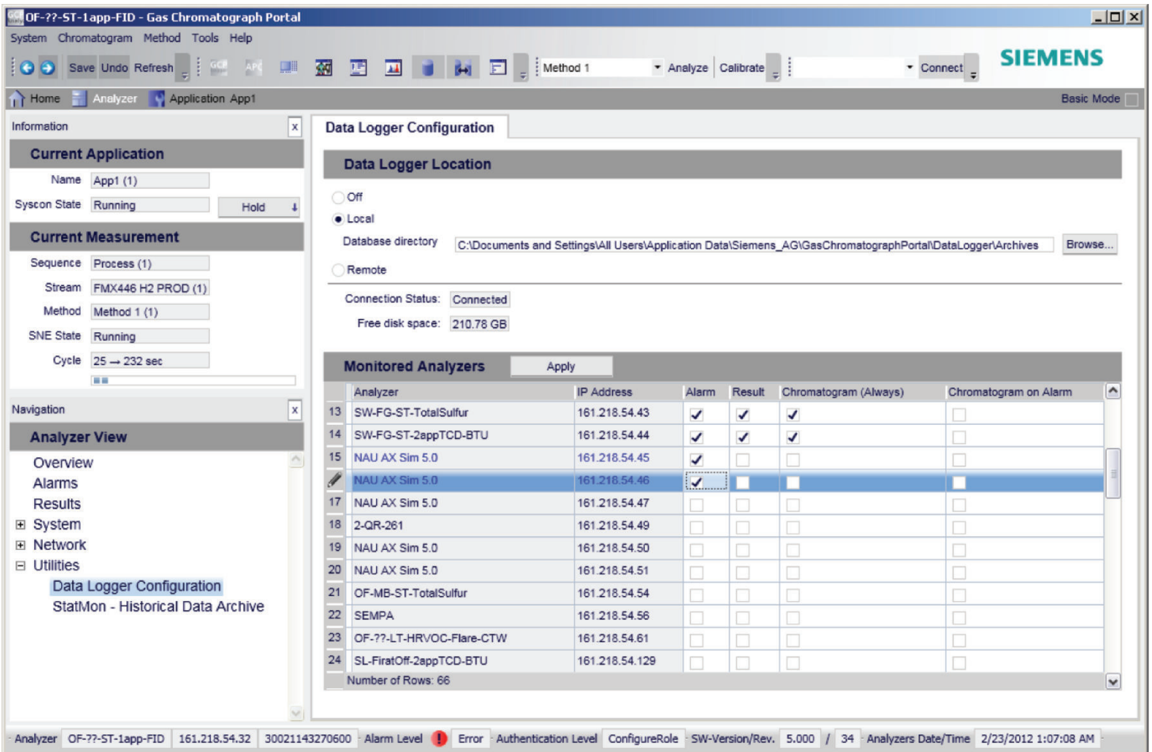


Figure 14-5 Data Logger Configuration

Setting the Location:

Any computer that is loaded with the Data Logger can serve as a Data Logger host. More than one computer in a network can be configured. If more than one Data Logger is configured, then each runs independently. When configuring a Data Logger using GCP, the first step is to connect to the correct Data Logger software. It is possible to connect to the Data Logger on the local computer or to one on a remote computer.

The upper section of the display window is used for defining the desired location. To connect to the Data Logger on the local computer, select "Local". The directory for the database file will be shown (here it is possible to change the location for storing database files). To connect to a Data Logger on a different computer, select "Remote" and then enter the IP address of the computer that has the Data Logger configured.

After setting the location, the Connection Status field should read "Connected". If it does not, then verify that the Data Logger service or application is running on the specificed computer. For a remote connection, it may be necessary to verify operation of the network. For a remote connection, it may also be necessary to configure the firewall to allow communication between the two computers (allowing TCP traffic on port 8004 as described in the section titled "Enabling Access to Remote Data Logger with Firewall").

Defining the Information to be Logged:

Once connected to either a local or remote Data Logger, the bottom half of the page is populated with a list of monitored analyzers that are known to the GCP software. If the desired analyzer is not on the list, then it will need to be added using the Add function on the GCP Network view.

There is no set limit on the number of analyzers that can be logged. However, it is possible that for some busy networks, monitoring a very large number of analyzers accompanied by short cycle times could create slow network conditions. This is dependent on network traffic and configuration.

For each analyzer in the list there are a line of check boxes that identify the data to be logged. Checking the Alarm, Result, and/or Chromatogram boxes identifies that the data will be collected for that analyzer. Two choices are available for logging chromatograms. Chromatograms may either always be logged or only on cycles when an alarm that affects the relevant stream occurs (only one of the chromatogram boxes may be checked at a time).

Each time a line is changed, the Analyzer name turns blue, indicating that the information is changed but not saved yet. After all desired boxes have been checked, hit the "Apply" button at the top of the "Monitored Analyzers" list in order to save changes. Changes are saved to the configuration file for the Data Logger software.

As soon as the Apply function is complete, the changes take effect and data logging is occurring.

14.4 Enabling Access to Remote Data Logger with Firewall

It is possible to configure the data logger running on one computer to be accessed as a server for other computers running GCP. The administrator can grant access to an individual computer or all computers in a network by defining appropriate firewall rules.

When a firewall exists, it is necessary to allow incoming connections for TCP traffic on port 8004 on the server running the GCP Data Logger and allow corresponding outgoing traffic on the computer that needs to access this GCP Data Logger remotely. In addition, ICMP messages must not be blocked on the respective computers. Refer to the following screen images for examples of Windows settings.

NOTICE
Changes to firewall security settings could compromise the network security. Any changes must only be done with the approval of relevant IT support.

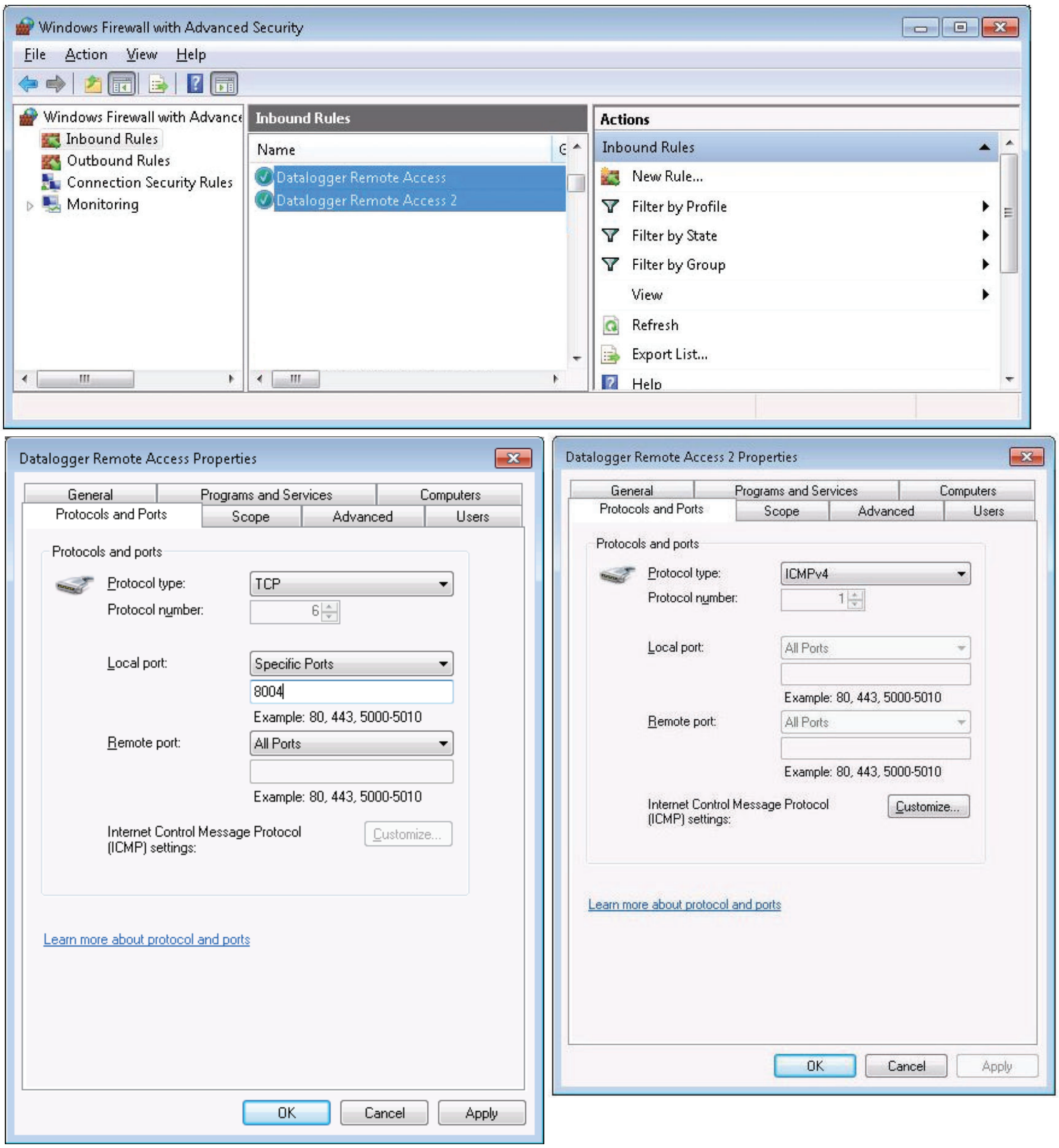


Figure 14-6 Windows Settings for Remote Access

Once firewall settings have been confirmed, it should be possible to access data on a remote computer using GCP on a different computer. To do this, set the data logger location to "Remote" and enter IP Address of computer running GCP data logger. After the IP Address is entered, the window will display the configuration of monitored analyzers on the remote data logger.

If the connection status shows disconnected, then there may still be a network configuration issue.

14.5 Logged Data

The Logged Cycle Data displays the Data Logger stored data. Data Logger must be running as a service or application on the workstation and Log All or Log Reduced must be checked for this table to be populated. Alarm data is viewed in Logged Alarms (Data Logger) tab under Alarms.

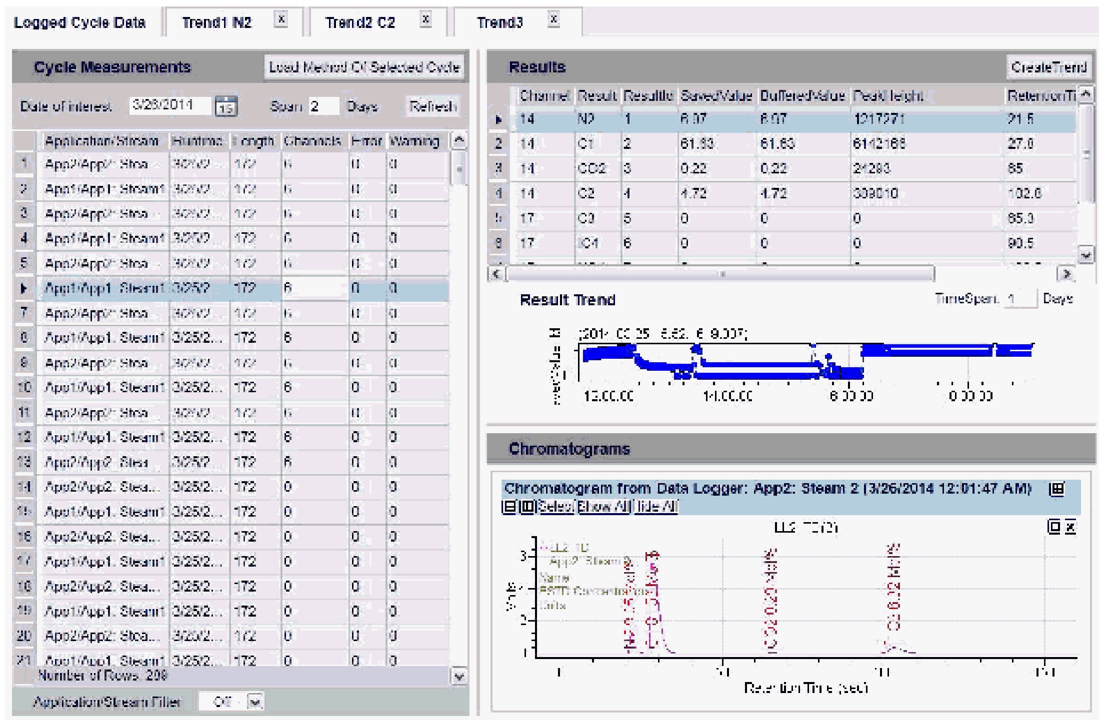


Figure 14-7 Logged Data

Cycle Measurement Table

- **Date of interest:** The left pane displays a range of Data Logger records starting at the ‘Date of interest’ date and Span the number of Days specified back in time. Date of interest and Span Days are in the header area of the Cycle Measurements table.
- **Refresh:** The Cycle Measurement table does not automatically refresh. When Date of interest is today’s date click the Refresh button to update the Cycle Measurements table with the latest cycle measured.

Load Method of Selected

CycleThe 'Load Method of Selected Cycle' action button in the Cycle Measurement title bar adds the Method of the selected cycle measurement to the GCP Methods view of the appropriate application. The Data Logger saved method name will start with DL, followed by the method name and the methods time stamp. Methods for Data Logger file are not saved in the Log Reduced file mode only in the Log All mode.

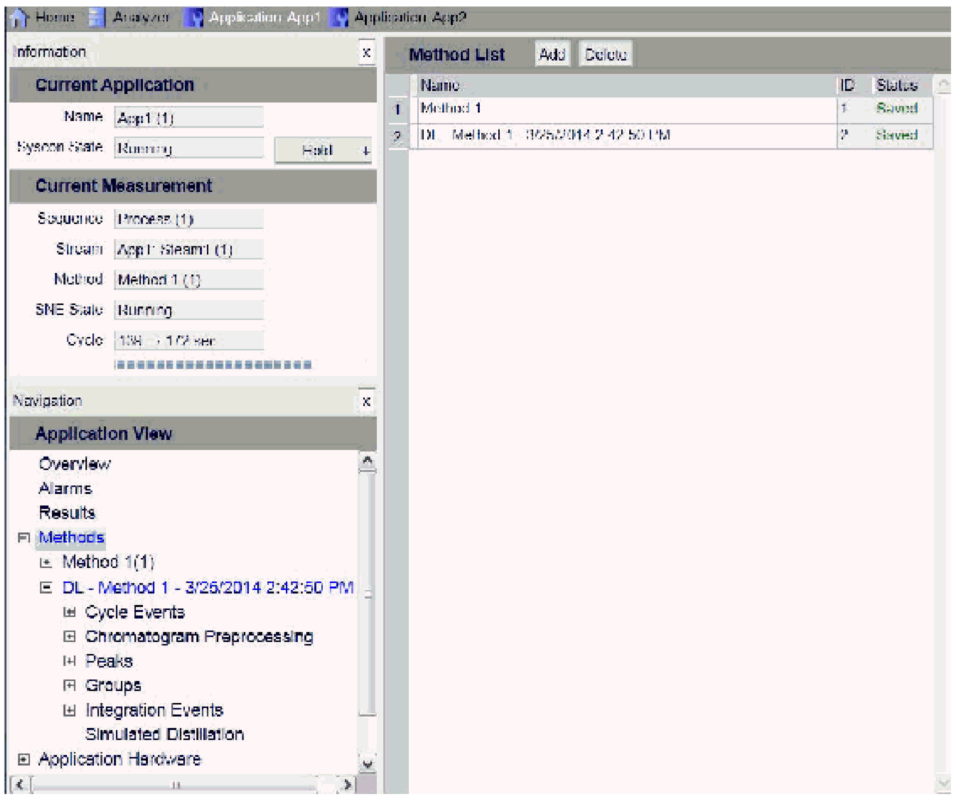


Figure 14-8 Load Method of Selected Cycle

- Channel Column: The Channel column value indicates the number of channels, detector chromatograms stored in each cycle record. Reduced Log mode will not save chromatograms. Therefore the channel value for cycle records saved in Reduced Log mode are zero indicating not chromatogram is saved for that cycle record.
- Applications/Stream Filter: At the bottom of the Cycle Measurements table is the Applications/Stream Filter. The drop down menu will allow users to select which applications or streams will be displayed in the Cycle Measurements table.

Results Table in Logged Data Cycle

Results: The Results table displays the stored analytical results for the selected Cycle Measurements record. Available columns include; Channel, Result Name, Result ID, Saved Value, Buffered Value, Peak Height, Retention Time, Resolution, Peak Area, Compare Value, Compare Margin, Compare Deviation Percent, and Compare State.

Result Trend: Below the Results table is the Result Trend graph for the selected result. The time span can be selected starting with the current date and spanning back in time the number of days entered. The graph functions similar to the chromatograph display. Use the graphical zoom to select the time period and saved value range to be displayed. Right click the graph to; Add Text …, Copy, Page Setup for Print, Print Preview, Print, Zoom Back, Zoom Forward and Zoom Full.

Chromatograms: Logged chromatograms are displayed in the bottom right pane. In Log Reduced mode the chromatograms will not be saved unless there is a cycle alarm. If the channel value for the record in the Cycle Measurements table is a zero this indicates not detector channels or chromatograms were saved in that record. Select Log All in the action bar to save chromatograms to the Data Logger database.

The default chromatogram display will show the chromatogram channel associated with the result selected in the Results table above. Select a result on a different chromatogram channel will change the chromatogram displayed to that chromatogram channel. The title bar for the chromatogram set displayed includes the application and stream name followed by the date and UTC time of the chromatogram. Use the Select, Show All and Hide All buttons to view other chromatogram channels in the selected data logger chromatogram file.

The graphic zoom and right click menu functions the same as all other chromatograms in GCP.

User Actions

Trend Tabs in the Logged Cycle Data window can be added for selected results.

Select a record in the Cycle Measurements table. Select one or more results in the Results table. To select multiple results hold down the Control key on the keyboard and click each result to be highlighted. With one or more results highlighted click the Create Trend button in the Result table header. This will add a new tab in the Logged Data main window labeled Trend1.

The tab can be renamed by clicking the tab name field and typing the new name. The tab can be removed by clicking the x in the tab field.

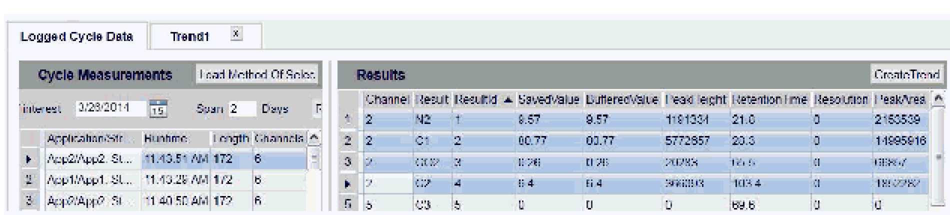


Figure 14-9 Create Logged Results Trend_image60

Trend Tab: Click on the created Trend tab to display the trend(s) selected. The Date of Interest and Span Days can be modified as needed. Click Refresh to update current results as needed. Multiple Trend graphs may be displayed stacked one over the other or in a Grid Tile pattern by clicking the Grid Tile check box. Select, Show All and Hide All buttons will allow users to manage the trend graphs similar to chromatograph displays.

Configure Export: The trend data can be exported to .txt file on the workstation computer memory storage device. Click the Configure Export Button and chose which result attributes to include in the export; Result Index, Result Name, Buffered Value, Cycle Runtime, Saved Value, Peak Height, Retention Time, Resolution and Peak Area.

Export: Click the Export button to create a tab delimited text file. The default file name is the analyzer name followed by the application and stream numbers with a .txt file extension.

Trend Graphs: The graph functions similar to the chromatograph display. Use the graphical zoom to select the time period and saved value range to be displayed. Right click the graph to; Add Text …, Copy, Page Setup for Print, Print Preview, Print, Zoom Back, Zoom Forward and Zoom Full. The cursor vertical track will move to the same time on all graphs, the cursor coordinates are in the upper left corner of each displayed graph. The Copy, Annotation and Print options will only apply to the selected graph.

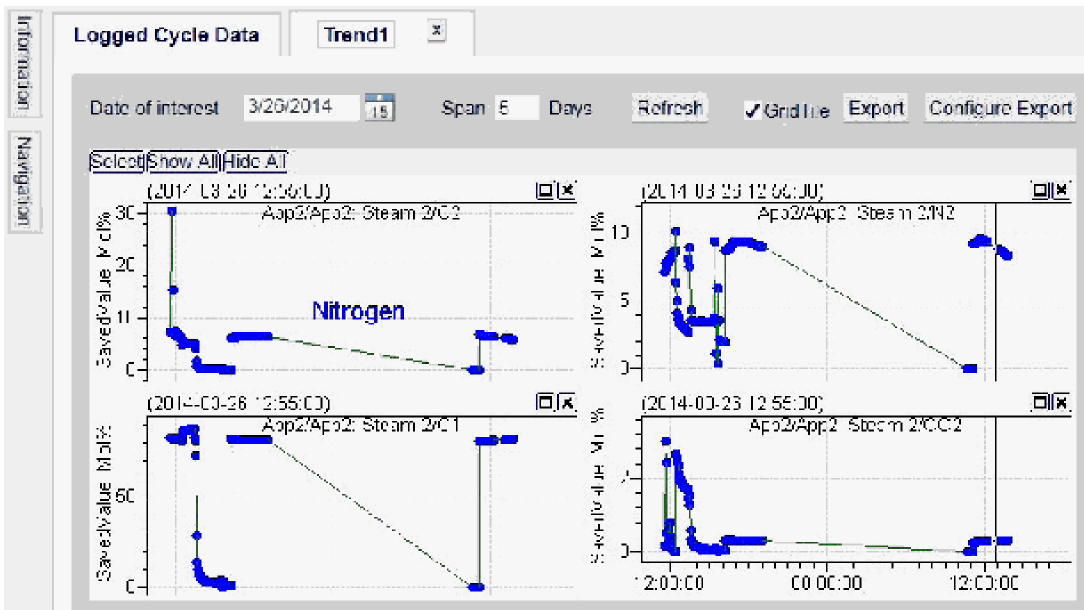


Figure 14-10 Graphs with four results selected ("Nitrogen" in the upper left graph is an example of an annotated text)

14.6 Accessing Logged Alarms

Logged Alarms for an analyzer can be found in either the Analyzer view or the Application view by choosing "Alarms" from the Navigation menu and then choosing the "Logged Alarms (Data Logger)" tab on the display window. See below.

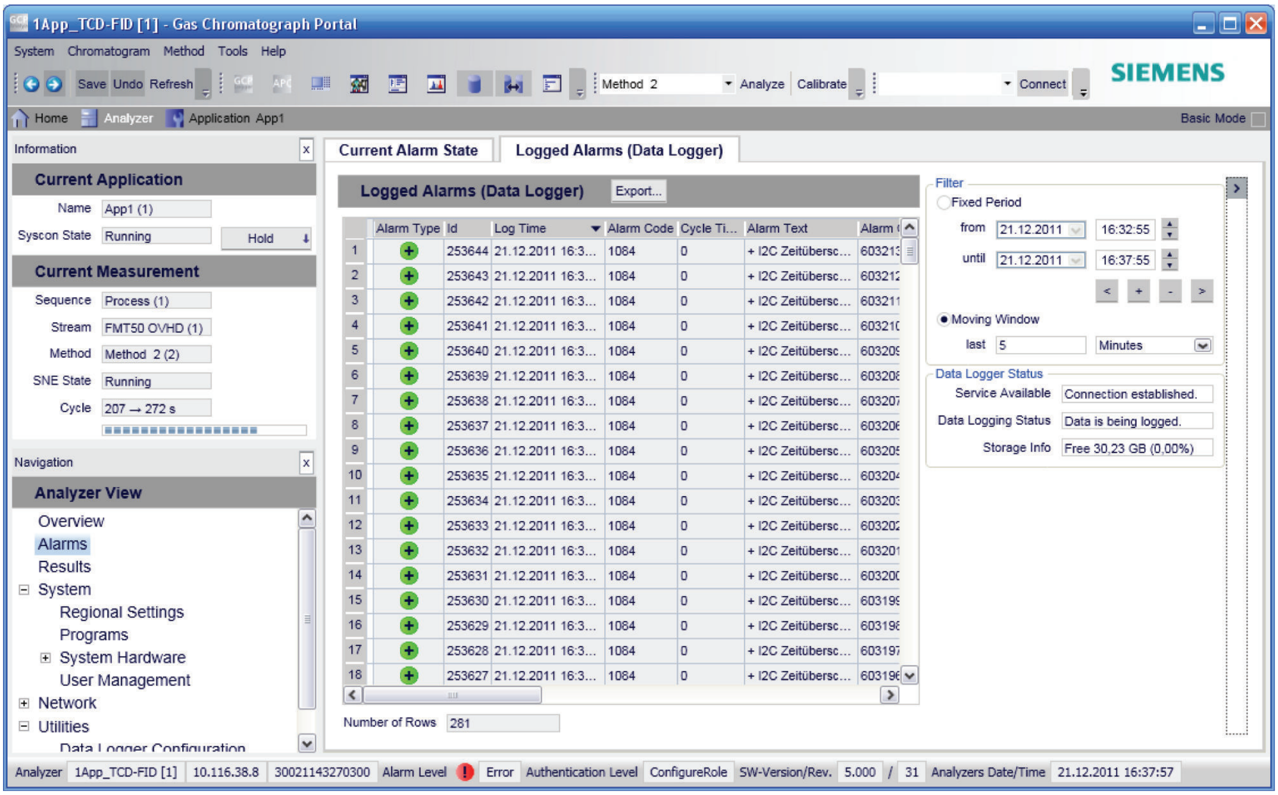


Figure 14-11 Logged Alarms Screen

Action is limited to viewing logged alarms. It is possible to use the filter on the right hand side of the window to see results for a particular time period. Results may either be displayed for a fixed period of time or a moving window of time.

When choosing a fixed period, use the drop down arrows to select a day and time to search. The icons below the period fields (<, +, -, >) are used to zoom and move forward and backward through the data. The zoom (+, -) reduces the overall internal. The arrows (<, >) go forward and backward in time.

When choosing a moving window, select the time units (days, hours, or minutes) and the amount of time. This will show all results from the present time back for the specified amount of time. This window of time is always advancing with the current system clock.

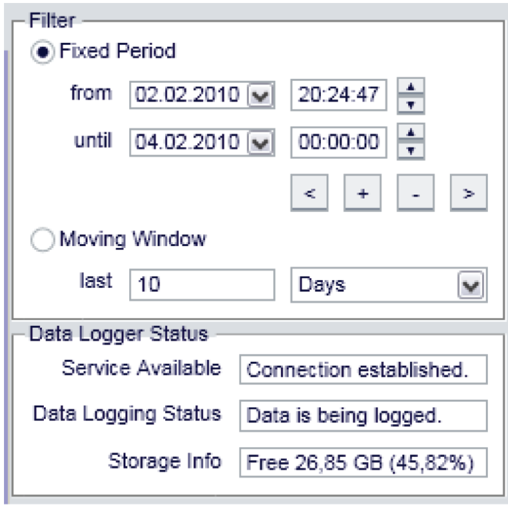


Figure 14-12 Time Based Data Filter

Export:

The Export button is used to save the data to a text file. Click the Export button and then enter the file name (or keep the default file name) and then click Save.

14.7 Accessing Logged Results

Logged Results for an analyzer can be found in the Analyzer view by choosing "Results" from the Navigation menu and then choosing the "Logged Results (Data Logger)" tab on the display window. See below.

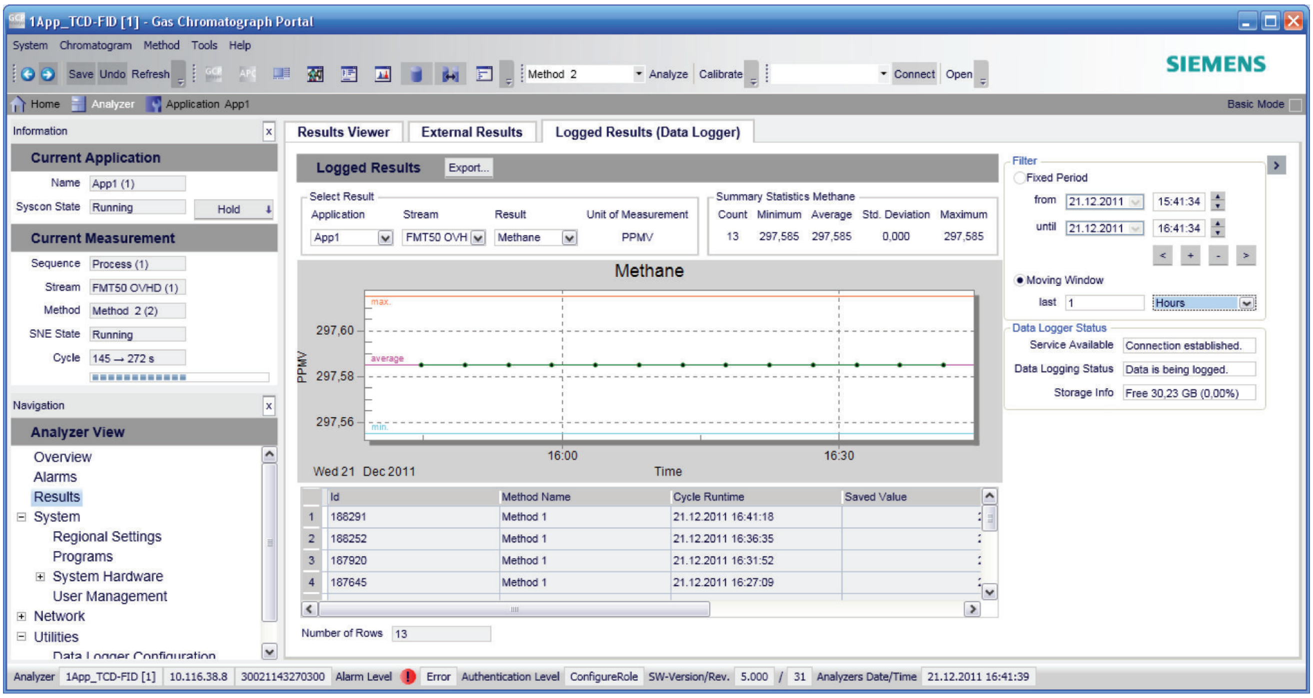


Figure 14-13 Logged Results Screen

Interpreting the Display:

One result can be shown at a time. To select a result, use the "Select Result" area at the top of the screen. First choose the Application from the drop-down menu and then the Stream. Then choose the desired Result from the list (note the selection must be done in that order, otherwise the Stream and Result fields will not have any options).

Instances of the selected Result will be displayed on the graph for the specified time period shown in the time filter. Also, statistics relating to the displayed data are shown in the Summary Statistics area at the top of the screen. These statistics are for the shown data points. If the time filter is changed to show more or fewer results, then the statistics may change.

Clicking holding the mouse button while over the graph allows the user to zoom in on a part of the graph. Right clicking allows the user to un-zoom the graph.

At the bottom of the display is a table of all the stored results, including the timestamp and value.

Time Filter:

It is possible to use the filter on the right hand side of the window to see results for a particular time period. Results may either be displayed for a fixed period of time or a moving window of time.

When choosing a fixed period, use the drop down arrows to select a day and time to search. The icons below the period fields (<, +, -, >) are used to zoom and move forward and backward through the data. The zoom (+, -) reduces the overall internal. The arrows (<, >) go forward and backward in time.

When choosing a moving window, select the time units (days, hours, or minutes) and the amount of time. This will show all results from the present time back for the specified amount of time. This window of time is always advancing with the current system clock.

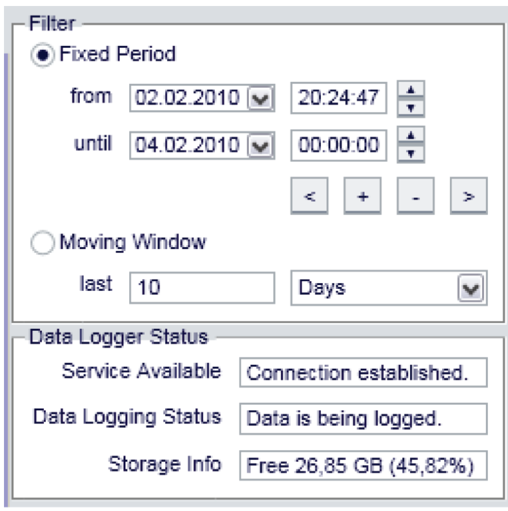


Figure 14-14 Time Based Data Filter

Export:

The Export button is used to save the data to a text file. Click the Export button and then enter the file name (or keep the default file name) and then click Save.

14.8 Accessing Logged Chromatograms

Logged chromatograms are accessed from the Chromatogram menu by choosing "Load From Data Logger"

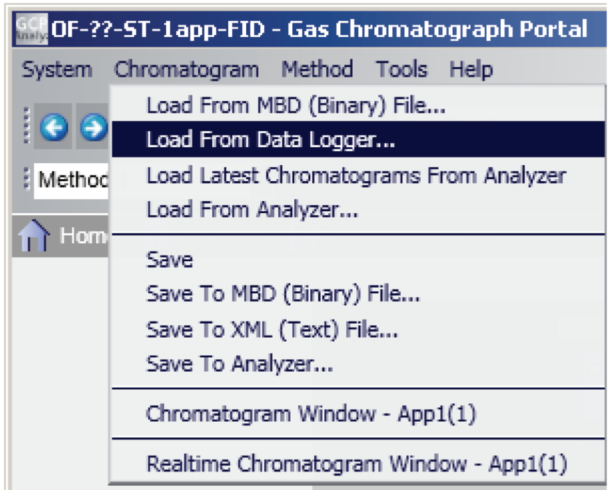
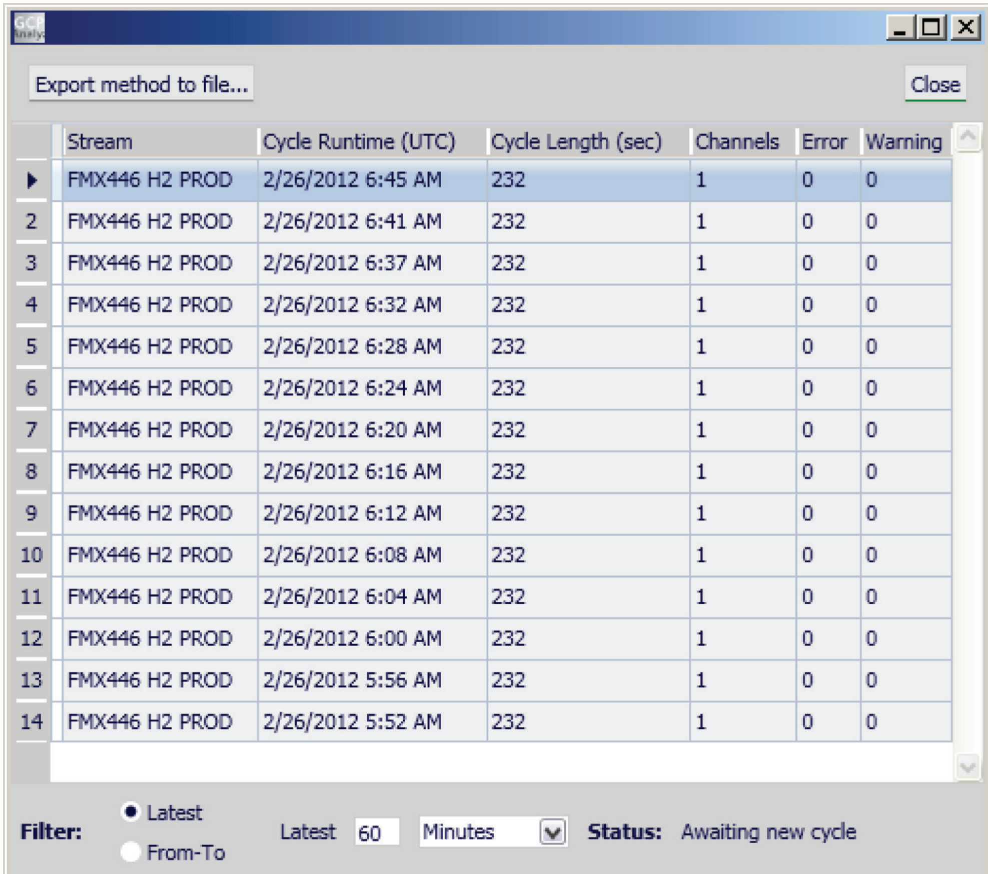


Figure 14-15 Loading Chromatograms from Data Logger

This function will load a list of all logged chromatograms for the current analyzer. This list will be displayed in a separate window as shown below. The filter at the bottom of the window allows the user to sort over a range of time or to see the most recent list going back to a specified point.



	Stream	Cycle Runtime (UTC)	Cycle Length (sec)	Channels	Error	Warning
▶	FMX446 H2 PROD	2/26/2012 6:45 AM	232	1	0	0
2	FMX446 H2 PROD	2/26/2012 6:41 AM	232	1	0	0
3	FMX446 H2 PROD	2/26/2012 6:37 AM	232	1	0	0
4	FMX446 H2 PROD	2/26/2012 6:32 AM	232	1	0	0
5	FMX446 H2 PROD	2/26/2012 6:28 AM	232	1	0	0
6	FMX446 H2 PROD	2/26/2012 6:24 AM	232	1	0	0
7	FMX446 H2 PROD	2/26/2012 6:20 AM	232	1	0	0
8	FMX446 H2 PROD	2/26/2012 6:16 AM	232	1	0	0
9	FMX446 H2 PROD	2/26/2012 6:12 AM	232	1	0	0
10	FMX446 H2 PROD	2/26/2012 6:08 AM	232	1	0	0
11	FMX446 H2 PROD	2/26/2012 6:04 AM	232	1	0	0
12	FMX446 H2 PROD	2/26/2012 6:00 AM	232	1	0	0
13	FMX446 H2 PROD	2/26/2012 5:56 AM	232	1	0	0
14	FMX446 H2 PROD	2/26/2012 5:52 AM	232	1	0	0

Figure 14-16 List of Chromatograms from Data Logger

At the same time the list is displayed, the chromatogram viewer is also opened, showing the first chromatogram in the list. The chromatogram viewer is described in other sections. Clicking on a line in the list window loads that chromatogram in the chromatogram viewer.

Note that the chromatogram loaded into the chromatogram viewer is also loaded into GCP, so that it can be used for functions such as method development.

If the method was saved with the chromatogram, then the button at the top of the list, titled "Export method to file", can be used to save the method to disk.

14.9 Managing Logged Data

As noted in previous sections, logged data is stored in an SQL database file. This file has a maximum size of 3.5 GB. When a file reaches this size, it is closed and a new one is opened. The files are stored in the location defined when the data logger is setup on the local computer.

Deleting Logged Data:

There is no option for selectively deleting logged data from existing files. The SQL database is designed such that deleting data in this way would not reduce the file size and would also adversely affect performance.

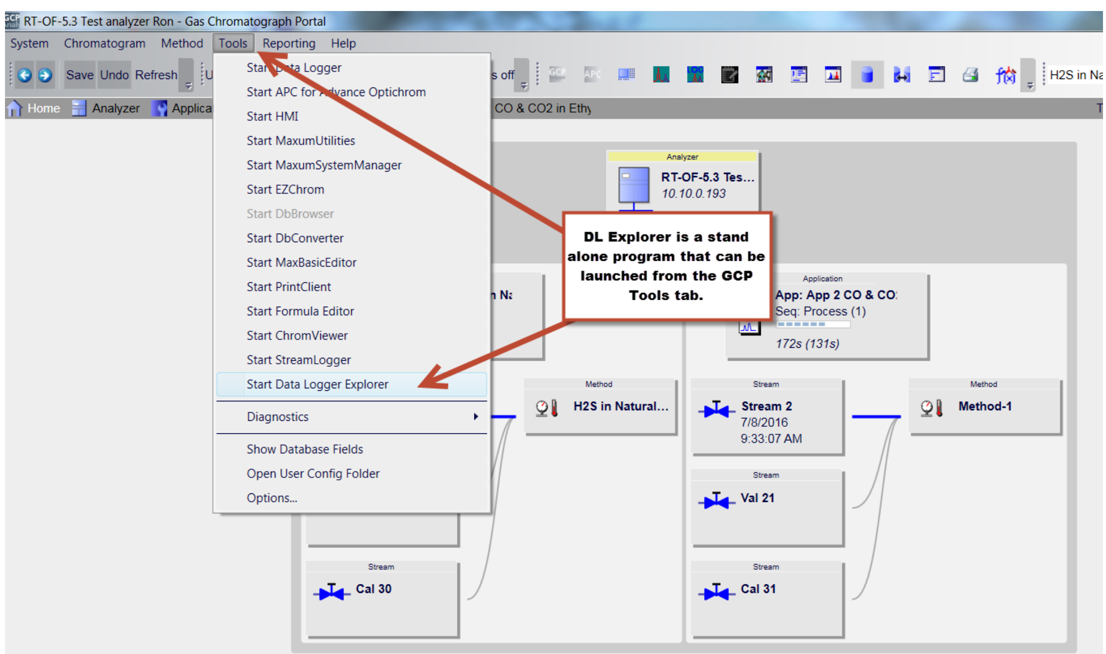
If it is necessary to recover hard drive space, then old files can be deleted (archiving elsewhere if required). The file names are automatically selected and based on the date of creation, as seen in the example names below.

- DataLoggerArchive_2011_11_20__08_16_31.sdf
- DataLoggerArchive_2012_01_12__14_32_46.sdf
- DataLoggerArchive_2012_03_01__12_14_09.sdf

The second file above was created on January 12, 2012 at 2:32:46 PM. If it is no longer necessary to keep information from prior to this time (or all data from prior to this time has been archived elsewhere, then the first file (created on November 20, 2011) can be deleted. Do not delete the most recent file.

14.10 DLExplorer

The Data Logger Explorer (DLExplorer) is a stand alone program to give the GCP user a way to manipulate saved data and methods. The data can be used at a later date for calculations, or comparisons with future data. The chromatograms can be archived for later use in comparisons or troubleshooting.

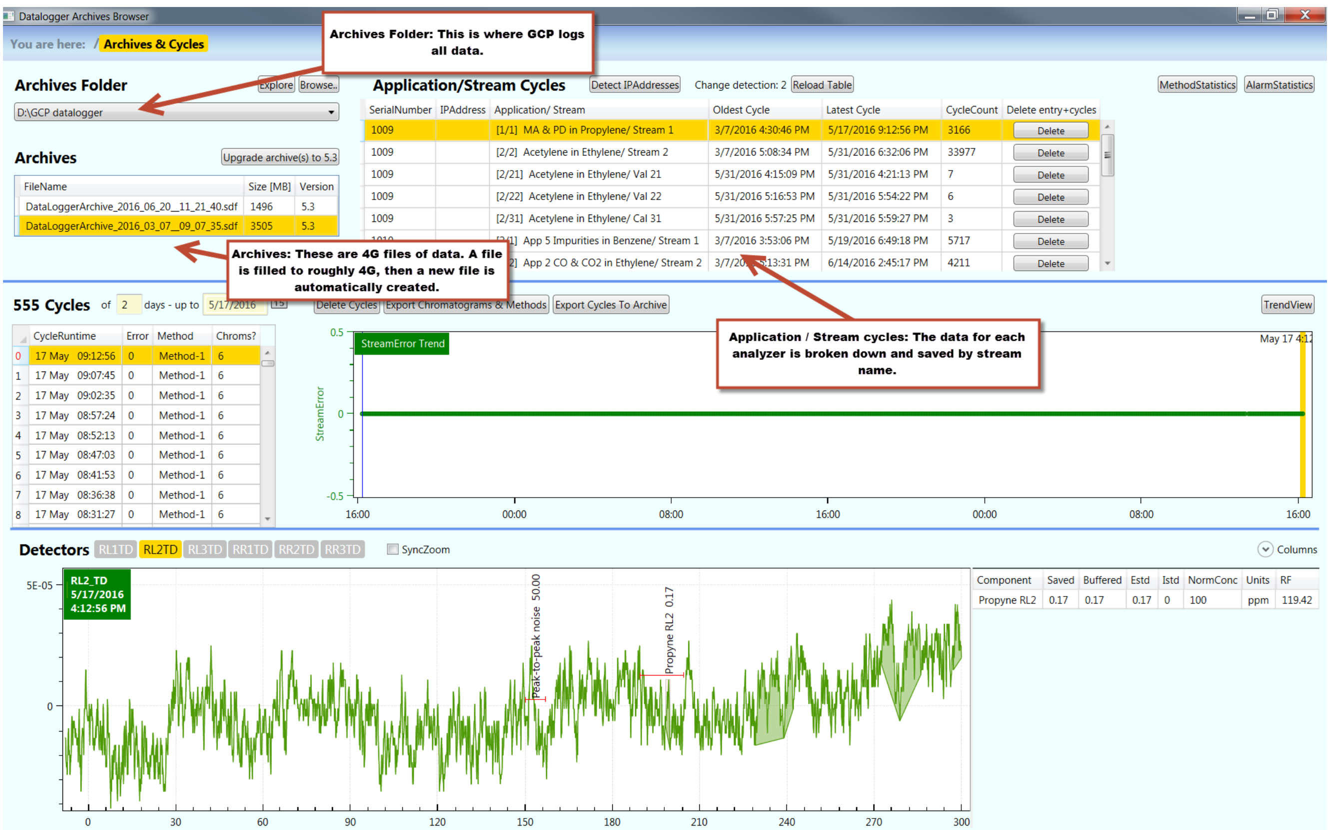


DLExplorer can be launched in the Tools menu of GCP.

14.10.1 DLExplorer Features

Archives Folder

This folder is where all data and chromatograms are stored. Data can be stored to any selected location. However, DLExplorer will only store to one location\file at a time.



Archives

This folder stores SDF files up to 4GB in size. As one file becomes full another 4GB file is created. A 4GB SDF file contains the data for all of the logged analyzers and streams.

Application/Stream Cycles

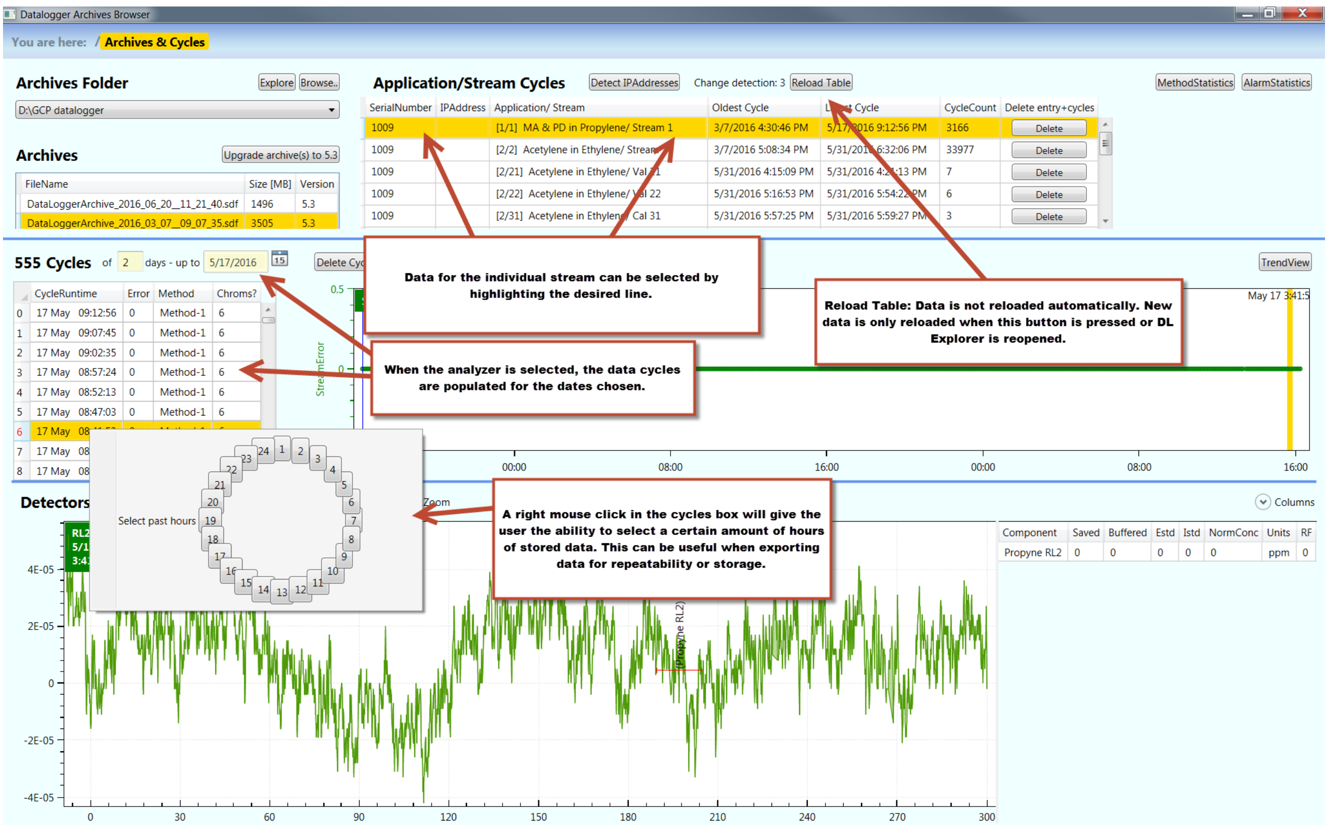
The application/stream table shows each app and stream that is being logged. These can be sorted by any column and may be deleted as an entire stream if desired.

Reload Table Button

Data being logged to DLExplorer does not automatically update. The reload button must be clicked each time to reload the newest data.

Cycles Table

When a stream is selected in the application table, the data for that stream will be populated in the cycles table. The cycles data can be shown for the entire date range in the SDF file or limited to a specific range using the range boxes at the top of the table. Right-click inside the cycles table to open a past-hours box. This gives the user an opportunity to choose a range of time to be saved or exported. This is useful for archiving data or repeatability.



Stream Error trend Table

The error trend table gives a quick overview to the user to differentiate good data from bad or no data. A green dot shows a good cycle has been logged.

Delete Cycles Button

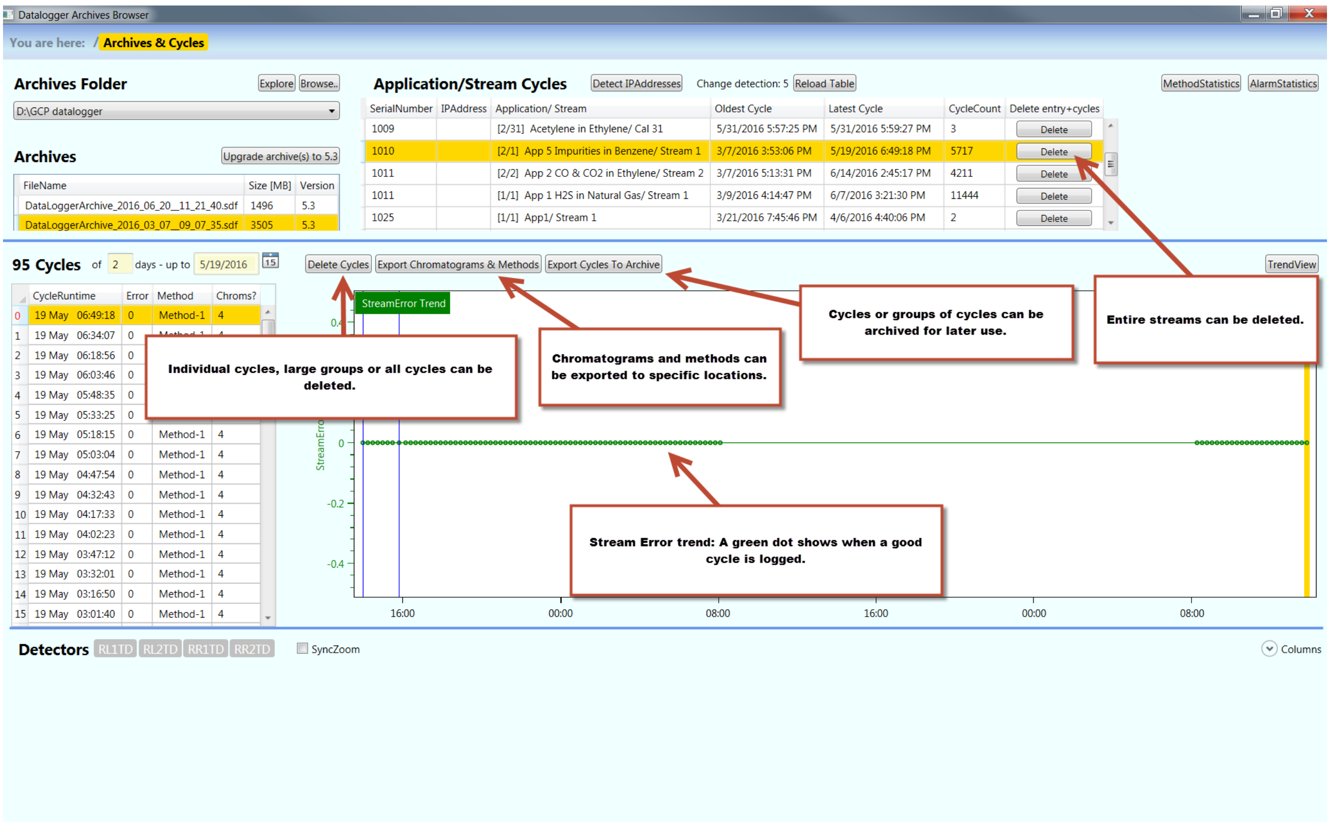
Individual cycles, large groups or all cycles can be deleted by selecting the cycles in the cycles table and then pushing this button.

Export Chroms and Methods Mutton

This button can be used to save or export chromatograms and methods. As with the delete button, select the cycles desired in the cycles table, and then push this button.

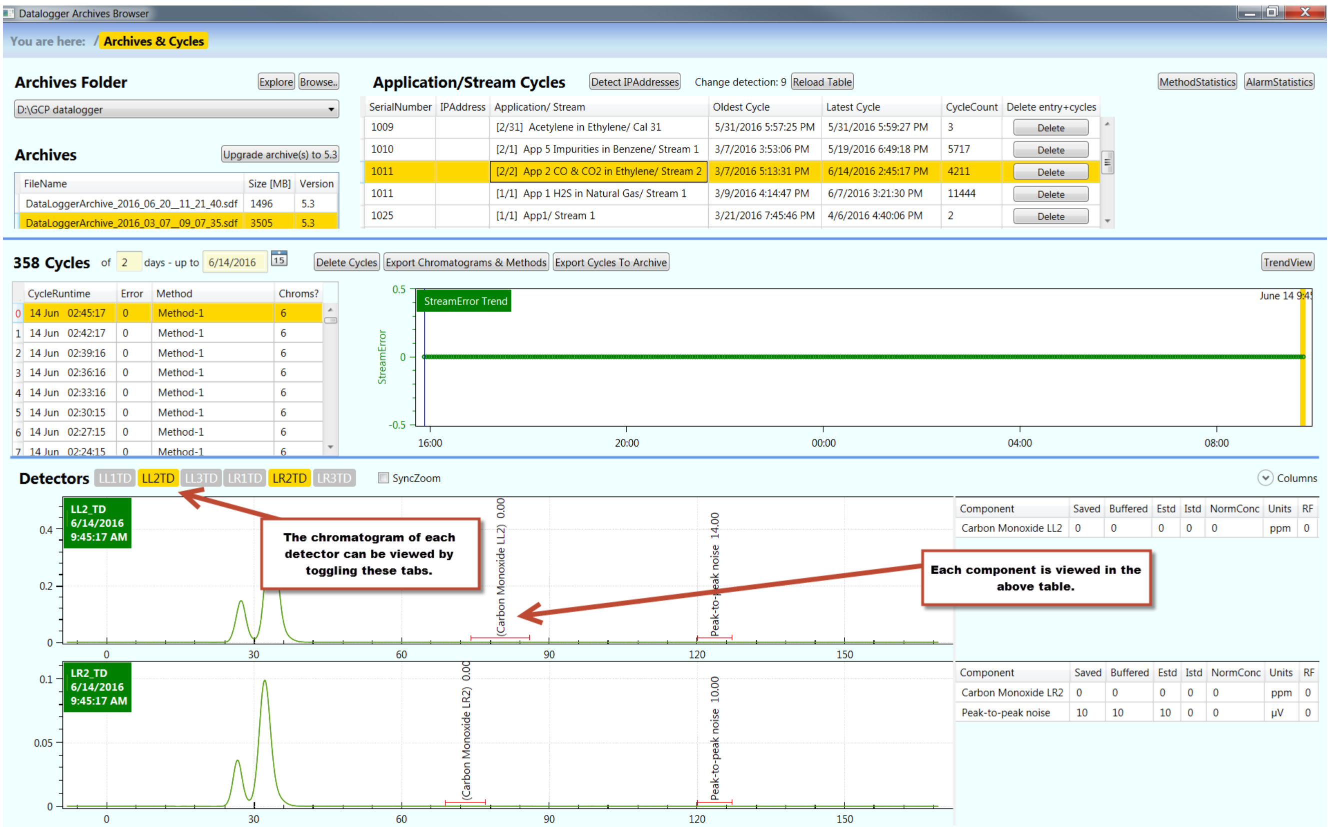
Export Cycles To Archive

This button archives desired cycles for later use by GCP.



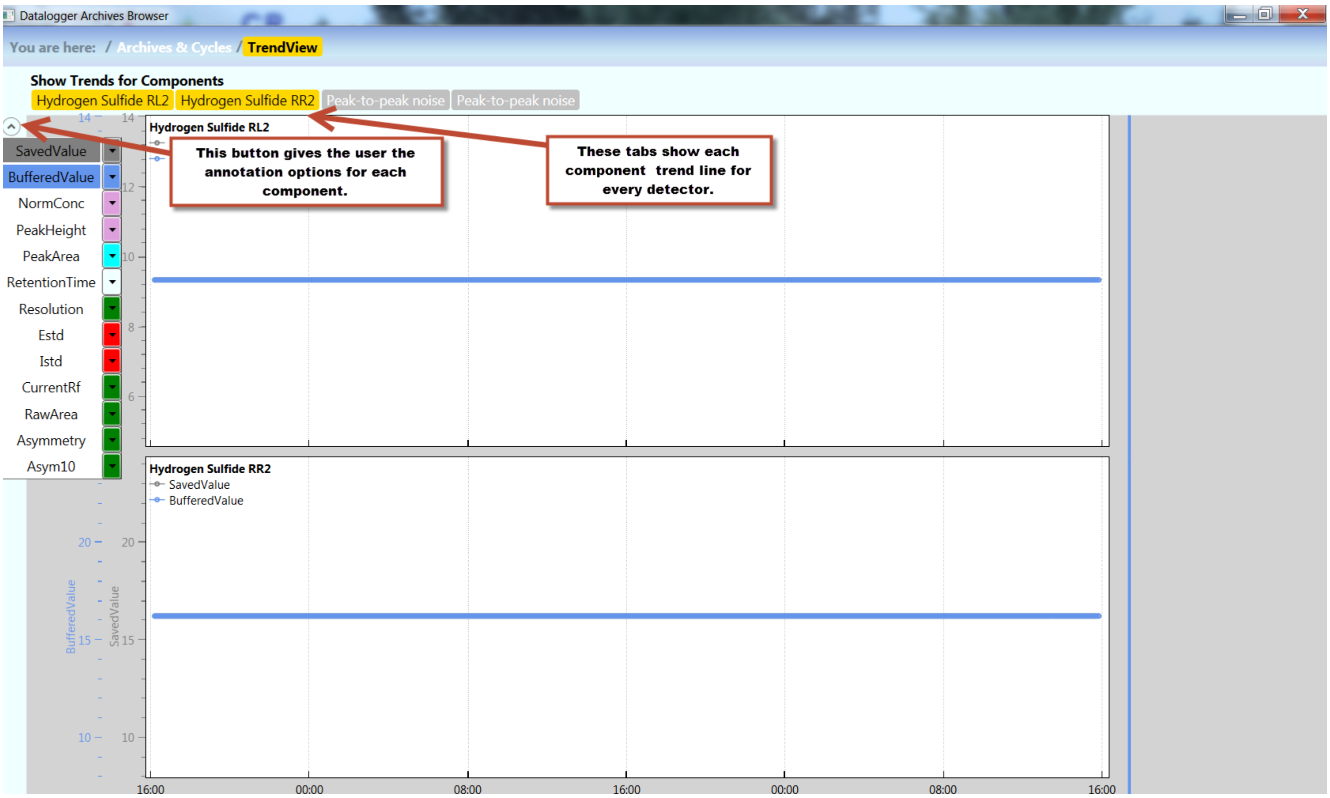
Detectors Table

The detectors table shows the chromatogram and component values for the current cycle chosen. Each detector channel view can be toggled on or off as desired. The chromatogram can be zoomed to show a close up of a desired peak. The components for each detector can be viewed and edited using the columns tab.

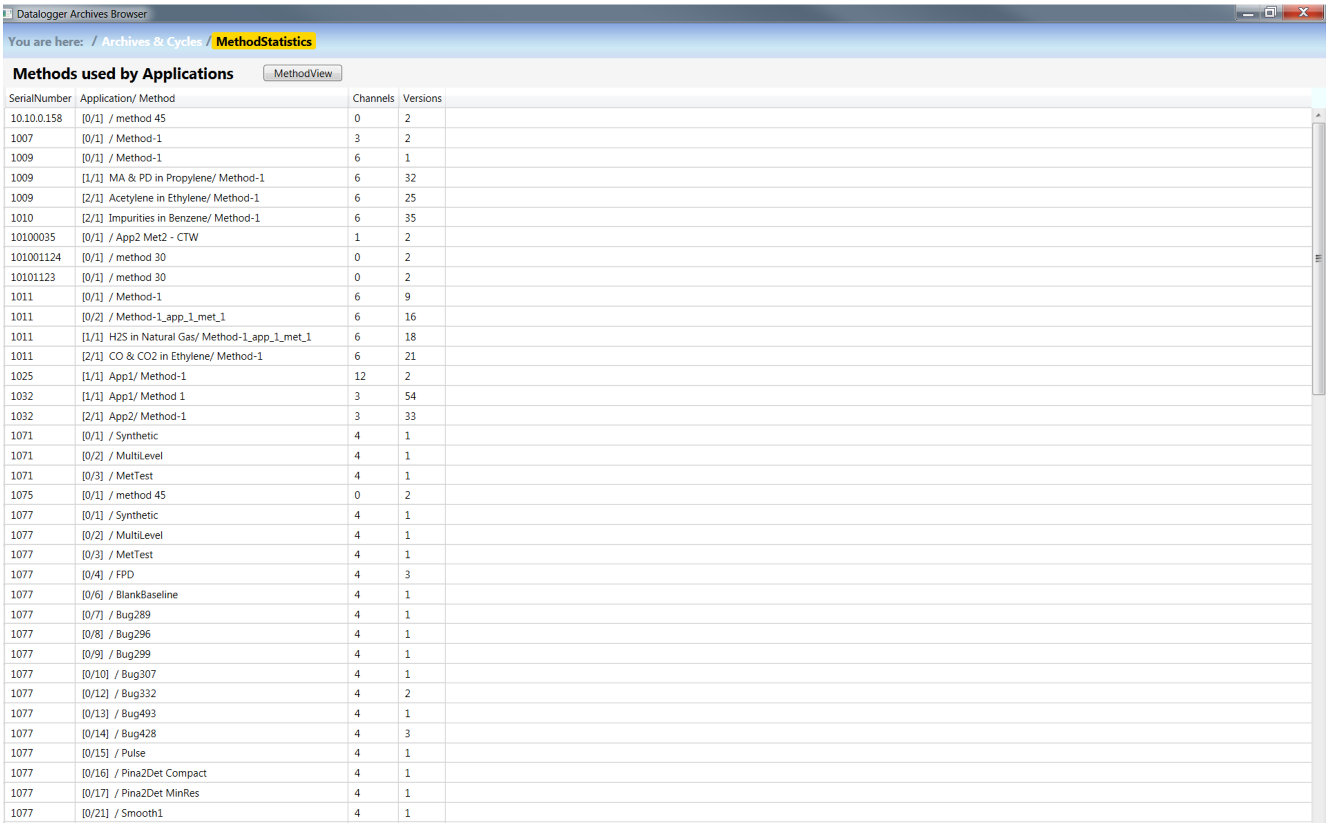


Trend View

This table shows the trend for every component on every detector. The chromatogram attributes can be selected using the down arrow at the left.



Method Statistics

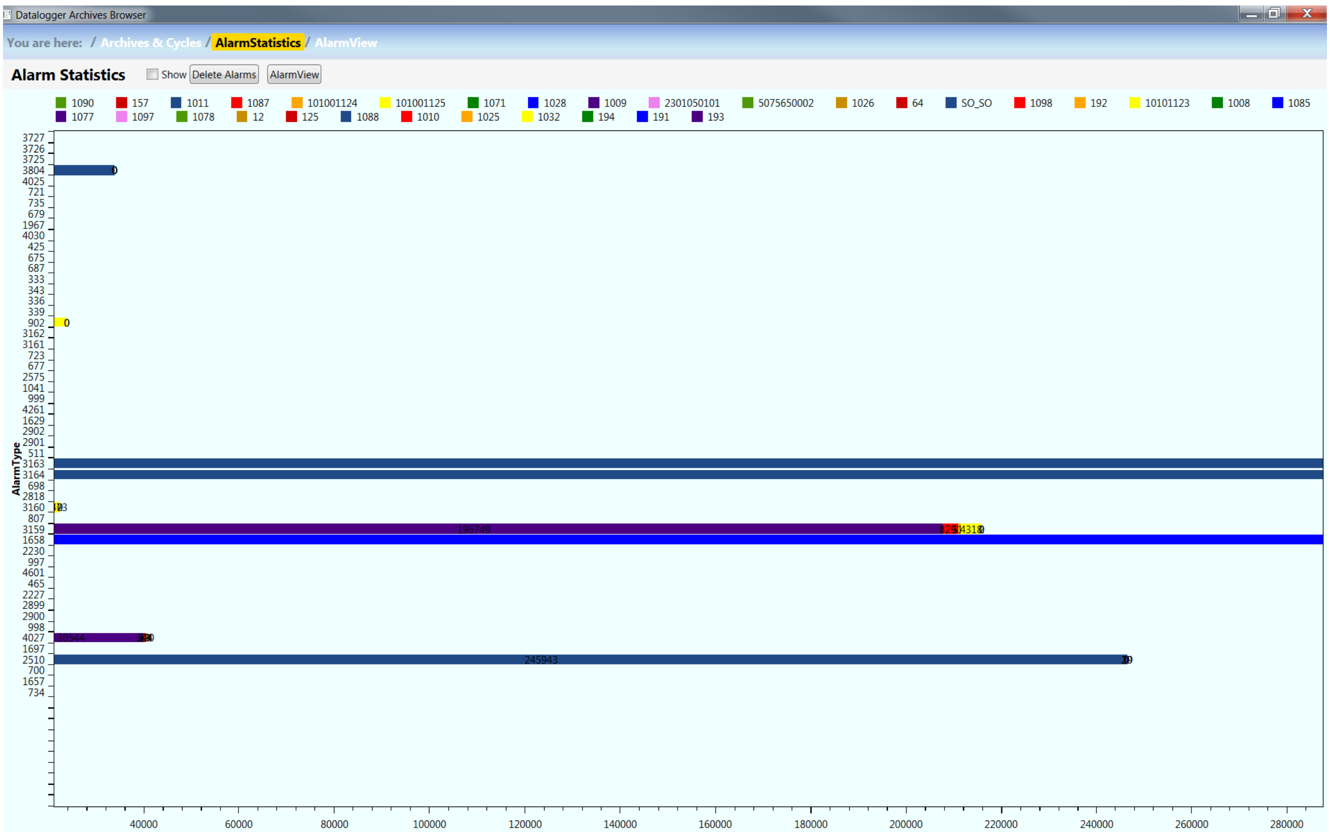

Datalogger Archives Browser

You are here: / Archives & Cycles / MethodStatistics

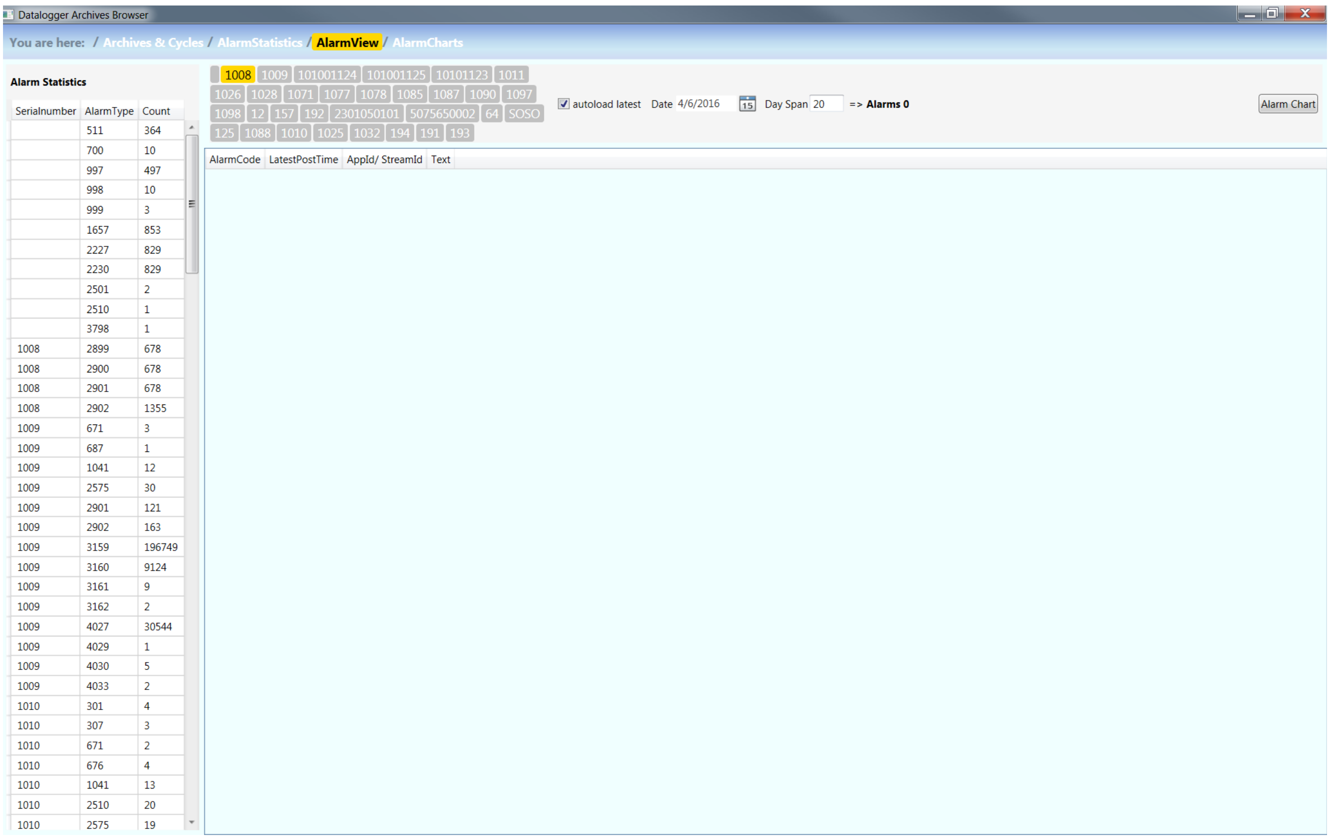
Methods used by Applications MethodView

SerialNumber	Application/ Method	Channels	Versions
10.10.0.158	[0/1] / method 45	0	2
1007	[0/1] / Method-1	3	2
1009	[0/1] / Method-1	6	1
1009	[1/1] MA & PD in Propylene/ Method-1	6	32
1009	[2/1] Acetylene in Ethylene/ Method-1	6	25
1010	[2/1] Impurities in Benzene/ Method-1	6	35
10100035	[0/1] / App2 Met2 - CTW	1	2
101001124	[0/1] / method 30	0	2
10101123	[0/1] / method 30	0	2
1011	[0/1] / Method-1	6	9
1011	[0/2] / Method-1_app_1_met_1	6	16
1011	[1/1] H2S in Natural Gas/ Method-1_app_1_met_1	6	18
1011	[2/1] CO & CO2 in Ethylene/ Method-1	6	21
1025	[1/1] App1/ Method-1	12	2
1032	[1/1] App1/ Method 1	3	54
1032	[2/1] App2/ Method-1	3	33
1071	[0/1] / Synthetic	4	1
1071	[0/2] / MultiLevel	4	1
1071	[0/3] / MetTest	4	1
1075	[0/1] / method 45	0	2
1077	[0/1] / Synthetic	4	1
1077	[0/2] / MultiLevel	4	1
1077	[0/3] / MetTest	4	1
1077	[0/4] / FPD	4	3
1077	[0/6] / BlankBaseline	4	1
1077	[0/7] / Bug289	4	1
1077	[0/8] / Bug296	4	1
1077	[0/9] / Bug299	4	1
1077	[0/10] / Bug307	4	1
1077	[0/12] / Bug332	4	2
1077	[0/13] / Bug493	4	1
1077	[0/14] / Bug428	4	3
1077	[0/15] / Pulse	4	1
1077	[0/16] / Pina2Det Compact	4	1
1077	[0/17] / Pina2Det MinRes	4	1
1077	[0/21] / Smooth1	4	1
1077	[0/22] / Smooth2	4	1

Alarm Statistics



Alarm View


Datalogger Archives Browser
You are here: / Archives & Cycles / AlarmStatistics / AlarmView / AlarmCharts
Alarm Statistics
Serialnumber AlarmType Count
511 364
700 10
997 497
998 10
999 3
1657 853
2227 829
2230 829
2501 2
2510 1
3798 1
1008 2899 678
1008 2900 678
1008 2901 678
1008 2902 1355
1009 671 3
1009 687 1
1009 1041 12
1009 2575 30
1009 2901 121
1009 2902 163
1009 3159 196749
1009 3160 9124
1009 3161 9
1009 3162 2
1009 4027 30544
1009 4029 1
1009 4030 5
1009 4033 2
1010 301 4
1010 307 3
1010 671 2
1010 676 4
1010 1041 13
1010 2510 20
1010 2575 19
1008 1009 101001124 101001125 10101123 1011
1026 1028 1071 1077 1078 1085 1087 1090 1097
1098 12 157 192 2301050101 5075650002 64 SOSO
125 1088 1010 1025 1032 194 191 193
autoload latest Date 4/6/2016 Day Span 20 => Alarms 0
Alarm Chart
AlarmCode LatestPostTime AppId/ StreamId Text

15 Software Versions

15.1 GCP 5.30.02

Maxum 5.30.02 Version Numbers:

Contents automatically generated on Mon Oct 15 14:40:25 CDT 2018

SYSCON:

Bootloader version: 4.01.03
OS version: 4.03.02
DB version: 5.30.16

SNE:

OS version: 0004.f16
APP version: 0004.e16

Maxum Workstation SW Components:

Gas Chromatograph Portal: 5.30.02
Maxum System Manager : 5.000.19
DbConverter : 5.30.16
Formula : 5.30.06
HMI : 5.30.19
PrintClient : 2.00.07

15.2 GCP 5.20

Maxum 5.20-07 Version Numbers:

SYSCON:

Bootloader version: 3.07.02
OS version: 3.07.08
DB version: 5.20-25

SNE:

OS version: 0004.f16
APP version: 0004.e16

The version numbers of workstation components are listed in the file
C:\Maxum System Manager\WorkstationVersions.txt

15.3 GCP 5.10

Maxum 5.10-15 Version Numbers:

SYSCON:
Bootloader version: 3.00.04
OS version: 3.00.13
DB version: 5.100-82
B/W HMI version 1.00.43
Touchscreen HMI 2.00.50
TEXT version: 5.10-02

SNE:
OS version: 0004.f16
APP version: 0004.e16

Workstation Software:
Gas Chromatograph Portal: 5.10.10.448
Maxum System Manager: 5.000.19
Touchscreen Workstation HMI: 2.0.51

Other Software:
APC: 8.1.6
MaxBasic: 1.0.10
SimDis.dll 4.100.5
Statmon 1.00.0010
Printclient 1.1.2
DbConverter 2.00.21
Formula 1.17.0

15.4 GCP 5.00

Maxum 5.00-10 Version Numbers:

SYSCON:
Bootloader version: 1.02.08
OS version: 1.03.05
DB version: 5.000-48
HMI version: 1.00.40

SNE:
OS version: 0004.f16
APP version: 0004.e16

Workstation Software:
EZChrom: 5.00.17
System Manager: 5.00.19
Touchscreen Workstation HMI:2.00.49
Workstation HMI: 1.00.45

Other Software:
APC: 8.1.6
MaxBasic: 1.0.10
SimDis.dll 4.100.5
Statmon 1.00.0010
Printclient 1.1.0
DBConverter 2.00.17

15.5 GCP 4.50

Maxum 4.50 Version Numbers:

SYSCON:
BIOS version: 04.11 (Mar 18, 2005)
OS version: V4.4.0 (Oct 2012)
DB version: 4.50-16
B/W HMI version 4.30-02 version for DM
Touchscreen HMI 2.00.50
TEXT version: 5.10-02

SNE:
OS version: 0004.f16
APP version: 0004.e16

Workstation Software:
EZChrom: 5.00.17
System Manager: 5.00.19
Touchscreen Workstation HMI: 2.0.49
Workstation HMI: 1.00.45

Other Software:
APC: 8.1.6
MaxBasic: 1.0.10
SimDis.dll 4.100.5
Statmon 1.00.0010
Printclient 1.1.0
DbConverter 2.00.17

15.6 GCP 4.40

Maxum 4.40 Version Numbers:

SYSCON:
BIOS version: 04.11 (Mar 18, 2005)
OS version: V4.4.0 (Oct 2012)
DB version: 4.40-11
B/W HMI version 4.30-02 version for DM
Touchscreen HMI 2.00.33
TEXT version: 5.10-02

SNE:
OS version: 0004.f16
APP version: 0004.e16

Workstation Software:
EZChrom: 5.00.17
System Manager: 5.00.19
Touchscreen Workstation HMI: 2.0.37.0
Workstation HMI: 1.00.42

Other Software:
APC: 8.1.6
MaxBasic: 1.0.10
SimDis.dll 4.100.5
Statmon 1.00.0010
Printclient 1.0.5.1
DbConverter 2.00.13

15.7 GCP 4.30

Maxum 4.3 Version Numbers:

SYSCON:
BIOS version: 04.11 (Mar 18, 2005)

OS version: V4.2.1 (Nov 2008)

DB version: 4.300-42

DM version: 4.300-02

TEXT version: 5.10-02

SNE:
OS version: 0004.f16
APP version: 0004.e16

Workstation Software:
EZChrom: 5.00.17
System Manager: 5.00.18

Other Software:
APC: 8.1.6
MaxBasic: 1.0.10
SimDis.dll 4.100.5
Statmon 1.00.0010
Printclient 1.04.00
DbConverter 1.0.16

15.8 GCP 4.20

Maxum 4.2 Version Numbers:

SYSCON:
BIOS version: 04.11 (Mar 18, 2005)
OS version: V4.2.1 (Dec 16, 2005)
DB version: 4.200-18
DM version: 4.200-05
TEXT version: 4.200-04

SNE:
OS version: 0004.f16
APP version: 0004.e16

Workstation Software:
EZChrom: 4.200.0
System Manager: 4.200.0

Other Software:
APC: 8.1.6
MaxBasic: 1.0.10
SimDis.dll 4.100.1

15.9 GCP 4.10

Maxum 4.1c Patch 3 HRVOC application update Version Numbers:

SYSCON:
BIOS version: 04.11 (Mar 18, 2005)
OS version: V4.2.1 (Dec 16, 2005)
DB version: 4.100-81
DM version: 4.100-19
TEXT version: 4.100-07

SNE:
OS version: 0004.f16
APP version: 0004.e16

Workstation Software:
EZChrom: 4.100.5
System Manager: 4.100.3

Other Software:
APC: 8.1.6
MaxBasic: 1.0.10
SimDis.dll 4.100.1

15.10 GCP 4.00

Maxum 4.0b Patch5 Version Numbers:

SYSCON:
BIOS version: 04.11 (Mar 18 2005)
OS version: V4.2.1 (Dec 16, 2005)
DB version: 4.000-36
DM version: 4.100-19
TEXT version: 4.100-07 (Text version will be at 4.000-00 for a patch upgrade.)

SNE:
OS version: 0004.f16

APP version: 0004.e16

Workstation Software:
Advance EZChrom: 4.0
EZChrom Maxum.IFace: 4.000.5
System Manager: 4.000.2

Other Software:
APC: 8.1.6
MaxBasic: 1.0.7
SimDis.dll 4.000.0

15.11 GCP 3.20

Maxum 3.2b Patch 3 Version Numbers:

SYSCON:
BIOS version: 04.11 (Mar 18 2005)
OS version: V4.2.1 (Dec 16, 2005)
DB version: 3.200-44
DM version: 3.200-05
TEXT version: 4.100-07 (Text version will be at 3.200-00 to -02 for a patch upgrade.)

SNE:
OS version: 0004.j15 (Dec 19, 2005)
APP version: 0004.c16 (Dec 16, 2005)

Workstation Software:
EZChrom: 3.200.4
System Manager: 3.200.9

Other Software:
APC: 8.1.6
MaxBasic: 1.0.1 - 16Nov01
SimDis.dll 3.200.3

Appendix A - Change Log

A

A.1 October 2018 Changes

The manual has been restructured with added topics in some areas.

1. Added description of log files in Upgrade Software for an Analyzer (Page 23).
2. New expanded topic, How To Configure TimeServer Access (Page 160)
3. New expanded topic. How To Enable and Use the LAN2 Port (Page 175)
4. Expanded suggested actions included in some alarms in Alarm Reference (Page 401).
5. Index links added for Modbus information in Index.

Appendix B - Contact Information

B

B.1 Contacts

Register at the Siemens Industry Online Support (SIOS) website (https://support.industry.siemens.com):

https://support.industry.siemens.com

International	USA
Siemens AG I IA SC PA PM Process Analytics Oestliche Rheinbrueckenstrasse 50 76187 Karlsruhe Germany Web site: www.siemens.com/processanalytics Support Information: https://support.industry.siemens.com **Spares** Contact your local Siemens sales representative **Support Requests** www.siemens.com/automation/support-request (https://www.siemens.com/automation/support-request)	Siemens Industry, Inc. 5980 West Sam Houston Parkway North Suite 500 Houston, TX 77041 USA Tel: +1 713 939 7400 Fax: +1 713 939 9050 Email: saasales.industry@siemens.com Web site: www.usa.siemens.com/pa **Training** Tel: +1 800 448 8224 (USA) Email: saatraining.industry@siemens.com **Spares** Tel: +1 800 448 8224 (USA) Email: PAspareparts.industry@siemens.com **Support Requests** www.siemens.com/automation/support-request Tel: +1 800 448 8224 (USA) Email: GCsupport.industry@siemens.com

Singapore	Online Support Request
Siemens Pte. Limited I IA SC Process Analytics 9 Woodlands Terrace Singapore 738434 Web Site: http://www.siemens.com.sg (http://www.siemens.com.sg)	Web site: www.siemens.com/automation/support-request

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