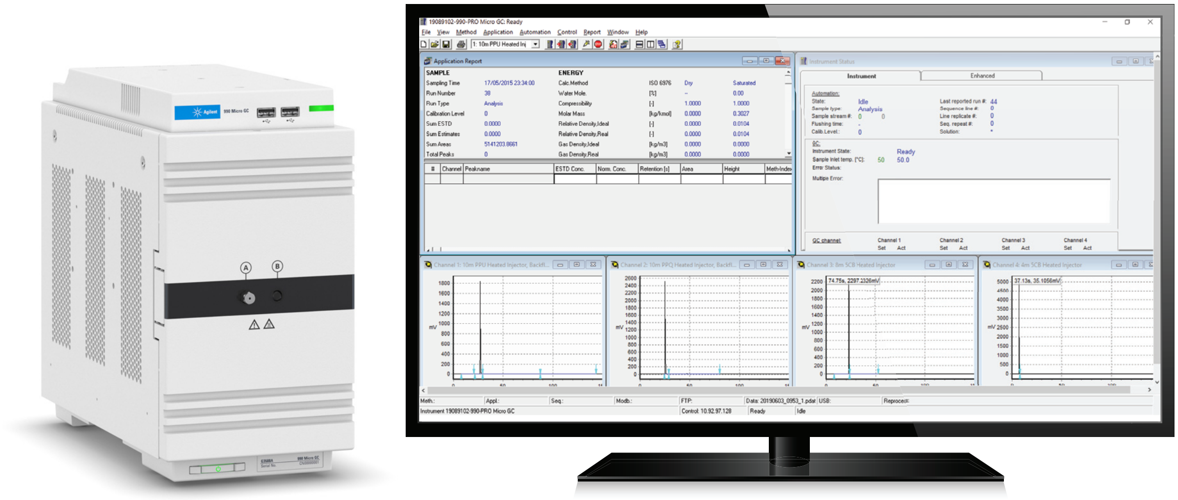
Agilent PROstation Software for 990 Micro GC

User Manual



Notices

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CAUTION

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Contents

1 PROstation Installation

This chapter describes how to install PROstation as well as other optional and convenient tools. All programs can be found on the Agilent PROstation CD-ROM. If the CD does not start automatically, double-click **autorun.exe** in the CD main directory to launch the installer.

Figure 1. Software tools installer screen

The following tools are available for installation:

- **PROstation:** A tool for configuration, method development, and collection analysis on results from the 990 Micro GC.
- **HistoryLog:** A tool for viewing logged result files according to **API21 Parameters**, optional license required.
- **VICI Valve Configurator:** A tool for configuring the optional available VICI Valco electric actuated valve.
- **WinDCS:** A tool for testing and simulating a DCS monitoring the 990 Micro GC through the Modbus serial or TCP/IP protocols.

After choosing a menu item, a setup will be started to guide you through the Installation procedure. See the next chapters for installation details.

Specific licenses are required for some instrument tools. Available licenses can be reviewed in the configuration screen in PROstation.

The PROstation software runs under Windows on a separate PC. When connected to the 990 Micro GC, PROstation allows the user to perform uploads and downloads of configuration and method settings, as well as to collect and display analysis results.

The 990 Micro GC can only store one functional method. Using serial valve interface or sample line control through the extension boards, multiple streams may be analyzed using that one method.

All workstation functions such as integration, identification, and quantification, as well as verification and calibration capabilities are performed inside the 990 Micro GC internal software. PROstation is used for method development, initial calibration and setup of communication required in most automated processes.

Once the method has been developed, an acceptance test can be performed. During this phase, PROstation is connected while a sequence of runs is performed. The analysis results collected by PROstation should indicate whether the method settings are appropriate to generate excellent analysis results.

Once the instrument is ready to monitor the real process, PROstation should be disconnected from the instrument while the 990 Micro GC operates autonomously. If tracing of data afterward is required, set up an FTP server.

Multiple 990 Micro GC instruments can be configured, but only one instrument can be actively monitored by PROstation at a time. This allows flexible switching between instruments if more 990 Micro GC analyzers are connected to the same network.

Connection with the 990 Micro GC is always through TCP/IP.

System Requirements

Hardware

- Processor speed: Processor with 2 GHz CPU or higher
- Internal RAM: Recommended 4 GB RAM or more using Windows 7
- Peripherals: CD-ROM player
- Free Ethernet port
- Free USB slot for the PROstation USB license key

Software

- Supported Microsoft Windows versions: Windows XP professional edition (ServicePack 2 or higher), Windows 7 32 or 64 bit (ServicePack 1 or higher), Windows 8.1, or Windows 10.
- Other BootP services must be disabled.

Install PROstation

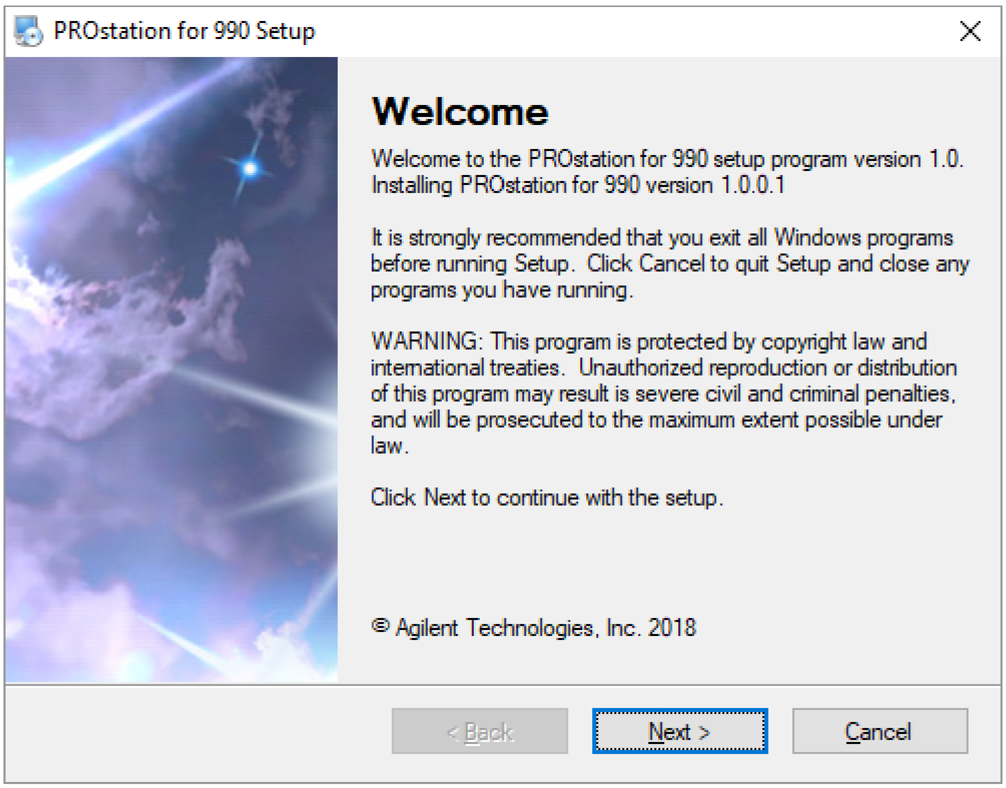
1 Log in as an administrator. Users must log in as a Windows administrator to install PROstation.

2 Ensure no other Windows applications are running during the PROstation installation.

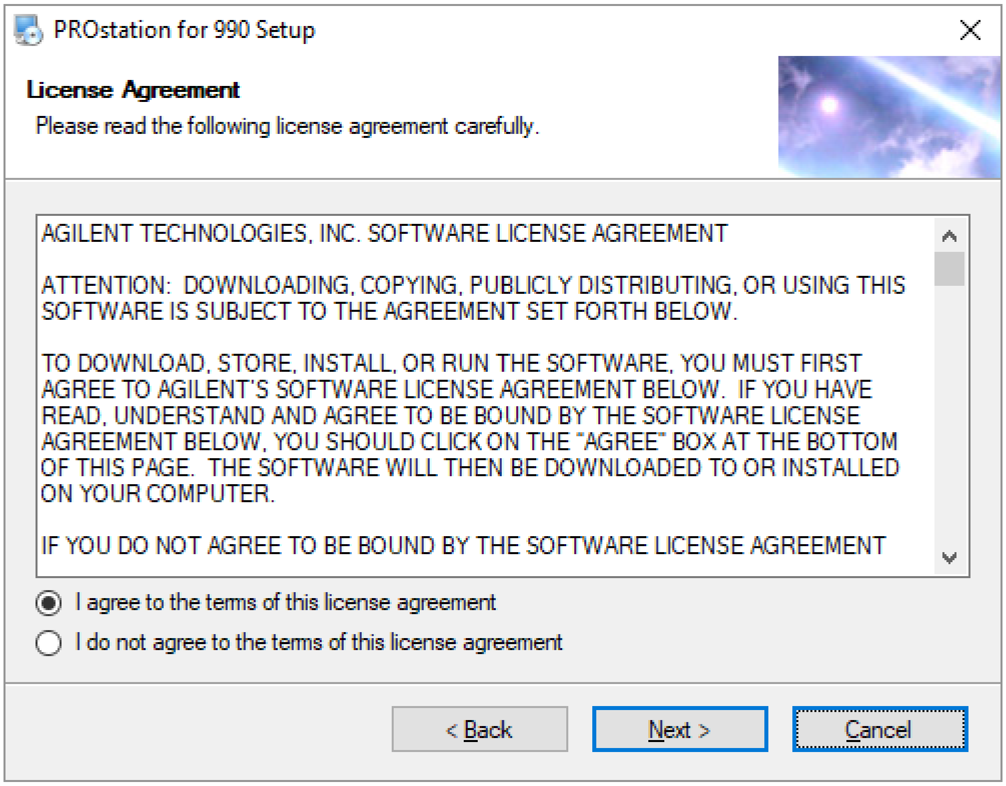
3 Insert the 990 Micro GC Software Tools CD-ROM. The installer will start automatically.

4 Click on **Install PROstation** to start the installation.

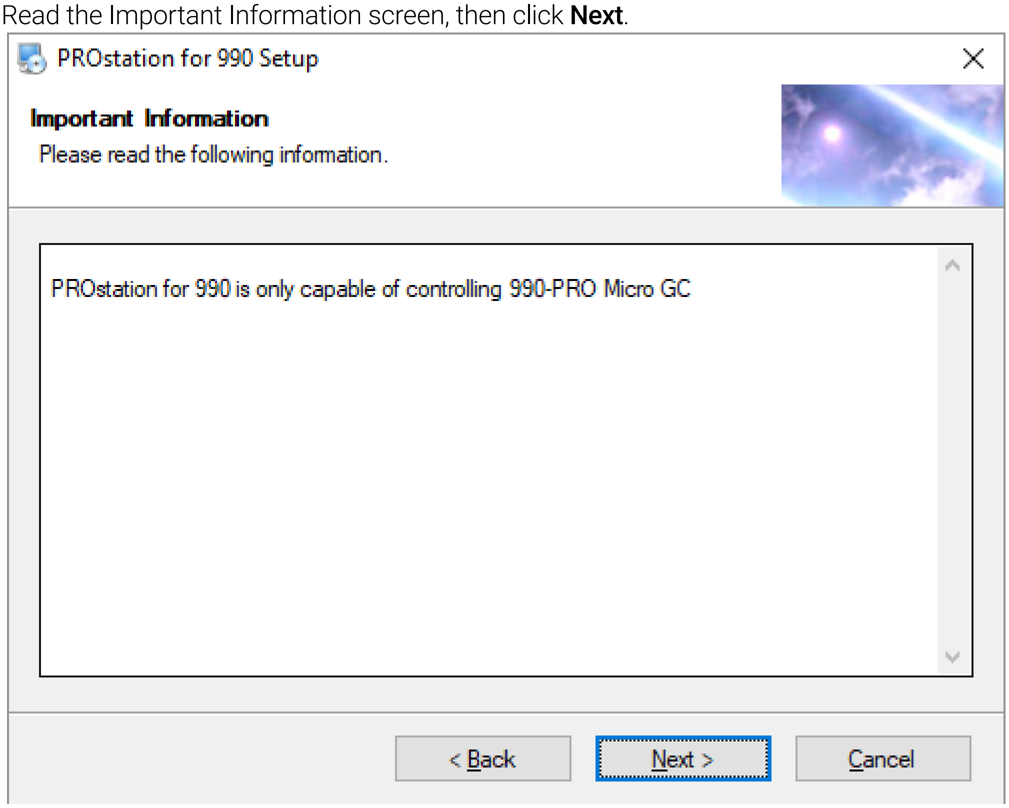
5 The welcome screen shows the version of PROstation and includes some important notes. **Click Next**.



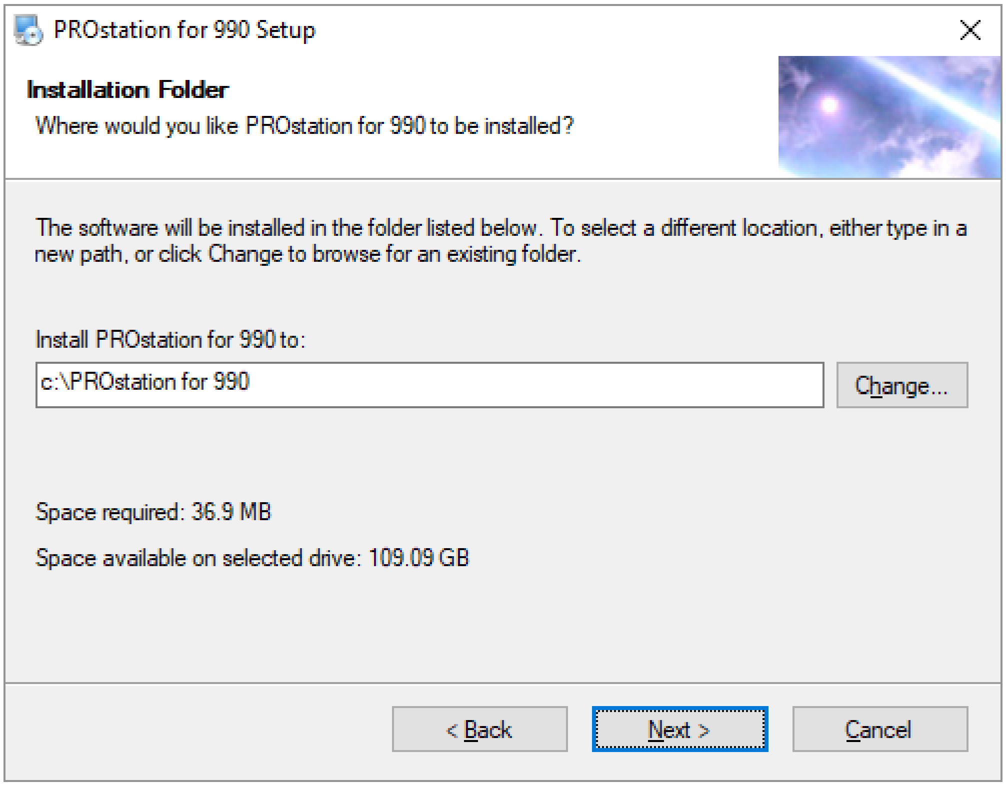
6 Read the license agreement.
To continue, select **I agree to the terms of this license agreement**, then click **Next**.



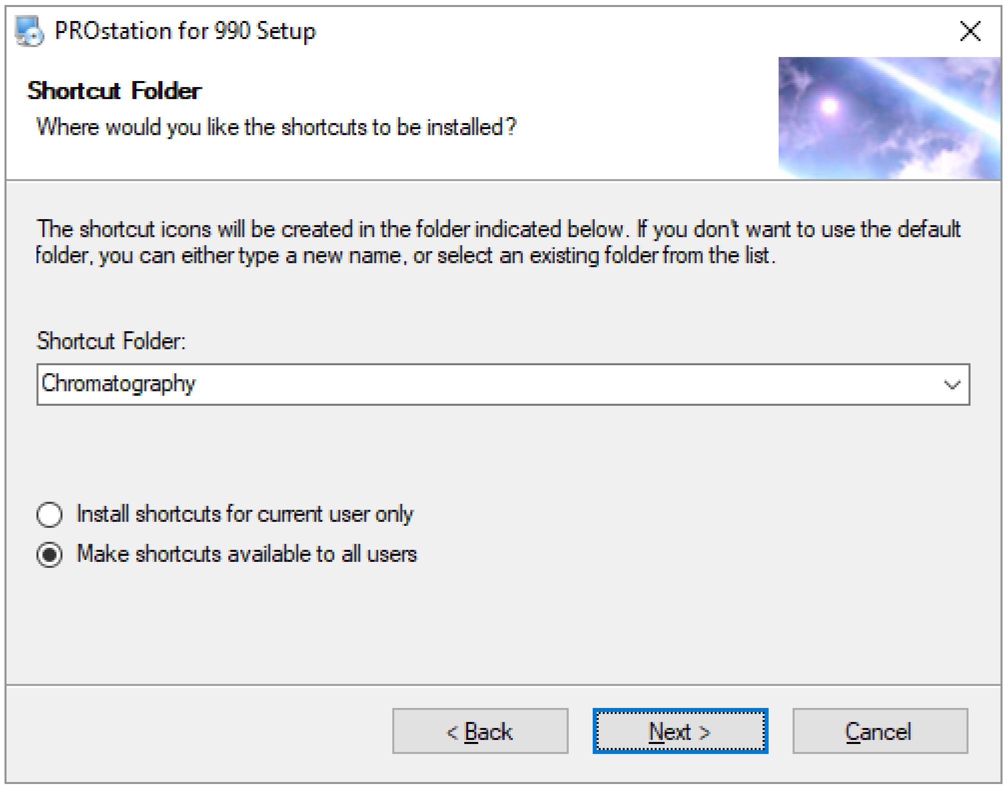
7 Read the Important Information screen, then click **Next**.



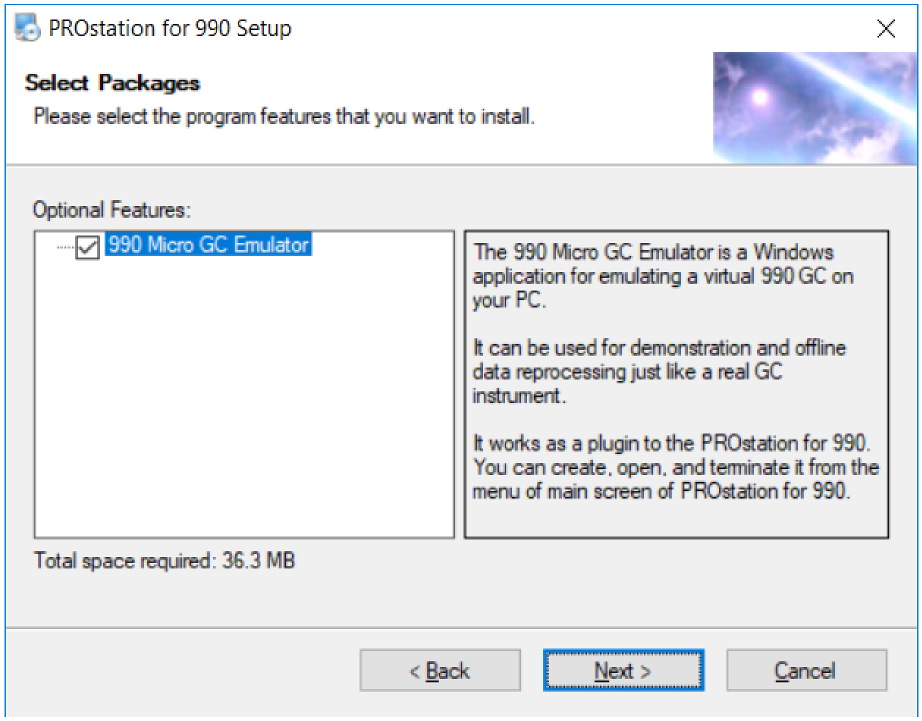
8 Use the recommended default folder for your PROstation software or click **Change** to choose another location. Click **Next** to continue.



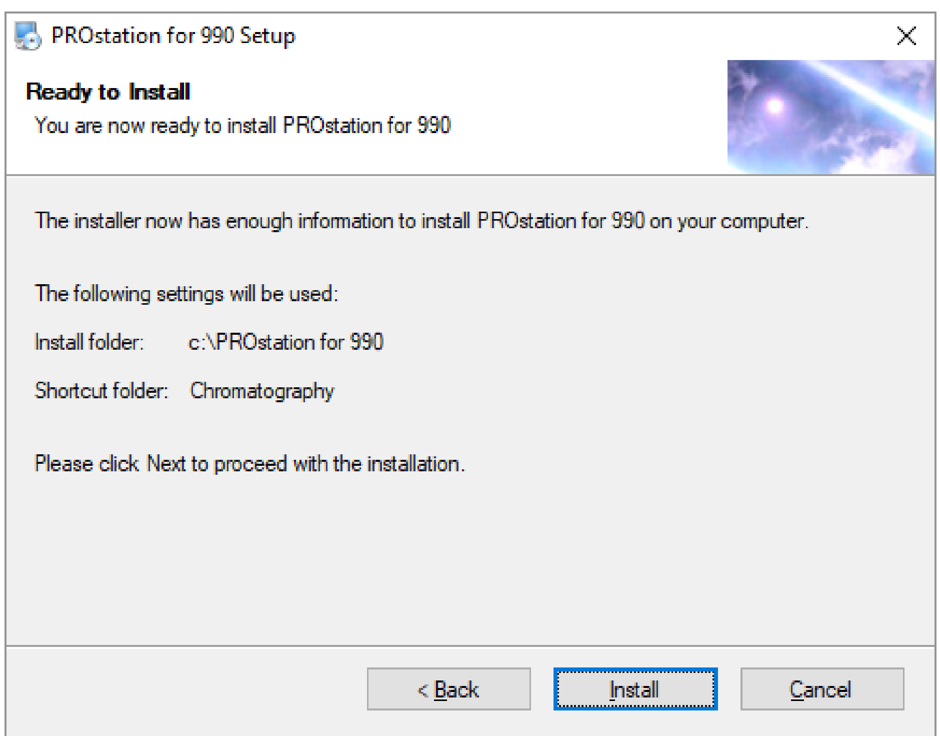
9 Use the default name, choose a name from the list, or enter a name for a Windows Start menu shortcut folder.
To display the folder in the Windows Start menu for the current user only, select **Install Shortcuts for current user only**. This selection only affects the display of the shortcut folder. It will not prevent other users from using the installed program.
To display the folder in the Windows Start menu for the all users, select **Make shortcuts available to all users**.
Click **Next**.



10 To install the 990 Micro GC Emulator, select **990 Micro GC Emulator**. Click **Next** to continue.

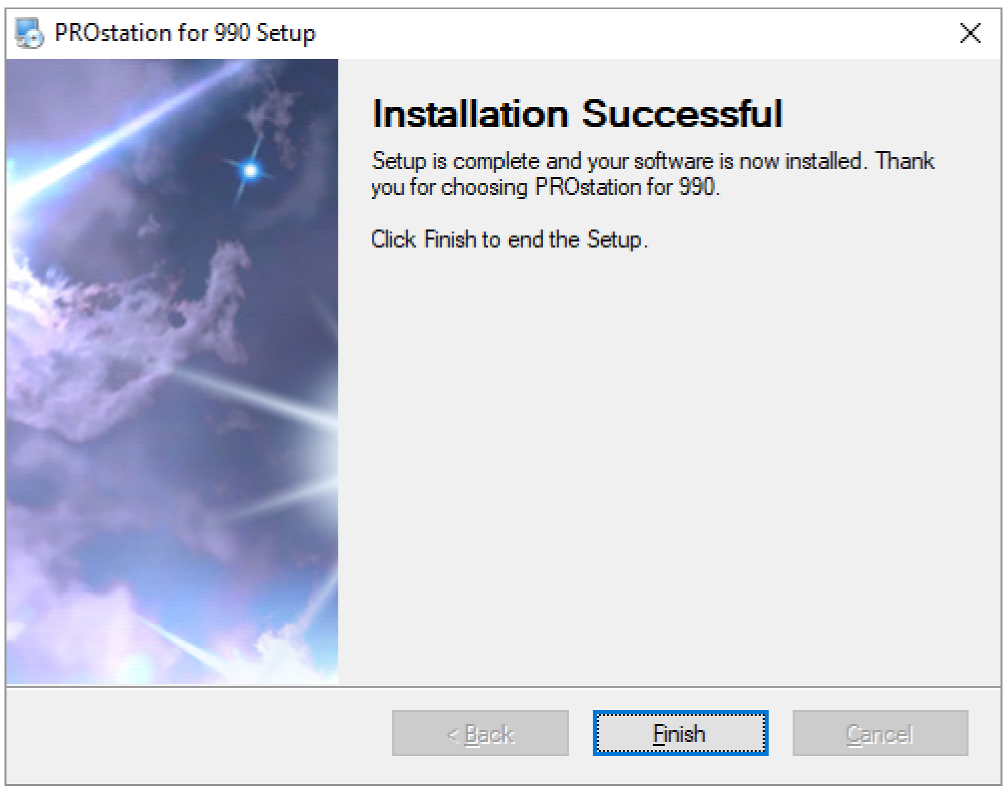


11 Review the installation settings. If they are acceptable, click **Install.**
If you would like to change the installation settings, click **Back** and make the appropriate changes.

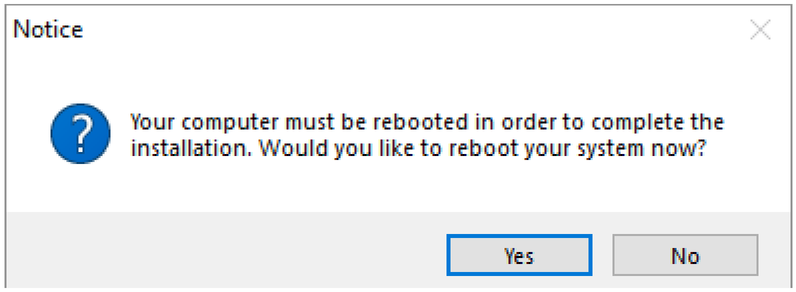


12 An information message about Crypto-Box setup may display if files for the PROstation USB Key already exist and they are in use by a previous version of PROstation or by another application. You can now either follow the instructions to complete the setup or cancel the installation. In either case, close all Windows applications and restart the installer in order to complete the Crypto-Box installation successfully.

13 Click **Finish** after installation.



14 Your system must be rebooted before using the software.
Click **Yes** to reboot your system.
Click **No** to complete the installation after the next reboot.



2 Instrument Configuration

The software settings for the instrument must be configured before operation.

Main Menu

PROstation can be started from either the Windows desktop or the Windows menu. After a login procedure, you enter the main menu manager where you can configure 990 Micro GC instruments.

Login procedure

After starting PROstation, a login screen is displayed.

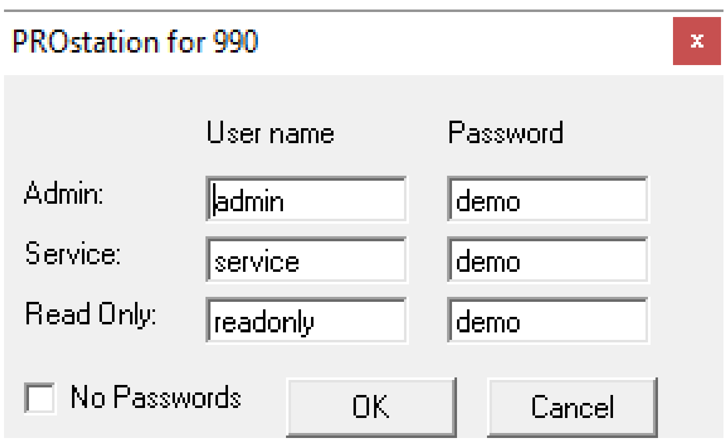
On the login screen, enter your username and password, then click **OK.** Depending on the username and password, you will access PROstation with one of the three default security levels.

Table 1 displays the default usernames and passwords.

Table 1 Security levels

Security level	Username	Password
Administrator level	admin	demo
Service level	service	demo
Read only level	readonly	demo

After entering an administrator username and password, usernames and passwords can be changed for all logins by clicking the **Change** button on the login screen.



Change password

To change the passwords, follow this procedure:

1. Enter the current admin username and password in the login screen.
2. Press the **Change** button.
3. Edit the passwords in the Password field as desired.
4. Click the **OK** button. The passwords are changed.
   PROstation will return to the main login window.
5. Log in with new password or click the **OK** button if the **No Password** option is enabled.
   PROstation opens with the main screen as shown in **Figure 2** on page 25.

No Password option: enabling this option gives the user the ability to log in to PROstation without password. If the No Password checkbox is enabled, passwords are not required to login. The Security levels and corresponding usernames are unchanged.

Depending on the security level, the user will have privileges as shown in **Table 2**.

Table 2 Privilege

Privilege	Administrator level	Service level	Read only level
Reading all available status parameters	X	X	X
Open, Edit and save Method-, application-, sequence-, datafiles, Modbus- and FTP settings,	X		
Up-/download and Edit calibration amounts	X	X	
Up-/download Method	X	X	
Up-/download Application	X		
Up-/download Sequence (Automation)	X	X	
Up-/download and Edit site information	X	X	
Up-/download Modbus settings	X		
Up-/download FTP service	X		
Up-/download chromatogram data	X		
Up-/download Real time clock	X	X	
Uploading sample results	X	X	
Uploading diagnostics	X	X	
Up-/download Usersettings from the Configuration	X	X*	X*
Starting and stopping the instrument	X		
Full control over the instrument	X		

* upload only

Unrestricted use of PROstation requires an authorization key dongle, which is delivered with the software disk. When the authorization key is not detected, PROstation runs in demonstration mode with limited functionality. Moreover, in demonstration mode, all privileges are set to read only. **Table 3** gives an overview of the available functionality for normal and demonstration mode.

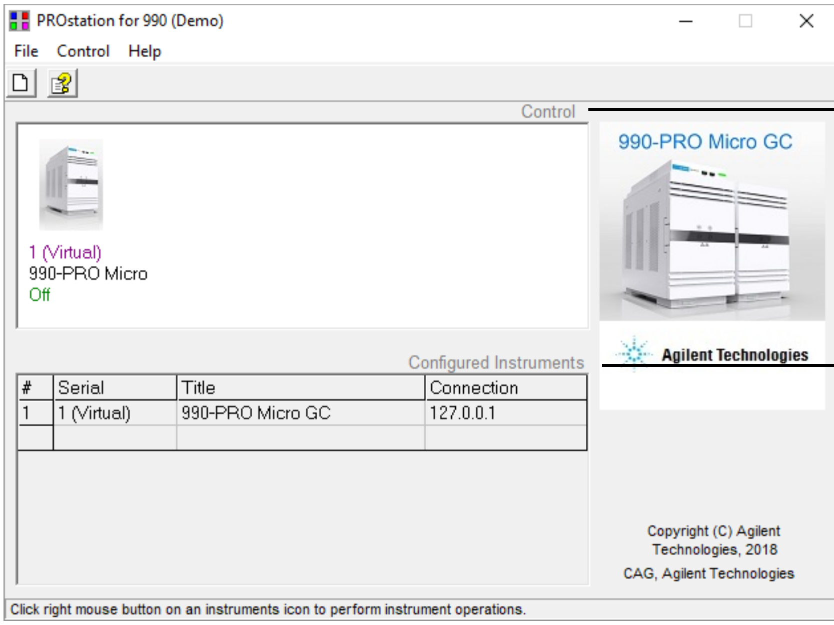
Table 3 PROstation functionality for normal versus demonstration mode

Option	Normal Agilent authorization key found	Demo No Agilent authorization key found, Offline instrument
Create a virtual instrument	X	X
Create online instrument	X	
Number of active instruments at the same time	4	1
Number of instruments created	100	1
Open Method-, application-, sequence-, datafiles, Modbus- and FTP settings	X*	X
Saving Method-, application-, sequence-, datafiles, Modbus- and FTP settings	X*	X
Download Method-, application-, sequence-, datafiles, Modbus- and FTP settings	X*	
Getting status information of an connected instrument	X	
Start or stop an instrument	X*	

* logged in as administrator only

Main Menu Functions

After login, the main menu will be started. The main menu consists of two frames. The upper frame shows all controllable instruments. The lower frame shows all configured instruments.



Control window

A maximum of four instruments can be shown in the control window, only one can be controlled at a time.

Configured Instruments window

Here all configured instruments are shown. The maximum number of configured instruments is 100.

Figure 2. Main menu

Configured instrument menu

The Configured Instrument menu can be popped up by a right--click on one of the configured instruments. In the Configured Instrument menu, the following menu items can be selected:

Copy instrument X to control window

Copies the selected instrument to the Control window, it is then available for controlling. An error message will be displayed when the:

- Instrument already exists in the Control frame.
- Number of instruments exceeds the maximum of four.

Configure Instrument X

Configures the selected instrument.

Create new Instrument

When a new instrument is created, it will appear in the Configured Instruments frame and in the Control frame (maximum number of controllable instruments in the control window is four).

You must be logged in as Administrator or Service level to create a new instrument.

Delete Instrument X

Removes the selected instrument permanently from the list with configured instruments and from PROstation.

Control menu

The Control window is the frame where all controllable instruments are visible. The maximum number of controllable instruments is four.

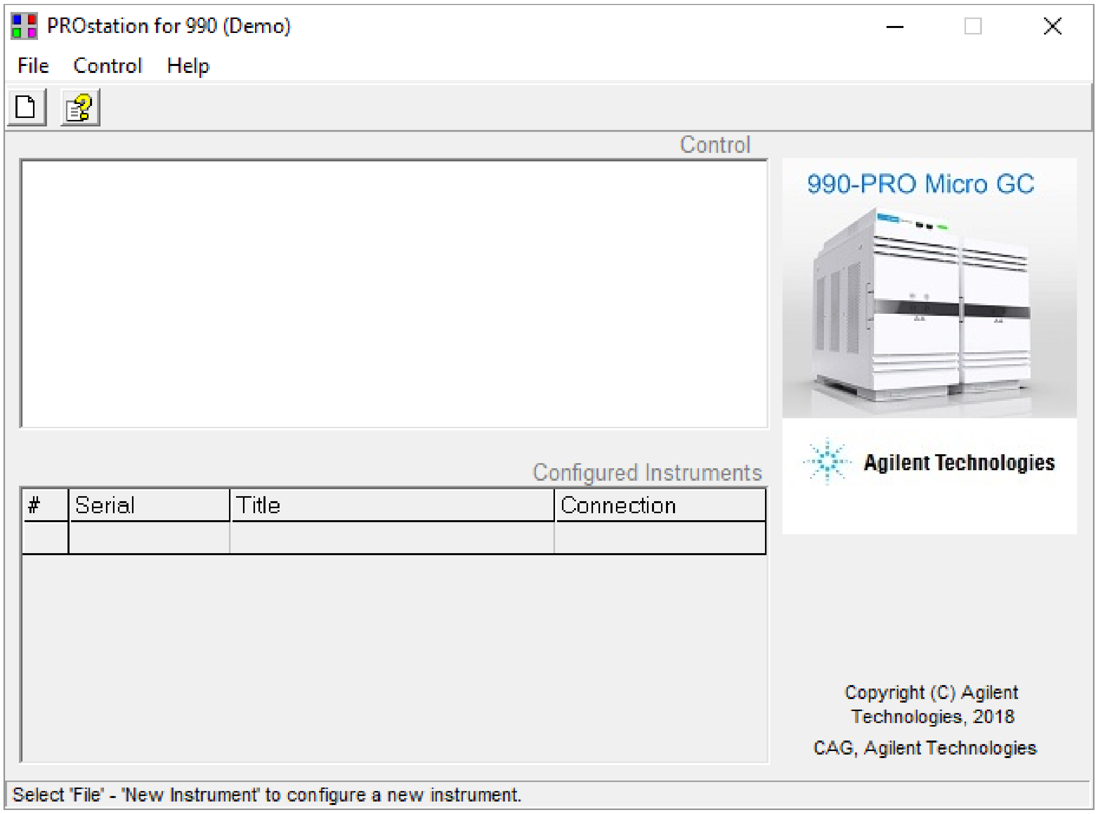


Figure 3. Control menu

Controllable Instrument Menu

The control menu, for an existing and configured instrument, can be accessed in several ways: through the **Control** pulldown menu and right clicking on a controllable instrument.

In the **Controllable Instrument** menu, the following items can be selected:

Open Open the selected Instrument. The privileges depend on the Login level, see **Login procedure** on page 22.

Open as read only Open the selected Instrument as read only. The instrument has the same capabilities as when you are logged in as Read only user, see **Login procedure** on page 22.

Open as Offline Open the selected instrument as Offline. The instrument allows method editing for that particular configured instrument.

Configure Configures the selected instrument. See **Instrument Configuration** on page 28.

Remove from control Removes the selected instrument from the control window. The removed Instrument will still be available in the Configured instruments window.

Virtual instrument

After creating a new instrument you can choose whether you want the instrument to be a real instrument or a Virtual instrument.

In PROstation, created instruments can be either new, configured or Virtual.

- **New instrument** is the instrument state directly after creation.
- **Configured instrument** is a new instrument, which had contact with an instrument and uploaded its configuration. If a configured instrument is used, the status will be either Busy or Off.
- **Virtual instrument** is used for creating a method without the need to be connected to an instrument. In the instrument configuration menu, hardware tab you can set the Virtual instrument mode.

Table 4 New Instrument

Option	New instrument **	Configured instrument opened normally	Configured instrument opened offline	Virtual instrument
Hardware Configuration editable	X			X
Selecting to create an Virtual instrument	X***			
Configure network-settings	X	X		
Upload Configuration	X	X		
Download User settings		X*		
Download PROstation settings		X*		
Open/Edit Method-, application-, sequence-, datafiles, Modbus- and FTP settings		X*	X*	X*
Saving/Edit Method-, application-, sequence-, datafiles, Modbus- and FTP settings		X*	X*	X*
Upload a method		X		
Download Method-, application-, sequence-, datafiles, Modbus- and FTP settings		X*		
Getting status information of a connected instrument		X		
Start or stop an instrument		X		

* Logged in as administrator only
** After configuring network settings and uploading configuration, the new instrument becomes configured.
*** When selecting this option an upload is not possible

It is not possible to make a configured instrument Virtual, although a configured instrument can be opened as Offline.

If PROstation is opened in Offline mode, it will not make contact with the instrument.

An instrument Opened as Offline has a fixed hardware configuration; in a virtual instrument the hardware configuration is freely editable.

Instrument Configuration

Configuration of instruments and detectors is done from the Main Menu of PROstation. To access instrument configuration, either create a new instrument or select an instrument by highlighting it, then select the **Control/Configure...** command. Or, click the instrument with the right-mouse button and select **Configure...** from the popup menu.

You must have PROstation Administrator privileges to configure instruments.

To configure a new instrument:

1 Select **File, New Instrument** or **Ctrl+N**.

2 A **Configure Instrument** window will appear, see **Figure 5**.

3 Instrument Serial number is not identified yet.

4 Click the **Configure** button. The **990 Micro GC configuration** window appears displaying the configuration settings of the instrument.

Instrument Type

Select instrument Micro GC

Serial Number

Instrument serial number will be displayed once communication is

Title

Enter an identification name for the instrument. The name will appear in the icon and in the application window, as well as in other areas.

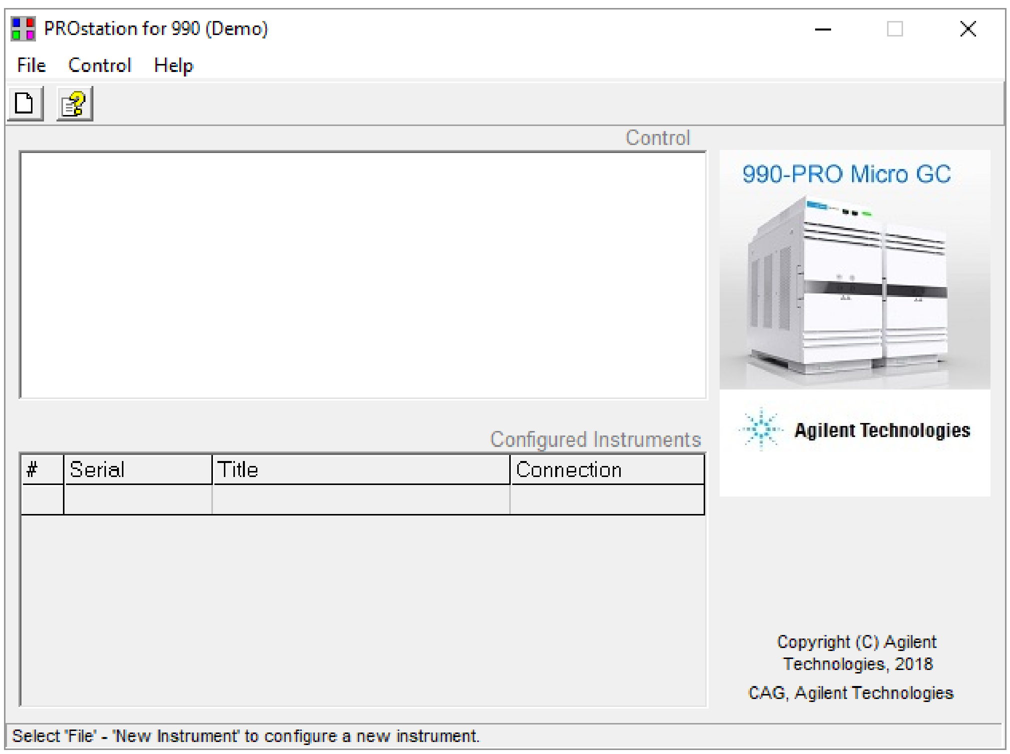


Figure 4. Configuration dialog

At this point, the default settings of PROstation are displayed.

When you select the Configure command for a 990 Micro GC, a configuration dialog box appears, see **Figure 6** on page 30.

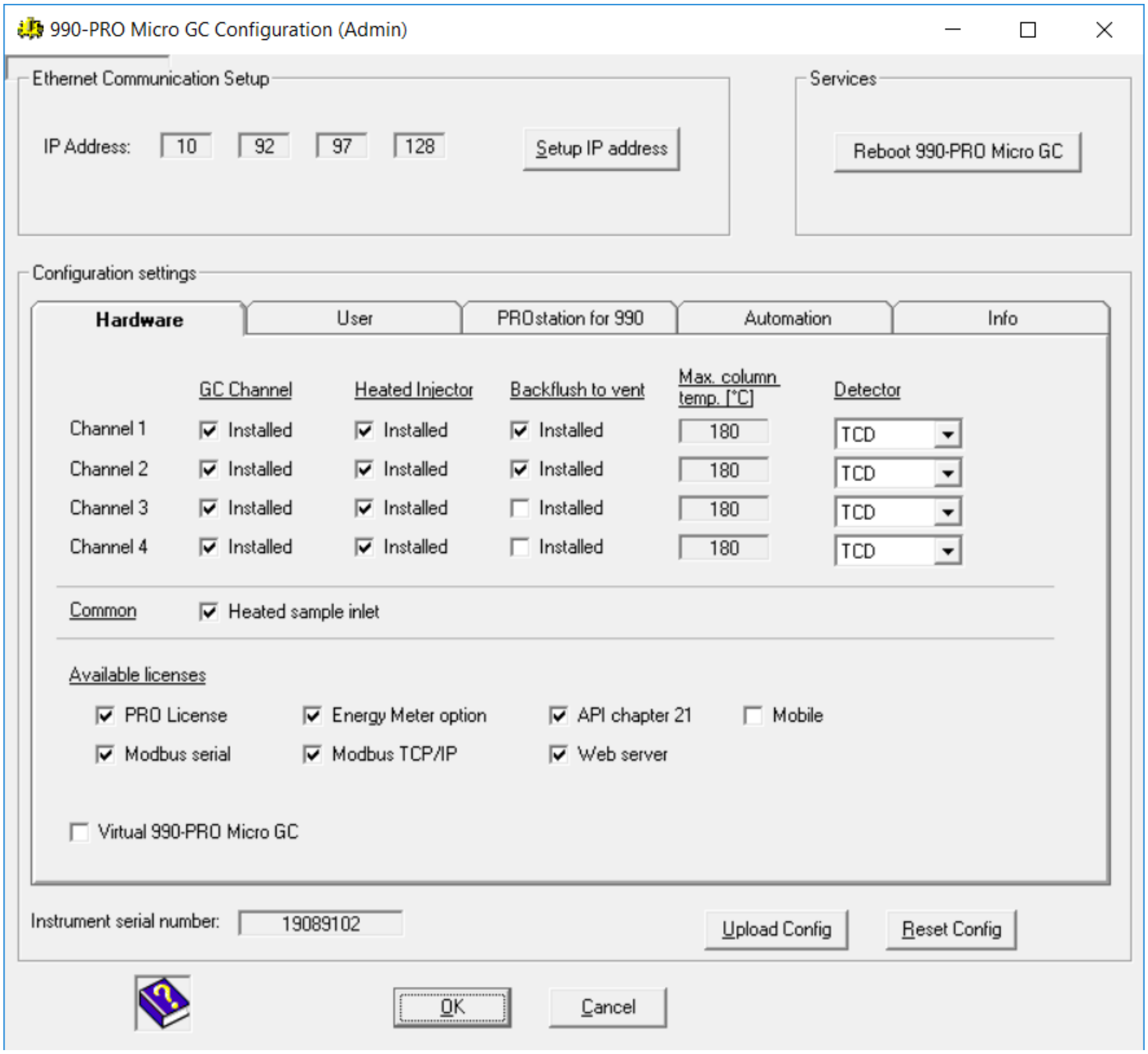


Figure 5. Configuration dialog

990 Micro GC Configuration

In this configuration screen, the 990 Micro GC can be configured. The screen is divided into three frames:

- Communication Frame
- Services Frame
- Configuration Frame

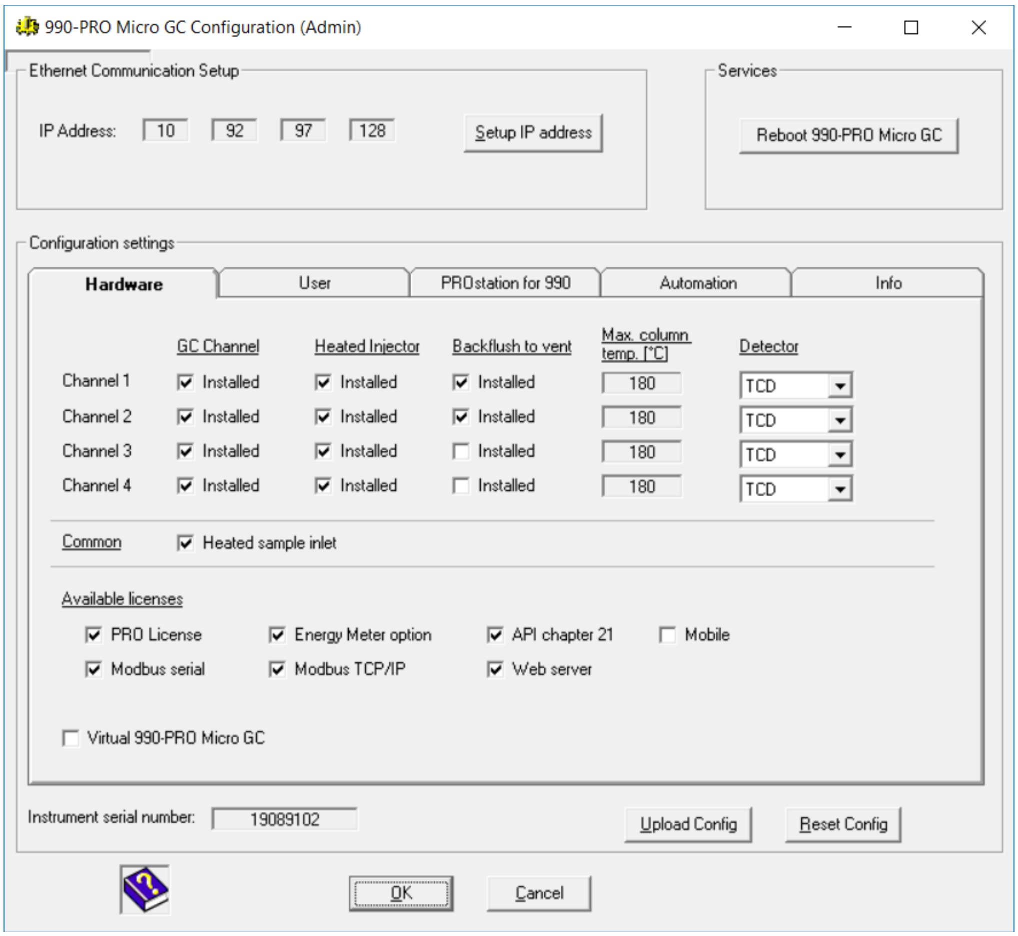


Figure 6. Configuration

1. Enter the IP address as described in **Ethernet communication** on page 31.
2. Press **Upload Config** to upload the 990 Micro GC hardware configuration to the computer. The uploaded configuration consists of user settings and all information about software versions, etc. Once the configuration is uploaded to the computer, all the settings in the **Hardware** tab will be locked.

   Do not press the Upload button if no 990 Micro GC is connected.

   Manually select the hardware settings which match a virtual connected 990 Micro GC. This can be useful for method development on a computer without having a 990 Micro GC connected.
3. Fill in the user settings parameters (carrier gas, number of flush cycles, etc) and download to the 990 Micro GC.

Communication Frame

Ethernet communication

Select the **Setup IP address** button to setup the IP address for the instrument. If the IP address is already known (and in the correct subnet range) only the IP address has to be typed in, see **Figure 7**.

It is also possible to change the IP address and to view all the 990 Micro GCs connected to the subnet.

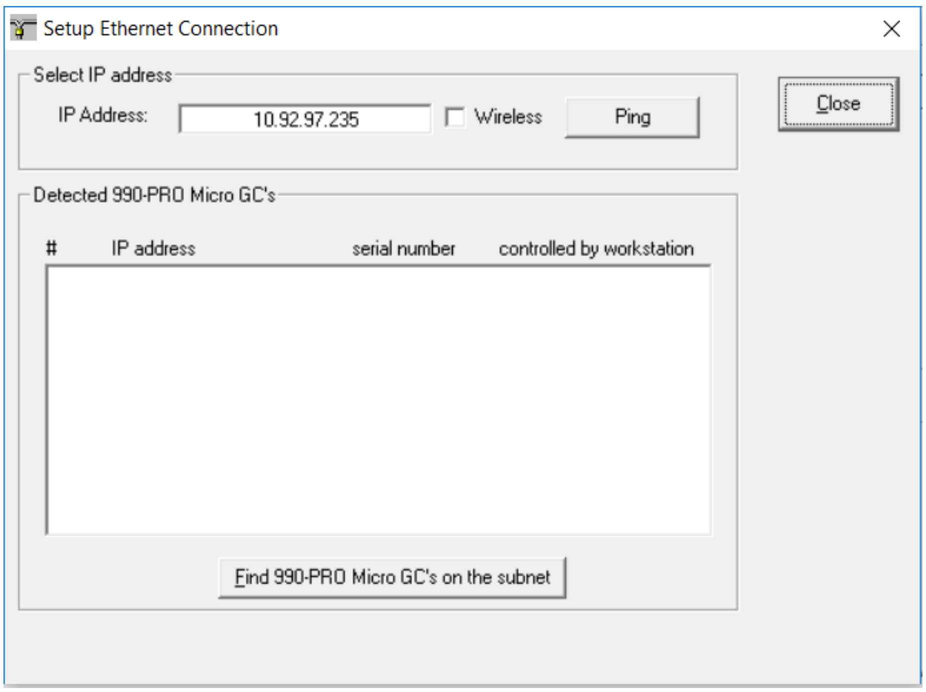


Figure 7. Setup Ethernet connection

Find instruments on the network

The **Find Instruments on the network** feature is used to view all the 990 Micro GCs on the local subnet.

For each 990 Micro GC detected, the IP address, instrument serial number and status is displayed.

If the instrument is already controlled from another computer, the IP address of that computer will be displayed. If not, the status **free** is displayed.

This can be helpful if the IP address of an instrument is forgotten or unknown.

Instruments connected to the network with an invalid IP address for that subnet are also detected, but without the instrument serial number. This is because the **Find Instruments on the network** feature is using a connection-less protocol (UDP); however, the serial number is loaded using a TCP/IP connection.

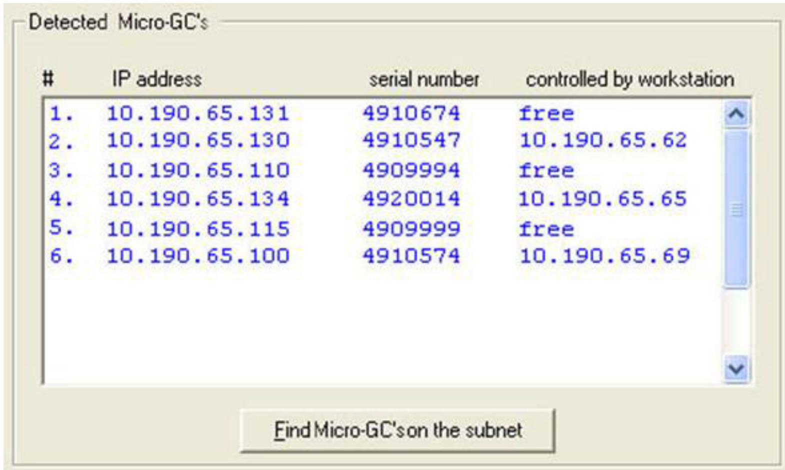


Figure 8. Find instruments on the network

Configuration Frame

In this frame, different tabs are available:

Always click the **Upload Config** button before editing the various tabs (except if you want to create a virtual instrument).

The instrument hardware settings, user settings, instrument serial number, available licenses, and general information (such as software version numbers, etc.) will be uploaded from the 990 Micro GC and displayed in the Configuration tabs.

Hardware tab

The Hardware Tab contains the hardware settings of the 990 Micro GC. These can be uploaded from the instrument by pressing the **Upload Config** button.

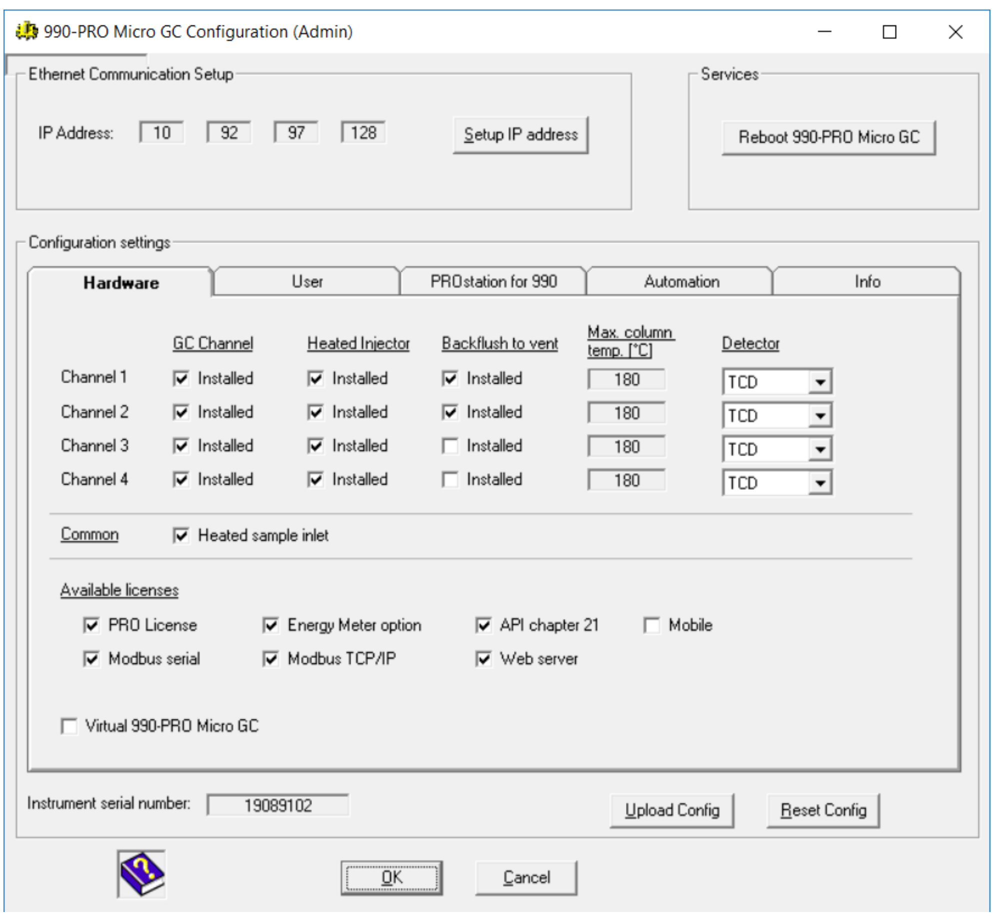


Figure 9. Hardware Tab

The configuration screen of newly created instruments will have all options available.

After an upload has been performed from a connected 990 Micro GC, all settings in the configuration screen will be overwritten with the settings of the connected 990 Micro GC. Some options will no longer be editable.

To overcome this, a checkbox option is available to create a virtual instrument, which cannot connect to an instrument and can always be used for method creation/demo purposes.

If not checked, the virtual instrument checkbox disappears as soon as an upload has been performed.

If the configuration is not uploaded from the instrument but manually selected, control of the instrument is impossible. Manual configuration can be useful for method development on a computer without having a 990 Micro GC connected.

Available Licenses and Options

After performing an upload, the available licenses in the 990 Micro GC will be visible.

Available licenses:

- 990 Micro GC Licenses

  License to identify itself as a 990 Micro GC and operate as such.
- Energy Meter option

  License to get enhanced calculation options.

  Energy meter option must be activated on the User Tab (only in combination with 990 Micro GC license).
- API 21 Logging

  Storing analysis results of 35 days maximum according to API chapter 21.

  API 21 must be activated on the **User** Tab (only in combination with 990 Micro GC license).
- Modbus serial

  Option to configure and use Serial Modbus communication. (only in combination with 990 Micro GC license.)
- Modbus TCP/IP
- Web Server

  Option to have access to the 990 Micro GC instrument web site, showing the instrument status and last analysis results.

User settings tab

The User settings tab contains user selectable parameters. Press the Download button to **download** all changes to the 990 Micro GC.

Carrier gas

Select the carrier gas for the application. Changing carrier gas requires a special procedure, which must be followed. The GC driver will guide you through the special procedure.

Pop up window: Reboot your instrument. In this example, system carrier gas type is changed from He to N_2.

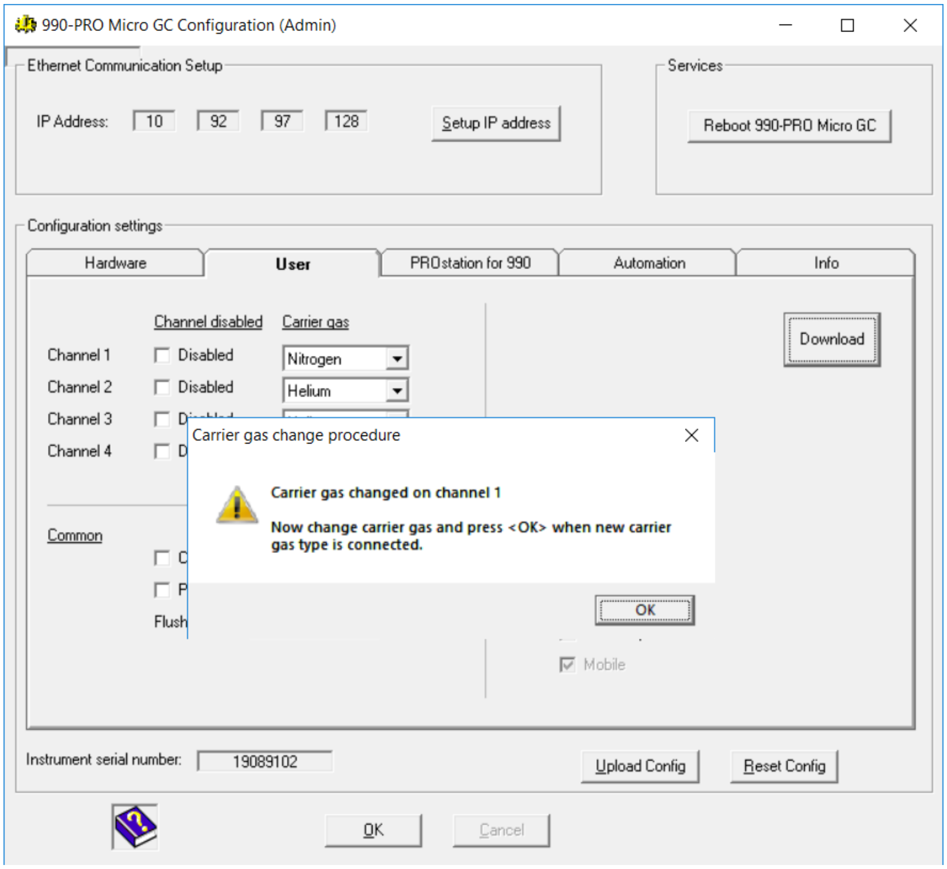


Figure 10. Pop up window changing carrier gas

Download User Settings

Press the **Download User settings** button to download the settings **Channel disabled**, **Carrier gas**, **Continuous flow**, **Peak simulation** and the **Number of flushcycles** to the 990 Micro GC. Only the parameters from the **user Settings** tab are downloaded.

Channel disabled

Disable an installed channel. Once an installed channel is disabled, the 990 Micro GC will ignore this channel.

Continuous Flow

Select **continuous flow** if this is required.

Peak simulation

Peak simulation can be used for demonstration and communication testing. If it is selected, all the GC channels will generate a default chromatogram.

Flush cycles

The number of flush cycles is configurable. Select between **None**, **1**, **2**, and **3** flush cycles. The Flush cycle is invoked at startup of the instrument or when pressure is restored after a low-pressure error.

990 Micro GC activation

Activate 990 Micro GC behavior. The connected instrument must have a 990 Micro GC License before activation is possible. See **Available Licenses and Options** on page 34.

Energy meter activation

Activate Energy meter behavior. The connected instrument must have a 990 Micro GC and Energy meter license before activation is possible. See **Available Licenses and Options** on page 34.

API 21 Logging activation

Activate API 21 logging behavior. The connected instrument must have a license before activation is possible. See **Available Licenses and Options** on page 34.

If not checked, the instrument will act as a standard 990 Micro GC which requires a workstation connected (Galaxie).

990-mobile activation

Activate 990-mobile behavior. The connected instrument must have a 990-mobile license before activation is possible. See **Available Licenses and Options** on page 34.

PROstation for 990 tab

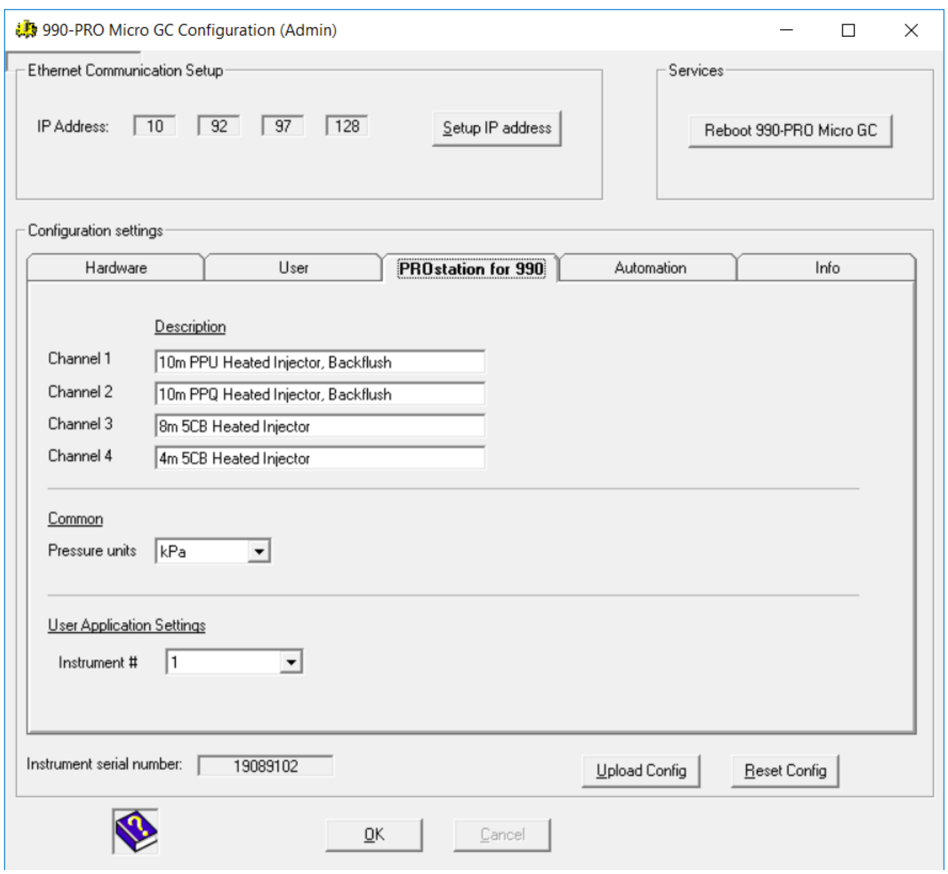


Figure 11. PROstation tab

- Channel description

  The channel descriptions are uploaded from the Electronic Data Sheets (EDS) of the GC channels each time the **Upload Config** button is pressed. This will be the description of the column installed. The descriptions will appear on top of each chromatogram window in Instrument control. The channel description can be replaced by any other text if this is desired, for instance the application name (hydrocarbons, permanent gases, etc).

- Pressure units

  Select between kPa and PSI. The column and ambient pressures status will be displayed in the selected pressure units in the **Method setup** on page 92 and Instrument Control window of **PROstation Instrument Control Menu** on page 437.

Automation tab

Settings for control over a number of external devices can be configured through the contents of the **Automation** tab.

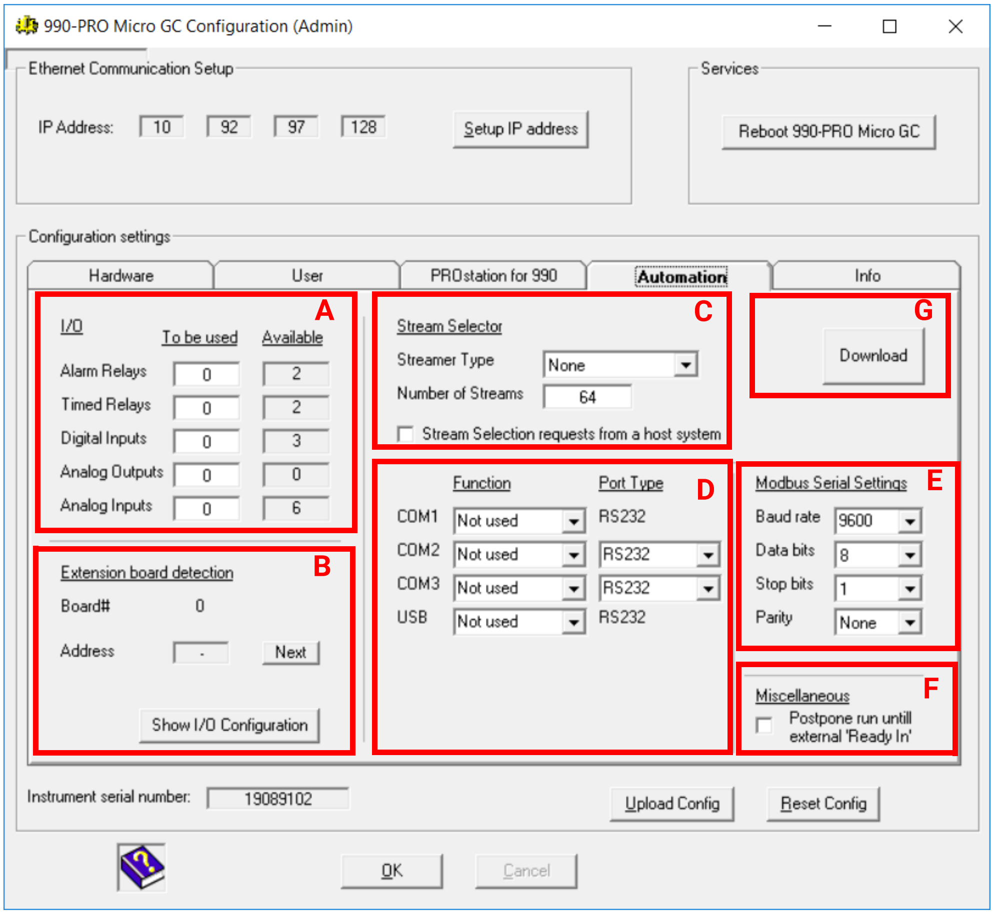


Figure 12. Automation tab

A. IO settings

The I/O settings show the availability and usage of the different types of I/O.

Alarm relays Can be used for alarming, for instance when a specific component concentration exceeds the predefined limits. Many more parameters can be checked for exceeding their limits. Enter the number of Alarm relays to use.

Timed relays Can be used for a timed program based upon the states of the run. For example a relay can be switched X seconds after injection. Enter the number of Timed relays to use.

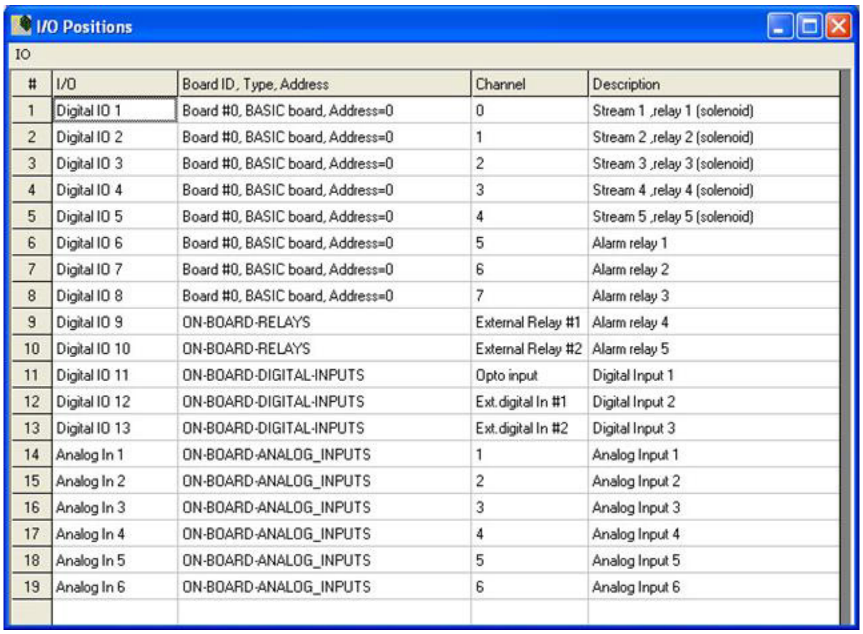
Digital inputs Can read information from devices connected to the 990 Micro GC, for example to request a calibration run or just to pass through over Modbus. Enter the number of Digital inputs to use.

Analog outputs To convert sample results to an analog output signal (4 to 20 mA). Many parameter values can be scaled to a 4 to 20 mA, 0 to 1 V or 0 to 10 V signal. Enter the number of Analog output channels to use.

Analog inputs For collecting analog inputs (0 to 10 V) from, for instance, a flow or pressure meter. The acquired voltages can be converted to predefined units using a linear equation (y=a.x+b). The calculated units can be used in alarming, reporting or become available for a Modbus master. Enter the number of Analog input channels to use.

B. Extension board detection

I/O's are available on both the 990 Micro GC and Extension boards. The possible I/O's can be divided over several Extension boards. The connections on the Basic Extension Basic board serve the I/O's that are located on the 990 Micro GC mainboard. Pressing the button **Show IO locations** shows a table with the physical location of every I/O on the Extension boards. It is a read only table. See **Figure 13**.



#	I/O	Board ID, Type, Address	Channel	Description
1	Digital IO 1	Board #0, BASIC board, Address=0	0	Stream 1 ,relay 1 (solenoid)
2	Digital IO 2	Board #0, BASIC board, Address=0	1	Stream 2 ,relay 2 (solenoid)
3	Digital IO 3	Board #0, BASIC board, Address=0	2	Stream 3 ,relay 3 (solenoid)
4	Digital IO 4	Board #0, BASIC board, Address=0	3	Stream 4 ,relay 4 (solenoid)
5	Digital IO 5	Board #0, BASIC board, Address=0	4	Stream 5 ,relay 5 (solenoid)
6	Digital IO 6	Board #0, BASIC board, Address=0	5	Alarm relay 1
7	Digital IO 7	Board #0, BASIC board, Address=0	6	Alarm relay 2
8	Digital IO 8	Board #0, BASIC board, Address=0	7	Alarm relay 3
9	Digital IO 9	ON-BOARD-RELAYS	External Relay #1	Alarm relay 4
10	Digital IO 10	ON-BOARD-RELAYS	External Relay #2	Alarm relay 5
11	Digital IO 11	ON-BOARD-DIGITAL-INPUTS	Opto input	Digital Input 1
12	Digital IO 12	ON-BOARD-DIGITAL-INPUTS	Ext. digital In #1	Digital Input 2
13	Digital IO 13	ON-BOARD-DIGITAL-INPUTS	Ext. digital In #2	Digital Input 3
14	Analog In 1	ON-BOARD-ANALOG_INPUTS	1	Analog Input 1
15	Analog In 2	ON-BOARD-ANALOG_INPUTS	2	Analog Input 2
16	Analog In 3	ON-BOARD-ANALOG_INPUTS	3	Analog Input 3
17	Analog In 4	ON-BOARD-ANALOG_INPUTS	4	Analog Input 4
18	Analog In 5	ON-BOARD-ANALOG_INPUTS	5	Analog Input 5
19	Analog In 6	ON-BOARD-ANALOG_INPUTS	6	Analog Input 6

Figure 13. I/O locations

Column description

I/O type Gives the type and number of the specific I/O's.

BoardID, Type, Address Shows the location address, the type of the board and the address of the board on which a specific I/O is located.

Channel Channel is the location of the specific I/O on the selected Extension board or 990 Micro GC mainboard.

Description A short description of the IO port related to its assigned function.

NOTE

For more details about extension board functionality and setup see the separate extension board manual.

C. Stream selection type

The 990 Micro GC supports a number of auto sampling devices:

- **None** - With this option selected, no stream selector is controlled by the 990 Micro GC.
- **Serial (VICI)** - If this option is selected, the option VICI is added in section D for the ports COM1 or USB. Only one COM-port can be used for a VICI Valco valve at a time. For connection through COM1 a cable (CP89103) should be used.
- **Relays (solenoids)** - With this option, selected relays are used to control solenoid valves. For each stream being used, one relay is required. When selecting a stream, the corresponding relay will close while all other relays are opened.

For more information about the setup and use of a VICI stream selector valve, see section **D. Communication port settings** on page 41 and **How to use a stream selector valve** on page 42.

Stream selection using relays

To use relays switching for stream selection, the **Streamer Type** in the **Automation** tab must be set to **Relays (solenoids)**.

Relays are used to control solenoid valves. One relay is required for each stream used. When selecting a stream, the corresponding relay will be activated. The number of streams must be set on the Automation tab, see **Figure 14**. The 990 Micro GC is equipped with two on-board relays. The number of relays can be increased using extension boards. Depending on the number of boards connected, 2 to 64 relays additional relays will be available. See the *Extension board manual* for details about this hardware.

The number of relays that must be used for stream selection should be set in the **Automation** tab, see **Figure 14**. The chosen number of relays reduces the available number of relays. The number of available relays for other tasks will be shown in the **To be used** column. If no relays are available, the numbers will color red, for an example see **Figure 15**.

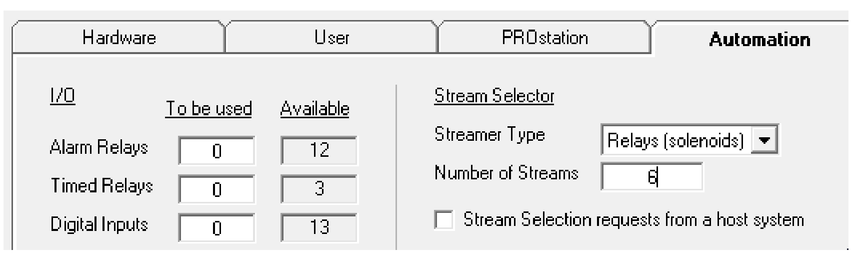
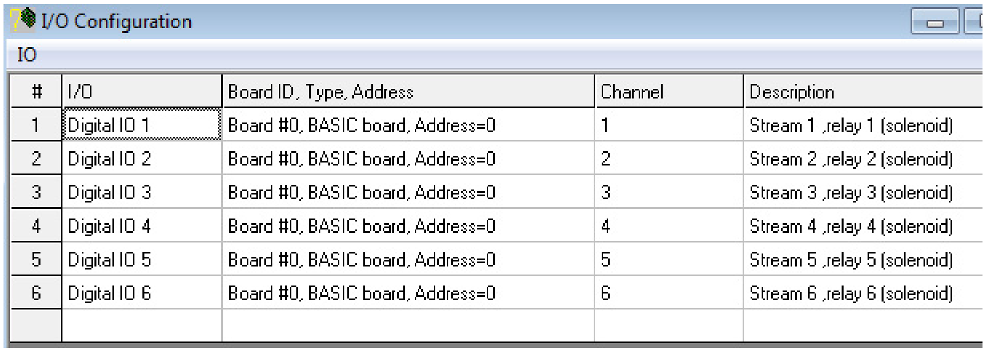


Figure 14. Dependency of **Available Relays** from **Number of Streams**

Figure 15. More Streams requested than Relays available

After having chosen the **Number of Streams**, the availability of the remaining Relays and Inputs are visible in the **I/O** section. Press the **Show IO Configuration** button to observe the assignment of stream ID's to IO ports. See **Figure 16**.



I/O Configuration

IO

#	I/O	Board ID, Type, Address	Channel	Description
1	Digital IO 1	Board #0, BASIC board, Address=0	1	Stream 1 ,relay 1 (solenoid)
2	Digital IO 2	Board #0, BASIC board, Address=0	2	Stream 2 ,relay 2 (solenoid)
3	Digital IO 3	Board #0, BASIC board, Address=0	3	Stream 3 ,relay 3 (solenoid)
4	Digital IO 4	Board #0, BASIC board, Address=0	4	Stream 4 ,relay 4 (solenoid)
5	Digital IO 5	Board #0, BASIC board, Address=0	5	Stream 5 ,relay 5 (solenoid)
6	Digital IO 6	Board #0, BASIC board, Address=0	6	Stream 6 ,relay 6 (solenoid)

Figure 16. Assignment of Stream ID's to IO ports using Streamer Type Relays (solenoids)

D. Communication port settings

The 990 Micro GC is equipped with four serial ports and one USB ports for connecting external devices.

- VICI Stream selector valves - micro electric actuated.
- Modbus and Modbus Redundant - These settings are used to setup Modbus serial connections to industrial devices.

NOTE

Modbus connection using TCP/IP is implicitly available. No additional configuration is required.

Figure 17 and Table 5 give an overview of the port settings.

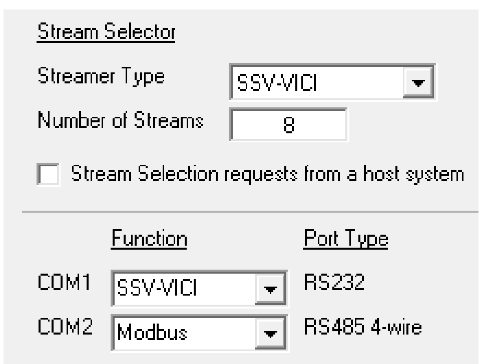


Figure 17. Communication port settings

Table 5 Communication port settings

Port	Function	Port type
COM1	Not used SSV-VICI Modbus Modbus Redundant	RS232
COM2	Not used Modbus Modbus Redundant	RS232 RS422 RS485 2-wire RS485 4-wire
COM3	Not used Modbus Modbus Redundant	RS232 RS422 RS485 2-wire RS485 4-wire
USB	Not used SSV-VICI	RS232

NOTE

VICI on COM 1 is only selectable when Streamer Type is set to SSV-VICI.
When Modbus or Modbus redundant is selected in combination with RS232, the RTS state is Active while not transmitting. This enables the use of a RS232-to-RS485 converter.
In the configuration, VICI, Modbus, and Modbus Redundant are limited to a single port.

Hardware configuration for stream selection valve

How to use a stream selector valve

The 990 Micro GC can control VICI micro-electric actuated stream selection valves connected through USB or the serial ports on the instrument's mainboard. To use these valves for stream selection, the **Streamer Type** in the **Automation** tab must be set to **SSV-VICI**. The number of streams must be set according to your setup.

Single valve connected through serial com ports When the **Number of Streams** is set to 16 or fewer (4, 6, 8, 10, 12, 14, or 16), the 990 Micro GC will recognize that one valve is connected. In this particular scenario, the valve **ID** must be set to **none**. Valves supplied by Agilent are standard shipped with **ID** = **none**. However, if a valve ID change is required, follow the instructions given in **Setup valve identity** on page 44.

A single valve must be connected to COM port 1. You can also connect valves to USB with the use of a USB-to-Serial Converter (FTDI FT232 or Prolific PL2302). See **Stream selector test via USB (one VICI)** on page 45. The setting **Comport VICI** in **Automation** tab is used to select the com port. A specific cable for each com port is available from Agilent. See **Figure 18** for cable part numbers.

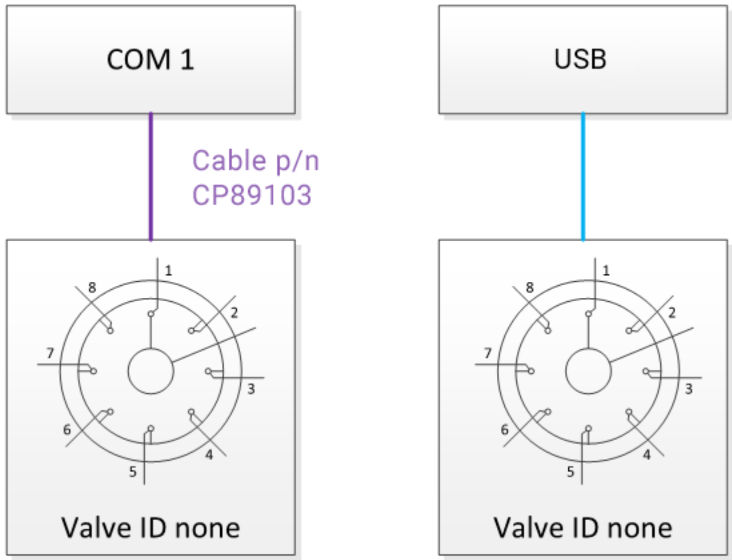


Figure 18. Connection of a single VICI stream selector valve

Multiple valves connected through USB Multiple stream selector valves, with a maximum of three, are supported on USB ports. The 990 Micro GC recognizes multiple valves are connected when the number of streams exceeds 16.

Each valve should have a unique valve ID when multiple valves are used; 0 for valve 1, 1 for valve 2, and 2 for valve 3. Valves supplied by Agilent are shipped with **ID** = **none**. For ID changes, follow the instructions given in **Setup valve identity** on page 44.

If two valves are connected, the first valve is required to be a 16-port valve. If three valves are used, the first and second valves must be equipped with 16 ports. Multiple valves should be connected in cascade mode. The outlet of valves 2 and 3 should be connected to stream number 16 on the previous valve. See **Figure 19** for logical stream numbers as used on the instrument.

For more than one valve, each valve should be connected directly to the USB ports on the Micro GC or through a USB hub.

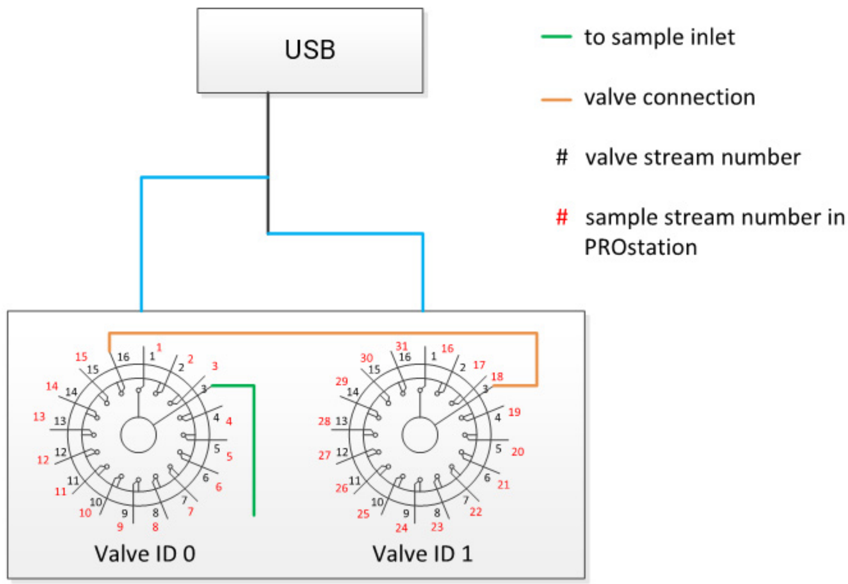


Figure 19. Connection of a multiple VICI stream selector valves

Setup valve identity

To set or change the valve's identity, use the program VICI Valve configurator.exe. This program can be installed from the PROstation installation DVD. Once installed, VICI Valve Configurator can be accessed from the Windows Start bar - All Programs - Chromatography - VICI Valve Configurator.exe or

C:\VICI Valve Configurator\VICI Valve Configurator.exe

The VICI Valve Configurator can set or change the ID for one valve at a time by connecting the valve to a free com port of your computer and performing the following steps.

1 Select the com port (of the PC) where the valve is connected, see **Figure 20** on page 45.
2 Click **Detect Valve**.
3 Set **Baud Rate** to 9600 Baud.
4 Set **ID** to desired number (see **Single valve connected through serial com ports** on page 42 or **Multiple valves connected through USB** on page 43 sections for correct setting for each scenario).
5 Click **Set new values**.

The correct values are now set, the program can be closed.

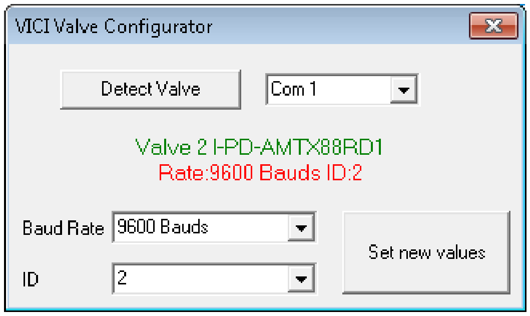


Figure 20. VICI Valve Configurator to set the correct valve ID

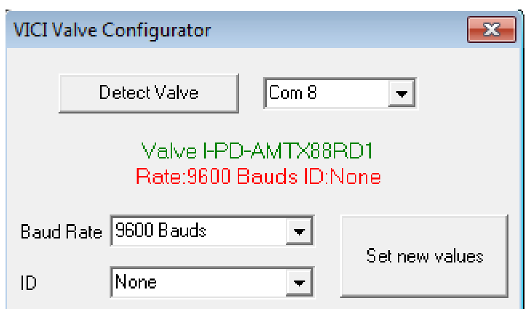
Stream Selection requests from host

Select this when Stream selection must be done from the host system. Otherwise, the sequence in the 990 Micro GC will select the valves.

Stream selector test via USB (one VICI)

To run the PROstation steam selector test with one VICI Valve:

1 Open the VICI Valve configurator. Set the VICI ID to None.



2 Connect the VICI Valve to your 990 Micro GC using either a USB-to-serial cable, or through a USB hub.

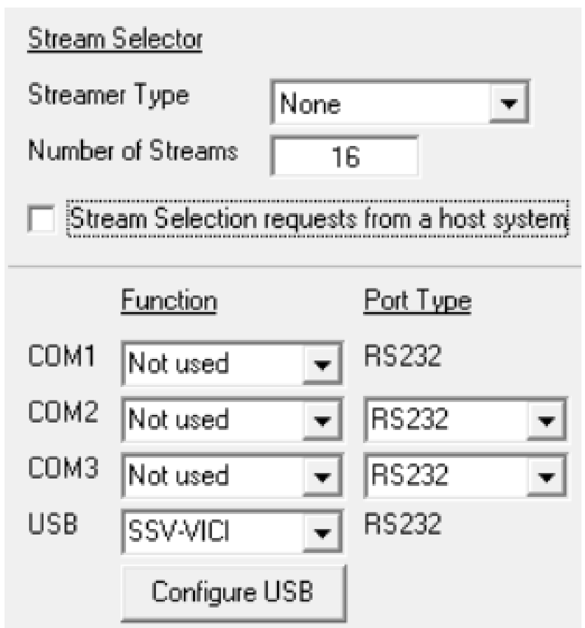
We currently support the following two types of chipsets.

Prolific PL2303

FTDI FT232

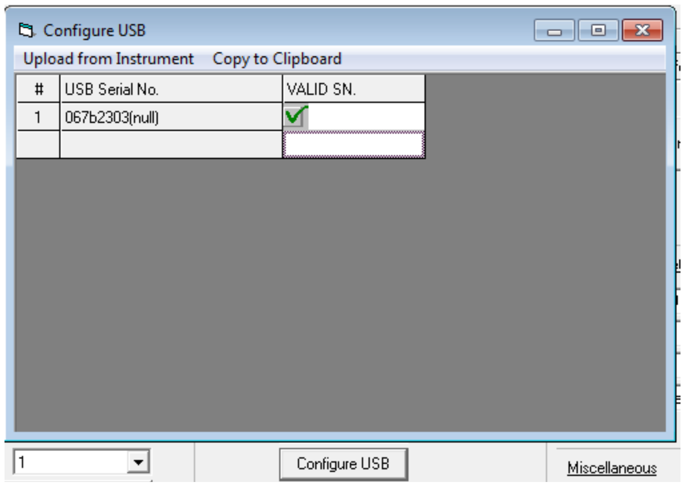
3 Open PROstation

4 Configure your 990 Micro GC. For one VICI Valve, the number of streams is <= 16.



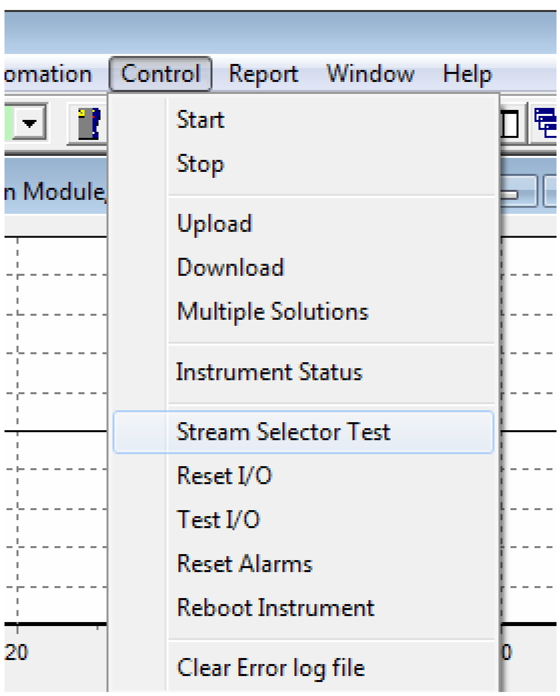
You can also click the **Configure USB** button to check whether the attached USB-to-serial converter is recognized. The 990 Micro GC will ignore any USB serial device with an invalid SN.

The Configure USB table is read only. Currently, a valid SN will have the pattern 067b2303* for a FTDI FT232 series chipset, or 04036001* for a Prolific PL2303 family chipset.

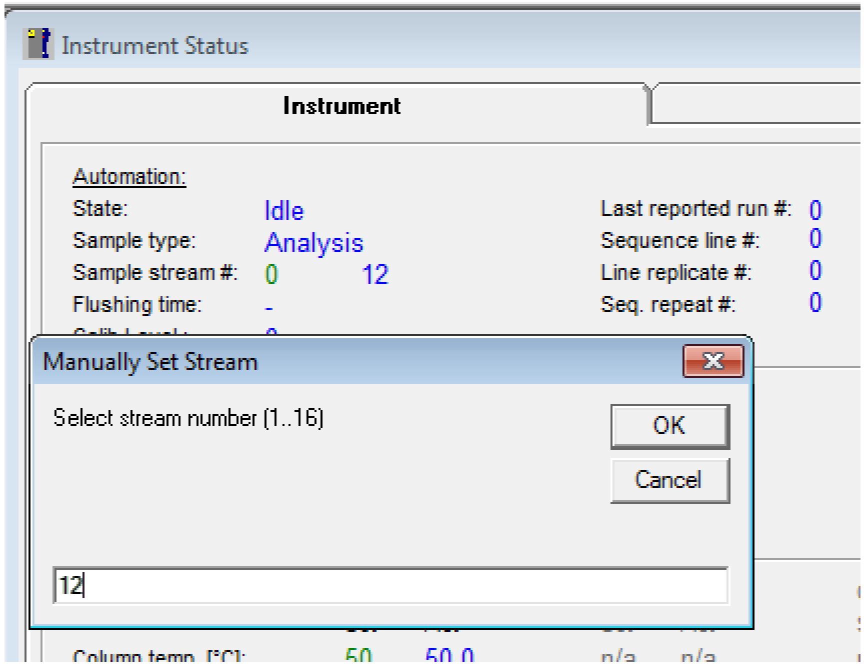


5 After rebooting, open the instrument in PROstation.

6 Select **Control > Stream Selector Test**.



7 Input the stream number you want to switch, and click **OK**. The VICI valve will switch to the target stream, and the **Sample stream #** will change to match.



Automated run via USB (one VICI)

To start an automated run on PROstation with only one VICI Valve:

1 Open the VICI Valve configurator. Set the VICI ID to **None**.

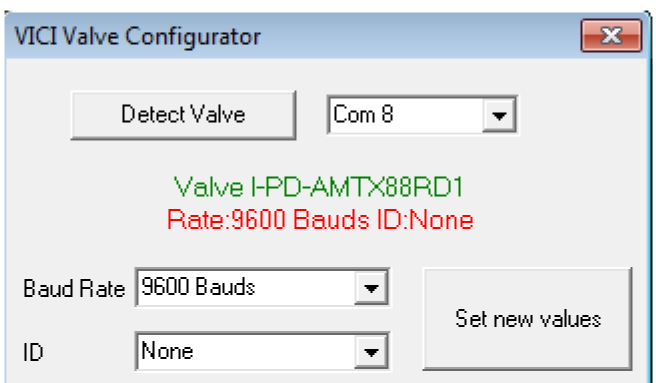


Figure 21. VICI valve configurator

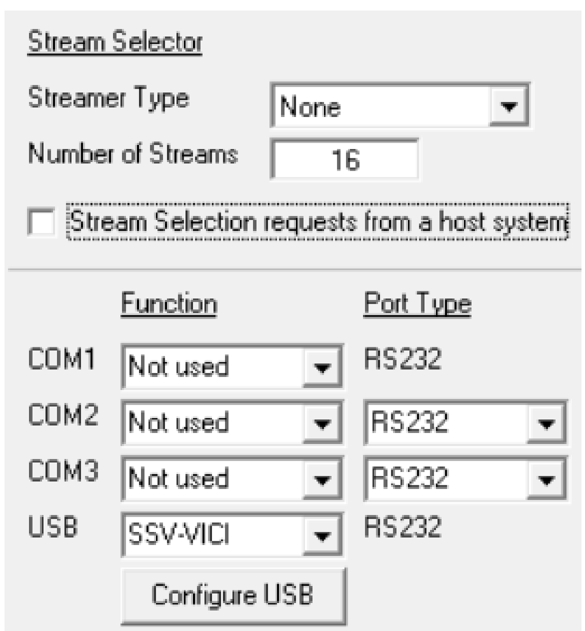
2 Connect the VICI Valve to your 990 Micro GC using either a USB-to-serial cable, or through a USB hub.
We currently support the following two types of chipsets.

Prolific PL2303

FTDI FT232

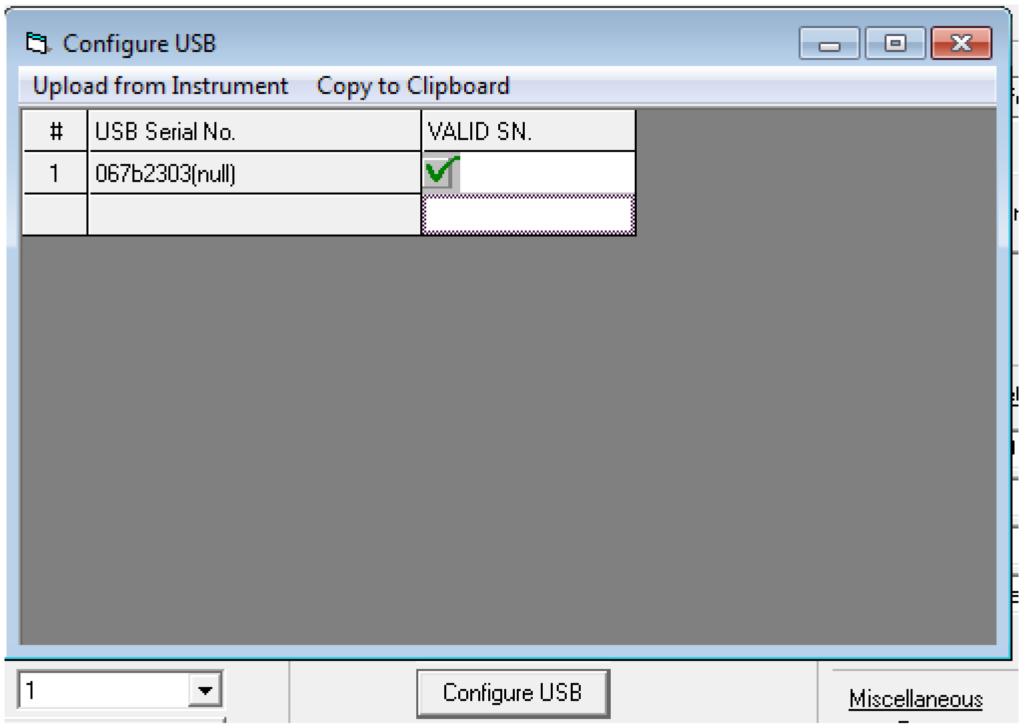
3 Open PROstation.

4 Configure your 990 Micro GC. For one VICI Valve, the number of streams is <= 16.



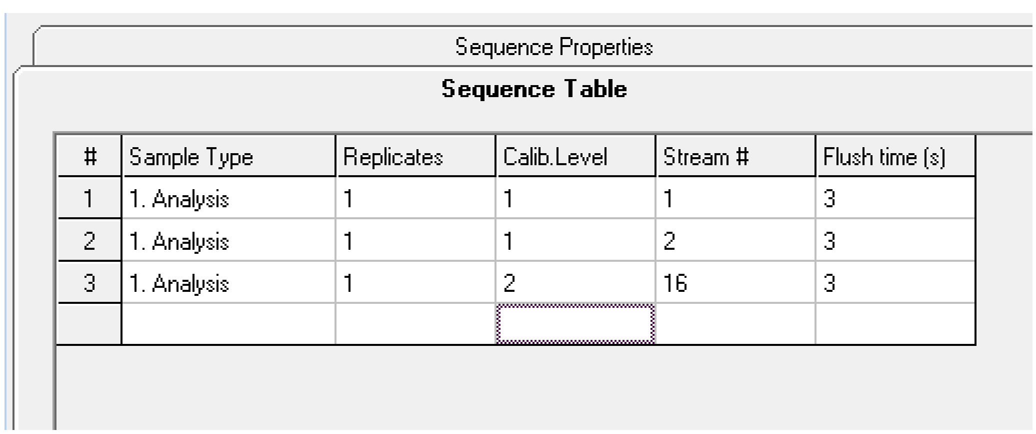
You can also click the **Configure USB** button to check whether the attached USB-to-serial converter is recognized. The 990 Micro GC will ignore any USB serial device with an invalid SN.

The Configure USB table is read only. Currently, valid SNs will have the pattern 067b2303* for a FTDI FT232 series chipset, or 04036001* for a Prolific PL2303 family chipset.



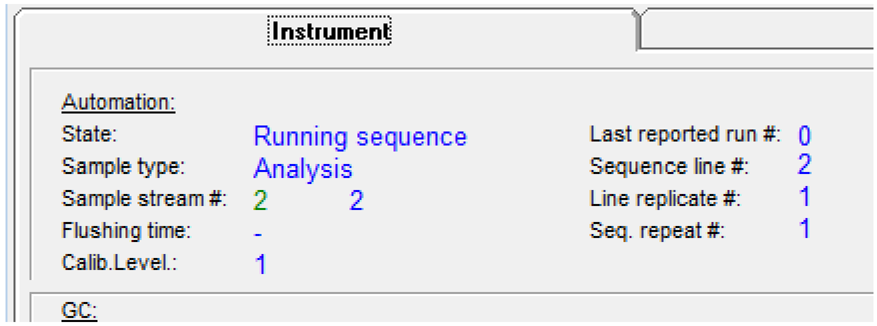
5 After rebooting, open the instrument in PROstation.

6 Set up the following sequence table and download it to your GC.



#	Sample Type	Replicates	Calib.Level	Stream #	Flush time (s)
1	1. Analysis	1	1	1	3
2	1. Analysis	1	1	2	3
3	1. Analysis	1	2	16	3

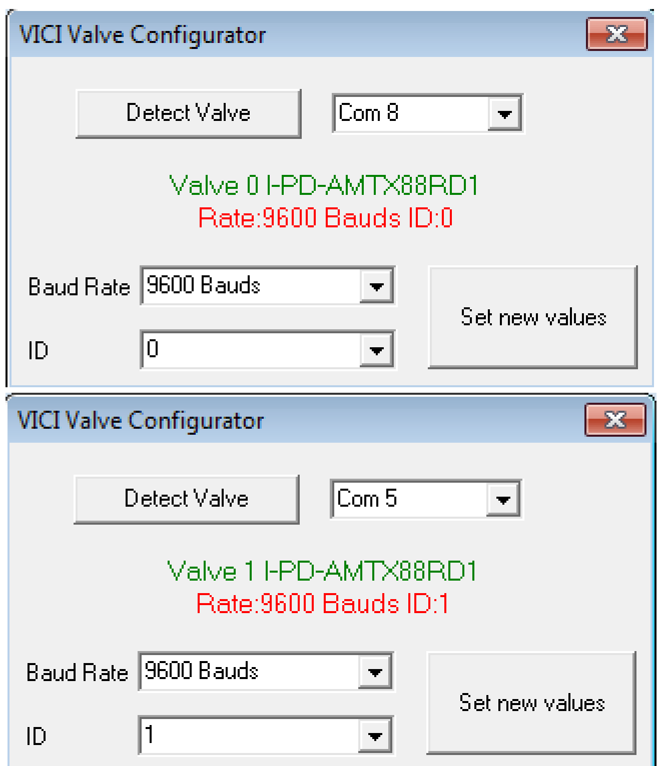
7 Start an automated run. The VICI valve will switch prior to each run, following the sequence table.



Stream selector test via USB (two VICI)

To run the PROstation stream selector test with two VICI Valves:

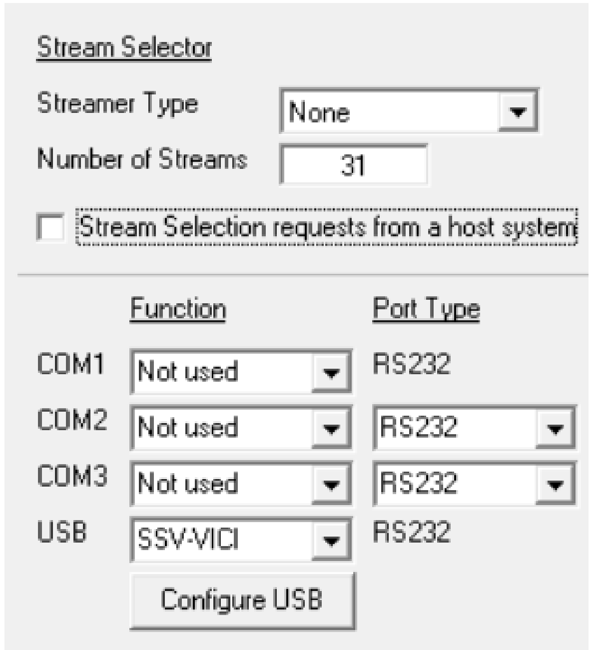
1 Open the VICI Valve configurator. Configure one VICI valve ID to **0**, and the other VICI valve ID to **1**.

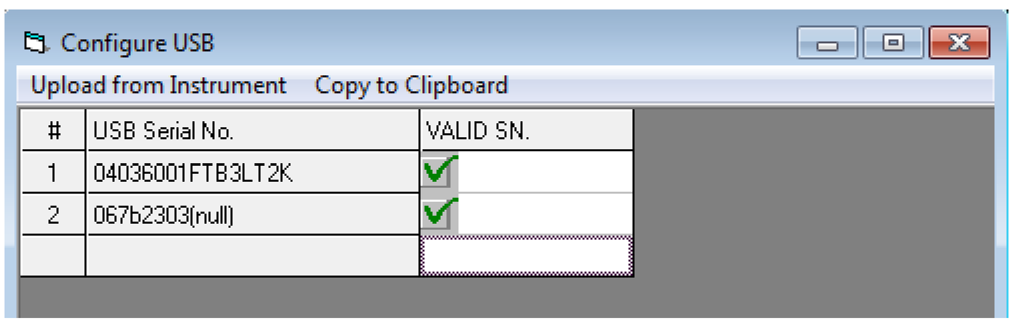


2 Attach the two VICIs to the 990 Micro GC through USB-to-serial converters and a USB hub.

3 Open PROstation.

4 Configure the 990 Micro GC as follows: For two VICI Valves, the **Number of Streams** is <= 31. You can also click **Configure USB** to check whether the attached USB-to-serial cable is recognized.





5 After rebooting, open the instrument in PROstation.

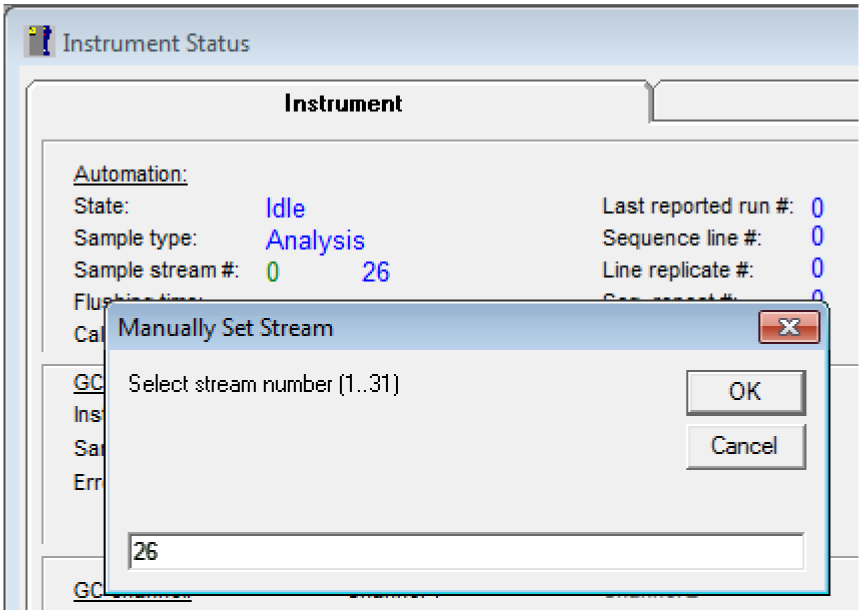
6 Click **control > stream selector test**.

7 Input stream 5 and click **OK**. The VICI0 switches to 5, and VICI1 does not change.

8 Input stream 17 and click **OK**. The VICI0 switches to 16, and VICI1 switches to 2.

9 Input stream 8 and click **OK**. The VICI0 switches to 8, and VICI1 does not change.

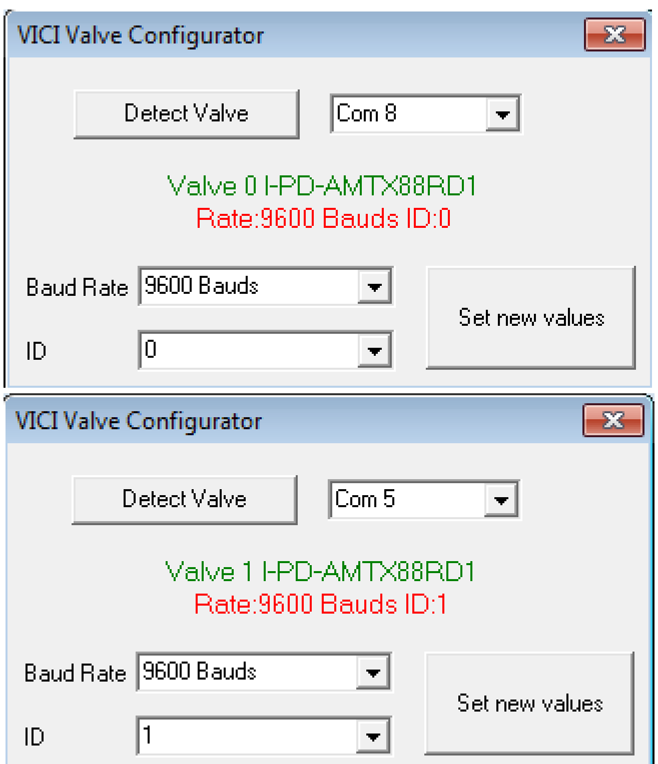
10 Input stream 26 and click **OK**. The VICI0 switches to 16, and VICI1 switches to 11.



Automated run via USB (two VICI)

To start an automated run on PROstation with two VICI Valves:

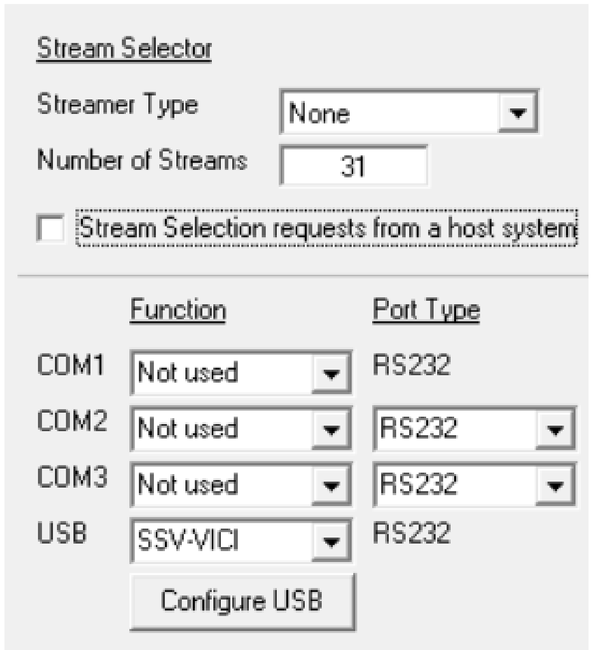
1 Open the VICI Valve configurator. Configure one VICI valve ID to **0**, and the other VICI valve ID to **1**.



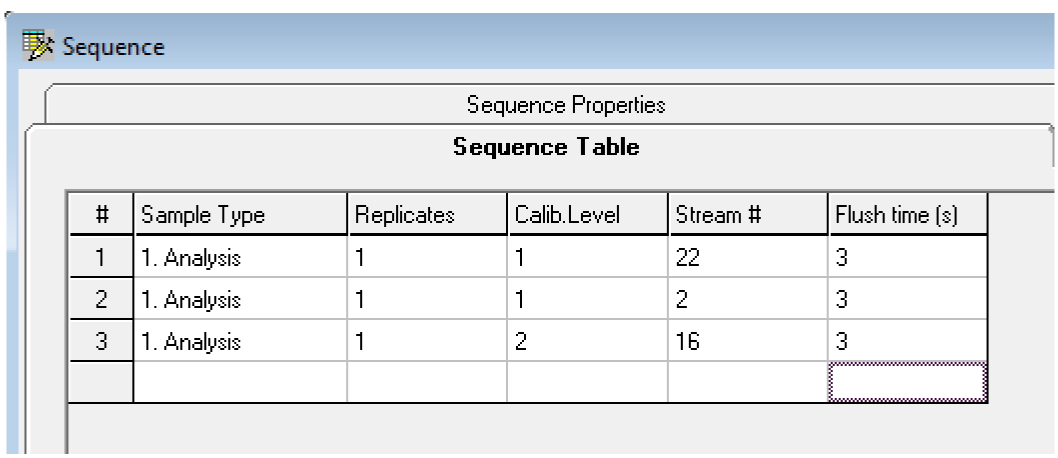
2 Attach the two VICIs to the 990 Micro GC through USB-to-serial converters and a USB hub.

3 Open PROstation.

4 Configure the 990 Micro GC as follows: For two VICI Valves, the **Number of Streams** is <= 31. You can also click **Configure USB** to check whether the attached USB-to-serial cable is recognized.

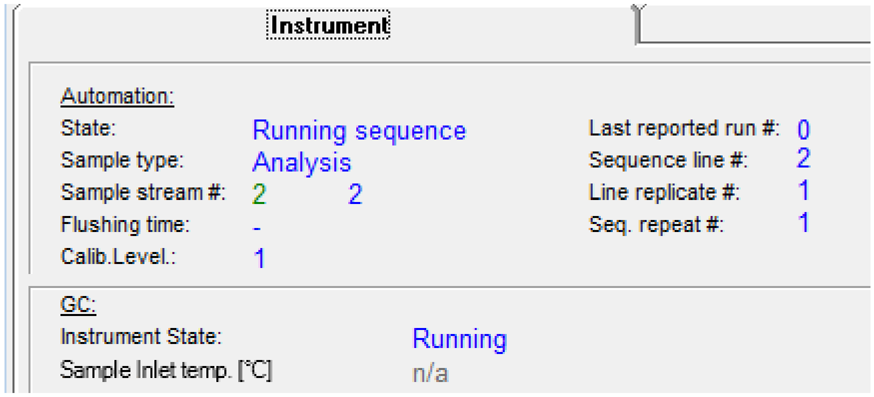


5 Setup the following sequence table and download it to your GC.



#	Sample Type	Replicates	Calib.Level	Stream #	Flush time (s)
1	1. Analysis	1	1	22	3
2	1. Analysis	1	1	2	3
3	1. Analysis	1	2	16	3

6 Start the automated run. The VICIs will switch according to the table.



E. Modbus serial settings

This section only applies to the Modbus communication over serial. These communication settings are the same for the Modbus primary and the Modbus Redundant connection. If Modbus over serial is not configured, one can ignore this section.

Baud rate	1200 | 2400 | 4800 | 9600 | 19200 | 38400 | 57600 | 115200
Data bits	8 | 7
Stop bits	1 | 2
Parity	None | Odd | Even

F. Postpone run till external ready in

This setting is used to synchronize another device with the 990 Micro GC. If selected, the 990 Micro GC will postpone the start of its run until the Ready-In signal is true. External Ready In is included in determination of overall Instrument Readiness.

G. Download

After changing the automation settings, it is mandatory to download these settings to the 990 Micro GC. After a download, a reboot of the instrument is required to enable all settings.

Info tab

The Info tab contains information about software versions, serial numbers and part numbers uploaded from the GC when the **Upload Config** button is pressed.

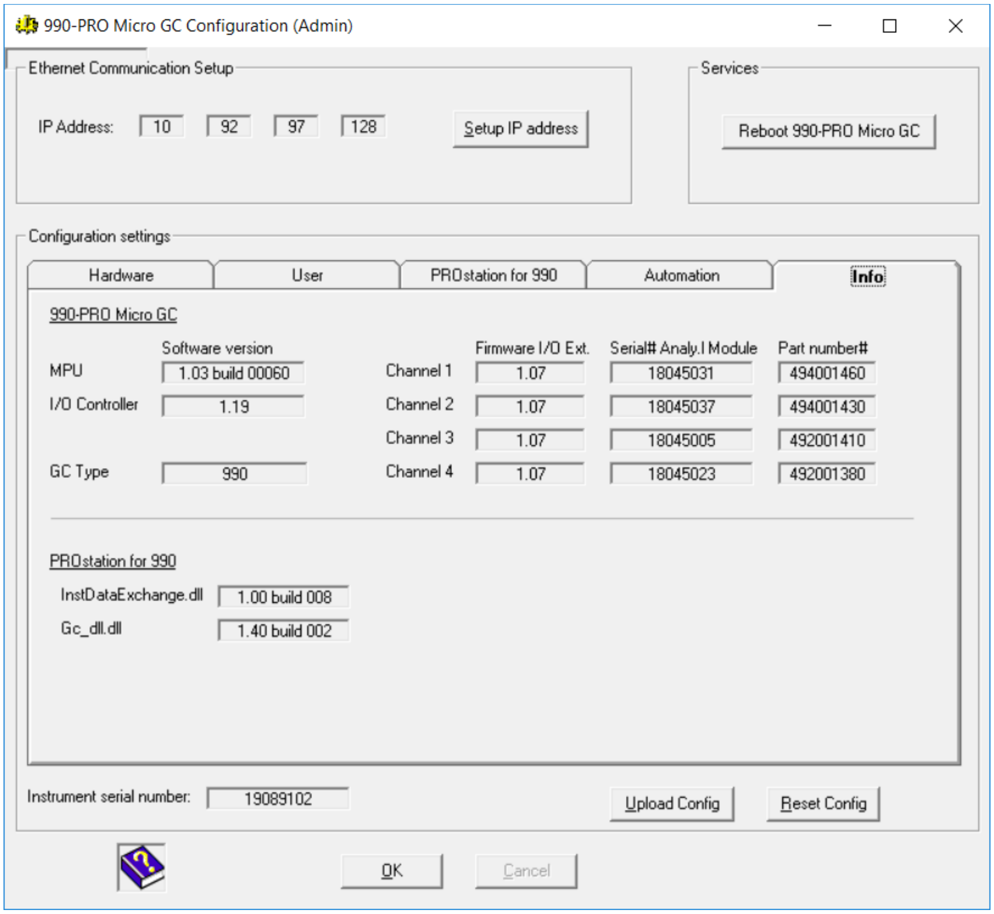


Figure 22. Configuration (Admin)

MPU

Software version of the GC application in the MPU of the 990 Micro GC.

Firmware I/O Ext.

Software version of the I/O Extenders, a micro controller in the 990 Micro GC on every GC channel.

Serial# Analytical Module

Serial numbers of the analytical module part of the GC channel.

Part number#

Part number of each GC channel.

GC_DLL

Software version of the GC_DLL.dll library used by the PROstation. This library contains the communication and protocol layer.

InstDataExchange

Software version of the InsDataExchange.dll used by PROStation. This library creates a connection between the different parts of PROstation.

I/O Controller

Software version of the I/O Controller, a micro controller in the 990 Micro GC

Exit configuration

Exit configuration screen by clicking the **OK** button. The instrument's serial number is displayed in the **Configure Instrument** screen.

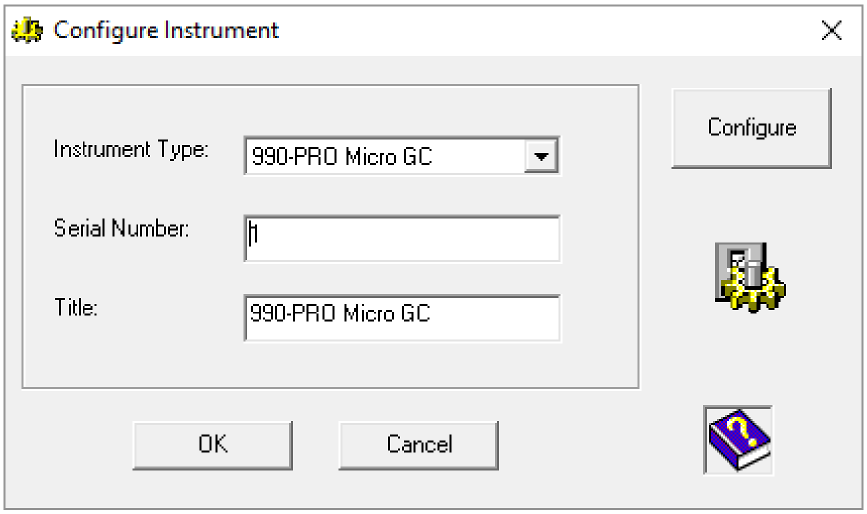


Figure 23. Exit system configuration

- Exit configuration by clicking the **OK** button **Figure 23**.
- The created instrument now appears in the **PROstation database** and its serial number is shown, as well as IP address and busy status, see **Figure 24** on page 58.
- When instrument connection status is Off, this indicates that the instrument is not in use.
- When instrument is in use (the instrument is opened in **PROstation**) **Busy** is displayed, see **Figure 24** on page 58.

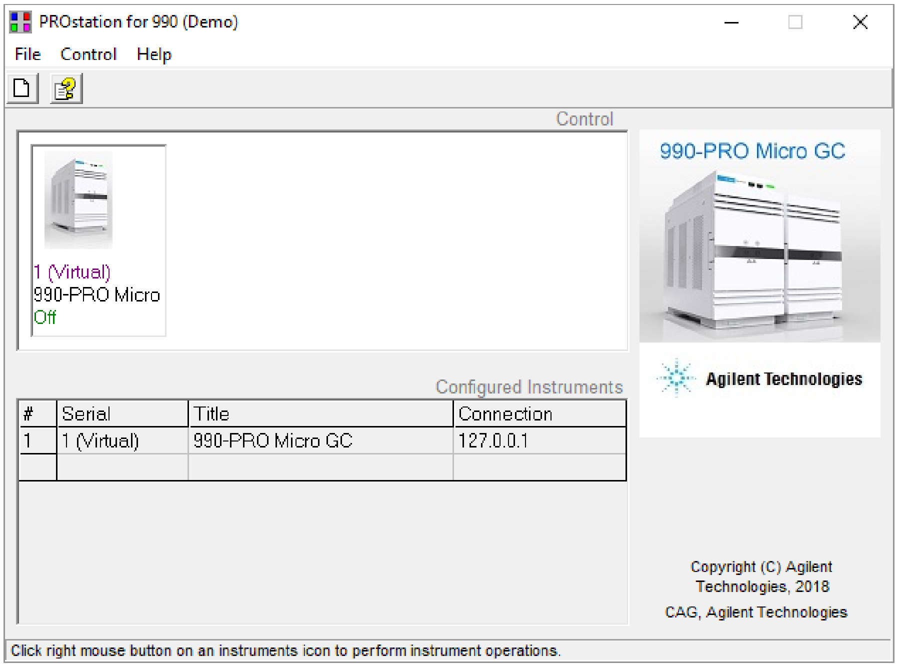


Figure 24. Instrument connected status

Services Frame

Reboot 990 Micro GC

The **Reboot 990 Micro GC** service allows you to restart the 990 Micro GC processor remotely. This can be useful in case of Ethernet communication and long distance between computer and 990 Micro GC.

End configuration

After all necessary information has been entered and downloaded to the 990 Micro GC instrument, the configuration must be exited and accepted by pressing the OK button on the 990 Micro GC configuration window and OK from the configuration instrument window.

Now the instrument is completely configured and the configuration information is stored.

From the PROstation main menu, one can select and open an instrument by double-left clicking on the appropriate instrument icon to continue method development.

PROstation Operation

Once programmed, the 990 Micro GC gas chromatograph is capable of running samples and report results to external computers without any workstation connected. Programming the 990 Micro GC is done using the PROstation package.

PROstation is the communication interface between your PC and the 990 Micro GC.

PROstation allows up- and downloading of various method parts. Inside PROstation, the methods can be edited only. PROstation is not a standard data handling system. It can not do any integration or result calculation. That is handled inside the 990 Micro GC.

PROstation is capable of collecting and showing results only. After the instrument(s) have been configured, a method should be developed.

Method development takes a number of separate steps: The first part is the development of the chromatographic method:

1 Set Clock (it is advised to use the PC clock).
2 Run a (test or calibration) sample with correct analytical instrument settings.
3 Develop and set integration parameters.
4 Run the method wizard.
5 Complete the identification table.
6 Set up calibration parameters.
7 Run the application wizard.
8 Complete all application features.
9 Run a sample and show integration and application results.
10 Setup automation (sequence, FTP service, etc).
11 Start full automation.

Method development tables should be completed for each individual channel separately. Once this is done, the application should be set. The application contains all information regarding the way results are reported, either after normalization or through the embedded Energy Meter application (license protected).

The Automation should be built. Automation determines how the 990 Micro GC will operate. Automation selects the sample stream, determines if a run is a normal run, a calibration, verification or a blank run. Automation also controls the external communication through ModBus as well as file and/or result transfer to an external storage facility (FTP)

Method -, Application -, and Automation information are all stored in separate files to allow the use of a specific part in another 990 Micro GC instrument that must handle a sample identically (automation) or communicates to the same external computer (Modbus).

Note that for changes to take effect, different types of downloads to the instrument are required.

All details about peak calibration can be found in the chapter **Multi Level Calibration** on page 463.

Find a number of Input Output signal cases in the chapter **I/O Cases** on page 501.

3 990 Micro GC Cycle Scheme

This chapter describes the order of five tasks a 990 Micro GC performs in the different modes.

990 Micro GC Cycle and Stream Selector

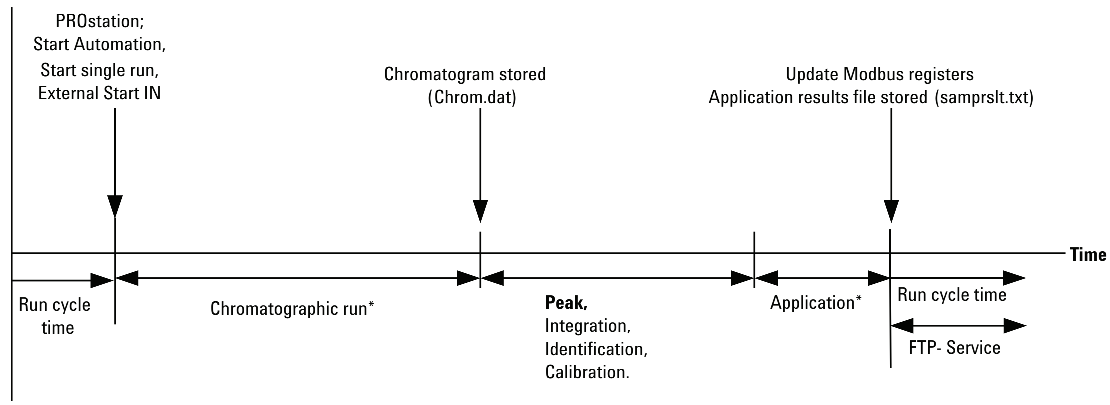


Figure 25. 990 Micro GC Cycle without Stream Selector

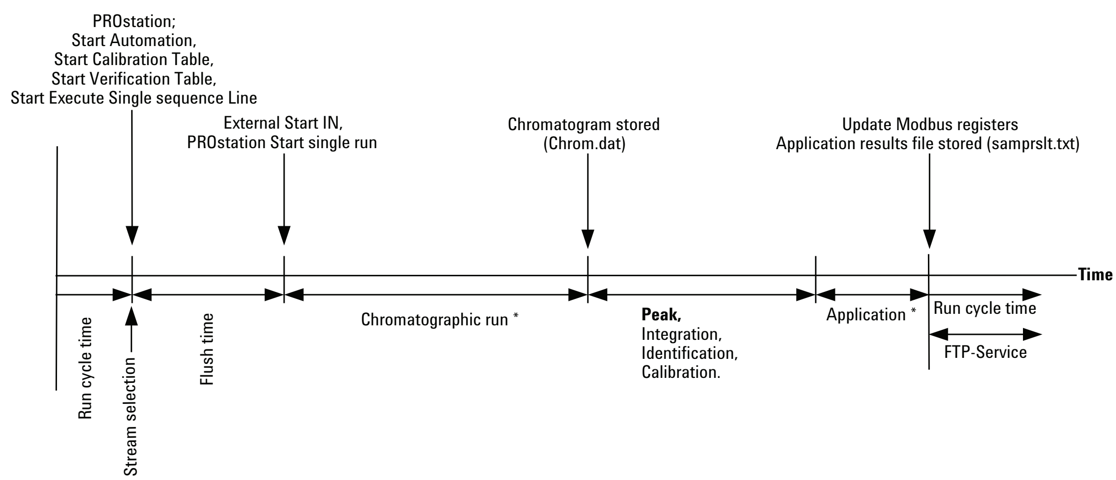


Figure 26. 990 Micro GC Cycle with Stream Select without Stream Ahead

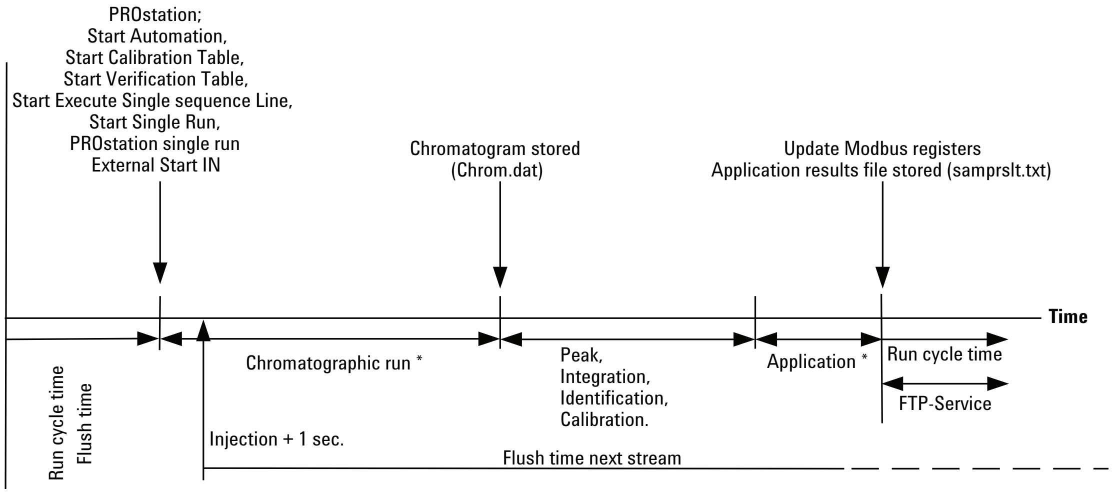


Figure 27. 990 Micro GC Cycle with Stream Select with Stream Ahead

990 Micro GC Chromatographic Run and Electronic Pressure

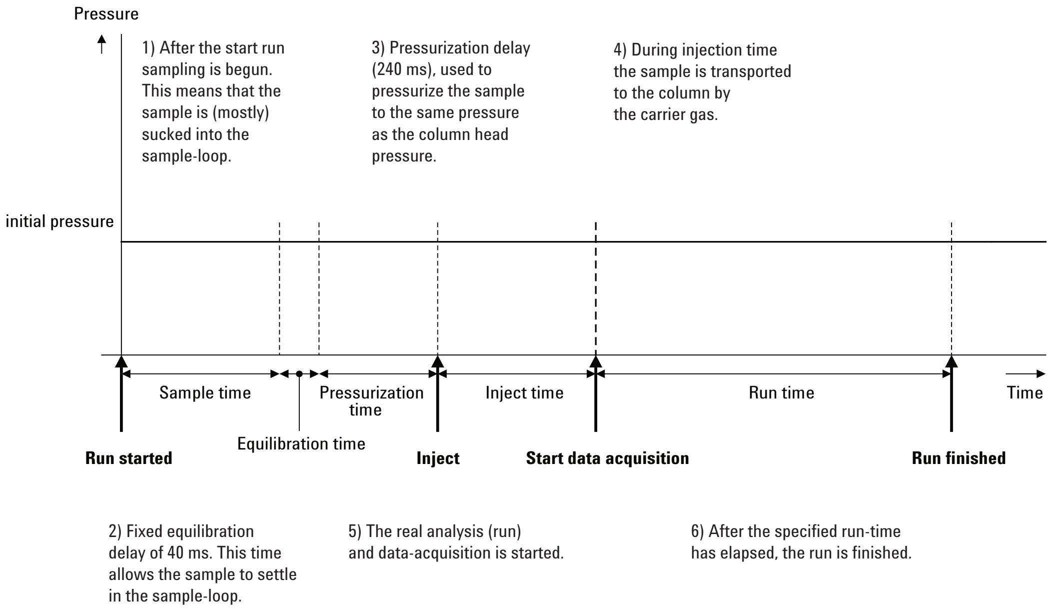


Figure 28. 990 Micro GC Run with Static (Electronic) Pressure

NOTE

This description is only for one channel. In most cases a dual-channel system is used; in this situation the sequence is the same, but the timing-settings can differ. If the sample-time on channel A and channel B are different, the longest time is used for both channels. Also the run-time can be specified per channel; the data-acquisition stops per channel as soon as the run-time has elapsed. The total analysis-time depends on the longest run-time.

The diagram shows the situation in the Micro GC, using electronic (programmed) pressure control. The timing before the injection is identical to the static pressure cycle.

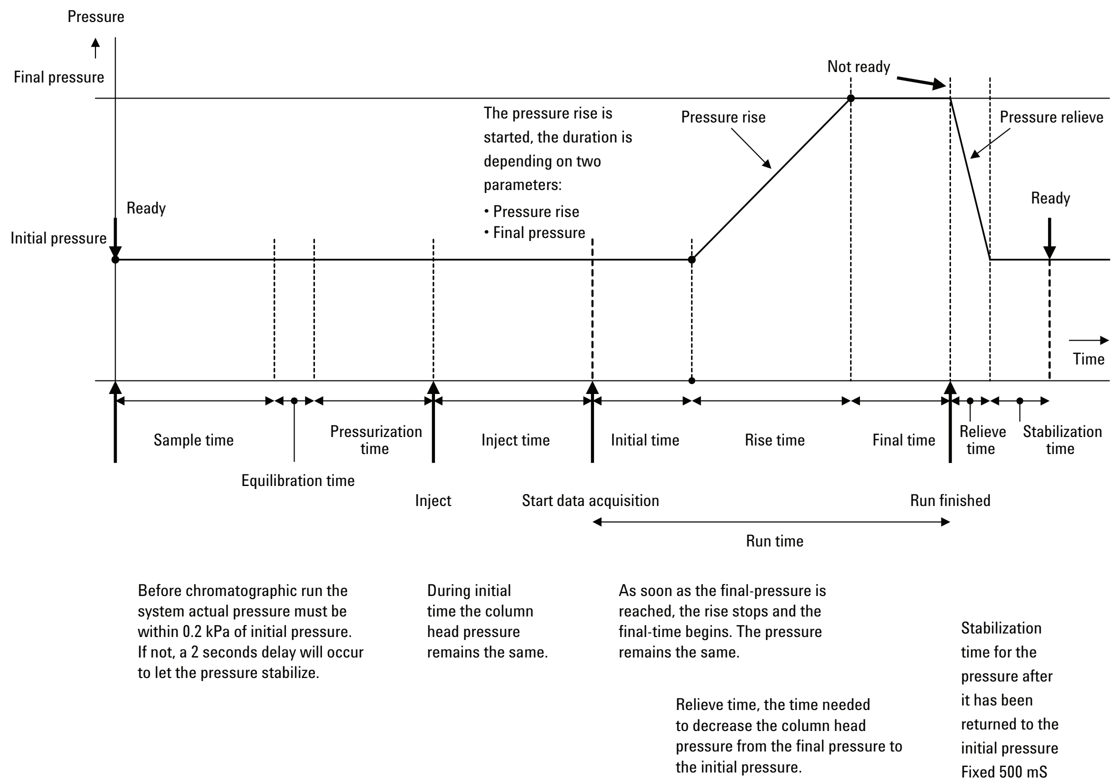


Figure 29. 990 Micro GC Run with Electronic Pressure Control

The remaining final time depends on the total run time, the duration of the initial time, and the pressure rise. This means that it is possible that the final time is zero. Another situation is that the final pressure is limited because of these settings. The software will check all parameter -values and change them into realistic values.

NOTE During the run-time, there can be only one pressure-ramp to higher pressure.

4 PROstation Instrument User Controls

Instrument Method Setup

- Right click on an instrument to display the instruments dialog menu.
- Select **Open** to view the full instrument control screen.
  This is required for method development and acceptance, see **Figure 30**.
  Open can also be activated by double-clicking the instruments icon.
- The operator is also able to remove the instrument from the **PROstation database, Open as read only** in order to only view the ongoing analysis or to **Open Off line** for off line method development or analysis results display.

There is detailed information about **Instrument Setup** on page 92.

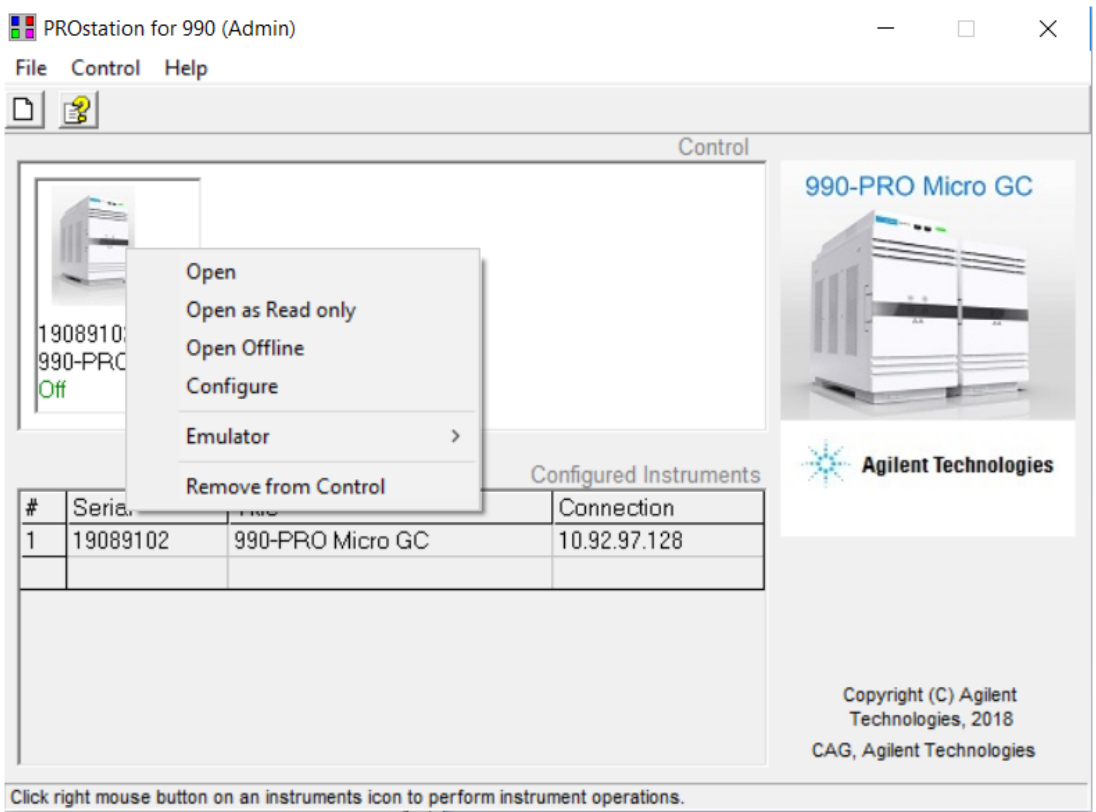


Figure 30. Open Instrument menu

User Log In

There are three user levels for logging into the instrument. Each level requires a unique login. Set up a unique password for each user, see **Figure 31**.

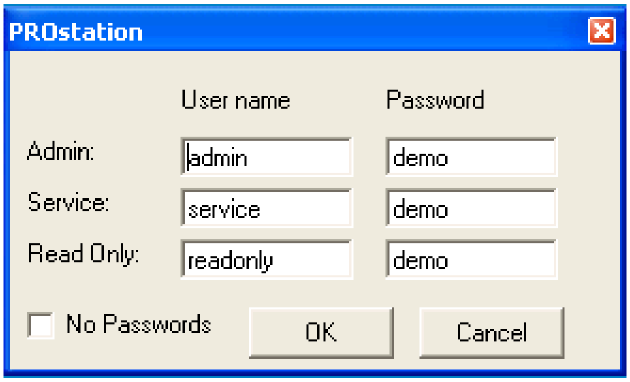


Figure 31. Three levels of login each with password

Method developer (admin)

Developers have full control of the instrument and are authorized to modify any parameter, unless the **method protection jumper** is placed, see **Chapter 2**, "Instrument Overview," starting on page 23.

Service engineer (service)

Engineers are authorized to change only a few parameters. These include:

- Changing the concentrations of calibration mixtures (after placing a new calibration bottle).
- Changing the sequence
- Starting and Stopping a sequence
- Testing Input/Output the signals
- Setting date and time of internal clock.
- Changing parameters in the Site Information window

Instrument control and method editing menus are limited, see **Figure 32** and **Figure 33** on **page 72**.

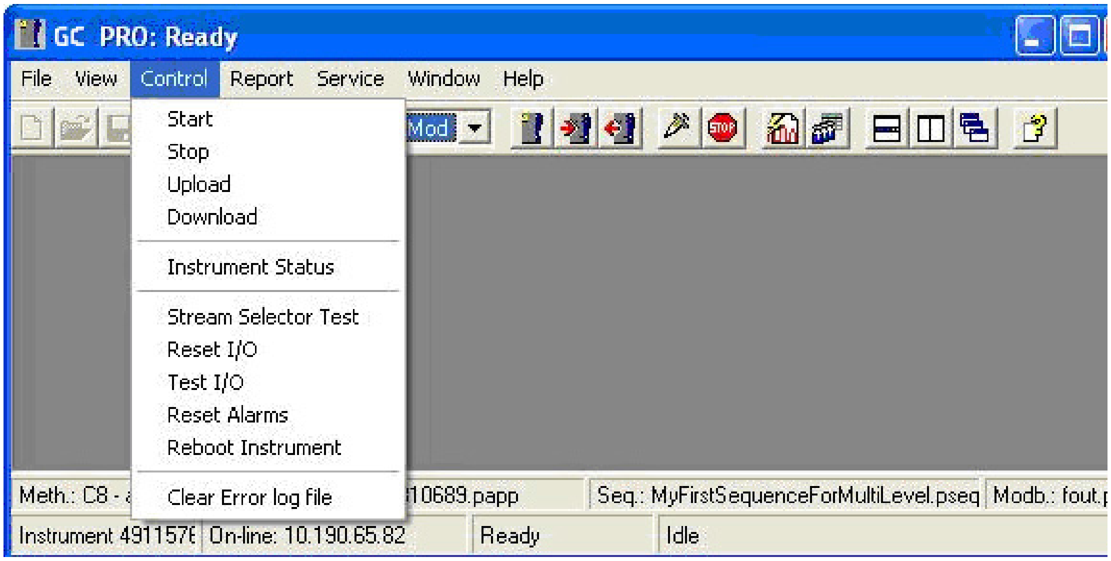


Figure 32. Instrument control menu for service engineers

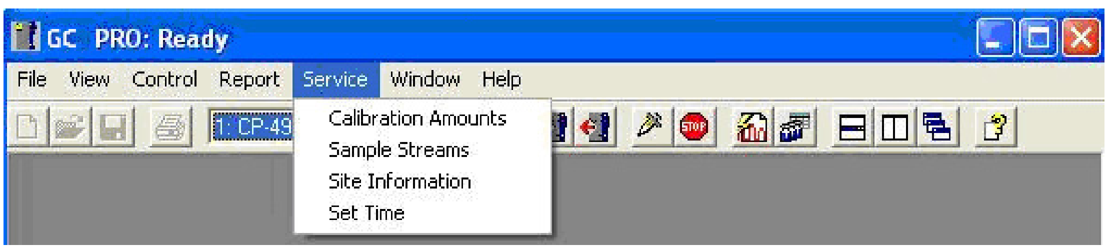


Figure 33. Service menu for changing methods for service engineers

Operator (read only mode)

The authorization only includes viewing reports, chromatograms, method, instrument status, etc. The Instrument Control menu only consists of uploading methods to PROstation and viewing instrument status.

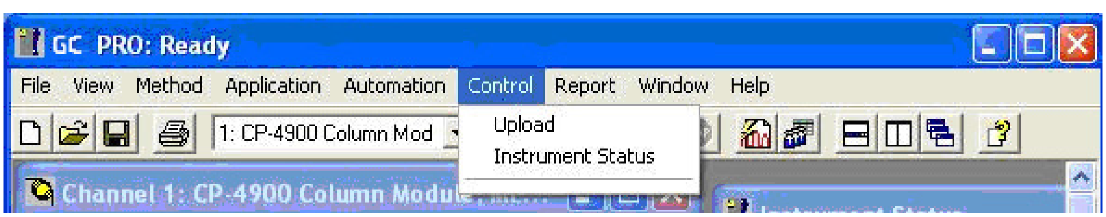


Figure 34. Control menu for operators (read only mode)

Off line control

Off line control allows you to setup methods without an instrument connected.

Another feature is exporting component results from a selected peak (searched by peak name) in a selected group of FTP sample results files. The exported file can be opened in Excel for further analysis. Also sample result files (file name *_prslt) generated by PROstation can be (re-) exported to a csv (comma separated text file). The export file is identical to the export file as defined in menu **Method - Advanced**.

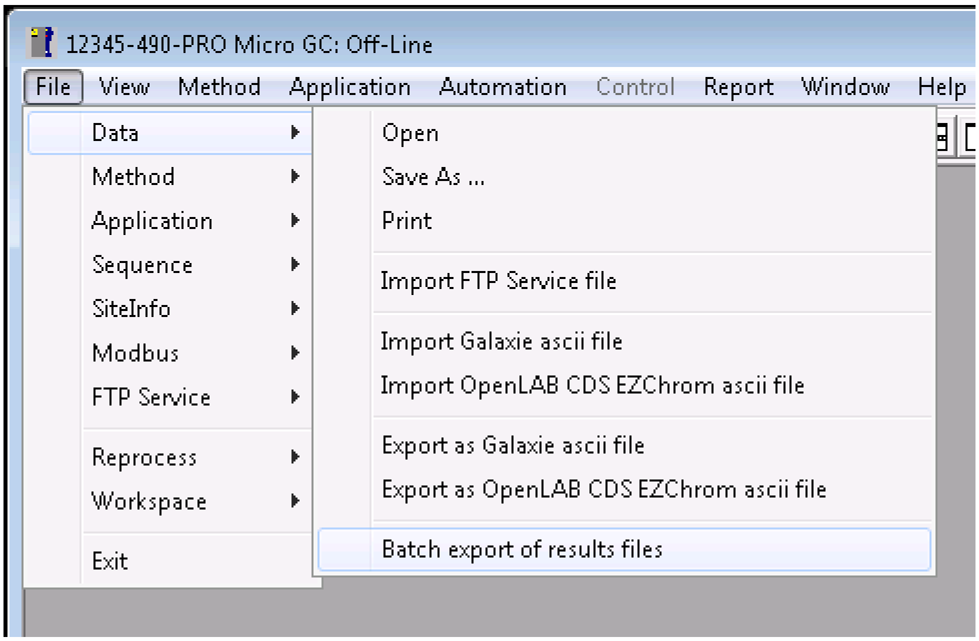


Figure 35. Off-Line control

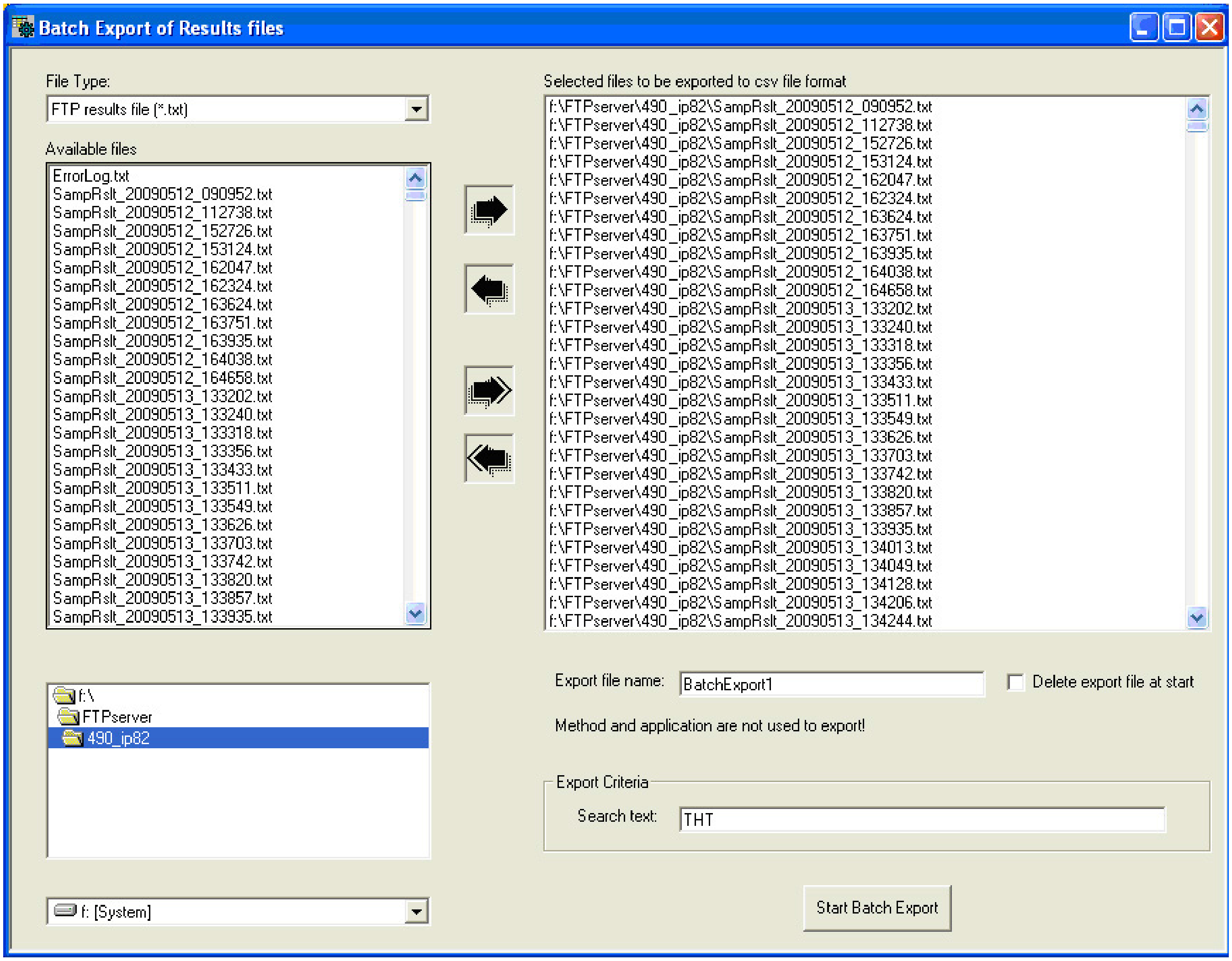


Figure 36. Batch report

Toolbar Instrument Control

Once logged in as an administrator (method development), the toolbar in **Figure 37** is shown.

Figure 37. GC Channel selector

The PROstation menus and toolbars should be used to instruct PROstation what to do. The more frequently used commands have images on the lower toolbar. Use the **GC Channel selector** to browse through all installed GC channels for every opened window under the Method menu.

5 PROstation Instrument File Menu

This chapter describes the Instrument Control program file menu. Its function is method development and monitoring analysis.

Import/Export

PROstation stores chromatograms in a proprietary format with a .pdat file extension. Using the import/export functionality of PROstation, it is possible to exchange chromatograms between OpenLAB CDS EZChrom, Galaxie CDS, PROstation FTP service, and PROstation.

The file menu gives access to this functionality, see **Figure 38**.

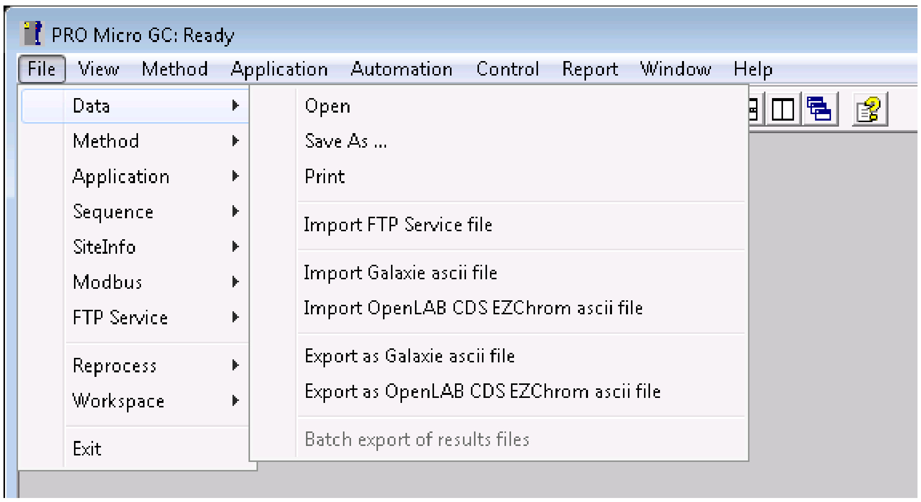


Figure 38. File menu

Import FTP Service file

The instrument typically runs in unattended mode, where configured calculation values are reported through Modbus and/or analog signals. The instrument can be configured to store chromatograms on an FTP server, see **Automation FTP Service** on page 425. This allows the user or service engineer to investigate the chromatograms.

The FTP service of the instrument stores the files with the .dat extension. These files can be imported into PROstation using the **Import FTP Service file**.

Import Galaxie ascii file

The Galaxie CDS collects chromatograms in its proprietary format. The method can be configured to export the chromatogram in ascii format, see Galaxie manual for details. The exported ascii files can be imported into PROstation. After importing the ascii file the chromatograms are shown in PROstation.

Import OpenLAB CDS EZChrom ascii file

The OpenLAB CDS EZChrom collects chromatograms in its proprietary format. The method can be configured to export the chromatogram in ascii format, see OpenLAB CDS EZChrom manual for details. The exported ascii files can be imported into PROstation. After importing the ascii file the chromatograms are shown in PROstation.

Export as Galaxie ascii file

The chromatograms collected in PROstation can be exported to Galaxie ascii format. A single channel can be exported to an ascii file. The channel should be selected using the Select Channel Galaxie Data screen, see **Figure 39**.

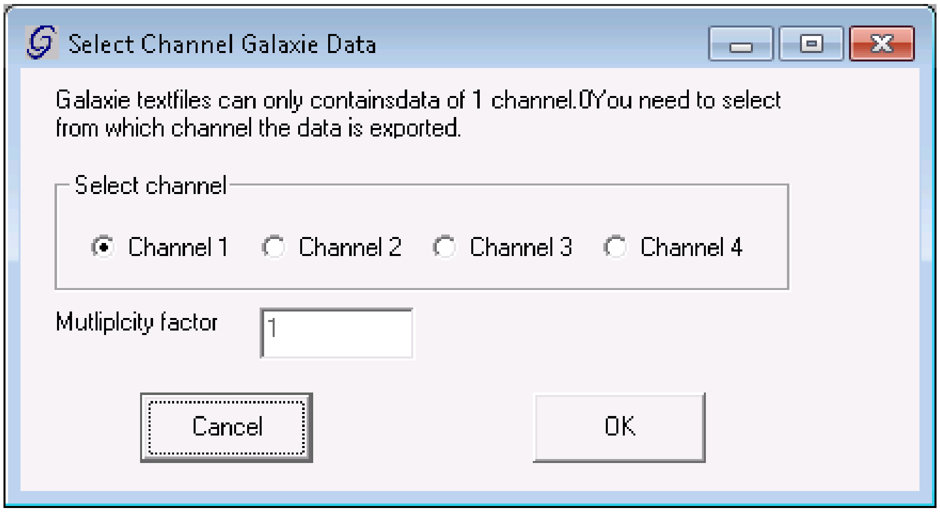


Figure 39. Channel selection

The exported ascii file contains two columns, the **Time** column in minutes and the **Value** column.

NOTE

This file can also be imported into Excel.

Export as OpenLAB CDS EZChrom ascii file

The chromatograms collected in PROstation can be exported to OpenLAB CDS EZChrom ascii format. This exported ascii file can be imported into OpenLAB CDS EZChrom using the **Open Data file** menu item (**File>Open>Data...** menu structure) and selecting the SSI Ascii (*.asc) file type, see **Figure 40** on page 80. For more details see the OpenLAB CDS EZChrom manual.

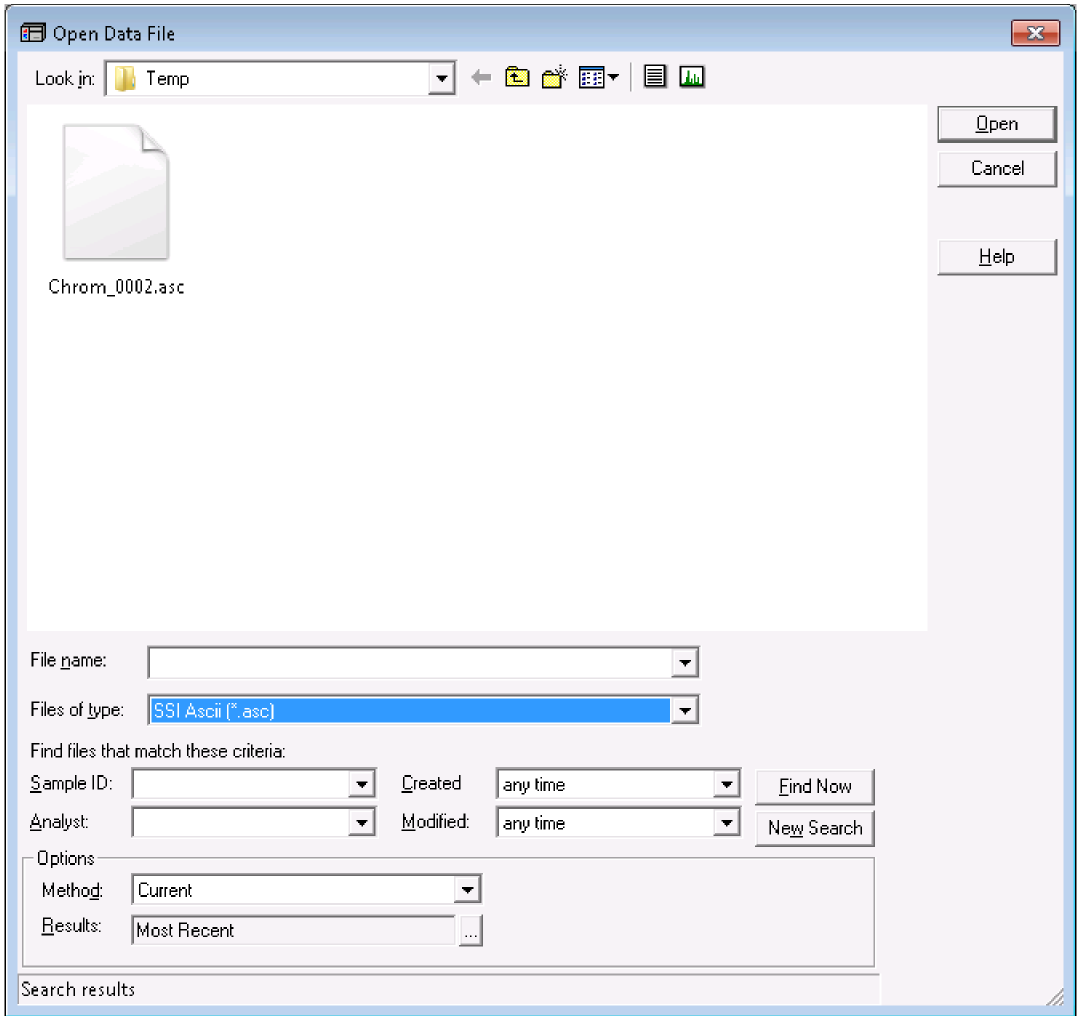


Figure 40. Import chromatogram into OpenLAB CDS EZChrom

Method Wizard

The method wizard can be used to easily generate a Method containing Peak identification/Calibration settings extracted from an analysis run.

Figure 41. Method Wizard

To activate the method wizard, from the PROstation toolbar select **file\method\wizard:**

The method wizard fills the different method tables with necessary default data. Check the appropriate boxes for the tables you want the wizard to fill. Note that filling the Peak Identification/Calibration Table is only valuable after the integration parameters have been optimized. This implies that you can use the wizard multiple times for different tables.

Application Wizard

From the **Application menu Normalization**, **Calorific Power**, **Analog**, and **Digital Control** can be defined.

An Application or Verification check is only required when Calorific values, IO's or an LCD screen are defined.

- Activate **Application Wizard**. Select **File\Application\Wizard**.
- Select from the **Application** window, select option **Generate Normalization** table from **Method-Peak** table, see **Figure 42** on page 83.
- Select the options required for later instrument operation and click **OK**.
- Save Application (**Save as...** option). Edit a proper application file name.

To access the sequence, select **Automation\Sequence**. Fine tune the sequence after the sequence wizard has created most of the parameters.

Find information about Sequence setup in the chapter **PROstation Automation Menu** on page 225.

Save sequence and download sequence to the instrument, see **Figure 42** on page 83.

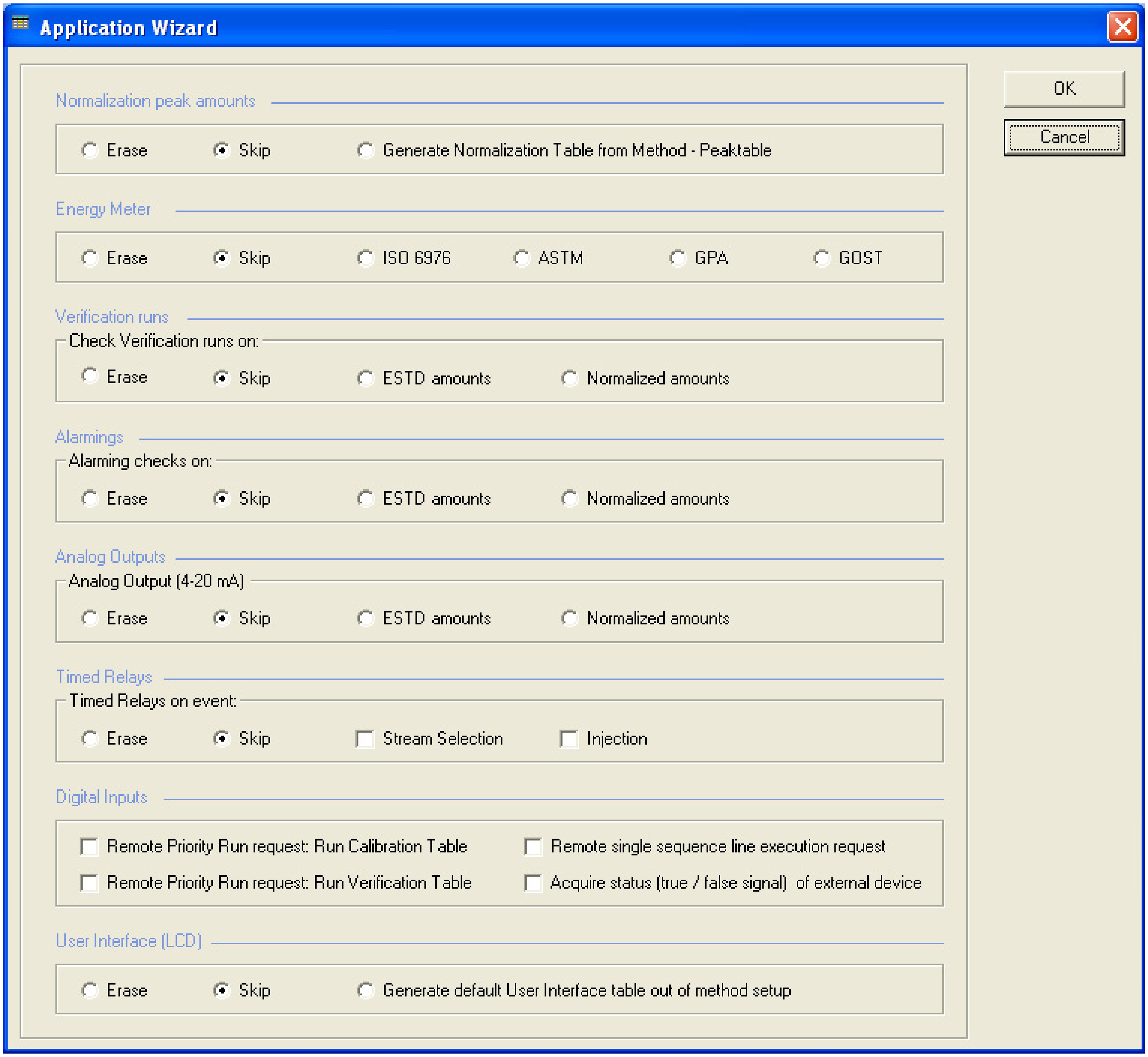


Figure 42. Application Wizard

Sequence Wizard

Select the sequence wizard to quickly set up a sequence from scratch.

To activate the sequence wizard, from the PROstation toolbar select **File\Sequence\Wizard**.

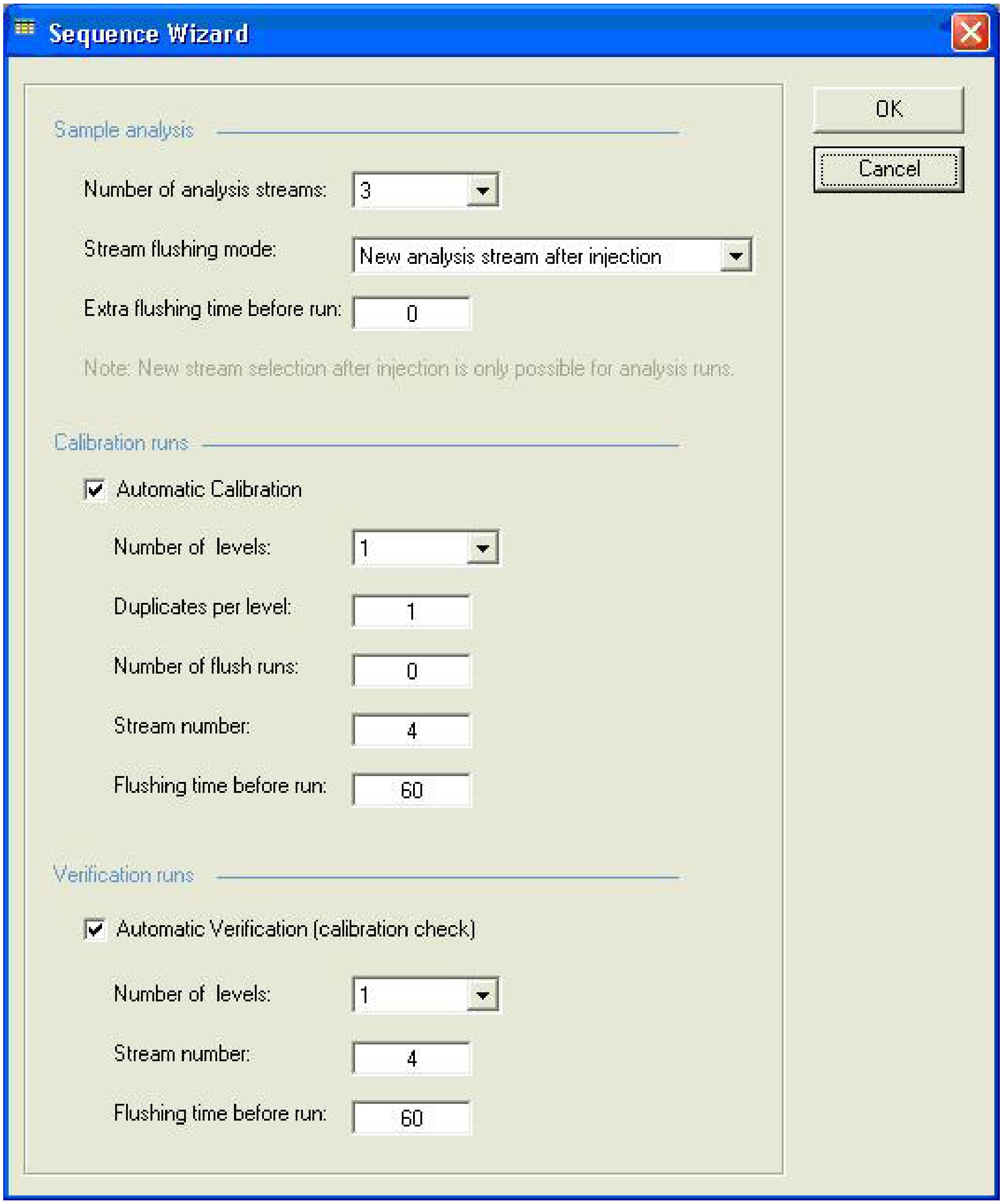


Figure 43. Sequence Wizard

Modbus Wizard

Select the Modbus Setup Wizard to generate a modbus table from scratch containing a list of modbus registers holding the sample results, instrument status, instrument control, etc. To activate the Modbus wizard, from the PROstation toolbar select **file\Modbus\wizard**. More information can be found in **Modbus Setup** on page 237.

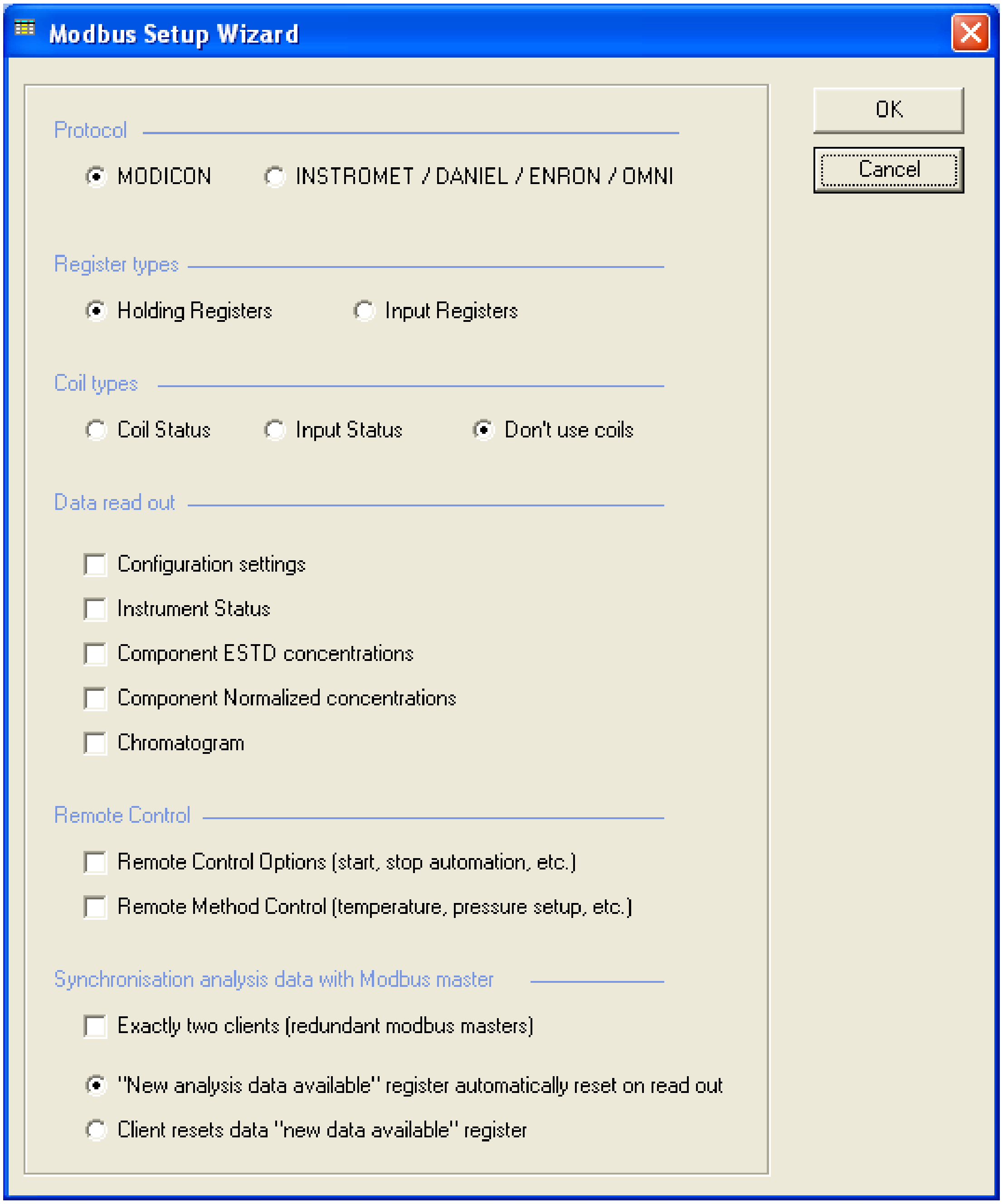


Figure 44. Modbus Setup Wizard

6 PROstation Instrument View Menu

This chapter describes the Instrument Control program view menu. Its function is method development and monitoring analysis.

View

From the PROstation toolbar, select **View**:

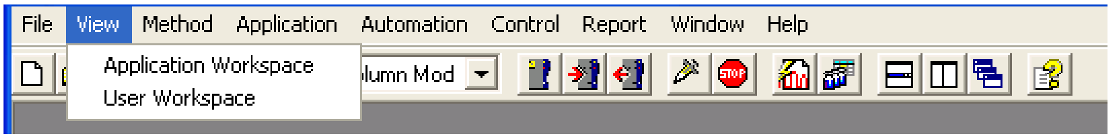


Figure 45. View menu

There is a choice between two different workspaces:

- When the instrument is running a single run or sequence, one can monitor the instrument by making **PROstation** display the live chromatogram, **Integration or Application** report and instrument status.
- The layout of **PROstation** can be defined by positioning the required windows on the screen and followed by a save of the workspace. In the **View** window, one can select the workspace to activate.

Application workspace

Detailed instrument status, application report and the actual channel data. The chromatogram window has all kinds of scaling functionality. This is identical to the scaling functions in the Calibration chart, see **Calibration chart** on page 138. **Figure 46** on page 88 is an example of the **Application Workspace**.

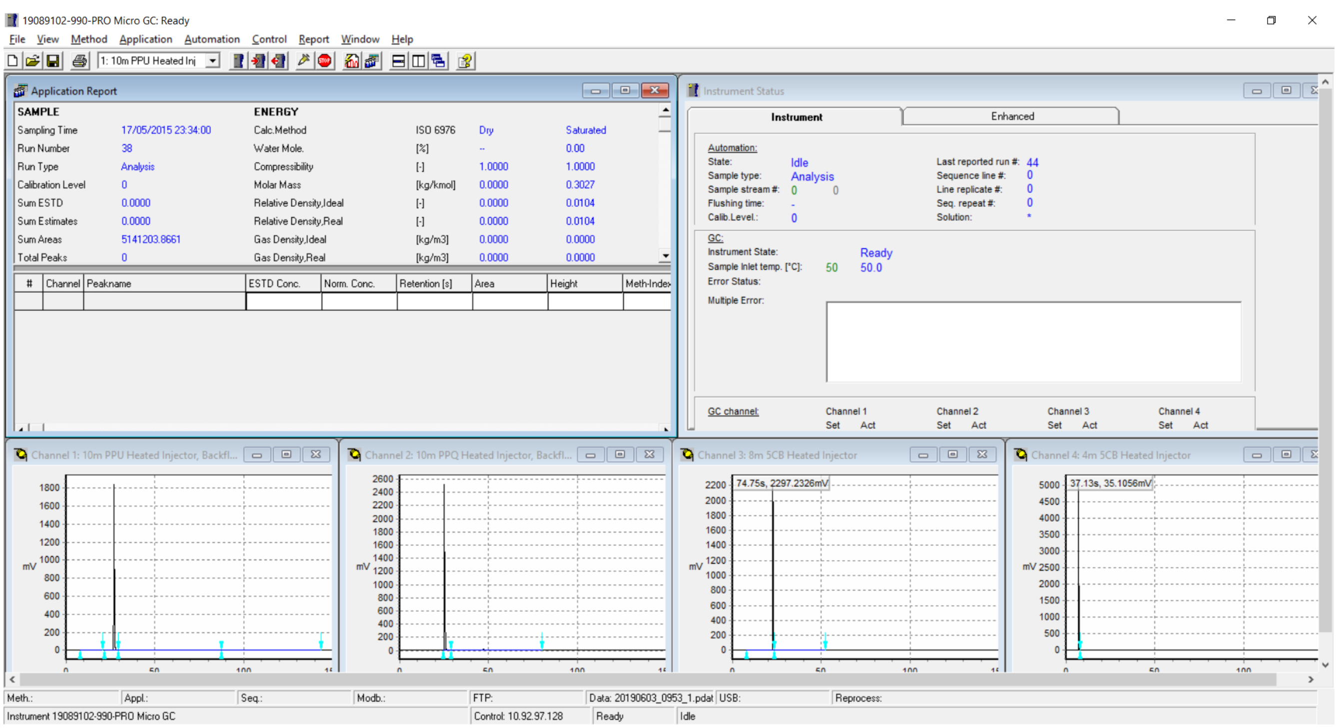


Figure 46. Example of application workspace of PROstation view.

In PROstation, the following reports are available:

- Integration Report
- Application Report
- Stream Application Report, the last application report for every sample stream.
- Diagnostic Report containing operation errors and other events (upload report first **Control\ diagnostic\OK**).
- Select **Report\ Report type**.
- Printing options are also available in this menu.

User workspace

The user workspace displays a fixed number of windows on the screen which cannot be changed.

7 PROstation Instrument Method Menu

This chapter describes the Instrument Control program method menu. Its function is method development and monitoring analysis

The method consists of all windows found under the Method menu.

Instrument Setup

Before you can make a run with your instrument, you must set up the instrument and data acquisition parameters for one or both channels of the instrument. To access the **Instrument Setup** dialog, click the Instrument Setup icon on the toolbar, or select the **Method/Instrument Setup** command from the menu.

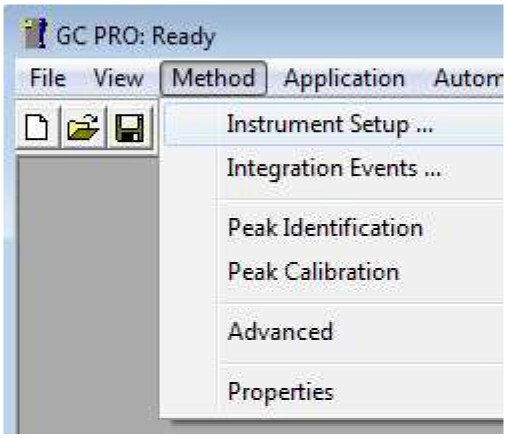


Figure 47. Method setup

Instrument Micro GC tab

The instrument Micro GC tab consists of the sub tabs: **Channel** and **Common**. For each single-channel installed in the instrument, a separate channel tab will appear. Installed channels, which are disabled in the configuration, will not be displayed.

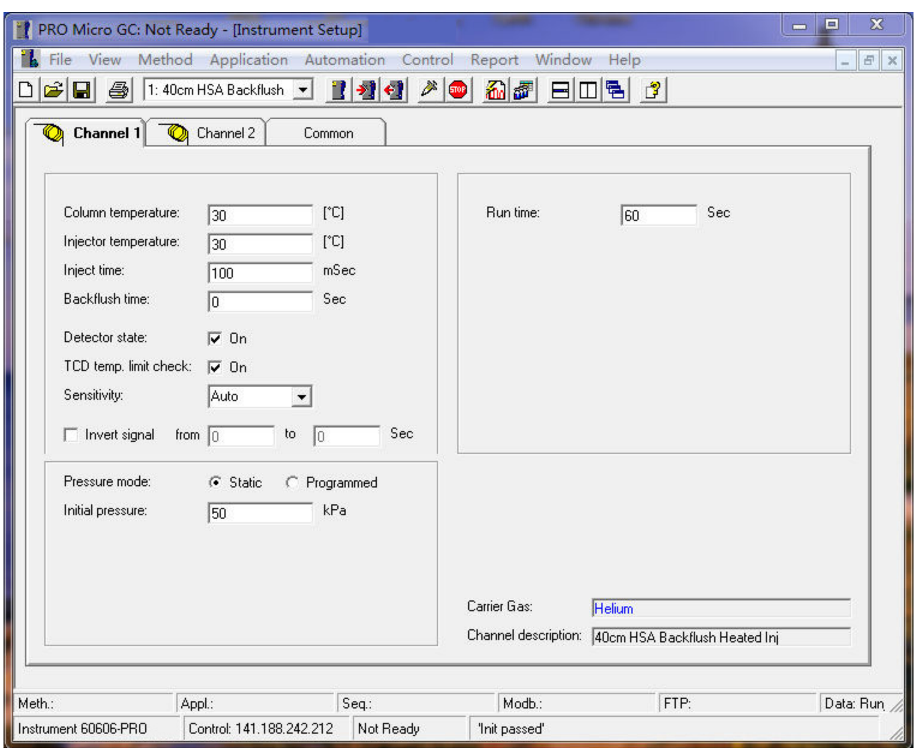


Figure 48. instrument Micro GC tab

Instrument common tab

This tab contains parameters you can set which are common for all installed channels.

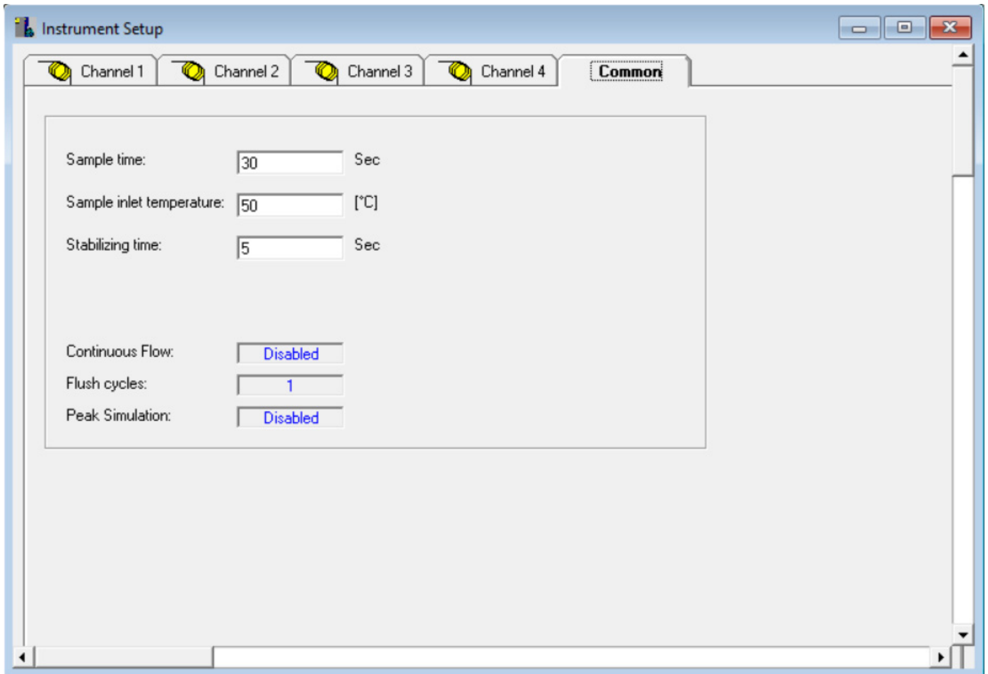


Figure 49. Common tab

Sample time

Sample time determines the amount of time the pump operates to draw the sample into the sample loop. The sample time entered here applies to all channels.

Sample inlet temperature

This setting controls the instrument heated sample inlet.

Stabilizing time

If a value larger than zero is entered for Stabilizing time, an extra instrument state will be created, the Stabilizing state.

Continuous flow

This is the current continuous flow setting in the instrument. At startup of Instrument control, this setting is uploaded from the instrument.

Flush cycles

This is the current number of flush cycles in the instrument. At startup of Instrument control this setting is uploaded from the instrument.

Peak simulation

This is the current peak simulation setting in the instrument. At the startup of Instrument control, this setting is uploaded from the instrument.

Stabilization Time

The stabilization state becomes active as soon as all individual temperature and pressure states of all channels are in the Ready state. In the Stabilizing state, all individual temperature and pressure states are checked.

If they all remain ready during the stabilizing period, the overall instrument state will become **Ready**. If during the stabilizing period one of the channel temperatures or pressures becomes **Not Ready**, the overall instrument state will jump to **Not Ready** and the whole process will start again. Enter zero for Stabilizing time if the stabilizing period is not required.

Instrument method channel tab

For each channel installed in the Hardware tab of the instrument configuration (and not disabled in the **User Settings** tab of the instrument configuration), a **Channel** tab appears.

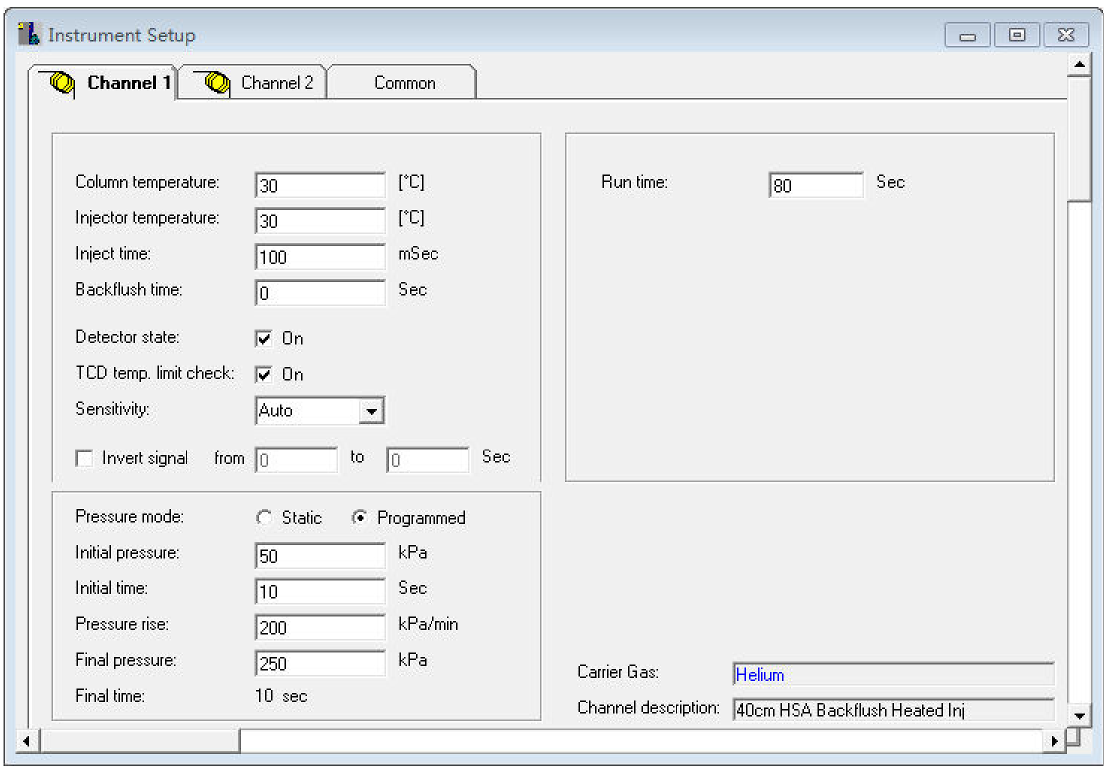


Figure 50. Channel tab

Column temperature

Enter the desired column temperature, in °C. The GC driver checks on the maximum allowed temperature, which can be found in the Hardware tab of the instrument configuration.

Injector temperature

Enter the desired injector temperature, in °C. This is only possible if the GC channel is equipped with heated injector hardware.

Inject time

Enter the Inject Time. The Inject Time determines the amount of time the injection valve will be open. A practical minimum value is 20 ms.

Backflush time

Enter the backflush time in seconds. This is only possible if the GC channel is equipped with backflush to vent hardware. A backflush time of zero means no backflush.

Detector state

Select this box to turn the detector filaments on.

Invert signal

Select this box to invert (change polarity) of the acquired detector data from selected time interval.

Sensitivity

Select the desired detector sensitivity - Auto (auto ranging), Low, Medium, High or Extra high. Auto is highly advised as it gives the widest linear dynamic range, with the lowest noise level.

TCD temp.limit check

Select this box to turn the TCD temperature limit check on. If activated the TCD will be protected against high amount of Air that could damage the filaments.

Pressure Mode

Select the pressure-programming mode to be used. Choose Static for nonramped mode. Choose Programmed if you want to enter a programming ramp rate. If you select Programmed, the following parameters will become available.

Run Time

Run Time determines the length of time, data will be sampled.

Initial Pressure

Enter the initial pressure setting, in kPa or PSI (depending on configuration).

Initial Time

Enter the time to hold the initial pressure, in seconds.

Pressure Rise

Enter the rate of pressure change for the ramp, in kPa/min or PSI/min (depending on configuration). Positive rise only.

Final Pressure

Enter the final pressure setting, in kPa or PSI (depending on configuration).

Final Time

The final time will be calculated and displayed, based on the **Run time** you have set in the Acquisition Parameters.

If the final time displayed is 0, this means that your Run time is equal to or less than the sum of your initial time and the time to ramp the pressure to the final pressure setting. You should change your run time accordingly.

If you have entered an incorrect parameter for any of the above items, an error message will be displayed in this field to aid you in correcting the setting.

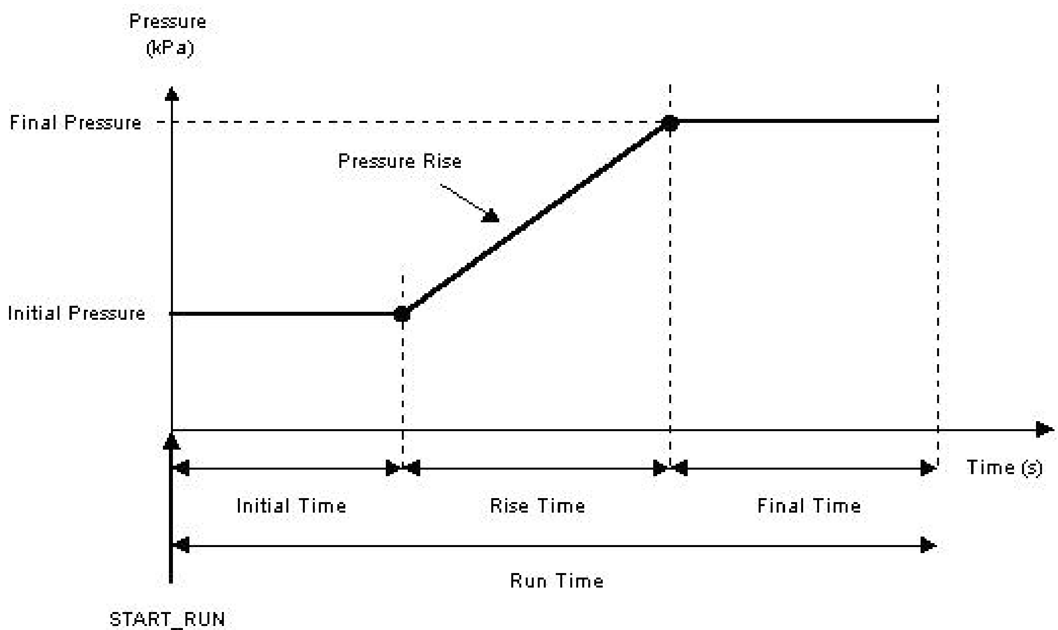


Figure 51. Pressure program scheme

Integration Events

To access integration events, click **Method** and select **Integration Events...**.

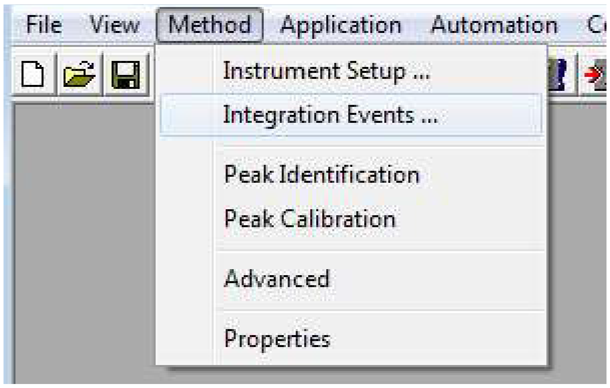


Figure 52. Method integration events

Chromatogram markers

PROstation presents the chromatograms collected from the instrument to the user. These chromatograms are instrumented using several markers.

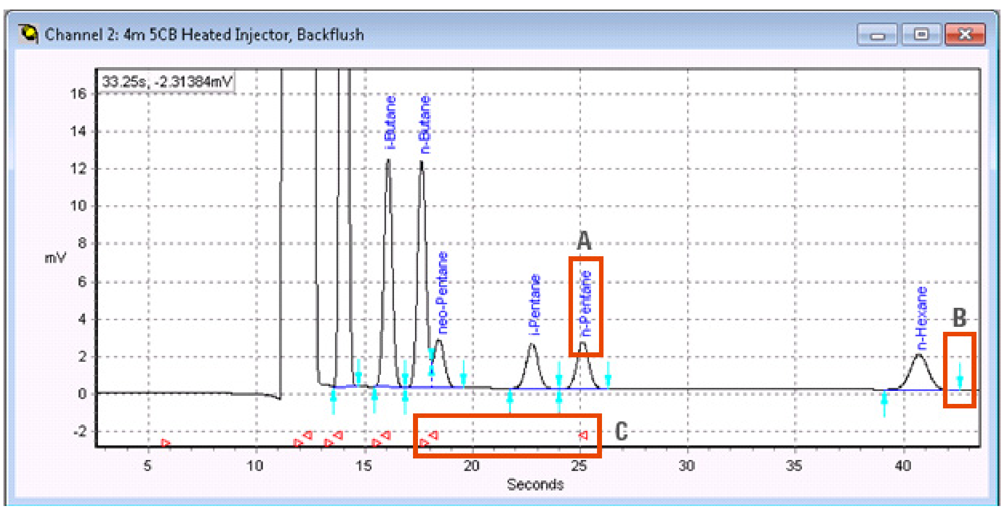


Figure 53. PROstation chromatogram

A. Component name

The component name is assigned to a peak using the criteria of the Peak Identification, see **Peak Identification** on page 112.

The component name is shown in blue in the chromatogram above the identified peak, see **Figure 53**.

B. Start / Stop baseline

The baseline of a peak is influenced by the shape of the peak and the integration parameters, see **Integration Events** on page 97. The details of the baseline are presented in PROstation using three visual elements.

- Start baseline: The turquoise arrow pointing up, underneath the baseline.
- Stop baseline: The turquoise arrow point down, above the baseline.
- Baseline: The blue line between the Start baseline marker and the Stop baseline marker.

C. Begin/End retention time window

The area of the identification of a peak is determined by the retention time window. The size and location of this window is configured using the Peak Identification, see **Peak Identification** on page 112.

The location of retention time windows can be inspected in the chromatogram on PROstation. The retention time window is marked with two markers in red. The triangle pointing to the right indicates the begin of a retention time window. The triangle point to the left indicates the end of a retention time window.

Set peak width

This event defines the width of the peak to be found in the chromatogram. This value is used to smooth the chromatogram by grouping several acquisition points during peak detection. The number of grouped points depends on the chosen width. A point whose height is the mean of all the points in the group represents each group.

Enter a value corresponding approximately to the width of the narrowest peak to be detected in the chromatogram.

If the peak width varies greatly in the same chromatogram, it is possible to change peak widths throughout the chromatogram as necessary. Set new values in **Set Peak Width**, half it using **Half Peak Width**, or double it using **Double Peak Width**. If the defined peak width value is too small, the peaks will be detected, but too late.

Figure 54. Peak width

If the defined peak width value is too large, the peaks will not be detected. A peak width must be defined before integrating the chromatogram. The default peak width is 0.2 seconds.

Set threshold

This parameter is used to define the start and the end of peaks and eliminates the lowest signal variations due to noise or to detector signal drift.

The chromatogram is first normalized to 100,000 (Highest peak of the chromatogram) to obtain a similar detection from one analysis to another (for example, if the injected quantity varies). Next, the points are grouped depending on the peak width defined above. The mean height of a group of points is compared to the mean height of the following group. If the difference is higher than the threshold, the integrator marks the beginning of a peak. The position of the marker is adjusted by only considering the points. The peak will only be kept if its area and height are larger than minimum values defined by user.

The peak ends are detected in the same way, using the threshold.

The value of the threshold is important. If a too high threshold value is defined, the peak starts will be detected too late and the peak ends too early. Moreover, small peaks could not be detected at all. If a too small threshold value is defined, the peak starts will be detected too early, and the peak ends too late, and signal noise can be detected as peaks.

The user can define the threshold value, or the instrument can estimate it using **Estimate threshold** according to the peaks that should be detected. It is also possible to add a value to the threshold using **Add to threshold**. For example, if the threshold is estimated at the beginning of the analysis, and the signal noise increases at the end of the analysis, the threshold should be increased only at the end. Note that it is possible to add a negative value in order to decrease the threshold value. The default threshold value is 10.

Set solvent threshold

This event permits the elimination of solvent peak(s) if they are not peaks of interest. The parameter associated with this event works without previous normalization of the chromatogram. The points are grouped depending on the peak width defined above. The mean height of a group is compared to the mean height of the following group. If the difference is higher than the solvent threshold, the instrument considers that the peak is a matrix peak, and does not integrate it.

The defined value must be high enough to prevent the deletion of peaks of interest.

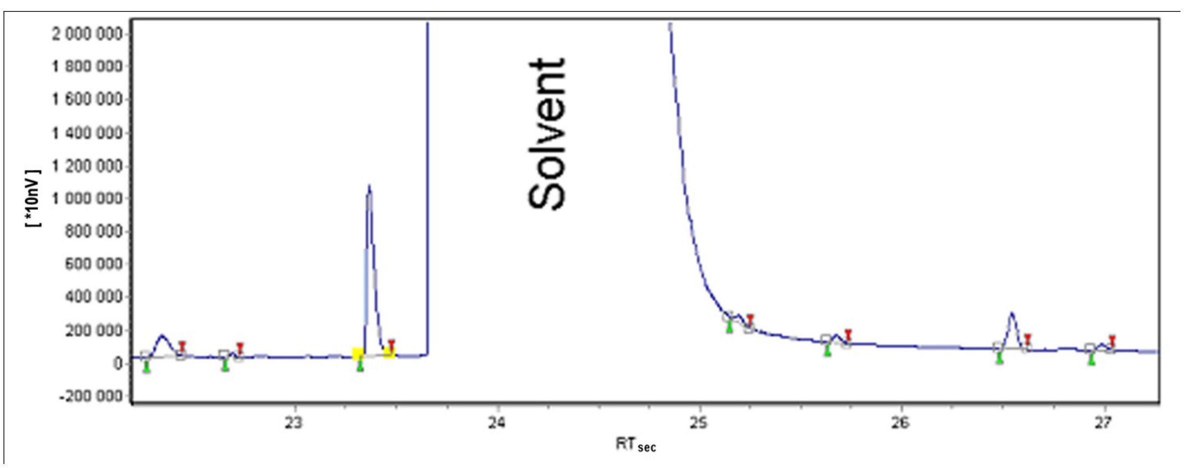


Figure 55. Solvent threshold

Estimate threshold

If the event Estimate threshold is not defined, solvent peaks are integrated. The user can define several Estimate threshold events. Each time the event is defined, the instrument calculates threshold.

Set minimum height/area

These parameters are used to prevent the integration of noise as peaks or to eliminate small peaks which are not of interest in the analysis.

All peaks, whose height or area is less than the minimal height and/or area parameters set, are deleted from the peak report. Therefore, choose parameters that are less than the areas and heights of all the peaks to be integrated. By default, minimum area and height settings are equal to zero.

Turn integration on/off

These events activate or deactivate integration within sections of the chromatogram (that is, during baseline fluctuations such as injection shock).

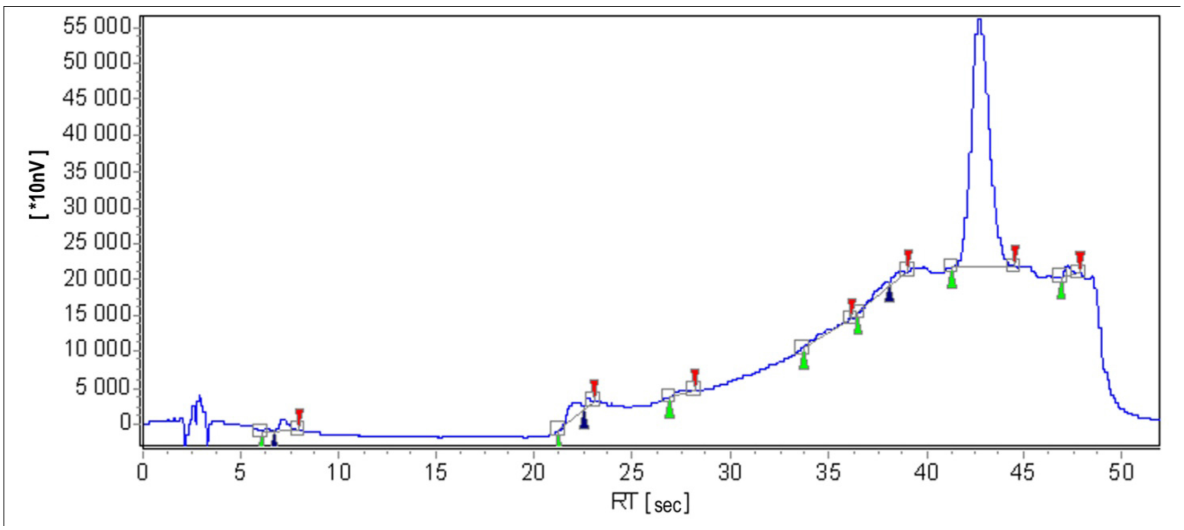


Figure 56. Deactivating integration

In the above example, integration has been deactivated during the first 5 seconds.

Start/Stop peak now

These events allow the start or the end of a peak to be defined, earlier or later, without having to modify the integration parameters. The marker is repositioned at a new retention time when this event is specified.

For example, before:

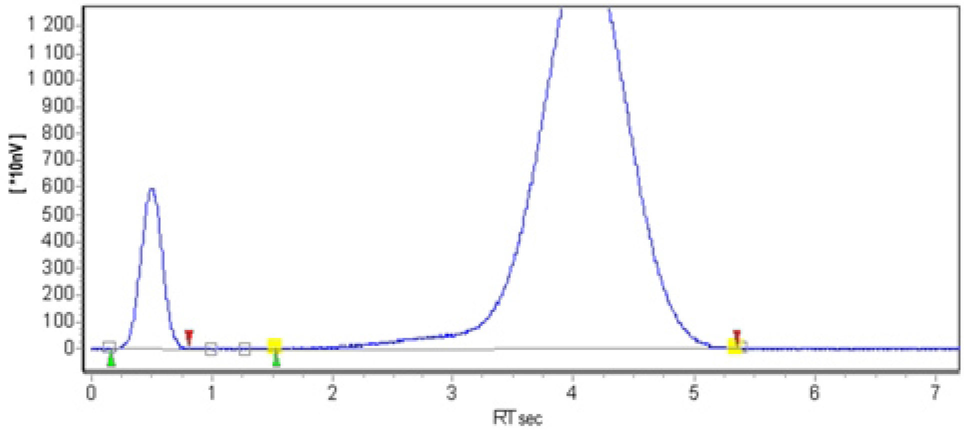


Figure 57. Marker repositioning before

After:

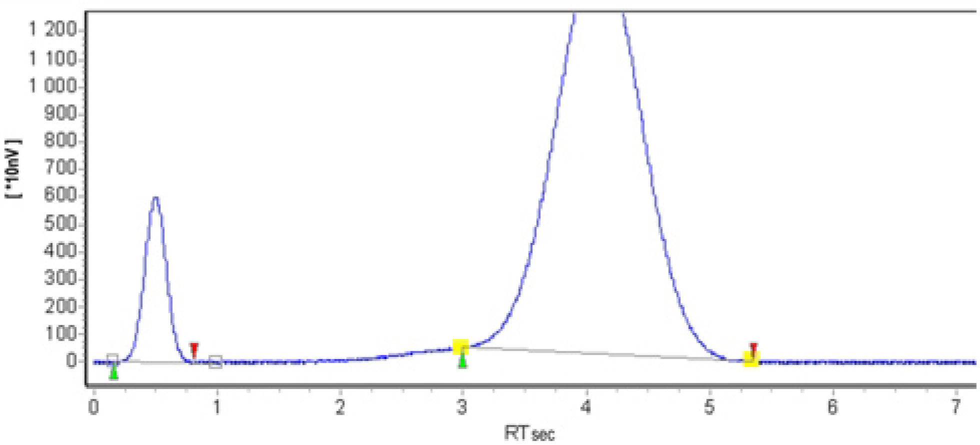


Figure 58. Marker repositioning after

Be cautious if using these events in automatic mode: check that retention times have not shifted from one analysis to another.

Add peaks/grouping

This event enables addition of several peaks. All the peaks defined between the activation and the deactivation of this event are grouped into one peak. For example, isomers whose names are not known peak by peak, but contain nearly the same response factors can be considered as one group. The peak grouping is considered as one peak. Note that the peak start or stop position is automatically adjusted around the defined time to avoid the baseline cut by the signal.

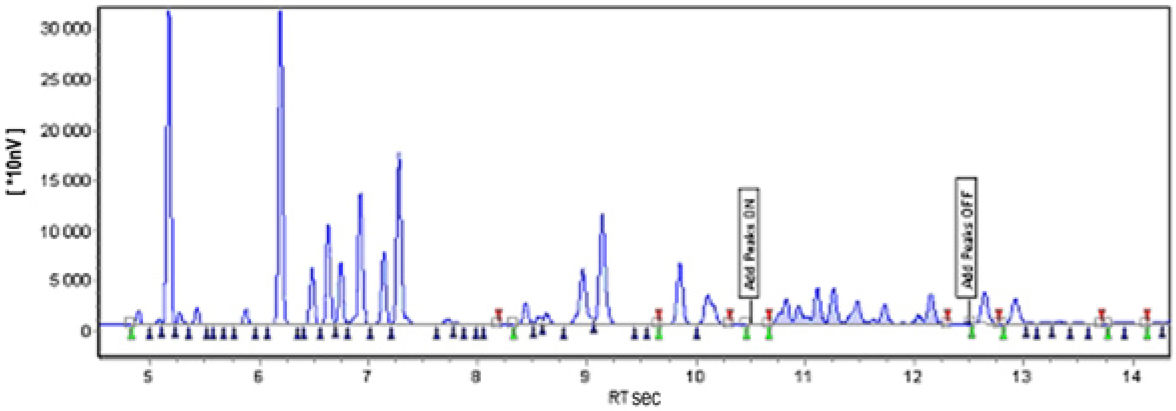


Figure 59. Adding peaks

In the above example, the peaks between 10.5 and 12.5 seconds are added.

If the baseline cuts the signal in the section corresponding to the **Add peaks** events (ON + OFF), the expected added peak may not be defined. In this case, change the baseline position thanks to the corresponding integration event(s).

Split peak

This event will split a peak into two parts, and can be used either to separate peaks that are not base line resolved or to obtain specific results on parts of some peaks in certain applications.

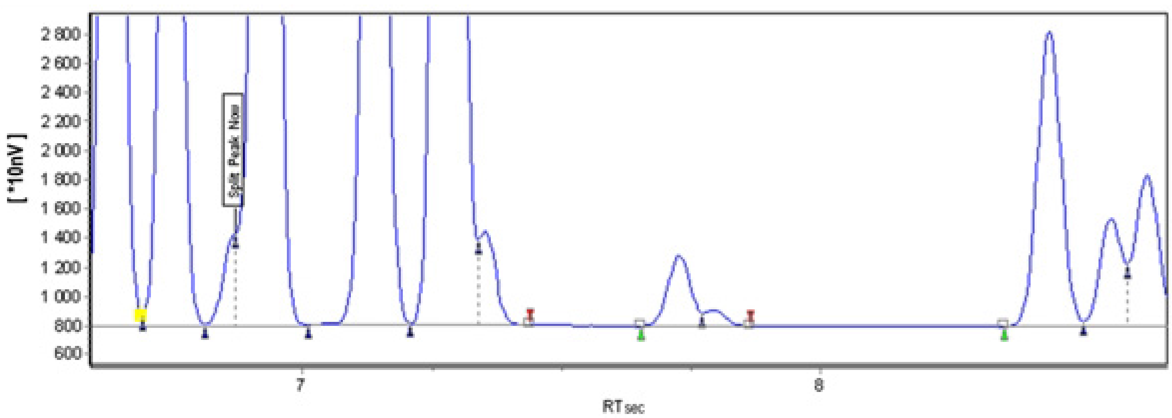


Figure 60. Split peak

NOTE

This integration event is time. Variation in peak retention times vary from one analysis to another, may result in incorrect results.

NOTE

The presence of an inflection point overrides the Split Peak integration Event. If there is an inflection point near the time for the Split Peak Integration Event, the Split Peak Integration Event is not executed. Without the inflection point the Split Peak Integration Event is executed. If the chromatogram is closely examined, the Split Peak Integration Event is executed on a merged peak without an inflection. If the Split Peak Integration Event was used near the peak at ~7.3 the inflection point would be executed instead.

Baseline processing

Baseline valley to valley On/Off

When this event is activated, the baseline passes through all the valleys.

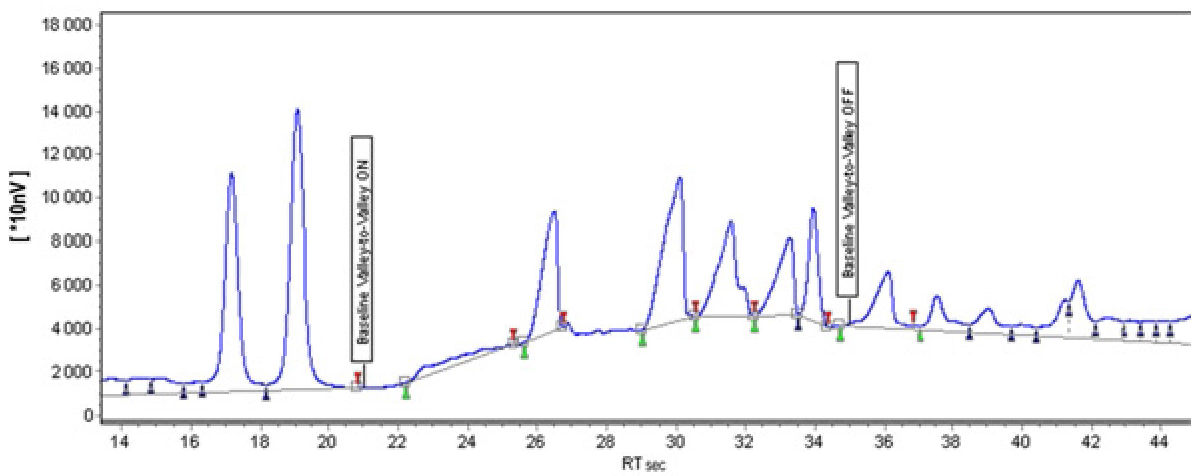


Figure 61. Baseline valley to valley

Each peak has its own baseline drawn from the peak start marker to the peak end marker.

Horizontal baseline

This event enables the definition of a horizontal baseline. A horizontal baseline is drawn from the activation of this event until its deactivation. It is imperative to define the event couple (ON and OFF) to apply this event.

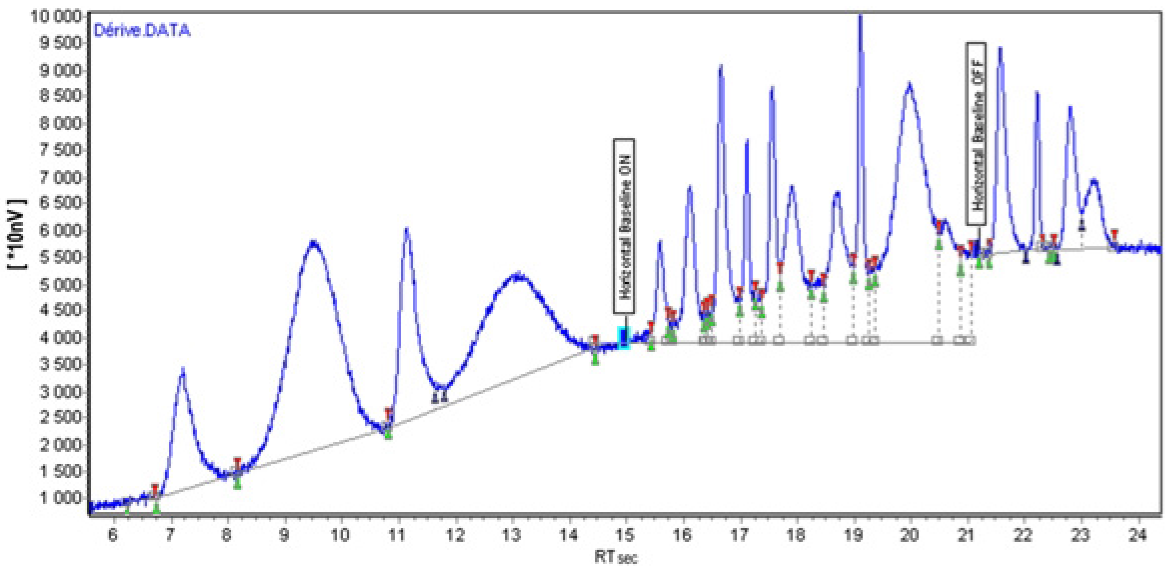


Figure 62. Horizontal baseline

The height of the baseline is the height of the signal when the event is activated. It is better to use the **Horizontal baseline by peak** event, because the height of the baseline will be related to the start or the end of a peak, and not to the event activation time.

Horizontal baseline by peak

This event enables definition of a horizontal baseline.

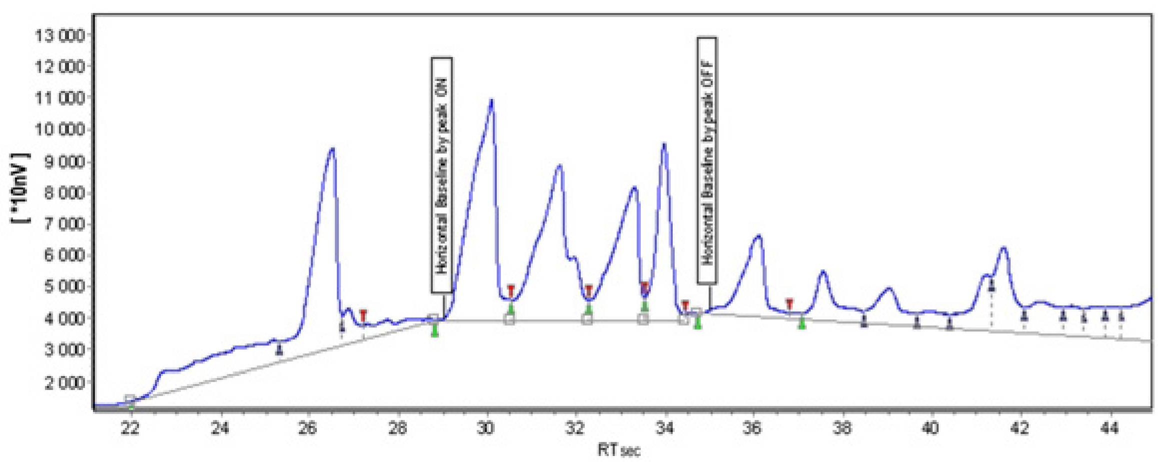


Figure 63. Horizontal baseline by peak

The horizontal baseline start or stop are not applied to the defined times, but to the nearest start or stop peak time.

If an event is activated at the beginning of a peak (between the start marker and the peak apex), it becomes operative at the peak start time. If the event is activated at the end of the peak (between the top of the peak and the stop marker), it becomes operative at the peak stop marker time.

Backward horizontal baseline

This event enables definition of a horizontal baseline at the level of the signal when this event is deactivated.

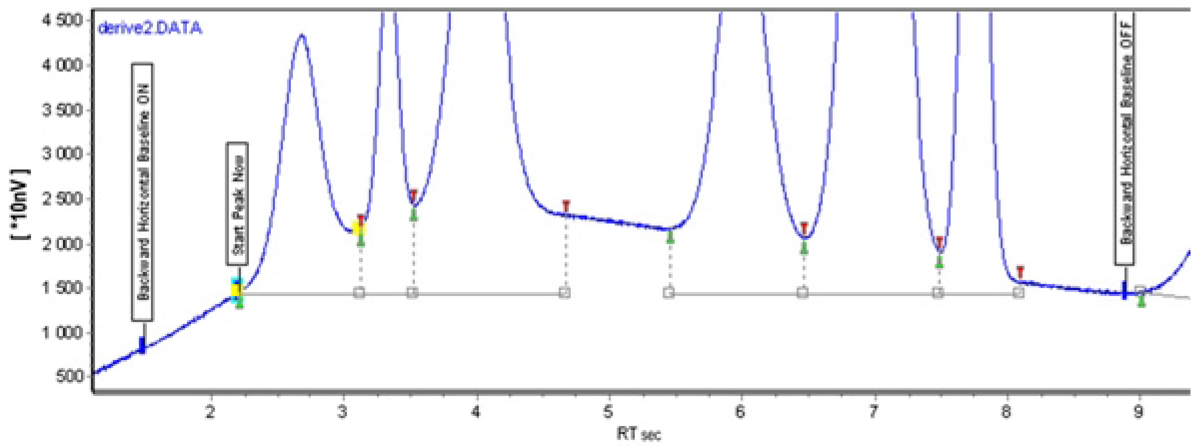


Figure 64. Backward horizontal baseline

The horizontal baseline is drawn from the activation of the event until its deactivation. The baseline is drawn at the level of the signal when the event is deactivated. As a consequence, the two events **Horizontal baseline Backward On** and **Horizontal baseline Backward Off** must be defined.

Backward horizontal baseline by peak

This event enables definition of a backward horizontal baseline. The horizontal baseline is drawn from the activation of the event until its deactivation. The baseline is drawn at the level of the signal at the stop marker of the peak preceding the event deactivation.

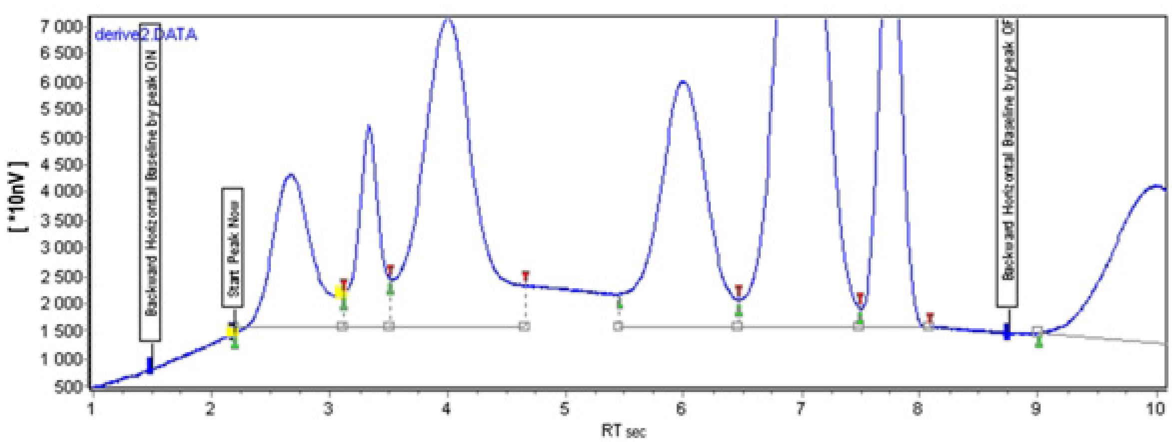
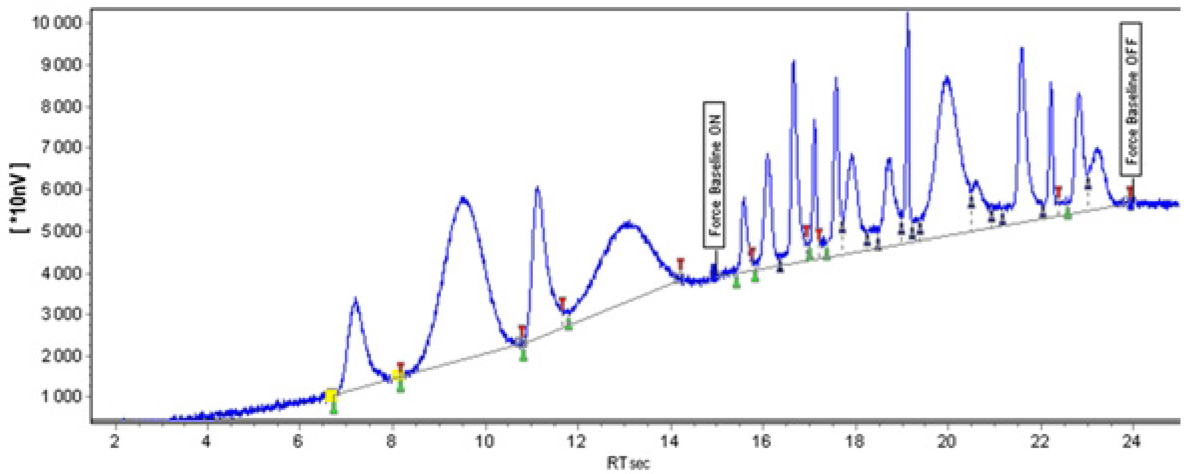


Figure 65. Backward horizontal baseline by peak

As a consequence, the two events **Backward Horizontal Baseline by peak On** and **Backward Horizontal Baseline by peak Off** must be defined.

Force baseline

This event forces all the peaks between the events **Force baseline On** and **Force baseline Off** to have a common baseline. The peak markers of the first and last peaks are, therefore, modified by this event. To prevent modification of the first and last peak markers, the recommended event to use is **Force baseline by peak**. As a consequence, the two associated events **Force baseline On** and **Force baseline Off** must be defined.



instead of

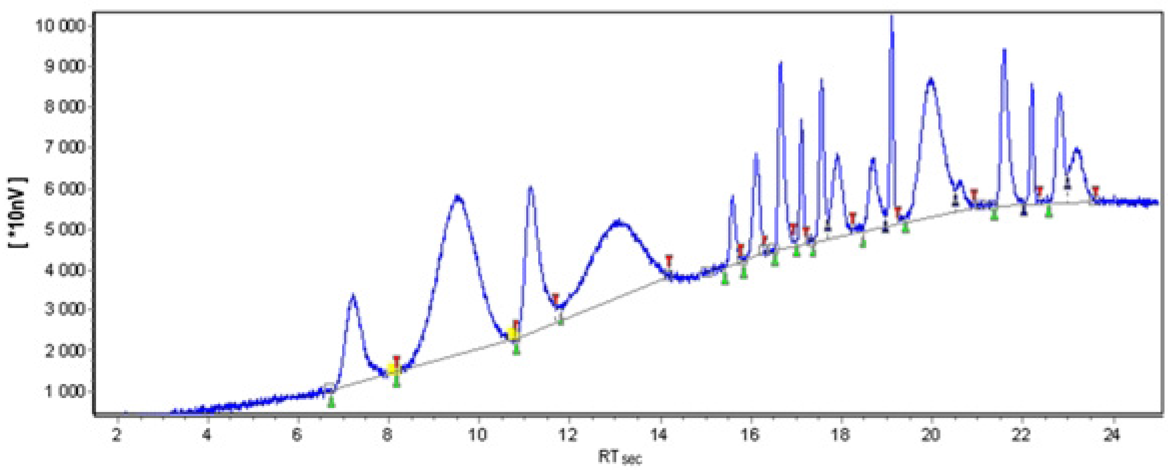
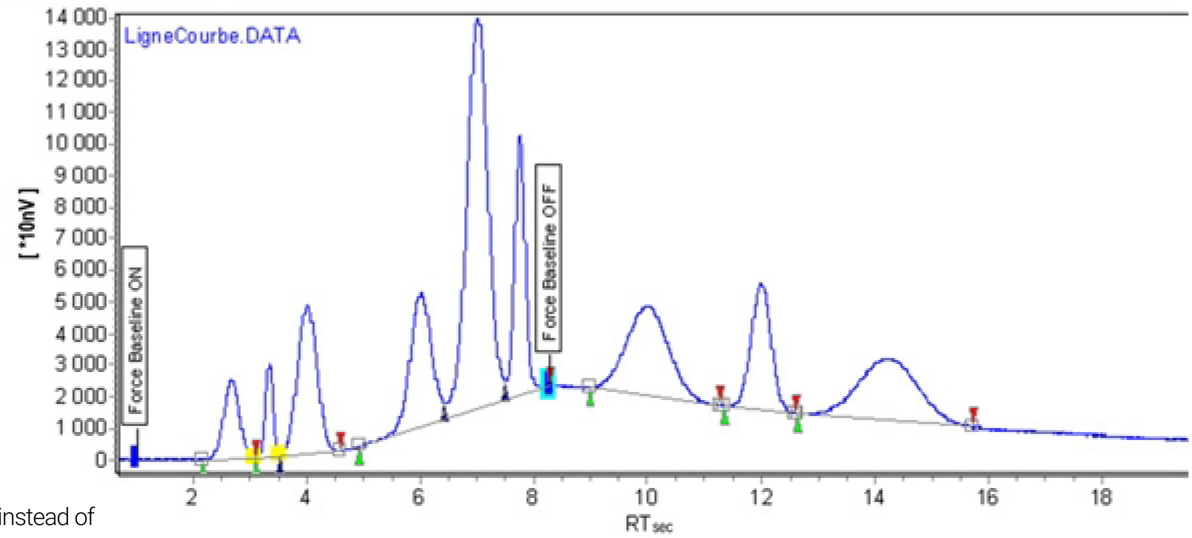


Figure 66. Force baseline On and Off

If the forced baseline penetrates the signal, the baseline will automatically adjust so that it always remains under the signal.



instead of

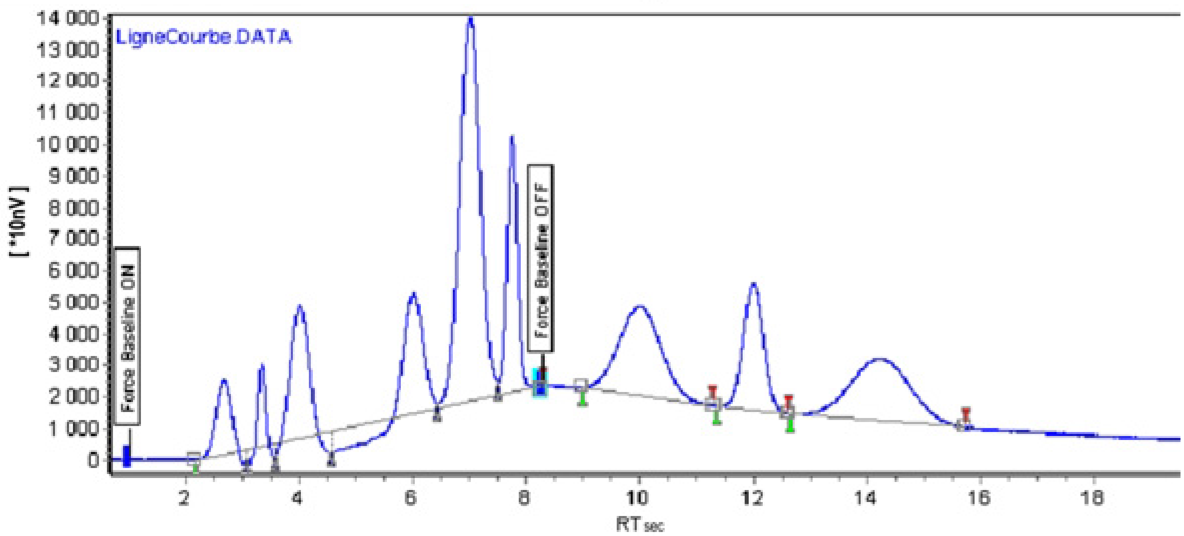


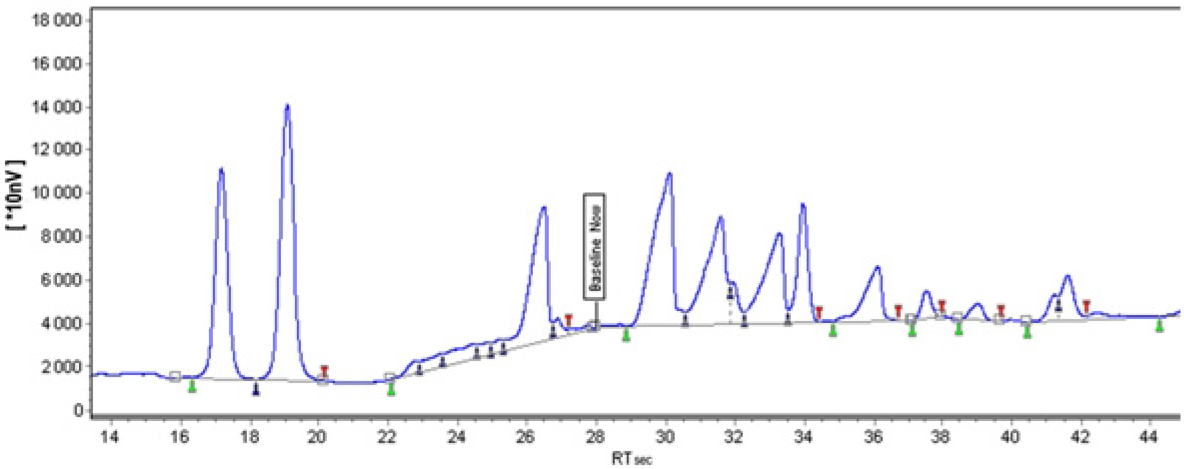
Figure 67. Force baseline by peak

Force baseline by peak

This event forces all the peaks between the events **Force baseline by peak On** and **Force baseline by peak Off** to have a common baseline. The difference with force baseline is that in this case, the markers of the first and the last peak are not modified.

Baseline now

This event forces the baseline to pass through the signal at the event time.



instead of

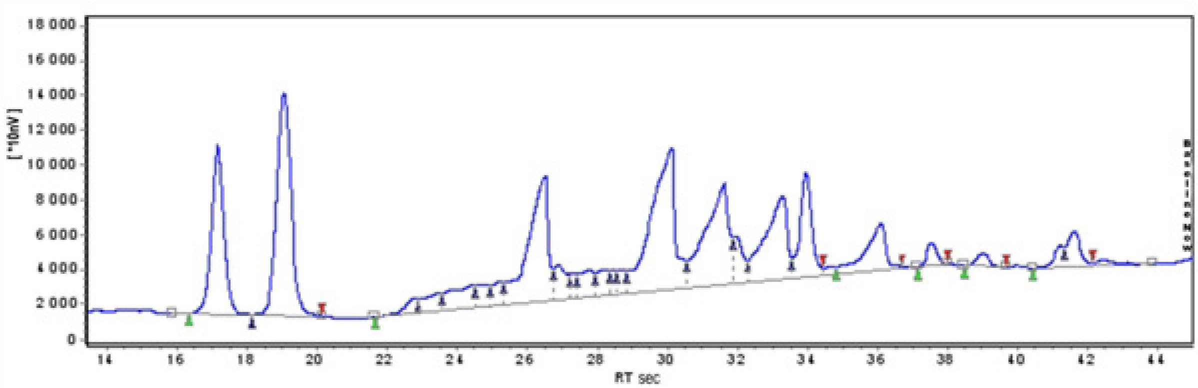


Figure 68. Baseline now

This event is used to bring the baseline back to the signal. Separate peaks, which have a common baseline, end a tailing peak earlier. The position of this event is relative to retention time drift, but as for most of the events, a similar peak-dependent event exists: **Baseline next valley**.

Baseline next valley

This event is similar to the previous one (Baseline now). The only difference is that the instrument waits for the valley following the event to bring back the baseline to the signal. As a consequence, this event is best suited for separation of peaks having a common baseline, since **Baseline next valley** is less dependent on retention time variations from one analysis to another.

Shoulder peaks

To integrate a peak as the skimming of another, **both peaks need first to be integrated**. Thus, it is important to define correct detection parameters (Set peak width and Set threshold) before defining the skimming parameters.

Set skim ratio

This event sets the shoulder integration threshold above a mother peak. This threshold must be associated to the events **Tangent skim front/rear** and **Exponential skim front/rear**. A peak will be integrated as a shoulder peak on another peak, if its height satisfies the shoulder peak criterion. In the following example, the second peak will be considered as a shoulder on the first peak if:

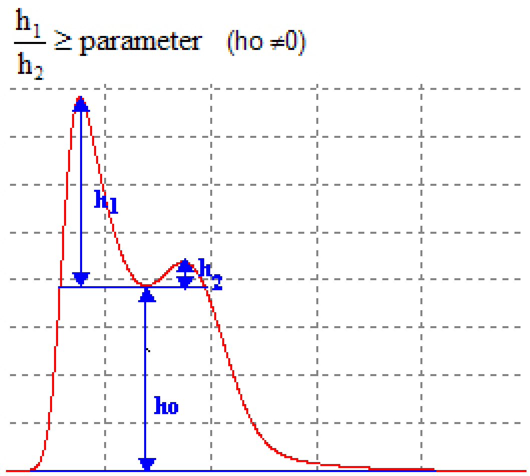


Figure 69. Set skim ratio

By default, this threshold is equal to 4.

Tangent skim next peaks on/off

If this event is activated (On), all the peaks having a common baseline are integrated as shoulder peaks on the first peak, with a tangent baseline.

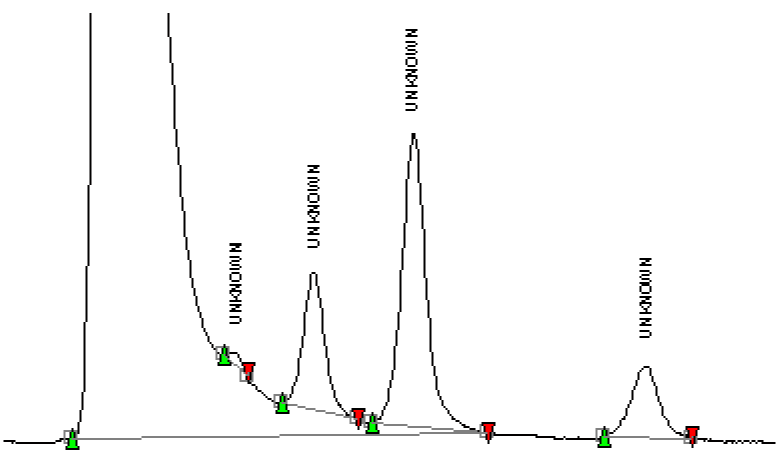


Figure 70. Tangent skim next peaks on/off

The **tangent skim Next Peaks** event does not work when the mother peak is not fully resolved (has a valley with the previous peak). The use of a **Baseline Now** event has the effect of removing the valley, and thus allows the skimming event to work properly.

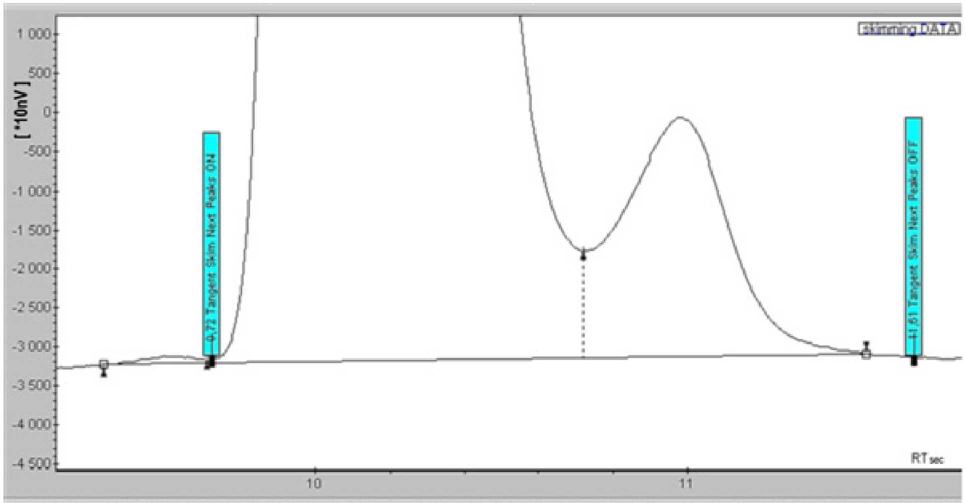


Figure 71. Without the baseline now event, there is a group of three peaks sharing a common baseline

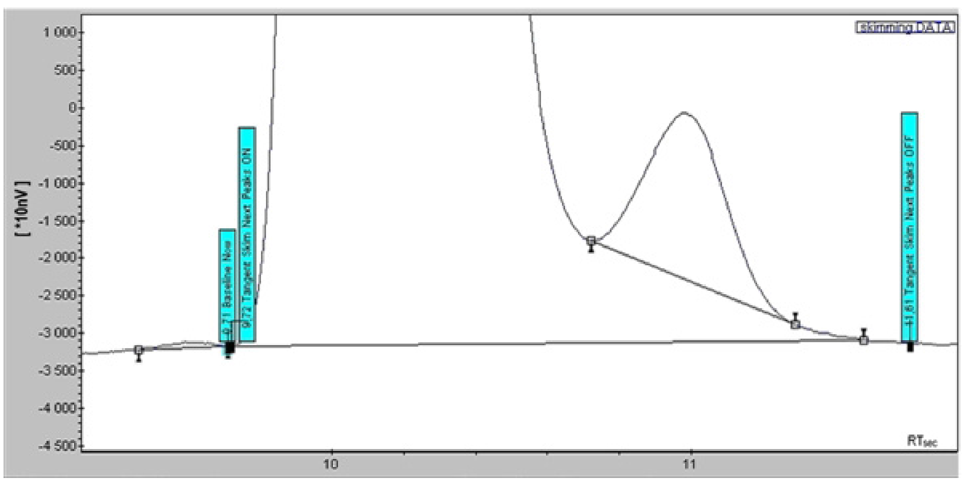


Figure 72. The baseline now event breaks the group of peaks

Note that there is another event, more powerful, called **Tangent Skim Rear**, which handles such situations.

Tangent skim rear/front

Select this event to integrate one or several peaks as shoulders on a mother peak with a tangent baseline. The instrument detects poorly resolved peaks whose heights satisfy the above height criterion (see **page 108**) and a tangent baseline is drawn underneath the shoulder peaks.

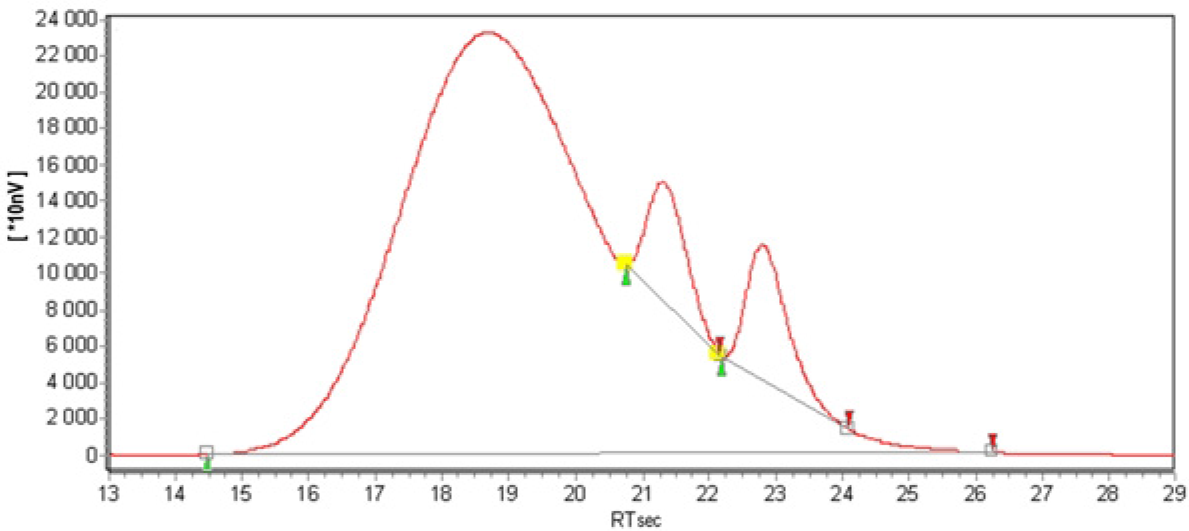


Figure 73. Tangent skim rear/front

If the event is **Tangent skim front**, the shoulders are integrated before the mother peak. If the event is **Tangent skim rear**, the shoulders are integrated after the mother peak.

Exponential skim rear/front

Select this event to integrate one or several shoulder peaks with an exponential baseline. If the instrument detects two poorly resolved peaks whose heights satisfy the above height criterion (see **page 108**), an exponential baseline is drawn underneath the shoulder peaks.

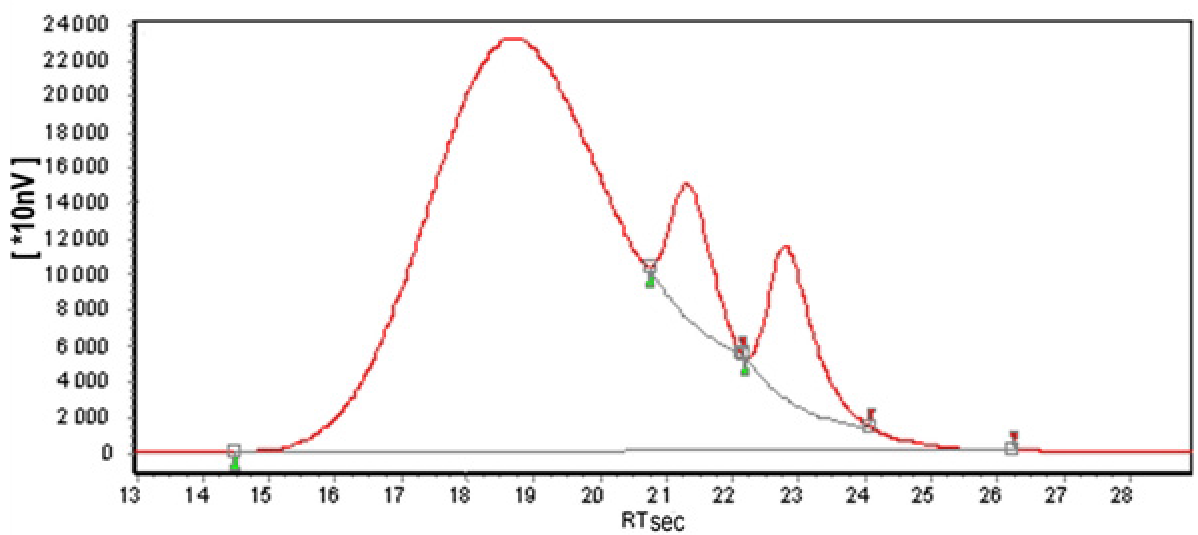


Figure 74. Exponential skim rear/front

Peak Identification

The **Peak Identification/Calibration** contains settings to identify a peak based on its retention time.

To access the **Peak Identification/Calibration Table**, click on Method, then select Peak Identification. If no method is developed before, it is easier to start with running the Method Wizard. Read the information in **Method Wizard** on page 81.

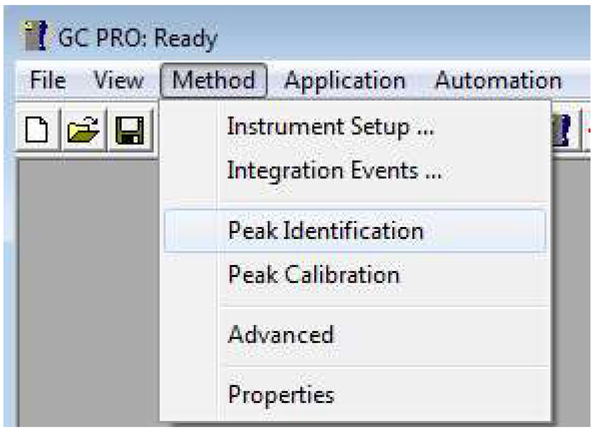
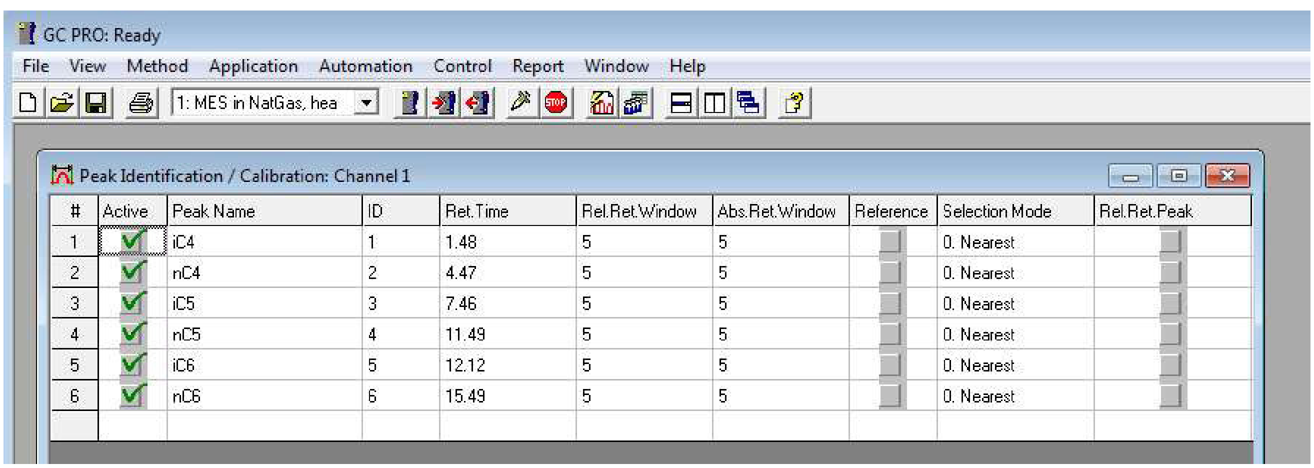


Figure 75. Peak identification

Peak identification table



#	Active	Peak Name	ID	Ret.Time	Rel.Ret.Window	Abs.Ret.Window	Reference	Selection Mode	Rel.Ret.Peak
1	✓	iC4	1	1.48	5	5		0. Nearest	
2	✓	nC4	2	4.47	5	5		0. Nearest	
3	✓	iC5	3	7.46	5	5		0. Nearest	
4	✓	nC5	4	11.49	5	5		0. Nearest	
5	✓	iC6	5	12.12	5	5		0. Nearest	
6	✓	nC6	6	15.49	5	5		0. Nearest	

Figure 76. The peak identification table

The first step is to fill out the identification table. The identification table associates a peak, identified by its retention time, to a name. It is possible to define reference peaks by checking the **Reference peaks** box. These are then used for the peak identification when differences in the retention times due to analytical conditions occur.

How to build an identification table

To fill a table, press the right mouse button when in the table. Insert as many lines as needed, fill in the names and retention times.

Each line of the table represents one peak. In each line, enter the name of the compound corresponding to the peak, identified by its retention time and then choose the identification window width in the columns **Abs. Ret Windows** and **Ret Ret Window** selection and the identification mode.

To delete an identification table line, highlight it by left clicking at the beginning of the line that is to be removed, then right click and choose **DELETE Line** in the popup menu.

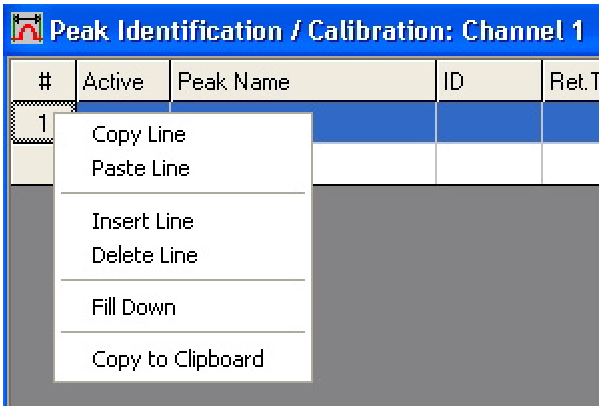


Figure 77. Peak identification/calibration

The popup menu of the peak identification table contains a Copy line option that enables its content to be copied and pasted into another application.

Identification table columns

The parameters in the Identification table used for peak identification.

Peak Name

The name of the compound corresponding to the peak. Two different peaks cannot have the same name.

Retention Time

The theoretical retention time of the peak. Two different peaks cannot have the same retention time.

Abs. Ret. Window

The absolute part of the identification window.

Ret. Ret. Window

The relative part of the identification window. These windows define the maximum interval around the retention time in which the peak will be assigned a specific compound name.

The absolute identification window is defined in seconds. The relative identification window is defined as a percentage of retention time. If the relative identification window percentage (Rel. Ret. Window) is used, the larger the retention time is, the wider the relative retention time window will be.

If retention time is RT, absolute window is Abs, and relative window is %W, a peak will be identified as the peak if its retention time is between

$$RT - Abs - \left(\frac{\%W \times RT}{100}\right) \text{ and } RT + Abs + \left(\frac{\%W \times RT}{100}\right)$$

The identification window can thus be defined in seconds using absolute or relative windows, or defined using a combination of both. The reference peak identification windows are treated separately. The reference peaks are identified first followed by all other peaks. If the reference peaks are correctly identified in these windows, it is then possible to define larger windows for reference peaks. This will ensure that they will be found, even if a retention time offset occurs.

Reference

To select reference peaks, check the **Ref** box in the appropriate line(s) to indicate that the selected peak is now considered a reference peak.

The theoretical retention times of the peaks will be corrected according to the difference between theoretical and experimental retention time of these peaks (see Nonreference peaks expected retention time).

The reference peaks must be chosen carefully. Reference peaks must be common constituents that will always appear in the chromatogram.

If a reference peak is not present, another peak could be incorrectly assigned as the reference peak, and thus, the identification of the other peaks will be severely affected.

Reference peaks should be easily recognizable. It is better to choose very high or large peaks, or the last peak of the run (with the certainty that no other peak will occur afterward).

Selection Mode

This column defines which peak will be chosen if several peaks are included in the identification window.

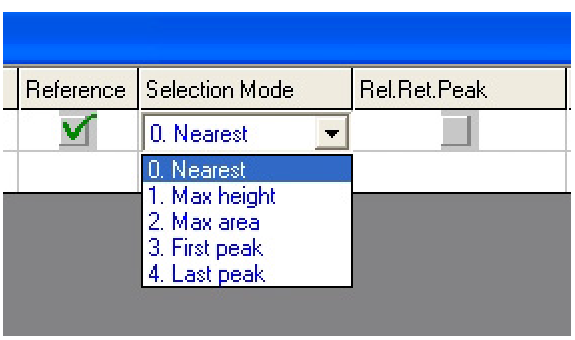


Figure 78. Selection mode

Nearest

The peak will be the one whose retention time is the closest to the defined time.

Max height

The peak will be the highest one.

Max area

The peak will be the largest one.

First

The peak will be the first peak found in the reference window.

Last

The peak will be the last peak found in the reference window.

Peaks are always listed in the retention time order.

Identification process

Peaks are identified by their retention times, according to the identification window defined by the user.

In simple cases, peak retention times are reproducible from one analysis to the other. In the case of nonreproducible retention times from one chromatogram to the other (due to analysis conditions, samples etc.), identification is more complicated and the definition of easily identifiable reference peaks is advisable.

In the first step, the instrument will identify the reference peaks and will estimate the time offset (according to the retention time) that will be applied during the identification of the other peaks of the chromatogram (nonreference).

First, the instrument checks that the identification windows of the reference peaks do not overlap each other. If window overlap occurs, the instrument resolves the overlaps and the reference peak identification is processed.

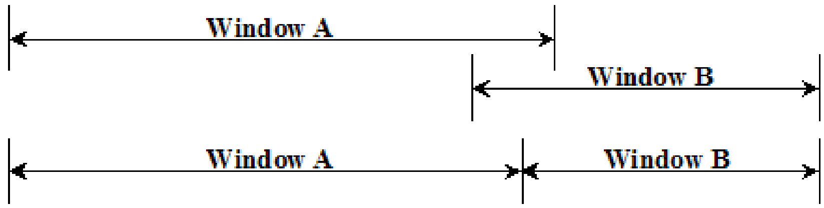
Using the experimental reference retention times, the instrument calculates the other expected retention times, resolves the nonreference peak window overlaps, and the nonreference peaks are identified with these retention times and windows.

Since the reference and nonreference peaks are processed separately, it is possible to define larger reference windows because it does not matter if they overlap with the nonreference identification windows.

Resolving window overlap

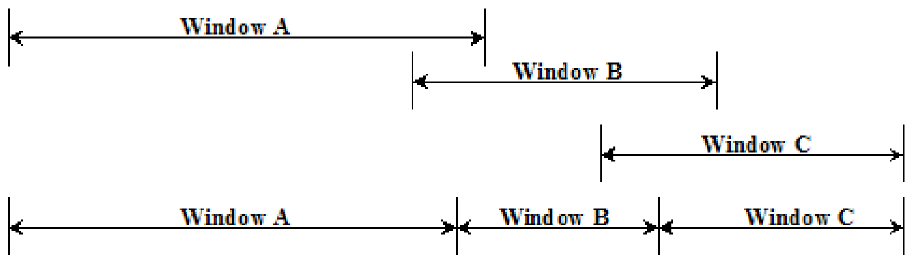
If peaks are very close together, windows can overlap. This means that the end of an identification window can occur after the beginning of the next one. To cope with this problem, the instrument considers the common part of the windows, splits it in two, and assigns half to each window.

For example:



If several successive windows overlap, the system resolves the first overlap (two first identification windows), then the next two.

For example:



When using the relative identification windows (Ret. Ret. Window), window overlaps can occur easily. If problems are encountered in peak identification, investigate what occurs during the window overlapping resolution.

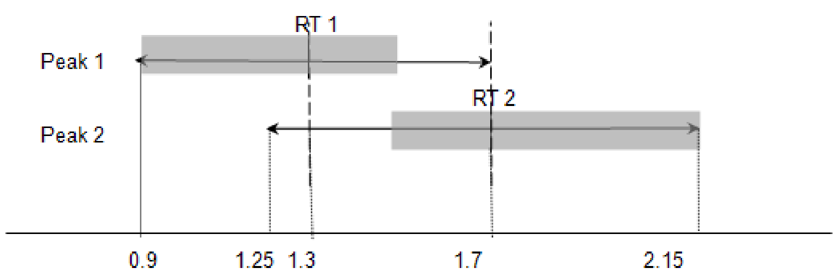
- **General rule**

  The window limit can not go beyond the retention time of the previous or of the next peak. In this case, the retention time of the previous/next peak is taken into account as the limit of the window, and the overlap is divided in two.

- **Example1**

  A peak retention time belongs to the identification window of another peak

```
Peak 1: RT1= 1.3 ID window: 0.4 min [0.9 -1.7]
Peak 2: RT2= 1.7 ID window: 0.45 min [1.25 -2.15]
```



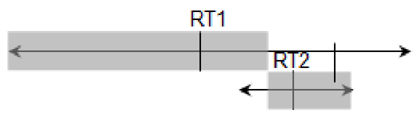
  The identification window of Peak 1 becomes: [0.9 to 1.5] where 1.5 = RT1 + (RT2−RT1)/2

  The identification window of Peak 2 becomes: [1.5 to 2.15] where 1.5 = RT2 - (RT2−RT1)/2

- **Example 2**

A peak window belongs entirely to another.

```
Peak 1: RT1= 1.7 ID window: 0.45: [1.25 -2.15]
Peak 2: RT2= 1.99 ID window: 0.04(W2) [1.95 -2.03]
```



The identification window of Peak 1 becomes: [1.25 to 1.97] where:

$$1.97 = RT1 + \left(RT2 - RT1 - \frac{W2}{2} \right)$$

The identification window of Peak 2 becomes: [1.97 to 2.03] where:

$$1.97 = RT2 - \left(\frac{W2}{2} \right)$$

Finding reference peaks

An identification window is defined for each peak. A peak is identified as the reference peak if its retention time is found to be within the reference identification window. If there are no such peaks, the reference is not found.

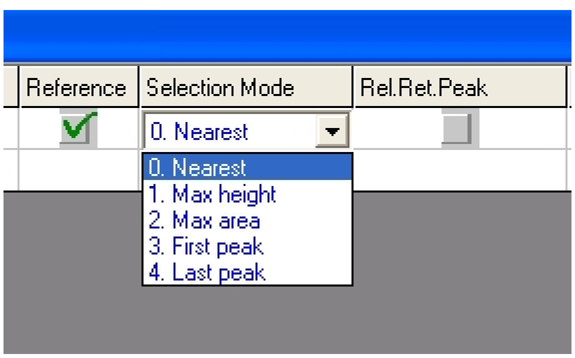


Figure 79. Finding reference peaks

If a reference identification window contains several peaks, the reference peak is chosen according to the selected reference window mode:

Nearest

The peak will be the one whose retention time is the closest to the defined time.

Max height

The peak will be the highest one.

Max area

The peak will be the largest one.

First

The peak will be the first peak found in the reference window.

Last

The peak will be the last peak found in the reference window.

Once the reference peaks are identified, the instrument will identify the other peaks.

Identification of the nonreference peaks

Generally, the retention times are recalculated according to the two adjacent reference peaks. The formula for calculating the expected retention times for the nonreference peaks is:

$$RT = RT_1 + (RT_{ID} - RT_{ID1}) \times \frac{RT_2 - RT_1}{RT_{ID2} - RT_{ID1}}$$

Where

- RT is the expected retention time for a nonreference peak.
- RT_1 is the real retention time of the reference peak preceding the peak.
- RT_2 is the real retention time of the reference peak following the peak.
- RT_{ID} is the theoretical retention time of the peak defined in the identification table.
- RT_{ID1} is the theoretical retention time of the reference peak preceding the peak, defined in the identification table.
- RT_{ID2} is the theoretical retention time of the reference peak following the peak, defined in the identification table.

If peaks are eluted before the first reference peak:

$RT_1 = RT_{ID1} = 0$

The index 2 is attributed to the next reference peak:

$$RT = RT_2 \frac{RT_{ID}}{RT_{ID2}}$$

If a peak appears after the last reference peak:

$$RT = RT_1 + (RT_{ID} - RT_{ID1}) \times \frac{RT_1 - RT_0}{RT_{ID1} - RT_{ID0}}$$

where RT_0 and RT_1 represent, respectively, the real retention times of the two reference peak eluted before the peak of interest.

This correction step works best when reference peaks are distributed throughout the entire chromatogram. In particular, be careful when using references that elute only at the beginning of a long run. They have a too strong impact on retention times at the end of the run. To minimize this effect, define a reference peak at the end of the run.

Once the system has calculated expected retention times for the remaining peaks, it centers the calculated identification windows on these times. If any windows overlap, the system will resolve the conflicts.

If several peaks fall within a window, the correct peak is chosen according to the selected identification mode:

Nearest

The peak will be the one whose retention time is the closest to the defined time.

Max height

The peak will be the highest one.

Max area

The peak will be the largest one.

First

The peak will be the first peak found in the reference window.

Last

The peak will be the last peak found in the reference window.

If a reference peak is not found, its retention time is the retention time set in the identification table, as if it had not shifted at all. The identification of the peaks placed between the previous and the next reference peak may be affected.

If no reference peak is defined or found, peaks are identified by the retention times set in the identification table. Each peak retention time is compared to the identification window defined in the identification table.

Example

Assume that three peaks exist in a chromatogram with theoretical retention times (saved in the identification table) of 5, 6, and 10 seconds.

When the sample is analyzed, the retention times have shifted to 6, 7.2, and 12 seconds. If the identification windows are 0.5 minute wide, and reference peaks are not used, the peaks will not be identified.

However, if the last peak at 12 seconds is defined as the reference peak, and it elutes 1.2 times later than the defined theoretical retention time of 10 seconds, the expected retention times for the two other peaks (nonreference peaks) can be calculated.

```
First peak: 5 × 1.2 = 6 seconds.
Second peak: 6 × 1.2 = 7.2 seconds.
```

The first two peaks can now be identified correctly with these new corrected retention times.

Moving retention window

The main peak identification is performed on retention window as defined in the **Peak Identification** on page 112. However, the retention of a peak can drift in time. Although the drift is small, on a longer time the peak can drift outside its retention window. The retention window of a peak can be set up to follow the actual retention in order to compensate for retention drift.

Open the **Calibration** window and set the parameters **Retention Update%** and **Retention Window Update** to activate retention compensation.

Retention Update%

With the **Retention Update%** parameter, one can set the percentage of shifting the Retention Window as defined in the Peak Identification/Calibration Table.

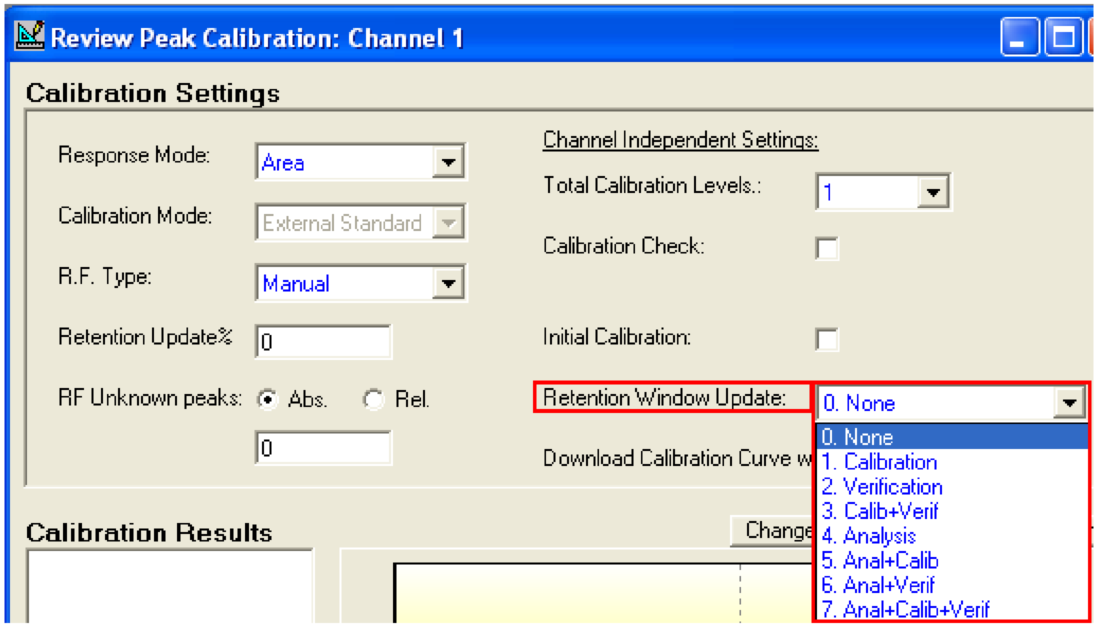


Figure 80. Retention window update

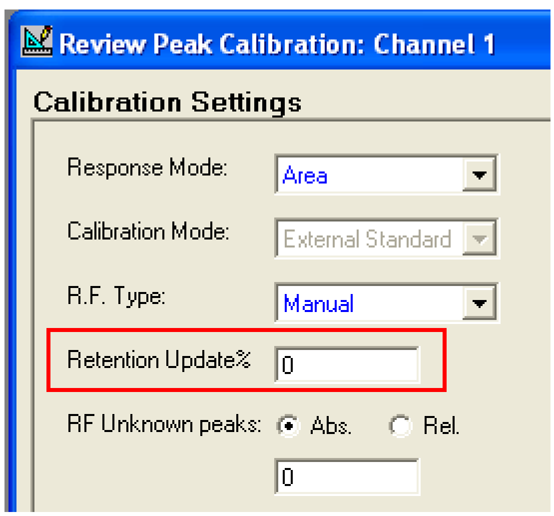


Figure 81. Retention Update %

Use this parameter to use the optimum retention window for peak identification. A peaks retention can shift over a longer period. By setting a positive value in the **Retention Update%** the retention window will shift with the percentage the retention from a peak differs from the retention in the Peak Identification/Calibration Table. One can determine to only update the retention window on a specific sample type, for instance a calibration run.

```
New_Ret = Current_Ret  + ( (New_Ret  - Current_Ret) *
RetentionUpdate/100)
```

Retention Window update

Select the type of runs on which the retention window must be updated for a GC channel.

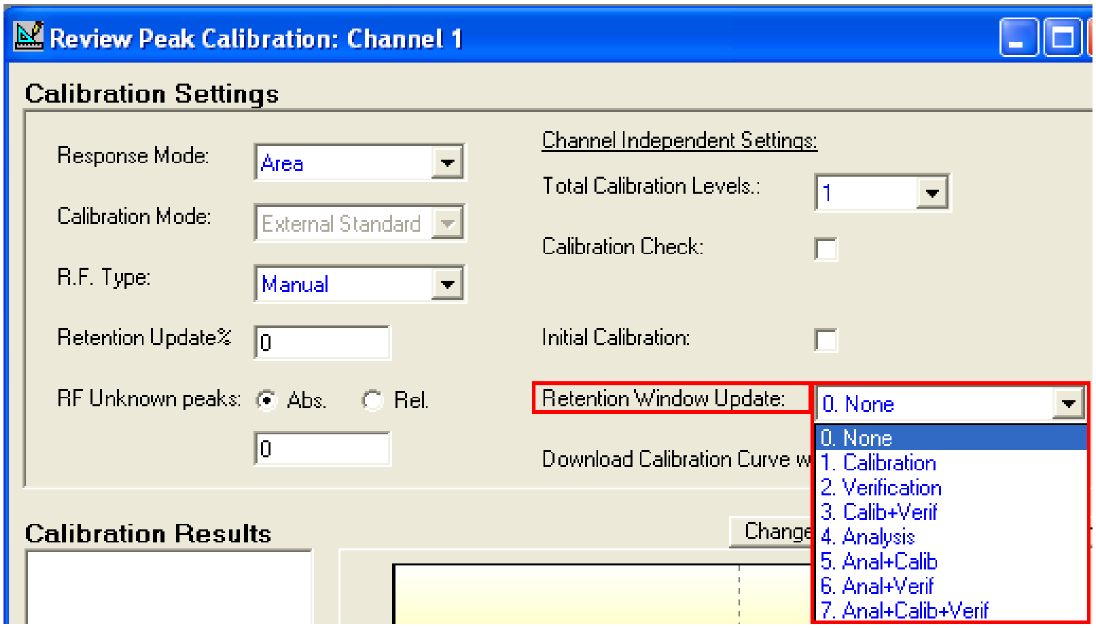


Figure 82. Selecting type of runs

Peak Calibration

The aim of this step is to define the calibration parameters. To define the calibration parameters select the Method/Peak Calibration menu.

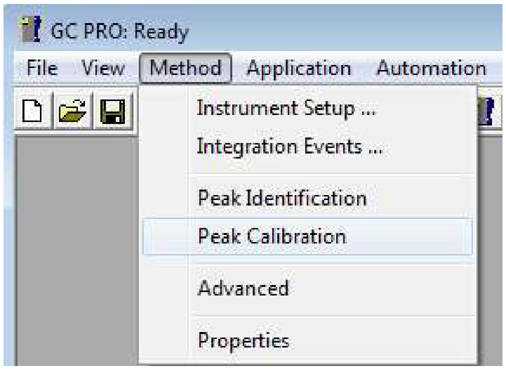


Figure 83. Peak calibration

A default calibration window will appear with several calibration options, see **Figure 84**. The following chapter describes the functionality of the different Calibration Settings.

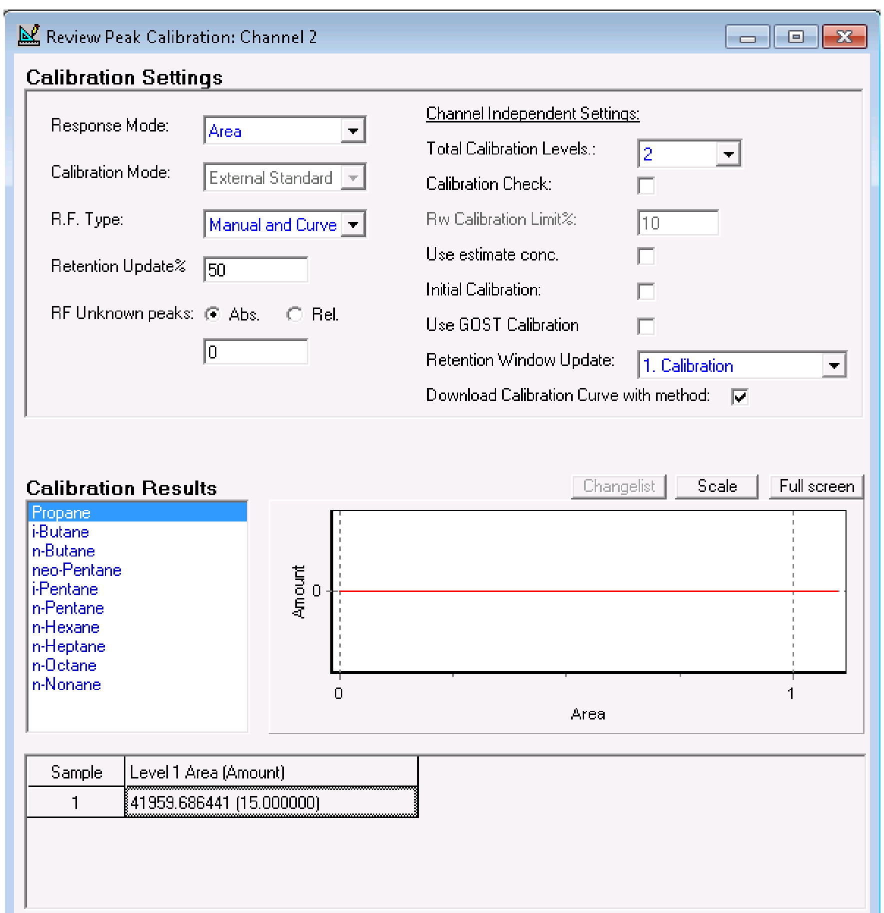


Figure 84. Review peak calibration window

Calibration parameters (channel dependent)

Channel unique calibration parameters.

Response Mode

Define the Response Mode. Select Area or Height from the list. This defines the processing of the peak concentration. For most applications, area must be selected.

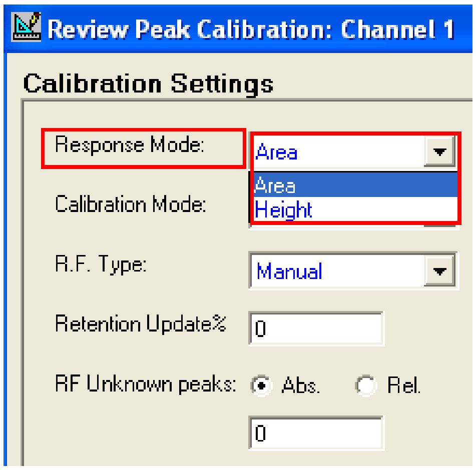


Figure 85. Response Mode

Calibration Mode

External Standard mode is the fixed mode for the calibration run.

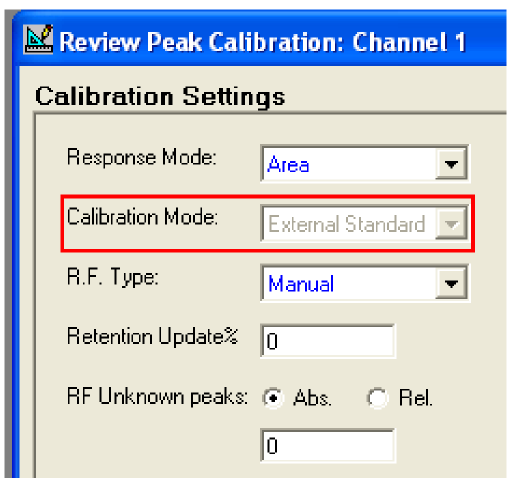


Figure 86. Calibration Mode

R.F. type

Define how the Response factor should be determined.

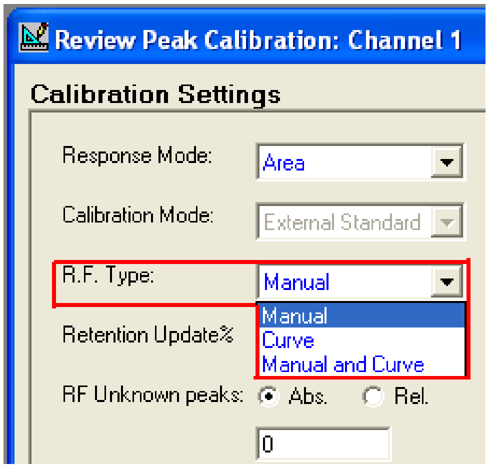


Figure 87. RF type

There are three options.

- **Manual**

  If the components Response Factor cannot be determined from a calibration mixture, it must be set manually in the Peak Identification/Calibration Table.

  The concentration of a peak (Q) is determined using the equation:

  Q= RF × R

  in which RF is the Manual R.F. of the component in the Peak Identification/Calibration Table. R is the response (area and height) of the peak.

- **Curve**

  If a component exists in the calibration mixture, the Response Factor can be determined by the instrument by running a calibration run. This option requires that every component in the Peak Identification/Calibration Table for that particular GC channel exists in the calibration mixture. Manually R.F. for other peaks are ignored and resulting in a peak concentration zero.

  The coordinates of a calibration point in the curve are the response area/height of the compound and the associated quantity (amount). The concentration of a peak (Q) is determine using the equation:

  Q = a * x3 + b * x2 + c * x + d

  in which a is the Cubic Coeff., b the Quadratic Coeff., c the Linear Coeff. and the Intercept. From the Peak Identification/Calibration Table, x is the response (area or height) of the peak.

- **Manual and Curve**

  If both manual R.F. and determined R.F. by the instrument are performed in one GC channel, select this option. See the description for R.F. type **Manual** and **Curve**.

RF Unknown peaks

It is possible to process the Response Factor of unknown components in two different ways.

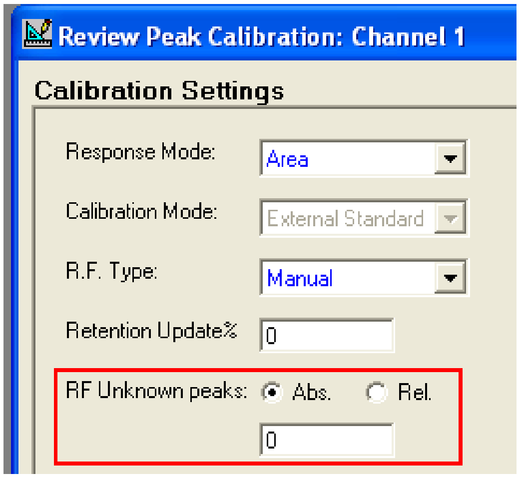


Figure 88. RF Unknown peaks

These are:

- Absolute (**Abs.**)

  Enter the Response Factor for all unidentified peaks of this GC channel. This R.F. is determined outside the instrument or described in literature.

  The concentration of an unidentified peak (Q) is determined by using the equation:

  `Q= RF × R`

  in which RF is the value from **RF Unknown** peaks and R is the response (area and height) of the peak.

- Relative (**Rel.**)

  In order to determine the concentration of an unidentified peak, the Response Factor will be used from the first identified peak following the unidentified peak. The concentration of an unidentified peak (Q) is determined by using the equation:

  `Q = a * x3 + b * x2 + c * x + d`

  in which a is the Cubic Coeff., b the Quadratic Coeff., and c the Linear Coeff. and the Intercept. From the Peak Identification/Calibration Table of the identified peak following (higher retention) the unidentified peak, x is the response (area or height) of the unidentified peak.

Calibration parameters (channel independent)

Calibration parameters common for all GC channels.

Total calibration level

Determines the Total Calibration Levels that are required.

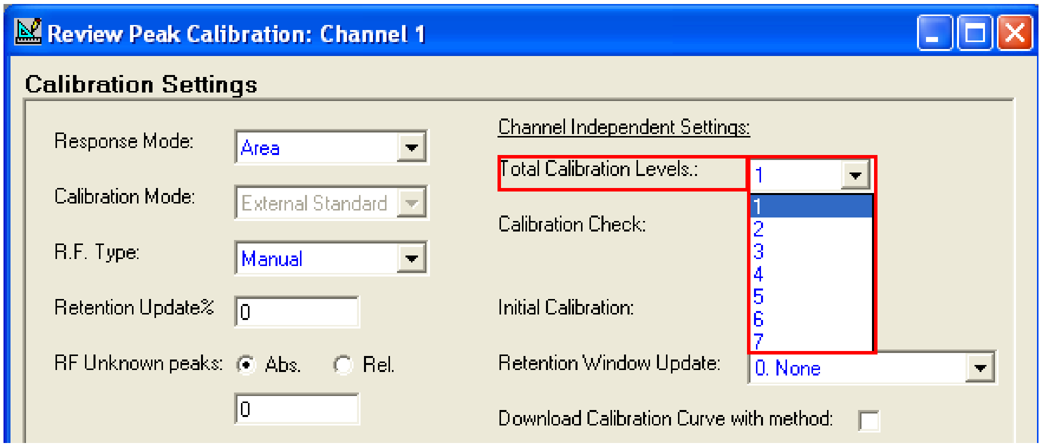


Figure 89. Total Calibration Levels

If only a single level calibration is performed, select 1. For Multilevel Calibration define the total levels to be used (maximum seven levels). Detailed description of Multilevel Calibration is given in **Setting Up a Typical Multilevel Calibration** on page 478.

Calibration Check

A calibration check is used to check whether the response factor (curve) drifts away in time after every new calibration.

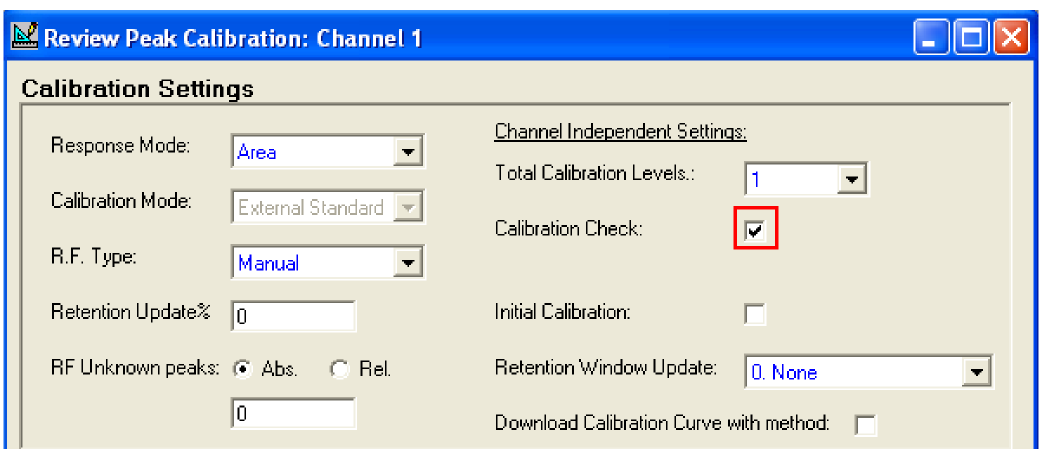


Figure 90. Calibration Check

When a new calibration is performed, the detector response will be compared with the initial calibration. In a single calibration level system, enter the percentages of drifting allowed in the table **Peak identification** on page 112 (**Initial RF%** and **Current RF%** attributes).

For a multilevel calibration level with a field correction calibration (Rw), the allowed drifting is entered in the **Rw Limit%** field.

Use Estimate Concentration

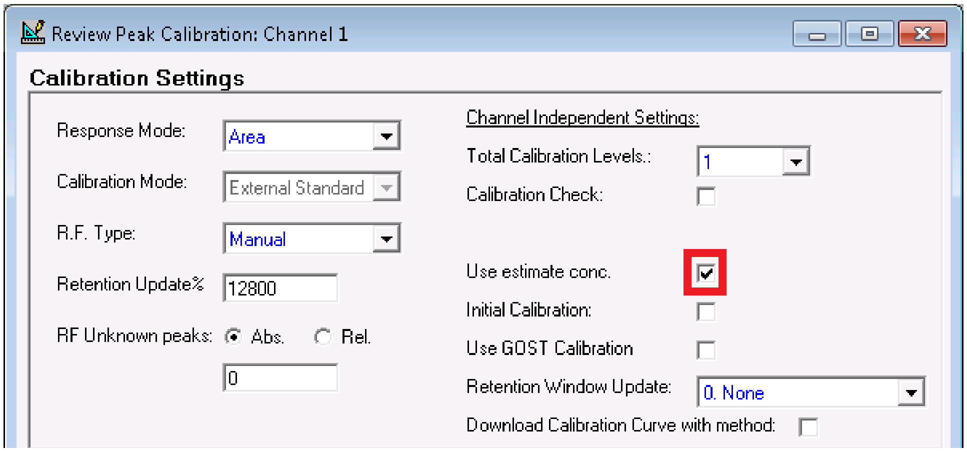


Figure 91. Use Estimate Concentration

The option Use Estimate Concentration is used to enable or disable the estimate concentrations of the normalization table. This option is only applicable to calibration and verification runs.

Use GOST calibration

The energy calculation norms GOST 22667 and GOST31369 describe that the calibration of the Micro GC should be performed according to norm GOST31371.7. This norm describes that the Micro GC should be calibrated using a sequence of three calibration runs. The results of these three calibrations (M1, M2 and M3 see **Figure 92** on page 128) should be within the specified limits of the norm. These limits are concentration depended. The limit per component is calculated using following formula:

$y = a x + b$ where

a and b are coefficients defined in the norm
x is the component concentration

If the set of three calibration is not within the limits, an addition calibration is started and the first calibration run is discarded. This process is repeated until five calibration runs are performed (M4 and when required M5 see **Figure 92** on page 128). A calibration alarm is generated if, after five calibration runs, the results are still not within the limits.

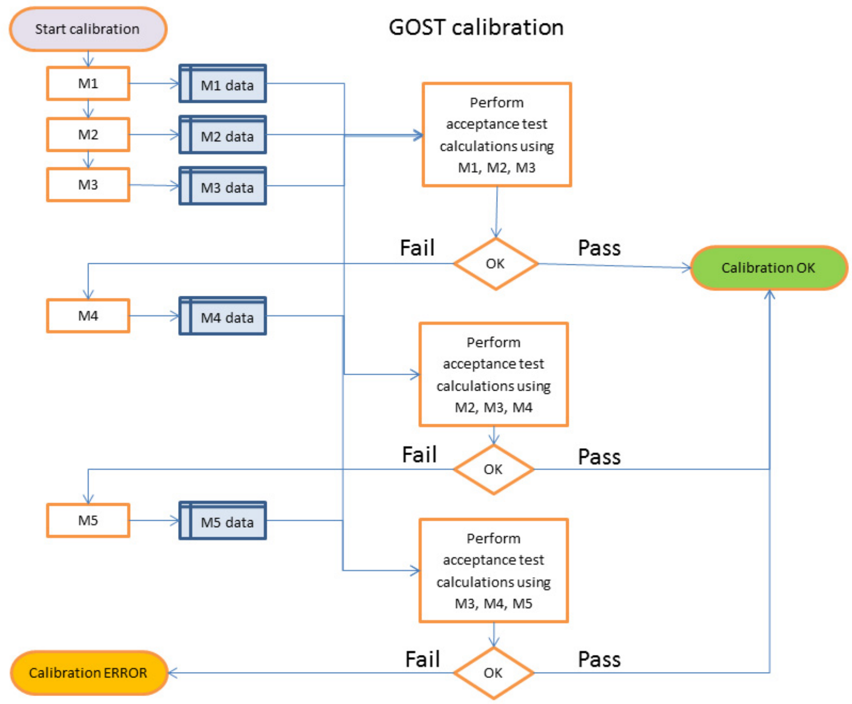


Figure 92. Flow chart with principle of GOST31371.7 calibration

The calibration GOST31371.7 is called GOST R7 calibration in the instrument. Results of the calibration can be viewed in FTP-report (generated by the instrument), and in Application and Integration report (PROstation). Application report has two fields: calibration method and calibration status. The integration report shows the alarms for calibration failure.

Below the user will find a guide to set up the GOST calibration for the instrument.

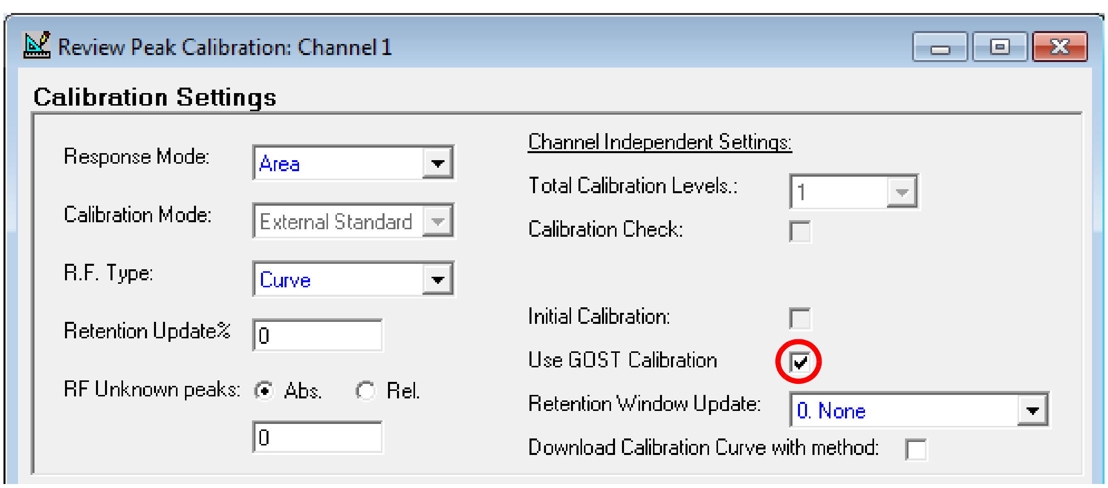


Figure 93. Use GOST Calibration

When the checkbox **Use GOST Calibration** is enabled, the calibration sequence is configured according to the GOST calibration norm:

- **Review Peak Calibration** screen, Figure 231:

- **Total Calibration Levels** is set to 1 and is grayed out
- **Calibration Check** and **Initial Calibration** are unchecked and grayed out

- In **Sequence** screen, **Figure 94**:
  - **On Runs Performed [runs]** is set unselectable and value is set 0
  - **On Time Elapsed [hours]** is set unselectable and value is set 0
  - **On Fixed Time** is selected. The **Hours** and **Minutes** options can be changed, but the **Once Every n days** is unselectable and value is set to 1.
  - **None** is set unselectable

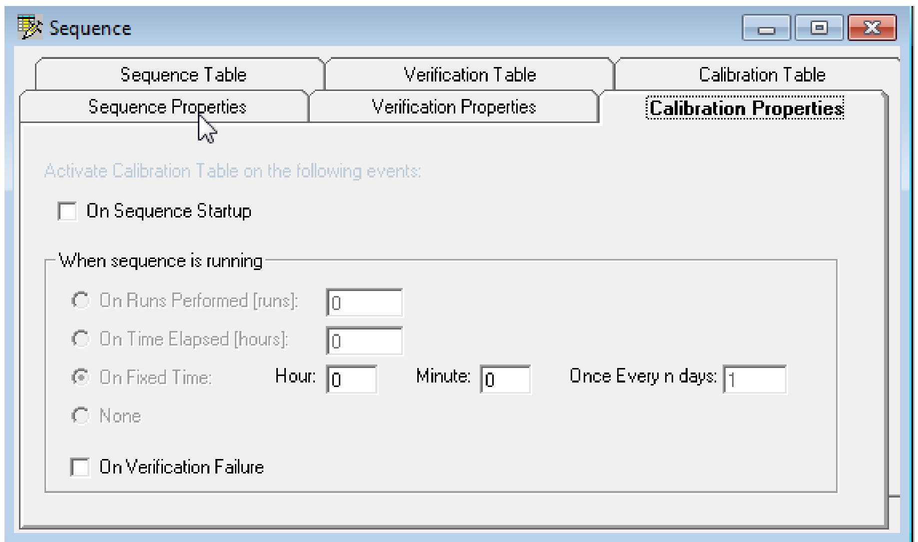
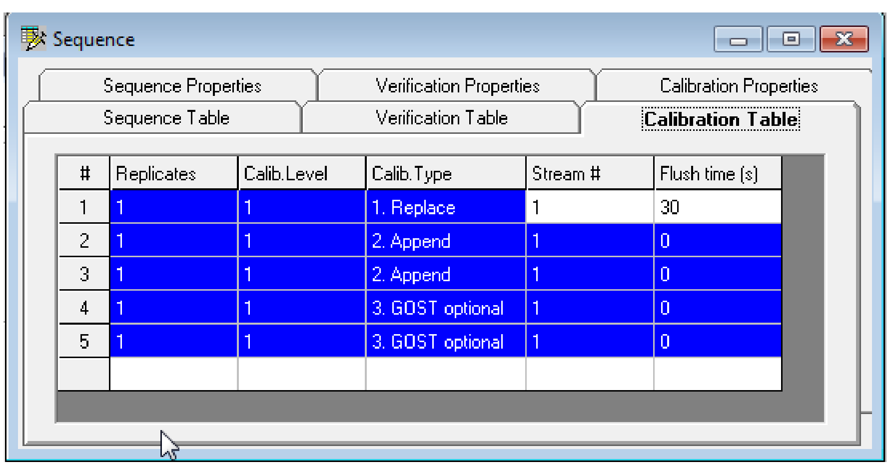


Figure 94. Sequence Calibration Properties

The **Calibration Table** is preconfigured according the GOST calibration norm. Only the **Stream #** and **Flush time (s)** of the first line can be set. See **Figure 95**.



#	Replicates	Calib.Level	Calib.Type	Stream #	Flush time (s)
1	1	1	1. Replace	1	30
2	1	1	2. Append	1	0
3	1	1	2. Append	1	0
4	1	1	3. GOST optional	1	0
5	1	1	3. GOST optional	1	0

Figure 95. Sequence Calibration Table

On the **Peak Identification/Calibration** table for each channel, four additional columns become available.

In the **Peak Identification/Calibration** table for each component, the calibration limit coefficients should be given the values according to the tables given in the GOST R7 calibration norm (**Figure 96**).

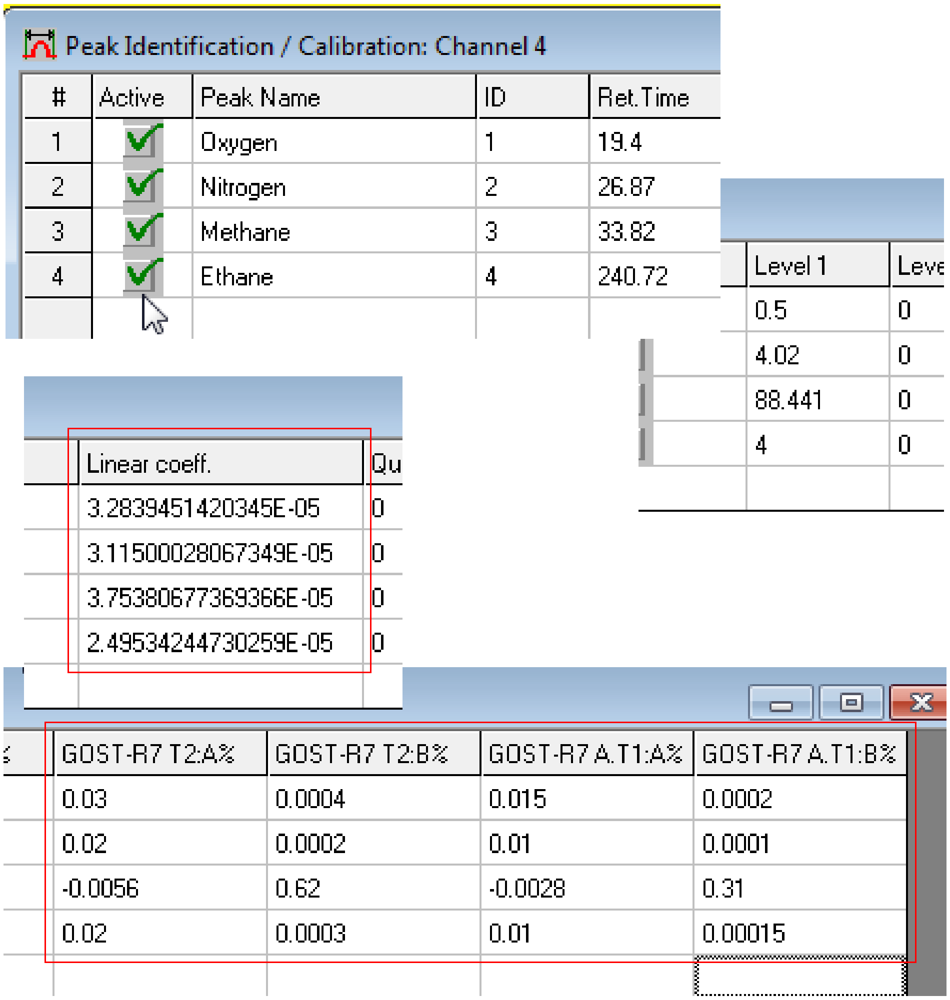


Figure 96. Peak Identification/Calibration tables

All changes should be saved. The settings of **Method** and **Sequence** should be downloaded to the Micro GC. See **Download** on page 444.

Results of the calibration can be viewed in FTP-report (generated by the instrument), and in Application and Integration report (PROstation). In the Application report the fields, calibration method and calibration status, inform the user GOST calibration has been performed.

The integration report shows the alarms. If the calibration alarm is raised, the mean calibration values calculated over the calibration runs, are outside the calculated limits.

Initial calibration

If it is required to check the Response factor of a new calibration run against current Response factor (determined in last calibration run) and initial Response factor (determined in an Initial Calibration run), select this option.

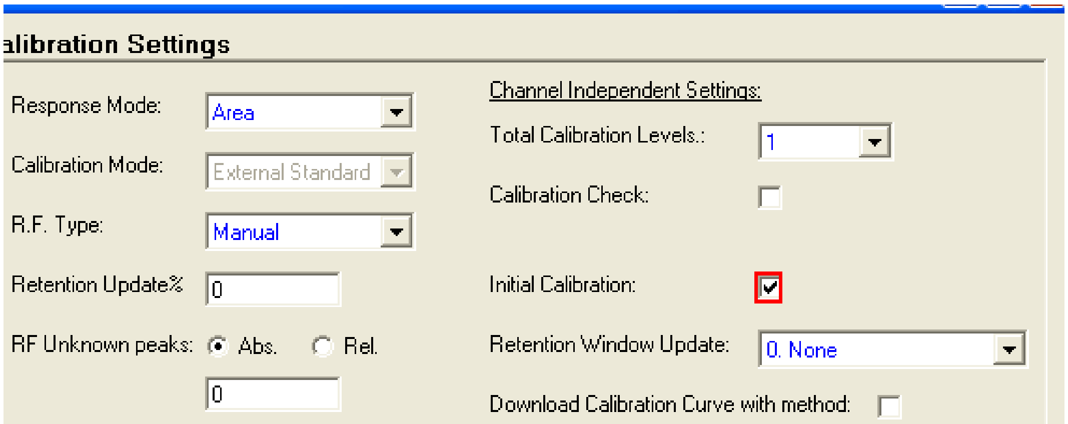


Figure 97. Initial Calibration

To setup a check for Response:

1 Select both **Initial Calibration** and **Calibration Check** and download method to the instrument and perform a calibration run(s). All new Response factors will be checked and stored in the instrument as **Initial RF** values.

2 Deselect **Initial Calibration**. Download the method to the instrument.

3 In the **Peak Identification/Calibration Table** in Figure 77 on page 113, enter percentages for **InitialRF%** and **CurrentRF%** attributes.

4 Now, perform analysis and daily calibration run(s) with **Calibration Check** (still) on. When a calibration run is performed and one of the peaks new R.F. exceeds its limits for **InitialRF** and **CurrentRF**, the entire calibration will be rejected and the instrument continues with R.F. from the last good calibration.

Download Calibration Curve with method

If a calibration curve (or R.F.) is determined outside the instrument, select **Download Calibration Curve** with method option.

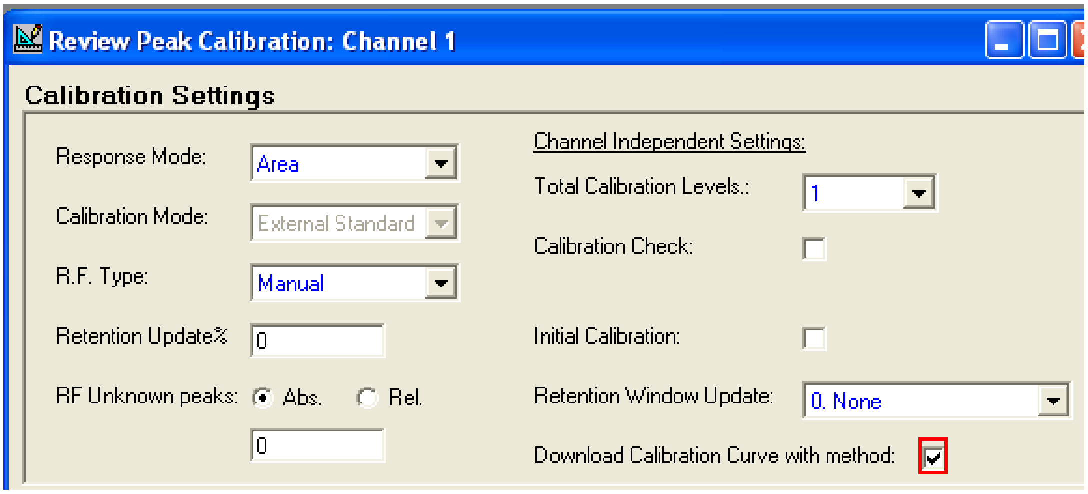


Figure 98. Download Calibration Curve with method

Enter the curve coefficients in the **Peak Identification/Calibration tables** on page 130. Find more information in **Offline calibration** on page 466.

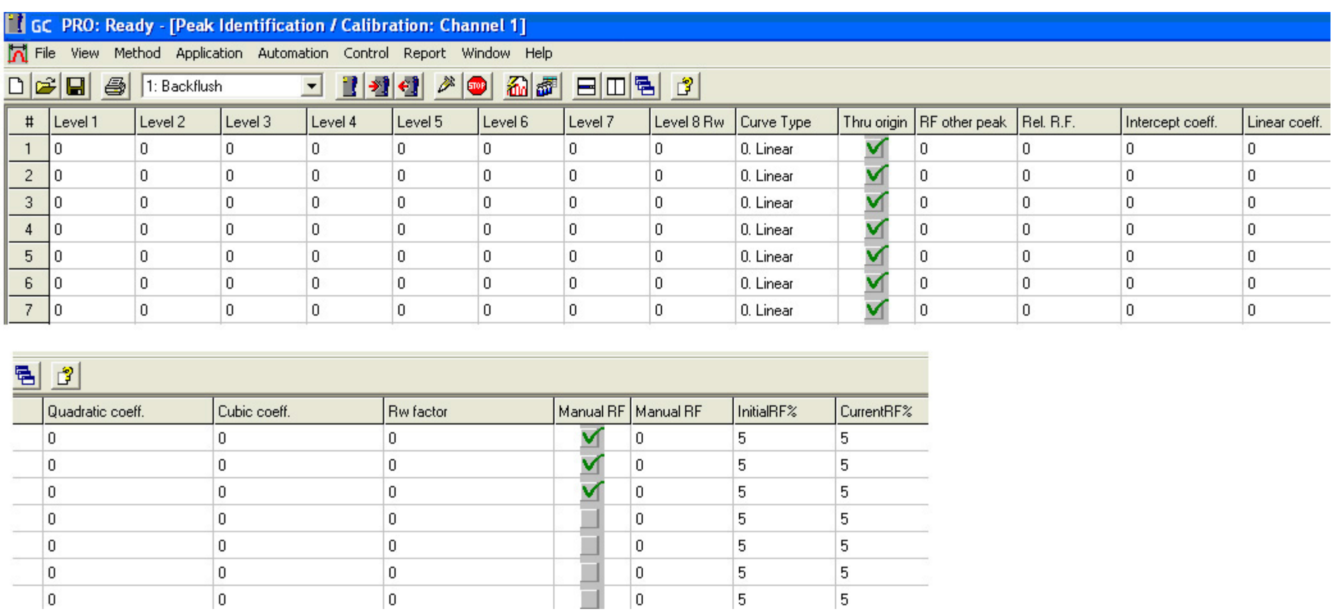
After downloading the new Calibration Curve (download Method), disable this option.

Prepare a calibration method

Setting up all parameters for a calibration.

Peak Identification/Calibration Table

This part defines how to prepare the calibration.



#	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8 Rw	Curve Type	Thru origin	RF other peak	Rel. R.F.	Intercept coeff.	Linear coeff.
1	0	0	0	0	0	0	0	0	0. Linear	✓	0	0	0	0
2	0	0	0	0	0	0	0	0	0. Linear	✓	0	0	0	0
3	0	0	0	0	0	0	0	0	0. Linear	✓	0	0	0	0
4	0	0	0	0	0	0	0	0	0. Linear	✓	0	0	0	0
5	0	0	0	0	0	0	0	0	0. Linear	✓	0	0	0	0
6	0	0	0	0	0	0	0	0	0. Linear	✓	0	0	0	0
7	0	0	0	0	0	0	0	0	0. Linear	✓	0	0	0	0

Quadratic coeff.	Cubic coeff.	Rw factor	Manual RF	Manual RF	InitialRF%	CurrentRF%
0	0	0	✓	0	5	5
0	0	0	✓	0	5	5
0	0	0	✓	0	5	5
0	0	0		0	5	5
0	0	0		0	5	5
0	0	0		0	5	5
0	0	0		0	5	5

Figure 99. Peak identification / calibration table

Open the **Peak Identification/Calibration Table**. Peaks are listed in order of their retention time and appropriate component name. Complete the Peak ID table.

- **Level 1-7**

  Fill in the “Levels” in the corresponding fields (level 1 to 7). These are the concentrations of components labeled on the gas bottle containing the calibration mixture. Level 1 contains the lowest sample concentration and level 7 the highest, see **Online calibration** on page 468.

- **Level 8 Rw**

  Fill in the Level 8 Rw value if performing a multilevel calibration with a field calibration correction. These are the concentrations of components labeled on the gas bottle containing the field calibration mixture, see **Rw Calibration** on page 471.

- **Curve Type**

  Three types of mathematical regression models are available, see **Chapter 12**, “Multi Level Calibration,” starting on page 463.

- **Thru origin**

  The curve will be forced to go through the origin (0.0). Find more information in **Multi Level Calibration** on page 463.

- **RF other peak**

  Select the peak number to use the calibration curve. For instance if peak 4 in the peak Identification table is n-Butane and peak 8 is n-Hexane and requires the Response factor from n-Butane, enter **4** in **RF other peak** for n-Hexane peak.

- **Rel. RF**

  Must be used in combination with RF other peak. This is an extra factor multiplied with the Response factor from the peak referring to.

  The concentration of an identified peak (Q) is determined by using the equation:
  `Qpeak = R * R.F.other_peak * Rel.RF.`

  in which R.F.other_peak is response factor from the peak referring and R is the response (area and height) of the peak.

- **Intercept Coeff**

  The calculated intercept coefficient of the calibration curve. Can also be set manually if the calibration is determined off-line. Find more information in **Multi Level Calibration** on page 463 and **Download Calibration Curve with method** on page 131.

- **Linear Coeff**

  The calculated linear coefficient of the calibration curve. Can also be set manually if the calibration is determined off-line. Find more information in **Multi Level Calibration** on page 463 and **Download Calibration Curve with method** on page 131.

- **Quadratic Coeff**

  The calculated Quadratic coefficient of the calibration curve. Only required if calibration curve is set to Quadratic of Cubic. Can also be set manually if the calibration is determined off-line. Find more information in **Multi Level Calibration** on page 463 and **Download Calibration Curve with method** on page 131.

- **Cubic Coeff**

The calculated Cubic coefficient of the calibration curve. Only required if calibration curve is set to Cubic.Can also be set manually if the calibration is determined off-line. Find more information in **Multi Level Calibration** on page 463 and **Download Calibration Curve with method** on page 131.

- **Rw factor**

  The calculated Rw coefficient of the calibration curve. Only required if a multilevel calibration is performed with a field correction calibration. Find more information in **Rw Calibration** on page 471.

- **Manual RF selection**

  Select this option if the Response factor can/should not be determined by the instrument and will be set manually by the operator. This option can only be used in single level calibration for a component. If selected enter a Response Factor in the next column **Manual RF**. Find more information in **R.F. type** on page 124.

- **Manual RF value**

  Enter a manual Response factor if **Manual RF** was selected in the previous column. Find more information in **R.F. type** on page 124.

- **Initial RF%**

  This is the percentage limit that the calculated Response Factor from a new calibration run can differ from the Initial Response Factor for that component. The entire calibration for all components will be rejected if exceeding this limit. Use this setting only for a single level calibration. Find more information in **Calibration Check** on page 126 and **Calibration Validation** on page 485.

- **Current RF%**

  This is the percentage the limit that the calculated Response Factor from a new calibration run can differ from the Current Response Factor for that component. The entire calibration for all components will be rejected if exceeding this limit. Use this setting only for a single level calibration. Find more information in **Calibration Check** on page 126 and **Calibration Validation** on page 485.

GOST R7 Coefficients

The four columns containing the GOST R7 coefficients will be enabled when the GOST calibration is enabled. For further explanation on GOST calibration method please refer to **Use GOST calibration** on page 127.

Running a new Calibration

If the calibration curve is not determined outside the instrument, but must be determined inside the instrument, perform all calibration levels in order to let the instrument determine the calibration curve for every peak. Ensure the Calibration method is saved and downloaded to the instrument. Start a Calibration run through Control/Start. Define correct parameters and press **Single Run** or run the Calibration block if it is prepared.

If a calibration analysis is already performed, reprocess the existing “Calibration run” manually for the selected level.

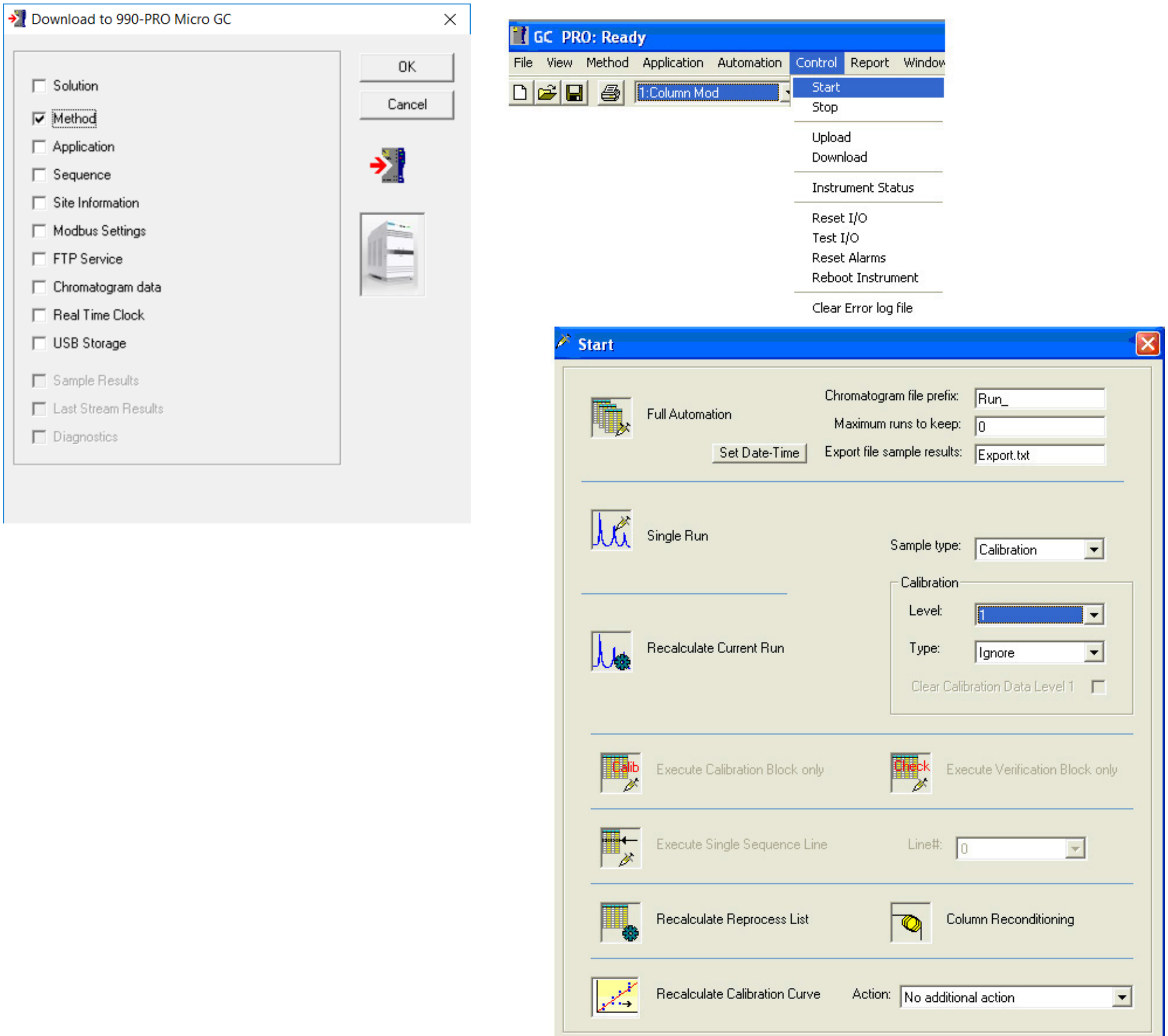


Figure 100. Running a new calibration

After completion of the run, the instrument processes the chromatogram. The chromatogram, analysis results and the updated method containing the calibration curve will be automatically uploaded to PROstation. The Analysis results can be found in the Integration Report, see **Figure 103** on page 136. The updated calibration curve can be found in the Preview Calibration window, see **Figure 101** on page 136. The calibration curve coefficients can be found in the Peak Identification/Calibration window, see **Figure 102** on page 136.

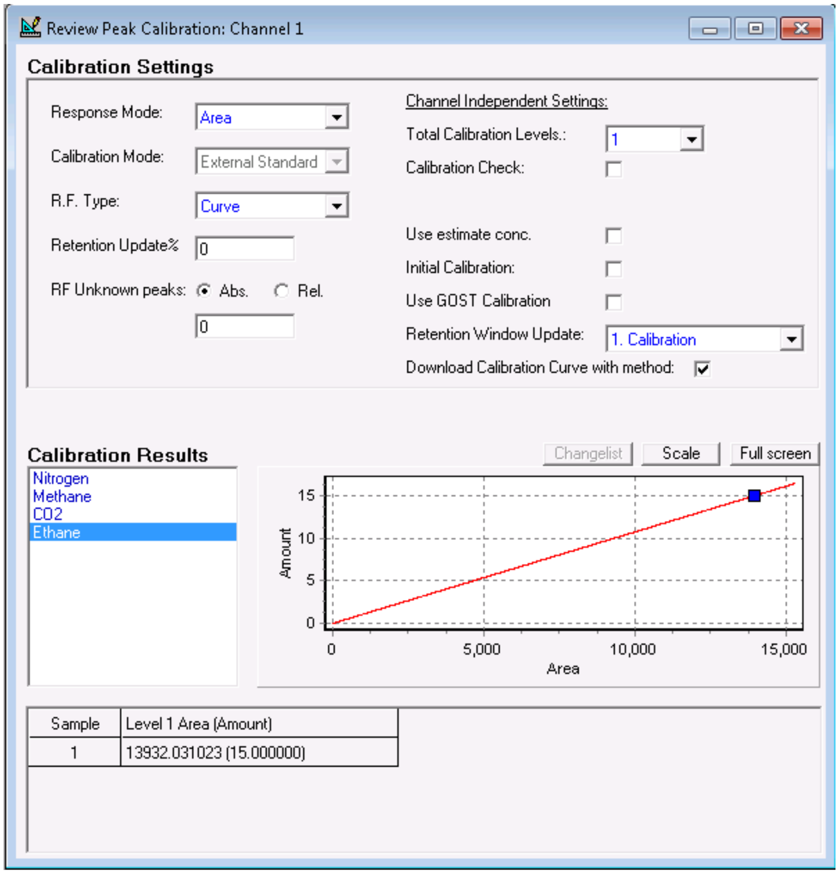


Figure 101. Example of a Calibration Curve (single calibration level).

Peak Identification / Calibration: Channel 1

#	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Curve Type	Thru origin	RF other peak	Intercept coeff.	Linear coeff.	Quadratic cc
1	8.2	0	0	0	0	0	0. Linear	✓	0	0	30328.0095141151	0
2	1.01	0	0	0	0	0	0. Linear	✓	0	0	44087.287923873	0
3	0.139	0	0	0	0	0	0. Linear	✓	0	0	52558.1201747489	0
4	0.199	0	0	0	0	0	0. Linear	✓	0	0	51790.3908422235	0
5	0.0011	0	0	0	0	0	0. Linear	✓	0	0	47256.2706191814	0
6	0.007	0	0	0	0	0	0. Linear	✓	0	0	60601.7721216526	0
7	0.00098	0	0	0	0	0	0. Linear	✓	0	0	70098.413805452	0

Figure 102. Peak ID/Calibration Table after calibration

Integration Report

#	Channel	Peak #	Peakname	Width	Separ.Code	Validation	Pk Start [s]	Pk End [s]	Assymetry 5%	New RF	InitRF Alarm
1	1	1	Peak1_11.49	0.4039	BB	0	11.12	12.19	1.4377	3.29728E-5	
2	1	2	Peak2_13.76	0.4258	BV	0	13.08	16.05	1.1155	2.26823E-5	
3	1	3	Peak3_16.95	0.5511	VV	0	16.05	18.43	1.0163	1.90266E-5	
4	1	4	Peak4_19.52	0.5729	VV	0	18.43	20.48	1.0291	1.93086E-5	
5	1	5	Peak5_20.8	0.7406	VB	0	20.48	21.94	2.1322	2.11612E-5	
6	1	6	Peak6_28.5	0.9060	BB	0	25.57	30.05	1.0119	1.65012E-5	
7	1	7	Peak7_33.05	0.9069	BB	0	31.62	35.09	1.6320	1.42657E-5	

Figure 103. Example of an Integration report.

Recalibrating an existing Calibration run

If a **Calibration** run (chromatogram) is already collected, reprocessing this data is sufficient to let the instrument determine the calibration curve. In all cases ensure the method is saved and method and chromatogram are downloaded to the instrument, see **Figure 104**.

The chromatogram, method, and analysis results will be uploaded to PROstation after the processing as described in **Chapter 12**, “Multi Level Calibration,” starting on page 463.

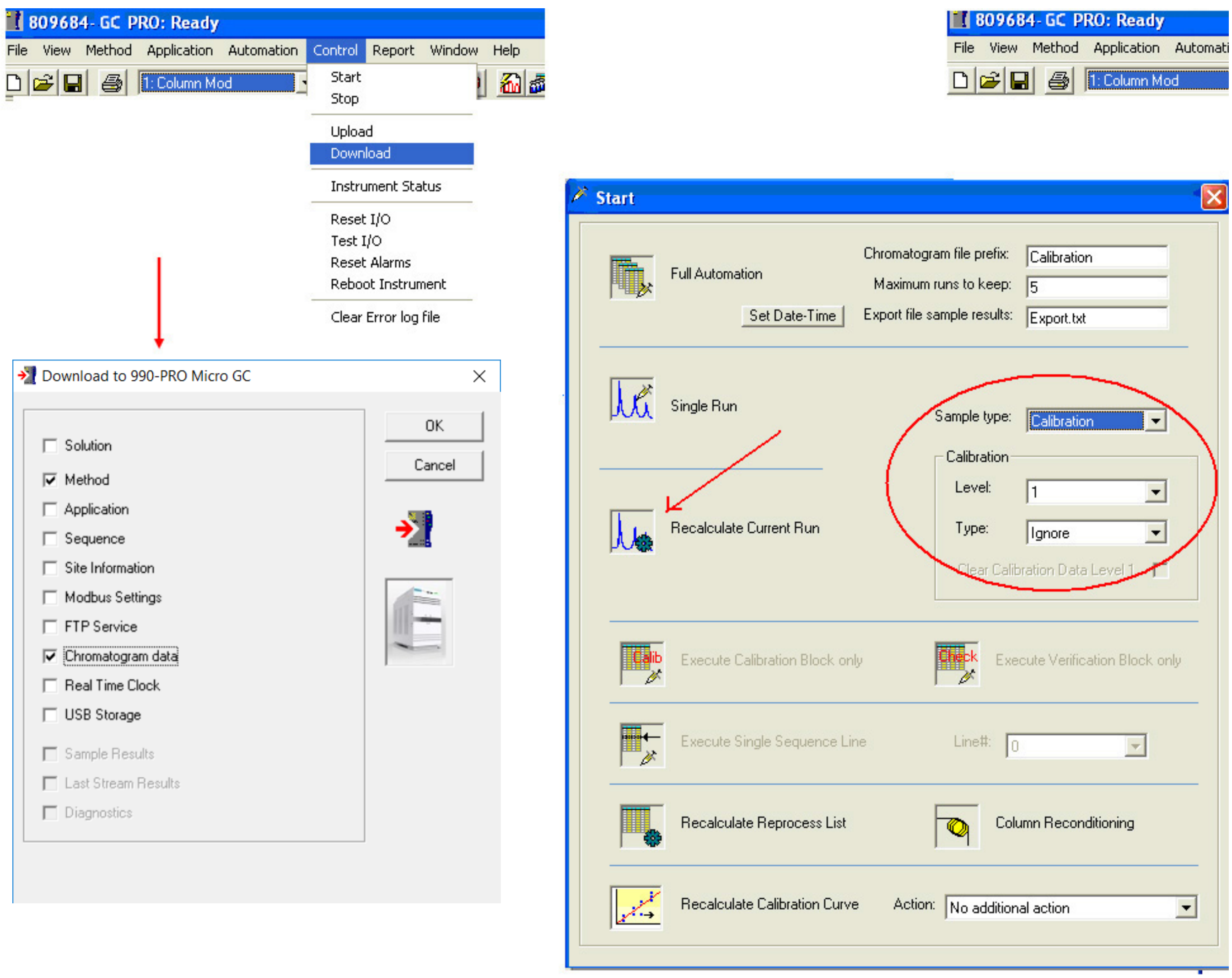
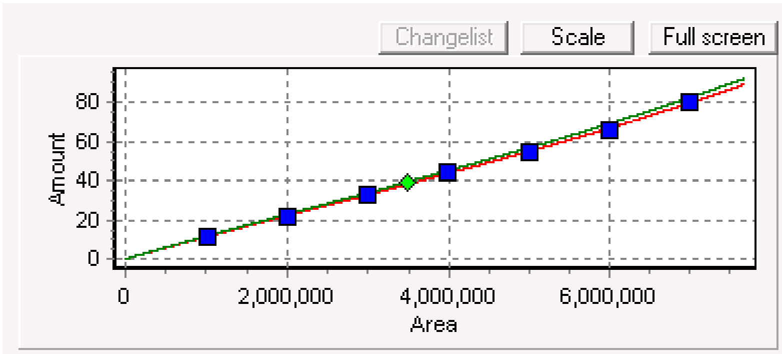


Figure 104. Reprocessing a calibration run.

Calibration chart

The Calibration graph has a certain functionality that makes it easier to work with and inspect the Calibration curve.



Change list

Click the **Changelist** button to load the change list. The function of the change list is explained in **Remove and revert calibration outliers** on page 140.

Zoom functionality

By selecting a location (rectangle) in the calibration chart with the left mouse button, and then dragging from the left upper position to right bottom (keeping the left mouse button pressed), will show a zoom rectangle. If the left mouse button is released, the chart will zoom in on the rectangle shown.

Figure 105. Zoom functionality

To zoom out, select any location in the calibration chart with the left mouse button and then drag from lower right to upper left corner of chart (keeping the left mouse button pressed). Again a rectangle is shown. When the left mouse button is released, the chart will fully zoom out.

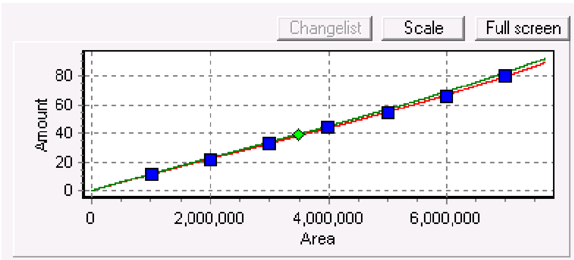
Drag functionality

Select any location in the calibration chart with the right mouse button and drag the mouse, keeping the button pressed. The calibration lines and points are dragged along in the chart window. When the button is released, the calibration chart remains as shown at that moment.

Scale setting

The scale button can be used to quickly inspect what shape/behavior the calibration curve has for higher concentrations. Typically, this function can be useful for nonlinear calibration curves.

The scale button switches between three steps. The default step is the same as the fully zoomed out view. The two other scale modes show the calibration curve for an amount respectively 4 times bigger and 20 times bigger than the biggest amount currently in the calibration graph.



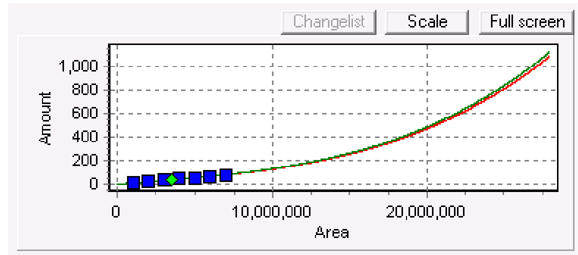


Figure 106. Scale setting

Full screen

Click **Full screen** to show the calibration chart maximized within the **Review Peak Calibration** window. All calibration chart functionality, such as drag and zoom functionality, are available in this view.

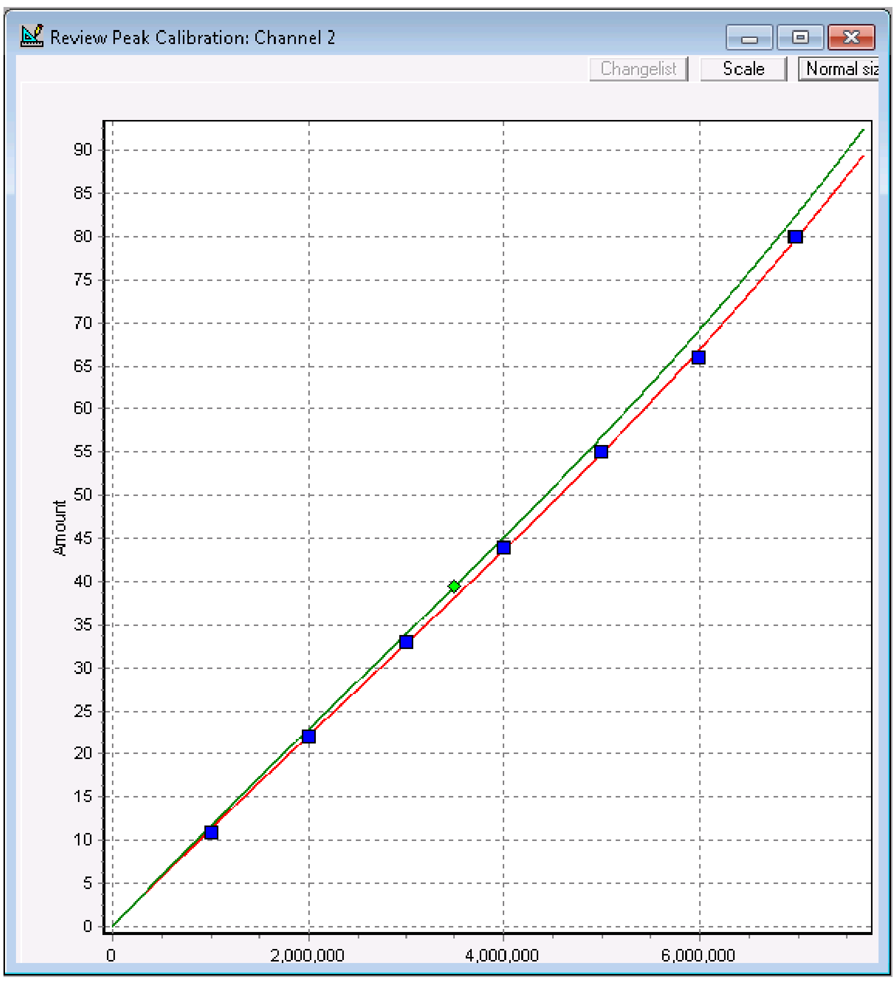


Figure 107. Full screen

To return to the normal view, click **Normal Size**.

Calibration graph tooltip text

When pointing with the mouse pointer at a calibration point or a calibration line, a tooltip text will appear, supplying information about the item the mouse pointer is pointing at. When the mouse pointer is hovering over a calibration point, it presents the Calibration level number, Area and amount of that calibration point. If the mouse pointer is pointing at a calibration line, the tooltip text appears, presenting the Area and Amount of the location on the calibration line. When the mouse pointer is pointing at an Rw Calibration point or corrected Rw calibration line, the tooltip text will inform about this as well.

Find more information about an Rw calibration in **Rw Calibration** on page 471.

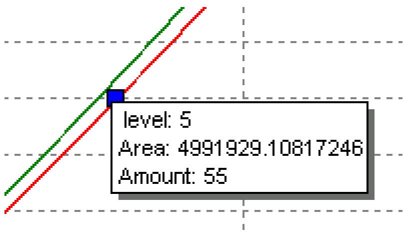


Figure 108. Marking calibration points

Remove and revert calibration outliers

Marking calibration outliers for delete Removing outliers from the calibration curve can be done by using the remove single calibration points mechanism. This chapter describes how this mechanism works, and how to use it.

Clicking on a calibration point with the left mouse button, marks that point for deletion. Marking for deletion means that the calibration point is stored in a change list, and the point will be colored red in the calibration graph.

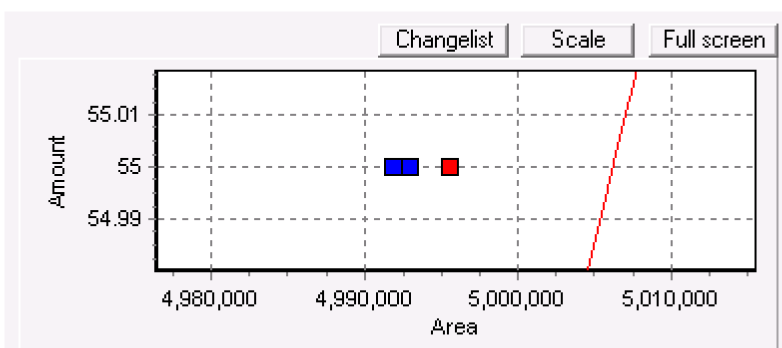


Figure 109. Marking calibration outliers for delete

Note that if calibration points are very close to each other, the red colored calibration point might not be visible.

To view the calibration point change list, open the change list viewer by clicking the **Changelist** button. The change list viewer shows the GC channel, component, calibration level, Area and Amount of the calibration points that are marked for deletion. The change list can contain numerous points of different channels, components, and levels.

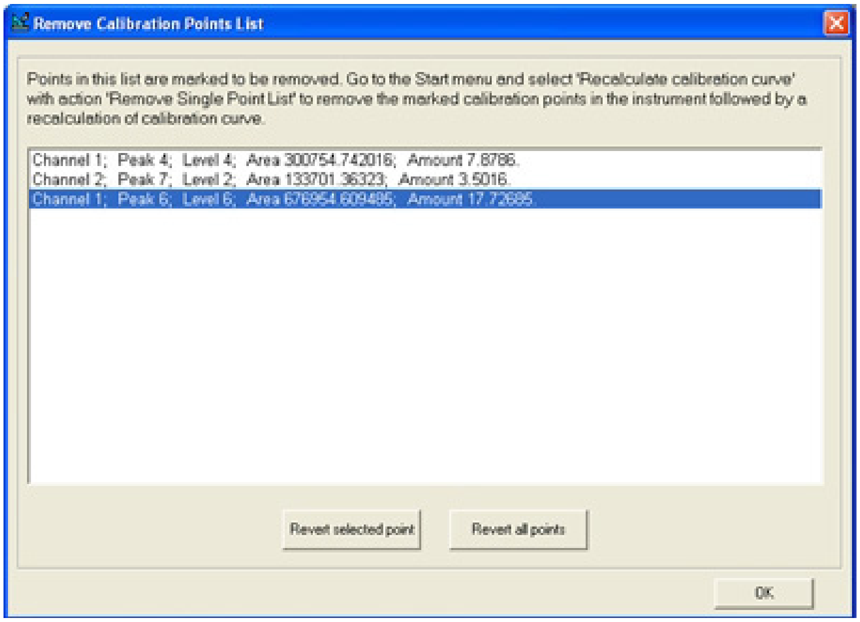
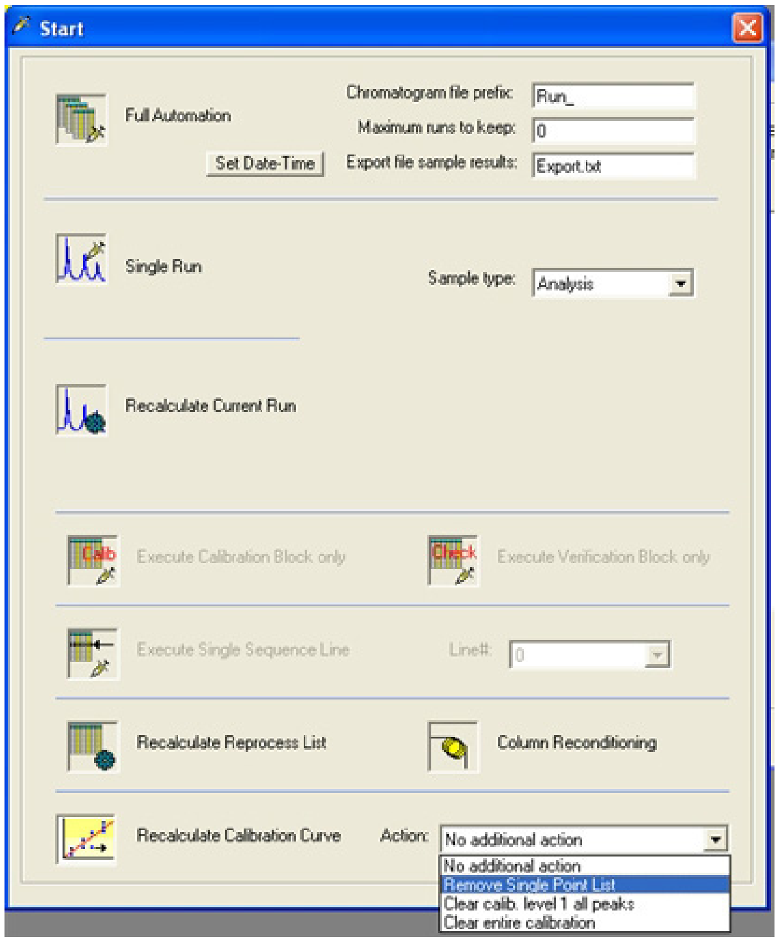


Figure 110. Remove calibration points list

Note that the change list is cleared when a method is uploaded from the instrument, when a new method is opened, or when PROstation is closed.

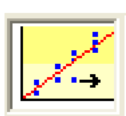
Removing calibration outliers The points are only marked visually, but they still are present in the calibration chart. At this stage the **Changelist** only exists in PROstation and not in the instrument. To remove the marked calibration points from the calibration graph:

1 Select the **Start automation** button from the tool bar (or select **Start** from the **Control** menu).



2 Go to the **Recalculate Calibration Curve** section and select **Remove Single Point List** from the **Action** list.

3 Click the **Recalculate Calibration Curve** button.



Now all marked calibration points are removed from corresponding calibration graphs (from the different channels and components), and all calibration curves are recalculated. Afterwards, the method is automatically uploaded including the updated calibration curves with the previous marked points removed. Note that the curve equation exists in the method peaktable.

The change list is cleared, since all points previously in the change list are now removed.

Note that points marked for delete can only be deleted by using the above guideline, and not by downloading the method. The change list is not downloaded to the instrument.

Note that the item **Remove Single Point List** in the **Recalculate Calibration Curve** list only exists when there are points in the Change list.

Reverting (rescuing) calibration points marked for deletion When an incorrect calibration point is accidentally marked for deletion, it can be reverted. To revert a calibration point in the change list, that calibration point is removed from the change list and is colored black again in the corresponding calibration graph. When actually removing the marked points as described in **Removing calibration outliers** on page 142, the reverted points will not be removed.

One can choose to revert a single point from the list or revert the complete list at once.

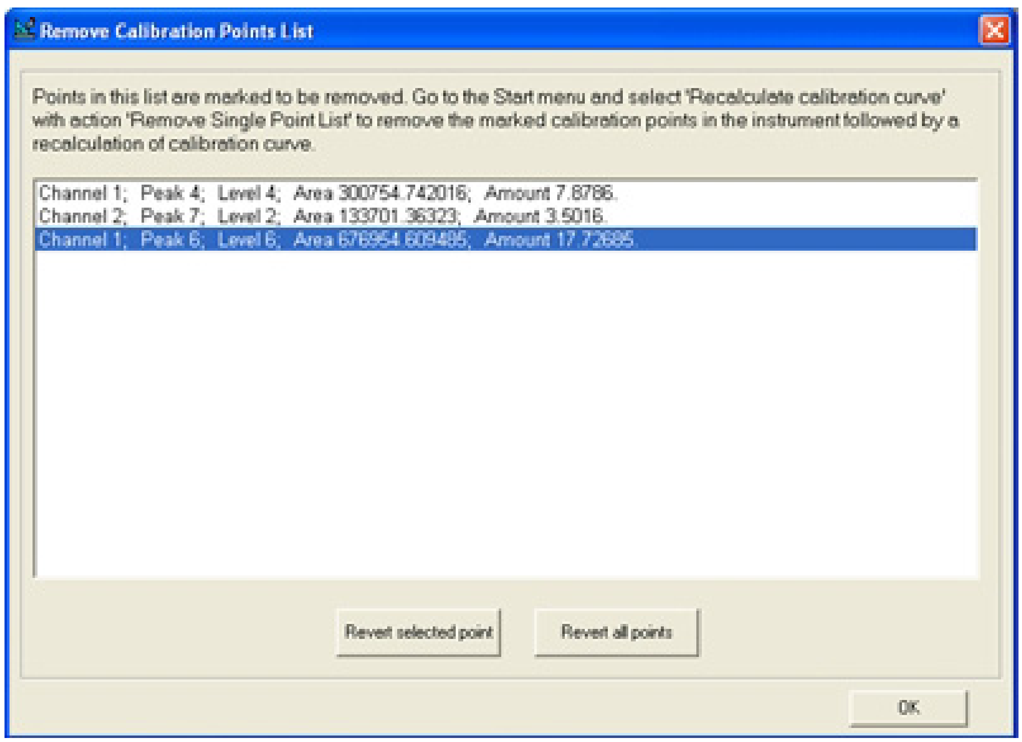
1 Go to the **Calibration method**.

2 To view the calibration point change list, start the change list viewer by clicking the **ChangeList** button.

3 Select a calibration point to revert by clicking on it.

4 Click the **Revert Selected Point** button.

5 To remove several points, redo this procedure.



6 To revert all points at once, click the **Revert All Points** button.

Method Advanced

In **Method\Advanced**, define the analysis parameters which should be exported to a tab separated text file (export file), for processing and diagnostics in MS Excel at a later stage.

- Select **Method\Advanced**.
- Select **Export enabled** option. Define which parameters to export.
- Save the method. A method download is not required since the export parameters exist only in **PROstation**.

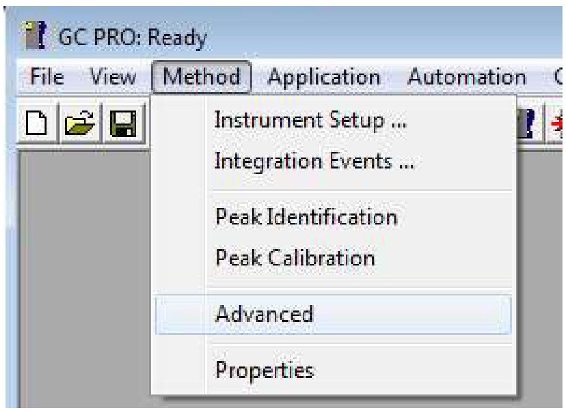


Figure 111. Open **Method Advanced**

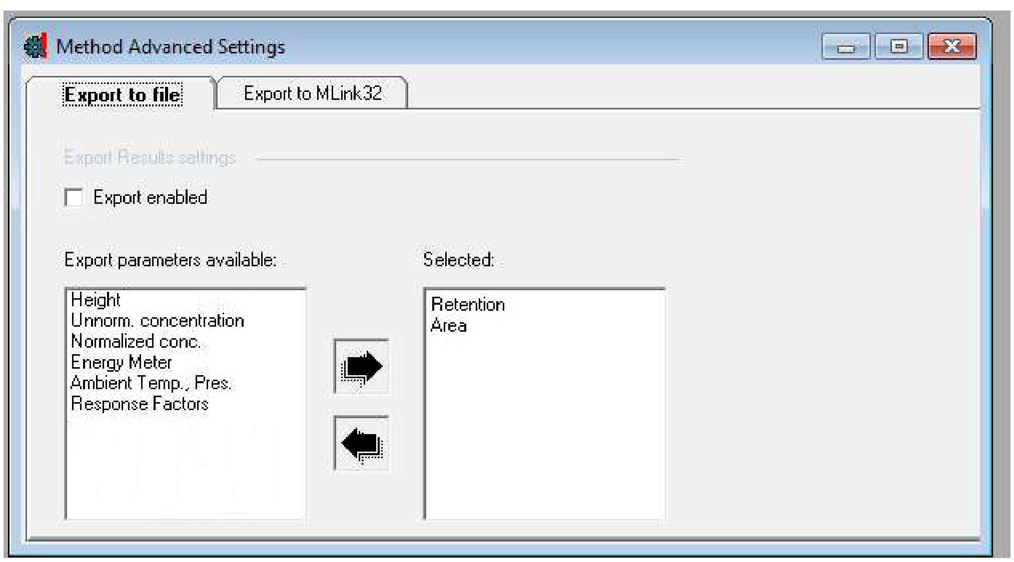


Figure 112. **Method Advanced Export Results** settings

Method Properties

The method properties define what the instrument executes after the chromatographic run has ended. If **Peak integration**, **Identification and Calibration** calculations is disabled, all runs will be performed without calculations.

If only the upper box is checked, the run data will be integrated; peak identification and concentration calculations will be performed and presented in the Integration Report. If the upper box is unchecked, the underlying lines are not accessible.

If the middle box is checked, which is only possible in combination with a checked upper box, application calculations will be performed and Input output signals are controlled. The sample results are presented in the Application Report.

If the bottom box is checked, which is only possible in combination with a checked middle box, application calculations will be performed using test amounts instead of actual calculated amounts.

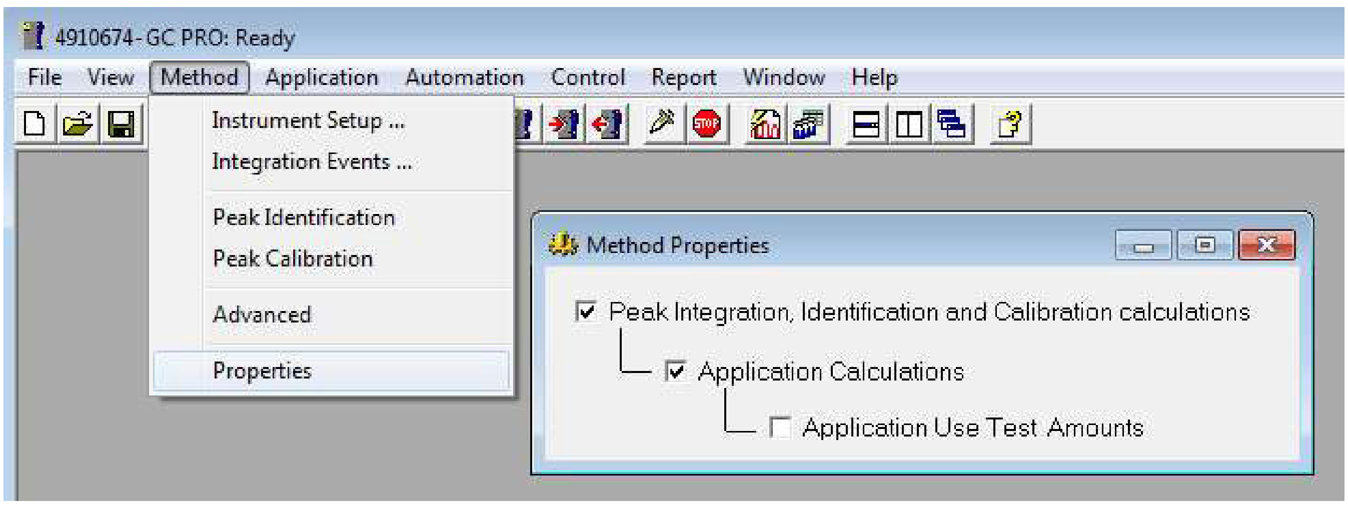


Figure 113. Method properties

8 PROstation Instrument Application Menu

This chapter describes the **Instrument Control** program application menu. Its function is method development and monitoring analysis.

The application allows additional calculations on the results as reported in the Integration Report. Also, analog and digital interfacing can be defined. The external interfacing is provided by the (on-board) standard GC I/O or by the Extension Boards.

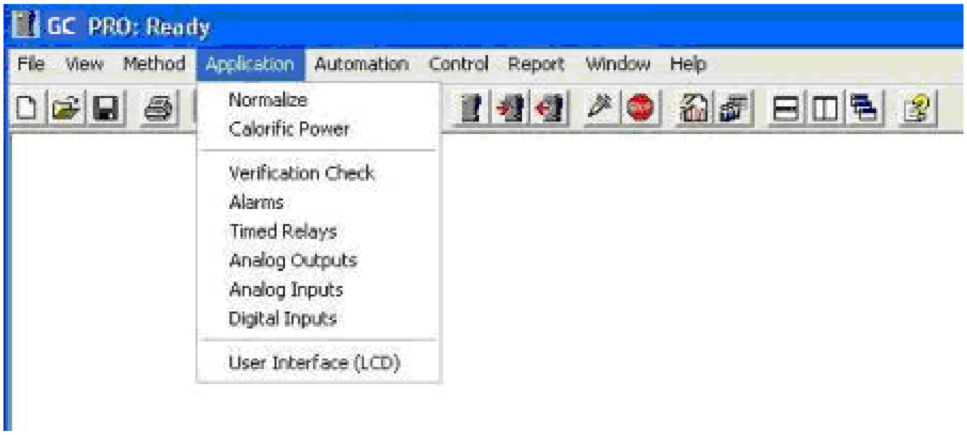


Figure 114. Instrument control program application menu

Application - Normalize

Normalization is a standard calculation available in PROstation, in addition to calculated external standard concentrations.

The Normalization table is activated under the **Application** menu. If the Normalization table is empty, run the **Application Wizard**. This automatically generates all peak names in the Normalization table for all configured peak names in the Peak Identification/Calibration Table.

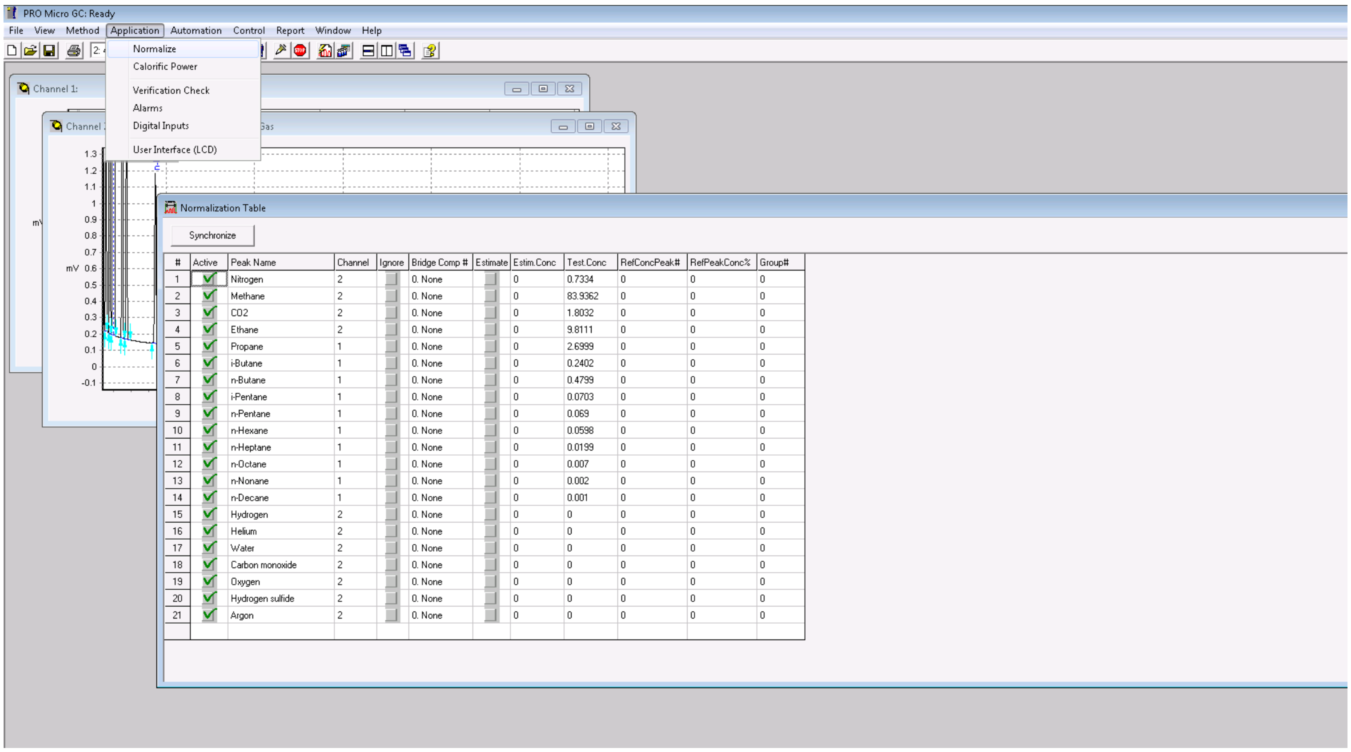


Figure 115. Normalize

Components in the Normalization table are identified only by their name used in the Peak Identification/Calibration Table. The normalization table consists of:

- **#**
  Index number
- **Active**
  If checked, the information of this peak will be downloaded to the instrument during a method download action.
- **Peak Name**
  The name must be identical to the peak name in the Peak Identification/Calibration Table. It can also be filled in automatically using the **Application** Wizard.
- **Channel**
  The GC channel on which the peak is detected.
- **Ignore**
  If checked, the external standard concentration for this peak is excluded from the normalization calculation.

- **Bridge Component**
  A bridge component is used to bridge two GC channels and compensate for an injection difference between the two channels, a so-called bridge component. This requires a component to be detected on two GC channels.

  Select **0.none** if not using a bridge component.

  Select **1.comp.1** for a component which is detected on two GC channels. Mark the same component on the other channel also with **1.comp.1**.

  If the instrument is equipped with three or four channels, two other channels can be bridged by marking the two components **2.comp.2**.

  Once a bridge component is defined, the instrument calculates a bridge factor of the component marked as **1.comp.1**. This factor is the result of dividing the two external standard concentrations. Note that this factor should be close to value 1.0. All peak concentrations of one channel will be multiplied with this bridge factor. Select **Ignore** for only one appearance of the bridge component. This will exclude one instance of the components concentration from the normalization concentration.
- **Estimate**
  Select to add a component that is not identified in the chromatographic run to the Application Normalization. Give a name in the name-field. The added component can either have an absolute value to be provided in the **Estmate Conc** field or the concentration can be set relative to an identified peak (add **indexnumber** to **RefConcPeak#** field) and a fixed percentage peak (add **%number** to **RefPeakConc%** field) of that peak.
- **Test Conc**
  Value to check the normalization calculation method. Any value given here will overrule the actual calculated normalized concentration. Note that you have to select the appropriate box **Application Use test Amount** under **Method\properties**.
- **RefConcPeak#**
  Must be used in combination with **Estimate**. See parameter **Estimate**.
- **RefPeakConc%**
  Must be used in combination with **Estimate**. See parameter **Estimate**.
- **Group#**

Multiple components can be grouped together. Groups will be separately reported in the Application Report. Add a component to a group by giving the group number, range: 1-9.

If, for instance, components Methane, Ethane, and Propane are to be grouped, enter a **1** in the **Group#** column for all three components.

Synchronize

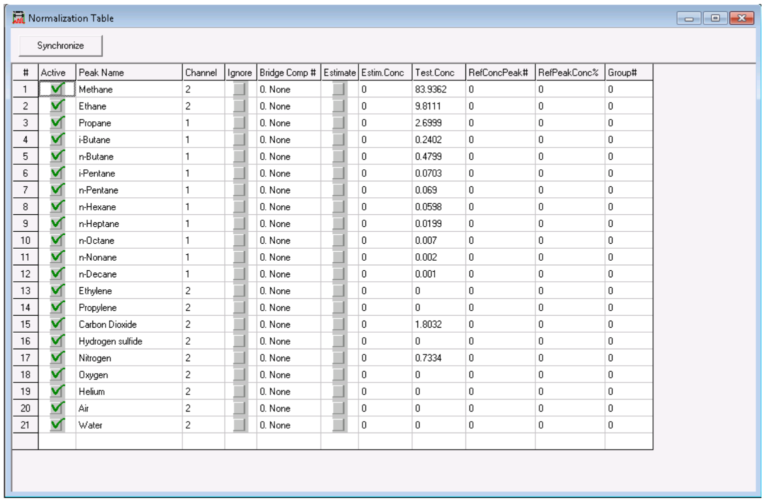


Figure 116. Synchronize with calorific power table

The **Normalization Table** and the **Component Constants** in the **Calorific Power** settings are linked. Changes made to the **Normalization Table** should be transmitted to the **Component Constants** in the **Calorific Power** settings. The **Synchronize** button activates the propagation process. With the synchronization process, components which are added or removed from the **Normalization Table** are automatically added or removed from the **Component Constants** table in the **Calorific Power** settings. Constants for added components in **Component Constants** table should be updated manually. Prior to synchronization, a popup message with the changes is presented to the user, giving the user the ability to authorize or abort the change.

NOTE

Closing of the Normalization Table and downloading of the application is blocked when changes to the Normalization Table are synchronized with the Component Constants table.

Application - Calorific Power

Introduction

Natural Gas is an energy source used throughout the world. The energy is generated by the reaction of the natural gas with oxygen (also known as combustion). For example, when propane is burned in air, the following reaction occurs.

$C_3H_8 + 5O_2$? #$3CO_2 + 4H_2O$ + heat

When propane is burned, the temperature where this reaction occurs may be in the range where the water can exist in either the liquid or gaseous state. When the water is condensed, the latent heat of vaporization provides additional heat. The total of the energy from the combustion and the latent heat of vaporization of the water is defined as the higher, gross, or superior Heat Value (Calorific Value). When the water is considered to remain in the gaseous state, the latent heat of vaporization is not included, and the heating value is called the lower, net, or inferior heat value. This gives the following relationship.

$$H_G = H_N + h_V * (n_{H2O}/n_{comb})$$

where

H_G = total heat value (Gross, Higher, Superior, Maximum)

H_N = heat value of combustion only (Net, Lower, Inferior, Minimum)

h_V = latent heat of vaporization for water

n_{H2O} = moles of water produced in combustion

n_{comb} = moles in combustion mixture.

When calculated on a per mole basis for a specific compound and assuming ideal gas behavior, the equation now becomes,

$$H_G^{id} = H_N + h_V^{id} * n_{H2O}$$

This allows the calculation of the Gross Heat and Net Heat values on per compound basis. When combined with the identification of the compounds in the natural gas to estimate the heat content.

The analysis of natural gas by gas chromatography is used to estimate the energy content of the natural gas. This provides a means to monitor custody transfer of the natural gas from the producer to the end user. Several organizations (Gas Processors Association (GPA) [now in conjunction with the American Petroleum Institute], ASTM international - formally American Society of Testing and Materials, International Organization for Standardization (ISO) [which is also considered as DIN standard and other Natural Gas Standards are based on the ISO standards]) have developed standards based on the individual compound energy values and other physical constants. The calculation is based on the assumption that the Natural Gas mixture can be separated into the individual components. This assumption is based on Dalton's law (the total pressure of a gas mixture is the sum of the partial pressures):

$$P = \Sigma_{p_i}$$

where

p_i is the partial pressure on compound i.

When Dalton's law is combined with the ideal gas law:

P * V = n * R * T

where P is the pressure, V is the volume, T is the temperature and R is the Gas Constant (the value will depend upon the units used for V, T, and P) and n is the number of moles.

When the Temperature and Volume are defined and constant, the number of moles for each component will be proportional to the partial pressure.

$x_i = pi/P = n_i/n_{tot}$

The amount xi can be calculated from the response of the individual component in the GC separation of the gas mixture. With gas mixtures, the total concentration is normalized to 100 %. The gas mixture suppliers usually provide the gas mixture with concentrations in mole %, however, it is possible that the concentrations will be given in volume % or weight %. If this is the case the volume % or weight % values will need to be converted to mole %, since the values in the tables are given in units/mole.

However, the gases in the Natural Gas mixture (with the possible exception of Helium) are non-ideal. Based on a per mole basis, the equation for a real gas is:

P * V = R * T * Z (T,P)

where

P is the absolute pressure

T is the thermodynamic temperature

V is the volume for one mole of gas

Z (T,P) is the compression factor

R is the molar gas constant (8.314472 J mol^{-1} °K^{-1} or 10.7316 psia (lbmol °$R)^{-1}$

This approach is then used to determine the compression factor for individual compounds. The compression factor is physically the amount of volume occupied at the temperature and pressure defined for the measurement. Near ambient, the truncated viral equation of state satisfactorily describes the behavior for natural gas.

z (T,P) = 1 + BP/RT

where

B = second viral coefficient for the gas mixture

B considers all the possible interactions between the components in the mixture. This has led to an alternate expression that is more convenient.

$$z(T, P) = 1 - \left(P \cdot [\Sigma_{x_j} \cdot (\beta_{jj})]^{\frac{1}{2}}\right)$$

where

xj = mole fraction of compound j

$\beta jj = \frac{\sqrt{Bjj}}{R * T}$ and $\sqrt{\beta jj}$ is the summation factor for component j.

The component constants are used in conjunction with the base pressure to calculate the different reported values.

Energy calculation setup

When the instrument includes an energy-meter license the user is able to set up the instrument using PROstation, and determine the calorific value and other physical properties in the (natural) gas being sampled. The availability of the energy-meter license can be checked in the instrument configuration on the **User** tab at **Available licenses**. See **Configuration Frame** on page 33 for additional information.

To calculate the physical properties of the (natural) gas confirm international standards ISO 6976, GPA 2172, ASTM D3588, GOST 22667 and GOST 31369 require five steps:

1 Select and optimize chromatographic conditions to provide sufficient separation of the components. **Instrument Setup** on page 92 describes the instrument's parameter settings.

2 Correctly integrate and identify the peaks. For additional information, see **Integration Events** on page 97 and **Peak Identification** on page 112.

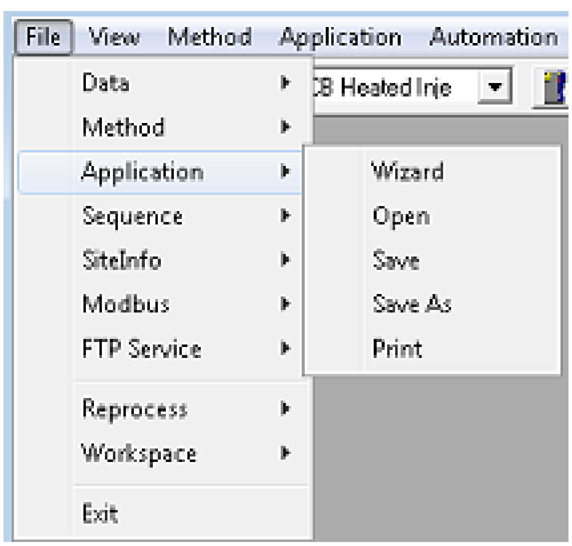
3 Calibrate the instrument. The calibration procedure is given is section **Peak Calibration** on page 122.

NOTE

When GOST 22667 calculation is selected, the use of embedded GOST calibration procedure is required. See **Use GOST calibration** on page 127 for additional information.

4 Normalize results from multiple channels. See **Application - Normalize** on page 148 for how to set up the normalization table.

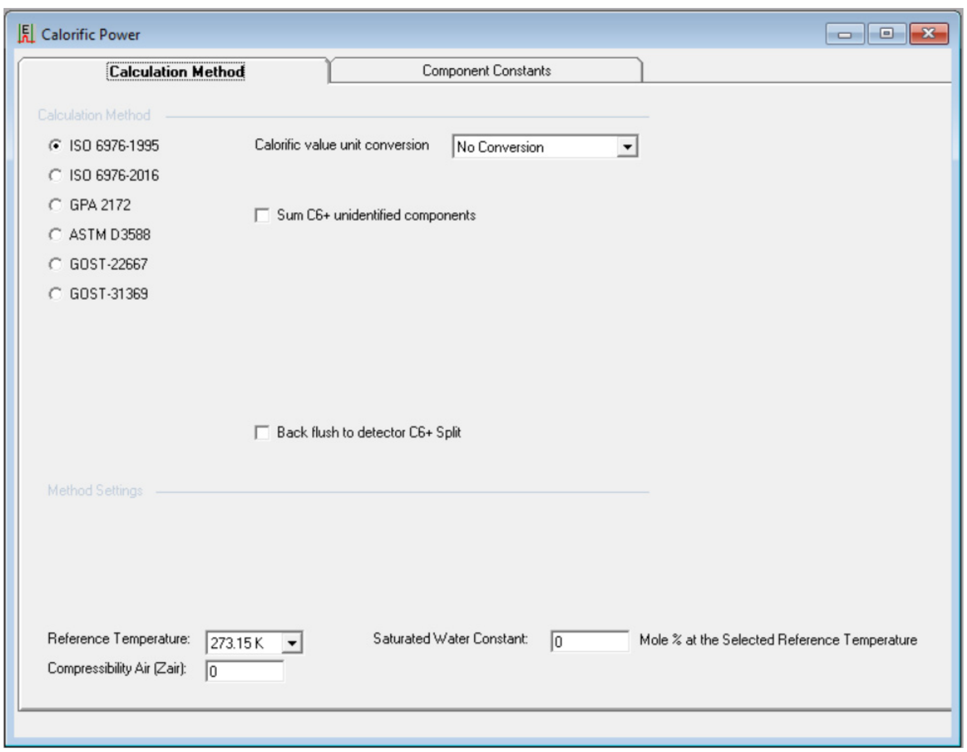
5 Select and set up the energy calculation. The sections below show how to select the calculation method and conditions used for the various official methods. Calorific Power can be displayed by selecting **Application>Calorific Power**. The PROstation also provides preconfigured applications which are stored as .papp files. The application can be loaded by selecting **File>Application>Open**.



Once Open is selected, the user can choose from the following preloaded .papp files or from applications they have already saved. There are 11 application files initially available. In addition to a default.papp file, files for ISO 6976, GPA 2172, ASTM D3588, and GOST 2267 are included.

ISO 6976-1995	ISO 0-0.papp, ISO 15-0.papp, ISO 15-15.papp, ISO 20-20.papp, ISO 25-0.papp, and ISO 25-20.papp. The first number indicates the combustion temperature and the second number the metering temperature. These files are based on ISO 6976 -1995 (including Technical Corrigendum 2). See **ISO 6976-1995 / GOST 31369** on page 154.
ISO 6976-2016	This is the updated heat value calculation of ISO 6976 from version 1995 to 2016. See **ISO 6976-2016** on page 161.
GPA 2172	GPA 14.696 Psi.papp. This file is based on GPA 2172 -09. GPA 2145 -09 is used for the physical properties. See **GPA 2172** on page 171.
ASTM D3588	D3588.papp and D3588_98.papp. D3588.papp is based on the most recent values form GPA (2145-09) and D3588_98.papp is based on values from the original D3588-98 (Table 1). See **ASTM D3588** on page 176.
GOST 22667	GOST 20-0.papp and GOST 20-20.papp. These files are based on GOST 22667 published in 1982. See **GOST 22667** on page 178.
GOST 31369	This standard was published in 2008 and is substantially based on ISO 6976. The availability of this functionality depends on your license. See **GOST 31369** on page 181.

ISO 6976-1995 / GOST 31369



For the calculations based on ISO 6976, selection of the metering temperature and the combustion temperature are necessary. On the **Calculation Method** tab, the **Reference Temperature** provides three choices of temperature:

- 273.15 K (0 °C)
- 288.15 K (15 °C)

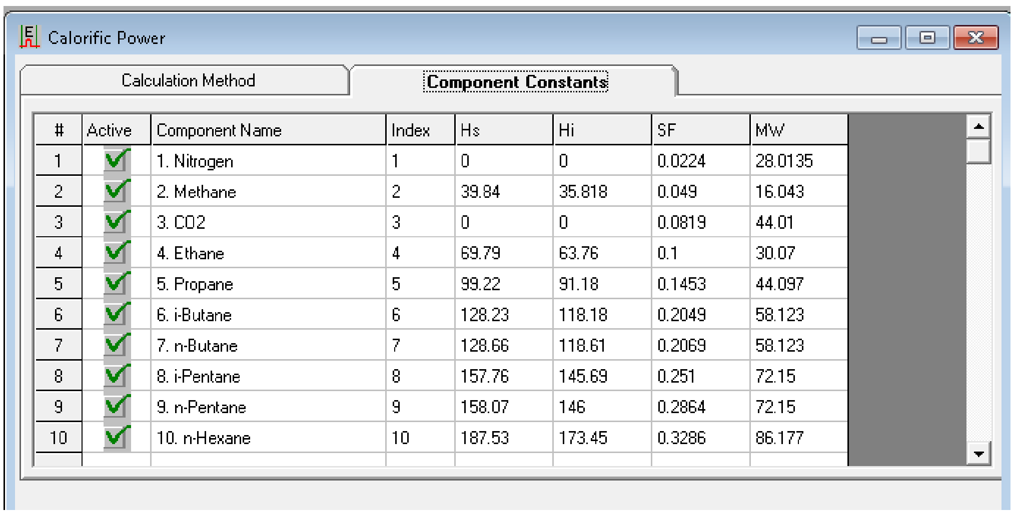
- 293.15 K (20 °C)

These correspond to the metering temperatures defined in ISO 6976. The Compressibility Air (Zair) is also needed for the calculations and is linked to the temperature.

- 273.15 K (0.99941)
- 288.15 K (0.99958)
- 293.15 K (0.99963)

For more details see **Sum C6+ unidentified components** on page 184.

Along with the metering temperature, the combustion temperature is required to define the values used in **Component Constants** table.



#	Active	Component Name	Index	Hs	Hi	SF	MW
1	✓	1. Nitrogen	1	0	0	0.0224	28.0135
2	✓	2. Methane	2	39.84	35.818	0.049	16.043
3	✓	3. CO2	3	0	0	0.0819	44.01
4	✓	4. Ethane	4	69.79	63.76	0.1	30.07
5	✓	5. Propane	5	99.22	91.18	0.1453	44.097
6	✓	6. i-Butane	6	128.23	118.18	0.2049	58.123
7	✓	7. n-Butane	7	128.66	118.61	0.2069	58.123
8	✓	8. i-Pentane	8	157.76	145.69	0.251	72.15
9	✓	9. n-Pentane	9	158.07	146	0.2864	72.15
10	✓	10. n-Hexane	10	187.53	173.45	0.3286	86.177

The Superior Heating Value (Hs) and Inferior Heating Value (Hi) are defined by the choice of the metering temperature and the combustion temperature, the Summation Factor (SF) is defined by the metering temperature and MW is the molecular weight of the component. The instrument calculates physical properties of the gas on volumetric base, therefor component specific values for Hs and Hi from Table 5 in ISO 6976:1995 (with the correction for Propane) should be used. The heating values are given in MJ m^{-3}.

In the Application Report, and on the instruments webpage, the following results are presented for Energy:

Name of parameter	Unit	Dry	Saturated
Molar mass	kg/kmol	$A1 = \Sigma X_j \cdot M_j$	$A2 = \Sigma X_j \cdot M_j \cdot (1 - X_{water}) + X_{water} \cdot M_{water}$
Relative density ideal (Molar mass ratio)	-	$B1 = \frac{A1}{M_{air}}$	$B2 = \frac{A2}{M_{air}}$
Relative density real	-	$C1 = \frac{B1 \cdot Z_{air}(t2.p2)}{Z_{mix}}$	$C2 = \frac{B2 \cdot Z_{air}(t2.p2)}{Z_{mix\_Saturated}}$
Gas density ideal	kg/m^3	$D1 = B1 \cdot \rho_{air} \cdot Z_{air}(t2.p2)$	$D2 = B2 \cdot \rho_{air} \cdot Z_{air}(t2.p2)$
Gas density real	kg/m^3	$E1 = \frac{D1}{F1}$	$E2 = \frac{D2}{F2}$

Name of parameter	Unit	Dry	Saturated
Zmix (compressibility)	-	$F1 = 1 - [\Sigma X_j \cdot \sqrt{b_j}]^2$	$F2 = 1 - [\Sigma(X_j \cdot \sqrt{b_j})(1 - X_{water}) + X_{water} \cdot \sqrt{b\_water}]^2$
Hs volume ideal	MJ/m3	$G1 = \Sigma X_j \cdot H_{s\_j}$	$G1 = \Sigma X_j \cdot H_{s\_j}(1 - X_{water}) + X_{water} \cdot H_{s\_water}$
Hs volume real	MJ/m3	$H1 = \frac{G1}{F1}$	$H2 = \frac{G2}{F2}$
Hi volume ideal	MJ/m3	$I1 = \Sigma X_j \cdot Hi_j$	$I2 = I1 \cdot (1 - X_{water})$
Hi volume real	MJ/m3	$J1 = \frac{I1}{F1}$	$J2 = \frac{I2}{F2}$
Hs molar	KJ/mol	$K1 = \Sigma X_j \cdot H_{sj.molar}$	$K2 = \Sigma X_j \cdot H_{sj.molar} \cdot (1 - X_{water}) + X_{water} \cdot H_{water.molar}$
Hi molar	KJ/mol	$L1 = \Sigma X_j \cdot H_{ij.molar}$	$L2 = \Sigma X_j \cdot H_{sj.molar} \cdot (1 - X_{water})$
Hs mass	MJ/kg	$M1 = \frac{K1}{A1}$	$M2 = \frac{K2}{A2}$
Hi mass	MJ/kg	$N1 = \frac{L1}{A1}$	$N2 = \frac{L2}{A2}$
Wobbe superior	MJ/m3	$O1 = \frac{H1}{\sqrt{C1}}$	$O2 = \frac{H2}{\sqrt{C2}}$
Wobbe inferior	MJ/m3	$Q1 = \frac{J1}{\sqrt{C1}}$	$Q2 = \frac{J2}{\sqrt{C2}}$

In the table shown above, each parameter value has both dry and saturated descriptions. Dry indicates that there is no water in the natural gas. Saturated indicates that water has been saturated in the natural gas. In ISO 6976, the reference temperate is 0 °C, 15 °C, or 20 °C. The saturated water mole fraction is 0.6%, 1.68%, and 2.31%.

The instrument has the ability to convert into other units as explained below.

Calorific value unit conversion

The calorific value unit conversion is present in the ISO calculation method screen. The ISO component constants are based on MJ/m3 for the heating values. The drop down menu provides a means for conversion to other units.

1 BTU = 1,054.6783 J (CRC Handbook, Condition 60 °F)

Conversion factor selection	Multiplier	Units
No Conversion	1	MJ/m3
MJ/m^3 -> KJ/m^3	1,000	KJ/m3
MJ/m^3 -> KWH/m^3	(1/3.6)	KWH/m3
MJ/m^3 -> $kcal/m^3$	239.00573613767	kcal/m3
MJ/m^3 -> BTU/ft^3	26.84875658	BTU/ft3

Calculations

Molar mass

The molar mass is molar weight.

The molar mas is calculated by:

Molar mass dry: $A1 = \Sigma X_j \cdot M_j$

Molar mass sat: $A2 = \Sigma X_j \cdot M_j \cdot (1 - X_{water}) + X_{water} \cdot M_{water}$

where

xj = mole fraction of component j

Mj = molar mass of component j

Xwater = saturated water mole fraction

Relative density ideal (Molar mass ratio)

The Relative density ideal is the ratio of molar mass to the molecular weight of air. Molar mass ratio is calculated by dividing the molar mass of the gas mixture by the molar mass of dry air.

Relative density ideal dry: B1 = A1/Mair.

Relative density ideal sat: B2 = A2/Mair.

where

Mair = 28.9626

Relative density real

Real gas relative density is equal to ideal gas density multiplied by Zair, then divided by Zmix.

Relative density real dry: $C1 = \frac{B1 \cdot Z_{air}(t2.p2)}{Z_{mix}}$

Relative density real sat: $C2 = \frac{B2 \cdot Z_{air}(t2.p2)}{Z_{mix\_Saturated}}$

where

Zair(t2, p2) is air compressibility; values are:

- 273.15 K (0.99941)
- 288.15 K (0.99958)
- 293.15 K (0.99963)

Gas density ideal

Ideal gas density is ideal mass per cubic meter, and is calculated as follows:

Gas density ideal dry: $D1 = B1 \cdot \rho_{air} \cdot Z_{air}(t2, p2)$

Gas density ideal sat: $D2 = B2 \cdot \rho_{air} \cdot Z_{air}(t2, p2)$

Where

rair is real air density:

rair(273.15k, 101,325 kpa) = 1.29292283 kg/m3

rair(288.15k, 101,325 kpa) = 1.22540971 kg/m3

rair(293.15k, 101,325 kpa) = 1.20444873 kg/m3

Gas density real

Real gas density is real gas mass per cubic meter, and is calculated as follows:

Gas density real, dry: $E1 = \frac{D1}{F1}$

Gas density real, sat: $E2 = \frac{D2}{F2}$

Zmix (Compressibility)

Compressibility is the departure from ideal gas behavior. For each compound in the sample, the following is calculated:

Zmix dry: $F1 = 1 - [\Sigma X_j \cdot \sqrt{b_j}]^2$

Zmix sat: $F2 = 1 - [\Sigma(X_j \cdot \sqrt{b_j})(1 - X_{water}) + X_{water} \cdot \sqrt{b\_water}]^2$

where

Xj = Mole fraction of compound j

bj = summation factor for component j

Xwater = saturated water mole fraction

Hs volume ideal

Hs ideal volume is based upon ideal gas superior heating value:

HS volume ideal dry: $G1 = \Sigma X_j \cdot H_{s\_j}$

HS volume ideal sat: $G1 = \Sigma X_j \cdot H_{s\_j}(1 - X_{water}) + X_{water} \cdot H_{s\_water}$

where

Hs_j is the superior heating value of compound j

Xwater is the mole fraction of saturated water

Hs_water is superior water heating value

Hs volume real

Hs volume real is volume based on real gas superior heating value:

Hs volume real dry: $H1 = \frac{G1}{F1}$

Hs volume real sat: $H2 = \frac{G2}{F2}$

Hi volume ideal

Hs ideal is the volume based idea gas inferior heating value:

Hs volume ideal dry: $I1 = \Sigma X_j \cdot H_{i\_j}$

HS volume ideal sat: $I1 = \Sigma X_j \cdot H_{i\_j}(1 - X_{water})$

where

Xj is the mole fraction of compound j

Hi_j is the superior heating value of compound j

Xwater is the mole fraction of saturated water

Hi_water is the superior water heating value

Hi volume real

Hi volume real is the volume based real gas inferior heating value:

Hi volume ideal dry: $J1 = \frac{I1}{F1}$

Hi volume ideal sat: $J2 = \frac{I2}{F2}$

Hs molar

Hs molar is the molar gas superior heating value expressed as KJ/mol:

Hs molar dry: $K1 = \Sigma X_j \cdot H_{sj.molar}$

Hs molar sat: $K2 = \Sigma X_j \cdot H_{sj.molar} \cdot (1 - X_{water}) + X_{water} \cdot H_{water.molar}$

where

Xj is the mole fraction of compound j

Hsj.molar is the superior heating value of compound j

Xwater is the mole fraction of saturated water

Hwater.molar is the water molar superior heating value

Hi molar

Hi molar is the molar based gas inferior heating value expressed as KJ/mol:

Hi molar dry: $L1 = \Sigma X_j \cdot H_{ij.molar}$

Hi molar sat: $L2 = \Sigma X_j \cdot H_{ij.molar} \cdot (1 - X_{water})$

where

Xj is the mole fraction of compound j

Hij.molar is the inferior molar heating value of compound j

Xwater is the mole fraction of saturated water

Hs mass

Hs mass is the mass based gas superior heating value expressed as MJ/kg:

Hs mass dry: $M1 = \frac{K1}{A1}$

Hs mass sat: $M2 = \frac{K2}{A2}$

Hi mass

Hi mass is the mass based gas inferior heating value expressed as MJ/kg:

Hi mass dry: $N1 = \frac{L1}{A1}$

Hi mass sat: $N2 = \frac{L2}{A2}$

Wobbe superior

Wobbe index based on superior heating value:

Wobbe superior dry: $O1 = \frac{H1}{\sqrt{C1}}$

Wobbe superior sat: $O2 = \frac{H2}{\sqrt{C2}}$

Wobbe inferior

Wobbe index based on inferior heating value:

Wobbe superior dry: $Q1 = \frac{J1}{\sqrt{C1}}$

Wobbe superior sat: $Q2 = \frac{J2}{\sqrt{C2}}$

ISO 6976-2016

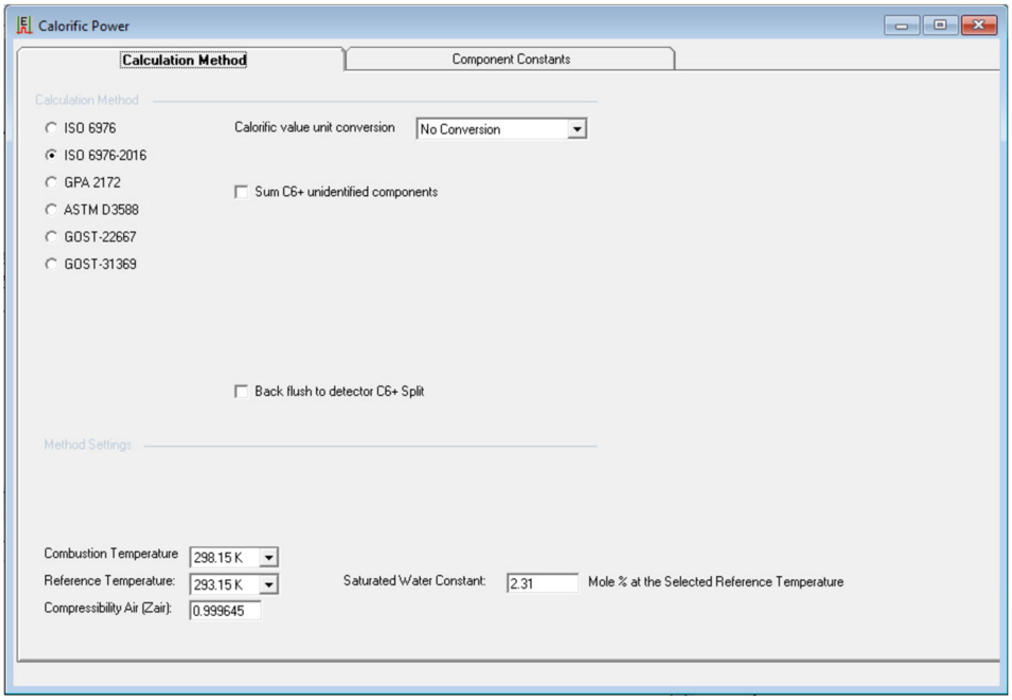


Figure 117. Calculation Method tab

For the calculations based on ISO 6976-2016, selection of the combustion temperature and reference temperature are required. On the **Calculation Method** tab, the **Combustion Temperature** (t_1) has five choices:

- 273.15 K (0 °C)
- 288.15 K (15 °C)
- 288.70 K (15.55 °C)
- 293.15 K (20 °C)
- 298.15 K (25 °C)

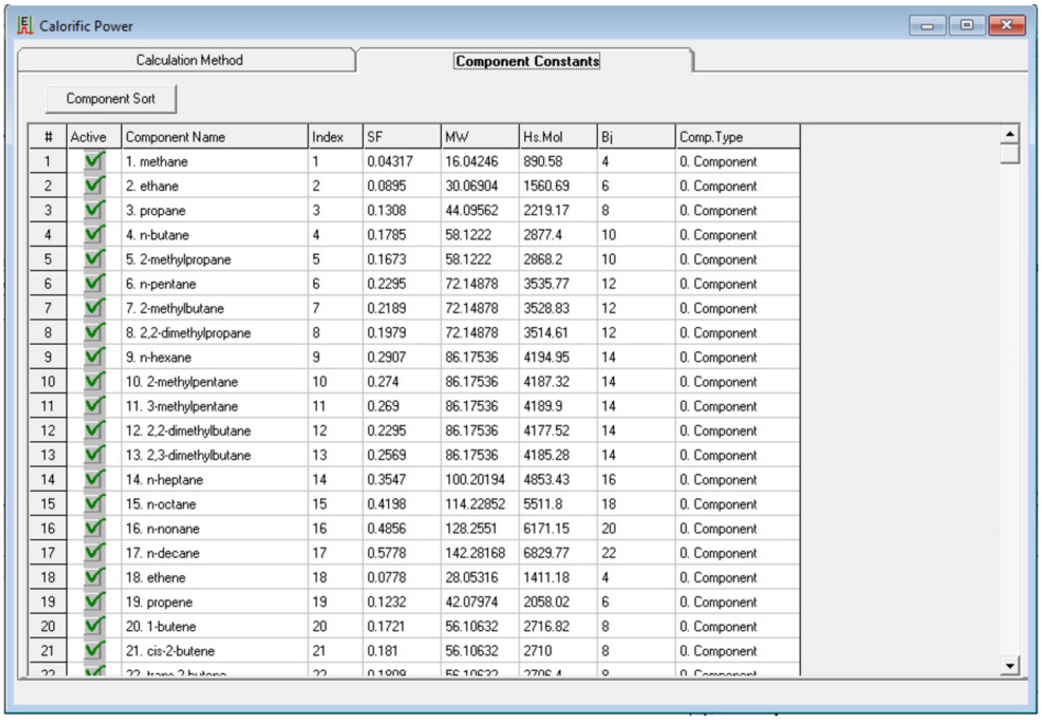
The **Reference Temperature** (t_2) has four choices:

- 273.15 K (0 °C)
- 288.15 K (15 °C)
- 288.70 K (15.55 °C)
- 293.15 K (20 °C)

The **Compressibility Air (Zair)** and **Saturated Water Constant (Mole %)** are also needed for the calculations and are linked to the reference temperature.

- 273.15 K (0.999419, 0.6 %)
- 288.15 K (0.999595, 1.68 %)
- 288.70 K (0.999601, 1.74 %)
- 293.15 K (0.999645, 2.31 %)

By defining **Combustion Temperature** and **Reference Temperature**, the values for calorific calculation will be automatically loaded in the **Component Constants** table. See **Figure 118**.



#	Active	Component Name	Index	SF	MW	Hs.Mol	Bj	Comp.Type
1	✓	1. methane	1	0.04317	16.04246	890.58	4	0. Component
2	✓	2. ethane	2	0.0895	30.06904	1560.69	6	0. Component
3	✓	3. propane	3	0.1308	44.09562	2219.17	8	0. Component
4	✓	4. n-butane	4	0.1785	58.1222	2877.4	10	0. Component
5	✓	5. 2-methylpropane	5	0.1673	58.1222	2868.2	10	0. Component
6	✓	6. n-pentane	6	0.2295	72.14878	3535.77	12	0. Component
7	✓	7. 2-methylbutane	7	0.2189	72.14878	3528.83	12	0. Component
8	✓	8. 2,2-dimethylpropane	8	0.1979	72.14878	3514.61	12	0. Component
9	✓	9. n-hexane	9	0.2907	86.17536	4194.95	14	0. Component
10	✓	10. 2-methylpentane	10	0.274	86.17536	4187.32	14	0. Component
11	✓	11. 3-methylpentane	11	0.269	86.17536	4189.9	14	0. Component
12	✓	12. 2,2-dimethylbutane	12	0.2295	86.17536	4177.52	14	0. Component
13	✓	13. 2,3-dimethylbutane	13	0.2569	86.17536	4185.28	14	0. Component
14	✓	14. n-heptane	14	0.3547	100.20194	4853.43	16	0. Component
15	✓	15. n-octane	15	0.4198	114.22852	5511.8	18	0. Component
16	✓	16. n-nonane	16	0.4856	128.2551	6171.15	20	0. Component
17	✓	17. n-decane	17	0.5778	142.28168	6829.77	22	0. Component
18	✓	18. ethene	18	0.0778	28.05316	1411.18	4	0. Component
19	✓	19. propene	19	0.1232	42.07974	2058.02	6	0. Component
20	✓	20. 1-butene	20	0.1721	56.10632	2716.82	8	0. Component
21	✓	21. cis-2-butene	21	0.181	56.10632	2710	8	0. Component
22	✓	[illegible]	22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Figure 118. Component Constants table

In the Application Report and on the instruments webpage, the following results are presented for Energy:

Name of parameter	Unit	Dry gas	Saturated gas
Compression factor **Z (t_2, p_2)**	-	$A1=1-\left(\frac{p_2}{p_0}\right)\left[\sum x_j * s_j(t_2,p_0)\right]^2$	$A2=1-\left(\frac{p_2}{p_0}\right)\left[\sum x_j * sj(t_2,p_0)(1-x_{water})+x_{water} * s_{j.water}\right]^2$
Molar mass **M**	kg/kmol	$B1=\sum x_j * M_j$	$B2 = \sum x_j * M_j * (1-x_{water}) + x_{water} * M_{water}$
Ideal-gas relative density **G°**	-	$C1 = \frac{B1}{M_{air}}$	$C2 = \frac{B2}{M_{air}}$
Real-gas relative density **G (t_2, p_2)**	-	$D1 = \frac{C1 * Z_{air}(t_2,p_2)}{A1}$	$D2 = \frac{B2 * Z_{air}(t_2,p_2)}{A2}$
Ideal-gas density **D° (t_2, p_2)**	kg/m^3	$E1 = \frac{B1}{V^0}$, $V^0=R*T_2/p_2$	$E2 = \frac{B2}{V^0}$, $V^0=R*T_2/p_2$
Real-gas density **D (t_2, p_2)**	kg/m^3	$F1 = \frac{E1}{A1}$	$F2 = \frac{E2}{A2}$

Name of parameter	Unit	Dry gas	Saturated gas
Molar-basis gross calorific value **Hc Gross**	KJ/mol	$G1=\sum x_j * H_{c.Gross.j}$	$G2=G1*(1-x_{water})+x_{water}*H_{c.water}$
Molar-basis net calorific value **Hc Net**	KJ/mol	$H1=G1-\sum x_j*\frac{b_j}{2}*L^0$	$H2=H1*(1-x_{water})$
Mass-basis gross calorific value **Hm Gross**	MJ/kg	$I1=\frac{G1}{B1}$	$I2=\frac{G2}{B2}$
Mass-basis net calorific value **Hm Net**	MJ/kg	$J1=\frac{H1}{B1}$	$J2=\frac{H2}{B2}$
Ideal-gas volume-basis gross calorific value **Hv Gross**	MJ/m^3	$K1=\frac{G1}{V^0}$, $V^0=R*T_2/p_2$	$K2=\frac{G2}{V^0}$, $V^0=R*T_2/p_2$
Ideal-gas volume-basis net calorific value **Hv Net**	MJ/m^3	$L1=\frac{H1}{V^0}$, $V^0=R*T_2/p_2$	$L2=\frac{H2}{V^0}$, $V^0=R*T_2/p_2$
Real-gas volume-basis gross calorific value **Hv Gross real**	MJ/m^3	$M1=\frac{G1}{V}$, $V=A1*R*T_2/p_2$	$M2=\frac{G2}{V}$, $V=A2*R*T_2/p_2$
Real-gas volume-basis net calorific value **Hv Net real**	MJ/m^3	$N1=\frac{H1}{V}$, $V=A1*R*T_2/p_2$	$N2=\frac{H2}{V}$, $V=A2*R*T_2/p_2$
Ideal-gas gross Wobbe index **$W^0_G(t_1, t_2, p_2)$**	MJ/m^3	$O1=\frac{K1}{\sqrt{C1}}$	$O2=\frac{K2}{\sqrt{C2}}$
Ideal-gas net Wobbe index **$W^0_N(t_1, t_2, p_2)$**	MJ/m^3	$P1=\frac{L1}{\sqrt{C1}}$	$P2=\frac{L2}{\sqrt{C2}}$
Real-gas gross Wobbe index **$W_G(t_1, t_2, p_2)$**	MJ/m^3	$Q1=\frac{M1}{\sqrt{D1}}$	$Q2=\frac{M2}{\sqrt{D2}}$
Real-gas net Wobbe index **$W_N(t_1, t_2, p_2)$**	MJ/m^3	$R1=\frac{N1}{\sqrt{D1}}$	$R2=\frac{N2}{\sqrt{D2}}$

Where R is molar gas constant and p_2 is standard atmosphere pressure, R=8.3144621 J/(mol*K) and p_2=14.696 psi.

ISO 6976-2016 is not supported in Application Wizard.

GPA2172 / ASTM-D3588

Name of parameter	Unit	Dry	Actual	Saturated
Molar mass	kg/kmol	$A1 = \frac{A2 - w\% \cdot Mwater}{(1 - w\%)}$	$A2 = \Sigma X_j \cdot M_j$	$A3 = A1(1 - 1.74\%) + 1.74\% \cdot M_{water}$
Relative density ideal Molar mass ratio)	-	$B1 = \frac{A1}{M_{air}}$	$B2 = \frac{A2}{M_{air}}$	$B3 = \frac{A3}{M_{air}}$
Relative density real (SG)	-	$C1 = \frac{B1}{F1} \cdot Z_{air}$	$C2 = \frac{B2}{F2} \cdot Z_{air}$	$C3 = \frac{B3}{F3} \cdot Z_{air}$
Gas density ideal	ibm/ft^3	$D1 = A1 \cdot P/(RT)$	$D2 = A2 \cdot P/(RT)$	$D3 = A3 \cdot P/(RT)$
Gas density real	ibm/ft^3	$E1 = \frac{D1}{F1}$	$E2 = \frac{D2}{F2}$	$E3 = \frac{D3}{F3}$
Zmix (compressibility)	-	$F1 = 1 - P_b \cdot \left[\frac{\Sigma X_i \cdot b_i - w\% \cdot b_w}{1 - w\%}\right]^2$	$F2 = 1 - P_b \cdot [X_i \cdot b_i]^2$	$F3 = 1 - \left[(1 - 1.74\%) \cdot \left[\frac{\Sigma X_i \cdot b_i - w\% \cdot b_w}{1 - w\%}\right] + 1.74\% \cdot b_w\right]^2 \cdot P_b$
H gross volume ideal	BTU/ft^3	$G1 = \frac{G2 - w\% \cdot H_{wv}}{1 - w\%}$	$G2 = \Sigma X_j \cdot H_{s\_j}$	$G3 = G1 \cdot (1\text{-}1.74\%) + 1.74\% \cdot H_{wv}$
H gross volume real	BTU/ft^3	$H1 = \frac{G1}{F1}$	$H2 = \frac{G2}{F2}$	$H3 = \frac{G3}{F3}$
H net volume ideal	BTU/ft^3	$I1 = \frac{I2 - w\% \cdot H_w}{1 - w\%}$	$I2 = \Sigma X_j \cdot H_{i\_j}$	$I3 = I1 \cdot (1\text{-}1.74\%)$
H net volume real	BTU/ft^3	$J1 = \frac{I1}{F1}$	$J2 = \frac{I2}{F2}$	$J3 = \frac{I3}{F3}$
H gross mass	BTU/ibm	$K1 = \frac{K2 - w\% \cdot H_{wm} \cdot \frac{M_w}{M}}{1 - w\% \cdot \frac{M_w}{M}}$	$K2 = \Sigma X_j \cdot \frac{M_j}{M} \cdot H_{s\_j.mass}$	$K3 = K1 \cdot \left(1\text{-}1.74\% \cdot \frac{M_w}{M}\right) + 1.74\% \cdot \frac{M_w}{M} \cdot H_{wm}$
H net mass	BTU/ibm	$L1 = \frac{L2 - w\% \cdot H_{wm} \cdot \frac{M_w}{M}}{1 - w\% \cdot \frac{M_w}{M}}$	$L2 = \Sigma X_j \cdot \frac{M_j}{M} \cdot H_{i\_j.mass}$	$L3 = L1 \cdot \left(1\text{-}1.74\% \cdot \frac{M_w}{M}\right)$
H gross molar	KJ/mol	$M1 = \frac{M2 - w\% \cdot H_{wm}}{1 - w\%}$	$M2 = \Sigma X_j \cdot H_{s\_j.molar}$	$M3 = M1 \cdot (1\text{-}1.74\%) + 1.74\% \cdot H_{wm}$
H net molar	KJ/mol	$N1 = \frac{N2 - w\% \cdot H_w}{1 - w\%}$	$N2 = \Sigma X_j \cdot H_{i\_j.molar}$	$N3 = N1 \cdot (1\text{-}1.74\%)$
Wobbe index, real	BTU/ft^3	$O1 = \frac{H1}{\sqrt{C1}}$	$O2 = \frac{H2}{\sqrt{C2}}$	$O3 = \frac{H3}{\sqrt{C3}}$

Name of parameter	Unit	Dry	Actual	Saturated
Spec. volume, real	ft^3/ibm	$P1 = 1/(E1)$	$P2 = 1/(E2)$	$P3 = 1/(E3)$
GPM total, real	gal/1,000 ft^3	$Q1 = \frac{Q_{act} - W\% \cdot GPM_w}{(1 - W\%)F1}$	$Q2 = \Sigma X_i \cdot (GPM_i)/(F2)$	$Q3 = \frac{Q_{dry} \cdot (1\text{-}1.74\%) + 1.74\% \cdot GPM_w}{F3}$

In the table shown above, each parameter value has Dry, Actual (act), and Saturated (sat) values. Dry indicates natural gas (containing no water). Actual indicates the known actual water mole fraction in real measured natural gas. Saturated indicates natural gas saturated with water. In GPA2172 and ASTM-D3588, tested base pressure is 14.696 psi, base temperature is 60 °F, accorded saturated water mole fraction is 1.74%, and actual water mole fraction is ³0 (Dry) and £1.74% (sat).

Calorific value unit conversion

The calorific value unit conversion is present in the ISO calculation method screen. The ISO component constants are based on BTU/ft3 or BTU/lbm for the values. The drop down menu provides a means for conversion to other units.

1 BTU = 1,055.0559 J (ASTM-D3588)

Conversion factor selection	Multiplier	Units
BTU/ft^3 -> BTU/m^3	(1/0.0283268466)	BTU/m^3
BTU/ft^3 -> MMBTU/ft^3	(1/1,000,000	MMBTU/ft^3
BTU/ft^3 -> MMBTU/m^3	(1/1,000,000*0.02831684666)	MMBTU/m^3
BTU/ft^3 -> MJ/m^3	(1/26.83914663)	MJ/m^3
BTU/lbm -> MJ/kg	(2.326/1,000)	MJ/kg

Calculations

Molar mass

The molar mass is molar weight.

The molar mass is calculated by:

Molar mass dry: $A1 = \frac{A2 - w\% \cdot M_{water}}{(1 - w\%)}$

Molar mass act: $A2 = \Sigma X_j \cdot M_j$

Molar mass sat: $A3 = A1(1 - 1.74\%) + 1.74\% \cdot M_{water}$

where

Xj is mole fraction of component j, including actual water mole fraction

Mj is molar mass of component j

w% is mole fraction of actual water

1.74% is mole fraction of saturated water

Relative Density Ideal (Molar Mass Ratio)

The Relative density ideal indicates the ratio of molar mass to the molecular weight of air. Molar mass ratio is calculated by dividing the molar mass of the gas mixture by the molar mass of dry air.

Relative density ideal dry: $B1 = \frac{A1}{M_{air}}$

Relative density ideal act: $B2 = \frac{A2}{M_{air}}$

Relative density ideal sat: $B3 = \frac{A3}{M_{air}}$

where

Mair = 28.9626

Relative Density Real (SG)

Real gas relative density is equal to ideal gas density multiplied by Z_{air} and then divided by Z_{mix}.

Relative density real dry: $C1 = \frac{B1}{F1} \cdot Z_{air}$

Relative density real act: $C2 = \frac{B2}{F2} \cdot Z_{air}$

Relative density real sat: $C3 = \frac{B3}{F3} \cdot Z_{air}$

where

Z_{air} is the compressibility of air = 0.9996

Gas density ideal

Ideal gas density is the ideal mass per cubic meter, and is calculated as follows:

Gas density ideal dry: $D1 = A1 \cdot P/(RT)$

Gas density ideal act: $D2 = A2 \cdot P/(RT)$

Gas density ideal sat: $D3 = A3 \cdot P/(RT)$

where

P is base pressure = 101325 pa

R is constant = 8.314510 J*mol-1* K-1

T is base temperature = 273.15k + 15.5k = 288.65k

Gas density real

Real gas density is real gas mass per cubic meter, and is calculated as follows:

Gas density real dry: $E1 = \frac{D1}{F1}$

Gas density real act: $E2 = \frac{D2}{F2}$

Gas density real sat: $E3 = \frac{D3}{F3}$

Z_{mix} (Compressibility)

Compressibility is a departure from ideal gas behavior. For each compound in the sample, the following is calculated:

Z_{mix} dry: $F1 = 1 - P_b \cdot \left[\frac{\Sigma X_i \cdot b_i - w\% \cdot b_w}{1 - w\%}\right]^2$

Z_{mix} act: $F2 = 1 - P_b \cdot [X_i \cdot bi]^2$

Z_{mix} sat: $F3 = 1 - \left[(1 - 1.74\%) \cdot \left[\frac{\Sigma X_i \cdot b_i - w\% \cdot b_w}{1 - w\%}\right] + 1.74\% \cdot b_w\right]^2 \cdot P_b$

where

Pb is the base pressure =14.696 psi

Xi is the mole fraction of component of i

bi is the summation factor of component i

bw is the summation factor of water

w% is the mole fraction of actual water

1.74% is the mole fraction of saturated water

H Gross volume ideal

H Gross volume ideal is the ideal gas volume based, gross heating value, and is calculated as follows:

H Gross volume ideal dry: $G1 = \frac{G2 - w\% \cdot H_{wv}}{1 - w\%}$

H Gross volume ideal act: $G2 = \Sigma X_j \cdot H_{s\_j}$

H Gross volume ideal sat: $G3 = G1 \cdot (1\text{-}1.74\%) + 1.74\% \cdot H_{wv}$

where

Xj is the mole fraction of component j

Hs_j is the gross heating value of component j

Hwv is the gross water heating value

W% is the mole fraction of actual water

1.74% is the saturated water mole fraction

H Gross volume real

H Gross volume real is the real gas gross heating value, and is calculated as follows:

H Gross volume real dry: $H1 = \frac{G1}{F1}$

H Gross volume real act: $H2 = \frac{G2}{F2}$

H Gross volume real sat: $H3 = \frac{G3}{F3}$

H Net volume ideal

H Net volume ideal is the ideal gas volume based, net heating value, and is calculated as follows:

H Net volume ideal dry: $I1 = \frac{I2 - w\% \cdot H_w}{1 - w\%}$

H Net volume ideal act: $I2 = \Sigma X_j \cdot H_{i\_j}$

H Net volume ideal sat: $I3 = I1 \cdot (1\text{-}1.74\%)$

where

Xj is the mole fraction of component j

Hi_j is the net heating value of component j

H Net volume real

H Net volume real is the real gas volume based, net heating value, and is calculated as follows:

H Net volume real dry: $J1 = \frac{I1}{F1}$

H Net volume real act: $J2 = \frac{I2}{F2}$

H Net volume real sat: $J3 = \frac{I3}{F3}$

H Gross Mass

H Gross Mass is the real gas mass based, gross heating value, and is calculated as follows:

H Gross Mass dry: $K1 = \frac{K2 - w\% \cdot H_{wm} \cdot \frac{M_w}{M}}{1 - w\% \cdot \frac{M_w}{M}}$

H Gross Mass act: $K2 = \Sigma X_j \cdot \frac{M_j}{M} \cdot H_{s\_j.mass}$

H Gross Mass sat: $K3 = K1 \cdot \left(1\text{-}1.74\% \cdot \frac{M_w}{M}\right) + 1.74\% \cdot \frac{M_w}{M} \cdot H_{wm}$

where

Xj is the mole fraction of component j

Hs_j.mass is the mass based gross heating value of component j

Mj is the molar mass of component j

M is the molar mass of act real gas

Hwm is the water mass based gross heating value

W% is the actual water mole fraction

1.74% is the mole fraction of saturated gas

H Net Mass

H Net Mass is the real gas mass based, net heating value, and is calculated as follows:

H Net Mass dry: $L1 = \dfrac{L2 - w\% \cdot H_{wm} \cdot \dfrac{M_w}{M}}{1 - w\% \cdot \dfrac{M_w}{M}}$

H Net Mass act: $L2 = \Sigma X_j \cdot \dfrac{M_j}{M} \cdot H_{i\_j.mass}$

H Net Mass sat: $L3 = L1 \cdot \left(1\text{-}1.74\% \cdot \dfrac{M_w}{M}\right)$

where

Xj is the mole fraction of component j

Hi_j.mass is the mass based net heating value of component j

Mj is the molar mass of component j

M is the molar mass of act real gas

Hwm is the water mass based gross heating value

W% is the actual water mole fraction

1.74% is the mole fraction of saturated gas

H Gross molar

H Gross molar is the molar based, gross heating value, and is calculated as follows:

H Gross molar dry: $M1 = \dfrac{M2 - w\% \cdot H_{wm}}{1 - w\%}$

H Gross molar act: $M2 = \Sigma X_j \cdot H_{s\_j.molar}$

H Gross molar sat: $M3 = M1 \cdot (1\text{-}1.74\%) + 1.74\% \cdot H_{wm}$

where

Xj is the mole fraction of component j

Hs_j.molar is the molar based gross heating value of component j

Hwn is the water molar based gross heating value

W% is the actual water mole fraction

1.74% is the mole fraction of saturated gas

H Net molar

H Net molar is the molar based, net heating value, and is calculated as follows:

H Net molar dry: $N1 = \frac{N2 - w\% \cdot H_w}{1 - w\%}$

H Net molar act: $N2 = \Sigma X_j \cdot H_{i\_j.molar}$

H Net molar sat: $N3 = N1 \cdot (1\text{-}1.74\%)$

where

Xj is the mole fraction of component j

Hi_j.molar is the molar based net heating value of component j

Hwn is the water molar based gross heating value

W% is the actual water mole fraction

1.74% is the mole fraction of saturated gas

Wobbe index, real

Wobbe index is the real gas based on gross heating value

Wobbe index, real dry: $O1 = \frac{H1}{\sqrt{C1}}$

Wobbe index, real act: $O2 = \frac{H2}{\sqrt{C2}}$

Wobbe index, real sat: $O3 = \frac{H3}{\sqrt{C3}}$

Spec. volume, real

Spec. volume, real is reciprocal of real gas density

Spec. volume, real dry: $P1 = 1/(E1)$

Spec. volume, real act: $P2 = 1/(E2)$

Spec. volume, real sat: $P3 = 1/(E3)$

GPM total, real

GPM total, real is the liquid volume equivalent, expressed as gallons per 1,000 cubic feet of gas:

GPM total, real dry: $Q1 = \frac{Q_{act} - W\% \cdot GPM_w}{(1 - W\%)F1}$

GPM total, real act: $Q2 = \Sigma X_i \cdot (GPM_i)/(F2)$

GPM total, real sat: $Q3 = \frac{Q_{dry} \cdot (1\text{-}1.74\%) + 1.74\% \cdot GPM_w}{F3}$

where

Xi is the mole fraction of component i

GPMi is the liquid volume equivalent expressed as gallons per 1,000 cubic feet of gas of component i (Xi*1000*Pb/(Vi*14.696))

Vi = cubic feet per gallon for compound i (this is shown as Vfact in the Component Constants table)

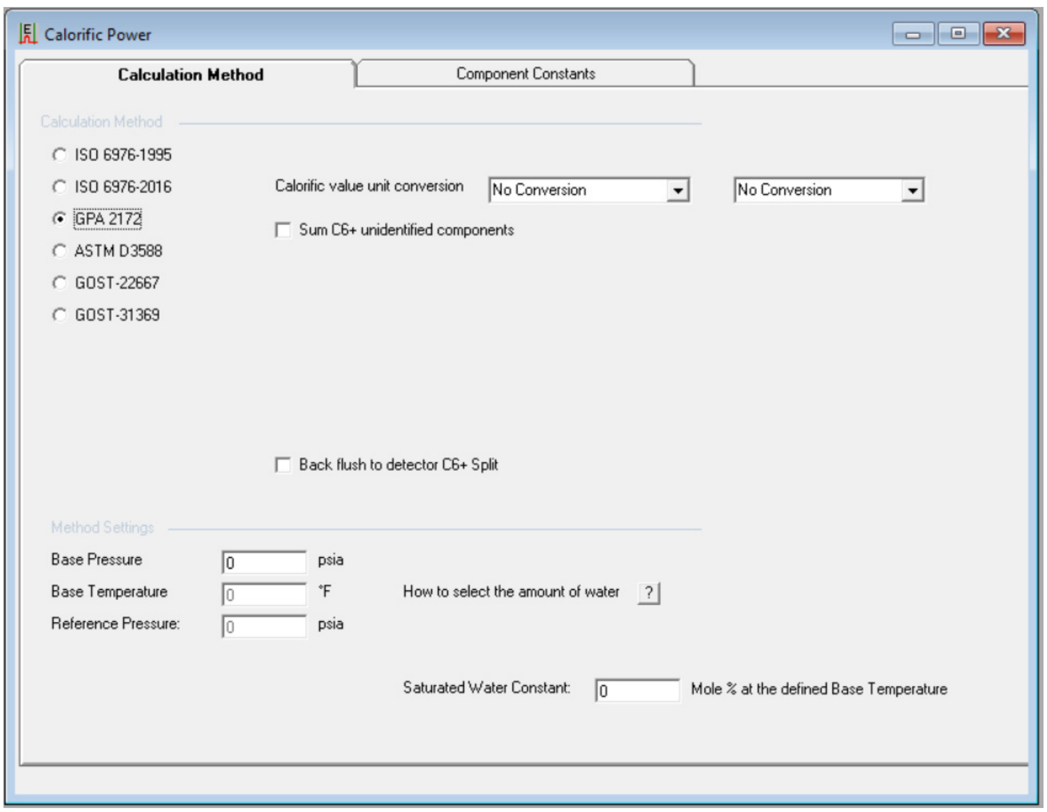
Pb = base pressure

W% is the actual water mole fraction

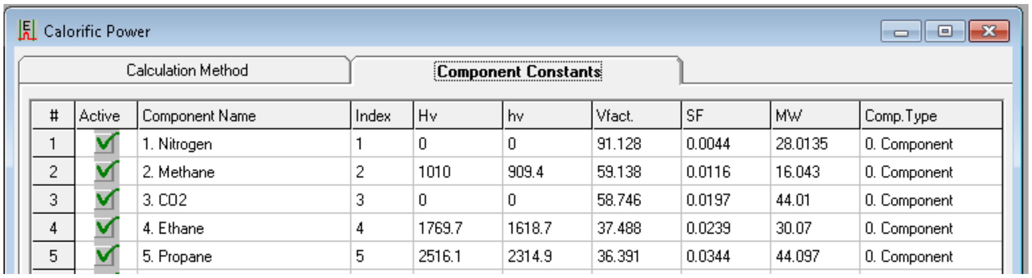
GPMw is the water liquid volume equivalent expressed as gallons per 1,000 cubic feet of gas

GPA 2172

For the calculations based on GPA 2172, selection of the metering temperature and the combustion temperature are defined at 60 °F. It is necessary to input the Base Pressure, normally 14.696 psia (1atm) is used unless a different base pressure is specified (GPA 2172 cites other common base pressures as 14.65psia, 14.73psia, and 15.025psia).



In addition to the **Component Name**, the **Component Constants** tab shows the following in the table. Check the values being used with the standard being used. You may be required to use a specific standard defined by publication year.



Hv is the Gross Heating Value, **hv** is the Net Heating Value, **Vfact**. is the Volume expressed as Ft3 ideal gas/gal liquid, **SF** is the summation factor, and **MW** is the molecular weight.

Comp. Type is a special variable which allows the user to calculate the calorific value for the natural gas which is partially saturated or has additional air. The use of estimates for water is described in section **Accounting for water - partially saturated natural gas** on page 183. The use of an estimate for air is highlighted in section **Using an estimate air concentration** on page 177.

Check the values being used with the standard being used. You may be required to use a specific standard defined by publication year.

The following calculations are now provided and reported (in the application report and webpage) for GPA 2172 and are shown in **Table 6**.

Table 6 GPA 2172 report calculations

GPA 2172 Application report parameter	Unit	Description (Natural gas sample being tested, unless noted otherwise)
Compressibility		Departure from ideal gas behavior
Molar mass	lb/lbmol	Molecular weight
Molar mass ratio		The ratio of the molar mass to the molecular weight of air (relative density for ideal gas)
Hv act	Btu/ft^3	Gross heating value
Hv dry	Btu/ft^3	Gross heating value for dry real gas
Hv wet	Btu/ft^3	Gross heating value for water saturated real gas
hv act	Btu/ft^3	Net heating value
hv dry	Btu/ft^3	Net heating value for dry real gas
hv wet	Btu/ft^3	Net heating value for water saturated real gas
S.G.		Specific gravity (Relative density for real gas)
Wobbe	Btu/ft^3	Wobbe index for real gas
Hv act MJ/M^3	MJ/M^3	Gross heating value converted to MJ/M^3
hv act MJ/M^3	MJ/M^3	Net heating value converted to MJ/M^3
Density lb/ft^3	lb/ft^3	Mass density for ideal gas
Spec. volume ft^3/lb	ft^3/lb	1 / mass density for ideal gas
GPM Total gal/1000 ft^3	gal/1000 ft^3	Total gallons of liquid hydrocarbon per thousand cubic feet of gas
GPM per compound gal/1000 ft^3	gal/1000 ft^3	Gallons of liquid per thousand cubic feet of gas calculated on per compound basis

Table 6 GPA 2172 report calculations

GPA 2172 Application report parameter	Unit	Description (Natural gas sample being tested, unless noted otherwise)
Weight % per component		The weight of a compound divided by the sample's total weight expressed as a percentage.

Calculations

Compressibility

For each compound in the sample the following is calculated.

$cf_j = x_j * SF_j$

where

x_i= Mole fraction of compound j

SF_j= summation factor for component j

$CF = \Sigma cf_j$

Compressibility = $1\text{-}CF^2$

Molar mass

Molar mass is calculated by:

Molar mass = $\Sigma\ x_j * M_j$

where

x_j = mole fraction of component j

M_j = molar mass of component j

Molar mass ratio

Molar mass ratio is calculated by dividing the molar mass of the gas mixture by the molar mass of dry air.

Molar mass ratio = Molar mass/28.9626

Gross Btu/ft^3 (Ideal gas dry gas)

Calculated as

$H_v(P_b) = \Sigma\ x_i * H_I(P_b/14.696)$

where

x_i = mole fraction of component i

$H_i(t_i)$ = Gross BTU/ft3 of compound i at temp ti

P_b = Base pressure

The total heat value of the mixture is the sum of each mole fraction multiplied by the calorific value of the compounds in the mixture.

Gross Btu /ft^3 (Real gas dry gas)

Calculated as

$Hv(dry) = ? [x_i * H_l^{id}(Pb/14.696)]/z_i$

where

x_i = mole fraction of component i

H_i^{id} = Gross BTU/ ft^3 of compound i

P_b = Base pressure

z_i = Compressibility of for the gas

Gross Btu /Ft^3 (Real gas wet gas)

Hv wet is then calculated as

$Hv^{id}(wet) = (1-x_w)*Hv^{id}(dry)$

$x_w = P_w^{sat}/P_b$

At 60 °F the vapor pressure of water is 0.25640 psia.

$P_w = 0.25640$

Net Btu /Ft^3 (Ideal gas dry gas)

Calculated as

$h_v(P_b) = \Sigma\, x_i * h_l(P_b/14.696)$

where

x_i = mole fraction of component i

$h_i(t_i)$ = net BTU/ft^3 of compound i at temp t_i

P_b = Base pressure

The total heat value of the mixture is the sum of each mole fraction multiplied by the calorific value of the compounds in the mixture.

Net Btu /ft^3 (Real gas dry gas)

Calculated as

$hv^{id}(dry)= \Sigma\, [x_i * H_l^{id}(P_b/14.696)]/z_i$

where

x_i = mole fraction of component i

h_i^{id} = Net BTU/ft^3 of compound i

P_b = Base pressure

z_i = Compressibility of for the gas

Net Btu /ft^3 (Real gas wet gas)

hv wet is then calculated as

$Hv^{id}(wet) = (1-x_w)*Hv^{id}(dry)$

$x_w = P_w^{sat}/P_b$

At 60 °F the vapor pressure of water is 0.25640 psia.

Specific gravity

Specific gravity is also known as relative density and is calculated from the molar mass.

$d° = \Sigma\, x_j * [M_j / M_{air}]$

where

d° = relative density of the ideal gas

M_j = molar mass of component j

M_{air} = 28.9626 kg*kmol-1 (molar mass of dry air of standard composition)

The relative density for a real gas is then calculated as

$SG = d° * (z_{air} / z_{sample})$

where

z_{air} = compression factor for air at t1

z_{sample} = compression factor for the sample at t1

Wobbe index

Wobbe = Hv act/√Rel. Density

Hv act MJ/M3

To convert from BTU/CF to MJ/M3

Convert Hv act from btu ft^{-3} to MJ/m^{-3}

= Hv act *(1055.0559 Joules/BTU * (1/ 0.0283168 m^3/ft^3)

hv act MJ/M3

To convert from BTU/CF to MJ/M3

Convert hv act from btu ft^{-3} to MJ/m^{-3}

= hv act *(1055.0559 Joules/BTU * (1/ 0.0283168 m^3/ft^3)

Density

The density of the ideal gas

$$\rho°(t,p) = \left(\frac{P}{(R \cdot T)}\right)(\Sigma x_j \cdot M_j)$$

where

$\rho°(t,p)$ = density of the ideal gas

$R = 8.314510\ J*mol^{-1} * K^{-1}$

$T = t + 273.15$ °K

where

T = temperature in °K

t = temperature in °C

The density of the real gas is calculated from

$\rho(t,p) = \rho°(t,p) / Z_{mix} (t,p)$

where

$Z_{mix} (t,p)$ = compressibility factor of the gas mixture

This is then converted to lb/ft^3.

Specific volume

Specific volume = 1/Density

GPM total

This is the liquid volume equivalent expressed as gallons per 1000 cubic feet of gas

$$GPM = \sum_{I=1}^{N} (x_i *1000) * P_b) / (V_i *14.696)$$

x_i = mole fraction of compound I

V_i = Cubic feet per gallon for compound I (this is shown as **Vfact.** in the **Component Constants** table)

P_b = Base pressure

N = number of components

ASTM D3588

For the calculations based on ASTM D3588, selection of the metering temperature and the combustion temperature are necessary. The ASTM calculations are the same as the GPA calculations. The Application Report provides the same calculations as the GPA Application Report. The application D3588.papp has the values from Figure 258 in the ASTM D3588 standard. These are based on the ASTM D3588-1989 version. Footnote A of Table 1 shown in Figure 258 states: This table is consistent with GPA 2145-89, but it is necessary to use the values from the most recent edition of GPA 2145 for custody transfer calculations.

Calorific Power

Calculation Method | **Component Constants**

#	Active	Component Name	Index	Hv	hv	Vfact.	SF	MW	Comp.Type
1	✓	1. Methane	1	1010	909.4	59.138	0.0116	16.043	0. Component
2	✓	2. Ethane	2	1769.7	1618.7	37.488	0.0239	30.07	0. Component
3	✓	3. Propane	3	2516.1	2314.9	36.391	0.0344	44.097	0. Component
4	✓	4. i-Butane	4	3251.9	3000.4	30.637	0.0458	58.123	0. Component
5	✓	5. n-Butane	5	3262.3	3010.8	31.801	0.0478	58.123	0. Component
6	✓	6. i-Pentane	6	4000.9	3699	27.414	0.0581	72.15	0. Component
7	✓	7. n-Pentane	7	4008.9	3703.9	27.658	0.0631	72.15	0. Component
8	✓	8. n-Hexane	8	4755.9	4403.9	24.38	0.0802	86.177	0. Component
9	✓	9. n-Heptane	9	5502.5	5100.3	21.73	0.0944	100.204	0. Component
10	✓	10. n-Octane	10	6248.9	5796.2	19.57	0.1137	114.231	0. Component

Figure 119. Component Constants for ASTM D3588 Table 1

Updating the application file with GPA 2145 updates for custody transfer calculations

Comparing the Component Constants to GPA 2145-09 does show some differences. Using n-pentane as an example, the value of Hv (Gross Heating Value) has changed from 4008.9 to 4008.7, the value of hv (Net Heating Value) has changed from 3703.9 to 3707, the value of SF (Summation Factor) has changed from 0.0631 to 0.0606, and MW (Molecular Weight) from 72.15 to 72.1488. The updated values can be entered by clicking on the cell and entering the updated value.

The Summation Factor for Air have also been updated. See **Figure 120**.

Calorific Power

Calculation Method | **Component Constants**

#	Active	Component Name	Index	Hv	hv	Vfact.	SF	MW	Comp.Type
20	✓	20. Air	20	0	0	95.678	0.005	28.9625	0. Component

Figure 120. Component Constants for Air

Using an estimate air concentration

The Summation Factor for Air has changed from 0.0050 to 0.00537. The 0.0050 value is used in the Energy Calculation, unless the air is used as an estimated concentration.

The PROstation also provides a means to use an estimated concentration of air. The application is setup for calculating the air using a different Summation Factor as follows.

If necessary, air is added to the **Normalization Table** and can either have an absolute value to be provided in the **Estim. Conc** field (**Estimate** must be checked) or the concentration can be set relative to an identified peak (add index number to **RefConcPeak#** field) and a fixed percentage peak (add % number to **RefPeakConc%** field) of that peak. See **Figure 121**.

Normalization Table

#	Active	Peak Name	Channel	Ignore	Bridge Comp #	Estimate	Estim.Conc	Test.Conc	RefConcPeak#	RefPeakConc%
1	✓	Methane	1		0. None		0	83.9362	0	0
2	✓	Ethane	1		0. None		0	9.8111	0	0
3	✓	Propane	2		0. None		0	2.6999	0	0
20	✓	Air	1		0. None	✓	0	0	0	0

Figure 121. Normalization table

When using the **Estimate** feature, air is not required in the **Peak Identification Table**, only the **Normalization Table**. See **Figure 122**.

Peak Identification / Calibration: Channel 1

#	Active	Peak Name	ID	Ret.Time	Rel.Ret.Window	Abs.Ret.Window	Reference	Selection Mode	Rel.Ret.Peak	Level 1
1	✓	Nitrogen	1	24.85	5	5		0. Nearest		6.5
2	✓	Methane	2	25.63	5	5		0. Nearest		69
3	✓	CO2	3	33.36	5	5		0. Nearest		1
4	✓	Ethane	4	40.3	5	5		0. Nearest		9

Figure 122. Peak Identification table

In the **Calorific Power** under the **Component Constants** table, **Comp. Type** is set by selecting **1**. Air from the drop down list. Either update the Summation Factor for Air or add the necessary values for the physical constants for Air to the table. Save the application. Download this application and then upload the application to check the values again.

GOST 22667

When GOST 22667 is selected, the **Calculation Method** tab shows the following screen. GOST 22667 does not require the selection of metering temperature and the combustion temperature. See **Figure 123**.

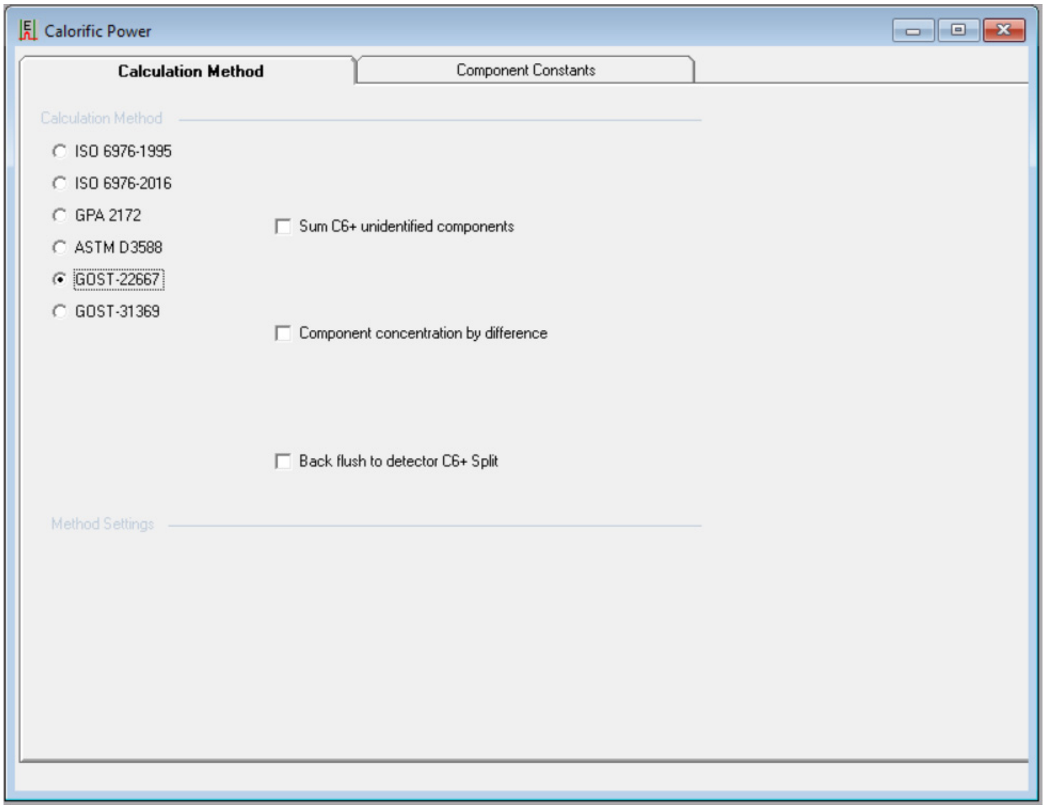


Figure 123. Calorific Power - Calculation Method

The Component Constants table has three columns. Hs(r) is the maximum heating value, **Hi(r)** is the minimum heating value, and **Rel.Density** is the relative density for each of the components. See **Figure 124**.

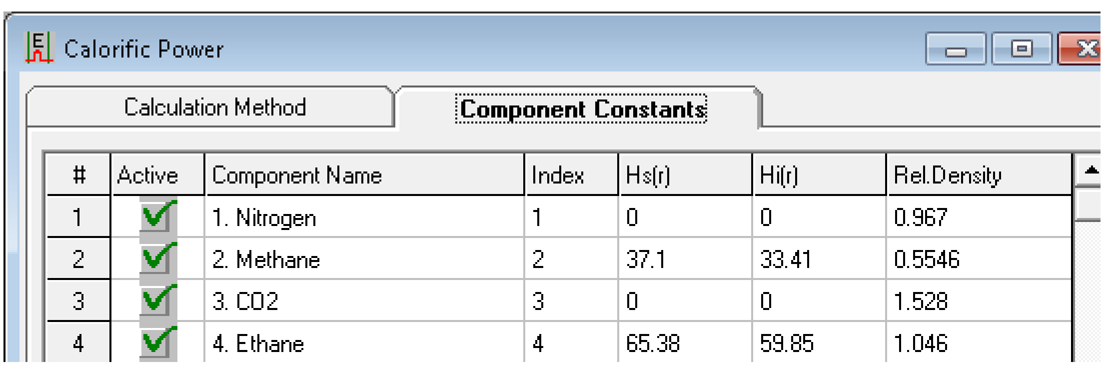


Figure 124. Calorific Power - Component Constants

The temperature used in the calculations is defined by the values used in the **Component Constants**. These values are for a combustion temperature of either 0 °C or 20 °C. The standard provides the maximum heating and minimum heating values in either MJ/m3 or kcal/m3 and the relative density. For the purposes of the calculations, the air density is accepted to be 1, and the heating values include each component's compressibility factor. The user must check the values against the standard to verify the correct values are being used.

See **Sum C6+ unidentified components** on page 184 and **Component concentration by difference** on page 188 for further discussion of these topics.

The following calculated results for the gas sample are reported in the Application report for GOST - 22667.

Rel. Density

Hs (Maximum heat value) in MJ/m^3 or kcal/m^3

Hi (Minimum heat value) in MJ/m^3 or kcal/m^3

Wobbe sup. (Wobbe index for maximum heat value) MJ/m^3 or kcal/m^3

Wobbe inf. (Wobbe index for minimum heat value) MJ/m^3 or kcal/m^3.

Calculations

Maximum heat value (Molar)

Hs(t1) = xi * Hi(t1)

where

xi = mole fraction of component i

Hi(ti) = maximum calorific value for 1 mole of i at temp tI

The total heat value of the mixture is the sum of each mole fraction × the calorific value of components in the mixture.

Minimum heat value (Molar)

Hi(t1) = xi * Hi(t1)

where

xi = mole fraction of component i

Hi(ti) = minimum calorific value for 1 mole of i at temp tI

The total heat value of the mixture is the sum of each mole fraction × the calorific value of components in the mixture.

Relative Density

For each compound in the sample the following is calculated.

$sg_i = x_i$ *(MWi/MWAir) where

x_i= Mole fraction of compound i

All of the sg's are summed to give the sum SG

Relative Density = Σ xi * (MW_i/MW_{Air})

Wobbe Index

The Wobbe Index is calculated for the gas sample:

Wobbe = Heat Value (Maximum or Minimum)/√(Relative Density)

The GOST standard allows the Wobbe index to be reported as the Maximum and Minimum values in either MJ/m^3 or kcal/m^3.

GOST 31369

The availability of this functionality depends on your license.

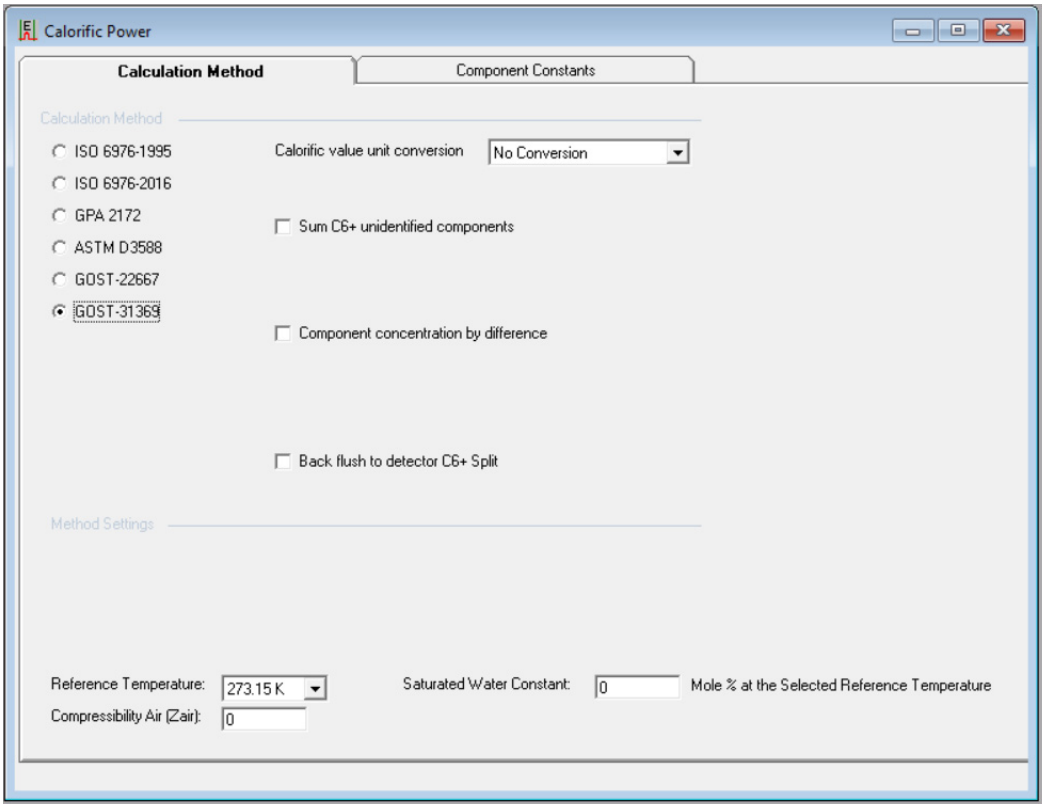


Figure 125. GOST 31369 Calculation Method

GOST 31369 Standard was published in 2008 and is substantially based on ISO 6976. Therefore, calculations require the selection of the metering temperature and the combustion temperature. On the **Calculation Method** screen, the **Reference Temperature** provides three choices of temperature:

- 273.15 K (0 °C)
- 288.15 K (15 °C)
- 293.15 K (20 °C)

These correspond to the metering temperatures defined in ISO 6976. The **Compressibility Air (Zair)** is also needed for the calculations and is linked to the temperature.

- 273.15 K (0.99941)
- 288.15 K (0.99958)
- 293.15 K (0.99963)

Along with the metering temperature, the combustion temperature is required to define the values used in the Component Constants table. The user should check the values being used with the standard being used.

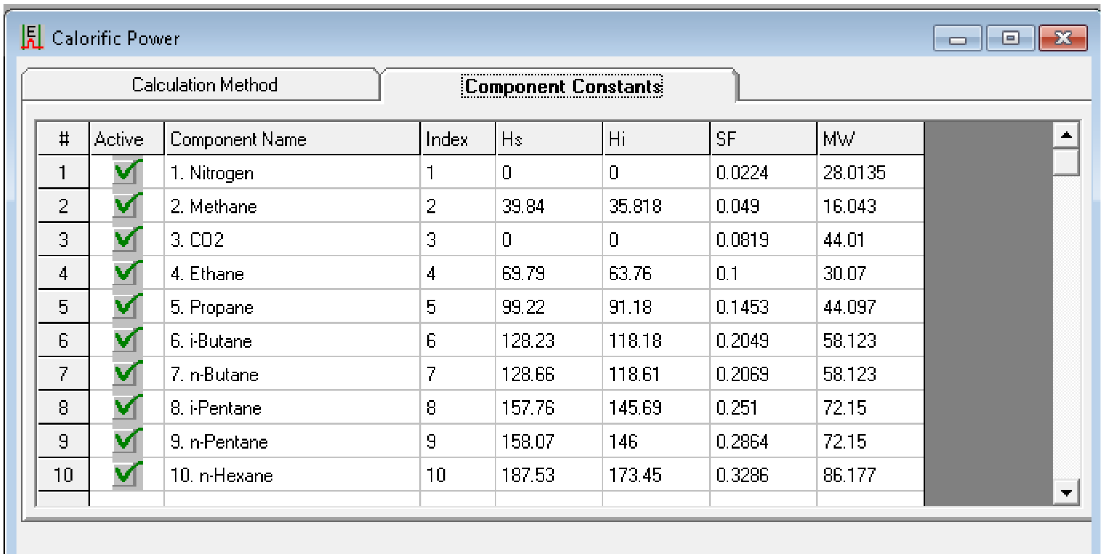


Figure 126. GOST 31369 Component Constants

The Superior Heating Value (Hs) and Inferior Heating Value (Hi) are defined by the choice of the metering temperature and the combustion temperature, the Summation Factor (SF) is defined by the metering temperature and MW is the molecular weight of the component. The instrument calculates physical properties of the gas on volumetric base, therefor component specific values for Hs and Hi from **Table 7** in GOST 31369 should be used. The heating values are given in MJ m-3.

In the Application Report and on the instrument's webpage, the following results are presented for Energy:

Table 7 GOST 31369 component values

GOST 31369 Application report parameter	Unit*	Description (for the Natural Gas sample being tested, unless noted otherwise)
Compressibility		Departure from ideal gas behavior
Molar mass	kg/kmol	Molecular weight
Molar mass ratio		The ratio of the molar mass to the molecular weight of air
Relative density		Density relative to density of air
Absolute density	Kg/m^3	Mass/Volume at specified temperature and pressure
Hs	MJ/m^3	Superior heating value
Hi	MJ/m^3	Inferior heating value
Wobbe superior	MJ/m^3	Wobbe index based on superior heating value
Wobbe inferior	MJ/m^3	Wobbe index based on inferior heating value

* Note: displayed units from GOST 31369.

Discussion of the calculations and conversion to other units are covered in **ISO 6976-1995 / GOST 31369** on page 154. See **Sum C6+ unidentified components** on page 184 and **Component concentration by difference** on page 188 for further discussion of these topics.

Accounting for water - partially saturated natural gas

The PROstation also provides a means to use an estimated concentration of water. Selecting ASTM 3588 or GPA 2172 in the Calorific Power Calculation Method panel gives information on how to estimate the water. See **Figure 127**.

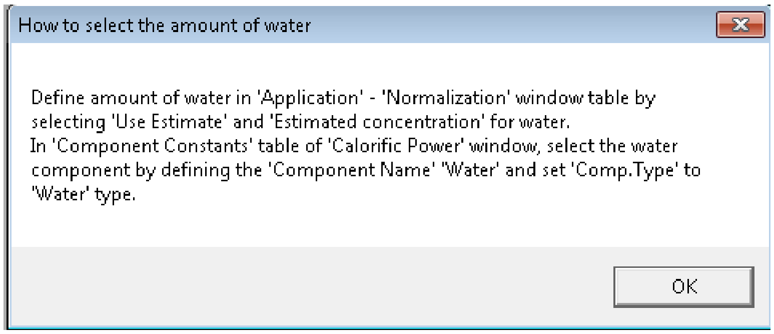
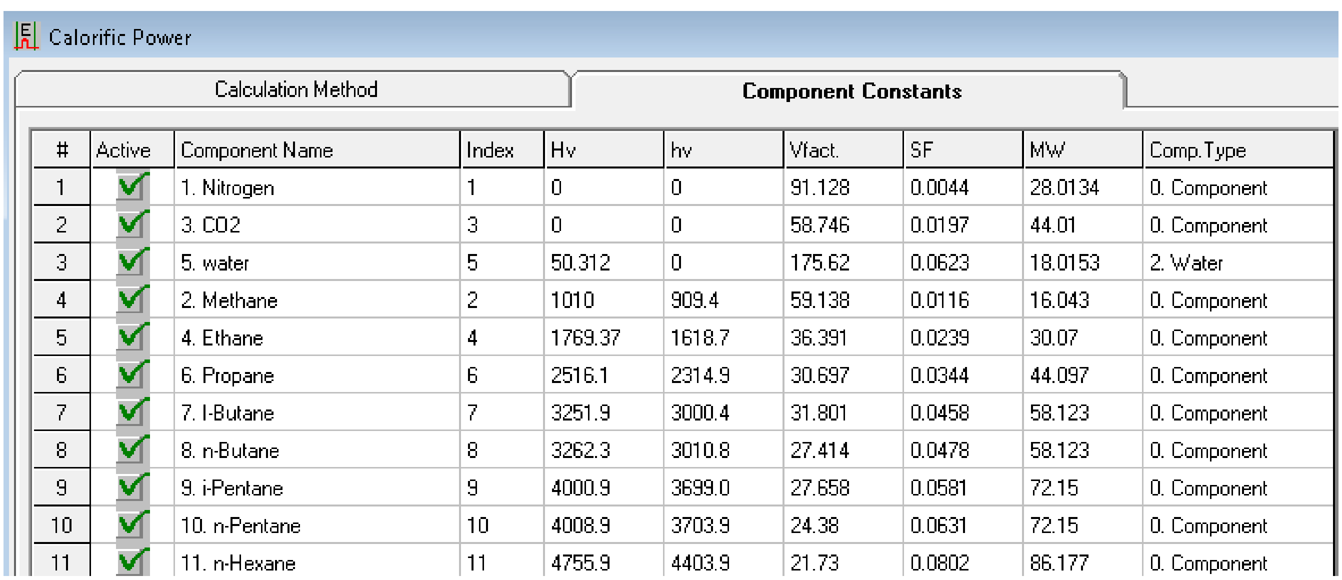


Figure 127. How to select water amounts

The application is setup for calculating the water in a partially saturated sample as follows.

Water is added to the **Normalization Table**, and can either have an absolute value to be provided in the **Estim. Conc** field (**Estimate** must be checked) or the concentration can be set relative to an identified peak (add index number to **RefConcPeak#** field) and a fixed percentage peak (add % number to **RefPeakConc%** field) of that peak.

In the **Calorific Power** under the **Component Constants** table, **Comp. Type** is set to **2. Water** for the water entry by selecting 2. Water from the drop down list for **Comp. Type**. Add the necessary values for the physical constants for water to the table. Save the application. Download this application and then upload the application to check the values again. See **Figure 128**.



#	Active	Component Name	Index	Hv	hv	Vfact.	SF	MW	Comp.Type
1	✓	1. Nitrogen	1	0	0	91.128	0.0044	28.0134	0. Component
2	✓	3. CO2	3	0	0	58.746	0.0197	44.01	0. Component
3	✓	5. water	5	50.312	0	175.62	0.0623	18.0153	2. Water
4	✓	2. Methane	2	1010	909.4	59.138	0.0116	16.043	0. Component
5	✓	4. Ethane	4	1769.37	1618.7	36.391	0.0239	30.07	0. Component
6	✓	6. Propane	6	2516.1	2314.9	30.697	0.0344	44.097	0. Component
7	✓	7. I-Butane	7	3251.9	3000.4	31.801	0.0458	58.123	0. Component
8	✓	8. n-Butane	8	3262.3	3010.8	27.414	0.0478	58.123	0. Component
9	✓	9. i-Pentane	9	4000.9	3699.0	27.658	0.0581	72.15	0. Component
10	✓	10. n-Pentane	10	4008.9	3703.9	24.38	0.0631	72.15	0. Component
11	✓	11. n-Hexane	11	4755.9	4403.9	21.73	0.0802	86.177	0. Component

Figure 128. Component Constants - Water

When the application report is displayed, the energy calculations show Hv act, Hv dry, and Hv wet. See **Figure 129**

Hv Act is the calculation that includes the water concentration and Hv dry compensates for the water amount. In this example the water concentration is 0.3 %, the Hv dry is calculated by dividing the Hv act by 0.997 which is [1/(1 - 0.003)] or in % [100/(100-0.3)]. Hv act is the ideal Hv adjusted for the. 0.3 % water. Hv act = Hv ideal - [(0.3*50.312)/100]

Hv act	1308.37164
Hv dry	1312.06626
Hv wet	1289.70388
hv act	1190.09155
hv dry	1193.59047
hv wet	1173.24734

Figure 129. Energy calculations

Sum C6+ unidentified components

Summing C6+ unidentified components must be used in combination with setting the **RF unknown peaks** to **Relative** in the **Method Calibration** window.

When **Calorific Power** is selected from the drop down for **Application**, the following screen appears. The top half of the screen under **Calculation Method** allows the user to select the calculation type. There is also a checkbox which can be selected to **Sum C6+ unidentified components**. See **Figure 130**.

Hv act	1308.37164
Hv dry	1312.06626
Hv wet	1289.70388
hv act	1190.09155
hv dry	1193.59047
hv wet	1173.24734

Figure 130. Sum 6+ unidentified components

Since the Micro GC does have back flush-to-detector it is necessary that *n*-hexane, and all peaks that elute beyond the C6 are summarized. The standards do provide for the grouping of the components by providing physical constant data for hexanes and heptanes. These values can be used for the summed peaks.

When using a TCD, it is appropriate to use different response factors for the components since the thermal conductivity has a molecular weight dependence.

Typically, for saturated hydrocarbons, the isomers of the *n*-alkane elute prior to the respective *n*-alkane. For example, it would be appropriate to use the response factor for *n*-hexane for the hexane isomers, 2-methylpentane, 3-methylpentane, 2,2-dimethylbutane, and 2,3-dimethylbutane. The isomers of n-heptane would then use the response factor of n-heptane, etc. See **Figure 131**.

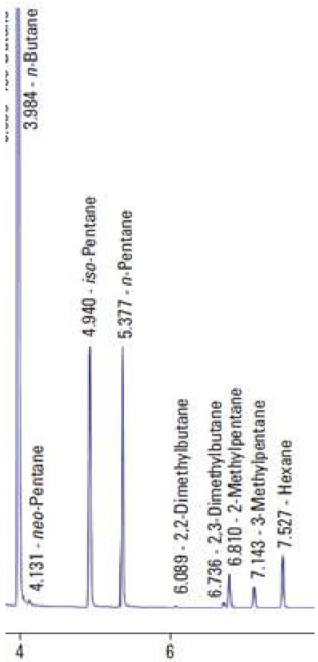


Figure 131. Elution order of the hexane isomers. (Chromatogram from application note for 7890)

However, if aromatic components are in the mixture, it is appropriate to exclude these components since the heating value is significantly different. **Table 8** is an excerpt from ISO 6976, Table 5. As can be seen, the aromatic compounds are significantly different from the alkanes in heating value for the same carbon number. With *n*-Hexane, Benzene, *n*-heptane, and *n*-octane identified and not excluded, the following regions are used for the response factors. See **Figure 132** on page 186.

Table 8 ISO 6976 Table 5 excerpt

Compound	Carbon number	Superior 15 °/15 °C MJ/m^3
n-Hexane	6	177.55
2-Methylpentane	6	177.23
3-Methylpentane	6	177.34
2,2-Dimethylbutane	6	176.82
2,3-Dimethylbutane	6	177.15
Benzene	6	139.69
n-Heptane	7	205.42
Toluene	7	167.05
n-Octane	8	233.28
Ethylbenzene	8	194.95
o-Xylene	8	194.49

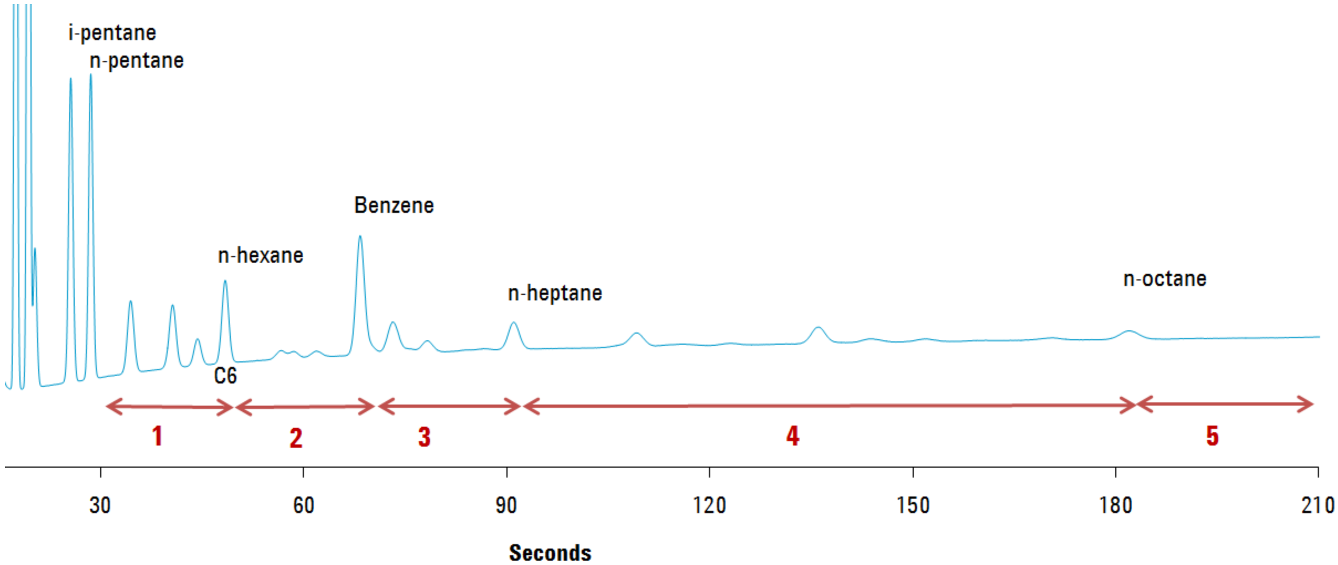


Figure 132. Response factors sorted by regions 1-5

Figure 132 shows region **1** includes the unidentified peaks eluting after n-pentane and up to and including n-hexane, **2** includes the unidentified peaks eluting after n-hexane and up to and including Benzene, **3** includes the unidentified peaks eluting after Benzene and up to and including n-heptane, **4** includes the unidentified peak eluting after n-heptane and up to and including n-octane, **5** is the region after the last identified peak. Region **1** uses the response factor for n-hexane, region **2** uses the response factor for Benzene, region **3** uses the response factor for n-heptane, region **4** uses the response factor for n-octane, and region **5** uses the response factor for n-octane since it is the last identified peak.

As one can see in **Table 7** on page 182 this will lead to erroneous values for the calculated amounts and calorific values. If the option is used to exclude a peak from the summation algorithm, for example, Benzene is excluded the earlier mentioned regions are redistributed a bit. (See **Figure 133** on page 187.) Region **2** is now allocated to Benzene only while Region **3** is expanded to include all unidentified peaks eluting right after n-Hexane up to and including n-Heptane.

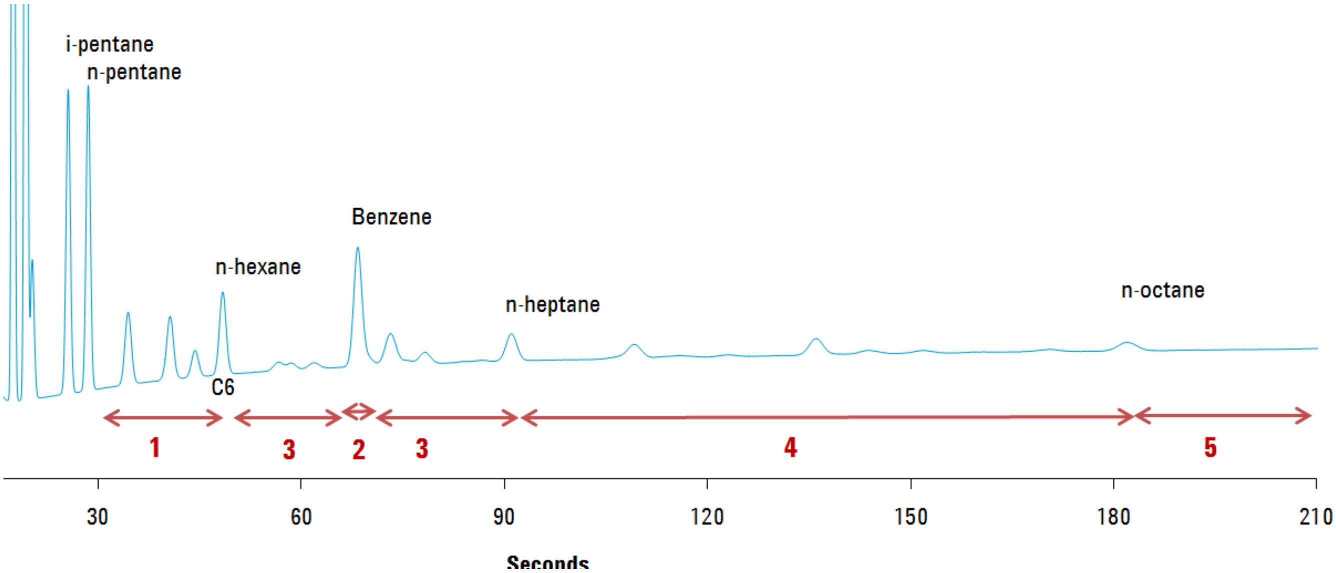


Figure 133. Response factor excluding a peak

The Integration Report shows the unidentified peaks, and the Application Report will show the summed unidentified peaks as part of the normalized amount for n-Hexane and n-Heptane and n-Octane and other identified peaks that are not excluded.

Normalization Table

#	Active	Peak Name	Channel	Ignore	Bridge Comp #	Estimate	Estim.Conc	Test.Conc	RefConcPeak#	RefPeakConc%	Group#
1	✓	Nitrogen	1		0. None		0	0	0	0	0
2	✓	Methane	1		0. None		0	0	0	0	0
3	✓	CO2	1		0. None		0	0	0	0	0
4	✓	Ethane	1		0. None		0	0	0	0	0
5	✓	water	1		0. None	✓	0.3	0	0	0	0
6	✓	Propane	2		0. None		0	0	0	0	0
7	✓	I-Butane	2		0. None		0	0	0	0	0
8	✓	n-Butane	2		0. None		0	0	0	0	0
9	✓	i-Pentane	2		0. None		0	0	0	0	0
10	✓	n-Pentane	2		0. None		0	0	0	0	0
11	✓	n-Hexane	2		0. None		0	0	0	0	0

Figure 134. Normalization Table - water

When using the **Estimate** feature, water is not required in the **Peak Identification** table, only the **Normalization Table**.

Peak Identification / Calibration: Channel 1

#	Active	Peak Name	ID	Ret.Time	Rel.Ret.Window	Abs.Ret.Window	Reference	Selection Mode	Rel.Ret.Peak	Level 1
1	✓	Nitrogen	1	24.85	5	5		0. Nearest		6.5
2	✓	Methane	2	25.63	5	5		0. Nearest		69
3	✓	CO2	3	33.36	5	5		0. Nearest		1
4	✓	Ethane	4	40.3	5	5		0. Nearest		9

Figure 135. Peak Identification table

Component concentration by difference

The availability of the Component Concentration by Difference option depends on your license. This option is used to normalize to 100 % using a selectable component. The concentration for the selected component is calculated using the following formula:

Component concentration = 100 % - (Sum all other measured component concentrations + Sum all estimated component concentrations).

The option is enabled using the checkbox. The specific component is selected using the combo boxes.

Application - Verification Check

As part of the automation, on the basis of time or number of runs passed, a verification block can be programmed.

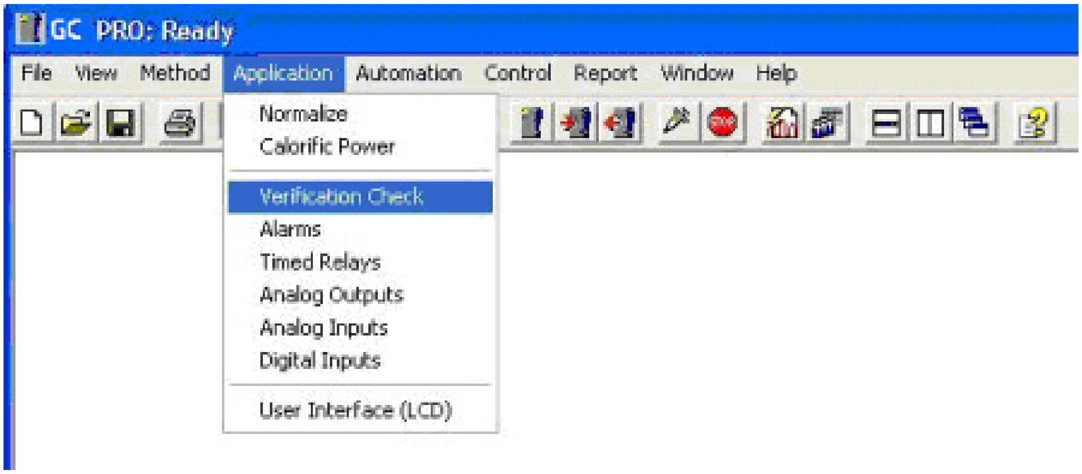


Figure 136. Verification block

The results of this verification will either be reported as a normal sample, identifying the run as a verification run or reported as normal, but also compared to a set of preprogrammed limits.

As part of the application, the user must define limits, against which the verification will be checked. The user can choose from raw results, sample results, or calculated results.

The user must program the appropriate minimum and maximum values. If outside the programmed range, the verification is set negative, initiating a calibration block.

Note that the Verification Table must be set very carefully. Too many variables will likely result in unwanted and unnecessary calibrations. Too few variables might result in unwanted errors. During a verification run, it is possible to check whether parameters are within limits. Such as:

- External standard or normalized concentrations of components listed in the **Application Report**.
- Sample results like sum or group total and bridge component as defined in the **Normalization** window (**Application** menu).
- Analog Inputs using the (sampling) converted values as defined in the **Analog Input** window.
- Calorific Power results as defined in the **Energy Calculation** window (**Application** menu).

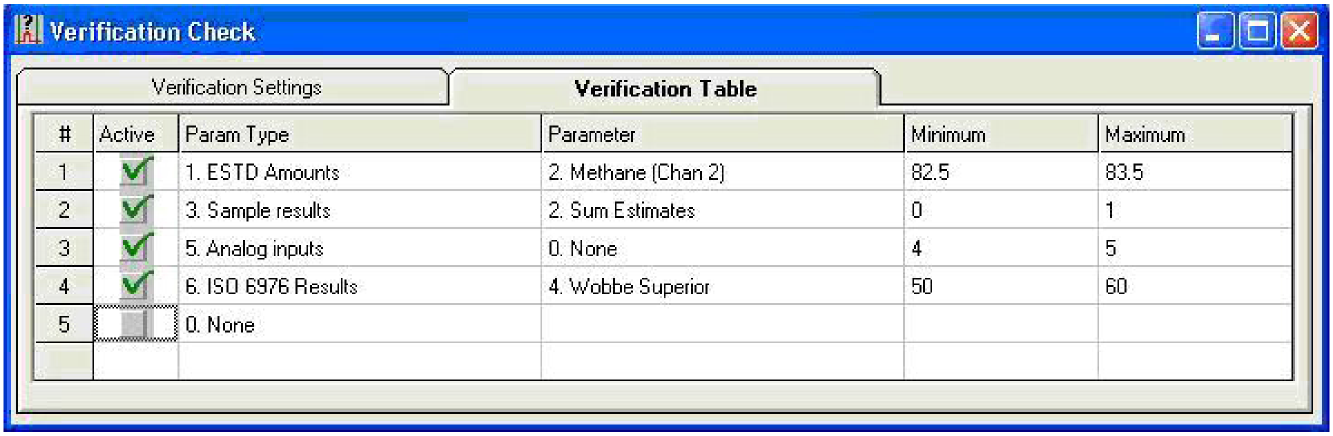


Figure 137. Verification check

A verification check is only performed after the sample calculation of a verification run, either from the Sequence- or Verification Table or Single run.

Enable the Verification Table in the **Settings** tab.

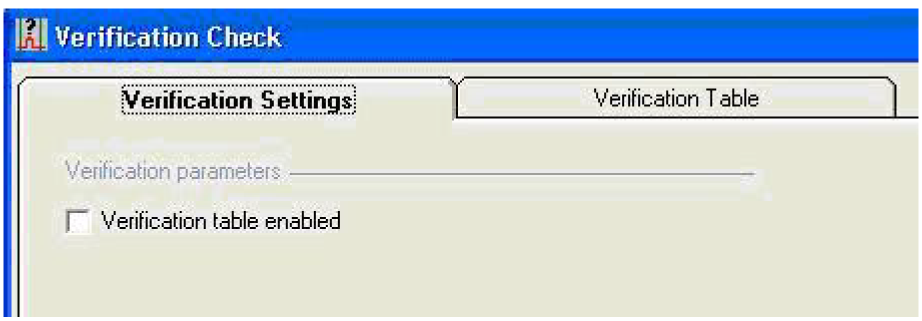


Figure 138. Verification enable

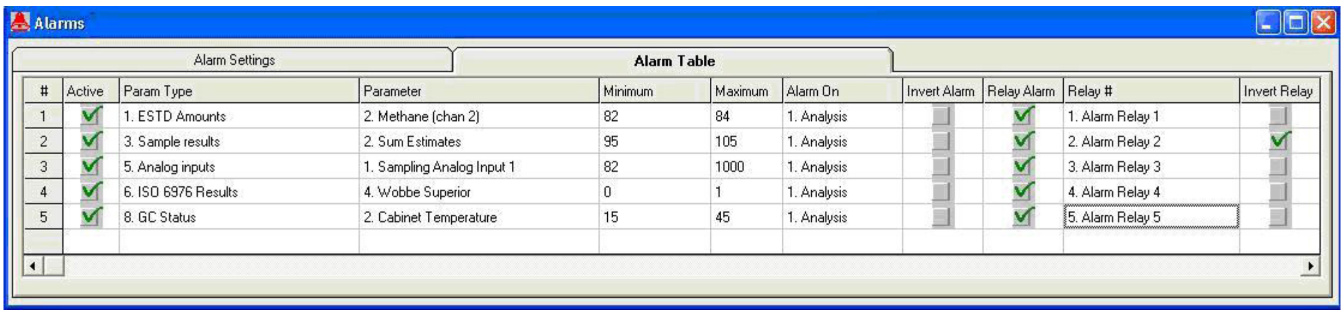
Use the **Download Application** from the **Control** menu to store the Verification settings to the instrument. Only the Activated lines in the Verification Table will be downloaded to the instrument.

Find more information in **Verification run** on page 485.

Application - Alarms

Alarm relays can be used to indicate whether parameters are out of limits. Such as:

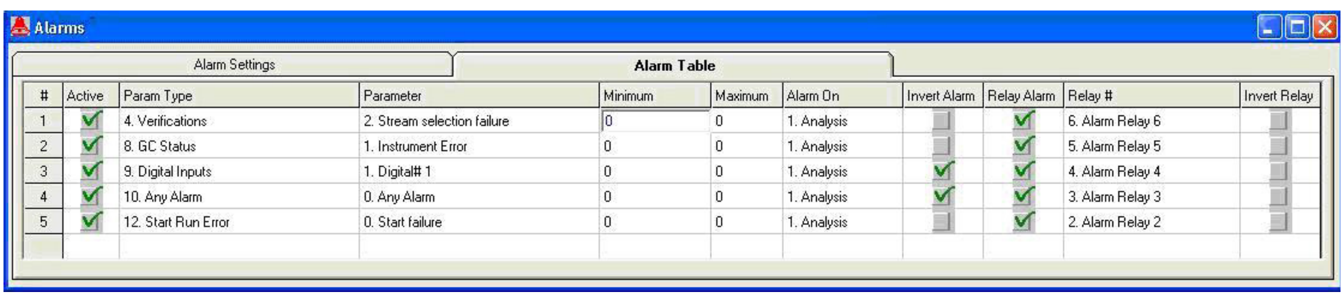
- External standard or normalized concentrations of components listed in the **Application** Report.
- Sample results such as sum or group total and bridge component as defined in the **Normalization** window (**Application** menu).
- Analog Inputs using the (sampling) converted values as defined in the **Analog Input** window.
- Calorific Power results as defined in the **Energy Calculation** window (**Application** menu).
- GC Status such as ambient temperature and pressure.
- External Digital inputs from other devices such as flowmeter.



#	Active	Param Type	Parameter	Minimum	Maximum	Alarm On	Invert Alarm	Relay Alarm	Relay #	Invert Relay
1	✓	1. ESTD Amounts	2. Methane (chan 2)	82	84	1. Analysis		✓	1. Alarm Relay 1	
2	✓	3. Sample results	2. Sum Estimates	95	105	1. Analysis		✓	2. Alarm Relay 2	✓
3	✓	5. Analog inputs	1. Sampling Analog Input 1	82	1000	1. Analysis		✓	3. Alarm Relay 3	
4	✓	6. ISO 6976 Results	4. Wobbe Superior	0	1	1. Analysis		✓	4. Alarm Relay 4	
5	✓	8. GC Status	2. Cabinet Temperature	15	45	1. Analysis		✓	5. Alarm Relay 5	

Figure 139. Alarms

The Minimum and Maximum column entries can be omitted (here left zero). Some parameters do not need maximum and minimum such as digital inputs.



#	Active	Param Type	Parameter	Minimum	Maximum	Alarm On	Invert Alarm	Relay Alarm	Relay #	Invert Relay
1	✓	4. Verifications	2. Stream selection failure	0	0	1. Analysis		✓	6. Alarm Relay 6	
2	✓	8. GC Status	1. Instrument Error	0	0	1. Analysis		✓	5. Alarm Relay 5	
3	✓	9. Digital Inputs	1. Digital# 1	0	0	1. Analysis	✓	✓	4. Alarm Relay 4	
4	✓	10. Any Alarm	0. Any Alarm	0	0	1. Analysis	✓	✓	3. Alarm Relay 3	
5	✓	12. Start Run Error	0. Start failure	0	0	1. Analysis		✓	2. Alarm Relay 2	

Figure 140. Alarms with no minimum or maximum

Using one relay output for multiple alarm conditions can be handled by using the **Any Alarm** parameter. For example, to set an alarm if either the ESTD Amount of Methane is out of limits or a Verification Failure occurs, use the following Alarm Table.

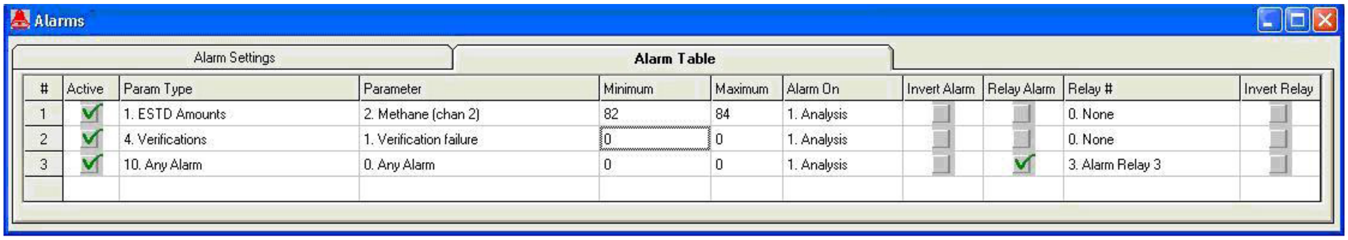


Figure 141. Any alarm parameter

Although the first two Alarms have no physical relay, their status can be read using **ModBus**. For fail-safe purposes or inverting a digital input, the alarm output can be inverted in the **Invert Alarm** column.

The analog outputs are set after processing a certain run type or when using **Recalculate Current Run**. The run type is defined in the **Alarm On** column as either Analysis, Blank, Calibration, or Verification

Enable the Alarm Table in the **Settings** tab.

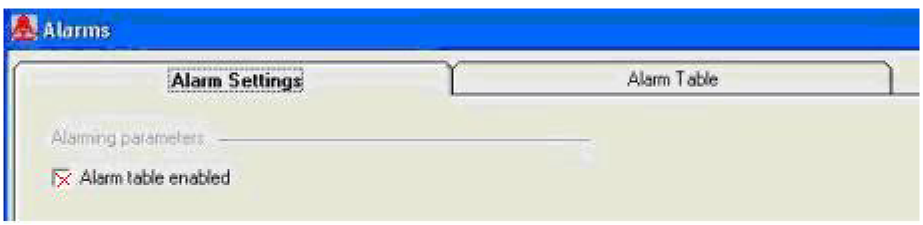


Figure 142. Alarm enable

Use Download Application from the Control menu to store the Alarm settings to the instrument. Only the Activated lines in the Alarm Table will be downloaded. Find more information in **Case 2: Alarms** on page 508.

Application - Analog Outputs

Analog outputs can be used to indicate a parameter value or status. The conversion from the input value is illustrated in the following curves:

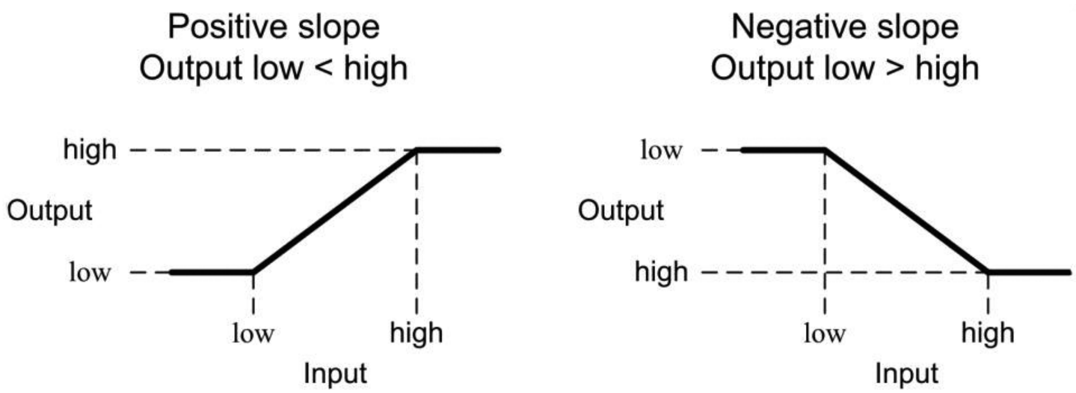


Figure 143. Input value conversion illustration

The conversion follows a straight line (linear interpolation) between the points [Input Low X1, Output Y1] and

[Input High X2, Output Y2].

Outside the <Input Low X1, Input High X2> input range the output is limited to the respective Output Y1 or Output Y2 value.

A negative slope is defined by making Output Y2 smaller than Output Y1.

A zero slope (equal Output Y1 and Y2) gives one output

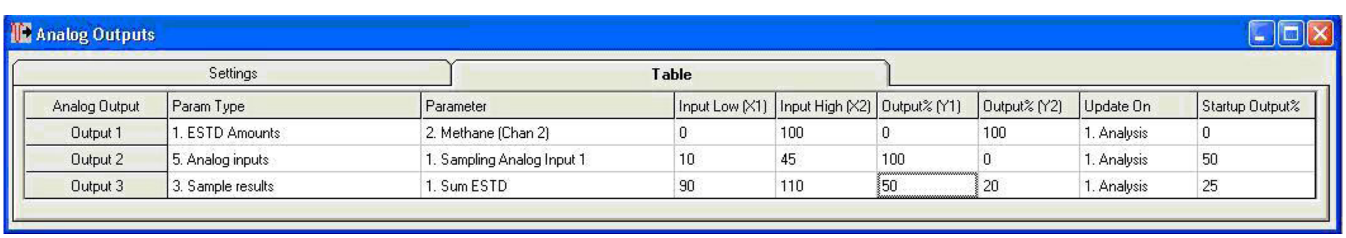
(Output Y1/Y2) for all input values.

Note that Input Low must always be smaller than Input High.

The analog outputs can be coupled to parameters as:

- Integration results for components defined in the Method menu.
- Sample results like sum or group total and bridge component as defined in the Normalization window (Application menu).
- Analog Inputs using the (sampling) converted values as defined in the Analog Input window.
- Calorific Power results as defined in the Energy Calculation window (Application menu).

Examples of these parameters and possible conversions are given below:



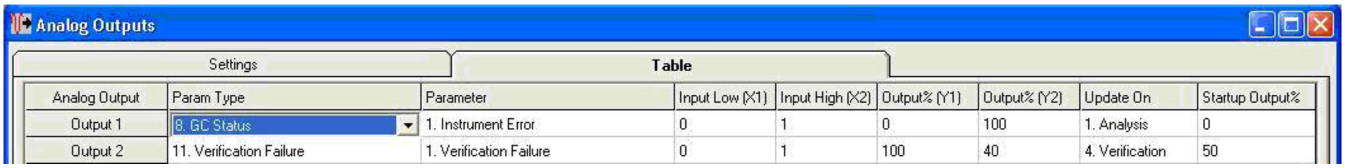
Analog Output	Param Type	Parameter	Input Low (X1)	Input High (X2)	Output% (Y1)	Output% (Y2)	Update On	Startup Output%
Output 1	1. ESTD Amounts	2. Methane (Chan 2)	0	100	0	100	1. Analysis	0
Output 2	5. Analog inputs	1. Sampling Analog Input 1	10	45	100	0	1. Analysis	50
Output 3	3. Sample results	1. Sum ESTD	90	110	50	20	1. Analysis	25

Figure 144. Analog outputs example parameters

Analog Outputs can also be coupled to digital signals. Such as:

- GC Status and
- Verification Failure

Use for digital inputs 0 and 1 as Input Low X1 and High X2 values. The output will be the respective Output Y1 or Y2 value.



Analog Output	Param Type	Parameter	Input Low (X1)	Input High (X2)	Output% (Y1)	Output% (Y2)	Update On	Startup Output%
Output 1	8. GC Status	1. Instrument Error	0	1	0	100	1. Analysis	0
Output 2	11. Verification Failure	1. Verification Failure	0	1	100	40	4. Verification	50

Figure 145. Analog outputs digital signals

The analog outputs are set after processing a certain run type (or when using **Recalculate Current Run**). The run type is defined in the **Update On** column. Choices are:

- Analysis
- Blank
- Calibration and
- Verification

Enable the **Analog Output** Table in the **Settings** tab.

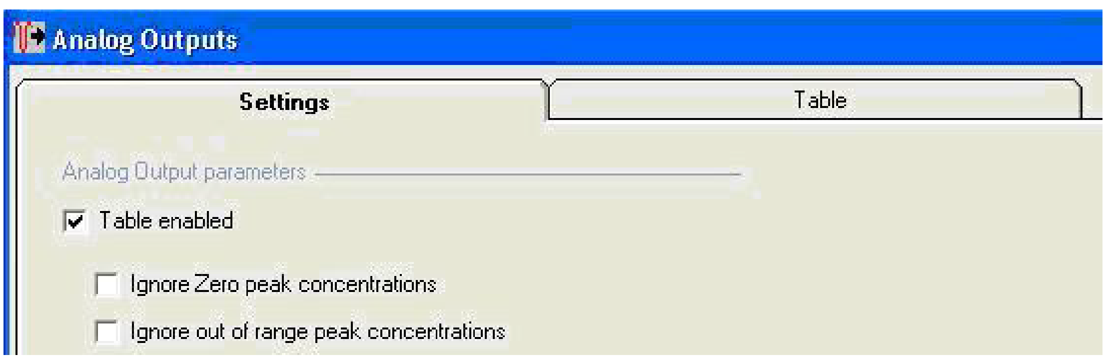


Figure 146. Analog output enable

Use **Download Application** from the **Control** menu to store the Analog Output settings to the instrument. Find more information in **Case 1: Analog Output** on page 505.

Parameters

The parameters for verifications, alarms, and analog output are listed in **Table 9**.

Table 9 Parameters for verifications, alarms, and analog output

	Parameter type	Parameter	Display
Integration results	(1) ESTD Amounts	<Component 1>	Application report (lower table)
		<Component 2>	
		...	
	(2) Normalized Amounts	<Component 1>	
		<Component 2>	
		...	
(3) Sample results		ESTD total Group 1	
		...	
		ESTD total Group 10	
		Normalized total group 1	
		...	
		Normalized total group 10	
		Sum ESTD	Application report (Sample column)
		Sum Estimates	
		Bridge comp. factor	
Inputs	(5) Analog inputs	Sampling Analog Input 1	Application report (Environment column)
		Sampling Analog Input 2	
		...	
	(9*) Digital Inputs	[Digital# 1]	
		[Digital# 2]	
		...	
Calorific Power	(6) ISO6976/GOST 31369 Results	1. Dry.Zmix	Application report (Energy column)
		2. Dry.Molar Mass	
		3. Dry.Rel.Dens.Ideal	
		4. Dry.Rel.Dens.Real	
		5. Dry.Gas.Dens.Ideal	
		6. Dry.Gas.Dens.Real	
		7. Dry.Hs.v.Ideal	
		8. Dry.Hs.v.Real	
		9. Dry.Hs.Mass	
		10. Dry.Hs.Molar	
		11. Dry.Hi.v.Ideal	
		12. Dry.Hi.v.Real	

Table 9 Parameters for verifications, alarms, and analog output

	Parameter type	Parameter	Display
Calorific Power (continued)	(6) ISO6976/GOST 31369 Results (continued)	13. Dry.Hi.Mass	Application report (Energy column)
		14. Dry.Hi.Molar	
		15. Dry.Wobbe index	
		16. Dry.Wobbe Inferior	
		17. Sat.Zmix	
		18. Sat.Molar Mass	
		19. Sat.Rel.Dens.Ideal	
		20. Sat.Rel.Dens.Real	
		21. Sat.Gas.Dens.Ideal	
		22. Sat.Gas.Dens.Real	
		23. Sat.Hs.v.Ideal	
		24. Sat.Hs.v.Real	
		25. Sat.Hs.Mass	
		26. Sat.Hs.Molar	
		27. Sat.Hi.v.Ideal	
		28. Sat.Hi.v.Real	
		29. Sat.Hi.Mass	
		30. Sat.Hi.Molar	
		31. Sat.Wobbe index	
		32. Sat.Wobbe Inferior	
	(7) ASTM/GPA Results	1. Act.Zmix	
		2. Act.Molar Mass	
		3. Act.Rel.Dens.Ideal	
		4. Act.Rel.Dens.Real	
		5. Act.Gas.Dens.Ideal	
		6. Act.Gas.Dens.Real	
		7. Act.Hs.v.Ideal	
		8. Act.Hs.v.Real	
		9. Act.Hmass	
		11. Act.hv.ideal	
		12. Act.hv.real	
		15. Act.Wobbe index	
		16. Act.Spec.Volume	
		17. Act.GPM Total[gal/1000ft3]	
		18. Act.Hv.MJ/m3	
		19. Act.hv.MJ/m3	
		20. Dry.Zmix	

Table 9 Parameters for verifications, alarms, and analog output

	Parameter type	Parameter	Display
Calorific Power (continued)	(7) ASTM/GPA Results (continued)	21. Dry.Molar Mass	Application report (Energy column)
		22. Dry.Rel.Dens.Ideal	
		23. Dry.Rel.Dens.Real	
		24. Dry.Gas.Dens.Ideal	
		25. Dry.Gas.Dens.Real	
		26. Dry.Hs.v.Ideal	
		27. Dry.Hs.v.Real	
		28. Dry.Hmass	
		30. Dry.hv.ideal	
		31. Dry.hv.real	
		34. Dry.Wobbe index	
		35. Dry.Spec.Volume	
		36. Dry.GPM Total[gal/1000ft3]	
		37. Dry.Hv.MJ/m3	
		38. Dry.hv.MJ/m3	
		39. Sat.Zmix	
		40. Sat.Molar Mass	
		41. Sat.Rel.Dens.Ideal	
		42. Sat.Rel.Dens.Real	
		43. Sat.Gas.Dens.Ideal	
		44. Sat.Gas.Dens.Real	
		45. Sat.Hs.v.Ideal	
		46. Sat.Hs.v.Real	
		47. Sat.Hmass	
		49. Sat.hv.ideal	
		50. Sat.hv.real	
		53. Sat.Wobbe index	
		54. Sat.Spec.Volume	
		55. Sat.GPM Total[gal/1000ft3]	
		56. Sat.Hv.MJ/m3	
		57. Sat.hv.MJ/m3	
		58. Zair	

Table 9 Parameters for verifications, alarms, and analog output

	Parameter type	Parameter	Display
GC Status	(10*) Any Alarm		from Alarm table
	(11**) Verification Failure		Application report (Verification Check)
	(4*) Verifications	Verification failure	
		Unknown peaks detected	
		Calibration Alarm	
		Stream selection failure	Instrument Status (Common tab)
	(12*) Start Run Error	Start failure	
	(8***) GC Status	Instrument Error	
		Cabinet Temperature	Application report (Environment column)
		Ambient Pressure	

* only for Alarms, ** only for Analog Outputs, *** not for Verifications <...> example, [...] option depends on configuration

Application - Timed Relays

Timed relays are used to signal run sequence events or control external actuators.

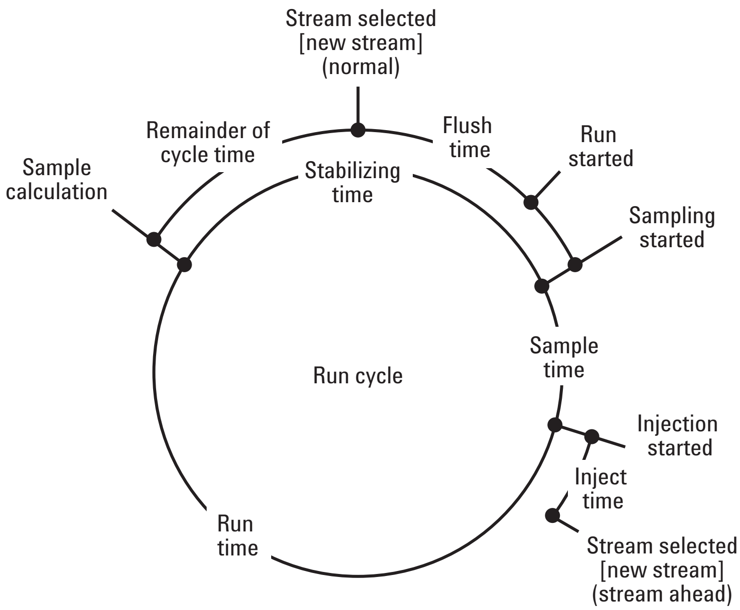


Figure 147. Timed relay run cycle

The following events are available:

Table 10 Available events

Run Started	the start of a new run
Sampling Started	the sample gas is directed through the injector
Injection Started	the sample gas is injected into the chromatography system
Sample Calculation	the results from the chromatogram are calculated
Steam Selected	a stream is selected
New Stream	a new stream is selected

Table 11 Time periods between events

Stabilizing time	defined in the Common tab of Instrument Method
Sample time	defined in the Common tab of Instrument Method
Inject time	defined in the Channel tabs of Instrument Method
Run time	defined in the Channel tabs of Instrument Method
Cycle time	combined time based on other timing as set in the method
Flush time	defined in the Tables of Automation Sequence

The timing of the events **Stream Selected** and **New Stream** depends on the **Stream Ahead Scheduling** option (**Sequence Properties** tab of **Automation Sequence**). Without **Stream Ahead**, the stream selector position is updated at the end of the run followed by the **Flush Time**. With **Stream Ahead**, the stream selector position is updated just after the injection. Flushing is started and the remaining **Flush Time** shorted.

To indicate that the chromatography system is in action, make the following definition in the Timed Relays tables.

Timed Relays

#	Event	Delay [s]	Timed Relay	Relay State
1	4. Injection Started	0	1. Timed Relay 1	1. Energize
2	5. Sample Calculation	0	1. Timed Relay 1	0. De-energize

Figure 148. Timed relays table

The first line defines the **Energize** event (Injection Started) for the Timed Relay 1. The second line defines the **De-energize** event (Sample Calculation).

To pulse a relay if a new stream is selected, make the following definition.

Timed Relays

#	Event	Delay [s]	Timed Relay	Relay State
1	6. New Stream	0	2. Timed Relay 2	1. Energize
2	6. New Stream	2	2. Timed Relay 2	0. De-energize

Figure 149. Timed relays example definition for pulse

Here, each time a new stream is selected, Timed Relay 2 is energized for 2 seconds.

Note that a timed relay basically requires two definition lines in the table. The number of lines is limited to 6, thus 3 timed relays can be defined.

Use **Download Application** from the Control menu to store the Timed Relay settings to the instrument

Find more information in **Case 3: Timed Relays** on page 509.

Application - Analog Inputs

The analog inputs are used to measure external parameters. They can be coupled to alarms or analog outputs. The conversion is defined in the Analog Inputs table columns:

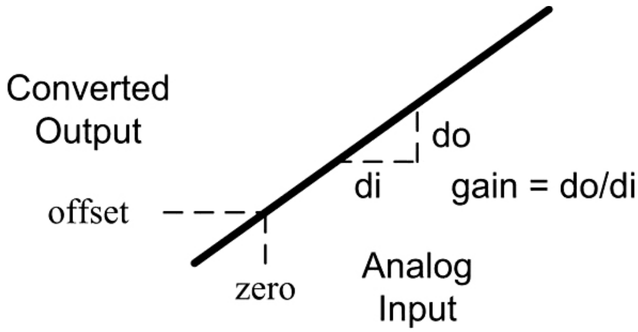


Figure 150. Analog input conversion

- The gain defines the change in output for a change in input. The offset is the output for zero input.
- The gain and offset can also be of negative value. In addition, decimal values are possible.
- For alarms and analog outputs, the converted output values are used.

With an external PT-100 temperature sensor, a current source of 5 mA is used for excitation. The analog input measures the voltage across the sensor. The conversion from input voltage to centigrade temperature is defined as follows.

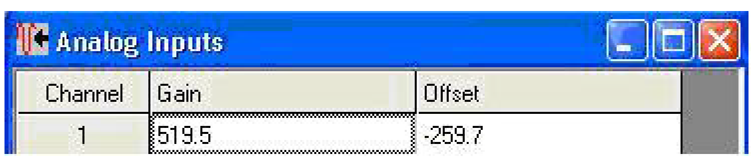


Figure 151. Analog inputs

The analog inputs are displayed in the Application Report. Note that the inputs are measured at the start of the sampling period. The Application Report is updated after the sample calculation is finished.

The Analog Inputs are continuously updated in the enhanced tab of the Instrument Status (control menu).

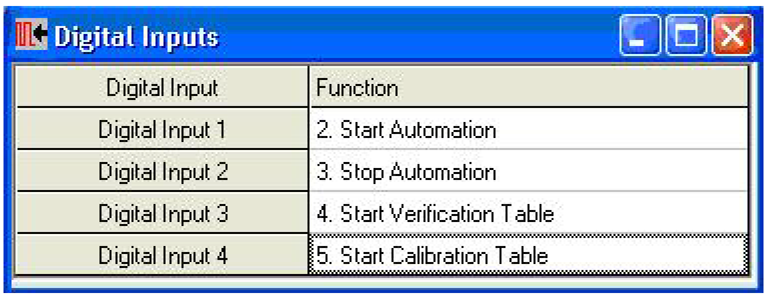
Use **Download Application** from the Control menu to store the Analog Input settings to the instrument.

Application - Digital Inputs

Digital Inputs are used to trigger automation events such as:

- Start/Stop Automation
- Start Calibration or Verification Table
- Run sequence line

In addition, they can also be used to signal an external device status or alarm. By using two Digital Inputs, the Automation mode can be started and stopped.



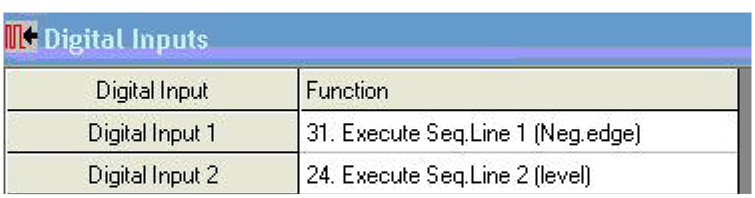
Digital Input	Function
Digital Input 1	2. Start Automation
Digital Input 2	3. Stop Automation
Digital Input 3	4. Start Verification Table
Digital Input 4	5. Start Calibration Table

Figure 152. Automation mode control

In addition, the Verification or Calibration Table can be started in idle or automation mode (priority run).

The triggering of a sequence line is done in idle mode only. For a single execution, use the edge-sensitive input. Shortly closing the digital input switch is sufficient to start the sequence line.

For continuous execution, use the level-sensitive input. The inputs are scanned every 5 seconds. To perform handshaking, use a timed relay to indicate that the run is started. This way one can also keep track of the number of runs started.



Digital Input	Function
Digital Input 1	31. Execute Seq.Line 1 (Neg.edge)
Digital Input 2	24. Execute Seq.Line 2 (level)

Figure 153. Continuous execution

During automation or a run, the digital inputs are scanned at the end of the run (event Sample Calculation).

All digital inputs are edge sensitive, except for the (nonlatching) on-board digital inputs and level sensitive defined (execute) sequence lines. Find more information in **Case 4: Digital Inputs** on page 510.

Application - Local User Interface (LCD)

The LCD has a user-customizable display for showing instrument specific information, such as:

- Actual operating conditions
- Instrument status as well as run status
- Calculated values
- Instrument errors

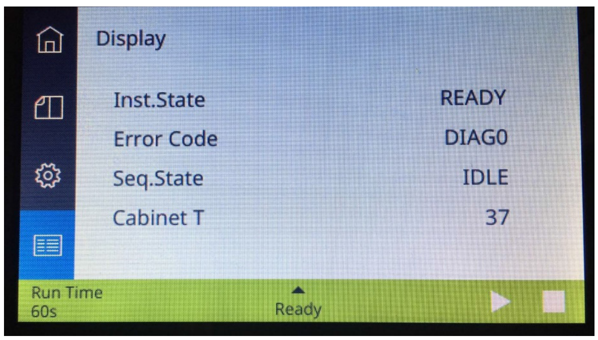
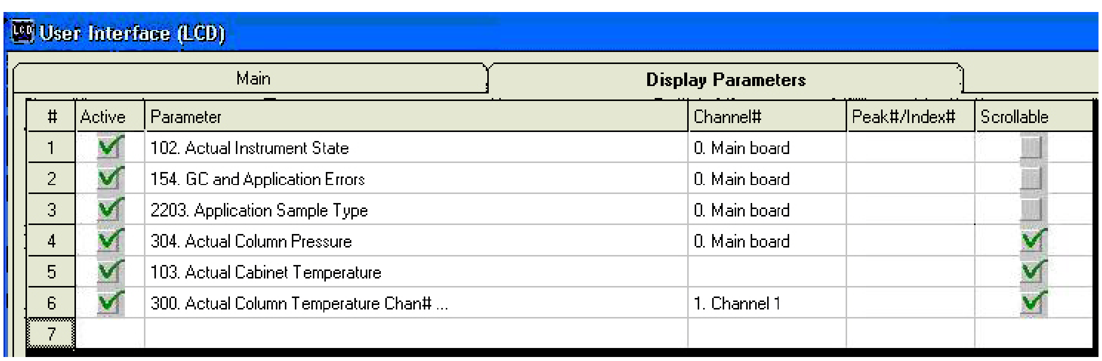


Figure 154. LCD display

The LCD output can be programmed from the application\user interface (LCD) in the PROstation toolbar. Use the **Display Parameters** tab to select which parameters should be presented on the screen, see an example in **Figure 155**. For each parameter, select whether the information should be fixed on the screen or scrollable. The right side of the **Main** tab provides a simulation of the selected parameters, see **Figure 156**.



#	Active	Parameter	Channel#	Peak#/Index#	Scrollable
1	✓	102. Actual Instrument State	0. Main board		
2	✓	154. GC and Application Errors	0. Main board		
3	✓	2203. Application Sample Type	0. Main board		
4	✓	304. Actual Column Pressure	0. Main board		✓
5	✓	103. Actual Cabinet Temperature			✓
6	✓	300. Actual Column Temperature Chan# ...	1. Channel 1		✓
7					

Figure 155. LCD setup - scrollable or fixed

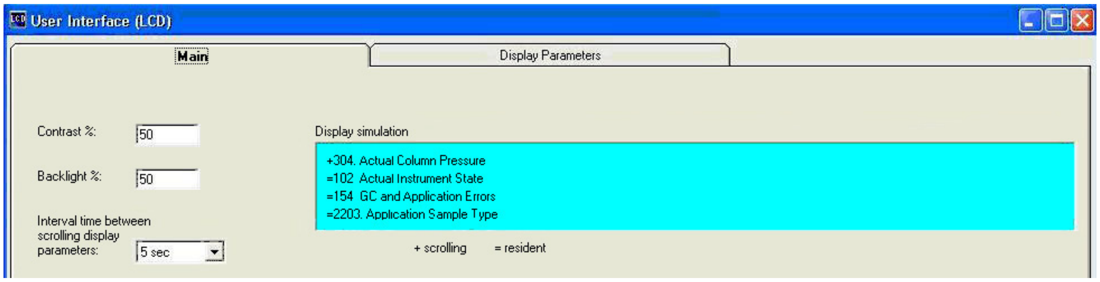


Figure 156. LCD setup - main screen

The sections below give a detailed overview of the information that can be displayed. For all parameters, the LCD screen output is here given as [screen output].

System status and info parameters

This section gives an overview of the system status and info parameters. The channel needs to be set to **0. Mainboard** in **Channel#** column, see Figure 157 for an example.

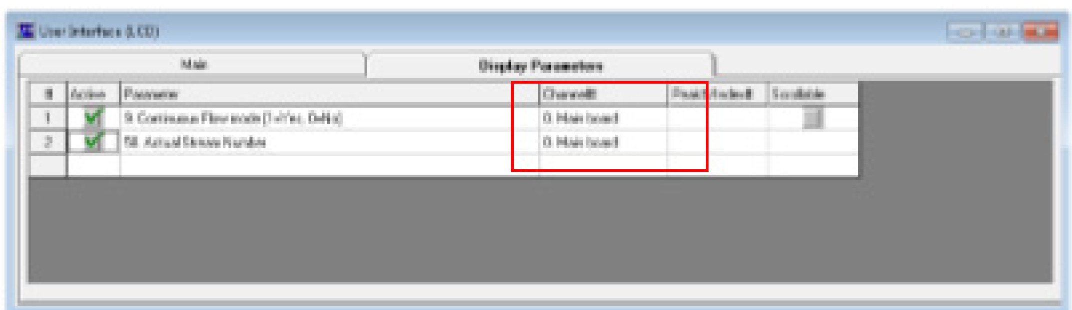


Figure 157. LCD setup - System status and info parameters

0. None

Display line is not configured, will result in empty line in LCD.

9. Continuous Flow mode [Cont. Flow]

Displays whether or not continuous flow mode is switched on in the instrument configuration.

Firmware ? Version 2.xx
0 = Continuous flow mode is switched off
1= Continuous flow mode is switched on

Firmware ? Version 3.xx
OFF = Continuous flow mode is switched off
ON = Continuous flow mode is switched on

58. Actual Stream Number [Actual Stream#]

Displays the current selected stream position.

2205. Application Stream number [Stream#]

Displays stream position of the last finished run.

100. Actual SampleLine Temp [SampleLine T]

Displays the current temperature of the sample line in degrees centigrade (°C).

102. Actual Instrument State [Inst. State]

Displays the overall instrument state of the instrument.

INIT = System is initializing
FLUSHING = Flush cycle is started
RUNNING or RUN.##s = Running, where ## is the run time in seconds
STABIL = Stabilizing method
READY = System is ready to use
ERROR = A critical or fatal error has occurred
REC ERROR = Recoverable error/advisory fault
UNREC ERR = Unrecoverable error, reboot the instrument
NOT RDY = Not ready, instrument parameters setting not yet reached
WAIT EXT RDY = Waiting for external ready in
CLEANING = System is performing a bake out

103. Actual Cabinet Temperature [Cabinet T]

Displays current instrument cabinet temperature in degrees centigrade (°C).

Note: Firmware version ? 2.xx will display [Ambient T] on screen instead of [Cabinet T].

104. Actual Ambient Pressure [Ambient P]

Displays the ambient pressure in kilo Pascal (kPa), measure in the instrument cabinet.

105. External Power Supply Voltage [Supply Volt]

Display the actual power supply voltage in Volt (V).

106. External Started status [Ext. Started]

Displays whether or not an external start is received.

0 = No External start received
1 = External start received

131. External Device Ready Status [Ext. Dev. State]

Displays the ready status of possible external connected device.

Firmware ? Version 2.xx
0 = External device not ready
1 = External device ready

Firmware ? Version 3.xx
NOT RDY = External device not ready
RDY = External device ready

132. Error Code status [Error Code]

Displays the instrument's error code. Error codes for the LCD are reported as [LCN]; where L = location of the error, C = severity class, and N = actual error number.

Location

[empty] = mainboard
1 - 4 = channel number

Severity classes

DIAG = diagnostic message,
RECO = recoverable/advisory error
CRIT = critical error
FATA = fatal error

Error number

Displayed as #, ## or ### (depending on error number). See **Chapter 18**, “Errors,” starting on page 551 for a description and required actions for each error number.

Note: Also see parameter **152. GC Errors only [GC Errors]** on page 207.

134. Actual Flush time [Stream flush t]

Displays remaining stream flush time in seconds.

138. Actual Sequence State [Seq. State]

Displays the current automation (or sequence) status.

IDLE = Idle
RUN MAN = A manual run (single run) has started
RUN SEQ = Running a sequence (full automation)
RUN CB = Running a calibration block
RUN VB = Running a verification block
RECALC = System is performing a recalculation
EQ STRM or EQ.STR ##s = Equilibrating a sample stream (selecting and flushing stream), where ## is the remaining equilibration time in seconds.

139. Actual Calibration Level Setting [Calib. Level]

Displays current calibration level, this could be either during calibration, verification using a certain calibration level and recalculation of a calibration.

1 to 7 = calibration level 1 to 7

8 = This level is used for Rw multilevel calibration, for more information see section **Rw Calibration** on page 471 for more information.

2204. Application Calibration Level [Calib Level]

Displays calibration level of the last finished run. This could be either a calibration, verification using a certain calibration level and recalculation of a calibration.

1 to 7 = calibration level 1 to 7

8 = This level is used for Rw multilevel calibration, for more information see section **Rw Calibration** on page 471 for more information.

141. Actual Sample Type [Sample Type]

Displays the sample type of the current run.

ANALYS = Analysis of an unknown sample
CALIB = Calibration gas
BLANK = Blank analysis (Baseline)
VERIF = Verification sample

2203. Application Sample Type [Samp Type]

Displays sample type of the last finished run.

ANALYS = Analysis of an unknown sample
CALIB = Calibration gas
BLANK = Blank analysis (Baseline)
VERIF = Verification sample

152. GC Errors only [GC Errors]

Displays whether or not there is a system error.

0 = No error
1 = Error

Note 1: This parameter only sets a notification (return value = 1) when the instrument has an error in one of the severity classes Advisory Fault, Critical Error, or Fatal Error. As soon as the instrument is no longer in error, this parameter is reset to 0.

Note 2: To obtain the error number use parameter **132. Error Code status [Error Code]** on page 205. See also parameter**2212. Application Alarm on Index# ..." ' Step [Alarm Index#]** on page 208 and parameter **2211. Application Alarm Status [Alarm status]**.

153. Application Errors only [Appl. Errors]

Displays whether or not there is a failure in the calibration conditions, or an error in the stream selection, or an alarm on one of the conditions specified in the alarm table.

0 = No error or alarm
1 = Error or alarm

Note: See also parameter **2211. Application Alarm Status [Alarm status]** and parameter **2212. Application Alarm on Index# ..." ' Step [Alarm Index#]** on page 208.

154. GC and Application Errors [GC+Appl Errors]

Displays whether or not there is a system or application error; combines parameter 152 and 153.

0 = No error or alarm
1 = Error or alarm

1331. Integration Report: Calibration Alarm [Calib Alarm]

Returns if a response factor of one or more peaks detected in the current calibration run does not meet the allowed variation. The allowed variation for response factor alarms is defined in the Method peak table.

0 = No calibration alarm
1 = Calibration alarm

2211. Application Alarm Status [Alarm status]

Displays whether any of the configured alarms from the alarm table was raised at the end of the last run.

0 = No alarm
1 = Alarm

2212. Application Alarm on Index# ..." ' Step [Alarm Index#]

Displays whether a particular configured alarm from the alarm table was raised at the end of the last run. The alarm index should be set in the Peak#/Index# column.

0 = No alarm
1 = Alarm

[Alarm Index#] where x is the alarm index number

500. MPU firmware version number [MPU version]

Displays the MPU firmware version and subversion and build number (build number only from firmware version 2.0 and up). MPU version is displayed as MVersion x.xx byyyyy, where x version# and yyyyy is the build number.

515. Current Time [Time]

Displays the current instrument's date and time setting.

601. Instrument Serial Number [Serial#]

Displays the instrument's serial number.

611. Operating Runs logging [Oper.Runs#]

Displays the total number of runs performed on the system.

612. Operating Time logging [Oper.Time]

Displays the total instrument up time in hours.

613. Operating Max Temperature logging [Oper.Max T]

Displays the maximum reached cabinet temperature in degrees centigrade (°C).

2200. New Data Available (synchronization flag) [New Data#]

Displays status of the new data available flag. Flag automatically resets 0 after the "Reset-Time data available flag" expires.

0 = No new data available/reset new data available
1 = (Still) new valid data available

2202. Application Run number ID [RUN ID#]

Displays the incremental run number, generated by the instrument.

2213. Application Verification Status [Verif.Status]

Displays whether or not the verification criteria as defined in the Verification Table passes.

Firmware ? Version 2.xx
0 = All verification criteria passed.
1 = One of the verification criteria did not pass.

Firmware ? Version 3.xx
PASS = All verification criteria passed.
FAIL = One of the verification criteria did not pass.

2216. Application Total Peaks [Total Peaks]

Displays the total number of detected peaks from application report, defined in the normalization table.

2217. Application Sum ESTD [Sum Unnorm]

Displays the sum of ESTD values of all detected peaks, defined in the normalization table, from the last finished run.

2218. Application Sum Estimates [Sum Estim]

Displays the sum of estimates that are identified as estimate peaks in the normalization table.

2221. Application Sum Areas [Sum Areas]

Displays the sum of areas of all detected peaks that are defined in the normalization table.

2225. Application Day of Injection [Inj Day]

Displays the day of injection of the last finished run.

2226. Application Hour of Injection [Inj Hour]

Displays the hour of injection of the last finished run.

2227. Application Minute of Injection [Inj Min]

Displays the minute of injection of the last finished run.

2228. Application Second of Injection [Inj Sec]

Displays the second of injection of the last finished run.

2229. Application Total Unknown Peaks [Unknown Pks]

Displays the total number of unknown peaks from the application report. A peak is handled as 'unknown' when it is not defined in the normalization table but still detected in the integration report.

Channel specific status parameters

For the channel specific status parameters, the desired channel is chosen by selecting 1. Channel 1, 2. Channel 2, 3. Channel 3 or 4. Channel 4 in **Channel#** column, see **Figure 158** for an example.

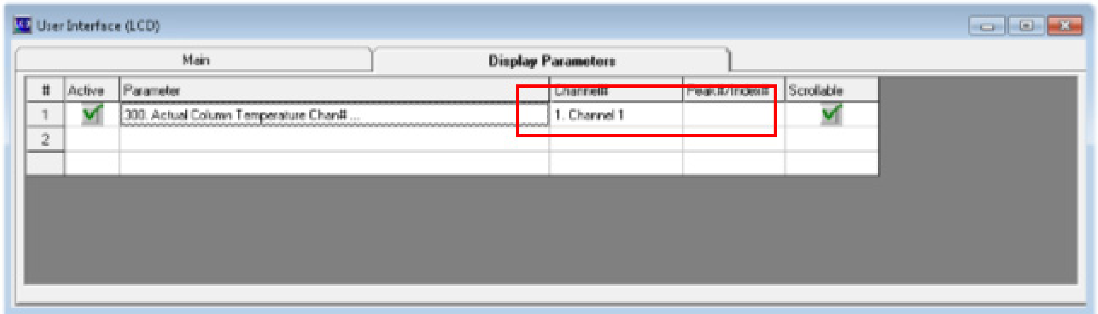


Figure 158. LCD setup channel specific status parameters

300. Actual Column Temperature Chan# ... [Column T #x]

Displays the actual column temperature in degrees centigrade (°C) for the selected channel.

[Column T #x]; x = channel #

302. Actual Injector Temperature [Injector T #x]

Displays the actual injector temperature in degrees centigrade (°C) for the selected channel.

[Injector T #x]; x = channel #

304. Actual Column Pressure [Column P #x]

Displays the actual column pressure in kilo Pascal (kPa) for the selected channel.

[Column P #x]; x = channel #

308. Board Temperature Chan# ... [PCB Temp #X]

Returns the actual channel board temperature in degrees centigrade (°C) for the selected channel.

Firmware ? Version 2.xx
[Ambient T#x]; x = channel #

Firmware ? Version 3.xx
[PCB Temp #x]; x = channel #

811. Operating Max Temperature logging Chan#... [Oper.Max T #x]

Displays the maximum operating column temperature in degrees centigrade (°C) for selected channel.

[Oper.Max T #x]; x = channel #

Channel specific result parameters

This section gives an overview of the available channel specific results that can be displayed on the LCD. For each parameter, a channel needs to be set using 1. Channel 1, 2. Channel 2, 3. Channel 3 or 4. Channel 4 in Channel# column. The component of interest can be selected using the index number (#) from the **Peak identification/Calibration** table in the **Method**. The component index number should be filled in the **Peak#/Index#** column. See **Figure 159** for an example. The LCD will show the first 5 characters of the peak name, indicated as **$$$$$** in the parameters below.

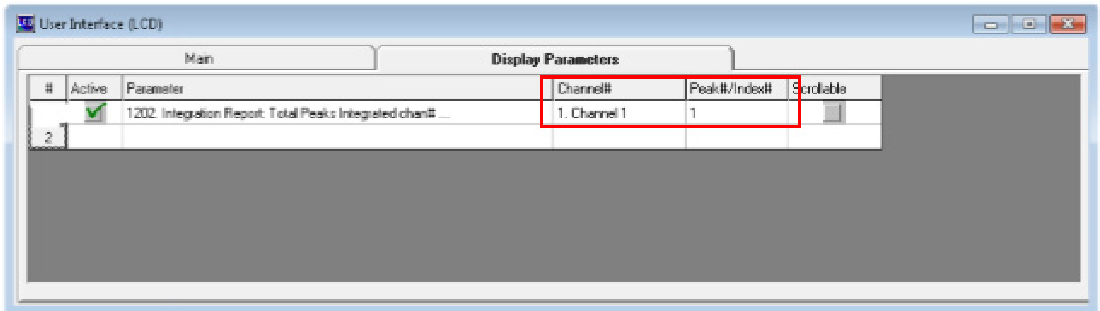


Figure 159. LCD setup channel specific result parameters

1202. Integration Report: Total Peaks Integrated chan# ... [Integ.pks#x]

Displays the total number of peaks (named and unnamed) for the selected channel.

[Integ.pks#x]; x = channel #

1214. Integration Report: Identified peaks chan# ... [Ident.pks#x]

Displays the total number of identified peaks for the selected channel.

[Ident.pks#x]; x = channel #

1375. Integration Report: Area meth-peak#.. chan#.. [$$$$$ Area]

Displays the peak area of the selected component.

1376. Integration Report: Height meth-peak#.. chan#.. [$$$$$ Hght]

Displays the peak height of the selected component.

1377. Integration Report: Amount meth-peak#.. chan#.. [$$$$$ ESTD]

Displays the calculated amount of the selected component.

1378. Integration Report: Retention meth-peak#.. chan#.. [$$$$$ Ret]

Returns the retention time in seconds (s) of the selected component.

Component specific result parameters

This section gives an overview of the available component specific normalized results that can be displayed on the LCD.

For each parameter, the channel# needs to be set to **0. Mainboard** in the **Channel#** column. The component of interest can be selected using the index number (#) from the **Normalization** table from the **Application**. The component index number should be filled in the **Peak#/Index#** column, see **Figure 160** for an example.

The required group number as used in the **Normalization** table from the **Application** should be filled in the **Peak#/Index#** column. The LCD will show the first 5 characters of the peak name, indicated as **$$$$$** in the parameters below.

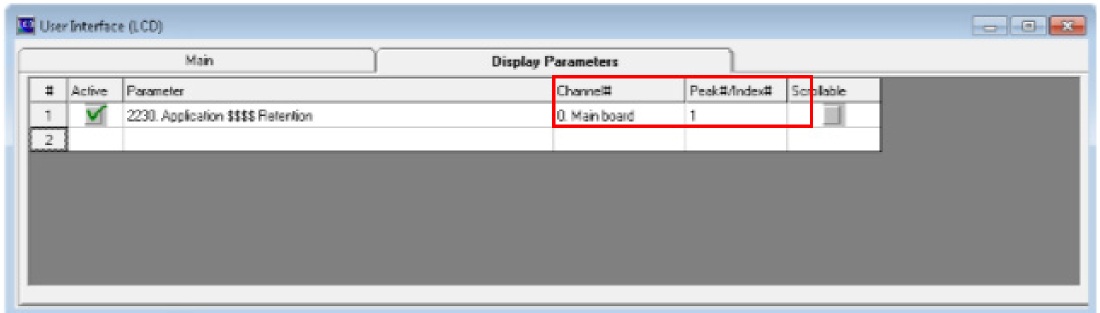


Figure 160. LCD setup component specific result parameters

2230. Application $$$$ Retention [$$$$$ Rt]

Displays the retention time in seconds of the selected component from the last finished run.

2231. Application $$$$ Height [$$$$$ Hght]

Displays the peak height of the selected component from the last finished run.

2232. Application $$$$ ESTD [$$$$$ ESTD]

Displays the calculated amount of the selected component from the last finished run.

2233. Application $$$$$ Normalized ESTD [$$$$$ Norm]

Displays the normalized amount of the selected component from the last finished run.

2235. Application Group @ Total ESTD [Group x ESTD]

Displays the sum of the ESTD concentrations of all peaks in the selected group from the last finished run.

[Group x ESTD] where x is the group number

2236. Application Group @ Total Norm [Group x Norm]

Displays the sum of the normalized concentrations in percentage (%) of all peaks in the selected group from of the last finished run.

[Group x norm] where x is the group number

2237. Application $$$$ Area [$$$$$ Area]

Displays the peak area of the selected component from the last finished run.

2310. Application: ASTM/GPA GPM [ft3/gal] #norm-peak (Float, MB) [$$$$$ GPM]

Displays the ideal GPM on component basis of the last run calculated according to the selected standard.

2312. Application: Weight Percentage [%] #norm-peak (Float, MB) [$$$$$ Wght%]

Displays the weight percentage on component basis of the last run.

Energy meter result parameters

This section gives an overview of the available energy meter results that can be displayed on the LCD. For each parameter, the channel# needs to be set 0. Mainboard in Channel# column, see **Figure 161** for an example. The results for these parameters are only available when calorific power calculation is enabled, see **Application - Calorific Power** on page 151 for more information.

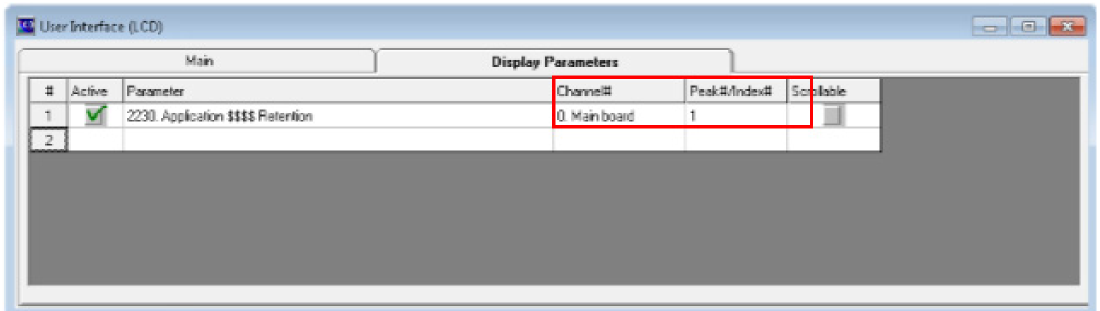


Figure 161. LCD setup application specific result parameters

2260. Application Calorific Value Calculation Method [EM-Method]

Displays the active energy meter calculation method as used in the application report of the last finished run.

ISO = ISO 6976
GPA = GPA 2172
ASTM = ASTM 3588
GOST = GOST 22667 or GOST 31369

2262. Application GPA/ASTM.Act.Zmix

Displays the Zmix of the actual sample from the last run calculated according to selected standard.

2263. Application GPA/ASTM.Act.Molar Mass

Displays the molar mass of the actual sample from the last run calculated according to selected standard.

2264. Application GPA/ASTM.Act.Rel.Dens.Ideal

Displays the ideal relative density of the actual sample from the last run calculated according to selected standard.

2265. Application GPA/ASTM.Act.Wobbe index

Displays the Wobbe superior index of the actual sample from the last run calculated according to selected standard.

2266. Application ISO/GOST.Dry.Hs.v.Real

Displays the volume based superior heating value of the dry sample from the last run calculated according to selected standard.

2267. Application ISO/GOST.Dry.Hi.v.Real

Displays the volume based inferior heating value of the dry sample from the last run calculated according to selected standard.

2268. Application ISO/GOST.Dry.Gas.Dens.Real

Displays the real gas density value of the dry sample from the last run calculated according to selected standard.

2269. Application ISO/GOST.Dry.Rel.Dens.Real

Displays the real gas relative density value of the dry sample from the last run calculated according to selected standard.

2271. Application ISO/GOST.Dry.Wobbe Inferior

Displays the Wobbe inferior value of the dry sample from the last run calculated according to selected standard.

2274. Application GPA/ASTM.Act.Hv.Real

Displays the volume based superior heating value of the actual sample from the last run calculated according to selected standard.

2275. Application GPA/ASTM.Dry.Hv.Real

Displays the volume based superior heating value of the dry sample from the last run calculated according to selected standard.

2276. Application GPA/ASTM.Sat.Hv.Real

Displays volume based superior heating value of the saturated sample from the last run calculated according to selected standard.

2277. Application GPA/ASTM.Act.Rel.Dens.Real Displays the real gas relative density of the actual sample from the last run calculated according to selected standard.

2278. Application GPA/ASTM.Act.Gas.Dens.Ideal

Displays the ideal gas density of the actual sample in pounds per cubic foot from the last run calculated according to selected standard.

2279. Application GPA/ASTM.Act.Spec.Volume

Displays the Specific Volume of the actual sample in cubic foot per pound from the last run calculated according to selected standard.

2280. Application GPA/ASTM.Act.Hv.MJM3 (Float, MB)

Displays the volume based superior heating value of the actual sample in mega Joule per cubic meter from the last run calculated according to selected standard.

2281. Application: Zair

Displays the Zair of the sample from the last run calculated according to selected standard.

2292. Application: GPA/ASTM Act.hv.Real

Displays the volume based inferior heating value of the actual sample from the last run calculated according to selected standard.

2293. Application: GPA/ASTM Dry.hv.Real

Displays the volume based inferior heating value of the dry sample from the last run calculated according to selected standard.

2294. Application: GPA/ASTM Sat.hv.Real

Displays the volume based inferior heating value of the saturated sample from the last run calculated according to selected standard.

2295. Application: GPA/ASTM Act.hv.MJM3 (Float, MB)

Displays the volume based superior heating value of the actual sample in mega Joule per cubic meter from the last run calculated according to selected standard.

2310. Application: GPA/ASTM GPM [gal/1000ft3] #norm-peak (Float, MB)

Displays the GPM [gal/1000ft3] norm-peak of the sample from the last run calculated according to selected standard.

2311. Application: GPA/ASTM Total GPM [gal/1000ft3] (Float, MB)

Displays the total ideal GPM of the last run calculated according to the selected standard.

2312. Application: Weight Percentage [%] #norm-peak (Float, MB)

Displays the Weight Percentage [%] #norm-peak from the last run calculated according to selected standard.

2102. Application: GPA/ASTM Act.Water mole

Displays the water mole of actual sample from the last run calculated according to selected standard.

2313. Application: ISO/GOST/GPA/ASTM.Sat.Zmix

Displays the Zmix of saturated sample from the last run calculated according to selected standard.

2314. Application: ISO/GOST/GPA/ASTM.Sat.Molar Mass

Displays the molar mass of saturated sample from the last run calculated according to selected standard.

2315. Application: ISO/GOST/GPA/ASTM.Sat.Wobbe index

Displays the superior wobbe index of saturated sample from the last run calculated according to selected standard.

2316. Application: ISO/GOST/GPA/ASTM.Sat.Water mole

Displays the water mole of saturated sample from the last run calculated according to selected standard.

2318. Application: ISO/GOST/GPA/ASTM.Dry.Zmix

Displays the Zmix of dry sample from the last run calculated according to selected standard.

2319. Application: ISO/GOST/GPA/ASTM.Dry.Molar Mass

Displays the molar mass of dry sample from the last run calculated according to selected standard.

2320. Application: ISO/GOST/GPA/ASTM.Dry.Rel.Dens.ideal

Displays ideal relative density of dry sample from the last run calculated according to selected standard.

2321. Application: ISO/GOST/GPA/ASTM.Sat.Rel.Dens.ideal

Displays ideal relative density of saturated sample from the last run calculated according to selected standard.

2322. Application: ISO/GOST/GPA/ASTM.Dry.Wobbe index Displays superior wobbe index of dry sample from the last run calculated according to selected standard.

2325. Application: ISO/GOST Sat.Hv.real

Displays the real gas volume based superior heating value of saturated sample from the last run calculated according to selected standard.

2326. Application: ISO/GOST Sat.hv.real

Displays the real gas volume based inferior heating value of saturated sample from the last run calculated according to selected standard.

2327. Application: ISO/GOST Sat.Gas.Den.Real

Displays the real gas density of saturated sample from the last run calculated according to selected standard.

2328. Application: ISO/GOST Sat.Rel.Dens.Real

Displays the real gas relative density of saturated sample from the last run calculated according to selected standard.

2329. Application: ISO/GOST Sat.Wobbe inferior

Displays the inferior wobbe index of saturated sample from the last run calculated according to selected standard.

2330. Application: ISO/GOST Dry.Gas.Dens.Ideal

Displays the ideal gas density of dry sample from the last run calculated according to selected standard.

2331. Application: ISO/GOST Sat.Gas.Dens.Ideal

Displays the ideal gas density of saturated sample from the last run calculated according to selected standard.

2333. Application: ISO/GOST Dry.Hmass

Displays the mass based superior heating value of dry sample from the last run calculated according to selected standard.

2334. Application: ISO/GOST Dry.hmass

Displays the mass based inferior heating value of dry sample from the last run calculated according to selected standard.

2335. Application: ISO/GOST Sat.Hmass

Displays the mass based superior heating value of saturated sample from the last run calculated according to selected standard.

2336. Application: ISO/GOST Sat.hmass

Displays the mass based inferior heating value of saturated sample from the last run calculated according to selected standard.

2337. Application: ISO/GOST Dry.Hmolar

Displays the molar based superior heating value of dry sample from the last run calculated according to selected standard.

2338. Application: ISO/GOST Dry.hmolar

Displays the molar based inferior heating value of dry sample from the last run calculated according to selected standard.

2339. Application: ISO/GOST Sat.Hmolar

Displays the molar based superior heating value of saturated sample from the last run calculated according to selected standard.

2340. Application: ISO/GOST Sat.hmolar

Displays the molar based inferior heating value of saturated sample from the last run calculated according to selected standard.

2341. Application: ISO/GOST Dry.Hv.ideal

Displays the ideal volume based superior heating value of dry sample from the last run calculated according to selected standard.

2342. Application: ISO/GOST Dry.hv.ideal

Displays the ideal volume based inferior heating value of dry sample from the last run calculated according to selected standard.

2343. Application: ISO/GOST Sat.Hv.ideal

Displays the ideal volume based superior heating value of saturated sample from the last run calculated according to selected standard.

2344. Application: ISO/GOST Sat.hv.ideal

Displays the ideal volume based inferior heating value of saturated sample from the last run calculated according to selected standard.

2317. Application: GPA/ASTM Act.Water mole

Displays the water mole of actual sample from the last run calculated according to selected standard.

2345. Application: GPA/ASTM Dry.Hv.ideal

Displays the ideal volume based superior heating value of dry sample from the last run calculated according to selected standard.

2346. Application: GPA/ASTM Sat.Hv.ideal

Displays the ideal volume based superior heating value of saturated sample from the last run calculated according to selected standard.

2347. Application: GPA/ASTM Act.Hv.ideal

Displays the ideal volume based superior heating value of actual sample from the last run calculated according to selected standard.

2348. Application: GPA/ASTM Act.hv.ideal

Displays the ideal volume based inferior heating value of actual sample from the last run calculated according to selected standard.

2349. Application: GPA/ASTM Dry.hv.ideal

Displays the ideal volume based inferior heating value of dry sample from the last run calculated according to selected standard.

2350. Application: GPA/ASTM Sat.hv.ideal

Displays the ideal volume based inferior heating value of saturated sample from the last run calculated according to selected standard.

2351. Application: GPA/ASTM Act.Hmass

Displays the mass based superior heating value of actual sample from the last run calculated according to selected standard.

2352. Application: GPA/ASTM Act.Hmolar

Displays the molar based superior heating value of actual sample from the last run calculated according to selected standard.

2353. Application: GPA/ASTM Dry.Hmass

Displays the mass based superior heating value of dry sample from the last run calculated according to selected standard.

2354. Application: GPA/ASTM Dry.Hmolar

Displays the molar based superior heating value of dry sample from the last run calculated according to selected standard.

2355. Application: GPA/ASTM Sat.Hmass

Displays the mass based superior heating value of saturated sample from the last run calculated according to selected standard.

2356. Application: GPA/ASTM Sat.Hmolar

Displays the molar based superior heating value of saturated sample from the last run calculated according to selected standard.

2357. Application: GPA/ASTM Act.hmass

Displays the mass based inferior heating value of actual sample from the last run calculated according to selected standard.

2358. Application: GPA/ASTM Act.hmolar

Displays the molar based inferior heating value of actual sample from the last run calculated according to selected standard.

2359. Application: GPA/ASTM Dry.hmass

Displays the mass based inferior heating value of dry sample from the last run calculated according to selected standard.

2360. Application: GPA/ASTM Dry.hmolar

Displays the molar based inferior heating value of dry sample from the last run calculated according to selected standard.

2361. Application: GPA/ASTM Sat.hmass

Displays the mass based inferior heating value of saturated sample from the last run calculated according to selected standard.

2362. Application: GPA/ASTM Sat.hmolar

Displays the molar based inferior heating value of saturated sample from the last run calculated according to selected standard.

2363. Application: GPA/ASTM Dry.Rel.Dens.Real

Displays the real gas relative density of dry sample from the last run calculated according to selected standard.

2364. Application: GPA/ASTM Sat.Rel.Dens.Real

Displays the real gas relative density of saturated sample from the last run calculated according to selected standard.

2365. Application: GPA/ASTM Dry.Gas.Dens.Ideal

Displays the real gas density of dry sample from the last run calculated according to selected standard.

2366. Application: GPA/ASTM Sat.Gas.Dens.Ideal

Displays the real gas density of saturated sample from the last run calculated according to selected standard.

2367. Application: GPA/ASTM Act.Gas.Dens.Real

Displays the real gas density of actual sample from the last run calculated according to selected standard.

2368. Application: GPA/ASTM Dry.Gas.Dens.Real

Displays the real gas density of dry sample from the last run calculated according to selected standard.

2369. Application: GPA/ASTM Sat.Gas.Dens.Real

Displays the real gas density of saturated sample from the last run calculated according to selected standard.

2370. Application: GPA/ASTM Dry.Spec.Volume

Displays the Spec Volume of dry sample from the last run calculated according to selected standard.

2371. Application: GPA/ASTM Sat.Spec.Volume

Displays the Spec Volume of saturated sample from the last run calculated according to selected standard.

2372. Application: GPA/ASTM Dry.GPM Total[gal/1000ft3]

Displays the GPM Total[gal/1000ft3] of dry sample from the last run calculated according to selected standard.

2373. Application: GPA/ASTM Sat.GPM Total[gal/1000ft3]

Displays the GPM Total[gal/1000ft3] of dry sample from the last run calculated according to selected standard.

2374. Application: GPA/ASTM Dry.Hv.MJM3 (Float, MB)"

Displays the volume based superior heating value of the dry sample in mega Joule per cubic meter from the last run calculated according to selected standard.

2375. Application: GPA/ASTM Dry.hv.MJM3 (Float, MB)"

Displays the volume based inferior heating value of the dry sample in mega Joule per cubic meter from the last run calculated according to selected standard.

2376. Application: GPA/ASTM Sat.Hv.MJM3 (Float, MB)"

Displays the volume based superior heating value of the saturated sample in mega Joule per cubic meter from the last run calculated according to selected standard.

2377. Application: GPA/ASTM Sat.hv.MJM3 (Float, MB)"

Displays the volume based inferior heating value of the saturated sample in mega Joule per cubic meter from the last run calculated according to selected standard.

I/O parameters

This section gives an overview of the available I/O parameters that can be displayed on the LCD. For each parameter, an I/O channel number in the **Channel#** column should be set, see **Figure 162** for an example.

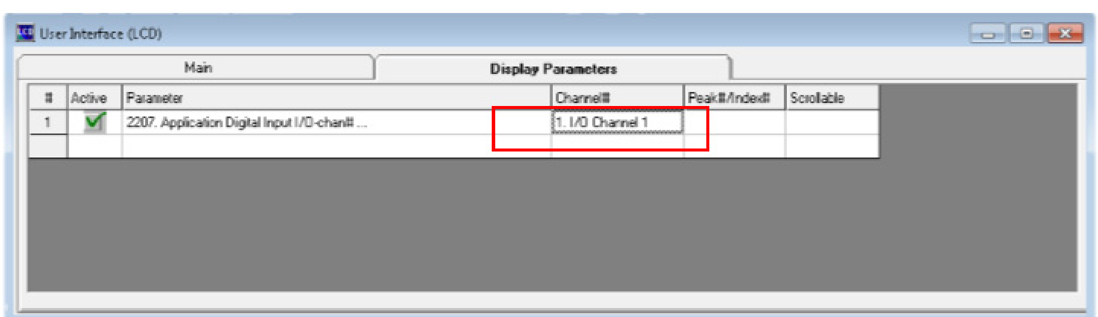


Figure 162. LCD setup I/O parameters

129. Digital Input #2 [Digital In#2]

Displays whether or not the Digital Input (pin 12 from External Digital I/O) is activated.

0 = Deactivated
1 = Activated

2207. Application Digital Input I/O-chan# ... [Digital In#x]

Displays whether or not the Digital Input was activated.

0 = Deactivated
1 = Activated

[Digital In#x] where x is the I/O Channel number

2208. Application Analog Input I/O-chan# ... [V] [R Anal.In#x]

Displays the value in volts (V) of the selected analog input. The value is measured continuously at the analog input and refreshed at screen refresh rate.

[R Anal.In#x] where x is the I/O channel number

2209. Application Computed Analog Input I/O-chan# ... [C Anal.In#x]

Displays the calculated value of the selected analog input, based on the gain and offset as defined in the analog input table. See **Application - Analog Inputs** on page 201 for more information. The value is measured and calculated continuously and refreshed at screen refresh rate.

[C Anal.IN#x] where x is the I/O channel number

2210. Application Current Analog Input I/O-chan# ... at sampling time [S Anal.In#x]

Displays the calculated value of the selected analog input, based on the gain and offset as defined in the analog input table. See **Application - Analog Inputs** on page 201 for more information. The value is measured only once during the run (at sampling) and directly displayed.

API21 Parameters

Statistical parameters

This section gives an overview of the available API21 average, minimum and maximum parameters which can be used in the LCD configuration. For each parameter the channel# and peak# needs to be set. The channel# should be set to the stream number. The stream number can be set from 1 till the maximum number of available streams. The peak# should be set to one of the API21-ParamID, see **Table 12** on page 221.

The CHAN identifies from which stream the results are requested. The API21-ParamID identifies which value is requested, for instance PARAM_ID = 101 identifies the Heating value superior.

Table 12 API21 ParamID - display text

Description	API21-ParamID	Display text
Year	1	Year
Month	2	Month
Day	3	Day
Hour	4	Hour
Minute	5	Min.
Second	6	Sec.
Number of analysis	7	#Ana.

Table 12 API21 ParamID - display text

Description	API21-ParamID	Display text
Number of analysis with active alarms	8	#Alrm
Heating value superior	101	HvSup
Heating value inferior	102	HvInf
Relative density	103	Rel.D
Wobbe index superior	104	WobSu
Wobbe index inferior	105	WobIn
Compressibility at base conditions	106	Compr
Total area, sum of all peaks	107	TArea
Unnormalised sum	108	Unsum
Concentration component 1	1001	First 5 characters of the component name
...	...	First 5 characters of the component name
Concentration component 19	1019	First 5 characters of the component name

12004. API21: Average per hour #stream #norm-peak [“Display Text” AVG[h]]

Displays the average value of the configured PARAM_ID (see **Table 12**) over current hour interval.

12005. API21: Average per day #stream #norm-peak [“Display Text” AVG[d]]

Displays the average value of the configured PARAM_ID (see **Table 12** on page 221) over current day interval.

12006. API21: Average per month #stream #norm-peak [“Display Text” AVG[m]]

Displays the average value of the configured PARAM_ID (see **Table 12** on page 221) over current month interval.

12007. API21: Minimum per hour #stream #norm-peak [“Display Text” MIN[h]]

Displays the minimum value of the configured PARAM_ID (see **Table 12** on page 221) over current hour interval.

12008. API21: Minimum per day #stream #norm-peak [“Display Text” MIN[d]]

Displays the minimum value of the configured PARAM_ID (see **Table 12** on page 221) over current day interval.

12009. API21: Minimum per month #stream #norm-peak [“Display Text” MIN[m]]

Displays the minimum value of the configured PARAM_ID (see **Table 12** on page 221) over current month interval.

12010. API21: Maximum per hour #stream #norm-peak [“Display Text” MAX[h]]

Displays the maximum value of the configured PARAM_ID (see **Table 12** on page 221) over current hour interval.

12011. API21: Maximum per day #stream #norm-peak [“Display Text” MAX[d]]

Displays the maximum value of the configured PARAM_ID (see **Table 12** on page 221) over current day interval.

12012. API21: Maximum per month #stream #norm-peak ["Display Text" MAX[m]]

Displays the maximum value of the configured PARAM_ID (see **Table 12** on page 221) over current month interval.

Historical parameters

This section gives an overview of the available API21 Latest, previous, 2nd previous and 3rd previous result parameter which can be used in the LCD configuration. This parameter provides access to the stored API21 values. For this parameter the channel# and peak# should be set. The channel# should be set to one of the following options:

- 0. Latest results
- 1. Previous results
- 2. 2nd Previous results
- 3. 3rd Previous results

The peak# should be set to one of the API21-ParamID, see **Table 13**.

Table 13 API21-ParamID - display text

Description	API21-ParamID	Display text
Year	1	Year
Month	2	Month
Day	3	Day
Hour	4	Hour
Minute	5	Min.
Second	6	Sec.
Analysis number	9	Ana.#
Stream number	10	Strm#
Alarm register 1	51	Alrm1
Alarm register 2	52	Alrm2
Alarm register 3	53	Alrm3
Alarm register 4	54	Alrm4
Heating value superior	101	HvSup
Heating value inferior	102	HvInf
Relative density	103	Rel.D
Wobbe index superior	104	WobSu
Wobbe index inferior	105	WobIn
Compressibility at base conditions	106	Compr
Total area, sum of all peaks	107	TArea
Unnormalised sum	108	Unsum
Concentration component 1	1001	First 5 characters of the component name

Table 13 API21-ParamID - display text

Description	API21-ParamID	Display text
...	...	First 5 characters of the component name
Concentration component 19	1019	First 5 characters of the component name

12015. API21: History Value #stream #norm-peak [“Display Text”]

9 PROstation Automation Menu

To automate your instrument, configure your instrument as described in **Instrument Configuration, Automation** tab. In this Configuration Setup, the user sets his I/O settings, Stream Selection hardware, Extension Boards and various other automation related parameters.

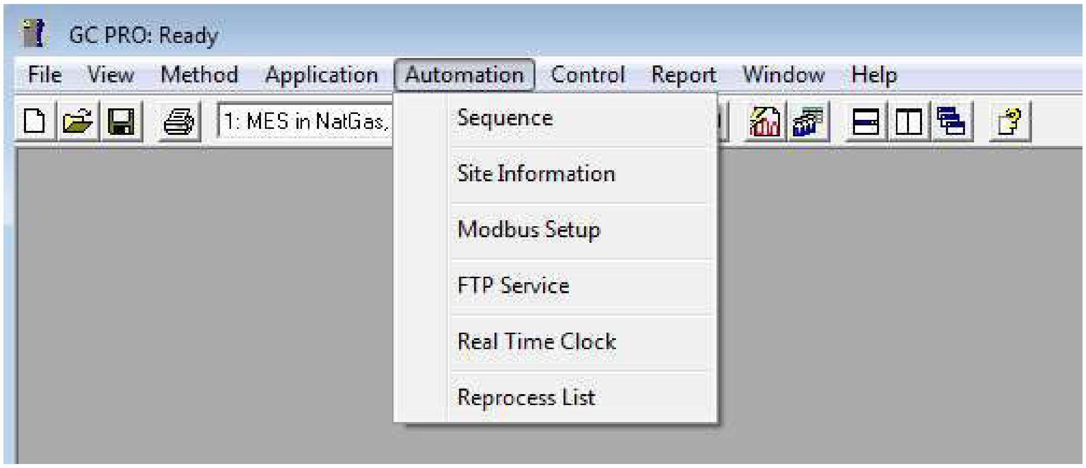


Figure 163. Automation tab

Automation Sequence

If no Sequence is available, execute the Sequence Wizard. This will generate a sequence upon the selections in the wizard, see **Sequence Wizard** on page 84.

To access Sequence, click the **Automation** pull down menu from the **PROstation Toolbar** and select **Sequence**.

The Sequence menu has two different layouts, depending on stream selection hardware present. A hardware setup with no stream selection device is unable to switch to different sample streams, or select calibration- or verification gas streams while being automated. A hardware setup with a VICI sample selection device or a Relay type sample selector has the ability to switch sample streams, run blank samples, run and perform timed calibrations or verifications.

A hardware setup with no stream selection device is unable to switch to different sample streams, or select calibration- or verification gas streams while being automated.

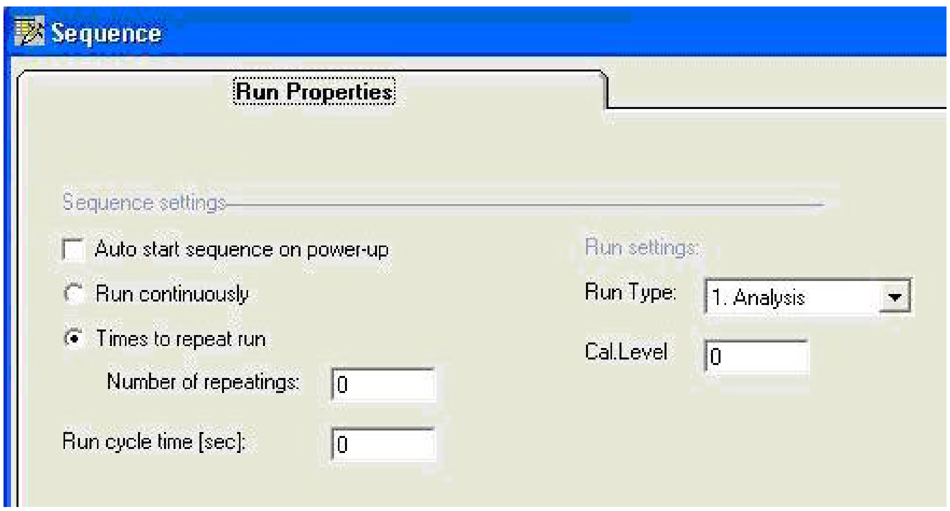


Figure 164. Single stream run properties

As only one single sample is connected, one run type can be performed. In case of a necessary calibration or verification, the sequence must be stopped, the appropriate sample connected and the Run Properties must be changed or another sequence opened and downloaded to the instrument. To resume normal operation again, the Run type must be reset to **Analysis**.

The single stream sequence properties screen is also active if a sampler has been selected in combination with Host System Control. A hardware setup with a VICI sample selection device or a Relay type sample selector has the ability to switch sample streams, run blank samples, run and perform timed calibrations or verifications.

Consequently the sequence menu will look like **Figure 165** on page 227.

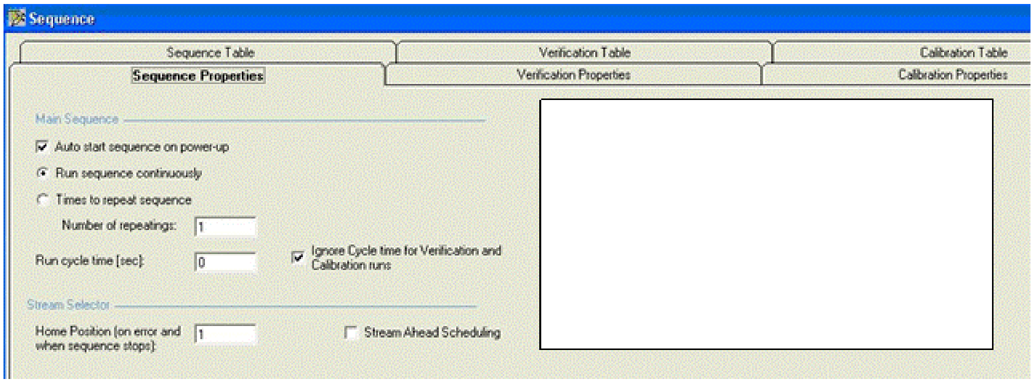


Figure 165. Multistream sequence properties

Auto start sequence on power-up

Used to start automation automatically after booting the instrument. When the checkbox is checked automation will start the Sequence Table and any present Calibration/Verification Tables in the active automation method. The instrument will resume its routine after a power cut or failure automatically without human intervention.

Enable this option when the GC is running in “stand-alone” mode, in case of a power failure the instrument will start the automation again. The sequence will start from the beginning.

Run sequence continuously

When this option is selected, the system will cycle the Sequence continuously. After completing the last line of automation in the Sequence Table, the system will continue with the first line in the Table. The system will stop only with human intervention or when it is indicated it should do so when Calibration or Verification fails.

A continuous sequence can be interrupted by:

- Programmed and activated calibration block
- Programmed and activated verification block
- External intervention through ModBus

Continuous analysis

The instrument will run continuously. An internal watchdog will monitor the ongoing process. If for some reason the ongoing process is disturbed, the instrument will be rebooted. Always have the **Restart on reboot** option enabled in the Automation sequence to let the instrument continue a sequence which was interrupted by reboot.

Times to repeat sequence

When this option is selected, the system will do a defined number of cycles of the Sequence Table. After completing its last cycle, the system will stop and go to ready state.

Number of repeatings

The number of times a sequence should be repeated.

Run cycle time

The run cycle time represents the time that should expire before a new run can be started. Normally a run cycle consists of sample flush time, chromatogram runtime, and calculation time (in this order).

When the cycle time is set greater than the total time needed to complete this chromatographic cycle, the system will hold and wait until the indicated amount of time has elapsed before proceeding to the next run (cycle).

Home position

Determines the position of the stream selection device at power startup and after completion of the sequence (including aborting the automation) or when the system has encountered an error. This option ensures that a known sample stream flows through the sample lines in case there is no analysis being performed by the system.

Stream ahead scheduling

When this option is selected, it enables the instrument to start preflushing the sample for the next sample stream, just 1 second after injection. This feature will cut down cycle times when switching streams, as switching to different sample streams often requires a longer time for a sample to reach equilibrium. Note that this option only works for analysis-to-analysis run types. A calibration or verification run cannot schedule the stream ahead.

Sequence Table

If a sequence is required with automatic calibration by means of a stream selector, it is recommended to put only analysis runs (Sample Type = Analysis) in the Sequence Table. In addition, fill the **Calibration Table** only with the required calibration runs and finally set the triggering for a calibration in the **Calibration Properties**.

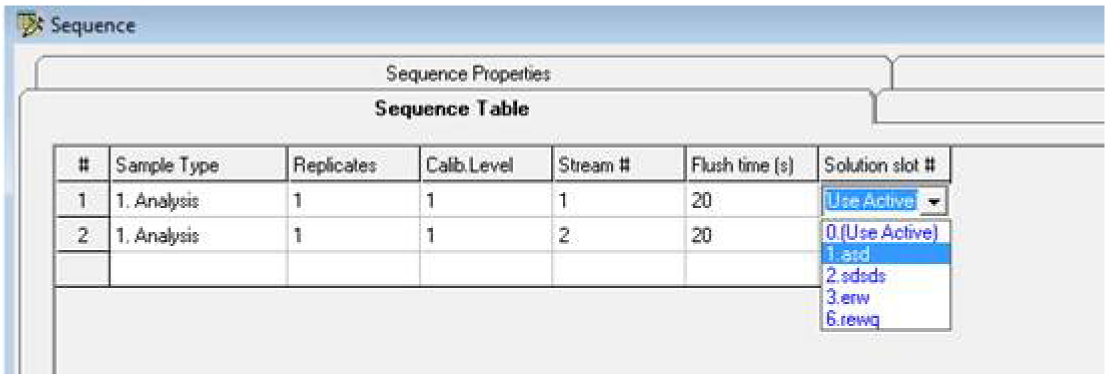


Figure 166. Sequence Table

Sample type

The sample type for this line (run). Can be set to **None**, **Analysis**, **Blank**, **Calibration**, **Verification**. **Sample type = None** represents a blank run without sample being injected (injectime = 0 msec).

Replicates

The number of runs for this line in the Sequence Table.

Calib. level

Sets the calibration level for the line. The number of Calibration levels available is determined by the calibration method. This field is only relevant when sample type is set to Calibration or Verification. For an Analysis run type, just enter 0.

Stream

The sample stream number for this line.

Flush time

Sets the time in seconds the sample selected in Stream# is flushed through the tubing before the actual injection is made. When Stream Ahead Scheduling is enabled, the flushing process of the next sample stream will be invoked five seconds after injection.

Solution slot

A solution is a set of method and application settings. PROstation allows you to create and store multiple solutions for use by the GC. Each solution is stored in a solution slot.

Existing solutions can be downloaded to the GC on demand, as well as be associated with one or more runs in a defined sequence. See **Solutions** on page 445.

Verification Properties

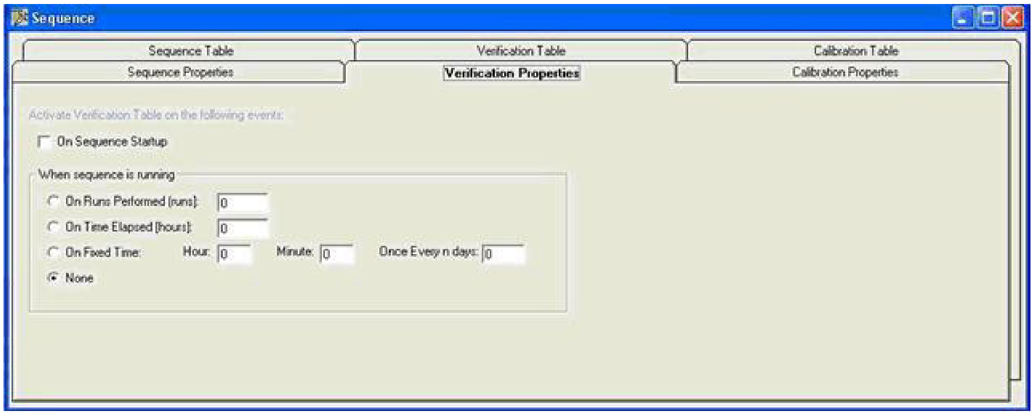


Figure 167. Verification Properties

On sequence start up

Checking **On Sequence Startup** forces the system to run the Verification Table on starting automation. Once the Verification Table is completed, the system will revert back to the Sequence Table contents.

On runs performed (runs)

Selecting this option forces the Sequence Table to be interrupted after a selected number of runs, and then switch to the **Verification Table**. Once the Verification Table is completed, the system will revert back to the Sequence Table.

On time elapsed (hours)

Selecting this option forces the Sequence Table to be interrupted every number of hours of runtime as indicated, and switch to the Verification Table. Once the Verification Table is completed, the system will revert back to the Sequence Table.

On fixed time/once every ‘n’ days

Selecting this option forces the Sequence Table to be interrupted at a fixed time every ‘n’ days, and switch to the Verification Table. Once the Verification Table is complete, the system will revert back to the Sequence Table.

The system will always complete the run in progress before switching to Verification Table contents. For instance, if we set the system to switch to Verification Table at 14:02 hrs each day and a 3-minute run is started at 14:01 hrs, this run will be completed and the actual switch to Verification Table will take place at 14:04 hrs. A Verification Table should be finished before reverting, unless it fails the verification criteria. In that case, it may switch automatically to the Calibration Table.

Verification Table

Figure 168. Verification Table

Replicates

Determines the number of cycles for this particular line in the Verification Table.

Calib. level

Set the calibration level for the line. The number of Calibration levels that are available is determined by the calibration method. Verification calculation is done against the set level of calibration

Stream

Sets the sample stream for this particular Sequence Table line.

Flush time

Sets the time in seconds the sample selected in Stream# is flushed through the lines before the actual injection is performed. Note that when **Stream Ahead Scheduling** is enabled, this flushing process may be started during the previous run.

Calibration Properties

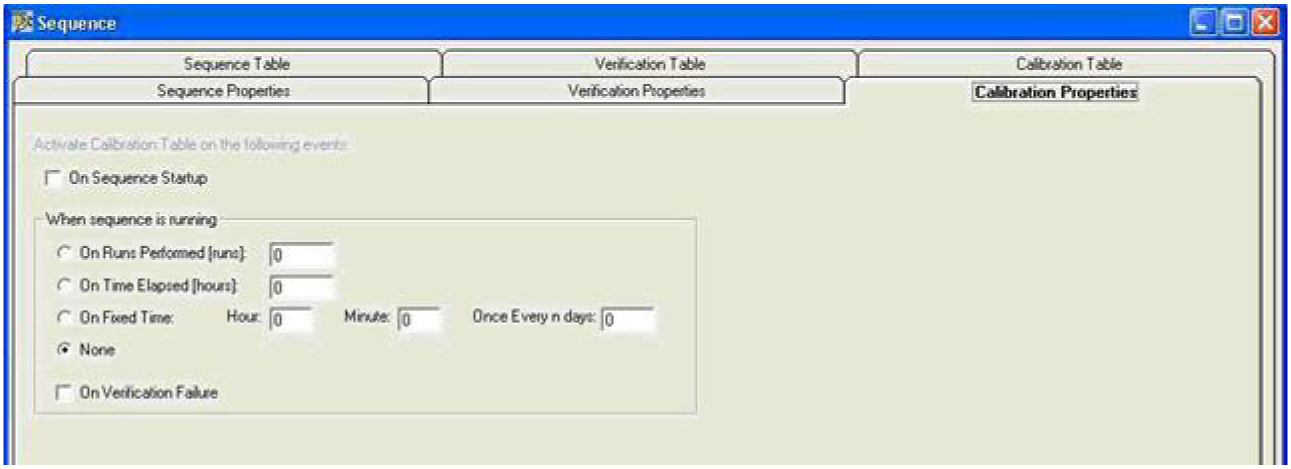


Figure 169. Calibration Properties

On Sequence Start up

Checking **On Sequence Startup** forces the system to run the Calibration Table on starting automation. Once the Calibration Table is completed, the system will revert back to the Sequence Table contents.

On Runs Performed (runs)

Selecting this option forces the Sequence Table to be interrupted after a selectable number of runs, and then switch to the Calibration Table. Once the Calibration Table is completed, the system will revert back to the Sequence Table.

On Time Elapsed (hours)

Selecting this option forces the Sequence Table to be interrupted every number of hours of runtime as indicated, and switch to the Calibration Table. Once the Calibration Table is completed, the system will revert back to the Sequence Table.

On Fixed Time/Once Every 'n' days

Selecting this option forces the Sequence Table to be interrupted at a fixed time every 'n' days, and switch to the Calibration Table. Once the Calibration Table is complete, the system will revert back to the Sequence Table.

On Verification Failure

When this option is selected, the system will run the calibration block after verification has failed to meet its criteria for that particular calibration level. System will complete Calibration Table and revert back to Verification Table, complete that and revert back to Sequence Table.

Note that the system will always complete the run in progress before switching to Calibration Table contents. In case a Calibration Table is running it will be completed at all times, before switching to verification block or reverting back to Sequence Table.

Calibration Table

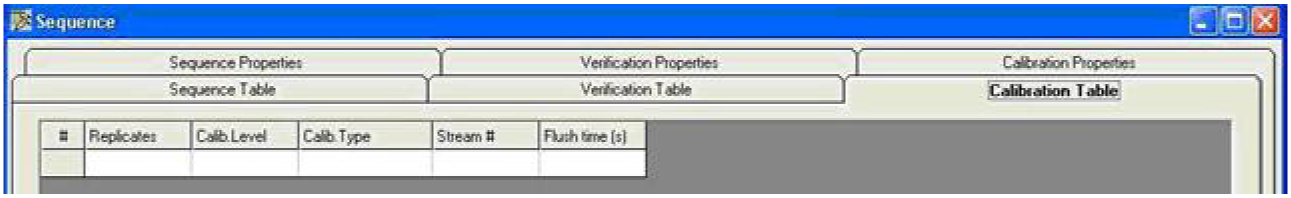


Figure 170. Calibration Table

Replicates

Determines the amount of cycles for this particular line in the Calibration Table.

Calib. Level

Set the calibration level for the line. The number of Calibration levels is determined by the calibration method. Calibrating will add data points to the calibration curve according to Calib level set.

Calib. Type

This field sets the way the calibration result is handled. Available options are **Ignore**, **Replace**, or **Append**. Selecting **Ignore** causes the calibration to be rejected and they will not be added to the calibration curve. This can be used for **flushing** runs. This cleaning the system without performing an update of the calibration curve. Selecting **Replace** will delete all available older calibration points for the particular level in the calibration curve and the new calibration result for the level is added instead. Selecting **Append** simply adds the result to the existing calibration curve.

Stream

Sets the sample stream for this calibration line.

Flush time

Sets the time in seconds the sample selected in **Stream#** is flushed through the tubes before the actual injection is performed. When **Stream Ahead Scheduling** is enabled, this flushing process may be started during the previous run.

The necessary information for the calibration calculations is taken from, and stored as a part of the method.

Site Information

Site information parameters are only used by **API 21 Logging 35 days analysis license**. The settings as listed below will be stored together with analysis results in a database stored in the instruments flash memory.

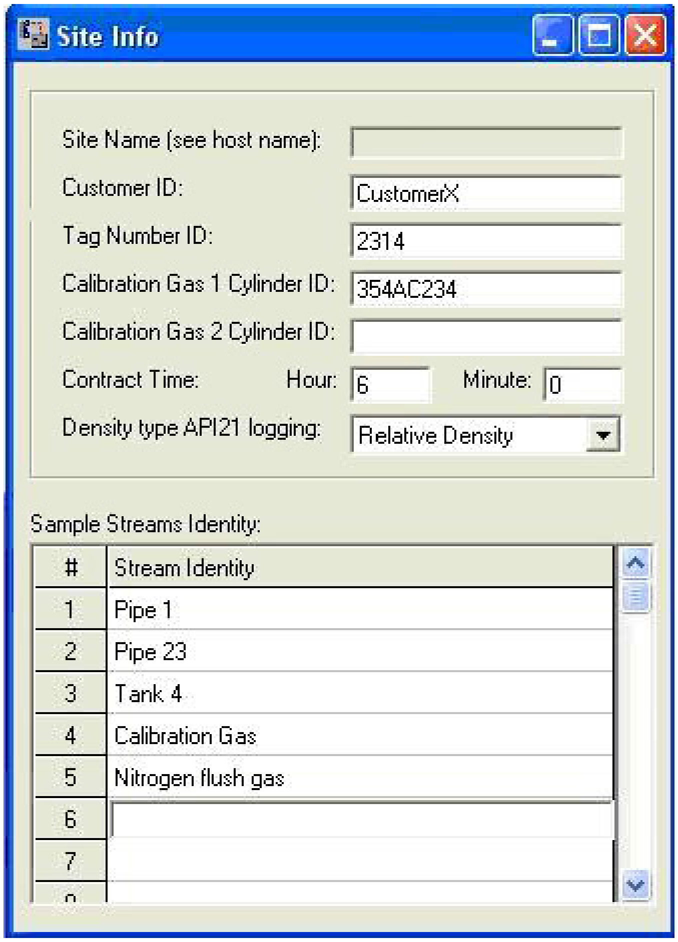


Figure 171. Site Information

Modbus Setup

To interact with the instrument, Modbus registers need to be coupled to parameters IDs. The Modbus table is the list where parameter IDs can be linked to Modbus registers. Follow the steps as described below for a proper Modbus table setup.

Process settings tab

The Modbus Setup will be visible throughout **Automation** and **Modbus setup**.

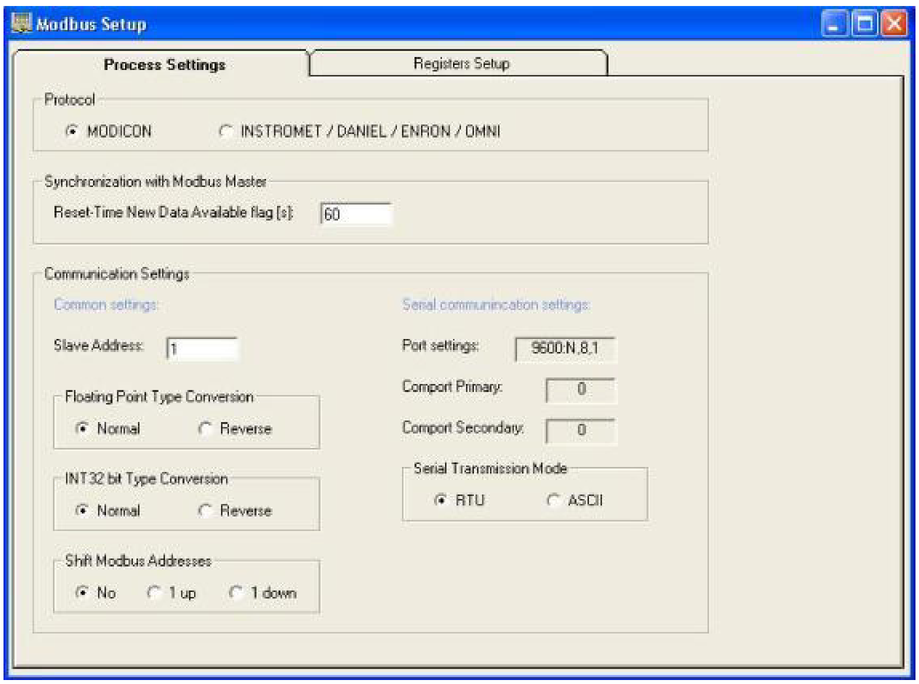


Figure 172. Modbus Setup

Protocol

Change the Modbus protocol from **standard MODICON** to **other derived Modbus protocols**. Modbus MODICON is a standard protocol for SCADA systems. Differences between Modbus MODICON and other Modbus protocols can mainly be found in the holding and input registers above the address 4999 range and above the 6999 range. Above address 4999, the non-MODICON protocol will return 4 byte integers, above 6999 the protocol will give 4 byte floating point values.

Synchronization with Modbus master

For certain parameters, synchronization is required, otherwise the values read are not reliable. Among others, the Reset Time New Data available flag and data flag itself avoid mixing up sample results of two following runs. The **Reset Time New Data available flag** is the time in seconds the data available flag remains set. Set the **data available flag** time lower than the instrument run time. The reset time avoids missing data when more then one Modbus master reads data from the same instrument or when the Modbus Master connects while a instrument is running, For more information see **Synchronize with new data available flag(s)** on page 247.

Modbus communication settings

Slave address

The Modbus serial slave address of the instrument. Every serial Modbus device must have a unique slave address. This way the Modbus Master (DCS, flow computer) knows how to contact a specific instrument.

In a Modbus TCP/IP network, the slave address is ignored in the instrument. If there is a conversion from Modbus TCP/IP to serial Modbus by a Modbus bridge, although ignored by Modbus TCP/IP devices, the slave address is vital when the Modbus request is passed from Modbus TCP/IP to Modbus serial by a Modbus bridge. For more information see **Modbus bridge** on page 253.

Serial communication settings

Baud rate

Baud rate of the serial connection. The speed in characters per second in which data is transmitted over the serial connection between the instrument (Modbus client) and the DCS or flow computer (Modbus Master).

Port settings

The port settings on which the primary and secondary comport are configured. This configuration is set in **D. Communication port settings** on page 41.

Comport Primary

The Comport to which the first Modbus master is connected as set in **D. Communication port settings** on page 41.

Comport Secondary

The Comport to which the second or redundant Modbus master is connected as set in **D. Communication port settings** on page 41.

Serial Transmission Mode

Remote Terminal Unit (RTU). RTU can only be used with 8 data bits serial communication. Note that with 8 data bits, 2 stop bits are not possible. ASCII is a standard for sending information (American Standard Code for Information Interchange). ASCII is standardized to 7 data bits serial communication, but if necessary can also be used on 8 data bits serial communication.

Floating point type conversion

The Modbus MODICON protocol has no definition of 32 bit floating point values. Lacking this definition, two kinds of floating point value definitions have emerged.

This option switches between both of the options, where **Normal** is the definition as used in the instrument and **Reverse** is the definition where the first 2 bytes are swapped with the last 2 bytes.

Int32 bit type conversion

The Modbus MODICON protocol has no definition of 32 bit integer values. Lacking this definition, two kinds of 32 bit integer value definitions have emerged.

This option switches between both of the options, where Normal is the definition as used in the instrument and Reverse is the definition where the first 2 bytes are swapped with the last 2 bytes.

Shift Modbus addresses

When using Modbus, several kinds of Modbus register addressing can be used. The instrument has three different options.

- No: where for register 500 a request for register 500 is sent out (as the instrument has always done)
- 1 down: where for register 500 a request for register 499 is sent out (which can mostly be found in the field)
- 1 up: Where for register 500 a request for register 501 is sent out (rarely used)

For more information see **Modbus register address shift** on page 249.

Registers setup tab

The Modbus Setup table is used to define the Modbus registers. Up to 1000 Modbus registers can be configured.

✓	2. Holding Register (RW)	1001	1. Int16	1. Stop Run (Execute Cmd, MB)	0. Main board	0
✓	2. Holding Register (RW)	1002	1. Int16	2. MPU Reset (Execute Cmd, MB)	0. Main board	0
✓	2. Holding Register (RW)	1003	1. Int16	16. Start Automation (Execute Cmd, MB)	0. Main board	0
✓	2. Holding Register (RW)	1004	1. Int16	17. Stop Automation (Execute Cmd, MB)	0. Main board	0
✓	2. Holding Register (RW)	1005	1. Int16	24. Start Calibration Table (Execute Cmd, MB)	0. Main board	0
✓	2. Holding Register (RW)	1006	1. Int16	25. Start Verification Table (Execute Cmd, MB)	0. Main board	0
✓	2. Holding Register (RW)	1007	1. Int16	29. Stop Cleaning Cycle (Execute Cmd, MB)	0. Main board	0
✓	2. Holding Register (RW)	1008	1. Int16	1000. Request Single Sequence Line (Int32, MB)	0. Main board	0
✓	2. Holding Register (RW)	1009	1. Int16	39. Select Stream (Int32, CHAN)	0. Main board	0
✓	2. Holding Register (RW)	1010	1. Int16	60. Set Manual Run RunType (Int32, MB)	0. Main board	0
✓	2. Holding Register (RW)	1011	1. Int16	61. Set Manual Run Calib. Level (Int32, MB)	0. Main board	0
✓	2. Holding Register (RW)	1012	1. Int16	62. Set Manual Run Stream Pos. (Int32, MB)	0. Main board	0
✓	2. Holding Register (RW)	1013	1. Int16	95. Set Channel to clean, 1=On (Int32, CHAN)	1. Channel 1	0
✓	2. Holding Register (RW)	1014	1. Int16	95. Set Channel to clean, 1=On (Int32, CHAN)	2. Channel 2	0
✓	2. Holding Register (RW)	1015	1. Int16	95. Set Channel to clean, 1=On (Int32, CHAN)	3. Channel 3	0
✓	2. Holding Register (RW)	1016	1. Int16	96. Request cleaning cycle, minutes(Int32, MB)	0. Main board	0
✓	2. Holding Register (RW)	1200	1. Int16	12. Run Continuously (Int32, MB)	0. Main board	0

Figure 173. Registers Setup tab

Register Type

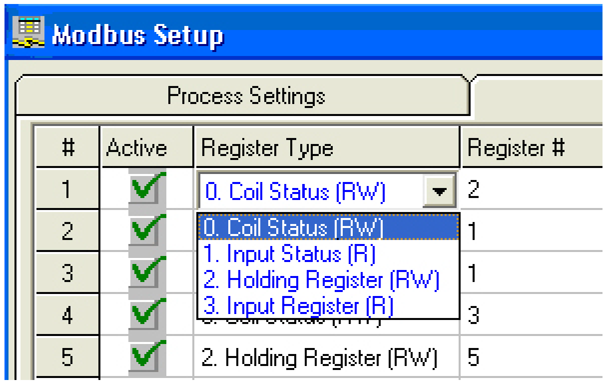


Figure 174. Register Type

Coil status This register is a single bit register. Modbus master is capable of reading and writing this register.

Input Status This register is a read-only single bit register. This register can only be read from a Modbus master.

Holding register This is a 16 bit integer register. Modbus master is capable of reading and writing. Two registers grouped together can hold a 4 byte integer or 4 byte floating point value.

Input register This is a 16 bit integer register. This register can only be read. Two registers grouped together can hold a 4 byte integer or 4 byte floating point value.

Register # The Register # column contains the Modbus register address. Note that **Holding** and **Input** registers require two registers to store a floating point or 32 bit integer value in MODICON mode.

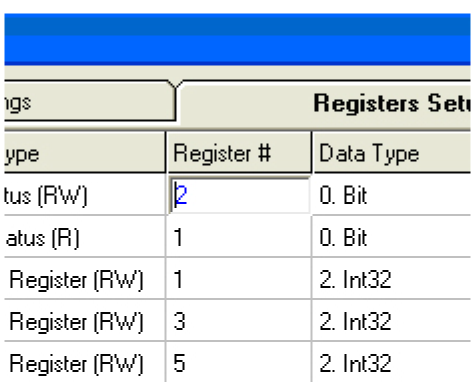


Figure 175. Register #

In the Modbus mode, used by Daniel, Elster-Instromet (and others), 32 bit integers and 32 bit floating point values are handled differently from Modbus MODICON. In contrast with Modbus MODICON, only 1 register is required. In Modbus Daniel mode, certain register ranges are built up of 32 bit registers, which means that 1 register can contain a complete floating point or 32 bit integer value. The 32 bit integers can only be stored in the register range between and including registers 5000 and 6999. Floating points can only be stored in the register range after and including register 7000.

Data Type

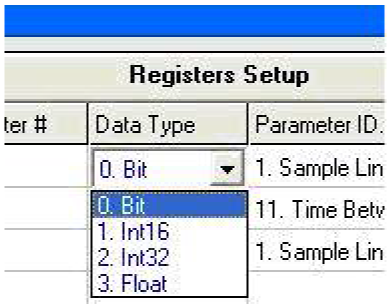


Figure 176. Data type

In the Data Type column, you can choose the register output data type.

Bit a single bit, value 0 or 1.

Int16 16 bit integer value.

Int32 32 bit integer value.

Float 4 byte floating point value.

Parameter ID

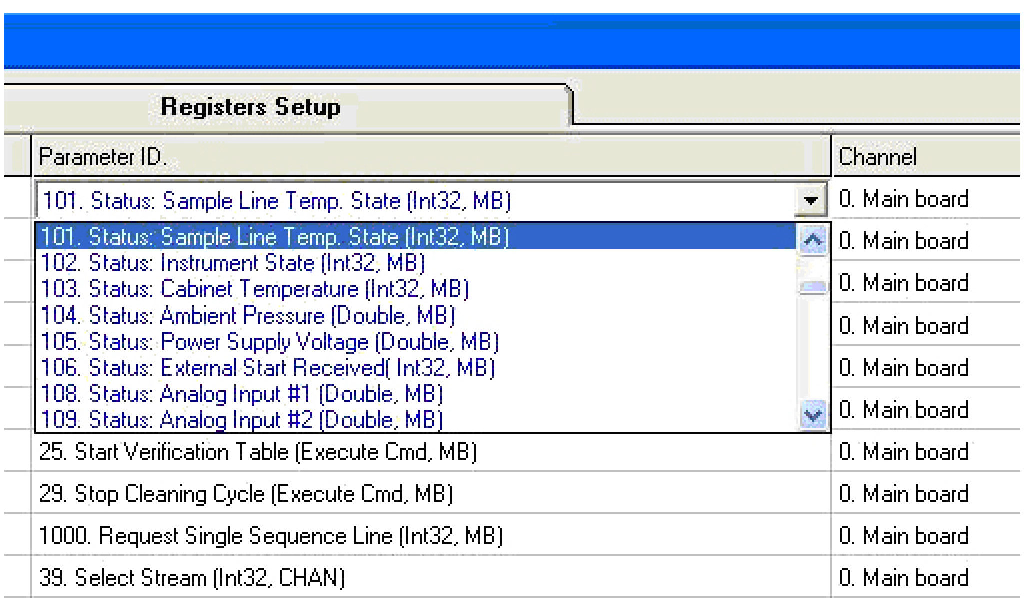


Figure 177. Parameter ID

The **Parameter ID** number is the output number in the instrument that corresponds with the parameter or function that needs to be called to retrieve a value from an instrument, or start an action in it. The Modbus parameters that can be selected in the Modbus table in PROstation are ordered by subject. This means that, for example, all Modbus parameters concerning integration results, are grouped together, whatever the parameters numbers are.

Note that the remarks between brackets reveal the data type for that particular parameter, (Bit, Int16, Int32, Float), the channel value (location of the part to address) and optionally the Peak values that should be used. Which data type, channel and peak value are required for each parameter, is defined in “Modbus Parameter ID Reference”.

Channel

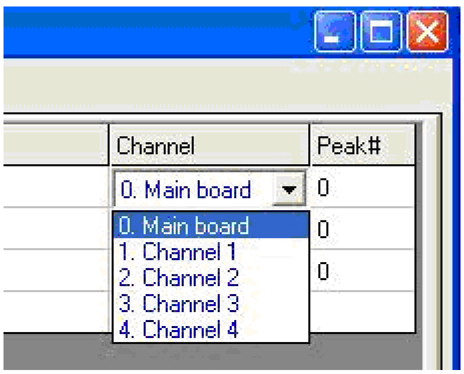


Figure 178. Channel

If a Parameter ID concerns the mainboard or the instrument itself, the choice should be 0 Mainboard. Otherwise, one of the four channels, required I/O number, stream number, etc must be chosen. Which channel setting is required for each parameter, is defined in **Modbus Parameter ID Reference** on page 255.

Peak#

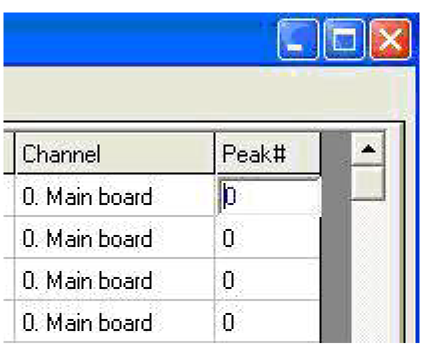


Figure 179. Peak #

Peak numbers should be set for those Parameter ID’s concerning peak related parameters or certain indexes. For some parameters the values in the **Peak#** column are used for other purposes. Which peak setting is required for each parameter, is defined in **Modbus Parameter ID Reference** on page 255.

Which Parameter IDs to use

The instrument uses parameter IDs to allow getting or setting data remotely.

Determine whether the Modbus master (DCS, etc.) must be capable to only read data from the instrument or also write data.

Setup and complete the method, application and automation. Ensure all method peaks exist in the application normalization table. If the application is still empty, run the application wizard in order to create a component list from the method peak table.

Now open a predefined GC Modbus table from hard disk or select the Modbus wizard when developing a new Modbus table. In the Modbus wizard, select the options that are required. It is advisable not to select options which are not requested by the Modbus master. Select **OK** to generate a dynamic Modbus table from the selected options. If **Elster-Instromet/Daniel** mode was selected, a component identity is created on holding register 3001 and up, for every component in the application normalization table. This is required in order to be Daniel protocol compatible.

Modify, delete, or add lines to the generated Modbus table to fulfill the requirements.

Download, Save, and Print the Modbus table. A printout is required for setting up the Modbus master's (DCS) Modbus registers.

The WinDCS application can be used to test the Modbus registers.

Table Copy Functions

By right mouse clicking on a row containing valid data, a menu dialog appears. This allows the operator to use copy and paste functions to set up the Modbus table more efficiently

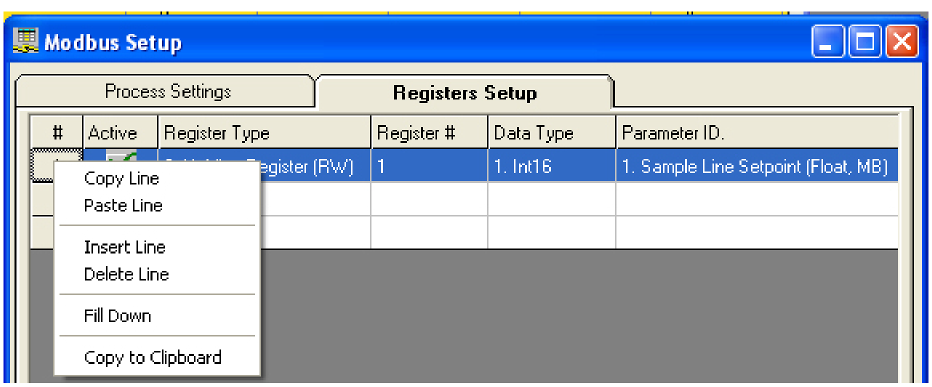


Figure 180. The Setup window

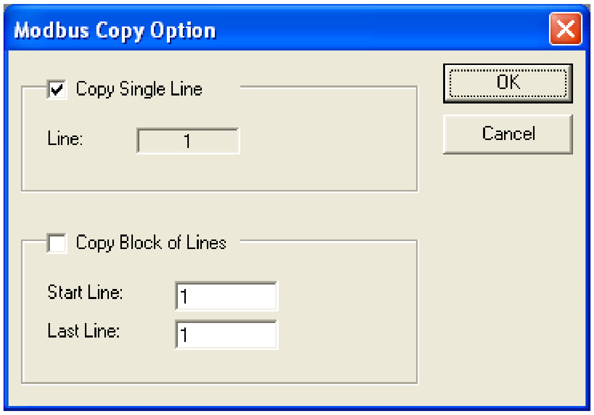


Figure 181. The Copy window

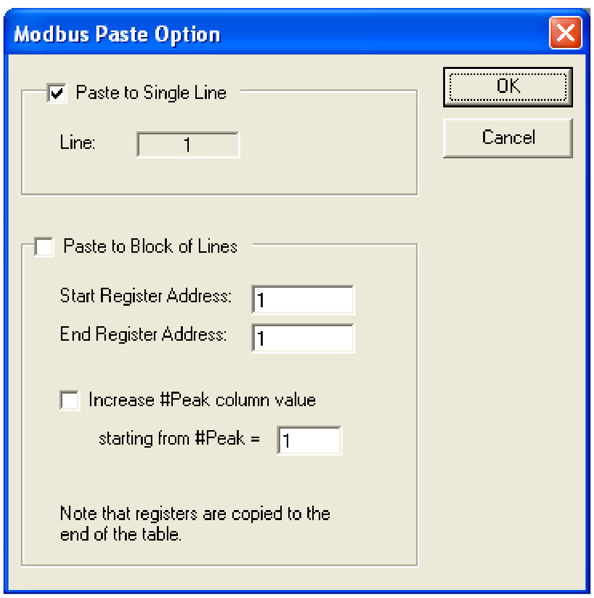


Figure 182. The Paste window

Remote system synchronization

Create Modbus holding registers containing the parameter IDs 515 to 520 in the Modbus table. Ensure the Modbus master sets parameter 518 to "second" as the last clock parameter. On downloading parameter 518 "second", the real-time clock is updated in the BIOS of the instrument. The BIOS is responsible for setting the application clock correctly at reboot.

Reading sample results

Use parameters 2203 to 2237 for reading all relevant sample results after detecting that new sample results are available (see synchronization). Unnormalized (ESTD) component concentrations can be read by reading the Modbus register containing parameter 2232. For normalized values use parameter 2233. The peak column must contain the component number from the application normalization window; channel must be set to **0-mainboard**. For an Energy meter parameter, ID's 2260 - 2280 must be read. All sample results parameters must wait for a "New data available flag" (synchronization bit) to be set.

Reading stream specific results

Parameter ID's 2400 - 2416 are used for reading the last stream specific sample results. The instrument holds the last sample results of every stream in RAM memory.

Fixed values

By using parameter "9000. Fixed Value (Int16, MB, PEAK=fixed value)", "fixed values", Modbus registers can be set up to return a fixed definable value. Enter the required value (INT16 value) in the "peak" column of the Modbus table. This parameter can be used for additional identification.

Execute commands

The "Execute commands" (0-36) can be used to remotely perform an action. Although these parameters trigger some action in the instrument, they still require regular Modbus parameters to be written to Modbus.

If, for example, the instrument must be rebooted on request, create the following line in the Modbus table:

```
Register type : "0 Coil Status" Register: 100 (any other coil address
is allowed) Data type: "0 Bit" Parameter ID: "2 MPU reset (execute
Cmd, MB)" Channel: "0 MB" Peak: "0"
```

To request the instrument to reboot, set coil status 100 to value 1.

Full remote control

Although the instrument can run in autonomic mode, it also can be configured to act as a slave. The Modbus master system is then responsible for selecting the stream, setting Run type, Calibration level, Starting runs, etc.

For remote control, setup a Modbus table containing at least the Parameter IDs as listed below. It is assumed that the method parameters should not be changed during operation.

```
0 Start Run (execute CMD, MB)
24 Start Calibration Table (execute CMD, MB) *
25 Start Verification Table (execute CMD, MB) *
60 Set Manual Run Type (INT16, MB)
61 Set Manual Run Calibration level (INT16, MB)
62 Set Manual Run Stream position (INT16, MB)
```

To prepare a new run, the Modbus master must set Run type, Calibration level and stream position, parameter ID's 60, 61, and 62 (see **page 267**), and then start a single run (parameter ID 0). Predefined calibration and/or Verification Tables can simply be started by sending out an execute command.

* These are priority runs. They will be executed after the current run is completed. In instrument idle mode, priority runs will be executed at once.

Advanced Modbus Information

Synchronize with new data available flag(s)

To synchronize a DCS with new analysis data, setup a Modbus table containing a **New data available** flag (synchronization parameters 2200, 2201, or 2238 see **page 312**) on an input status register or, if required, an input register.

All sample result related parameter IDs, which are linked to Modbus registers, should only be read when the **New data available** flag is set to 1. This means the run has finished, all calculation is done, and Modbus registers containing result data have been updated with information of the finished run.

Now all sample results parameter IDs can be read any time.

The instrument has three different **New Data Available** flags (that cannot be used in combination), with their own behavior when it comes to resetting the flag.

Parameter 2200 is set to 1 when all sample result data of the last finished run are available. This value is automatically reset after the **Reset-Time data available** flag expires. The **Reset-Time data available** can be set in the **process setting** tab **Modbus Setup**. These parameters should not be used when more than one Modbus master reads data from the same instrument. Parameters 2201 and 2238 become 1 the moment all sample result data of the last finished run is available. This value is reset back to 0 directly after the register is read by a flow computer. However, if the parameter is not read, the value will be reset automatically after the **Reset-Time data available flag** expires. The **Reset-Time data available flag** can be set in the **process setting** tab **Modbus Setup** on **page 237**. These parameters must be used when more then one Modbus master reads data from the same instrument, otherwise one of the Modbus Masters misses new data. Check "Modbus pitfalls, attention points and recommendations" for additional information.

Modbus pitfalls, attention points and recommendations

Modbus synchronization has some pitfalls and points of attention. Some are unique to the instrument, some are general to Modbus. The most common are listed. Use identical Modbus settings and Modbus table on both master and slave side. Modbus settings on the instrument (slave) should be the same as on the Flow Computer side (master).

Reset time new data available flag

Ensure the **Reset-Time data available** flag is smaller than the run time, but long enough to be detected by the Modbus master(s). Please see **Synchronize with new data available flag(s)** on page 247 for additional information.

New Data available flag only accounts for result data

The new data available **2200. Sync: Data available (Bit, MB)** on page 312, **2201. Sync: Data available with reset(Bit, MB)** on page 312, or **2238. Sync: Data available2 with reset(Bit, MB)** on page 312 are only applicable to sample result data. Status data is valid at any time and reading status does not require waiting for the synchronization parameter to be set to 1. Please see **Synchronize with new data available flag(s)** on page 247 for additional information.

Do not combine new data available flags

Do not use any combination of 2200, 2201, or 2238 in the same Modbus table. You should use either parameters 2200, 2201, or 2238.

If you use them combined, unexpected behavior will occur, if, for example, parameter 2201 is read, parameter 2201 will be reset to 0, but parameters 2200 and 2238 will be reset as well. Similar issues could occur when using a combination of two or more times the same synchronization 2200, 2201, or 2368.

Int32 and Float data types in Modbus MODICON.

When working in Modbus MODICON mode, always use 2 register spaces for 32 bit values, because Modbus MODICON, by design, only accommodates 16 bit register spaces. The 32 bit values that can be used are Float and Int32 (32 bit integer).

Modbus MODICON

Table 14 Modbus MODICON

Register	Register type	Data type	Parameter ID
502	Holding register	Float	2232. Application: Comp. ESTD Conc.
504	Holding register	Float	2237. Application: Comp. Area

Int32 and Float data types in Modbus Daniel

When working in a Modbus addition as used by Elster-Instromet, Daniel, Enron or Omni, you have 32 bit address spaces available, but only for certain address ranges. From address 5000 to 6999, only 32 bit integers can be used. From 7000 and up only floating points can be used. These address ranges have 32 bit address spaces, so for one 32 bit integer or 1 floating point value (which is 32 bit as well), only one address space has to be used.

Modbus Elster-Instromet/Daniel/Enron/Omni Int32

Table 15 Modbus Elster-Instromet/Daniel/Enron/Omni Int32

Register	Register type	Data type	Parameter ID
7002	Holding register	Float	2232. Application: Comp. ESTD Conc.
7003	Holding register	Float	2237. Application: Comp. Area

Modbus register address shift

Manufacturers of Modbus equipment can start counting a Modbus table at various starting points, different from what is shown to the user. The various ways of counting are explained below. Those different ways of counting are better known as address shift (manual and PROstation).

If the Modbus master (flow computer) internally starts counting the Modbus table at 0, the master requests register 499 if register 500 is defined in the Modbus table presented to the user of the Modbus Master. The instrument (Modbus slave) - if address shift configured correctly - returns the content of register 500. If the instrument is configured in another way, the Modbus master will end up with the content of register 499 or 501 or with an error. This is most common in the field according to the official Modbus MODICON standard. To handle this type of address shift properly, set the Modbus address shift to **1 down**.

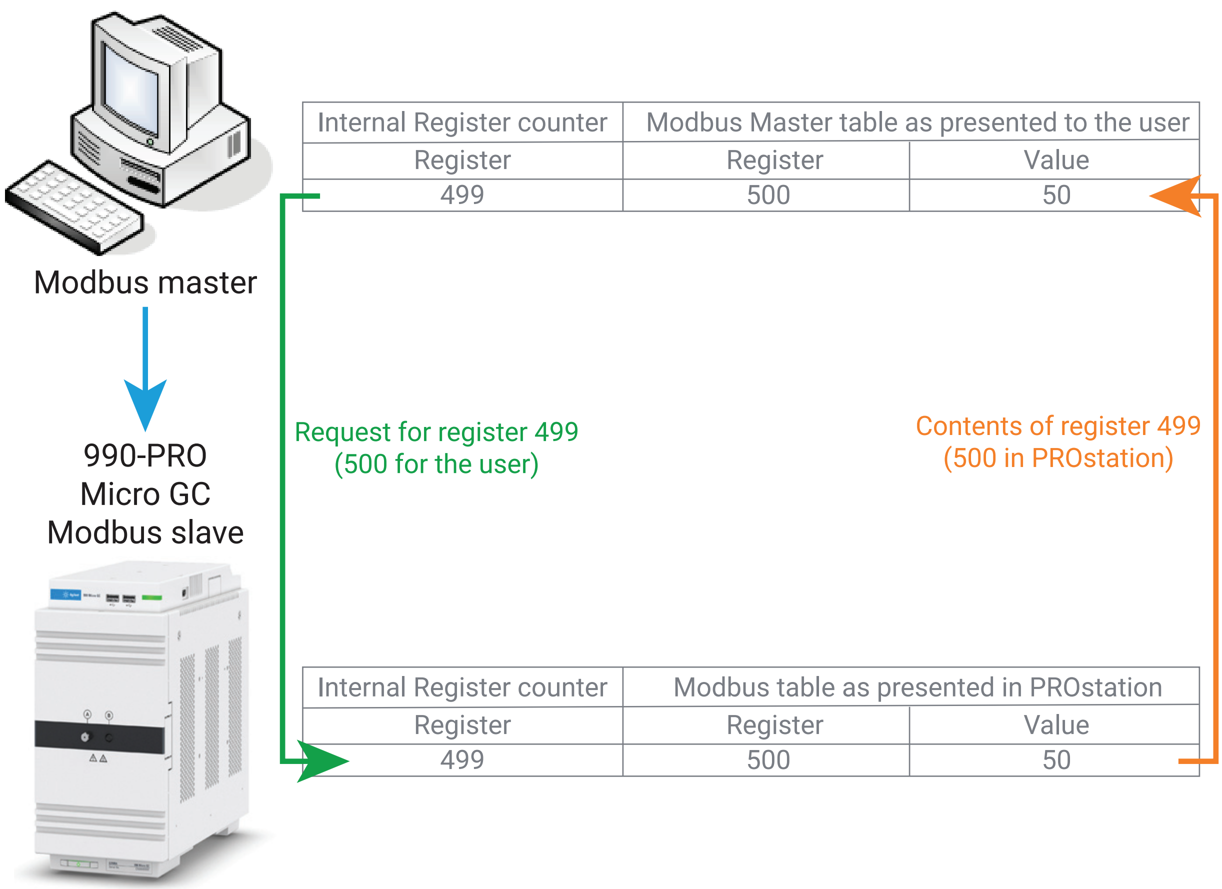


Figure 183. Modbus address shift **1 down**

If the Modbus master (flow computer) internally starts counting the Modbus table at 1, the master requests register 500 if register 500 is defined in the Modbus table presented to the user of the Modbus Master. The instrument (Modbus slave) - if address shift configured correctly - returns the content of register 500. If the instrument is configured in another way, the Modbus master will end up with the content of register 499 or 501 or with an error. This is the way the instrument has operated in the past. To handle this type of address shift properly, set the Modbus address shift to **No**.

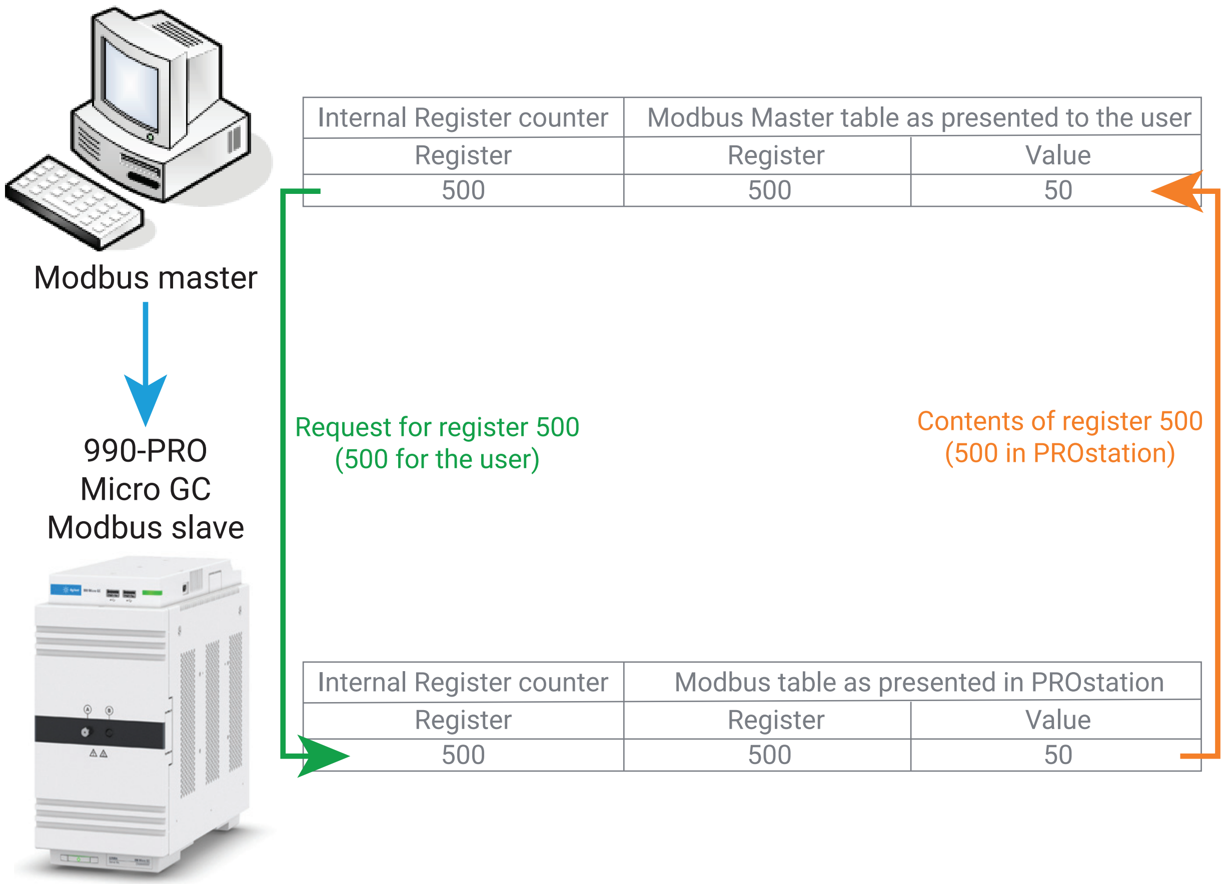


Figure 184. Modbus address shift to **No**

If the Modbus master (flow computer) internally starts counting the Modbus table at 2, the master requests register 501 if register 500 is defined in the Modbus table presented to the user of the Modbus Master. In this case, the Modbus table presented to the user often starts at 0. The instrument (Modbus slave) - if address shift configured correctly - returns the content of register 500. If the instrument is configured in another way, the Modbus master will end up with the content of register 499 or 501 or with an error. To handle this type of address shift properly, set the Modbus address shift to **1 up**.

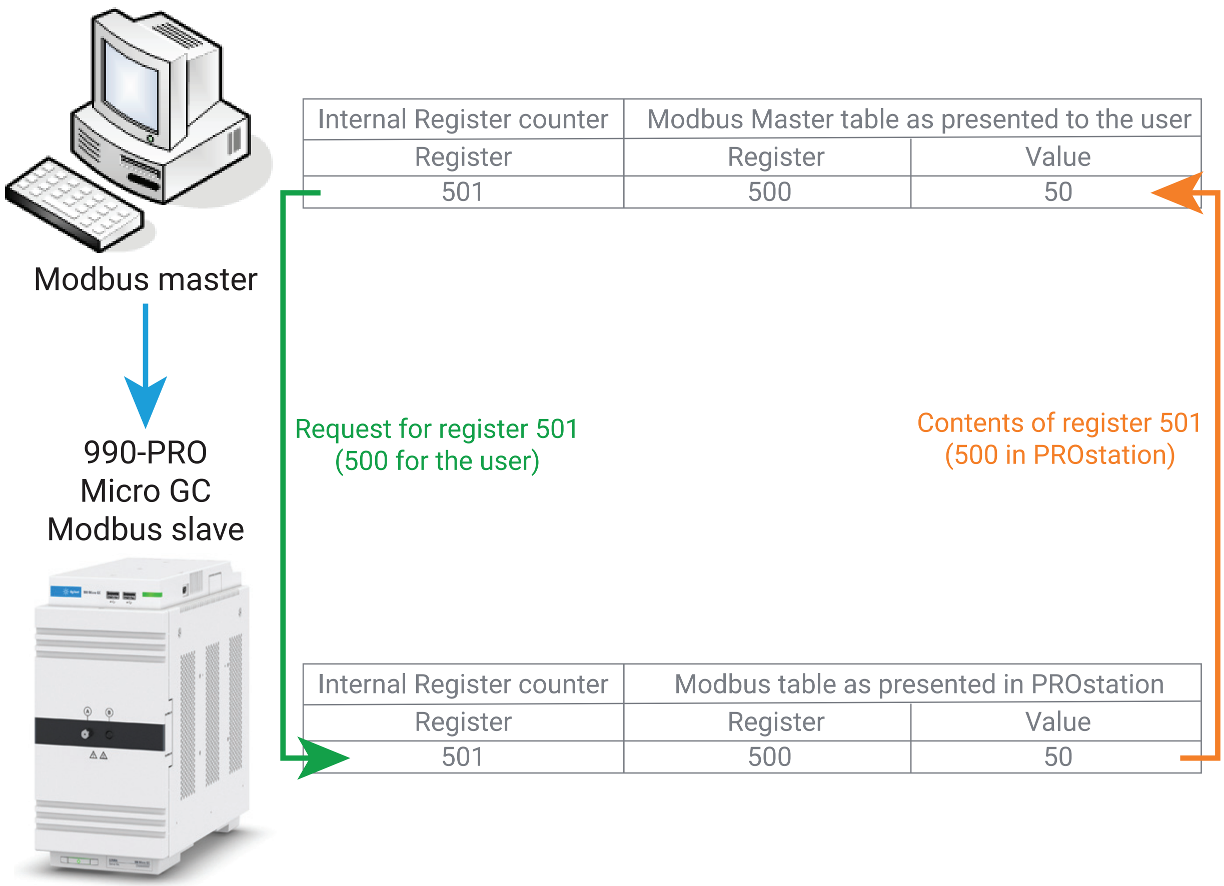


Figure 185. Modbus address shift to **1 up**

Register requests outside the instrument Modbus table

If an address is requested outside the table defined in the instrument, the GC will ignore the request and return an error. For example, assume this is the complete table defined in the instrument table (Daniel mode)

Table 16 Example table

Register	Register type	Data type	Parameter ID
7002	Holding register	Float	2232. Application: Comp. ESTD Conc.
7003	Holding register	Float	2237. Application: Comp. Area

Now assume a block of registers ranging from 7001 up to and including 7004 is requested by the flow computer. The instrument responds with an error, because registers 7001 and 7004 are not configured in the GCs Modbus table.

Communication start test

Some Modbus Master applications (for example Simplicity) test all their configured Modbus registers in large blocks at the start of communication. These blocks often exceed the limits as defined in the Modbus table of the Modbus master or used during normal communication. The register blocks to which the instrument responds with an error will be removed from the communication schedule. Therefore, all registers and register blocks that fail during this test will never be requested again until the communication is stopped and restarted (again the configured registers are tested).

Configured Modbus master table

During normal communication, register 500 and 520 will be requested independently. While testing, it is possible that a block of registers is requested from 500 to 520 at once. Due to the instrument behavior described above, this test will fail, although nothing is wrong with the instrument configuration. The test algorithm and how or when several independent registers are grouped during the test, is unknown to us.

Table 17 Configured Modbus master table

Register	Data type
500	Int16
520	Int16

To have a workaround for this problem, do not leave gaps between registers of the same type.

Modbus bridge

Because of the variety of Modbus variants and connection possibilities, one can come across a Modbus network configuration that the instrument does not or cannot support. The same problem can occur when a Modbus serial network is required and all serial ports are occupied for additional equipment. In such cases, a Modbus bridge can be the solution.

Cases where a Modbus bridge can help

- Modbus RS485 2-wire serial network
- Any Modbus serial network where all serial ports of the instrument are in use
- Modbus RS422 serial network
- Modbus TCP/IP Master for some reason does not communicate with Modbus TCP/IP in the instrument

To help with these issues, we have tested a couple of Modbus bridges of Moxa Inc. operating in **serial to Modbus TCP** mode and **Modbus TCP to serial** mode. It is advisable to use one of these Modbus bridges in case one is needed. Moxa comes in two Modbus bridge series: a standard series (MB3x80, where x is the number of ports) and an industrial series (MB3x70 where x is the number of ports)

Often, the standard series (MB3x80) is more suitable when the instrument is used in a clean laboratory environment.

The industrial series is more suitable for use in industrial environments. It has some specific industrial options, such as redundant power supply, power supply alarm, rack mounting, Ethernet cascading, and priority control for urgent commands etc.

Here is an example diagram of a situation where two GCs are connected to a Modbus RS485 2-wire serial network, which is normally not supported by the instrument.

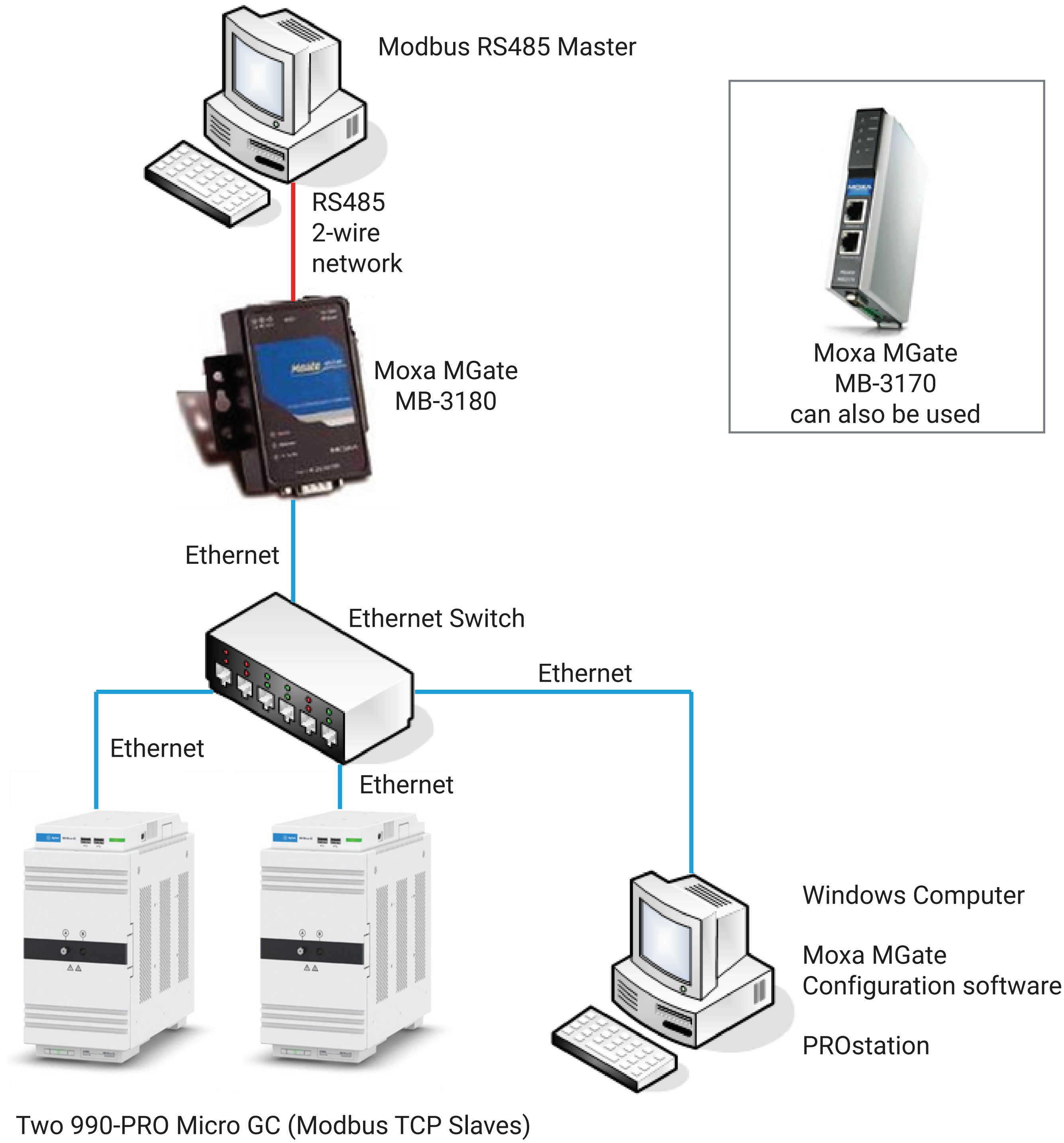


Figure 186. Modbus gateway

If there are one or more Modbus Master(s) on the Modbus TCP/IP network that need to communicate with the network, note that a 2-port Modbus gateway is required (or two individual Modbus gateways).

Modbus Parameter ID Reference

This section lists and explains all available Modbus parameters. The Modbus parameters are listed in the same order and manner as they are listed in the Modbus configuration of PROstation. This means that the Modbus parameters are ordered by subject. Each subject that contains a Modbus parameter is put into a separate paragraph, making it easier to find the correct Modbus parameters.

Each Modbus parameter description consists of several fields. Some fields are only for use in the Modbus table of PROstation (Modbus slave), others are required to use in PROstation and the DCS or flow computer (Modbus masters). Below is a description of all possible fields. The fields of interest for the PROstation Modbus table are marked:

Description The general task Allowed values: One of the defined values is selected for each Modbus parameter, depending on whether the particular value is read-only, write-only or read/write.

Return value The kind or range of return value for a read-only parameter. (Corresponds with return value field in the Modbus Master). If an error occurs, a Modbus error will be returned instead.

Set Value The kind or allowed range of set value for a write only parameter (Corresponds with return and set value field in the Modbus Master). If successful, 0 will be returned, otherwise a Modbus error is returned.

Return/Set value The kind or allowed range of return or set value for a read/write parameter (Corresponds with return and set value field in the Modbus Master). If successful, 0 will be returned, otherwise a Modbus error is returned.

Unit Specification of the used unit (if any).

Accuracy The returned or required accuracy (if specifiable).

Modbus data type The advised data type that should be used to work with a particular Modbus parameter.

Channel (PROstation) The location of the instrument to which the Modbus request should be addressed. This field contains a select list with possible locations for the selected parameter ID. This select list changes according to the Modbus parameter specified (corresponds with the Channel column in the Modbus table in PROstation).

Peak (PROstation) A field that is required for some Modbus parameters to do additional selections. Most of the times it is used to select a particular peak, but often it is used to select a particular relay or IO port. (Corresponds with the Peak column in the Modbus table in PROstation).

Remarks Specifies additional behavior, characteristics, warnings and/or attention points. This field gives links to related Modbus parameters or related sections elsewhere in the manual.

Modbus Parameter ID table of contents

System method and configuration settings

1. Sample Line Setpoint (Float, MB)

Description
Returns/sets the sample line Setpoint.

Return/Set value
30 to 110

Unit
degrees Centigrade (°C)

Accuracy
1 °C

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bits floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
Before use, check if a heated sample line is installed.

See also
Sample line setpoint method screen.
Heated sample line information.

2. Flush Cycle Active (bit, MB)

Description
Returns/sets whether or not the instrument will perform a flush cycle when needed. For example after restart (changing gas bottle).

Set Value
0 = No flush cycle will be performed
1 = Flush cycle will be performed

Register type
Bit (1 Bit)

Channel (PROstation)
Mainboard (value = 0)

Remarks
When recovering from a too low pressure error, a flush cycle is always performed. A too low pressure error occurs when changing a gas bottle or certain gas errors.

See also
Flush cycle setting. The chapter about the factory default settings briefly mentions the flush cycle. For detailed information about the flush cycle, refer to the 990 Micro GC manual.

3. Number of flush cycles (Int16, MB)

Description
Returns/sets the number of flush cycles set in the instrument configuration.

Set Value
1, 2, or 3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0) This parameter can return a value bigger than 0, even when parameter number 2. Flush Cycle Active (bit, MB) is set to 0.

See also
Flush cycle method setting. The section about the factory default settings briefly mentions the flush cycle. For detailed information about the flush cycle, refer to the instrument cycle schema.

4. Sampling Time [ms] (Int16, MB)

Description
Returns/sets sampling time set in the instrument method.

Set Value
0 to 999

Unit
milliseconds (ms)

Accuracy
1 ms

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

See also
Sampling time method setting.

9. Continuous Flow Mode (bit, MB)

Description
Returns/sets whether or not continuous flow mode is switched on as set in the instrument configuration.

Set Value
0 = Continuous flow mode is switched off
1 = Continuous flow mode is switched on

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

See also
Continuous flow configuration settings.

10. Stabilization Time [s] (Int16, MB)

Description
Returns/sets the stabilizing time as set in the instrument method.

Set Value
0 to 99

Unit
Seconds (s)

Accuracy
1 s

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
0 = stabilizing time off

See also
Stabilizing time
Stabilizing Time method setting
Explanation chromatographic run in instrument cycle schema

Automation 1 - Modbus parameters

11. Cycle time [min] (Float, MB)

Description
Returns/set the total cycle time of a instrument cycle (run).

Return/Set value
0 to 1440

Unit
minutes (min)

Accuracy
0.01 min

Modbus Register Type
Holding Register (Input register in case of reading)

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remark
This value in PROstation is defined in seconds.

See also
990 Micro GC cycle schema

Corresponding value in the sequence properties of PROstation (Note that this value is in seconds.)

12. Run Continuously (bit, MB)

Description
Returns/sets whether or not the instrument is set to run the Sequence continuous.

Return/Set value
0 = Run Continuously option is not activated
1 = Run Continuously option is activated

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

See also
Corresponding value in the sequence properties of PROstation.

15. Number of Automation Runs (Int32, MB)

Description
Returns/sets the number of runs to perform as set in the sequence.

Return/Set value
0 to 2147483647

Unit
none

Accuracy
1

Modbus Register Type
Holding

Register/Input Register Modbus data type
Int32 (32 bit integer)

Channel (PROstation)
Mainboard (value = 0)

See also
Corresponding value in the sequence properties of PROstation.

16. Calibration at Startup (bit, MB)

Description
Returns/sets whether or not the Calibration Table will be executed at startup of the sequence.

Return/Set value
0 = At startup of the sequence the Calibration Table will be started (before the sequence starts)
1 = At startup of the sequence no calibration will be performed

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

19. Verification at Startup (bit, MB)

Description
Returns/sets whether or not the Verification Table will be executed at startup of the sequence.

Return/Set value
0 = At startup of the sequence the Verification Table will be started (before the sequence starts)
1 = At startup of the sequence no verification will be performed

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

35. Verification After Calibration Failure (bit, MB)

Description
Returns/sets whether or not a new calibration will be performed in case the verification fails.

Return/Set value
0 = No calibration will be performed on verification failure
1 = The Calibration Table will be executed when the verification fails.

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

See also
Verification Properties.

Hardware

39. Select Stream (Int16, CHAN)

Description
Switches the stream selector to the stream supplied.

Set Value
1 to the number of streams set in the configuration.

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Unit
none

Accuracy
1

Channel (PROstation)
The CHAN argument holds the desired stream number.

See also
This parameter does the same as Stream selection test.

41. Set Digital Channel (bit, CHAN)

Description
Sets the value of a digital output.

Set Value
0 = Deactivate digital output
1 = Activate digital output

Modbus Register Type
Coil status

Modbus data type
Bit (1 bit)

Remarks
Using extension boards, this parameter only resembles the value sent to the extension boards. On the extension boards a choice can be made between normally open and normally closed relays.

Channel (PROstation)
The CHAN argument selects the digital output.

51. Read Analog Output (Float, CHAN)

Description
Returns the actual value from an analog output.

Return value
Analog out value depending on settings in the Analog output table.

Unit
Set output signal in percent.

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
The CHAN argument selects the analog Output. The number of analog outputs depends on the configuration.

Remarks
This parameter only returns valid information if extension boards are installed and Analog outputs are configured.

52. Read Digital Output (bit, CHAN)

Description
Returns the current value from a digital output.

Return value
0 = Deactivated
1 = Activated

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
The CHAN argument selects the digital output.

Remarks
This parameter only resembles the value read from the extension boards. On the extension boards a choice can be made between normally open and normally closed relays.

See also
Extension boards

53. Read Digital Input (bit, CHAN)

Description
Returns the current value from a digital output.

Return value
0 = Deactivated
1 = Activated

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
The CHAN argument selects the digital input.

See also
Application - Digital Inputs

54. Read Digital Input Pos edge (bit, CHAN)

Description
Returns the latched positive edge of the signal on a digital input.

Return value
0 = No Positive edge detected
1 = Positive edge has been detected

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
The CHAN argument selects the digital input.

Remarks
The parameter is reset after reading.

See also
Application - Digital Inputs on page 202

55. Read Digital Input Neg edge (bit, CHAN)

Description
Returns the latched negative edge of the signal on a digital input.

Return value
0 = No negative edge detected
1 = Negative edge has been detected

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
The CHAN argument selects the digital input.

Remarks
The parameter is reset after reading.

See also
Application - Digital Inputs on page 202

57. Read Requested Stream Position (Int16, MB)

Description
Returns the last requested stream position.

Return value
Integer value more than 0, representing the stream position.

Unit
none

Accuracy
1

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
If the stream selector is controlled by the instrument, the maximum number of stream positions depends on the number of streams selected in the configuration.

58. Read Current Stream Position (Int16, MB)

Description
Returns the current selected stream position.

Return value
Integer value more than 0, representing the stream position.

Unit
none

Accuracy
1

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
If the stream selector is controlled by the instrument, the maximum number of stream positions depends on the number of streams selected in the configuration.

Automation 2 - Modbus parameters

60. Set Manual Run RunType (Int16, MB)

Description
Sets the run type in the single run settings.

Set Value
0 = Analysis/unknown
1 = Calibration
2 = Blank (Baseline)
3 = Verification

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This option only applies to the manual or single run.

61. Set Manual Run Calib. Level (Int16, MB)

Description
Sets the Calibration level in the single run settings.

Set Value
Integer value from 1 to 7 depending on the number of calibration levels. The Set value can also be 8 in case the number of calibration level is more than 3 (Multilevel calibration).

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This option only applies to the manual run (single run). Note that level 8 is the Rw calibration.

62. Set Manual Run Stream Pos. (Int16, MB)

Description
Sets the stream position in the single run settings.

Set Value
1 to the number of streams configured in the instrument (maximum 64 streams)

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This option only applies to the manual or single run.

63. Set Stream Ahead Scheduling (Bit, MB)

Description
Return/Sets the stream ahead scheduling.

Set Value
0 = Stream ahead scheduling off
1 = Stream ahead scheduling on

Modbus Register Type
Coil status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This option only applies to full automation analysis runs.

64. Set Calibration Hour (Int16, MB)

Description
Sets the hour value of the calibration start on fixed time option.

Set Value
Integer value from 0 to 23

Unit
Hours

Accuracy
1 hour

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This option only applies to full automation calibration runs.

65. Set Calibration Minute (Int16, MB)

Description
Sets the minute value of the calibration start on fixed time option.

Set Value
Integer value from 0 to 59

Unit
Minutes

Accuracy
1 minute

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This option only applies to full automation calibration runs.

66. Set Days Between Calibration (Int16, MB)

Description
Sets the days value of the calibration start on elapsed days option.

Set Value
Integer value from 1 to 365

Unit
Days

Accuracy
1 day

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This option only applies to full automation calibration runs.

67. Set Verification Hour (Int16, MB)

Description
Sets the hour value of the verification start on fixed time option.

Set Value
Integer value from 0 to 23

Unit
Hours

Accuracy
1 hour

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This option only applies to full automation verification runs.

68. Set Verification Minute (Int16, MB)

Description
Sets the minute value of the verification start on fixed time option.

Set Value
Integer value from 0 to 59

Unit
Minutes

Accuracy
1 minute

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This option only applies to full automation verification runs.

69. Set Days Between Verification (Int16, MB)

Description
Returns/Sets the days value of the verification start on elapsed days option Return.

Set Value
Integer value from 1 to 365

Unit
Days

Accuracy
1 day

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This option only applies to full automation verification runs.

Method protection - Modbus parameters

70. Read Method protection (Bit, MB)

Description
Returns the lock status of the method protection.

Return value
0 = Method protection disabled (unlocked)

1 = Method protection enabled (locked)

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

91. Set Unlock Method Protection (Bit, MB)

Description
Unlocks/relocks the method protection when the hardware method locking is enabled.

Set Value
0 = Relock method protection

1 = Unlock method protection

Modbus Register Type
Coil status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This option only applies when the Method protection switch is enabled. If Method locking is unlocked and the instrument is rebooted, the method is automatically relocked.

95. Set Channel to clean, 1=On (Bit, CHAN)

Description
Selects a channel to be cleaned.

Set Value
0 = Deselect channel for cleaning

1 = Select Channel for cleaning

Modbus Register Type
Coil status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Channel (value = 1 to 4)

Remarks
The channels selected for cleaning will only be cleaned after parameter 96 Request cleaning cycle minutes is sent and handled by the instrument.

See also
Execute command **29. Stop Cleaning Cycle (Execute Cmd, MB)** on page 420

Parameter **96. Request cleaning cycle, minutes(Int32, MB)**

96. Request cleaning cycle, minutes(Int32, MB)

Description
Sets the cleaning time in minutes and requests a cleaning cycle.

Set Value
Cleaning time in minutes

Unit
Minutes

Accuracy
1 minute

Modbus Register Type
Holding Register

Modbus data type
Int32 (32 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
When the instrument receives a request for cleaning it will schedule the cleaning cycle. The cleaning cycle will be started after finishing the current run.

See also
Execute command **29. Stop Cleaning Cycle (Execute Cmd, MB)** on page 420

Parameter **95. Set Channel to clean, 1=On (Bit, CHAN)** on page 271

99. Set Extension Bus Relay (Int16, CHAN, PEAK)

Description
Switches one of the relays positioned on one of the additional extension boards.

Set Value
1 to the number of configured relays

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Use the CHAN argument to select the relay. This should be the relay number as assigned in the Automation TAB of the configuration window of PROstation.

Peak (PROstation)
Use the PEAK argument to select the state of the relay.

0 = De-energized

1 = Energized

Remarks
The channel cleaning for the channels to clean begins after the current run finishes.

See also
Execute command **9. Energize Relay 1 (Execute Cmd, MB)** on page 414

Execute command **10. De-energize Relay 1 (Execute Cmd, MB)** on page 415

Execute command **11. Energize Relay 2 (Execute Cmd, MB)** on page 415

Execute command **12. De-energize Relay 2 (Execute Cmd, MB)** on page 416

Execute Command **31. Reset Timed Relays (Execute Cmd, MB)** on page 420

Execute Command **32. Reset Alarm Relays (Execute Cmd, MB)** on page 420

Execute Command **33. Reset Analog Outputs (Execute Cmd, MB)** on page 421

Execute Command **35. Reset All Alarms (Execute Cmd, MB)** on page 422

1000. Request Single Sequence Line (Int16, MB)

Description
Requests to run a single line from the sequence.

Set Value
1 to maximum number of lines in the sequence

Unit
none

Accuracy
1

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
When the instrument receives a request to run a single sequence line, it will schedule this single run. It will be started after finishing the current run.

GC status - Modbus parameters

100. Status: Sample Line Temp. (Float, MB)

Description
Returns the current temperature of the sample line.

Return value
30 to 110

Unit
Degrees Centigrade (°C)

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

101. Status: Sample Line Temp. State (Bit, MB)

Description
Returns whether or not the heated sample line is ready.

Return value
0 = Not ready (Temperature not yet reached)

1 = Not ready (Temperature reached)

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

102. Status: Instrument State (Int16, MB)

Description
Returns the overall instrument state of the instrument.

Return value
0 = Initializing

1 = Flushing

2 = Running

3 = Stabilizing

4 = Ready

5 = Critical or Fatal Error

6 = Advisory Fault

7 = Broken

8 = Not ready

9 = Waiting for external ready in

10 = Cleaning

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

103. Status: Cabinet Temperature (Int16, MB)

Description
Returns the instrument cabinet temperature.

Return value
Cabinet temperature

Unit
Degrees Centigrade (°C)

Accuracy
1 °C

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
–40 to 50 are the specified operating temperatures

104. Status: Ambient Pressure (Float, MB)

Description
Returns the ambient pressure measured in the instrument cabinet.

Return value
Pressure

Unit
Kilopascal (kPa)

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

105. Status: Power Supply Voltage (Float, MB)

Description
Returns the actual power supply Voltage of the instrument.

Return value
Around 12 to 14 V

Unit
Volt (V)

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

106. Status: External Start Received(Bit, MB)

Description
Returns whether or not an external start is received.

Return value
0 = No External start received
1 = External start received

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

Remarks
After reading this parameter the value will be reset to 0.

108. Status: Analog Input #1 (Float, MB)

Description
Returns the current voltage of analog input 1 as provided by an external device.

Return value
Voltage (1 to 10 V)

Unit
Volt

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

See also
Application - Analog Inputs on page 201

109. Status: Analog Input #2 (Float, MB)

Description
Returns the current voltage of analog input 2 as provided by an external device.

Return value
Voltage (1 to 10 V)

Unit
Volt

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

See also
Application - Analog Inputs on page 201

110. Status: Analog Input #3 (Float, MB)

Description
Returns the current voltage of analog input 3 as provided by an external device.

Return value
Voltage (1 to 10 V)

Unit
Volt

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

See also
Application - Analog Inputs on page 201

111. Status: Analog Input #4 (Float, MB)

Description
Returns the current voltage of analog input 4 as provided by an external device.

Return value
Voltage (1 to 10 V)

Unit
Volt

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

See also
Application - Analog Inputs on page 201

112. Status: Analog Input #5 (Float, MB)

Description
Returns the current voltage of analog input 5 as provided by an external device.

Return value
Voltage (1 to 10 V)

Unit
Volt

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

See also
Application - Analog Inputs on page 201

113. Status: Analog Input #6 (Float, MB)

Description
Returns the current voltage of analog input 6 as provided by an external device.

Return value
Voltage (1 to 10 V)

Unit
Volt

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

See also
Application - Analog Inputs on page 201

114. Status: Current Sequence Solution Slot Number (Int16, MB)

Description
Returns the solution slot number of current run during the sequence run.

Return value
0 to 9

Unit
none

Accuracy
1

Modbus Register Type
Holding Register / Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value=0)

Remarks
This parameter only supplies valid data during the sequence table running.

GC/Run mode status - Modbus parameters

131. Status: External Device Ready Status [Bit, MB]

Description
Returns the ready status of possible external connected device.

Return value
0 = External is device not ready
1 = External is device ready

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

132. Status: Error Number (Int32, MB)

Description
Returns the GC error status number. See **Chapter 18**, “Errors,” starting on page 551 for an explanation of the error codes.

Return value
Error number generated when the instrument is in error.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int32 (32 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
Use parameter “152. Status: Instrument Error Status(Bit, MB)” to get only a notification whether or not the instrument is in error. This parameter returns an error number when the instrument has an error in the severity classes: **Advisory Fault**, **Critical Error**, or **Fatal Error** as soon as the instrument is no longer in error, this parameter returns to 0.

134. Status: Actual Flush time [min] (Float, MB)

Description
Returns the remaining sample stream flush time.

Return value
Time

Unit
Minutes

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

138. Status: Current Sequence State (Int16, MB)

Description
Returns the current automation (or sequence) state.

Return value
0 = Idle
1 = Running Manual (single run)
2 = Running sequence (full automation)
3 = Running calibration block
4 = Running verification block
5 = Equilibrating stream (selecting and flushing stream)

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

139. Status: Current Calibration Level Setting (Int16, MB)

Description
Returns the current calibration level.

Return value
Integer value from 0 to 8 depending on the number of calibration levels. Level 8 is the Rw Calibration that can be used in Multilevel calibration. Level 0 is an Analysis (Unknown) run.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
Current calibration level 1 to 8 can also be returned in case of blank or verification runs.

141. Status: Current Sample Type (Int16, MB)

Description
Returns the sample type of the current run.

Return value
0 = Analysis/unknown
1 = Calibration
2 = Blank (Baseline)
3 = Verification

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

152. Status: Instrument Error Status(Bit, MB)

Description
Returns whether or not the instrument is in error.

Return value
0 = instrument is not in error

1 = instrument is in error

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

Remarks
To obtain the error number use parameter “132. Status: Error Number (Int32, MB)” . This parameter only sets a notification (return value = 1) when the instrument has an error in one of the severity classes **Advisory Fault**, **Critical Error**, or **Fatal Error**. As soon as the instrument is no longer in error, this parameter is reset and will return value 0.

See also
Parameter **2212. Application: Alarm status On Index (Bit, MB, PEAK=Index)** on page 320
Parameter **2211. Application: Overall Alarm status (Bit, MB)** on page 319
Parameter **2402. Appl.: Stream Alarm on Index(Bit, CHAN=stream, PEAK=index)** on page 377

153. Status: Application Error Status (Bit, MB)

Description
Returns whether or not there is a failure in the calibration conditions, or an error in the stream selection, or an alarm on one of the conditions specified in the alarm table at the moment of requesting this Modbus parameter.

Return value
0 = No error or alarm at this moment
1 = An error or alarm raised in Calibration, Stream selection, or in any condition specified in the alarm table

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

See also
Parameter **2212. Application: Alarm status On Index (Bit, MB, PEAK=Index)** on page 320
Parameter **2211. Application: Overall Alarm status (Bit, MB)** on page 319
Parameter **2402. Appl.: Stream Alarm on Index(Bit, CHAN=stream, PEAK=index)** on page 377
Parameter **2403. Appl.: Stream Overall Alarm Status (Bit, CHAN=stream)** on page 378

161. Status: Current running time (Int16, MB)

Description
Returns the runtime of the current run starting as shown, during the run, in Instrument status in the GC section of the status screen. The return value is 0 at the beginning of the run and increases while the run proceeds.

Return value
0 to the runtime as specified in the method (maximum run time is 600)

Unit
seconds (s)

Accuracy
1 s

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter resets to 0 at the end of the run.

163. Status: Current Stream Analyzing (Int16, MB)

Description
Returns the stream number, which the current run uses to analyze gas.

Return value
0 to the runtime as specified in the method (maximum run time is 600)

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This value is set at the beginning of a run and will not be reset until the next run is being analyzed from a different stream. If there is no following run, the last returned value will remain until the instrument is switched off.

176. Status: Current Sequence Solution Slot Number (Int32, MB)

Description
Returns the current solution number in sequence.

Return value
Positive integer value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int32 (32 bit integer)

Channel (PROstation)

Mainboard (value = 0)

Channel method setting - Modbus parameters

202. Set Column Temperature (Float, CHAN)

Description
Sets the column temperature of the selected channel in the method of the instrument.

Set Value
30 °C to the maximum allowed channel temperature most used maximum temperatures are 160 or 180 °C

Unit
Degrees Centigrade (°C)

Accuracy
1 °C

Modbus Register Type
Holding Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

Remarks
The maximum allowed column temperature is shown in the configuration screen.

See also
Hardware Tab

203. Set Injector Temperature (Float, CHAN)

Description
Sets the injector temperature of the selected channel in the method of the instrument Return.

Set Value
30 to 110 °C

Unit
Degrees Centigrade (°C)

Accuracy
1 °C

Modbus Register Type
Holding Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

204. Set Run Time [s] (Int16, CHAN)

Description
Sets the run time of the selected channel in the method of the instrument.

Set Value
1 to 600

Unit
seconds (s)

Accuracy
0.1 s

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Channel (value = 1 to 4)

205. Set Injection Time [ms] (Int16, CHAN)

Description
Sets the injection time of the selected channel in the method of the instrument.

Set Value
1 to 600

Unit
milliseconds (ms)

Accuracy
1 ms

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Channel (value = 1 to 4)

207. Set Back flush Time [s] (Float, CHAN)

Description
Sets the back flush time of the selected channel in the method of the instrument.

Set Value
1 to 600

Unit
seconds (s)

Accuracy
1 s

Modbus Register Type
Holding Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

Remark
The value of this parameter is only taken into account in case of a backflush channel.

209. Set Initial Pressure [Pa] (Float, CHAN)

Description
Sets the initial pressure of the selected channel in the method of the instrument.

Set Value
50 to 350

Unit
Pascal (Pa)

Accuracy
1 pa

Modbus Register Type
Holding Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

Remarks
Note that the initial pressure anywhere in PROstation is shown in kPa.

215. Set TCD Power [1=On/0=Off] (Bit, CHAN)

Description
Sets the Detector state or TCD power on or off for the selected channel in the method of the instrument.

Set Value
0 = Detector state/TCD power Off
1 = Detector state/TCD power On

Modbus Register Type
Coil status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Channel (value = 1 to 4)

218. Set TCD Range [0,16,256,1024] (Int16, CHAN)

Description
Sets the TCD sensitivity range of the TCD Detector for the selected channel in the method of the instrument.

Set Value
0 = Low

16 = Medium

256 = High

1024 = Extra High

Modbus Register Type
Holding Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Channel (value = 1 to 4)

Remarks
If parameter auto ranging (220. Set TCD Auto Ranging) is switched on, the values are ignored.

220. Set TCD Auto Ranging [1=On/0=Off] (Bit, CHAN)

Description
Sets the TCD sensitivity of the TCD detector to Auto ranging for the selected channel in the method of the instrument.

Set Value
0 = Switch Auto ranging off
1 = Switch Auto ranging on

Modbus Register Type
Coil status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Channel (value = 1 to 4)

Remarks
If parameter auto ranging is switched off, a manual TCD sensitivity range needs to be set by means of parameter **218. Set TCD Range [0,16,256,1024] (Int16, CHAN)** on page 287.

221. Set TCD Invert Signal [1=On/0=Off] (Bit, CHAN)

Description
Sets the Invert signal option on or off for TCD detector of the selected channel in the method of the instrument.

Set Value
0 = TCD Invert signal switched Off
1 = TCD Invert signal switched On

Modbus Register Type
Coil status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Channel (value = 1 to 4)

224. Set TCD Invert Signal Start Time [s] (Float, CHAN)

Description
Sets the Invert signal start time of the selected channel in the method of the instrument.

Set Value
0 to 600

Unit
seconds (s)

Accuracy
0.1 s

Modbus Register Type
Holding Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

225. Set TCD Invert Signal Stop Time [s] (Float, CHAN)

Description
Sets the Invert signal stop time of the selected channel in the method of the instrument.

Set Value
0 to 600

Unit
seconds (s)

Accuracy
0.1 s

Modbus Register Type
Holding Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

Channel status - Modbus parameters

300. Column Temperature (Float, CHAN)

Description
Returns the actual column temperature for the selected channel, as displayed in the GC-Channel status part of the Instrument status screen.

Return value
The actual column temperature can be 30 to 160 °C or 30 to 180 °C, depending on the maximum allowed.

Unit
Degrees Centigrade (°C)

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4) The maximum allowed column temperature is shown in the Hardware Tab of the configuration screen.

See also
Hardware Tab

301. Column Temp.State (Bit, CHAN)

Description
Returns whether or not the actual column temperature has reached the channel's setpoint for the selected channel. The return value is equal to the ready status of the channel temperature as shown in the GC-Channel status part of the Instrument status screen (Column temp value is

blue = ready/Column temp value is red = not ready.

Return value
0 = The actual column temperature has not reached the channel's set point (Not Ready).
1 = The actual column temperature has reached the channel's set point (Ready).

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Channel (value = 1 to 4)

302. Injector Temperature(Float, CHAN)

Description
Returns the actual injector temperature for the selected channel, as displayed in the GC-Channel status part of the Instrument status screen.

Return value
The actual injector temperature vary between 30 to 110 °C.

Unit
Degrees Centigrade (°C)

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

303. Injector Temp.State (Bit, CHAN)

Description
Returns whether or not the actual injector temperature has reached the channel's setpoint for the selected channel. The return value is equal to the ready status of the injector temperature as shown in the GC-Channel status part of the Instrument status screen (injector temp value is blue = ready/injector temp value is red = not ready.

Return value
0 = The actual injector temperature has not reached the channel's set point (Not Ready).

1 = The actual injector temperature has reached the channel's set point (Ready).

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Channel (value = 1 to 4)

304. Column Pressure (Float, CHAN)

Description
Returns the actual column pressure for the selected channel, as displayed in the GC-Channel status part of the Instrument status screen.

Return value
The actual column pressure varies between 50 and 350.

Unit
Pascal (Pa)

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

Remarks
Note that the column pressure anywhere in PROstation is shown in kPa.

305. Column Pressure State (Bit, CHAN)

Description
Returns whether or not the actual column pressure has reached the channel's setpoint for the selected channel. The return value is equal to the ready status of the column pressure ready status as shown in the GC-Channel status part of the Instrument status screen (column pressure value is blue = ready. Column pressure value is red = not ready).

Return value
0 = The actual column has not reached the channel's setpoint (Not Ready).

1 = The actual injector temperature has reached the channel's setpoint (Ready).

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Channel (value = 1 to 4)

308. Channel Board Temp (Int16, CHAN)

Description
Returns the actual channel board temperature for the selected channel.

Return value
The actual board temperature should vary between the approximate ambient temperature and the maximum allowed board temperature.

Unit
Degrees centigrade (°C)

Accuracy
1 °C

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Channel (value = 1 to 4)

Mainboard - Modbus parameters

500. MPU firmware (Float, MB)

Description
Returns the MPU firmware version and subversion and build number (build number only from version 2.0 and up), combined in one number.

Return value
The value returned is build up in this way: <Version>.<subversion(2 digits)><Build number(remaining digits)> Example 2.1117579 - Version 2, subversion 11, build number 17579

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

Remarks
The build number is only returned from firmware version 2.00 and up.

501. IOC firmware (Float, CHAN)

Description
Returns the IOC firmware version and build, combined in one number.

Return value
The value returned is built up in this manner: <version>.<subversion>

Example 1.15 - version 1, subversion 15

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

502. Channel 1 installed (1 bit)

Description
Returns whether or not channel 1 is installed.

Return value
0 = Channel 1 is not installed
1 = Channel 1 is installed

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
none

503. Channel 2 installed (1 bit)

Description
Returns whether or not channel 2 is installed.

Return value
0 = Channel 2 is not installed
1 = Channel 2 is installed

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
none

504. Channel 3 installed (1 bit)

Description
Returns whether or not channel 3 is installed.

Return value
0 = Channel 3 is not installed
1 = Channel 3 is installed

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
none

505. Channel 4 installed (1 bit)

Description
Returns whether or not channel 4 is installed.

Return value
0 = Channel 4 is not installed
1 = Channel 4 is installed

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
none

515. Clock: Day of Month (Int16, MB)

Description
Returns the current day of month of the system date set in the instrument.

Set Value
Integer value from 1 to 31

Unit
Days

Accuracy
1 day

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

516. Clock: Month (Int16, MB)

Description
Returns the current month of the system date set in the instrument.

Set Value
Integer value from 1 to 12

Unit
Months

Accuracy
1 month

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

517. Clock: Year (Int16, MB)

Description
Returns the current year of the system date set in the instrument.

Set Value
Integer value from 1 to 99

Unit
Years

Accuracy
1 year

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

518. Clock: Second (Int16, MB)

Description
Returns the current second of the system time set in the instrument.

Set Value
Integer value from 0 to 59

Unit
Seconds (s)

Accuracy
1 s

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

519. Clock: Minute (Int16, MB)

Description
Returns the current minute of the system time set in the instrument.

Set Value
Integer value from 0 to 59

Unit
Minutes (min)

Accuracy
1 min

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

520. Clock: Hour (Int16, MB)

Description
Returns the current hour of the system time set in the instrument.

Set Value
Integer value from 1 to 23

Unit
Hours (h)

Accuracy
1 h

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Mainboard EDS - Modbus parameters

601. Instrument serial number (Int32, MB)

Description
Returns the instrument serial number.

Return value
Serial number

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int32 (32 bit integer)

Channel (PROstation)
Mainboard (value = 0)

611. Log: Number of runs (Int32, MB)

Description
Returns the total number of runs performed on the system.

Return value
Number of runs

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int32 (32 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This value is not viewable from PROstation.

612. Log: Operating Period (Float, MB)

Description
Returns the total instrument up time.

Return value
Operating period

Unit
Hours

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This value is not available in PROstation.

613. Log: Max Ambient Instrument Temperature (Int16, MB)

Description
Returns the maximum reached cabinet temperature in degrees centigrade (°C).

Return value
Maximum ambient temperature

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This value is not available in PROstation.

Integration method - Modbus parameters

1230. Integ.Meth.: Level 1 amount (Float, CHAN, MetPEAK)

Description
Returns/sets the amount for calibration level 1 of the selected peak on the selected channel. This value is entered in the Level 1 column for the selected peak in the method peak table of the selected channel.

Set Value
Any 32 bit floating point value

Unit
none

Accuracy
Floating point single precision

Modbus Register Type
Holding Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

MetPeak (PROstation)
Peak number index as used in the method peak table. The Method peak numbers start with 1 for the first peak in the list, increasing with 1 for each following peak in the method peak table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

General integration results - Modbus parameters

1202. Int.Rep.: Number of Peaks, Named + Unnamed(Int16, CHAN)

Description
Returns the total number of peaks (named and unnamed) for the selected channel.

Return value
Total number of peaks for the selected channel, detected during integration. Total number of peaks is the sum of all named peaks (peaks defined in the method peak table) as well as all unnamed peaks (not defined peaks or not detected within the defined window of a peak).

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit Integer)

Channel (PROstation)
Channel (value = 1 to 4)

Remarks
Named peaks are peaks that are detected during integration, within the retention time peak window of a peak or group defined in the method peak table. Unnamed peaks are peaks that are detected during integration but fall outside any peak or group window defined in the method peak table. This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

See also
Parameter **1214. Int.Rep.: Number of Named Peaks(Int16, CHAN)** on page 300

Parameter **1215. Int.Rep.: Number of Unnamed Peaks(Int16, CHAN)** on page 301

Parameter **2216. Application: Total Peaks (Int16, MB)** on page 321

Parameter **2229. Application: Total Unknown peaks. (Int16, MB)** on page 327

1214. Int.Rep.: Number of Named Peaks(Int16, CHAN)

Description
Returns the total number of named peaks for the selected channel.

Return value
Total number of named peaks for the selected channel, detected during integration.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit Integer)

Channel (PROstation)
Channel (value = 1 to 4)

Remarks
Named peaks are peaks that are detected during integration, within the retention time peak window of a peak or group defined in the method peak table. This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

See also

Parameter **1202. Int.Rep.: Number of Peaks, Named + Unnamed(Int16, CHAN)** on page 300

Parameter **1215. Int.Rep.: Number of Unnamed Peaks(Int16, CHAN)** on page 301

Parameter **2216. Application: Total Peaks (Int16, MB)** on page 321

Parameter **2229. Application: Total Unknown peaks. (Int16, MB)** on page 327

1215. Int.Rep.: Number of Unnamed Peaks(Int16, CHAN)

Description

Returns the total number of unnamed peaks for the selected channel.

Return value

Sum of total number of unnamed peaks and total number of named peaks. Named peaks are peaks detected during integration within a peak window of a component defined in the method peak table. Unnamed peaks are peaks detected outside any peak window.

Modbus Register Type

Holding Register/Input Register

Modbus data type

Int16 (16 bit Integer)

Channel (PROstation)

Channel (value = 1 to 4)

Remarks

Unnamed peaks are peaks that are detected during integration but fall outside any retention time peak or group window defined in the method peak table. This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

See also

Parameter **1202. Int.Rep.: Number of Peaks, Named + Unnamed(Int16, CHAN)** on page 300

Parameter **1214. Int.Rep.: Number of Named Peaks(Int16, CHAN)** on page 300

Parameter **2216. Application: Total Peaks (Int16, MB)** on page 321

Parameter **2229. Application: Total Unknown peaks. (Int16, MB)** on page 327

1331. Int. Rep.: Calibration Alarm (Bit, MB)

Description

Returns if a response factor of one or more peaks detected in the current calibration run does not meet the allowed variation. The allowed variation for response factor alarms is defined in the Method peak table.

Return value
0 = Current run has no calibration alarm
1 = Current run does have a Calibration alarm

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter will only be set at the end of the calibration run. If in the following run the error or alarm doesn't occur anymore, the return value is reset to 0. This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

Integration results of all peaks named and unnamed

1219. Int.Rep.All: Retention Time (Float, CHAN, Peak)

Description
Returns the retention time of the peak selected from the list of all detected peaks (named and unnamed).

Unit
Minutes

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

Peak (PROstation)
Peak number index as used in integration result table or the integration report. The integration peak numbers start with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

1203. Int.Rep.All: Peak Area (Float, CHAN, Peak)

Description
Returns the peak area of the peak selected from the list of all detected peaks (named and unnamed).

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

Peak (PROstation)
Peak number index as used in integration result table or the integration report. The integration peak numbers starts with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

1204. Int.Rep.All: Peak Height (Float, CHAN, Peak)

Description
Returns the peak height of the peak selected from the list of all detected peaks (named and unnamed).

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

Peak (PROstation)
Peak number index as used in integration result table or the integration report. The integration peak numbers starts with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

1205. Int.Rep.All: Amount (Float, CHAN, Peak)

Description
Returns the amount of the peak selected from the list of all detected peaks (named and unnamed).

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

Peak (PROstation)
Peak number index as used in integration result table or the integration report. The integration peak numbers starts with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

1207. Int.Rep.All: Peak Width (Float, CHAN, Peak)

Description
Returns the width of the peak selected from the list of all detected peaks (named and unnamed).

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

Peak (PROstation)
Peak number index as used in integration result table or the integration report. The integration peak numbers starts with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

1209. Int.Rep.All: Peak Named Yes/No (Bit, CHAN, Peak)

Description
Returns whether or not the selected peak is a named or unnamed peak.

Return value
0 = Current selected peak is a unnamed peak 1 = Current selected peak is a named peak

Modbus data type
Bit (1 bit)

Modbus Register Type
Coil status/Input Status

Channel (PROstation)
Channel (value = 1 to 4)

Peak (PROstation)
Peak number index as used in integration result table or the integration report. The integration peak numbers starts with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

Integration results named peaks only

1375. Int.Rep.Named: Area Named Peak (Float, CHAN, MetPEAK)

Description
Returns the peak area of the selected named peak.

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

MetPeak (PROstation)
Peak number index as used in method peak table. The method peak table index number starts with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

1376. Int.Rep.Named: Height Named Peak (Float, CHAN, MetPEAK)

Description
Returns the peak height of the selected named peak.

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

MetPeak (PROstation)
Peak number index as used in method peak table. The method peak table index number starts with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

1377. Int.Rep.Named: Amount Named Peak (Float, CHAN, MetPEAK)

Description
Returns the amount of the selected named peak.

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

MetPeak (PROstation)
Peak number index as used in method peak table. The method peak table index number starts with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

1378. Int.Rep.Named: Retention Named Peak (Float, CHAN, MetPEAK)

Description
Returns the retention time of the selected named peak.

Accuracy
Floating point single precision

Unit
Seconds (s)

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

MetPeak (PROstation)
Peak number index as used in method peak table. The method peak table index number starts with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

1380. Int.Rep.Named: Width Named Peak (Float, CHAN, MetPEAK)

Description
Returns the width at half height of the selected named peak.

Accuracy
Floating point single precision

Unit
Minutes

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

MetPeak (PROstation)
Peak number index as used in method peak table. The method peak table index number starts with 1 for the first peak in the list, increasing with 1 for each up following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

1381. Int.Rep.Named: StartTime Named Peak (Float, CHAN, MetPEAK)

Description
Returns the start time of the selected named peak.

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

MetPeak (PROstation)
Peak number index as used in method peak table. The method peak table index number starts with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

1382. Int.Rep.Named: EndTime Named Peak (Float, CHAN, MetPEAK)

Description
Returns the end time of the selected named peak.

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

MetPeak (PROstation)
Peak number index as used in method peak table. The method peak table index number starts with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

1383. Int.Rep.Named: Asym Named Peak (Float, CHAN, MetPEAK)

Description
Returns the end time of the selected named peak.

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Channel (value = 1 to 4)

MetPeak (PROstation)
Peak number index as used in method peak table. The method peak table index number starts with 1 for the first peak in the list, increasing with 1 for each following peak in the integration result table.

Remarks
This parameter only supplies valid data of the last run when a synchronization parameter is set to 1.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

New data available flag

2200. Sync: Data available (Bit, MB)

Description
Returns 1 at the moment all sample result data of the last finished run is available, and resets automatically to 0 after the Reset-Time data available flag expires. This parameter can also be reset by the Master.

Set Value
0: No new data available/reset new data available
1: (Still) new valid data available

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

Remarks
The Reset-Time data available flag can be set in the Process Setting tab Modbus Setup (**Synchronization with Modbus master** on page 237). It is advised not to set 1 in the Modbus register.

2201. Sync: Data available with reset(Bit, MB)

Description
Returns 1 at the moment all sample result data of the last finished run is available and resets automatically to 0 after a Modbus Master has read the new data.

Return value
0: No new data available
1: New (not yet read) valid data available

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

Remarks
If the no Modbus master is reading the new data the value is automatically reset to 0 after the Reset-Time data available flag expires. The Reset-Time data available flag can be set in the Process Setting tab Modbus Setup (**Synchronization with Modbus master** on page 237) Parameter 2238 is a copy of this parameter.

2238. Sync: Data available2 with reset(Bit, MB)

Description
Returns 1 at the moment all sample result data of the last finished run is available and resets automatically to 0 after a Modbus Master has read the new data.

Return value
0: No new data available
1: New (not yet read) valid data available

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

Remarks
If the no Modbus master is reading the new data, the value is automatically reset to 0 after the Reset-Time data available flag expires. The **Reset-Time data available flag** can be set in the **Process Setting** tab **Modbus Setup** (**Synchronization with Modbus master** on page 237) parameter is a copy of parameter 2201.)

2202. Sync: Run Number (Int32, MB)

Description
Returns a number, which is increased at the end of every run. This number is increased for each run, whether the current run is an Analysis (unknown), Calibration, verification or blank (check).

Return value
Positive integer value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int32 (32 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
After a restart of the instrument, this parameter is reset to 0. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

Application data - Modbus parameters

2203. Application: Sample Type (Int32, MB)

Description
Returns the sample type of the last run.

Return value
0 = Analysis/unknown
1 = Calibration
2 = Blank (Baseline)
3 = Verification

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int32 (32 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
After a restart of the instrument, this parameter is reset to 0. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

2399. Application: Is Analysis Run (Bit, MB)

Description
Returns whether or not the last run was an analysis.

Return value
0 = Last run is not an Analysis run, but calibration, blank or verification
1 = Last run is an Analysis run

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

2290. Application: Calibration Method (Int16, MB)

Description
Returns the calibration method of the last run.

Return value
0 = default calibration method
1 = GOST calibration method

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

2291. Application: Calibration Status (Int16, MB)

Description
Returns the calibration status of the last run.

Return value
0 = Calibration failed
1 = Calibration OK
2 = GOST calibration is still busy (run 1 and 2)
3 = GOST calibration runs where not accepted (run 3 or 4)

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

2204. Application: Calibration Level (Int16, MB)

Description
Returns whether the calibration level of the last run.

Return value
0 = No calibration level, thus no calibration or verification run
1 to 8 = calibration level depending on the number of calibration levels. The return value can be 8 if the number of calibration levels is greater then 3 (Multilevel calibration)

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

2239. Application: Calibration ignore (Bit, MB)

Description
Returns whether the last run is an ignored calibration. An ignored calibration is a calibration run that will not be accepted as such. In other words flush run with calibration gas.

Return value
0 = A normal calibration run
1 = A calibration run that will be ignored

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter returns 0 if the last run was an Analysis, verification or blank run. Ensure the run type is known before using this parameter This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

2205. Application: Stream Position (Int16, MB)

Description
Returns the stream that was requested for the last run. This is the stream position request at the start of the sequence or single run.

Return value
Integer value greater than 0

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
If the stream selector is controlled by the instrument, the maximum number of stream positions depends on the number of streams selected in the configuration. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

2206. Application: Stream Position OK (Bit, MB)

Description
Returns whether or not the requested stream of the last run is correctly switched.

Return value
0 = Requested stream is not switched due to communication failure with the stream selector or stream selector failure. In other words, last run is sample from a wrong stream position.
1 = Requested stream is successfully switched

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

2207. Application: Digital Input (Bit, CHAN)

Description
Returns whether or not the Digital Input was activated at the start of the run, value reported at the end of the last run.

Return value
0 = Deactivated
1 = Activated

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
The CHAN argument selects the digital input.

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

2208. Application: Raw Analog In (Float, CHAN)

Description
Returns the value in volts (V) of the selected analog input. The value is measured at the analog input and reported at the end of the last run.

Return value
0 to 10

Unit
Volt

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
The CHAN argument selects the analog input.

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters “2200. Sync: Data available (Bit, MB)” , “2201. Sync: Data available with reset(Bit, MB)” , or “2238. Sync: Data available2 with reset(Bit, MB)” can be used.

2209. Application: Computed Analog In (Float, CHAN)

Description
Displays the calculated value of the selected analog input, based on the gain and offset as defined in the analog input table. See **Application - Analog Inputs** on page 201 for more information. This calculated value is reported at the end of the last run.

Return value
The calculated analog value

Unit
The unit as calculated in the analog input table

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
The CHAN argument selects the analog input.

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

2210. Application: Sampling comp.Analog In (Float, CHAN)

Description
Displays the calculated value of the selected analog input, based on the gain and offset as defined in the analog input table. The value is measured only once during the run (at sampling) and directly displayed.

Return value
The calculated analog value

Unit
The unit as calculated in the analog input table.

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
The CHAN argument selects the analog input.

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

2211. Application: Overall Alarm status (Bit, MB)

Description
Returns whether any of the configured alarms from the alarm table was raised at the end of the last run.

Return value
0 = No alarm raised
1 = An alarm from the alarm table was raised at the end of the last run.

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

See also
Parameter **2212. Application: Alarm status On Index (Bit, MB, PEAK=Index)** on page 320

Parameter **152. Status: Instrument Error Status(Bit, MB)** on page 282

Parameter **2402. Appl.: Stream Alarm on Index(Bit, CHAN=stream, PEAK=index)** on page 377

Parameter **2403. Appl.: Stream Overall Alarm Status (Bit, CHAN=stream)** on page 378

2212. Application: Alarm status On Index (Bit, MB, PEAK=Index)

Description
Returns whether or not the selected alarm from the alarm table was raised at the end of the last run.

Return value
0 = No alarm raised
1 = An alarm from the alarm table was raised at the end of the last run

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 0)

Peak (PROstation)
Use the PEAK argument to select an alarm (by line number/index) from the alarm table.

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters:
2200. Sync: Data available (Bit, MB) on page 312,
2201. Sync: Data available with reset(Bit, MB) on page 312, or
2238. Sync: Data available2 with reset(Bit, MB) on page 312 can be used.

See also
Parameter **2211. Application: Overall Alarm status (Bit, MB)** on page 319,

Parameter **152. Status: Instrument Error Status(Bit, MB)** on page 282, Parameter **2402. Appl.: Stream Alarm on Index(Bit, CHAN=stream, PEAK=index)** on page 377,

Parameter **2403. Appl.: Stream Overall Alarm Status (Bit, CHAN=stream)** on page 378

2213. Application: Overall Verification status (Bit, MB)

Description
Returns whether or not all verification criteria are passed. The verification criteria are defined in the Verification Table.

Return value
0 = All verification criteria passed.
1 = One of the verification criteria did not pass.

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

See also
Parameter **2211. Application: Overall Alarm status (Bit, MB)** on page 319

Parameter **152. Status: Instrument Error Status(Bit, MB)** on page 282

Parameter **2402. Appl.: Stream Alarm on Index(Bit, CHAN=stream, PEAK=index)** on page 377

Parameter **2403. Appl.: Stream Overall Alarm Status (Bit, CHAN=stream)** on page 378

2216. Application: Total Peaks (Int16, MB)

Description
Returns the total number of peaks of the application report. These are peaks that are defined in the normalization table (maximum 100 peaks) and which are also detected in the integration report.

Return value
0 to maximum number of peaks in the application report (maximum 100 peaks)

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (Value = 0)

Remarks
The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

See also
Parameter "2229. Application: Total Unknown peaks. (Int16, MB)" .

Parameter "1202. Int.Rep.: Number of Peaks, Named + Unnamed(Int16, CHAN)" .

Parameter "1214. Int.Rep.: Number of Named Peaks(Int16, CHAN)" .

Parameter "1215. Int.Rep.: Number of Unnamed Peaks(Int16, CHAN)" .

2217. Application: Sum ESTD (Float, MB)

Description
Returns the sum of ESTD values of all peaks in the application report of the last run. These are peaks that are defined in the normalization table (maximum 100 peaks) and which are also detected in the integration report.

Return value
Positive value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (Value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

See also
Parameter "2418. Appl.: Stream Sum ESTD (Float, CHAN=stream)" .

2218. Application: Sum Estimates (Float, MB)

Description
Returns the sum of estimates of all peaks that are identified as estimate peaks in the normalization table and also detected in the integration report.

Return value
0 to 100

Unit
Percent (%)

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (Value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2221. Application: Sum Areas. (Float, MB)

Description
Returns the sum of areas of all peaks that are defined in the normalization table (maximum 100 peaks) and also are detected in the integration report.

Return value
Positive value

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (Value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2222. Application: Is Startup Run. (Bit, MB)

Description
Returns whether or not the last run was the first run after startup of the instrument.

Return value
0 = Last run was not a startup run
1 = Last run was a the first run after startup of the instrument

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2223. Application: Year of Injection (Int16, MB)

Description
Returns the year of injection of the last run.

Return value
Integer value from 1 to 99

Unit
Years

Accuracy
1 year

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2224. Application: Month of Injection (Int16, MB)

Description
Returns the month of injection of the last run.

Return value
Integer value from 1 to 12

Unit
Months

Accuracy
1 month

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2225. Application: Day of Injection (Int16, MB)

Description
Returns the day of injection of the last run.

Return value
Integer value from 1 to 31

Unit
Days

Accuracy
1 day

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2226. Application: Hour of Injection (Int16, MB)

Description
Returns the hour of injection of the last run.

Return value
Integer value from 1 to 23

Unit
Hours (h)

Accuracy
1 h

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2227. Application: Minute of Injection (Int16, MB)

Description
Returns the minute of injection of the last run.

Return value
Integer value from 1 to 60

Unit
Minutes (min)

Accuracy
1 min

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2228. Application: Second (time) of Injection (Int16, MB)

Description
Returns the second of injection of the last run.

Return value
Integer value from 1 to 60

Unit
Seconds (s)

Accuracy
1 s

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2229. Application: Total Unknown peaks. (Int16, MB)

Description
Returns the total number of unknown peaks of the application report. These are peaks that are NOT defined in the normalization table but still detected in the integration report.

Return value
0 to maximum number of peaks in the application report (maximum 100 peaks)

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (Value = 0)

Remarks
The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

See also
Parameter “2216. Application: Total Peaks (Int16, MB)” .

Parameter “1202. Int.Rep.: Number of Peaks, Named + Unnamed(Int16, CHAN)” .

Parameter “1214. Int.Rep.: Number of Named Peaks(Int16, CHAN)” .

Parameter “1215. Int.Rep.: Number of Unnamed Peaks(Int16, CHAN)” .

2230. Application: Comp. Retention. (Float, MB, PEAK)

Description
Returns the Retention time of the selected peak from the application report of the last run.

Return value
0 to maximum runtime of this run.

Unit
Minutes

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)
Use the PEAK argument to select a Peak (component) in the last application report. To do so, fill in the peak index of the corresponding peak in the normalization table.

Remarks
The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2231. Application: Comp. Height. (Float, MB, PEAK)

Description
Returns the height of the selected peak from the application report of the last run.

Return value
Any floating point value

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)
Use the PEAK argument to select a Peak (component) in the last application report. To do so, fill in the peak index of the corresponding peak in the normalization table.

Remarks
The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2232. Application: Comp. ESTD Conc. (Float, MB, PEAK)

Description
Returns the ESTD concentration of the selected peak from the application report of the last run.

Return value
A positive floating point value

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)
Use the PEAK argument to select a Peak (component) in the last application report. To do so, fill in the peak index of the corresponding peak in the normalization table.

Remarks
The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2233. Application: Comp. Normalized Conc. (Float, MB, PEAK)

Description
Returns the Normalized concentration of the selected peak from the application report of the last run.

Return value
0 to 100

Unit
Percent (%)

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)
Use the PEAK argument to select a Peak (component) in the last application report. To do so, fill in the peak index of the corresponding peak in the normalization table.

Remarks
The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2237. Application: Comp. Area (Float, MB, PEAK)

Description
Returns the area of the selected peak from the application report of the last run.

Return value
A positive floating point value

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)
Use the PEAK argument to select a Peak (component) in the last application report. To do so, fill in the peak index of the corresponding peak in the normalization table.

Remarks
The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2235. Application: Group total ESTD. (Float, MB, PEAK)

Description
Returns the sum of the ESTD concentrations of all peaks in the selected group from the application report of the last run.

Return value
A positive floating point value

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)
Supply the peak index for a group in the normalization table in the PEAK argument, to find the corresponding group in the application report.

Remarks
The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2236. Application: Group total Normalized (Float, PEAK)

Description
Returns the sum of the normalized concentrations of all peaks in the selected group from the application report of the last run.

Return value
0 to 100

Unit
Percent (%)

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)
Supply the peak index from a group in the normalization table in the PEAK argument to find the corresponding group in the application report.

Remarks
The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2297. Application: Alarm status (Int16, MB)

Description
Returns the status of the first 16 alarms defined in the alarm table. Each bit represents an alarm. An active alarm is presented as logical high (= 1).

Return value
The value returned is an integer value of 16 bits

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

2298. Alarm Parameter Min Value (Float, PEAK=Index)

Description
Returns the maximum limit setting of the selected alarm row from the alarm table .

Return value
maximum limit value

Unit
none

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)
Use the PEAK argument to select an alarm (by line number/index) from the alarm table.

2299. Alarm Parameter Max Value (Float, PEAK=Index)

Description
Returns the minimum limit setting of the selected alarm row from the alarm table .

Return value
minimum limit value

Unit
none

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)
Use the PEAK argument to select an alarm (by line number/index) from the alarm table.

Application - Alarms

2033. Alarm Parameter Min Value (Float, PEAK=Index)

Description
Returns minimum setting value in alarm table.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Peak (PROstation)
Use the PEAK argument to select an alarm (by line number/index) from the alarm table.

2034. Alarm Parameter Max Value (Float, PEAK=Index)

Description
Returns maximum setting value in alarm table.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Peak (PROstation)
Use the PEAK argument to select an alarm (by line number/index) from the alarm table.

Energy meter method

2255. Application: Comp New RF (Float, MB, PEAK)

Description
Returns the new Response Factor of the selected peak from the application report of the last run.

Return value
Any floating point value

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)
Use the PEAK argument to select a Peak (component) in the last application report. To do so, fill in the peak index of the corresponding peak in the normalization table.

Remarks
The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2256. Application: Comp. Current RF (Float, PEAK)

Description
Returns the Current Response Factor of the selected peak from the application report of the last run.

Return value
Any floating point value

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)
Use the PEAK argument to select a Peak (component) in the last application report. To do so, fill in the peak index of the corresponding peak in the normalization table.

Remarks
The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2258. Application: Comp. Initial RF (Float, PEAK)

Description
Returns the Initial Response Factor of the selected peak from the application report of the last run.

Return value
Any floating point value

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)
Use the PEAK argument to select a Peak (component) in the last application report. To do so, fill in the peak index of the corresponding peak in the normalization table.

Remarks
The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters**2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2289. Application: Comp. Rw (Float, MB, PEAK)

Description
Returns the field calibration correction Factor (Rw factor) of the selected peak from the application report of the last run.

Return value
Any floating point value

Accuracy
Floating point single precision

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Peak (PROstation)

Use the PEAK argument to select a Peak (component) in the last application report. To do so, fill in the peak index of the corresponding peak in the normalization table.

Remarks

The application report is a system wide report, so one cannot select peaks per channel from the application report. This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

Energy meter results

2260. Application: Calorific Value Calculation Method (Int16, MB)

Description
Returns the calorific valve calculation method as used in the application report of the last run.

Return value
1 = ISO 6976
2 = GPA 2172
3 = ASTM 3588
4 = GOST 22667
5 = GOST 31369

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2262. Application: GPA/ASTM.Act.Zmix (Float, MB)

Description
Returns the actual Zmix value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2263. Application: GPA/ASTM.Act.Molar Mass (Float, MB)

Description
Returns the actual molar mass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2264. Application: GPA/ASTM.Act.Rel.Dens.Ideal (Float, MB)

Description
Returns the actual ideal relative density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2265. Application: GPA/ASTM.Act.Wobbe index (Float, MB)

Description
Returns the actual Wobbe index of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2266. Application: ISO2016/ISO/GOST.Dry.Hs.v.Real (Float, MB)

Description
Returns the volume based dry real Hs value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2267. Application: ISO2016/ISO/GOST.Dry.Hi.v.Real (Float, MB)

Description
Returns the volume based dry real Hi value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2268. Application: ISO2016/ISO/GOST.Dry.Gas.Dens.Real (Float, MB)

Description
Returns the dry real gas density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2269. Application: ISO2016/ISO/GOST.Dry.Rel.Dens.Real (Float, MB)

Description
Returns the dry real relative density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2271. Application: ISO2016/ISO/GOST.Dry.Wobbe Inferior (Float, MB)

Description
Returns the dry Wobbe inferior value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2274. Application: GPA/ASTM.Act.Hv.Real (Float, MB)

Description
Returns the actual real Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2275. Application: GPA/ASTM.Dry.Hv.Real (Float, MB)

Description
Returns the dry real Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2276. Application: GPA/ASTM.Sat.Hv.Real (Float, MB)

Description
Returns the saturated real Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2277. Application: GPA/ASTM.Act.Rel.Dens.Real (Float, MB)

Description
Returns the actual real relative density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2278. Application: GPA/ASTM.Act.Gas.Dens.Ideal (Float, MB)

Description
Returns the actual ideal gas density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2279. Application: GPA/ASTM.Act.Spec.Volume (Float, MB)

Description
Returns the actual specific volume of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2280. Application: GPA/ASTM.Act.Hv.MJM3 (Float, MB)

Description
Returns the actual Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculamtion method is used.

Return value
A positive floating point value

Unit
MJ/m3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2281. Application: GPA/ASTM.Zair (Float, MB)

Description
Returns the Zair value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculamtion method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2292. Application: GPA/ASTM Act.hv.Real (Float, MB)

Description
Returns the actual real hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2293. Application: GPA/ASTM Dry.hv.Real (Float, MB)

Description
Returns the dry real hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2294. Application: GPA/ASTM Sat.hv.Real (Float, MB)

Description
Returns the saturated real hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2295. Application: GPA/ASTM Act.hv.MJM3 (Float, MB)

Description
Returns the actual hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
MJ/m3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2310. Application: GPA/ASTM GPM [gal/1000ft3] #norm-peak (Float, MB)

Description
Returns the GPM value of the selected component in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
gal/1000ft3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2311. Application: GPA/ASTM Total GPM [gal/1000ft3] (Float, MB)

Description
Returns the total GPM value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
gal/1000ft3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2312. Application: ISO2016/ISO/GOST/GPA/ASTM.Weight.percentage (Float, MB)

Description
Returns the weight percentage value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

2313. Application: ISO2016/ISO/GOST/GPA/ASTM.Sat.Zmix (Float, MB)

Description
Returns the saturated Zmix value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2314. Application: ISO2016/ISO/GOST/GPA/ASTM.Sat.Molar Mass (Float, MB)

Description
Returns the saturated molar mass value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2315. Application: ISO2016/ISO/GOST/GPA/ASTM.Sat.Wobbe index (Float, MB)

Description
Returns the saturated Wobbe index of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2316. Application: ISO2016/ISO/GOST/GPA/ASTM.Sat.Water mole (Float, MB)

Description
Returns the saturated water mole value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2317. Application: GPA/ASTM Act.Water mole (Float, MB)

Description
Returns the actual water mole value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2318. Application: ISO2016/ISO/GOST/GPA/ASTM.Dry.Zmix (Float, MB)

Description
Returns the dry Zmix value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2319. Application: ISO2016/ISO/GOST/GPA/ASTM.Dry.Molar Mass (Float, MB)

Description
Returns the dry molar mass value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2320. Application: ISO2016/ISO/GOST/GPA/ASTM.Dry.Rel.Dens.ideal (Float, MB)

Description
Returns the dry ideal relative density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2321. Application: ISO2016/ISO/GOST/GPA/ASTM.Sat.Rel.Dens.ideal (Float, MB)

Description
Returns the saturated ideal relative density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2322. Application: ISO2016/ISO/GOST/GPA/ASTM.Dry.Wobbe index (Float, MB)

Description
Returns the dry Wobbe index of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2325. Application: ISO2016/ISO/GOST.Sat.Hv.real (Float, MB)

Description
Returns the saturated real Hv value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2326. Application: ISO2016/ISO/GOST.Sat.hv.real (Float, MB)

Description
Returns the saturated real hv value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2327. Application: ISO2016/ISO/GOST.Sat.Gas.Den.Real (Float, MB)

Description
Returns the saturated real gas density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2328. Application: ISO2016/ISO/GOST.Sat.Rel.Dens.Real (Float, MB)

Description
Returns the saturated real relative density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2329. Application: ISO2016/ISO/GOST.Sat.Wobbe inferior (Float, MB)

Description
Returns the saturated Wobbe inferior value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2330. Application: ISO2016/ISO/GOST.Dry.Gas.Dens.Ideal (Float, MB)

Description
Returns the dry ideal gas density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2331. Application: ISO2016/ISO/GOST.Sat.Gas.Dens.Ideal (Float, MB)

Description
Returns the saturated ideal gas density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2332. Application: ISO2016/ISO/GOST.Sat.Rel.Dens.ideal (Float, MB)

Description
Returns the saturated ideal gas relative density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

2333. Application: ISO2016/ISO/GOST.Dry.Hmass (Float, MB)

Description
Returns the dry Hmass value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2334. Application: ISO2016/ISO/GOST.Dry.hmass (Float, MB)

Description
Returns the dry hmass value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2335. Application: ISO2016/ISO/GOST.Sat.Hmass (Float, MB)

Description
Returns the saturated Hmass value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2336. Application: ISO2016/ISO/GOST.Sat.hmass (Float, MB)

Description
Returns the saturated hmass value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2337. Application: ISO2016/ISO/GOST.Dry.Hmolar (Float, MB)

Description
Returns the dry Hmolar value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2338. Application: ISO2016/ISO/GOST.Dry.hmolar (Float, MB)

Description
Returns the dry hmolar value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2339. Application: ISO2016/ISO/GOST.Sat.Hmolar (Float, MB)

Description
Returns the saturated Hmolar value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2340. Application: ISO2016/ISO/GOST.Sat.hmolar (Float, MB)

Description
Returns the saturated hmolar value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2341. Application: ISO2016/ISO/GOST.Dry.Hv.ideal (Float, MB)

Description
Returns the dry ideal Hv value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2342. Application: ISO2016/ISO/GOST.Dry.hv.ideal (Float, MB)

Description
Returns the dry ideal hv value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2343. Application: ISO2016/ISO/GOST.Sat.Hv.ideal (Float, MB)

Description
Returns the saturated ideal Hv value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2344. Application: ISO2016/ISO/GOST.Sat.hv.ideal (Float, MB)

Description
Returns the saturated ideal hv value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2345. Application: GPA/ASTM Dry.Hv.ideal (Float, MB)

Description
Returns the dry ideal Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2346. Application: GPA/ASTM Sat.Hv.ideal (Float, MB)

Description
Returns the saturated ideal Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2347. Application: GPA/ASTM Act.Hv.ideal (Float, MB)

Description
Returns the actual ideal Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2348. Application: GPA/ASTM Act.hv.ideal (Float, MB)

Description
Returns the actual ideal hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2349. Application: GPA/ASTM Dry.hv.ideal (Float, MB)

Description
Returns the dry ideal hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2350. Application: GPA/ASTM Sat.hv.ideal (Float, MB)

Description
Returns the saturated ideal hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2351. Application: GPA/ASTM Act.Hmass (Float, MB)

Description
Returns the actual Hmass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2352. Application: GPA/ASTM Act.Hmolar (Float, MB)

Description
Returns the actual Hmolar value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2353. Application: GPA/ASTM Dry.Hmass (Float, MB)

Description
Returns the dry Hmass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2354. Application: GPA/ASTM Dry.Hmolar (Float, MB)

Description
Returns the dry Hmolar value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2355. Application: GPA/ASTM Sat.Hmass (Float, MB)

Description
Returns the saturated Hmass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2356. Application: GPA/ASTM Sat.Hmolar (Float, MB)

Description
Returns the saturated Hmolar value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2357. Application: GPA/ASTM Act.hmass (Float, MB)

Description
Returns the actual hmass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2358. Application: GPA/ASTM Act.hmolar (Float, MB)

Description
Returns the actual hmolar value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2359. Application: GPA/ASTM Dry.hmass (Float, MB)

Description
Returns the dry hmass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2360. Application: GPA/ASTM Dry.hmolar (Float, MB)

Description
Returns the dry hmolar value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2361. Application: GPA/ASTM Sat.hmass (Float, MB)

Description
Returns the saturated hmass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2362. Application: GPA/ASTM Sat.hmolar (Float, MB)

Description
Returns the saturated hmolar value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2363. Application: GPA/ASTM Dry.Rel.Dens.Real (Float, MB)

Description
Returns the dry real relative density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2364. Application: GPA/ASTM Sat.Rel.Dens.Real (Float, MB)

Description
Returns the saturated real relative density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2365. Application: GPA/ASTM Dry.Gas.Dens.Ideal (Float, MB)

Description
Returns the dry ideal gas density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2366. Application: GPA/ASTM Sat.Gas.Dens.Ideal (Float, MB)

Description
Returns the saturated ideal gas density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2367. Application: GPA/ASTM Act.Gas.Dens.Real (Float, MB)

Description
Returns the actual real gas density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2368. Application: GPA/ASTM Dry.Gas.Dens.Real (Float, MB)

Description
Returns the dry real gas density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2369. Application: GPA/ASTM Sat.Gas.Dens.Real (Float, MB)

Description
Returns the saturated real gas density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2370. Application: GPA/ASTM Dry.Spec.Volume (Float, MB)

Description
Returns the dry specific volume of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2371. Application: GPA/ASTM Sat.Spec.Volume (Float, MB)

Description
Returns the saturated specific volume of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2372. Application: GPA/ASTM Dry.GPM Total[gal/1000ft3] (Float, MB)

Description
Returns the dry total GPM of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
gal/1000ft3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2373. Application: GPA/ASTM Sat.GPM Total[gal/1000ft3] (Float, MB)

Description
Returns the saturated total GPM of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
gal/1000ft3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2374. Application: GPA/ASTM Dry.Hv.MJM3 (Float, MB)

Description
Returns the dry Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
MJ/m3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2375. Application: GPA/ASTM Dry.hv.MJM3 (Float, MB)

Description
Returns the dry hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
MJ/m3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2376. Application: GPA/ASTM Sat.Hv.MJM3 (Float, MB)

Description
Returns the saturated Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
MJ/m3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2377. Application: GPA/ASTM Sat.hv.MJM3 (Float, MB)

Description
Returns the saturated hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
MJ/m3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Remarks
This parameter only supplies valid data of the last run, at the end of the run. Use one of the synchronization parameters to detect the end of the run.

For synchronization, parameters **2200. Sync: Data available (Bit, MB)**, **2201. Sync: Data available with reset(Bit, MB)**, or **2238. Sync: Data available2 with reset(Bit, MB)** can be used.

2378. Application: ISO2016.Dry.Wobbe.ideal (Float, MB)

Description
Returns the dry ideal Wobbe index value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

2379. Application: ISO2016.Sat.Wobbe.ideal (Float, MB)

Description
Returns the saturated ideal Wobbe index value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

2380. Application: ISO2016.Dry.Wobbe.inferior.ideal (Float, MB)

Description
Returns the dry ideal Wobbe inferior value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

2381. Application: ISO2016.Sat.Wobbe.inferior.ideal (Float, MB)

Description
Returns the saturated ideal Wobbe inferior value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (value = 0)

Stream specific application data

2400. Appl.: Stream Component ESTD(Float, CHAN=stream, PEAK)

Description
Returns the ESTD concentration of the selected peak from the application report of the last run, which was sampled and analyzed on the selected stream.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the last ESTD value.

Peak (PROstation)
Use the PEAK argument to select a Peak (component) in the last application report generated on the selected stream. To do so, fill in the peak index of the corresponding peak in the normalization table.

2401. Appl.: Stream Component Norm%(Float, CHAN=stream, PEAK)

Description
Returns the Normalized concentration of the selected peak from the application report of the last run, which was sampled and analyzed on the selected stream.

Return value
A positive floating point value

Unit
Percent (%)

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the last Normalized concentration value.

Peak (PROstation)
Use the PEAK argument to select a Peak (component) in the last application report generated on the selected stream. To do so, fill in the peak index of the corresponding peak in the normalization table.

2402. Appl.: Stream Alarm on Index(Bit, CHAN=stream, PEAK=index)

Description
Returns whether or not the selected alarm from the alarm table was raised at the end of the last run, which was sampled and analyzed from the selected stream.

Return value
0 = No alarm raised

1 = An alarm from the alarm table was raised at the end of the last run for the selected stream.

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the last Alarm results.

Peak (PROstation)
Use the PEAK argument to select an alarm (by line number/index) from the alarm table.

See also
Parameter **2403. Appl.: Stream Overall Alarm Status (Bit, CHAN=stream)** on page 378

Parameter **2211. Application: Overall Alarm status (Bit, MB)** on page 319

Parameter **2212. Application: Alarm status On Index (Bit, MB, PEAK=Index)** on page 320

Parameter **152. Status: Instrument Error Status(Bit, MB)** on page 282

2403. Appl.: Stream Overall Alarm Status (Bit, CHAN=stream)

Description
Returns if any of the configured alarms from the alarm table was raised at the end of the last run, which was sampled and analyzed from the selected stream.

Return value
0 = No alarm raised
1 = An alarm from the alarm table was raised at the end of the last run for the selected stream.

Modbus Register Type
Coil status/Input Status

Modbus data type
Bit (1 bit)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the last Alarm results.

See also
Parameter **2402. Appl.: Stream Alarm on Index(Bit, CHAN=stream, PEAK=index)** on page 377.

Parameter **2211. Application: Overall Alarm status (Bit, MB)** on page 319

Parameter **2212. Application: Alarm status On Index (Bit, MB, PEAK=Index)** on page 320

Parameter **152. Status: Instrument Error Status(Bit, MB)** on page 282

2404. Appl.: Stream GPA/ASTM.Act.Zmix (Float, CHAN=stream)

Description
Returns the actual Zmix value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual Zmix.

2405. Appl.: Stream GPA/ASTM.Act.Wobbe index (Float, CHAN=stream)

Description
Returns the actual Wobbe index value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual Wobbe index.

2406. Appl.: Stream ISO2016/ISO/GOST.Dry.Hs.v.Real (Float, CHAN=stream)

Description
Returns the volume based dry real Hs value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the volume based dry real Hs.

2407. Appl.: Stream ISO2016/ISO/GOST.Dry.Hi.v.Real (Float, CHAN=stream)

Description
Returns the volume based dry real Hi value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the volume based dry real Hi.

2408. Appl.: Stream ISO2016/ISO/GOST.Dry.Gas.Dens.Real (Float, CHAN=stream)

Description
Returns the dry real gas density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry real gas density.

2409. Appl.: Stream ISO2016/ISO/GOST.Dry.Rel.Dens.Real (Float, CHAN=stream)

Description
Returns the dry real relative density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry real relative density.

2410. Appl.: Stream ISO2016/ISO/GOST.Dry.Wobbe Inferior (Float, CHAN=stream)

Description
Returns the dry Wobbe inferior value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry Wobbe inferior.

2411. Appl.: Stream GPA/ASTM.Act.Hv.Real (Float, CHAN=stream)

Description
Returns the actual real Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual real Hv.

2412. Appl.: Stream GPA/ASTM.Dry.Hv.Real (Float, CHAN=stream)

Description
Returns the dry real Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry real Hv.

2413. Appl.: Stream GPA/ASTM.Sat.Hv.Real (Float, CHAN=stream)

Description
Returns the saturated real Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated real Hv.

2414. Appl.: Stream GPA/ASTM.Act.Rel.Dens.Real (Float, CHAN=stream)

Description
Returns the actual real relative density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual real relative density.

2415. Appl.: Stream GPA/ASTM.Act.Gas.Dens.Ideal (Float, CHAN=stream)

Description
Returns the actual ideal gas density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual ideal gas density.

2416. Appl.: Stream GPA/ASTM.Act.Spec.Volume (Float, CHAN=stream)

Description
Returns the actual specific volume value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual specific volume.

2417. Appl.: Stream GPA/ASTM.Act.Hv.MJM3 (Float, CHAN=stream)

Description
Returns the actual Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
MJ/m3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual Hv.

2418. Appl.: Stream Sum ESTD (Float, CHAN=stream)

Description
Returns the sum of ESTD values of all peaks in the application report of the last run, which was sampled and analyzed from the selected stream. These peaks are defined in the normalization table (maximum 100 peaks) and are also detected in the integration report.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the Sum ESTD value.

2419. Appl.: Stream GPA/ASTM Act.hv.Real (Float, CHAN=stream)

Description
Returns the actual real hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual real hv.

2420. Appl.: Stream GPA/ASTM Dry.hv.Real (Float, CHAN=stream)

Description
Returns the dry real hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry real hv.

2421. Appl.: Stream GPA/ASTM Sat.hv.Real (Float, CHAN=stream)

Description
Returns the saturated real hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated real hv.

2422. Appl.: Stream GPA/ASTM Act.hv.MJM3 (Float, CHAN=stream)

Description
Returns the actual hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
MJ/m3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual hv.

2423. Appl.: Stream GPA/ASTM.Act.Molar Mass (Float, CHAN=stream)

Description
Returns the actual molar mass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual molar mass.

2424. Appl.: Stream ISO2016/ISO/GOST/GPA/ASTM.Dry.Zmix (Float, CHAN=stream)

Description
Returns the dry Zmix value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry Zmix.

2425. Appl.: Stream ISO2016/ISO/GOST/GPA/ASTM.Dry.Wobbe index (Float, CHAN=stream)

Description
Returns the dry Wobbe index of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry Wobbe index.

2426. Appl.: Stream ISO2016/ISO/GOST/GPA/ASTM.Dry.Molar Mass (Float, CHAN=stream)

Description
Returns the dry molar mass value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry molar mass.

2427. Appl.: Stream ISO2016/ISO/GOST/GPA/ASTM.Sat.Zmix (Float, CHAN=stream)

Description
Returns the saturated Zmix value of the selected component in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated Zmix.

2428. Appl.: Stream ISO2016/ISO/GOST/GPA/ASTM.Sat.Wobbe index (Float, CHAN=stream)

Description
Returns the saturated Wobbe index value of the selected component in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated Wobbe index.

2429. Appl.: Stream ISO2016/ISO/GOST/GPA/ASTM.Sat.Molar Mass (Float, CHAN=stream)

Description
Returns the saturated molar mass value of the selected component in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated molar mass.

2430. Appl.: Stream ISO2016/ISO/GOST.Dry.Hv.ideal (Float, CHAN=stream)

Description
Returns the dry ideal Hv value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry ideal Hv.

2431. Appl.: Stream ISO2016/ISO/GOST.Dry.hv.ideal (Float, CHAN=stream)

Description
Returns the dry ideal hv value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve dry ideal hv.

2432. Appl.: Stream ISO2016/ISO/GOST.Dry.Hmolar (Float, CHAN=stream)

Description
Returns the dry Hmolar value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry Hmolar.

2433. Appl.: Stream ISO2016/ISO/GOST.Dry.hmolar (Float, CHAN=stream)

Description
Returns the dry hmolar value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry hmolar.

2434. Appl.: Stream ISO2016/ISO/GOST.Dry.Hmass (Float, CHAN=stream)

Description
Returns the dry Hmass value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry Hmass.

2435. Appl.: Stream ISO2016/ISO/GOST.Dry.hmass (Float, CHAN=stream)

Description
Returns the dry hmass value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry hmass.

2436. Appl.: Stream ISO2016/ISO/GOST.Sat.Hv.ideal (Float, CHAN=stream)

Description
Returns the saturated ideal Hv value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated ideal Hv.

2437. Appl.: Stream ISO2016/ISO/GOST.Sat.hv.ideal (Float, CHAN=stream)

Description
Returns the saturated ideal hv value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated ideal hv.

2438. Appl.: Stream ISO2016/ISO/GOST.Sat.Hmolar (Float, CHAN=stream)

Description
Returns the saturated Hmolar value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated Hmolar.

2439. Appl.: Stream ISO2016/ISO/GOST.Sat.hmolar (Float, CHAN=stream)

Description
Returns the saturated hmolar value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated hmolar.

2440. Appl.: Stream ISO2016/ISO/GOST.Sat.Hmass (Float, CHAN=stream)

Description
Returns the saturated Hmass value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated Hmass.

2441. Appl.: Stream ISO2016/ISO/GOST.Sat.hmass (Float, CHAN=stream)

Description
Returns the saturated hmass value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated hmass.

2442. Appl.: Stream ISO2016/ISO/GOST.Dry.Gas.Dens.Ideal (Float, CHAN=stream)

Description
Returns the dry ideal gas density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry ideal gas density.

2443. Appl.: Stream GPA/ASTM.Act.Rel.Dens.Ideal (Float, CHAN=stream)

Description
Returns the actual ideal relative density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual ideal relative density.

2444. Appl.: Stream GPA/ASTM Dry.Gas.Dens.Ideal (Float, CHAN=stream)

Description
Returns the dry ideal gas density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry ideal gas density.

2445. Appl.: Stream ISO2016/ISO/GOST/GPA/ASTM.Dry.Rel.Dens.ideal (Float, CHAN=stream)

Description
Returns the dry ideal relative density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, ASTM 3588 or GPA 2172 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry ideal relative density.

2446. Appl.: Stream GPA/ASTM Dry.Gas.Dens.Real (Float, CHAN=stream)

Description
Returns the dry real gas density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 or energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry real gas density.

2447. Appl.: Stream GPA/ASTM Dry.Rel.Dens.Real (Float, CHAN=stream)

Description
Returns the dry real relative density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry real relative density.

2448. Appl.: Stream ISO2016/ISO/GOST.Sat.Gas.Dens.Ideal (Float, CHAN=stream)

Description
Returns the saturated ideal gas density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated ideal gas density.

2449. Appl.: Stream ISO2016/ISO/GOST/GPA/ASTM.Sat.Rel.Dens.ideal (Float, CHAN=stream)

Description
Returns the saturated ideal relative density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated ideal relative density.

2450. Appl.: Stream ISO2016/ISO/GOST.Sat.Gas.Den.Real (Float, CHAN=stream)

Description
Returns the saturated real gas density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated real gas density.

2451. Appl.: Stream ISO2016/ISO/GOST.Sat.Rel.Dens.Real (Float, CHAN=stream)

Description
Returns the saturated real relative density value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated real relative density.

2452. Appl.: Stream ISO2016/ISO/GOST.Sat.Wobbe inferior (Float, CHAN=stream)

Description
Returns the saturated Wobbe inferior value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated Wobbe inferior.

2453. Appl.: Stream GPA/ASTM Act.Hv.ideal (Float, CHAN=stream)

Description
Returns the actual ideal Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual ideal Hv.

2454. Appl.: Stream GPA/ASTM Act.hv.ideal (Float, CHAN=stream)

Description
Returns the actual ideal hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual ideal hv.

2455. Appl.: Stream GPA/ASTM Act.Hmolar (Float, CHAN=stream)

Description
Returns the actual Hmolar value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual Hmolar.

2456. Appl.: Stream GPA/ASTM Act.hmolar (Float, CHAN=stream)

Description
Returns the actual hmolar value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual hmolar.

2457. Appl.: Stream GPA/ASTM Act.Hmass (Float, CHAN=stream)

Description
Returns the actual Hmass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual Hmass.

2458. Appl.: Stream GPA/ASTM Act.hmass (Float, CHAN=stream)

Description
Returns the actual hmass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 or energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual hmass.

2459. Appl.: Stream GPA/ASTM Dry.Hv.ideal (Float, CHAN=stream)

Description
Returns the dry ideal Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry ideal Hv.

2460. Appl.: Stream GPA/ASTM Dry.hv.ideal (Float, CHAN=stream)

Description
Returns the dry ideal hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry ideal hv.

2461. Appl.: Stream GPA/ASTM Dry.Hmolar (Float, CHAN=stream)

Description
Returns the dry Hmolar value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry Hmolar.

2462. Appl.: Stream GPA/ASTM Dry.hmolar (Float, CHAN=stream)

Description
Returns the dry hmolar value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry hmolar.

2463. Appl.: Stream GPA/ASTM Dry.Hmass (Float, CHAN=stream)

Description
Returns the dry Hmass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry Hmass.

2464. Appl.: Stream GPA/ASTM Dry.hmass (Float, CHAN=stream)

Description
Returns the dry hmass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry hmass.

2465. Appl.: Stream GPA/ASTM Sat.Hv.ideal (Float, CHAN=stream)

Description
Returns the saturated ideal Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated ideal Hv.

2466. Appl.: Stream GPA/ASTM Sat.hv.ideal (Float, CHAN=stream)

Description
Returns the saturated ideal hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated ideal hv.

2467. Appl.: Stream GPA/ASTM Sat.Hmolar (Float, CHAN=stream)

Description
Returns the saturated Hmolar value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated Hmolar.

2468. Appl.: Stream GPA/ASTM Sat.hmolar (Float, CHAN=stream)

Description
Returns the saturated hmolar value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated hmolar.

2469. Appl.: Stream GPA/ASTM Sat.Hmass (Float, CHAN=stream)

Description
Returns the saturated Hmass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated Hmass.

2470. Appl.: Stream GPA/ASTM Sat.hmass (Float, CHAN=stream)

Description
Returns the saturated hmass value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated hmass.

2471. Appl.: Stream GPA/ASTM Total GPM [gal/1000ft3] (Float, CHAN=stream)

Description
Returns the total GPM value of the selected component in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
gal/1000ft3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the total GPM.

2472. Appl.: Stream GPA/ASTM Dry.Spec.Volume (Float, CHAN=stream)

Description
Returns the dry specific volume value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 or energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry specific volume.

2473. Appl.: Stream GPA/ASTM Dry.GPM Total[gal/1000ft3] (Float, CHAN=stream)

Description
Returns the dry total GPM value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
gal/1000ft3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry total GPM.

2474. Appl.: Stream GPA/ASTM Sat.Spec.Volume (Float, CHAN=stream)

Description
Returns the saturated specific volume value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated specific volume.

2475. Appl.: Stream GPA/ASTM Sat.GPM Total[gal/1000ft3] (Float, CHAN=stream)

Description
Returns the saturated total GPM value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
gal/1000ft3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated total GPM.

2476. Appl.: Stream ISO2016/ISO/GOST.Sat.Hv.real (Float, CHAN=stream)

Description
Returns the saturated real Hv value of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated real Hv.

2477. Appl.: Stream ISO2016/ISO/GOST.Sat.hv.real (Float, CHAN=stream)

Description
Returns the saturated real hv of the sample reported in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369 or GOST 22667 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated real hv.

2479. Appl.: Stream GPA/ASTM Act.Water mole (Float, CHAN=stream)

Description
Returns the actual water mole value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual water mole.

2480. Appl.: Stream ISO2016/ISO/GOST/GPA/ASTM.Sat.Water mole (Float, CHAN=stream)

Description
Returns the saturated water mole value of the selected component in the application report of the last run. This value is only valid if ISO 6976-2016, ISO 6976, GOST 31369, GOST 22667, GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated water mole.

2481. Appl.: Stream GPA/ASTM Dry.Hv.MJM3 (Float, CHAN=stream)

Description
Returns the dry Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 or energy calculation method is used.

Return value
A positive floating point value

Unit
MJ/m3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry Hv.

2482. Appl.: Stream GPA/ASTM Dry.hv.MJM3 (Float, CHAN=stream)

Description
Returns the dry hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
MJ/m3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry hv.

2483. Appl.: Stream GPA/ASTM Sat.Hv.MJM3 (Float, CHAN=stream)

Description
Returns the saturated Hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
MJ/m3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated Hv.

2484. Appl.: Stream GPA/ASTM Sat.hv.MJM3 (Float, CHAN=stream)

Description
Returns the saturated hv value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Unit
MJ/m3

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated hv.

2485. Appl.: Stream GPA/ASTM.Zair (Float, CHAN=stream)

Description
Returns the Zair value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the Zair.

2487. Appl.: Stream GPA/ASTM Sat.Rel.Dens.Real (Float, CHAN=stream)

Description
Returns the saturated real relative density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated real relative density.

2488. Appl.: Stream GPA/ASTM Sat.Gas.Dens.Ideal (Float, CHAN=stream)

Description
Returns the saturated ideal gas density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated ideal gas density.

2489. Appl.: Stream GPA/ASTM Act.Gas.Dens.Real (Float, CHAN=stream)

Description
Returns the actual real gas density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 or energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the actual real gas density.

2490. Appl.: Stream GPA/ASTM Sat.Gas.Dens.Real (Float, CHAN=stream)

Description
Returns the saturated real gas density value of the sample reported in the application report of the last run. This value is only valid if GPA 2172 or ASTM 3588 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated real gas density.

2491. Appl.: Stream ISO2016.Dry.Wobbe.ideal (Float, CHAN=stream)

Description
Returns the dry ideal gas Wobbe index value of the selected component in the application report of the last run. This value is only valid if ISO 6976-2016 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry ideal gas Wobbe index.

2492. Appl.: Stream ISO2016.Sat.Wobbe.ideal (Float, CHAN=stream)

Description
Returns the saturated ideal gas Wobbe index value of the selected component in the application report of the last run. This value is only valid if ISO 6976-2016 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated ideal gas Wobbe index.

2493. Appl.: Stream ISO2016.Dry.Wobbe.inferior.ideal (Float, CHAN=stream)

Description
Returns the dry ideal gas Wobbe inferior value of the selected component in the application report of the last run. This value is only valid if ISO 6976-2016 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the dry ideal gas Wobbe inferior value.

2494. Appl.: Stream ISO2016.Sat.Wobbe.inferior.ideal (Float, CHAN=stream)

Description
Returns the saturated ideal gas Wobbe inferior value of the selected component in the application report of the last run. This value is only valid if ISO 6976-2016 energy calculation method is used.

Return value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Use the CHAN argument to select the stream to retrieve the saturated ideal gas Wobbe inferior value.

Site info parameters

965. SiteInfo: Calorific Value (Float, MB)

Description
Returns/sets the Calorific value, which is inserted in the Site Info area. The Calorific value is taken from the specification on the calibration gas bottle.

Set Value
A positive floating point value

Unit
Depends on the unit specified on the calibration gas bottle.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (Value = 0)

966. SiteInfo: Density (Float, MB)

Description
Returns/sets the Density value, which is inserted in the Site Info area. The Density value is taken from the specification on the Calibration gas bottle.

Set Value
A positive floating point value

Modbus Register Type
Holding Register/Input Register

Modbus data type
Float (32 bit floating point)

Channel (PROstation)
Mainboard (Value = 0)

API21 parameters

Statistical parameters

This section gives an overview of the available API21 parameters which can be used in the Modbus configuration. For each parameter, the channel# and peak# should be set. The channel# should be set to the stream number. The stream number can be set from 1 up to the maximum number of available streams. The peak# should be set to one of the API21-ParamID, see **Table 18**.

The CHAN identifies from which stream the results are requested. The API21-ParamID identifies which value is requested, for instance PARAM_ID = 101 identifies the Heating value superior.

Table 18 API21-ParamID - data type

Description	API21-ParamID	Data type
Year	1	Integer
Month	2	Integer
Day	3	Integer
Hour	4	Integer
Minute	5	Integer
Second	6	Integer
Number of analysis	7	Integer
Number of analysis with active alarms	8	Integer
Heating value superior	101	Float
Heating value inferior	102	Float
Relative density	103	Float
Wobbe index superior	104	Float
Wobbe index inferior	105	Float
Compressibility at base conditions	106	Float
Total area, sum of all peaks	107	Float
Unnormalised sum	108	Float
Concentration component 1	1001	Float
...	...	Float
Concentration component 19	1019	Float

12004. API21: Average per hour (CHAN=stream, PARAM_ID)

Description
Returns the average value of the configured PARAM_ID (see table) over current hour interval.

Return value
The value returned is the average over the current hour interval.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Depending on the configured PARAM_ID

12005. API21: Average per day (CHAN=stream, PARAM_ID)

Description
Returns the average value of the configured PARAM_ID (see table) over current day interval.

Return value
The value returned is the average over the current day interval.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Depending on the configured PARAM_ID

12006. API21: Average per month (CHAN=stream, PARAM_ID)

Description
Returns the average value of the configured PARAM_ID (see table) over current month interval.

Return value
The value returned is the average over the current month interval.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Depending on the configured PARAM_ID

12007. API21: Minimum per hour (CHAN=stream, PARAM_ID)

Description
Returns the minimum value of the configured PARAM_ID (see table) over current hour interval.

Return value
The value returned is the minimum over the current hour interval.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Depending on the configured PARAM_ID

12008. API21: Minimum per day (CHAN=stream, PARAM_ID)

Description
Returns the minimum value of the configured PARAM_ID (see table) over current day interval.

Return value
The value returned is the minimum over the current day interval.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Depending on the configured PARAM_ID

12009. API21: Minimum per month (CHAN=stream, PARAM_ID)

Description
Returns the minimum value of the configured PARAM_ID (see table) over current month interval.

Return value
The value returned is the minimum over the current month interval.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Depending on the configured PARAM_ID

12010. API21: Maximum per hour (CHAN=stream, PARAM_ID)

Description
Returns the maximum value of the configured PARAM_ID (see table) over current hour interval.

Return value
The value returned is the maximum over the current hour interval.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Depending on the configured PARAM_ID

12011. API21: Maximum per day (CHAN=stream, PARAM_ID)

Description
Returns the maximum value of the configured PARAM_ID (see table) over current day interval.

Return value
The value returned is the maximum over the current day interval.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Depending on the configured PARAM_ID

12012. API21: Maximum per month (CHAN=stream, PARAM_ID)

Description
Returns the maximum value of the configured PARAM_ID (see table) over current month interval.

Return value
The value returned is the maximum over the current month interval.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Depending on the configured PARAM_ID

Historical parameters

This section gives an overview of the available API21 latest, previous, 2nd previous and 3rd previous result parameter which can be used in the Modbus configuration. This parameter provides access to the stored API21 values. For this parameter the channel# and peak# should be set. The channel# should be set to one of the following options:

- 0. Latest results
- 1. Previous results
- 2. 2nd Previous results
- 3. 3rd Previous results

The peak# should be set to one of the API21-ParamID, see **Table 19**.

Table 19 API21-ParamID

Description	API21-ParamID	DataType
Year	1	Integer
Month	2	Integer
Day	3	Integer
Hour	4	Integer
Minute	5	Integer
Second	6	Integer
Analysis number	9	Integer
Stream number	10	Integer
Alarm register 1	51	Integer
Alarm register 2	52	Integer
Alarm register 3	53	Integer
Alarm register 4	54	Integer
Heating value superior	101	Float
Heating value inferior	102	Float
Relative density	103	Float
Wobbe index superior	104	Float
Wobbe index inferior	105	Float
Compressibility at base conditions	106	Float
Total area, sum of all peaks	107	Float
Unnormalised sum	108	Float
Concentration component 1	1001	Float
...	...	Float
Concentration component 19	1019	Float

12015. API21: History Value (CHAN=history#, PARAM_ID)

Description
Returns the value of the configured PARAM_ID (see table) of the selected analysis (channel#).

Return value

The value returned is the value of the configured PARAM_ID of the selected analysis (channel#).

Modbus Register Type

Holding Register/Input Register

Modbus data type

Depending on the configured PARAM_ID

Execute commands

Unlike all other Modbus parameters, these Modbus parameters perform an action rather than return or set a value. Most of these execute commands can also be requested from PROstation.

0. Start Run (Execute Cmd, MB)

Description
Starts a single run (manual run) using the method, application, and all other concerned parameters that are currently in the instrument. After ending this run, the instrument returns to idle mode.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 0)

See also
Parameter **16. Start Automation (Execute Cmd, MB)** on page 417

Parameter **24. Start Calibration Table (Execute Cmd, MB)** on page 418

Parameter **25. Start Verification Table (Execute Cmd, MB)** on page 419

Parameter **17. Stop Automation (Execute Cmd, MB)** on page 418

1. Stop Run (Execute Cmd, MB)

Description
Stops the current running single run (manual run). After the current run has stopped, the instrument returns to idle mode.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 0)

See also
Parameter **17. Stop Automation (Execute Cmd, MB)** on page 418

2. MPU Reset (Execute Cmd, MB)

Description
This causes a software reboot. It also resets some automation parameters, but leaves parameters that can be downloaded from PROstation untouched.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 0)

Remarks
The onboard I/O (Standard or general I/O) of the instrument will be reset during a software reboot. All I/O of the optional extension boards remains untouched during a software reboot except for the onboard I/O which are operated on the Basic Extension Board.

7. Calibrate TCD (Execute Cmd, CHAN)

Description
This command can be used to calibrate the TCD of a channel of the instrument. Only use this command if suspicion is raised that the TCDS are not performing correctly.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Channel (value = 1 to 4)

Remarks
The TCDS are calibrated at startup. Before calibrating the TCDS, ensure that the instrument is in idle mode and that no run or sequence is about or scheduled to start. If the TCD is calibrated during a run, the calibration is not reliable.

9. Energize Relay 1 (Execute Cmd, MB)

Description
This command energizes (switches on) onboard relay 1.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 1)

Remarks
When an optional extension board is used, the onboard relays are put through on the Basic Extension Board.

See also

Parameter **99. Set Extension Bus Relay (Int16, CHAN, PEAK)** on page 272

Execute command **10. De-energize Relay 1 (Execute Cmd, MB)** on page 415

Execute command **11. Energize Relay 2 (Execute Cmd, MB)** on page 415

Execute Command **12. De-energize Relay 2 (Execute Cmd, MB)** on page 416

Execute Command **31. Reset Timed Relays (Execute Cmd, MB)** on page 420

Execute Command **32. Reset Alarm Relays (Execute Cmd, MB)** on page 420

Execute Command **33. Reset Analog Outputs (Execute Cmd, MB)** on page 421

10. De-energize Relay 1 (Execute Cmd, MB)

Description
This command de-energizes (switches off) onboard relay 1.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 1)

Remarks
When an optional extension board is used, the onboard relays are put through on the Basic Extension Board.

See also

Parameter

Execute command

Execute command

Execute Command

Execute Command Execute Command Execute Command Outputs Execute Command

11. Energize Relay 2 (Execute Cmd, MB)

Description
This command energizes (switches on) the onboard relay 2.

Set Value
0 = No effect1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 1)

Remarks
When an optional extension board is used, the onboard relays are put through on the Basic Extension Board.

See also
Parameter **99. Set Extension Bus Relay (Int16, CHAN, PEAK)** on page 272

Execute command **9. Energize Relay 1 (Execute Cmd, MB)** on page 414

Execute command **10. De-energize Relay 1 (Execute Cmd, MB)** on page 415

Execute Command **12. De-energize Relay 2 (Execute Cmd, MB)** on page 416

Execute Command **31. Reset Timed Relays (Execute Cmd, MB)** on page 420

Execute Command **32. Reset Alarm Relays (Execute Cmd, MB)** on page 420

Execute Command **33. Reset Analog Outputs (Execute Cmd, MB)** on page 421

Execute Command **35. Reset All Alarms (Execute Cmd, MB)** on page 422

12. De-energize Relay 2 (Execute Cmd, MB)

Description
This command de-energizes (switches off) onboard relay 2.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 1)

Remarks
When an optional extension board is used, the onboard relays are put through on the Basic Extension Board.

See also
Parameter **99. Set Extension Bus Relay (Int16, CHAN, PEAK)** on page 272

Execute command **9. Energize Relay 1 (Execute Cmd, MB)** on page 414

Execute command **10. De-energize Relay 1 (Execute Cmd, MB)** on page 415

Execute command **11. Energize Relay 2 (Execute Cmd, MB)** on page 415

Execute Command **31. Reset Timed Relays (Execute Cmd, MB)** on page 420

Execute Command **32. Reset Alarm Relays (Execute Cmd, MB)** on page 420

Execute Command **33. Reset Analog Outputs (Execute Cmd, MB)** on page 421

Execute Command **35. Reset All Alarms (Execute Cmd, MB)** on page 422

13. Store Config on Flash (Execute Cmd, MB)

Description
This command stores the instrument configuration on the onboard flash disk. All configuration settings that have been changed since last save action or since last startup, will now be stored in the configuration. This command only concerns configuration

parameters that have been changed by means of Modbus. Configuration parameters downloaded from PROstation are automatically stored on flash. The configuration of the instrument is considered as all parameters that can be changed in the configuration screen of PROstation.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 1)

Remarks
Configuration parameters downloaded from PROstation are automatically stored on flash. Be aware that downloading configuration parameters from PROstation will overwrite configuration changes done through Modbus and vice versa. When configuration changes are done through Modbus, ensure in PROstation to first upload the current (changed) configuration from the instrument. Changed parameters, even if not saved, will be uploaded when in the configuration screen of PROstation an upload is performed.

15. Store Method on Flash (Execute Cmd, MB)

Description
This command stores the instrument method on the onboard flash disk. All method settings that have been changed since last save action or since last startup, will now be stored in the method. This command only concerns method parameters that have been changed by Modbus. Parameters downloaded from PROstation are automatically stored on flash. The method of the instrument is defined as the parameters that determine the instrument conditions during the analysis run. The PROstation method screens provide the user interface to these method parameters.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 1)

Remarks
Modbus parameters downloaded from PROstation are automatically stored on flash. Be aware that downloading method parameters from PROstation will overwrite configuration changes done through Modbus and vice versa. When changes are done through Modbus, ensure in PROstation to first upload the current (changed) method from the instrument. Changed parameters, even if not saved, will be uploaded when in the PROstation an upload of the method is performed.

16. Start Automation (Execute Cmd, MB)

Description
This command starts the automation using the method, application, and all other concerned parameters that are currently in the instrument. After automation has ended (when the automation is not set to endless running), the instrument returns to idle mode.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 0)

Remarks
Start automation does not necessarily start the sequence. If the sequence settings instruct to first start the verification or Calibration Table, the instrument will perform as instructed.

See also
Parameter **24. Start Calibration Table (Execute Cmd, MB)** on page 418

Parameter **25. Start Verification Table (Execute Cmd, MB)** on page 419

Parameter **17. Stop Automation (Execute Cmd, MB)** on page 418

17. Stop Automation (Execute Cmd, MB)

Description
This command stops the automation of the instrument. After automation is ending (when the automation is not set to endless running), the instrument returns to idle mode. The Automation will only stop after the current run has finished.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 0)

See also
Parameter **16. Start Automation (Execute Cmd, MB)** on page 417

Parameter **24. Start Calibration Table (Execute Cmd, MB)** on page 418

Parameter **25. Start Verification Table (Execute Cmd, MB)** on page 419

24. Start Calibration Table (Execute Cmd, MB)

Description
This command starts the Calibration Table using the method, application, and all other concerned parameters that are currently in the instrument. If the instrument is in idle mode, executing the Calibration Table starts immediately. If it is in running automation mode, executing the Calibration Tables starts after the current run has finished. After the

Calibration Table has ended, the instrument returns to idle mode or to running automation, depending upon whether the instrument was in idle mode or in running automation mode at the moment of starting the Calibration Table.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 0)

Remarks
Running the Calibration Table will stop after Parameter **17. Stop Automation (Execute Cmd, MB)** is executed. If automation was running before the Calibration Table was started, then the automation will be stopped as well.

See also
Parameter **16. Start Automation (Execute Cmd, MB)**

Parameter **25. Start Verification Table (Execute Cmd, MB)**

Parameter **17. Stop Automation (Execute Cmd, MB)**

25. Start Verification Table (Execute Cmd, MB)

Description
This command starts the Verification Table using the method, application, and all other concerned parameters that are currently in the instrument. If the GC is in idle mode, executing the Verification Table starts immediately. If it is in running automation mode, executing the Verification Tables starts after the current run has finished. After the Verification Table has ended, the instrument returns to idle mode or to running automation, depending upon whether the instrument was in idle mode or in running automation mode at the moment of starting the Verification Table.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 0)

Remarks
Running the Verification Table will stop after 17. Stop Automation is executed. If automation was running before the Verification Table was started, then the automation will be stopped as well.

See also
Parameter **16. Start Automation (Execute Cmd, MB)** on page 417

Parameter **17. Stop Automation (Execute Cmd, MB)** on page 418

Parameter **24. Start Calibration Table (Execute Cmd, MB)** on page 418

29. Stop Cleaning Cycle (Execute Cmd, MB)

Description
This command stops the cleaning cycle if that is currently running. If the automation was running before the cleaning cycle was started, the instrument will return to running automation. Otherwise it will return to idle mode.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 0)

See also
Parameter Parameter minutes

31. Reset Timed Relays (Execute Cmd, MB)

Description
This command resets all timed relays to their original setting.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value= 1)

See also
Parameter **99. Set Extension Bus Relay (Int16, CHAN, PEAK)** on page 272

Execute command **9. Energize Relay 1 (Execute Cmd, MB)** on page 414

Execute command **10. De-energize Relay 1 (Execute Cmd, MB)** on page 415

Execute command **11. Energize Relay 2 (Execute Cmd, MB)** on page 415

Execute command **12. De-energize Relay 2 (Execute Cmd, MB)** on page 416

Execute Command **32. Reset Alarm Relays (Execute Cmd, MB)** on page 420

Execute Command **33. Reset Analog Outputs (Execute Cmd, MB)** on page 421

Execute Command **35. Reset All Alarms (Execute Cmd, MB)** on page 422

32. Reset Alarm Relays (Execute Cmd, MB)

Description
This command resets all alarm relays to their original setting.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 1)

Remarks
The extra relays that become available when using one or more optional extension board can be connected as normally open or normally closed. Relays that are connected as normally open will be reset to open and oncs that are connected as normally closed will be reset to closed. The standard onboard relays are normally open only.

See also
Parameter **99. Set Extension Bus Relay (Int16, CHAN, PEAK)** on page 272

Execute command **9. Energize Relay 1 (Execute Cmd, MB)** on page 414

Execute command **10. De-energize Relay 1 (Execute Cmd, MB)** on page 415

Execute command **11. Energize Relay 2 (Execute Cmd, MB)** on page 415

Execute command **12. De-energize Relay 2 (Execute Cmd, MB)** on page 416

Execute Command **31. Reset Timed Relays (Execute Cmd, MB)** on page 420

Execute Command **33. Reset Analog Outputs (Execute Cmd, MB)** on page 421

Execute Command **35. Reset All Alarms (Execute Cmd, MB)** on page 422

33. Reset Analog Outputs (Execute Cmd, MB)

Description
This command resets the analog outputs to their low signal. For a 4 to 20 mA and a 0 to 10 V output it means that the analog signal is reset to 4 mA and 0 V respectively.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 1)

Remarks
Analog outputs are only available when using an analog extension board in combination with a basic extension board.

See also
Parameter **99. Set Extension Bus Relay (Int16, CHAN, PEAK)** on page 272

Execute command **9. Energize Relay 1 (Execute Cmd, MB)** on page 414

Execute command **10. De-energize Relay 1 (Execute Cmd, MB)** on page 415

Execute command **11. Energize Relay 2 (Execute Cmd, MB)** on page 415

Execute command **12. De-energize Relay 2 (Execute Cmd, MB)** on page 416

Execute Command **31. Reset Timed Relays (Execute Cmd, MB)** on page 420

Execute Command **32. Reset Alarm Relays (Execute Cmd, MB)** on page 420

Execute Command **35. Reset All Alarms (Execute Cmd, MB)** on page 422

35. Reset All Alarms (Execute Cmd, MB)

Description
This command resets all alarms to their original setting. This command resets the alarm relays, the calibration alarms, overall alarm status and the verification alarms.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 1)

See also
Parameter **99. Set Extension Bus Relay (Int16, CHAN, PEAK)** on page 272

Execute command **9. Energize Relay 1 (Execute Cmd, MB)** on page 414

Execute command **10. De-energize Relay 1 (Execute Cmd, MB)** on page 415

Execute command **11. Energize Relay 2 (Execute Cmd, MB)** on page 415

Execute command **12. De-energize Relay 2 (Execute Cmd, MB)** on page 416

Execute Command **31. Reset Timed Relays (Execute Cmd, MB)** on page 420

Execute Command **32. Reset Alarm Relays (Execute Cmd, MB)** on page 420

Execute Command **33. Reset Analog Outputs (Execute Cmd, MB)** on page 421

36. Empty ErrorLog file (Execute Cmd, MB)

Description
This command empties the instrument error log file. This is the log file which is uploaded when an upload diagnostic is performed.

Set Value
0 = No effect
1 = Execute the command specified

Modbus Register Type
Coil

Modbus data type
Bit (1 bit)

Channel (PROstation)
Mainboard (Value = 1)

Remarks

Fixed value repeater

9000. Fixed Value (Int16, MB, PEAK=fixed value)

Description
Returns the value that needs to be defined in the peak argument for this parameter. This parameter can be used, for example, to let the instrument return an additional identification.

Return value
Fixed value defined in the peak column of the Modbus table.

Modbus Register Type
Holding Register/Input Register

Modbus data type
Int16 (16 bit integer)

Channel (PROstation)
Mainboard (Value = 1)

Peak (PROstation)
Use the Peak argument to define the fixed value to return.

Automation FTP Service

The instrument FTP Service is responsible for transferring analysis results, RAW data (chromatogram) and diagnostic data to a Predefined FTP Server.

The instrument firmware has an onboard FTP Client, capable of sending files to an FTP server.

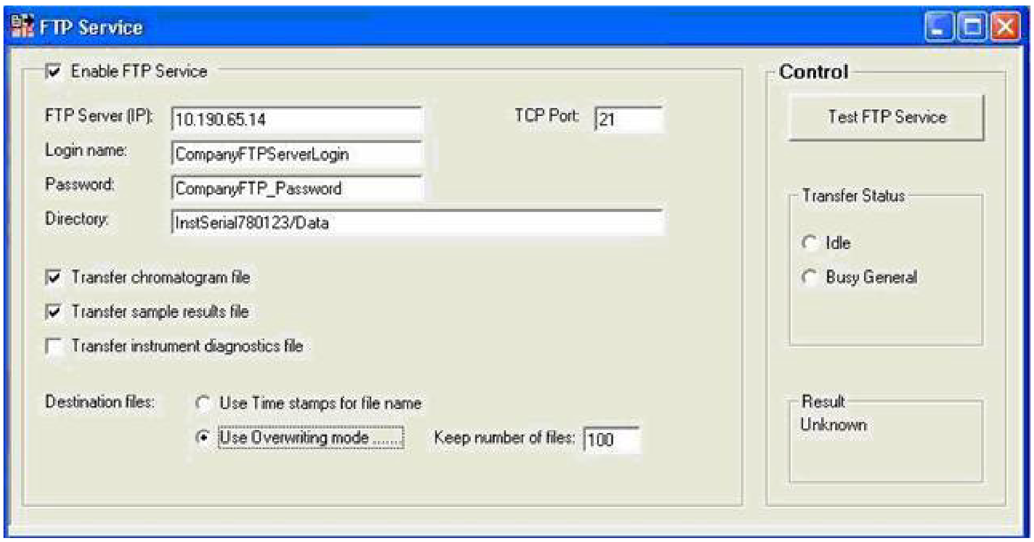


Figure 187. The FTP server

The FTP server name must be set up by entering its IP address. To store the instrument data in a subdirectory on the FTP server, be sure to use / (slash) instead of \ (backslash) to set a subdirectory. If only one subdirectory deep from the root directory, a slash is not required.

In Figure 325, the files are stored in **InstSerial780123Data** folder, which is a subdirectory of the default directory after logging in with an FTP client using the login name and password as defined above. If this subdirectory has a subdirectory **test1** and data should be stored in this folder, enter `InstSerial780123Data/test1`.

In this example, the chromatogram file and sample results file are sent to the FTP server at the end of every run. **Destination Files** can be set under which name to store the selected files.

If Time stamps are selected, the chromatogram is stored as Chrom_[time].dat, the sample results as `Chrom_[time].txt` and the diagnostic data as `ErrorLog.txt`. The Chromatogram file as stored on the FTP server can be opened in PROstation in a later stage for diagnostics purposes. The sample results and ErrorLog file are simple text files and can be opened in any ordinary text editor.

Set TCP Port to a value other than default 21 if this required by the FTP server.

The **Test FTP Service** button can be used to check whether the correct FTP server settings are used. By pressing the button, the selected files are immediately sent to the FTP server. Check on the FTP server if they were received.

USB Storage

USB storage setup

1 Ensure your USB has only one partition with FAT32 or exFAT format.

2 Create a folder named gcroot under the root path of the USB disk, otherwise the 990 Micro GC will not save anything into the USB.

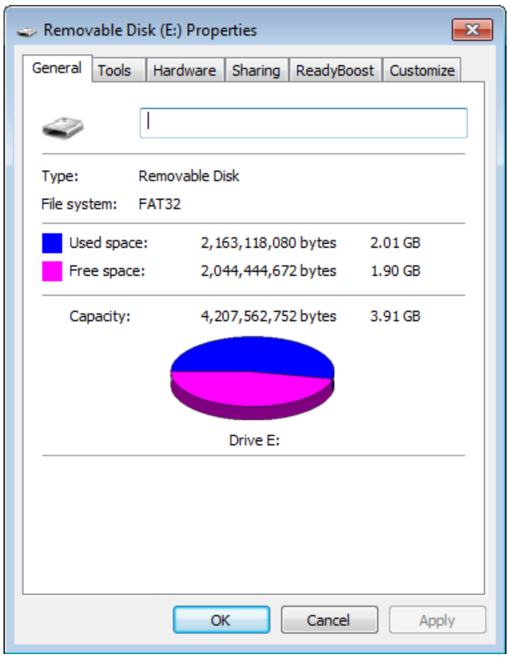


Figure 188. USB properties

USB menus

You may access the USB from the file menu, toolbar icons, and automation menus.

File menu

File > USB Storage > ...

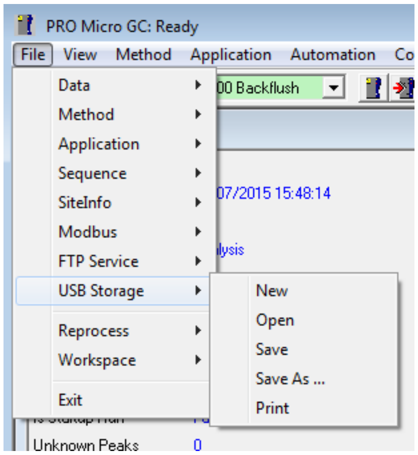


Figure 189. File menu

Toolbar icons

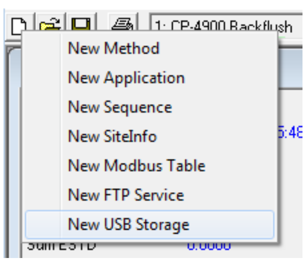


Figure 190. "New" icon

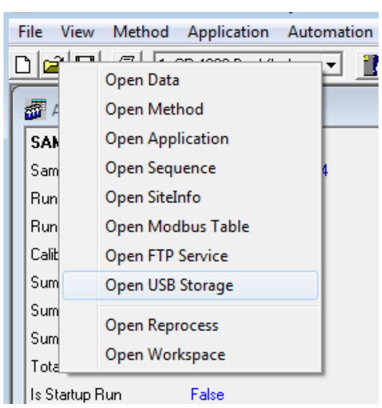


Figure 191. "Open" icon

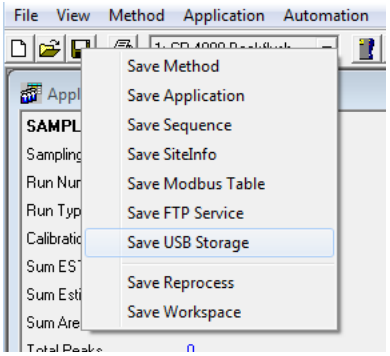


Figure 192. “Save” icon

Automation menu

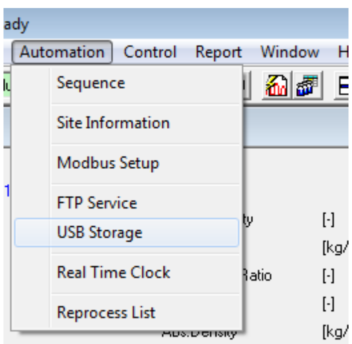
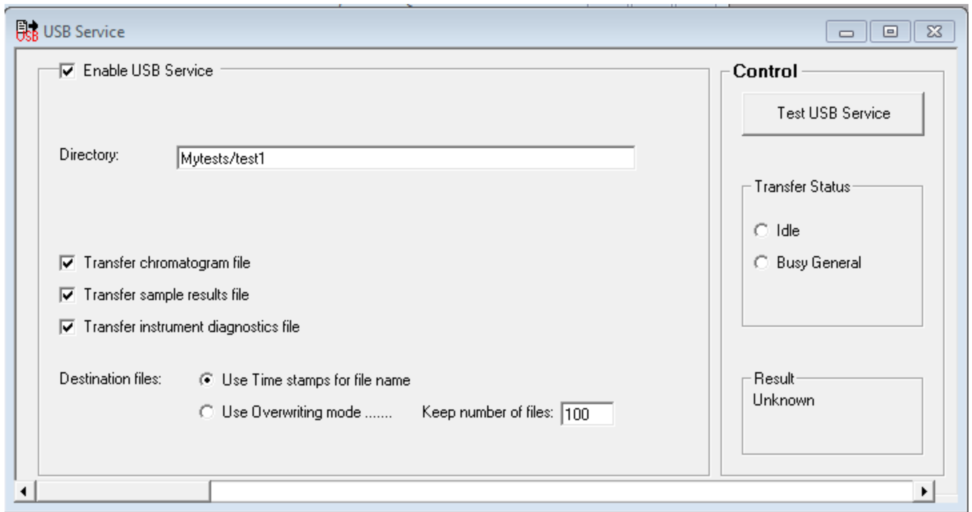


Figure 193. Automation menu

USB storage settings

To setup the automated settings that will be used when data is saved to the USB drive:

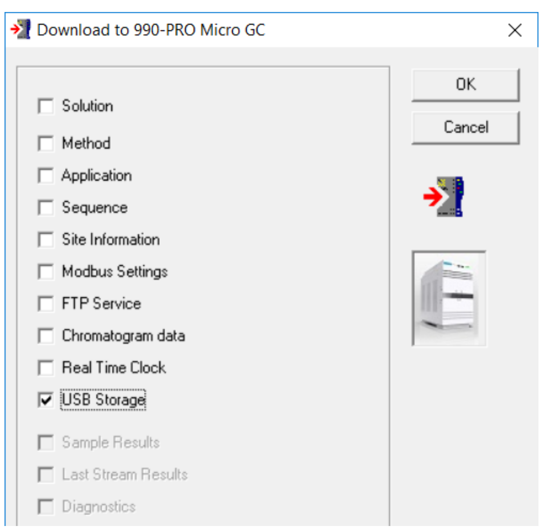
1 Select **Automation > USB Storage**. The USB storage dialog appears. The settings for USB storage are similar to those of FTP.



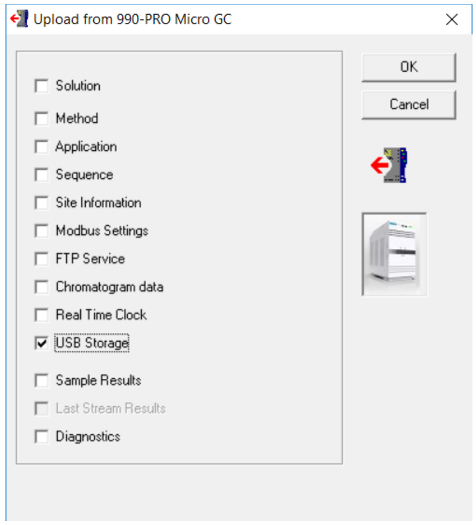
2 Complete each field as applicable for your system. Below are brief descriptions of the major input fields:

- **Enable USB Service:** If selected, USB storage service is enabled.
- **Directory:** The location the data saves to. In this example, files will be saved to folder <USB root>/gcroot/Mytests/test1/.
- **Transfer chromatogram file:** If selected, raw chromatogram data will be saved.
- **Transfer sample result file:** If selected, a text file containing sample results will be saved.
- **Transfer instrument diagnostics file:** If selected, the ERROR.txt file will be saved.
- **Use Time stamps for file name and Use Overwriting mode:** Determines the naming strategy of destination files, just like that of FTP service.

3 Download the USB storage to your 990 Micro GC.



You can also upload USB storage settings from your GC to PROstation. Check the USB storage dialog again to see if the downloading takes effect.



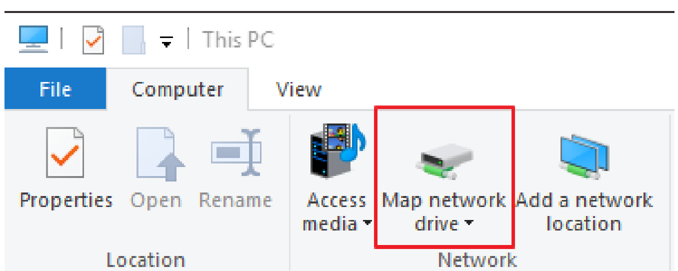
USB storage network mapping

You can easily create a network shortcut to the GC USB mass storage by mapping that location. After the network driver is mapped, it will show up as a new driver in your File Explorer so that you can quickly access the files of USB mass storage remotely, just as if they were on your local hard drive.

Follow these steps to map a network drive on Windows 10:

1 Open File Explorer and select **This PC**.

2 Click the **Map network drive** button.



3 Select the drive id.

4 In the **Folder** box, type the path to the target GC.
The format is *\\gcIPAddr\media*.
gcIPAddr is the GC IP address, and media is the share folder name.

5 Check **Connect using different credentials**.

6 Then click **Finish**.

Test USB storage directly

To test the USB storage:

1 Follow the steps in USB Storage settings to download the USB settings.

2 Ensure the root folder of your USB contains a folder named gcroot.

3 Plug the USB directly into the 990 Micro GC or into a connected USB hub.

4 In PROstation, open the USB Storage dialog.

5 Click **Test USB Service**. If it successfully saves the destination files, the displayed result will be **Success**.

Figure 194.Successful USB storage test

6 Use the USB storage network mapping to check whether the files have really been saved. In this example, the chrom data and sample result is saved to the folder <USB>/sdX/gcroot/Mytest/test1/.

Save data to USB during automated runs

To save data to a USB during automated runs:

1 Download the following USB settings to your GC.

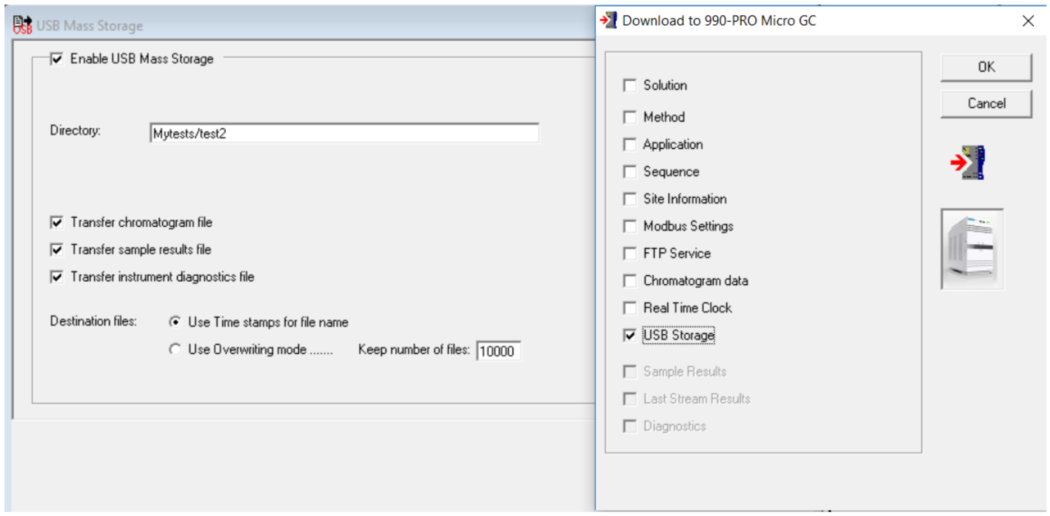


Figure 195.USB settings to be downloaded

2 Saving the results of experiment runs to your USB requires the USB service, and the **Application Calculations** in the method properties dialog to be enabled. Once both are enabled, download the method.

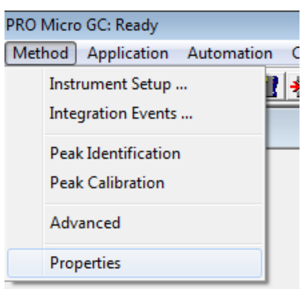


Figure 196.Method dropdown menu

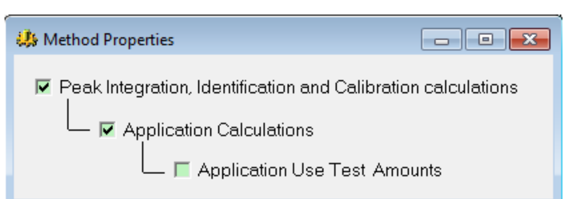


Figure 197.Method properties

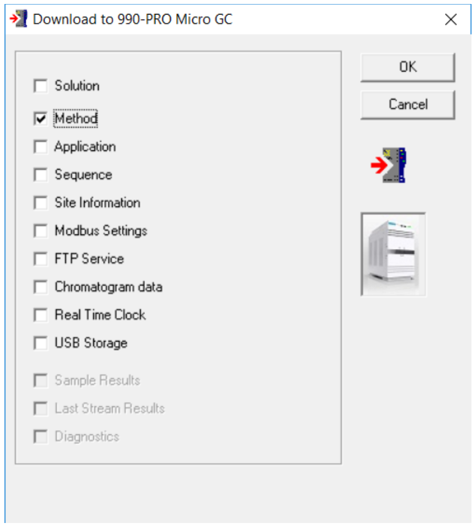


Figure 198.Download method to 990 Micro GC

3 Start an automated or a single run.

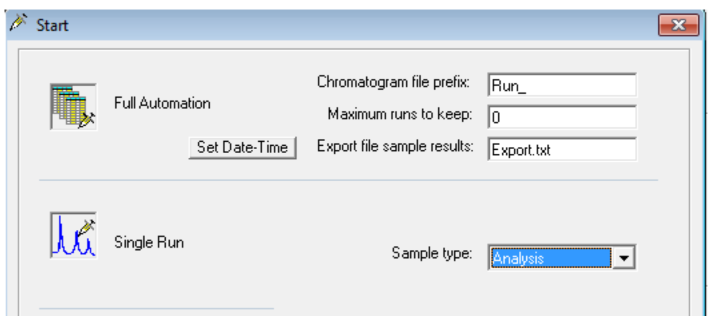


Figure 199. Start a run dialog

4 Check the content of the USB storage network mapping. In this case, check the folder <USB>/sdX/gcroot/Mytest/test2/.

Real Time Clock

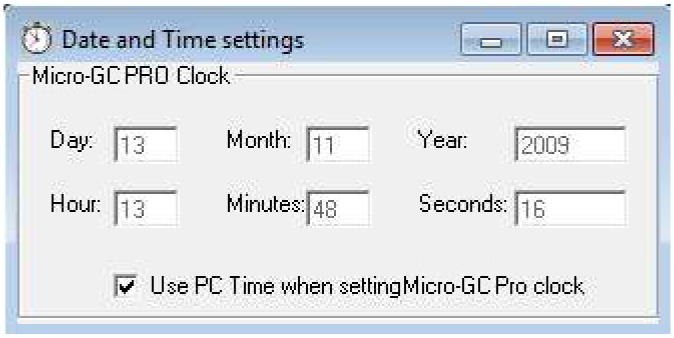


Figure 200. Real Time Clock

You may either enter the time as is, or select **Use PC Time**. Leave this window open and select **Download** from the **Control** menu, check **Real Time Clock** and press **OK** to set the time in the instrument.

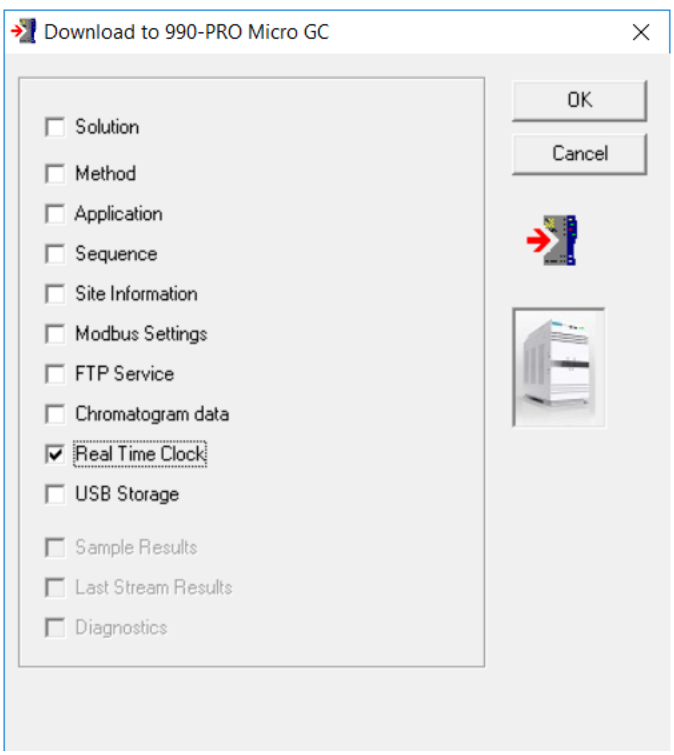


Figure 201. Downloading time

An alternate way to set the time is through Modbus communication protocol in an automated process where clock synchronization is required.

Reprocess List

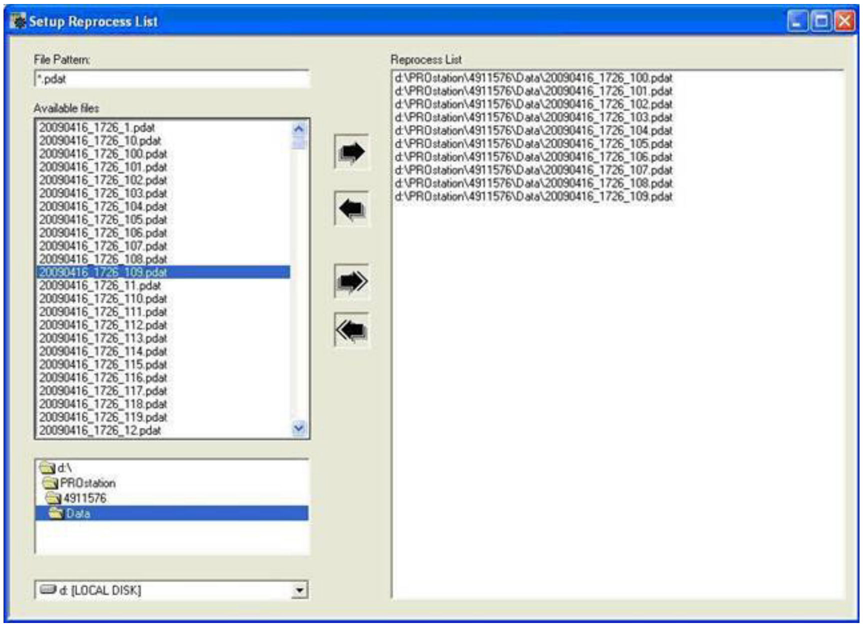


Figure 202. Reprocessing

Close this window and you will be asked to enter a name. The list will be stored under this name. This list can always be reopened using the menu **File - Reprocess - Open**.

From the **Control** menu, select **Start, Recalculate Reprocess List**. PROstation will download the first chromatogram from the list to the instrument and request the instrument to process this chromatogram. When the instrument completes the calculations, the result and chromatogram are shown in PROstation. Now the second chromatogram will be downloaded to the instrument. This will continue till the results of the last processed chromatogram are uploaded to PROstation.

Note that you can only reprocess chromatograms on a nonrunning instrument. PROstation itself has no process capabilities.

10 PROstation Instrument Control Menu

Under **Control** you will find all items related to instrument communication: **start/stop**, **up- and down loading controls**, **status**, and so forth.

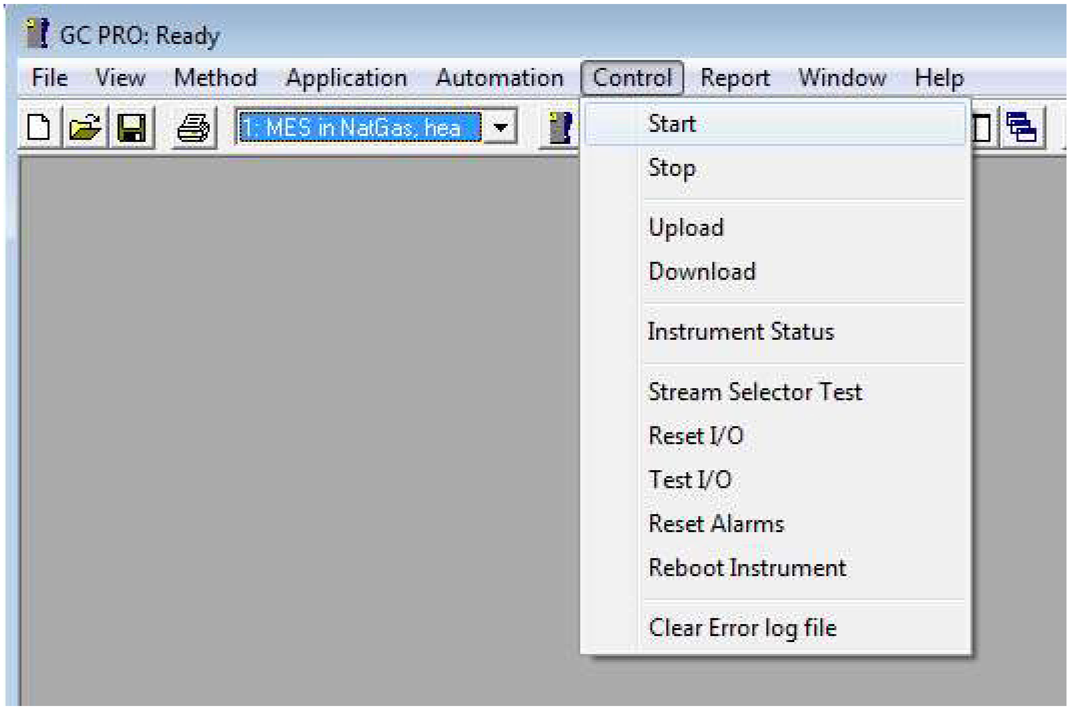


Figure 203. Control menu

Start the Analyzer

Start full Automation to test instrument performance.

- Select **Control\Start**.
- Set chromatogram file name in the correct field, see **Figure 205** on page 439.
- Set Maximum runs, for example, 100 runs, see **Figure 205** on page 439.
- Set **Export file sample results** file name. Results will be exported in a tab separated file. This can be opened in Excel at a later stage.
- Ensure all sample streams and calibration mixture(s) are connected to the stream selector. When only one sample stream is selected, stream selection parameters can be ignored.
- Now start full automation by pressing **Full Automation**.

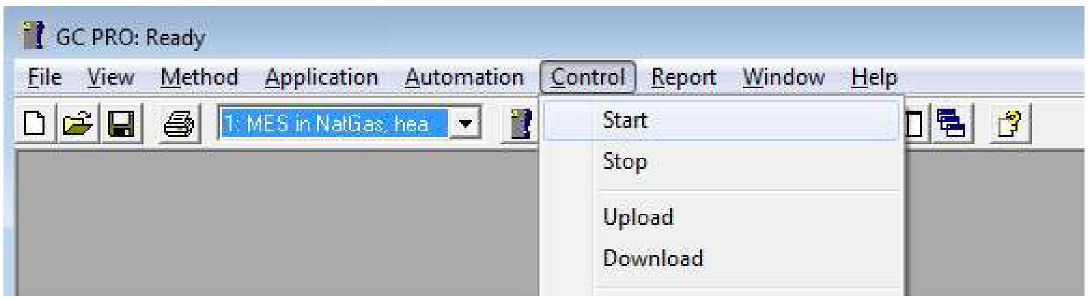


Figure 204. Control menu start

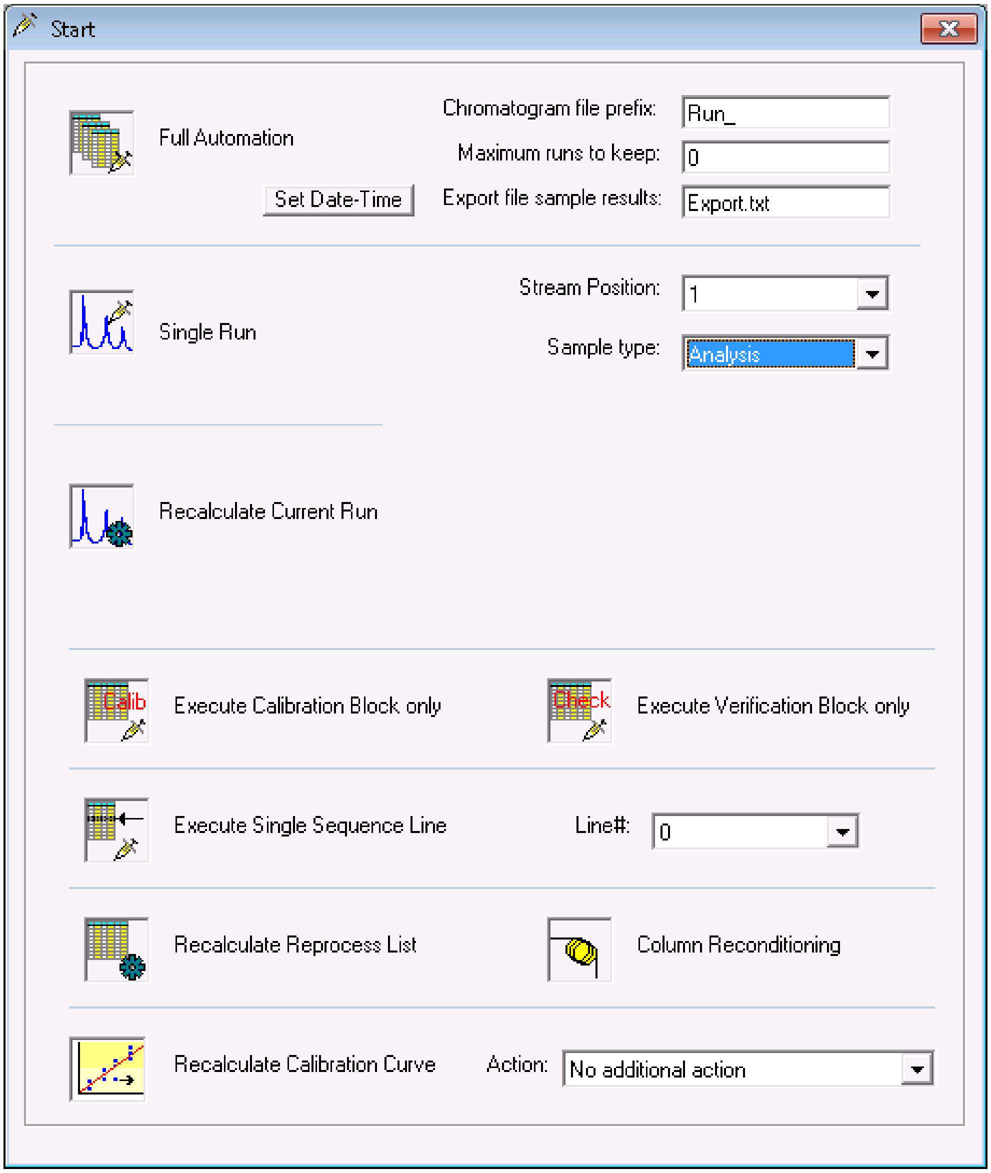


Figure 205. Start

Find detailed information about the**Automation Sequence** on page 226 and **Sequence Table** on page 229.

Because the instrument is capable of executing several different tasks, it is necessary to identify what to start. Apart from **Full Automation**, most of the possibilities listed are used during method development or instrument service.

Execution of the various items is only possible after the appropriate methods have been downloaded to the instrument.

Full Automation

This will start the execution of the **Full Automation** sequences as developed under automation and downloaded to the instrument. The automation consists of a main sequence and optionally a calibration and verification sequence. Those sequences run in the instrument and continue, even if PROstation is exited.

Full Automation requires the parameters **Chromatogram file prefix**, **Maximum runs to keep**, and **Export file sample results** to be filled in.

Once the automation is started, the collected chromatogram and sample results are stored on the local hard disk of the PROstation PC under the file name as defined **Chromatogram file prefix**. In addition, all sample results are stored in a **tab separated file** as defined by **Export file sample results** parameter. This text file can be opened in Excel for statistical analysis.

When **Automation** is running, do not open the export file. Instead, open a copy of this file.

Single Run

This will start a **Single Run**. This consists of sample injection, chromatographic separation, integration, and calculation. Depending on the availability of an application method, this will be performed as well.

This option requires the parameters **Stream Position** and **Sample type**.

If a run is a calibration run, **Level** and **Type** must be filled in.

Recalculate current run

This option allows the user to reintegrate and recalculate the run currently in memory of the instrument. This feature is especially useful when developing methods. Integration, calibration or application methods can be edited and downloaded to the instrument. Changes can be made by recalculating the same run as before.

You can only reprocess the current on a nonrunning instrument. PROstation itself has no process capabilities.

Execute Calibration Block

This option allows the user to directly start a **Calibration Block**. Practically, this will be used only to perform a calibration without running the main sequence.

Execute Verification Block

This option allows the user to directly start a **Verification Block** only. This will be used to check a calibration without running the main sequence.

Execute Single Sequence Line

This option allows the user to start a single line from a complete sequence.

This option requires the parameters **Stream Position**, **Sample type**, **Level** and **Type**.

Recalculate Reprocess List

This option will start the reprocessing (integration/calculation), following the list as defined under **Automation/Reprocess List**.

Column Reconditioning

To bake out the column(s) on the maximum allowed temperature for that column for a period of time, select the **Column Reconditioning** option.

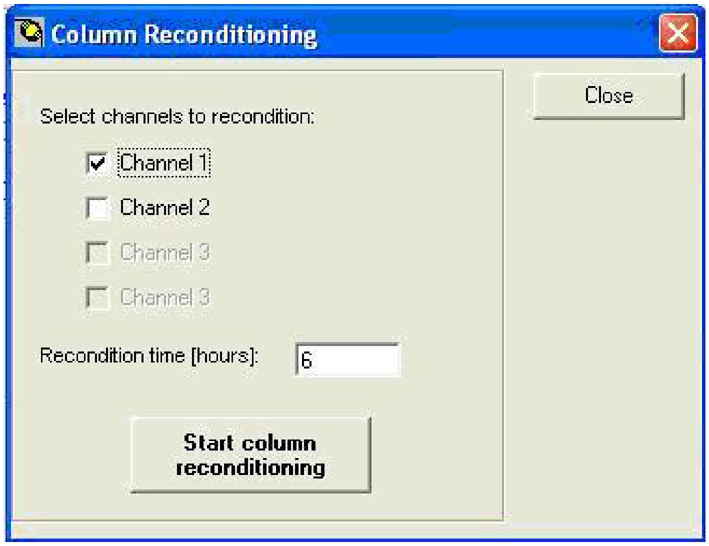


Figure 206. Column Reconditioning

In this example, only the column in Channel 1 will be baked out for 6 hours on its maximum allowed temperature, which is stored in channel persistent memory. Press the **Start column reconditioning** button to start this process. When reconditioning time expires, the column temperature will return to its operating temperature.

Recalculate Calibration Curve

Use this option to let the instrument recalculates its calibration curve out of the available calibration data (amount and area for all calibration levels).

In addition, a pre-recalculation action can be performed before recalculating the curve fit. These are:

- **Remove Single Point List:** If single calibration points are marked in the Method - Calibration window in order to be removed from the calibration curve, this option will appear. The selected points will be removed from the calibration fit and the curve will be recalculated.
- **Clear calib. level 1 all peaks:** Clears all calibration data performed with calibration level 1. If more calibration levels exist, these can be cleared as well.
- **Clear Rw values:** Resets all Rw values to 1.0. This option is only required in a multilevel calibration in combination with a field calibration, used to make a correction on the curve.
- **Clear entire calibration:** This clears the entire calibration curve of all peaks and requires performing a new calibration from scratch.

Stop Column Reconditioning

Once the **Column Reconditioning** is started, this option will become visible in the **Control** menu. Select **Stop Column Reconditioning** to abort this process immediately and return to operating column temperature.

Stop

To stop instrument activity, select **Control/Stop** or click directly on the **Stop** icon.

On a **Stop Automation** the current run will first be completed, before **Automation** is stopped.

When an execute block is performed, the current run will be aborted immediately and the **Automation** will be stopped.

When **Automation** is stopped, all **Timed Relays** will be reset to their default state.

Upload

Uploading from the instrument to PROstation.

From the PROstation toolbar, select **Control/Upload**.

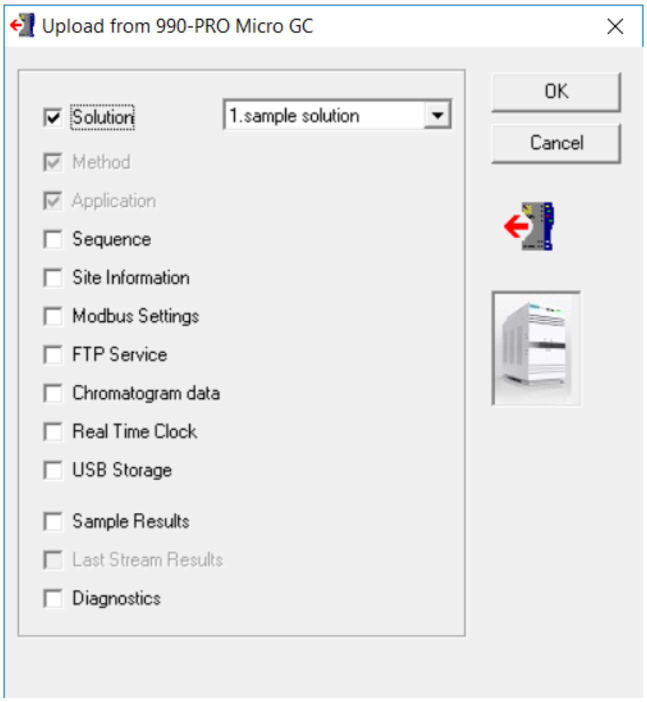


Figure 207. Control/Upload

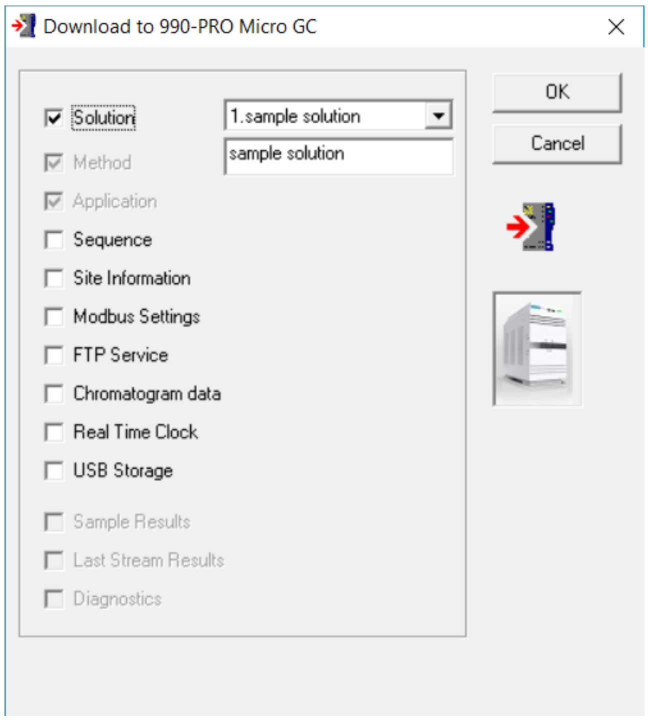
As different parts of the complete instrument method are stored in different sections, one must identify which part needs to be uploaded from or downloaded to the instrument. This minimizes traffic, and at the same time allows the user to focus on specific parts.

Download

Downloading from PROstation to the instrument:

1 From the PROstation toolbar, select **Control/Download.**

2 Select the items to download:



Method change is related to Jumper 5 in the hardware manual.

Sample results and diagnostics should not be downloaded to the instrument, hence they are grayed out.

Solutions

A solution is a set of method and application settings. PROstation allows you to create and store multiple solutions for use by the GC. This allows to use store multi method and application setting in the instrument and use these different settings in a sequence.

Existing solutions can be downloaded to the GC on demand, as well as be associated with a defined sequence.

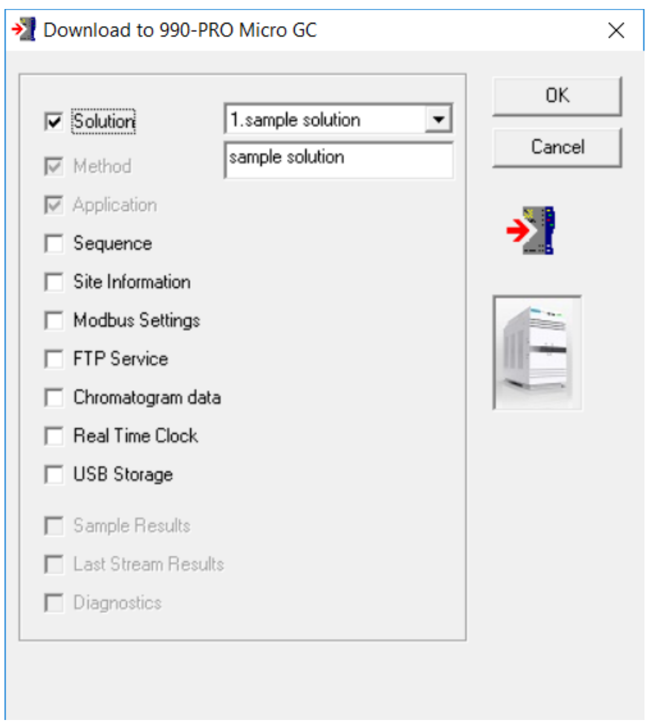
Creating a solution

Solutions can either be created within PROstation, or created by uploading the current method and application being used on the GC to a solution slot in PROstation.

Creating a solution within PROstation

Once a method is defined (see **PROstation Instrument Method Menu** on page 91), and an application is defined (see **PROstation Instrument Application Menu** on page 147), they can be stored as a solution.

1 From the PROstation toolbar, select **Control/Download**. The Download dialog box appears.



2 Check **Solution**, and the Method and Application check boxes are disabled. A drop-down list box and text field appear to the right of the check boxes.

3 Use the drop-down list box to choose the slot in which you want to store the solution. If a solution already exists in the selected slot, it will be overwritten.

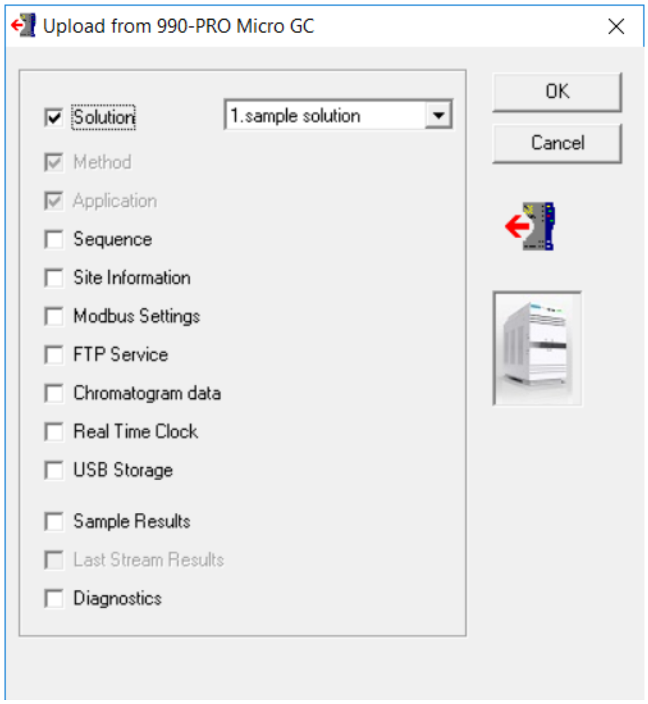
4 Enter or edit the name for the solution in the text field.

5 Click **OK**. The solution is saved within PROstation and is also downloaded to the GC.

Creating a solution based on the existing method and application settings on the GC

A solution can be created based on the existing method and application parameters currently in use on the GC.

1 From the PROstation toolbar, select **Control/Upload**. The Upload dialog box appears.



2 Check **Solution**, and the Method and Application check boxes are disabled. A drop-down list box appears to the right of the check boxes.

3 Use the drop-down list box to choose the slot in which you want to store the solution. If a solution already exists in the selected slot, it will be overwritten.

4 Click **OK**. The method and application details are uploaded from the GC, and saved as a solution within PROstation.

Using solutions in a sequence

Once a solution is created (see **Creating a solution** on page 445), it can be associated with individual runs as part of a sequence.

In the Sequence Table (see **Sequence Table** on page 229), use the Solution slot # drop down list box to choose a sequence to associate with the corresponding run.

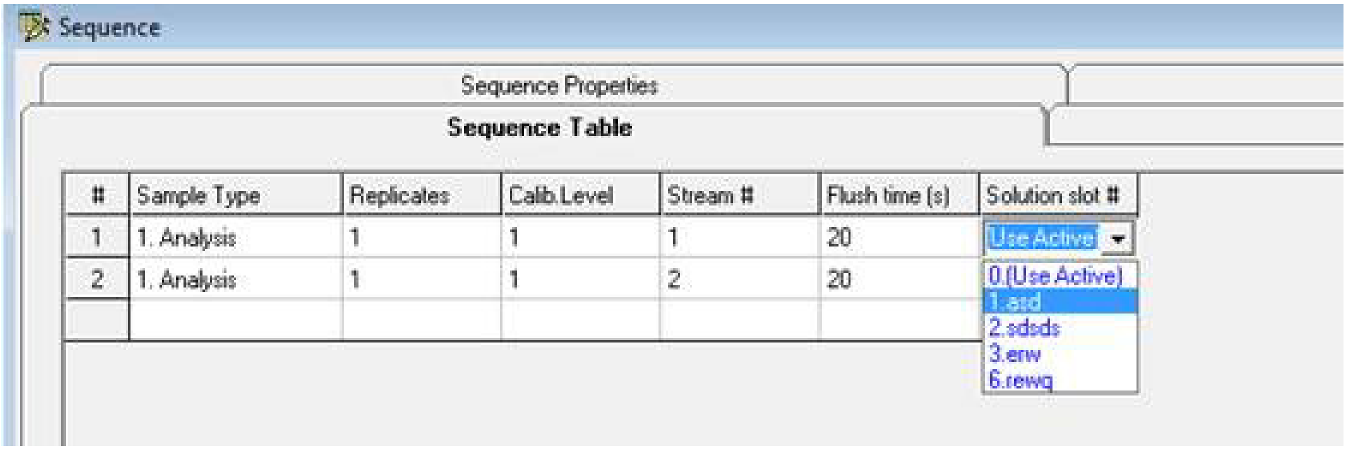


Figure 208. Sequence Table

If you choose slot 0 Use Active, the currently active solution loaded on the GC will be used for the run. If you do not choose slot 0 Use Active, the specified solution will be used for the run.

The solution name will be displayed in the instrument overview, the web interface, and reports.

Instrument Status

The **Control/Instrument Status** command is used to bring up a real-time status screen for your instrument. The instrument method settings (**Set** column) will only appear if a method is up or downloaded from/to the instrument.

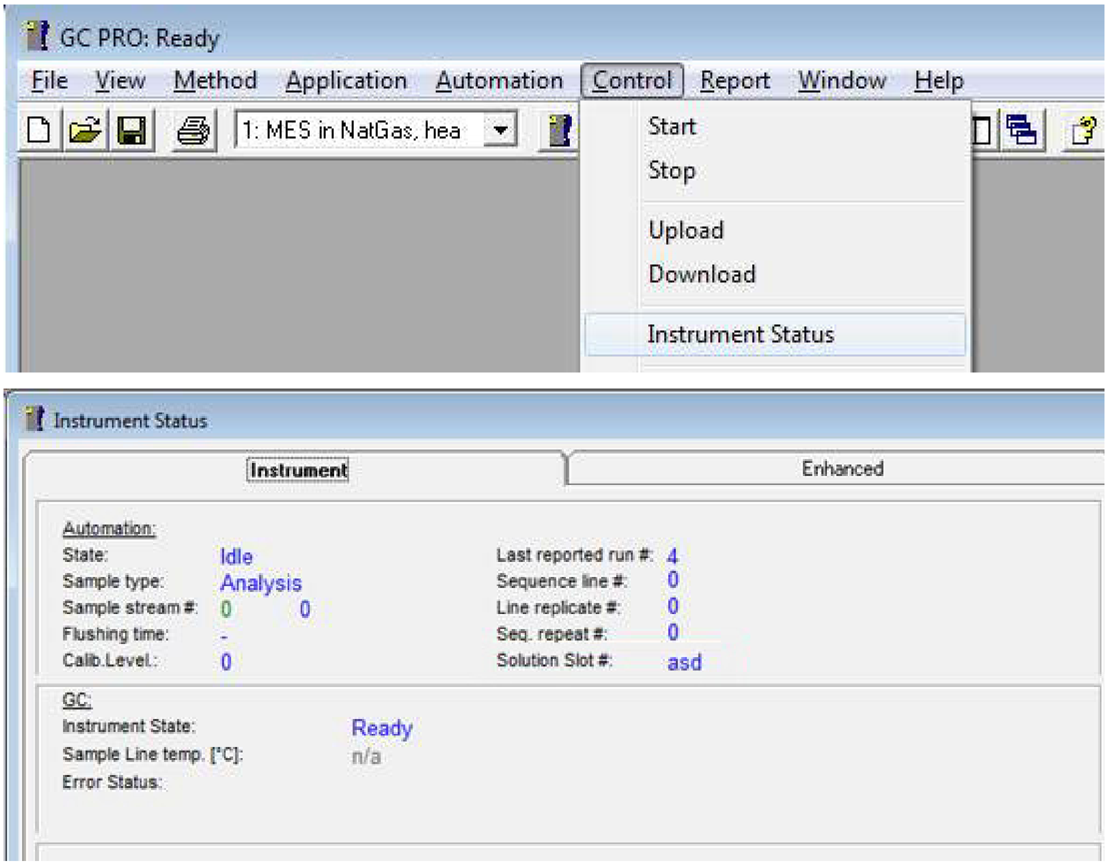


Figure 209. Instrument status

Automation

Current Automation State, **Sample type**, **Sample stream**, **Flushing time**, **Calib. Level** and more are displayed.

GC

Instrument State, **Sample line temperature** and **Error Status** appear.

GC channel

The channel status contains settings and actuals. Status data is colored blue if the actuals are within the settings window and colored red if they are outside the settings windows.

Enhanced status

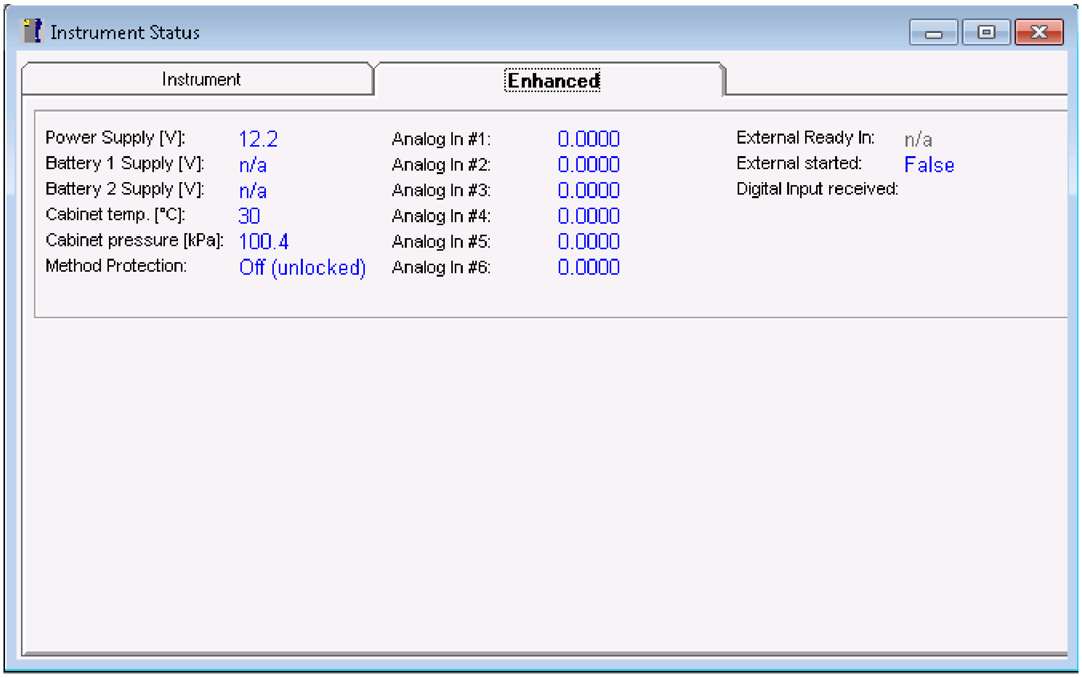


Figure 210. Enhanced status

Status of **Power Supply**, **Battery Supplies**, **Cabinet pressure**, and temperature of the instrument, external analog input (corrected by scaling factor and offset value set in the application), external **Ready In**, **External Start** and digital input received for **Configured Digital Inputs** (represented in binary format).

Stream Selector Test

From the PROstation toolbar, select **Stream Selector Test**.

Select a stream number within the configured range and click **OK**. The stream selector (whether a VICI valve or a relay configured device) should now switch the requested stream number.

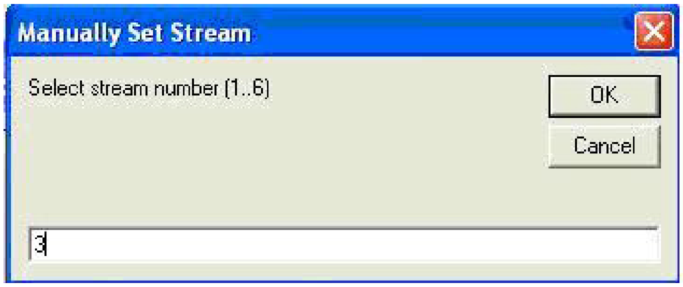


Figure 211. Stream selector test

Control Reset I/O

From the PROstation toolbar, select **Control/Reset I/O**.

Select the type of I/O which should be reset and click **OK** to request the instrument to execute the selected options.

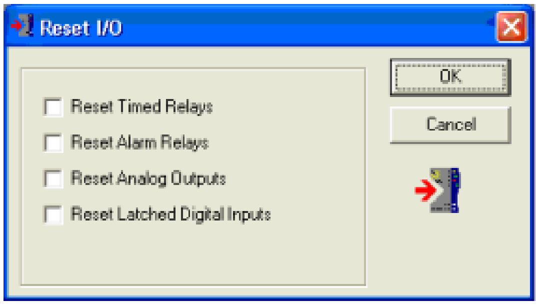


Figure 212. Control/Reset I/O

Control Test I/O

From the PROstation toolbar, select **Control/Test I/O**.

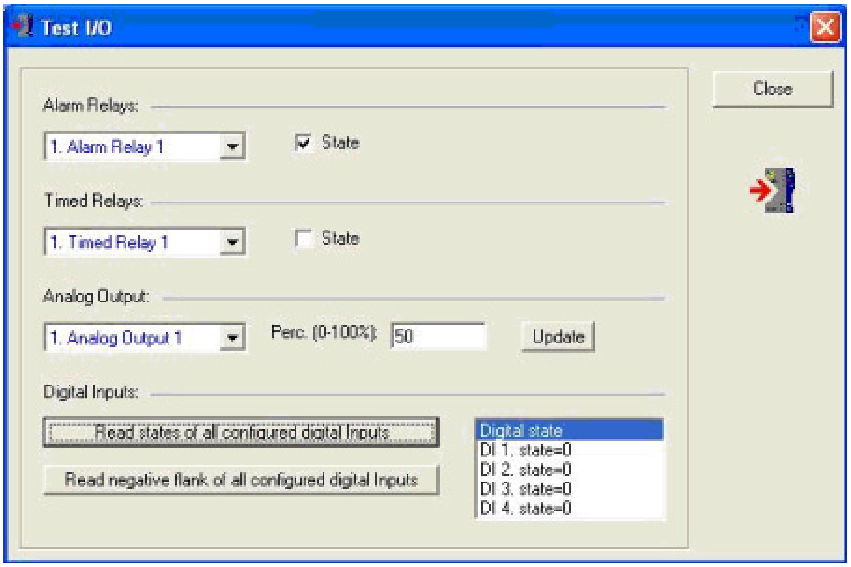


Figure 213. Testing I/O

The hardware and software configuration of your predefined I/O's can be checked.

Select an **Alarm** from the list and toggle the **State** check. The relay should switch.

Select a **Timed Relay** from the list and toggle the **State** check. The relay should switch.

Select an **Analog Output** from the list and enter a percentage of the full scale the hardware can provide. Measure the generated output with a digital multimeter.

Generate a digital input (shortcut of digital input to ground) and press **Read states of all configured digital Inputs**. The correct digital input state must have value **1**. Release the shortcut and again press this button. The state of the digital input should show **0**.

With the **Read negative flank of all configured digital Inputs** option, only the change from **no shortcut** to **shortcut**, **results in state=1**. The state is cleared after reading its status. Check this by again pressing this button after you have generated a negative flank and check that the state becomes **0**.

Reset Alarms

From the PROstation toolbar, select **Control/Test I/O**.

Figure 214. Alarm testing

Pressing **OK** resets all application alarms in the instrument. Application alarms are set if parameters exceed their range as defined in the **Alarm** table of the **Application**.

Reboot Instrument

From the PROstation toolbar, select **Control/Reboot**.

If it is required to reboot the system, click **OK**.

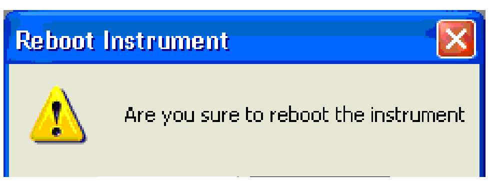


Figure 215. Reboot testing

Clear Error Log

From the PROstation toolbar, select **Control/Clear Error Log**.

Click **OK** to clear (empty) the error log.

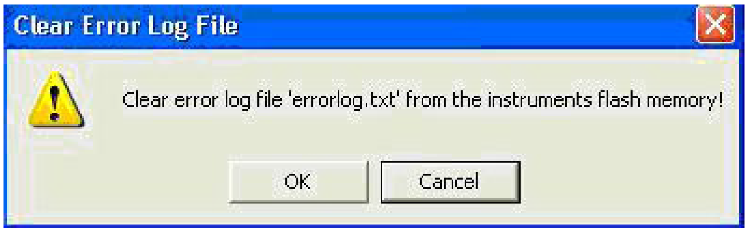


Figure 216. Clearing error log

After clearing **ErrorLog**, upload **Diagnostics** followed by **Displaying Diagnostic**. The **Error Report** will be empty.

11 PROstation Instrument Report Menu

To access the reporting capabilities, from the PROstation toolbar select **Report**.

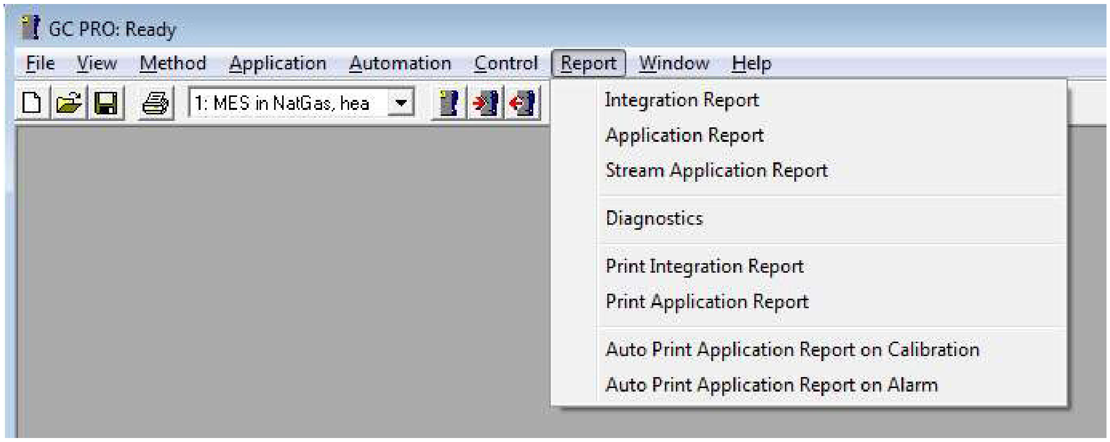


Figure 217. PROstation toolbar

The pull down menu is divided into sections:

- **Integration**, **Application** and **Stream Application Report** (displayed on screen)
- **Diagnostics**
- **Print Integration Report** or **Print Application Report**
- **Automated Print Request** on **Calibration** or **Alarm**

Integration Report

Integration Report

#	Channel	Peak #	Peakname	ESTD Conc.	Retention [s]	PeakRRT [s]	Area	Height	Width[s]
1	1	1	?	0.000000	2.44	0.0000	42.3083	6151.0638	0.3950
2	1	2	Peak1_6.49	0.000000	6.49	0.0000	2850.0000	400000.0000	0.4028
3	1	3	Peak2_7.12	0.000000	7.12	0.0000	1379.4000	200000.0000	0.4247
4	1	4	?	0.000000	10.49	0.0000	704.9000	100000.0000	0.3983

Figure 218. Integration report

The **Integration Report** parameters are determined in the instrument at the end of a chromatographic run and uploaded to PROstation.

The following properties are part of the integration report:

- **Index**
  Line number
- **Channel**
  GC channel
- **Peak Number**
  Peak number in GC channel
- **Peak Name**
  Name of the peak as given in the Peak Identification/Calibration Table
- **ESTD Conc**
  Calculated external standard concentration
- **Retention [s]**
  Retention time in seconds
- **PeakRRT [s]**
  Relative retention time calculated if reference peak has been identified in the peak table.
  RRTi = PEAKi_retention/PEAKref_retention
- **Area**
  Peak area in [x 10 nV.s] units
- **Height**
  Peak height in [x 10 nV] units
- **Width [s]**
  Peak width at half height in seconds
- **Sep.Code**
  Peak separation code identifying the baseline relative to the peak
  This can be BB, BV, VB, VV in which B = baseline and V = value
- **Validation**
  Not used
- **Pk Start [s]**
  Start time for the peak
- **Pk End [s]**
  End time for the peak
- **Asym 5%**
  Peak asymmetry factor at a height of 5 %

- **Used RF**
  Response factor used to calculate the external standard concentration
  This parameter is only reported in a single level calibration.
- **Rw**
  Factor calculated from measured concentration of calibration sample divided by given calibration of level 8 value from the **Peak Identification/Calibration Table**.
  Response factor used to calculate the external standard concentration.
  This parameter is only reported in a multilevel calibration performing a calibration of level 8.
- **Init RF Alarm**
  A calibration failure based on a too large difference of the new response factor compared to the initial response factor. This parameter is only reported for a calibration run in a single level calibration.
- **Current RF Alarm**
  A calibration failure based on a too large difference of the new response factor compared to the current response factor. This parameter is only reported for a calibration run in a single level calibration.
- **Rw Alarm**
  Response factor used to calculate the external standard concentration.
  This parameter is only reported in a multilevel calibration performing a level 8 calibration.

Application Report

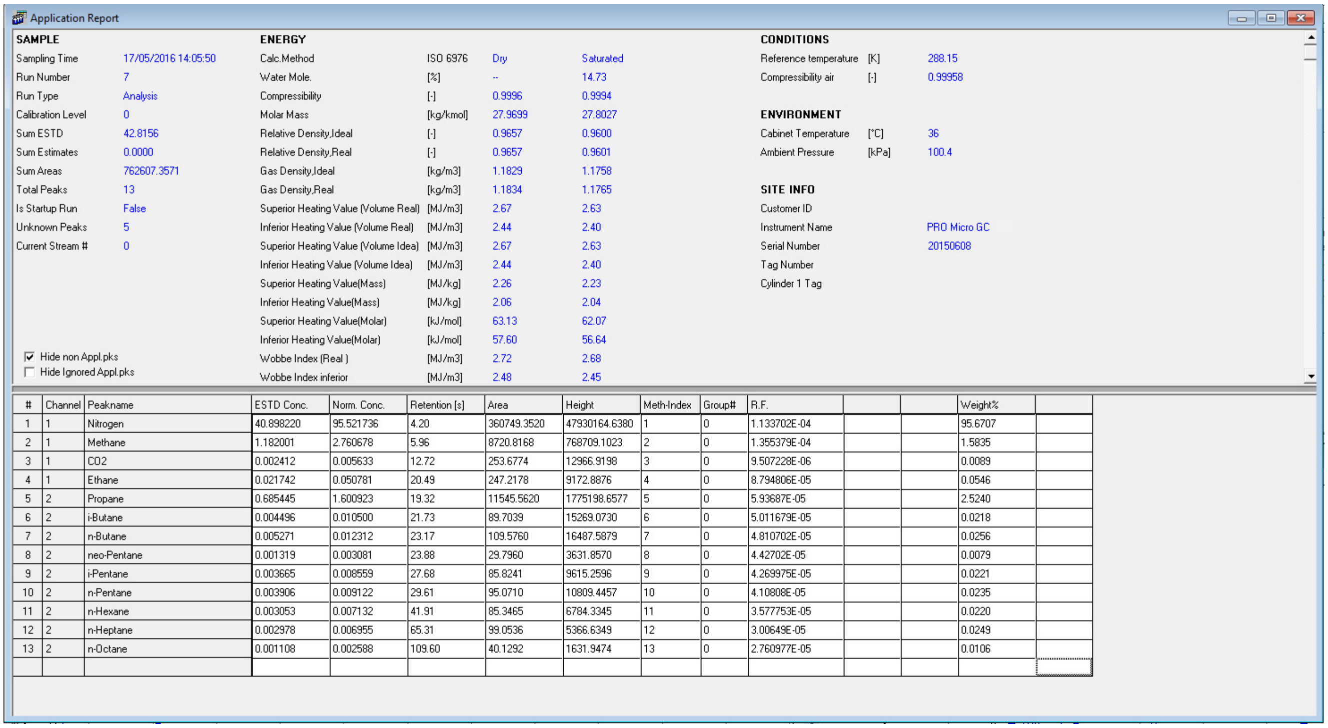


Figure 219. Application Report

The **Application Report** parameters are determined in the instrument at the end of a chromatographic run and uploaded to PROstation.

The application report contains the results from all, instrument wide, application-related calculations, that is, normalization, possibly in combination with calorific power calculation. Figure 366 shows the report after instrument wide normalization.

Components are identified on their name as they were reported in the **Integration Report**. Find more information in the Normalization section.

SAMPLE

- **Sampling time**
  The time the sample was injected according the instrument internal clock.
- **Analysis #**
  Run ID number, increases with every analysis by 1. This number resets at reboot of the instrument.
- **Run type**
  Indication of the run type: analysis, calibration, verification or blank run
- **Calibration level**
  Identifies the calibration level (range 1 to 8) of a calibration run. For a non calibration 0 is reported
- **Sum ESTD**
  Sum of external standard concentrations for all components listed in the normalization table excluding components marked as Estimate

- **Sum Estimates**
  Sum of all component concentrations defined in the normalization table as Estimate
- **Sum Area**
  Sum of area of all peaks in all channels detected
- **Total Peaks**
  Total identified peaks in all GC channels
- **Is Startup Run**
  Identifies if the current run is the first run after an instrument reboot (power up)
- **Unknown peaks**
  Number of unidentified peaks in all GC channels
- **Current stream #**
  The current stream number at the moment the report is generated in the instrument.
- **Alarms**
  All alarms, as defined in the Alarming window under the Application menu, are reported here on Alarm Index, if an alarm occurs.

ENERGY

All parameters related to calculating calorific value of a gas mixture are reported in this section. The report will be slightly different depending on the energy method selection (ISO, GPA, ASTM, GOST).

ENVIRONMENT

- **Sampling Analog #**
  These are the converted analog input values as defined in the **Analog Input** window under the **Application** menu. During the sampling state part of a chromatographic run, analog input signals are measured, converted to real units and stored in the instrument.
- **Cabinet Temperature**
  Internal analyzer temperature, measured by a temperature sensor on the mainboard
- **Ambient Pressure**
  Internal analyzer ambient pressure, measured by a pressure sensor on the mainboard

SITE INFO

This data was defined in the **Site Info** window found under the **Automation** menu.

COMPONENTS LIST

The component list contains the peaks as defined in the **Normalization** window found under the **Application** menu. It contains the following parameters:

- **#**
  Index number
- **Channel**
  The GC channel peak was identified.
- **Peak name**
  The name of the peak as defined in the Normalization table found under the Application menu.
- **ESTD Conc**
  The external standard concentration of the peak found in the integration report.

- **Norm Conc**
  Calculated concentration after normalization following
  the normalization table. For ignored bridge components no **Norm Conc** is calculated, these compounds are presented as **bridged cmp**.
- **Retention[s]**
  The retention of the peak found in the integration report
- **Area**
  The area of the peak found in the integration report
- **Height**
  The height of the peak found in the integration report
- **Meth-Index**
  Peak index number as the peak is defined in the Normalization table
- **Group #**
  This peak is part of a group as defined in the Normalization table.
- **RF**
  Response factor used to calculate external standard concentration. This parameter is only reported in a single level calibration.
- **Rw**
  The Rw factor used to calculate external standard concentration from the corrected curve. This parameter is only reported for a multilevel calibration with field calibration correction.
- **Weight %**
  Mass per component relative total mass
- **GPM**
  Theoretical hydrocarbon liquid content per component. This results is shown when GPA 2172 or ASTM D3588 energy calculation are chosen.

Depending on the extent of the application as well as the configured stream selection, specific information becomes available.

The application report is updated after every run.

Stream Application Report

The stream application report is an equivalent of the application report. It basically contains concentration results and, if selected, energy meter results and limited sample information. The stream application report however, is updated after that particular stream has been run again. The specific stream information is available while other streams are being analyzed.

Diagnostics

The diagnostic report becomes available after uploading using **Control\Upload Diagnostics**. The information is brought on screen after **Report\Diagnostics** is selected from the PROstation toolbar:

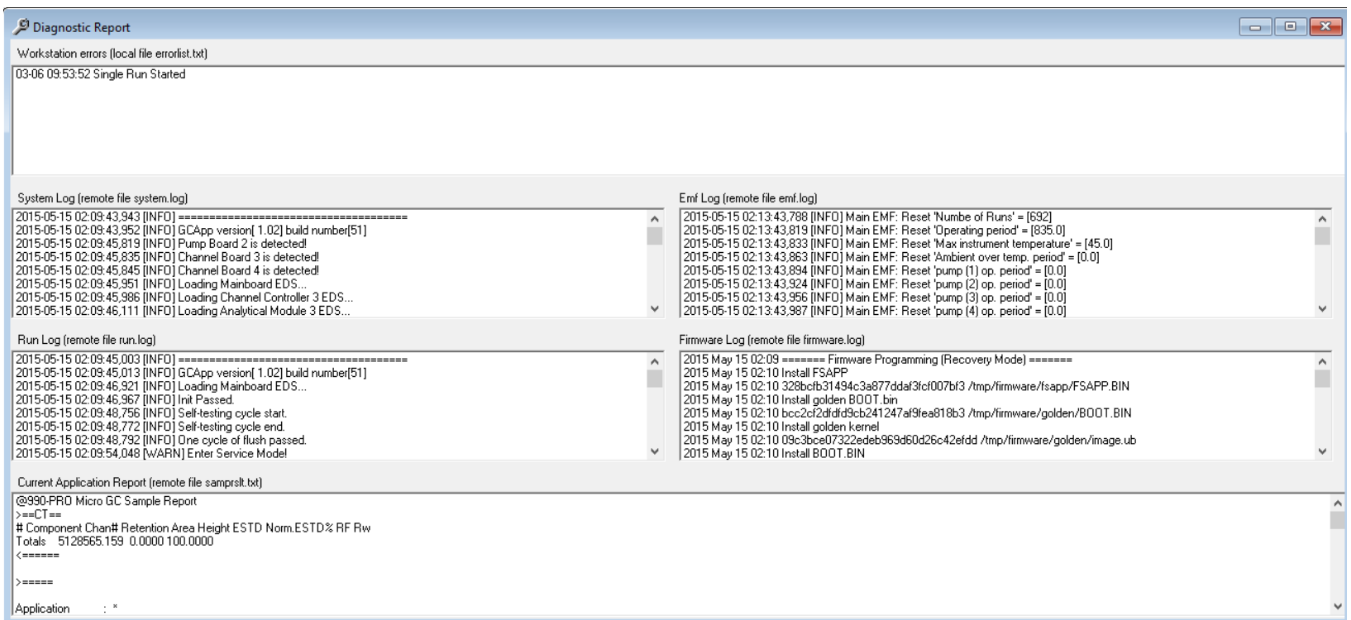


Figure 220. Diagnostic Report

Three different diagnostic reports are available:

- **Workstation errors**
  (errorlist.txt on PROstation computer)
  Information about uploads from the instrument and downloads to the instrument; any communication that has taken place. The file is cleared after a start (run, sequence, recalculation) has been sent to the instrument.
- **Internal instrument errors**
  (errorlog.txt on instrument flash memory)
  This file contains all class 1 and higher errors that have occurred.
  Also the firmware updates are recorded.
  More extended error information is provided in Errors on page 551.
  The file can be cleared after a remote request: from the PROstation toolbar select **Control/Clear Error Log File**.

- **Current application report**
  (samprslt.txt on instrument flash)
  The bottom field shows the last report as stored on flash. This is made available for diagnostics after a system crash.

Print Integration/Application Report

After an upload of sample results, the integration report will be printed after selecting **Report/Print Integration Report** from the PROstation toolbar.

After an upload of sample results, the application report will be printed after selecting **Report/Print Application Report** from the PROstation toolbar.

Auto Print Application Report After Calibration or Alarm

This only works properly if PROstation is continuously connected.

Select **Report/Auto Print Application Report after Calibration** from the PROstation toolbar if the application report needs to be printed after every calibration.

Select **Report/Auto Print Application Report after Alarm** from the PROstation toolbar if the application report needs to be printed after every calibration.

12

Multi Level Calibration

This chapter describes the calibration mechanism available in the 990 Micro GC. The multilevel calibration is compliant with ISO-10723 Natural gas - Performance evaluation for on-line analytical systems.

Chromatogram

The primary data from a GC is a chromatogram, as seen here.

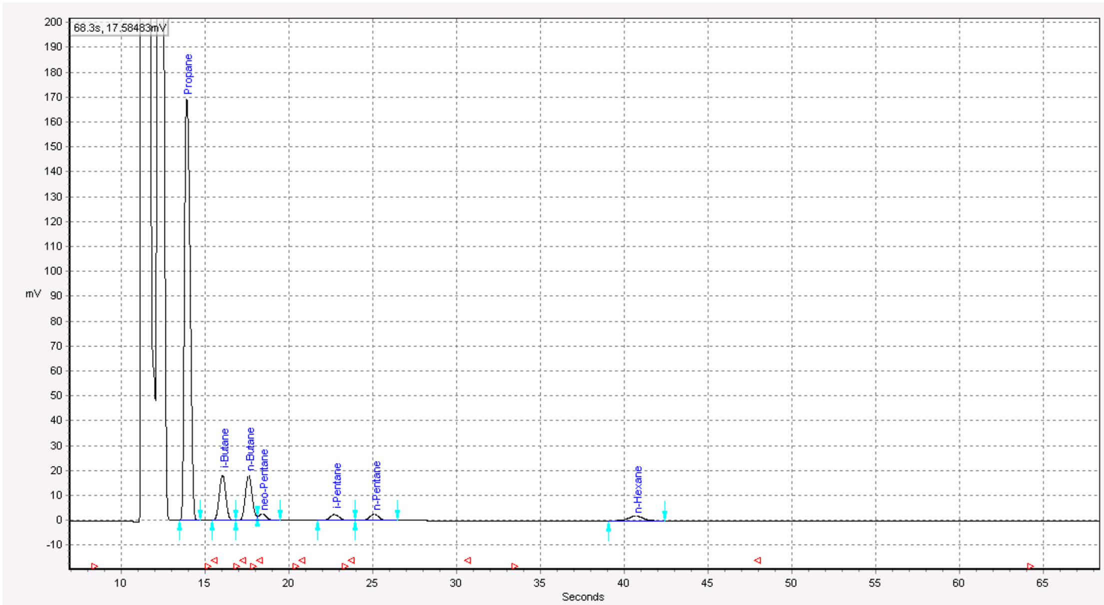


Figure 221. Chromatogram

Using an integration module, the chromatogram can be analyzed. The output of the integration is the combination of the retention time of a peak and its area. The retention time, in combination with the **Peak Identification** table, identifies the component. The area under the component peak, is proportional to the concentration of that particular component.

The integration of a single chromatogram results in multiple areas, one area for each component.

Calibration Options

The relation between the area and the concentration of a component can be determined using a calibration mixture containing known concentrations for all components. A unique calibration mixture with known concentrations is called a level.

Calibrating with only one level is called a single level calibration and is described in “Single level calibration” below. Calibrating with more than one level is called a multilevel calibration and is described in “Multilevel calibration” .

Single level calibration

When calibrating with only one level, the relation between area and concentration can only be described with a linear curve through the origin (0,0).

Y = a * x

x represents the Area

y represents the Concentration

Coefficient a is calculated using the following formula:
a = Concentration/Area

Coefficient a is also known as Response Factor (RF).

Example:

Data set

Level	Area	Concentration
1	2850	3.5

a = 3.5/2850 = 0.0012

Multilevel calibration

By using multiple calibration mixtures, a multilevel calibration can be performed.

Each calibration level results in a point on the calibration curve. The calibration curve gets more accurate by calibrating with more than one calibration level.

The relation between the area and concentration is described using a polynomial curve, up to cubic is supported. Linear and quadratic curves can be achieved by setting the coefficients a and b to zero.

Y = a * x3 + b * x2 + c * x + d

x represents the Area

y represents the Concentration

Example:

Data set:

Level	Area	Concentration
1	2850	1.0
2	5700	2.0

Level	Area	Concentration
3	8550	3.0
4	11400	4.0
5	14250	5.0
6	19950	6.0
7	22800	7.0

The data above has been used to fit a cubic curve.

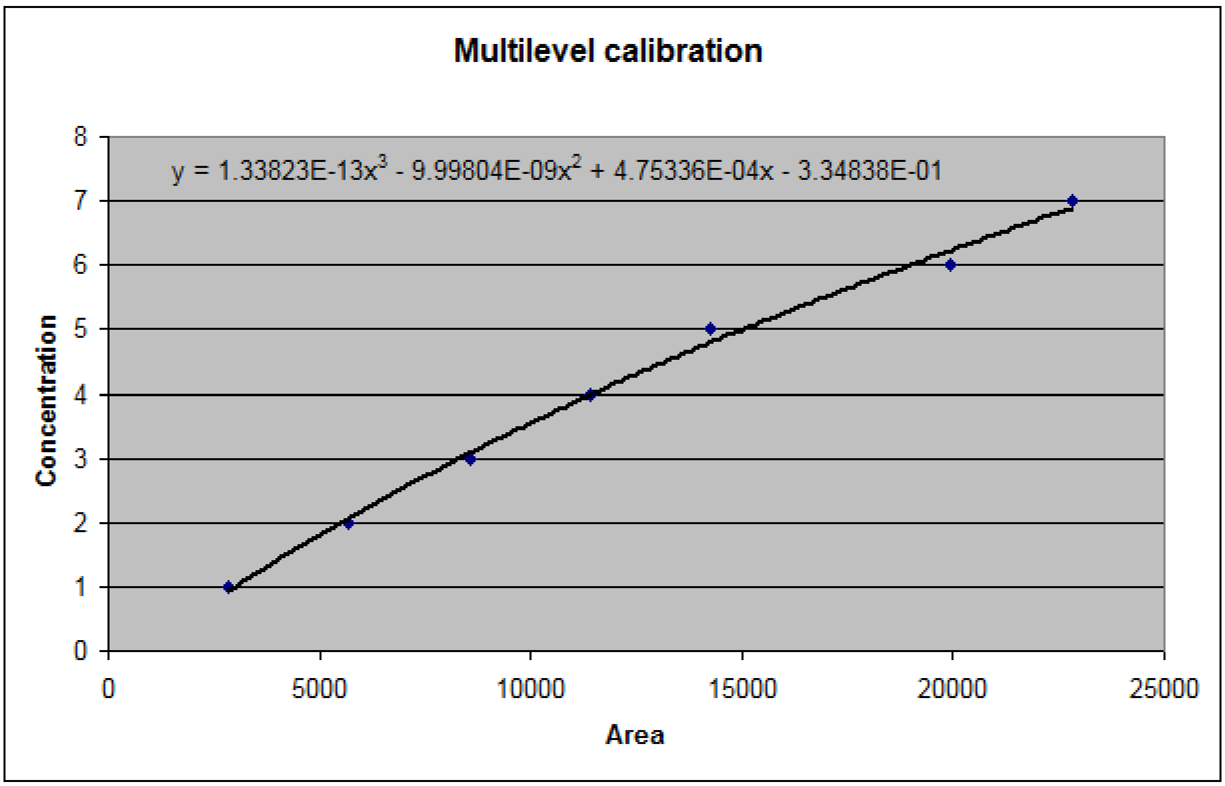


Figure 222. Multilevel calibration using cubic fit

Offline calibration

The coefficients of the polynomial equation can be determined in third party mathematical tools. This is called **Offline Calibration**.

The coefficients for the polynomial equation can only be set if the option **Allow overriding Curve Coefficients** is enabled in the **Peak Calibration** screen, see screen dumps below.

The **Peak Calibration** screen can be opened using the menu option shown below.

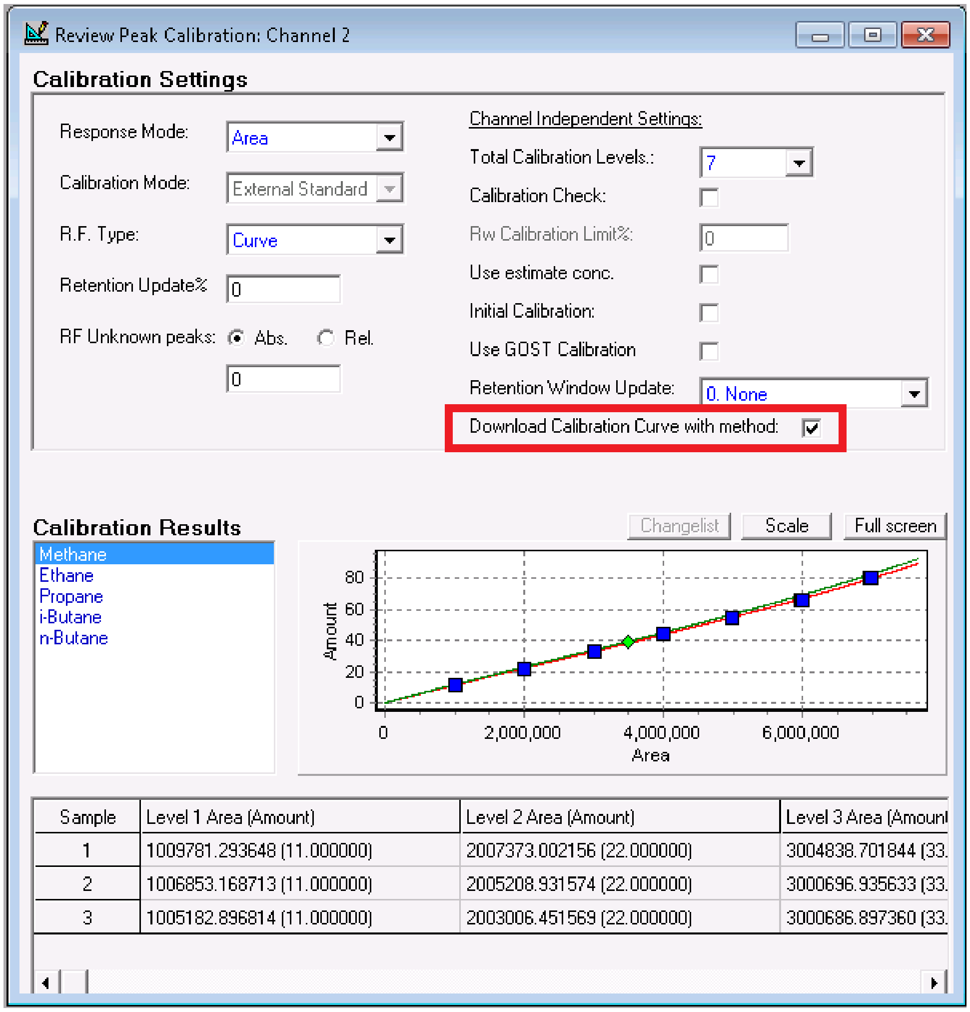


Figure 223. Calibration settings

The coefficients of the polynomial curve can be downloaded to the instrument using the method.

The coefficients of the curve can be entered in the **Peak Identification** table. The **Peak Identification** can be selected from the **Method** menu.

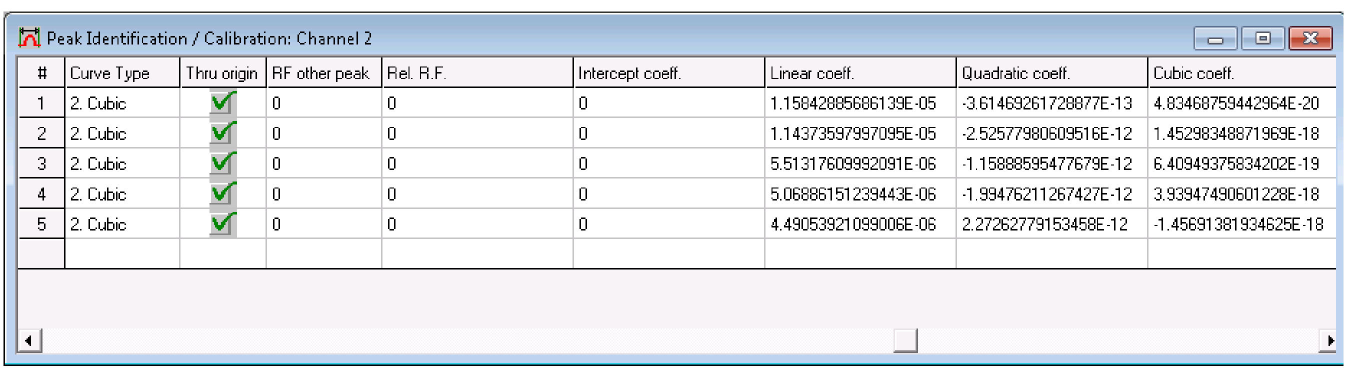


Figure 224. Coefficients polynomial

The coefficients of the polynomial curve y = a * x3 + b * x2 + c* x + d are defined as follows:

a = Cubic coeff.
b = Quadratic coeff.
c = Linear coeff.
d = Intercept coeff.

Online calibration

The 990 Micro GC is capable of performing the calibration by itself. The sequence containing the Calibration Table can be downloaded to the 990 Micro GC.

A typical calibration sequence for seven calibration levels is shown in the following figure:

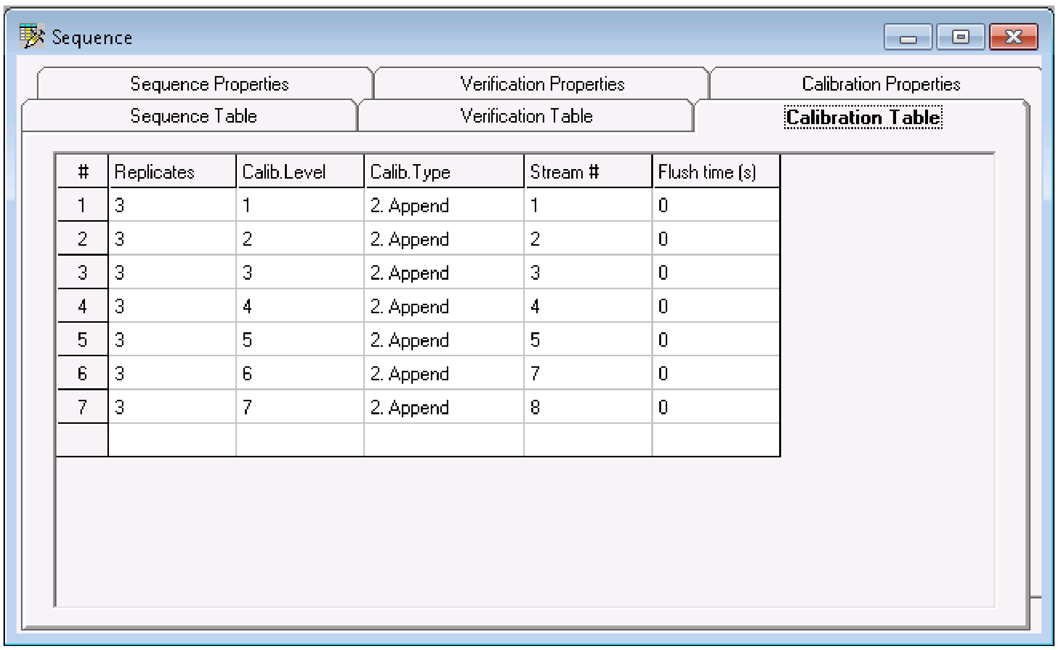


Figure 225. Calibration Table

The 990 Micro GC is capable of calibrating up to seven levels. After each calibration run, the 990 Micro GC will perform a curve fit using the available calibration data.

When more than one replicate is chosen, the 990 Micro GC will average the measured areas.

The level of the polynomial fit, either linear, quadratic or cubic, can be selected. The curve can also be forced through the origin (Point (0,0)). The options for the fit can be entered in the **Peak Identification** table.

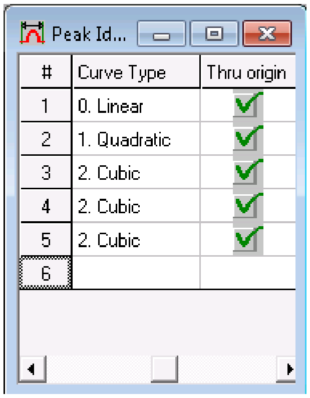


Figure 226. Peak Identification Table, Curve Type, and Thru origin

The user is responsible for verification of the calibration output. PROstation is capable of showing the calibration curve and points for each component. The graphical output of the calibration can be examined in the **Peak Calibration**.

After selecting the **Peak Calibration**, the screen in **Figure 227** on page 469 is displayed.

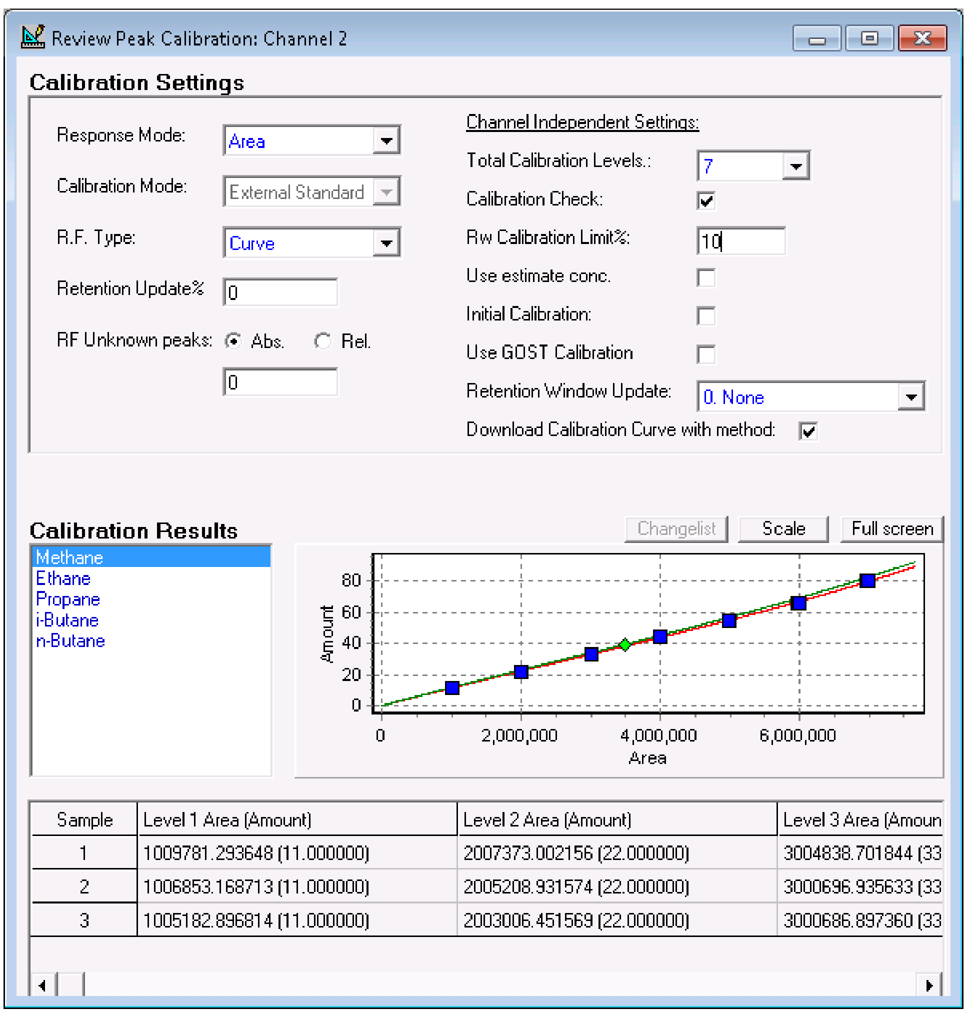
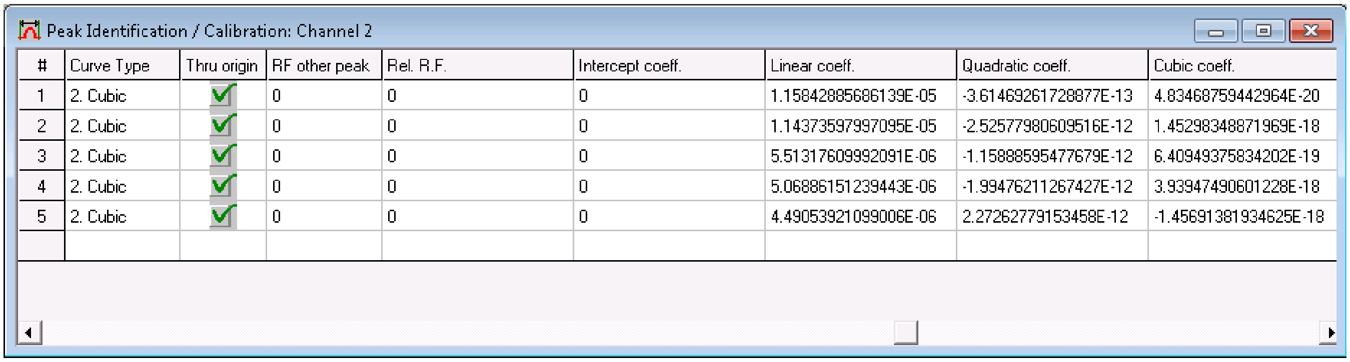


Figure 227. Calibration screen

The coefficients can be examined in the **Peak Identification Table** after uploading the method:



#	Curve Type	Thru origin	RF other peak	Rel. R.F.	Intercept coeff.	Linear coeff.	Quadratic coeff.	Cubic coeff.
1	2. Cubic	✓	0	0	0	1.15842885686139E-05	-3.61469261728877E-13	4.83468759442964E-20
2	2. Cubic	✓	0	0	0	1.14373597997095E-05	-2.52577980609516E-12	1.45298348871969E-18
3	2. Cubic	✓	0	0	0	5.51317609992091E-06	-1.15888595477679E-12	6.40949375834202E-19
4	2. Cubic	✓	0	0	0	5.06886151239443E-06	-1.99476211267427E-12	3.93947490601228E-18
5	2. Cubic	✓	0	0	0	4.49053921099006E-06	2.27262779153458E-12	-1.45691381934625E-18

Figure 228. Coefficients Polynomial

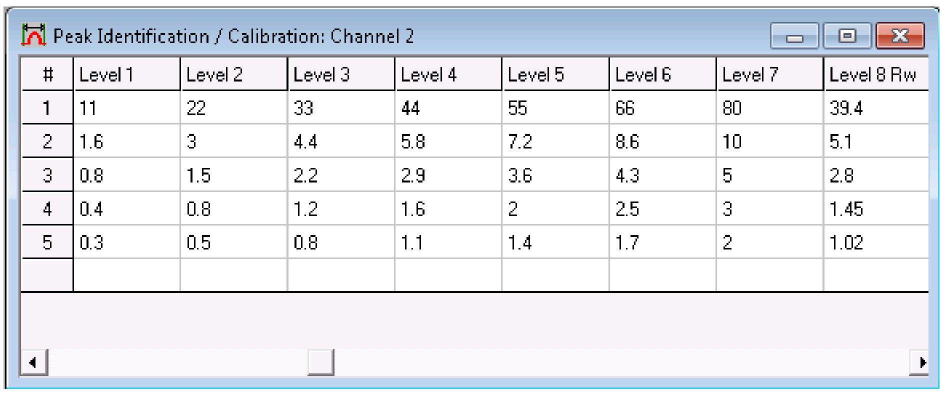
Rw Calibration

After determining the relation between the area and concentration through the fit, the validity of the curve should be checked periodically. Typically, a daily interval is chosen.

The ambient pressure and detector aging are factors for which a correction should be made.

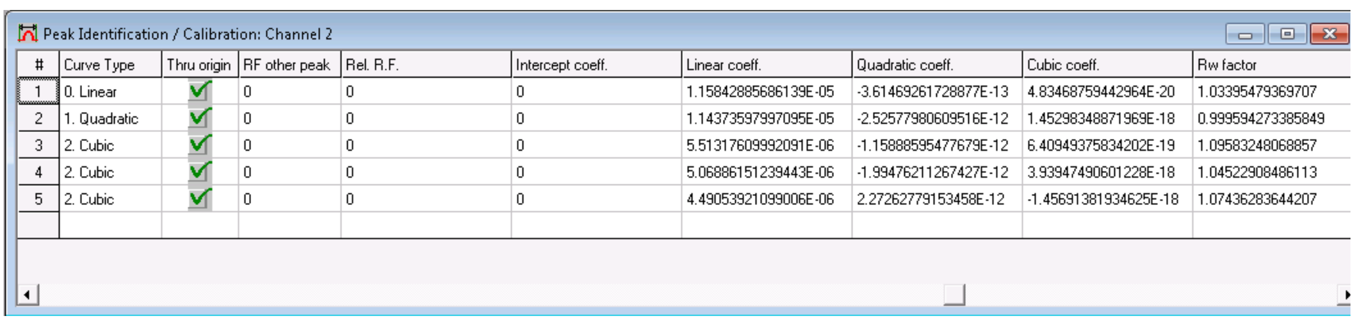
Figure 229 on page 471 shows the fitted curve in the middle and two possible field calibrations: one above the fitted curve and one below the fitted curve.

The concentration of the Rw calibration gas must be filled in, this is called Level 8 Rw. During the calibration, the 990 Micro GC calculates the factor between the concentration found using the fitted curve and the concentration entered (see **Figure 229**). This factor is called the Rw factor.


Peak Identification / Calibration: Channel 2

#	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8 Rw
1	11	22	33	44	55	66	80	39.4
2	1.6	3	4.4	5.8	7.2	8.6	10	5.1
3	0.8	1.5	2.2	2.9	3.6	4.3	5	2.8
4	0.4	0.8	1.2	1.6	2	2.5	3	1.45
5	0.3	0.5	0.8	1.1	1.4	1.7	2	1.02

Figure 229. Peak Identification Table, the levels


Peak Identification / Calibration: Channel 2

#	Curve Type	Thru origin	RF other peak	Rel. R.F.	Intercept coeff.	Linear coeff.	Quadratic coeff.	Cubic coeff.	Rw factor
1	0. Linear	✓	0	0	0	1.15842885686139E-05	-3.61469261728877E-13	4.83468759442964E-20	1.03395479369707
2	1. Quadratic	✓	0	0	0	1.14373597997095E-05	-2.52577980609516E-12	1.45298348871969E-18	0.999594273385849
3	2. Cubic	✓	0	0	0	5.51317609992091E-06	-1.15888595477679E-12	6.40949375834202E-19	1.09583248068857
4	2. Cubic	✓	0	0	0	5.06886151239443E-06	-1.99476211267427E-12	3.93947490601228E-18	1.04522908486113
5	2. Cubic	✓	0	0	0	4.49053921099006E-06	2.27262779153458E-12	-1.45691381934625E-18	1.07436283644207

Figure 230. Peak Identification Table, the Rw factor

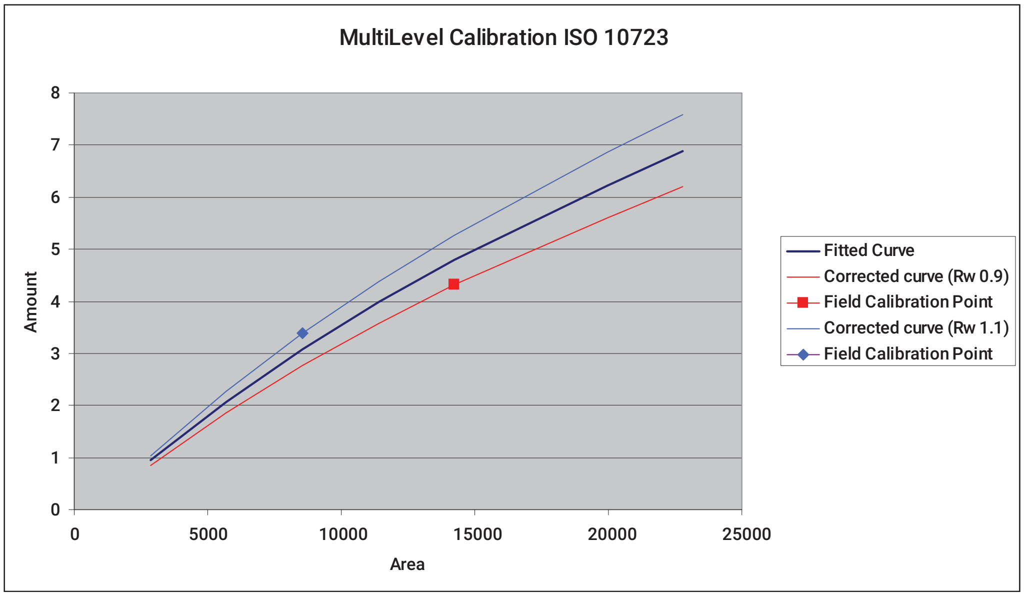


Figure 231. Graphical representation of the Rw correction

Typically, the Rw factor will vary around 1.

An Rw calibration can be scheduled in the sequence identical to other calibration levels.

The Rw limit can be specified using a percentage, for instance an Rw limit of 10 % means that the Rw must be within 0.9 and 1.1.

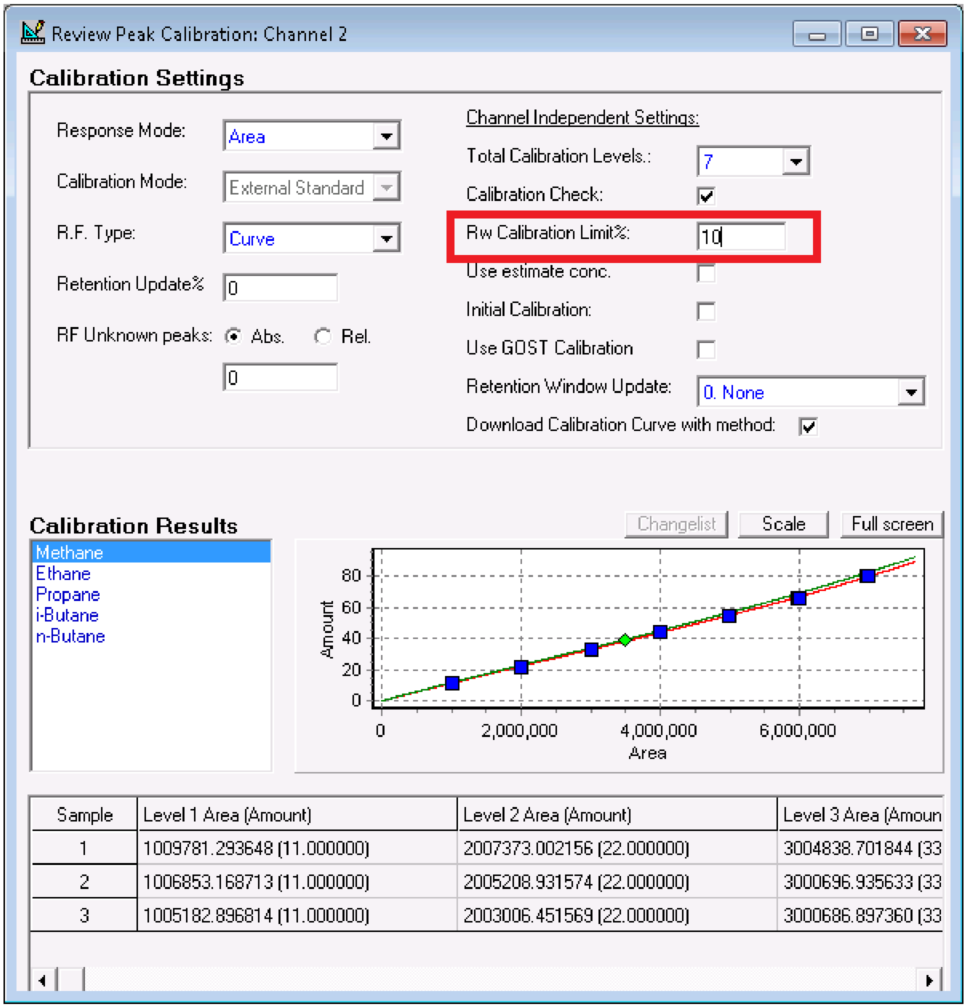


Figure 232. Rw Limit

The Rw factor will be used as follows:

y = Rw * (a * x3 + b * x2 + c* x + d)

"x" represents the Area

"y" represents the Concentration

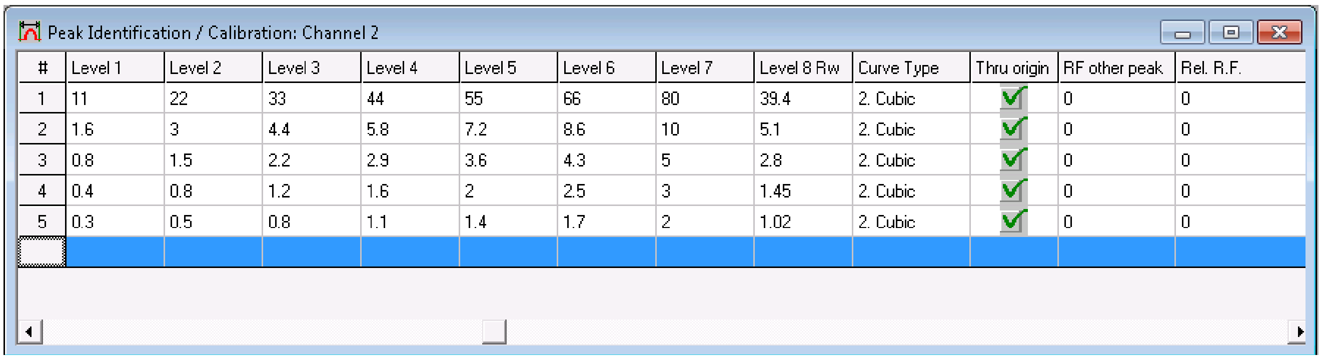
Relative RF

When it is not possible to determine a calibration curve for a component, it is possible to refer to a component that does have a curve.

During an analysis, the 990 Micro GC will use the curve of the referred component in combination with the Relative RF factor.

Typical use: C6+ components refer to the C3 curve with a Relative RF factor.

The Relative RF factor can be determined using a Lab GC.



#	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8 Rw	Curve Type	Thru origin	RF other peak	Rel. R.F.
1	11	22	33	44	55	66	80	39.4	2. Cubic	✓	0	0
2	1.6	3	4.4	5.8	7.2	8.6	10	5.1	2. Cubic	✓	0	0
3	0.8	1.5	2.2	2.9	3.6	4.3	5	2.8	2. Cubic	✓	0	0
4	0.4	0.8	1.2	1.6	2	2.5	3	1.45	2. Cubic	✓	0	0
5	0.3	0.5	0.8	1.1	1.4	1.7	2	1.02	2. Cubic	✓	0	0

Figure 233. Peak Identification Table, Rel.R.F

Peak © referring to peak c:

y = Rel. R.F.i * Rwc * (ac * x3 + bc * x2 + cc* x + dc)

"x" represents the Area

"y" represents the Concentration

Setting Up a Typical Single Level Calibration

This section describes typical usage of the 990 Micro GC in combination with a single level calibration.

Environment

The description of this section is based on the environment described in this paragraph.

Three streams to analyze continuously

One calibration stream

Sequence

The sequence is setup using the Sequence Table and the Sequence Properties. The Sequence Properties determine how the Sequence Table will be used.

Sequence Table

The Sequence Table defines which analyses should be run, and in what order. **Figure 234** shows that three streams are to be analyzed, starting with stream 1, followed by stream 2 and then stream 3. Each stream starts with flushing for 60 seconds to prevent mixing of the different streams.

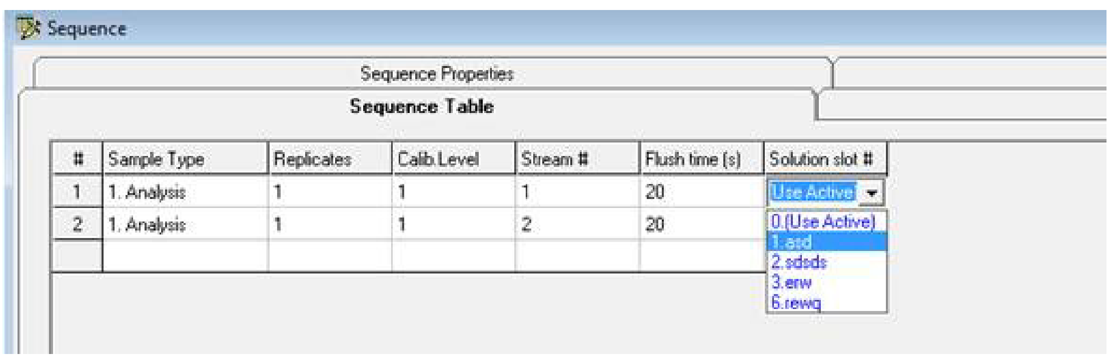


Figure 234. Sequence Table

Sequence Properties

The sequence properties define how the Sequence Table is being used. **Figure 235** on page 476 defines that the sequence should start at startup of the 990 Micro GC and that it should run continuously. The option Home Position (on error and when sequence stops) defines the position of the stream when the sequence has been interrupted. This option can be used to prevent waste of (expensive) calibration mixture in case of an error.

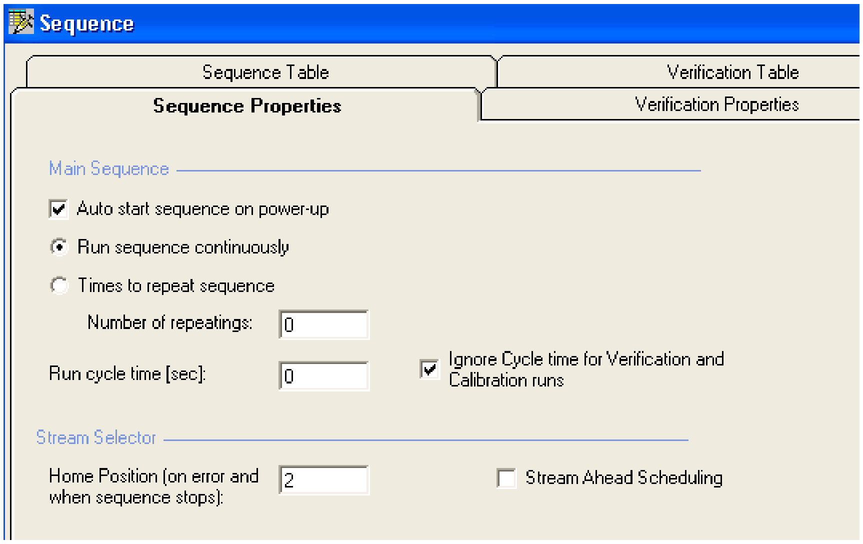


Figure 235. Sequence Properties

Calibration Table

The Calibration Table defines how a calibration should be performed. In this example, the calibration mixture is connected to stream 4.

The concentration of the calibration level and curve type must be entered in the Peak Identification table.

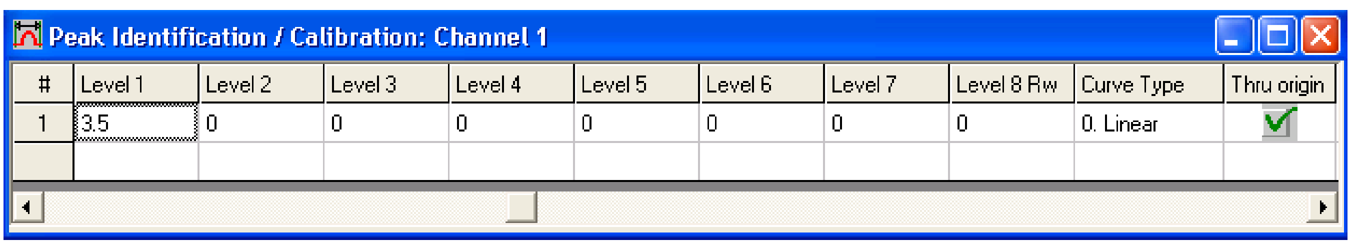


Figure 236. Peak Identification table

The calibration consists of two steps: the Ignore step and the Append step. The Ignore step is responsible for flushing the 990 Micro GC to ensure a reliable calibration. The Append step, with the number of replicates set to two, forces the 990 Micro GC to clear the previous calibration points and add two new calibration points. Based on these points, the coefficient of the linear curve is determined.

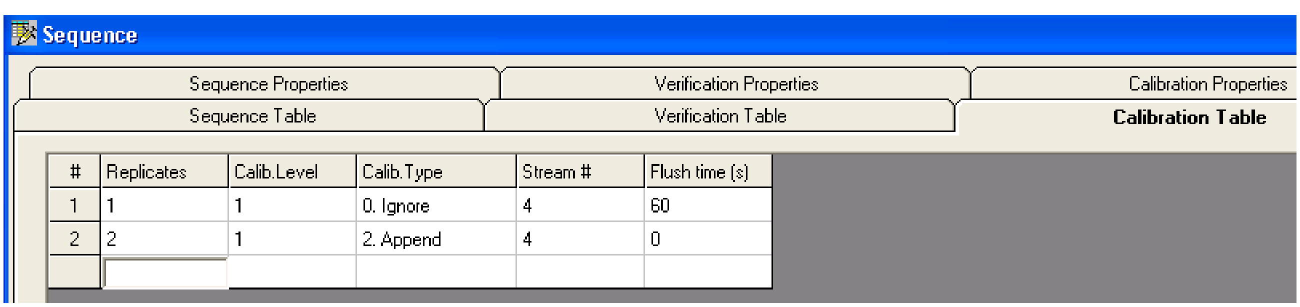


Figure 237. Calibration Table

Calibration properties

The calibration properties define how the Calibration Table will be used. The figure below defines that the calibration should start at 07:00 o'clock every day.

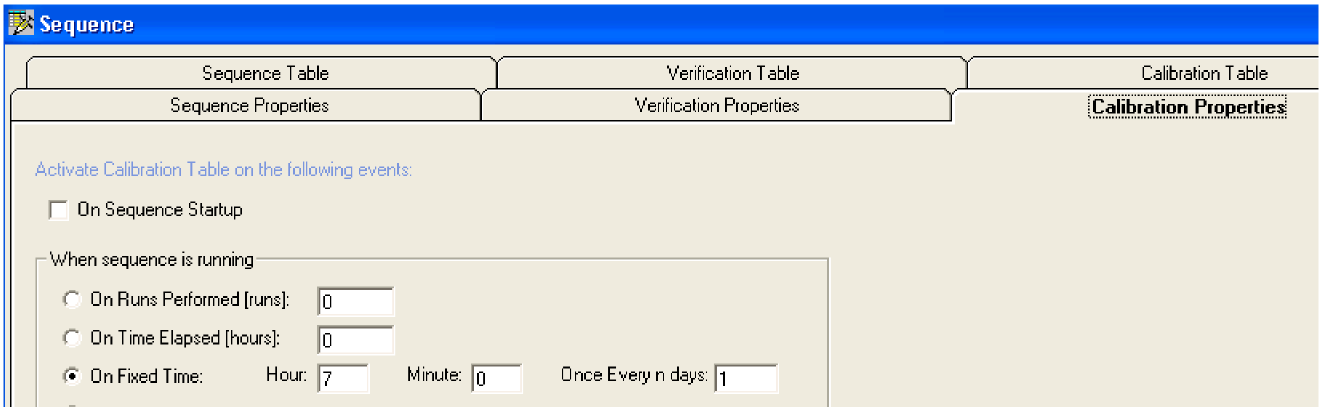


Figure 238. Calibration Properties

Setting Up a Typical Multilevel Calibration

This section describes typical usage of the 990 Micro GC in combination with multilevel calibration.

Environment

The description of this section is based on the environment described in this paragraph.

The 990 Micro GC will be used in two different contexts, the Calibration of the multilevel curve and the daily usage.

Calibration of the multilevel curve:

Seven calibration streams

One Rw calibration stream

Daily usage:

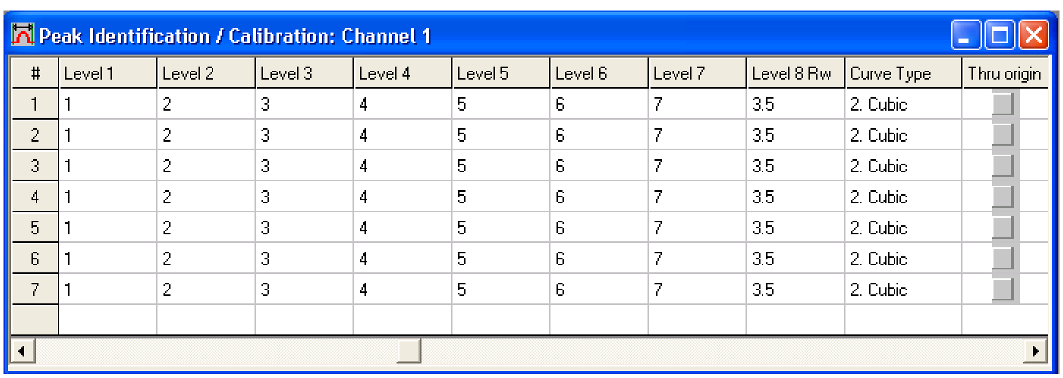
Three streams to analyze continuously

The Rw calibration stream

Calibration of the multilevel curve

Before the 990 Micro GC can be used with a multilevel curve, it is necessary to calibrate the multilevel curve. Typically the multilevel curve is determined on a laboratory with all calibration mixtures available.

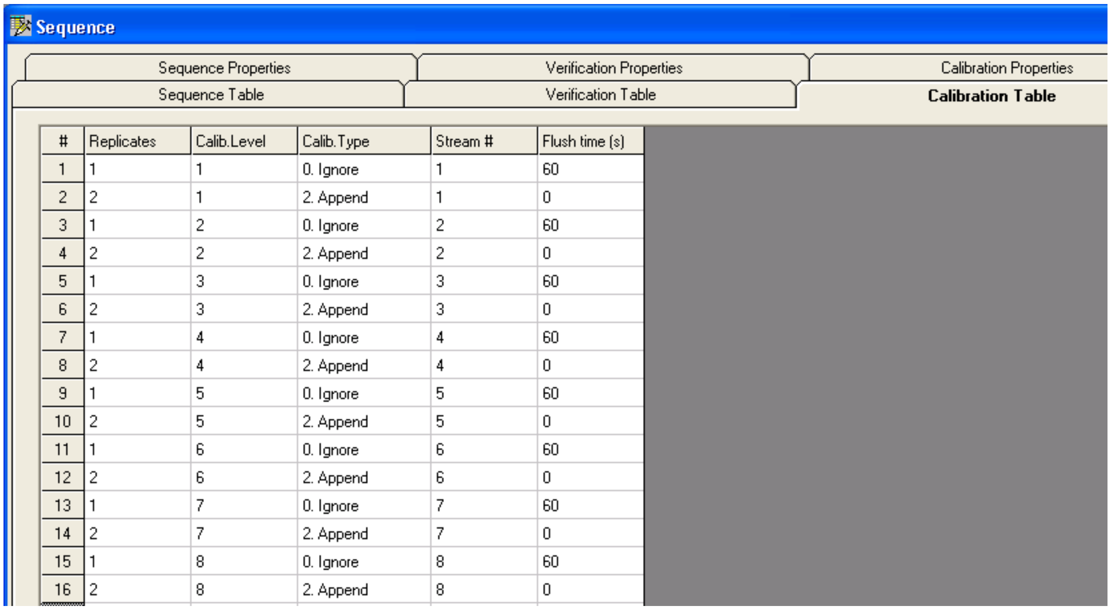
For each calibration level the concentration and curve type must be filled in the Peak Identification table.


Peak Identification / Calibration: Channel 1

#	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8 Rw	Curve Type	Thru origin
1	1	2	3	4	5	6	7	3.5	2. Cubic	
2	1	2	3	4	5	6	7	3.5	2. Cubic	
3	1	2	3	4	5	6	7	3.5	2. Cubic	
4	1	2	3	4	5	6	7	3.5	2. Cubic	
5	1	2	3	4	5	6	7	3.5	2. Cubic	
6	1	2	3	4	5	6	7	3.5	2. Cubic	
7	1	2	3	4	5	6	7	3.5	2. Cubic	

Figure 239. Peak Identification table containing the component concentration of the mixture

Figure 240 on page 479 shows the Calibration Table for performing the calibration of level 1 to 7 and level 8 (Rw).



#	Replicates	Calib.Level	Calib.Type	Stream #	Flush time (s)
1	1	1	0. Ignore	1	60
2	2	1	2. Append	1	0
3	1	2	0. Ignore	2	60
4	2	2	2. Append	2	0
5	1	3	0. Ignore	3	60
6	2	3	2. Append	3	0
7	1	4	0. Ignore	4	60
8	2	4	2. Append	4	0
9	1	5	0. Ignore	5	60
10	2	5	2. Append	5	0
11	1	6	0. Ignore	6	60
12	2	6	2. Append	6	0
13	1	7	0. Ignore	7	60
14	2	7	2. Append	7	0
15	1	8	0. Ignore	8	60
16	2	8	2. Append	8	0

Figure 240. Calibration Table

The calibration can be started using the Start screen.

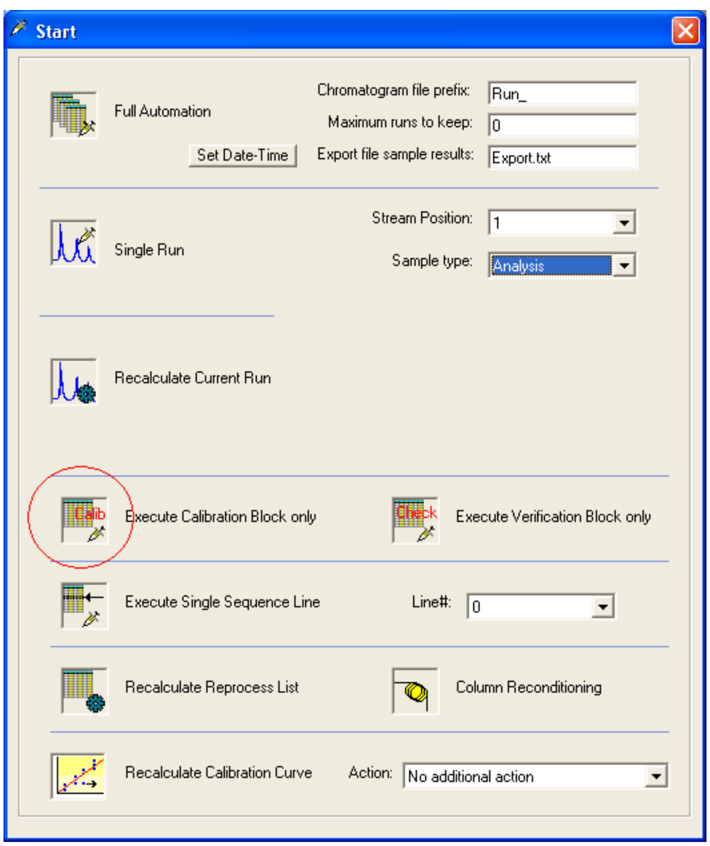


Figure 241. Starting Calibration Table

When the calibration sequence has finished, the derived curves and their coefficients can be examined in the Peak Calibration screen and the Peak Identification table, see **Figure 242** and **Figure 243** on page 480.

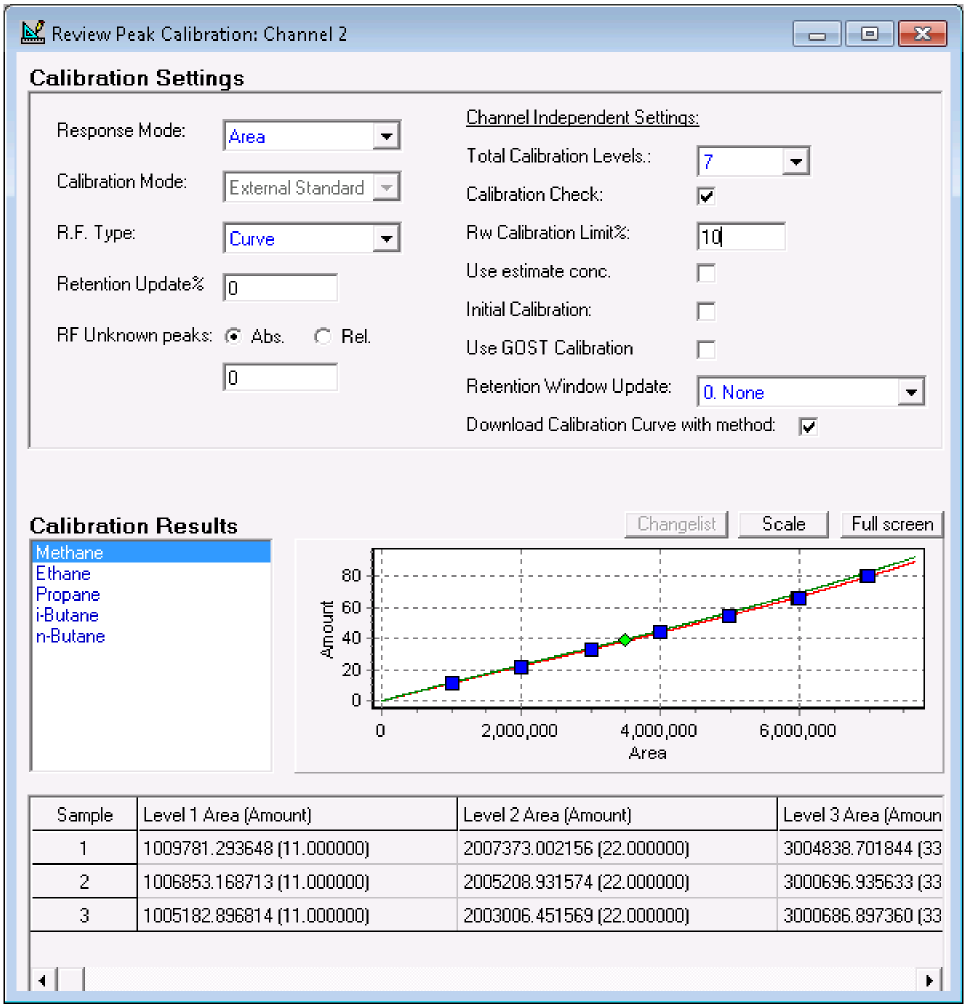


Figure 242. Peak Calibration screen

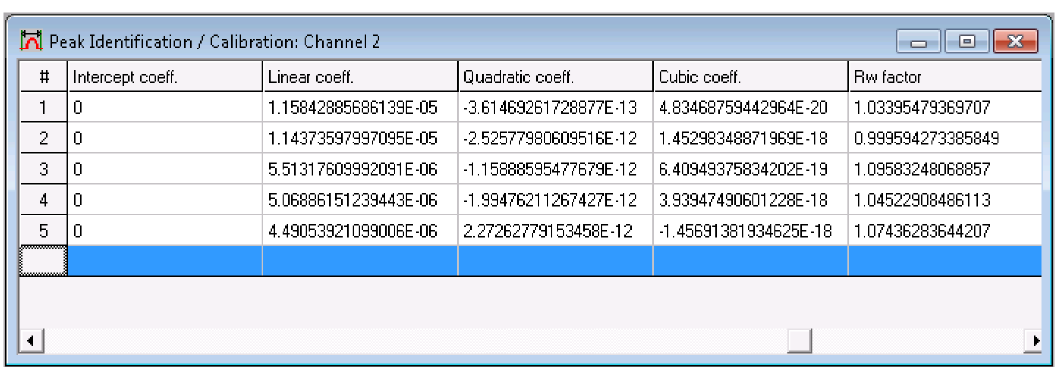


Figure 243. Peak Identification table, the coefficients

Sequence

The sequence is setup using the Sequence Table and the Sequence Properties. The Sequence Properties determine how the Sequence Table will be used.

Sequence Table

The Sequence Table defines which analyses should be run and in what order. The figure below shows that two streams are to be analyzed.

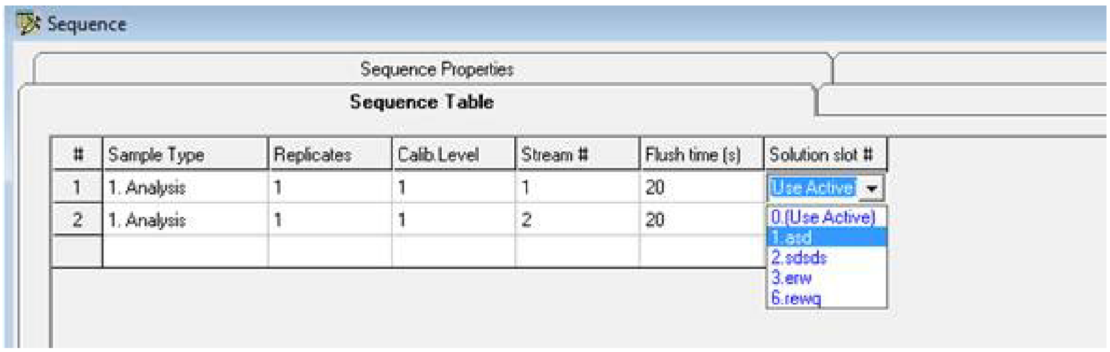


Figure 244. Sequence table

Each stream starts with flushing for 20 seconds to prevent mixing of the different streams.

Sequence properties

The sequence properties define how the Sequence Table is being used. **Figure 245** on page 481 defines that the sequence should start at startup of the 990 Micro GC and it should run continuously. The option Home Position (on error and when sequence stops) defines the position of the stream when the sequence has been interrupted. This option can be used to prevent waste of (expensive) calibration mixture in case of an error.

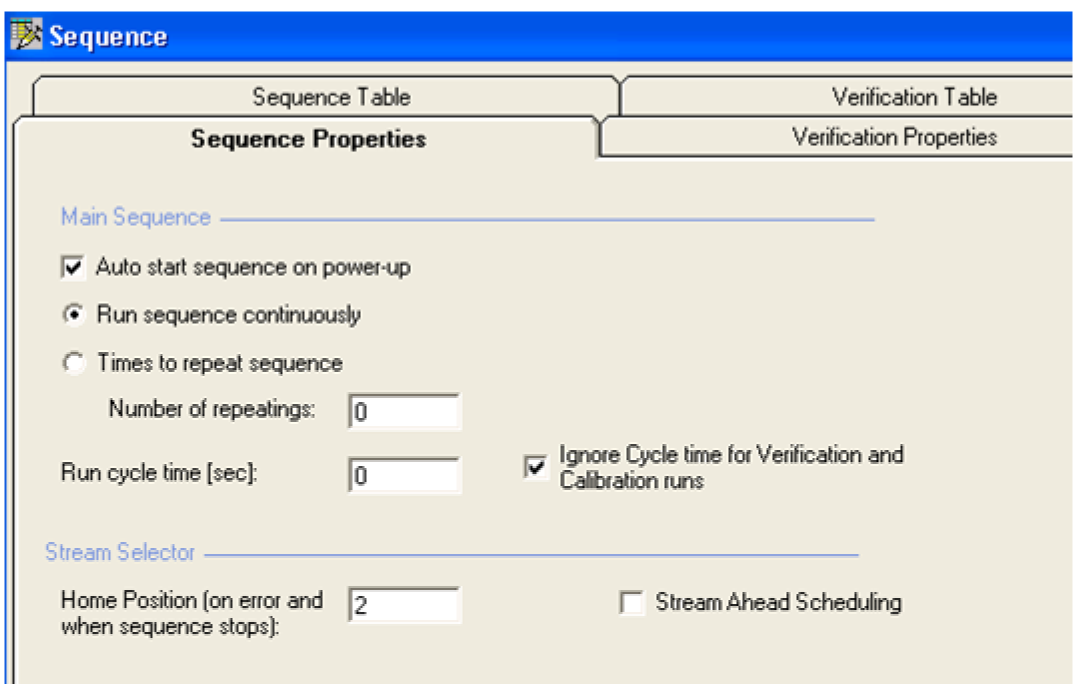


Figure 245. Sequence Properties

Calibration Table

The Calibration Table defines how a calibration should be performed. In this example, the Rw calibration mixture is connected to stream 4.

The calibration is set up with two steps: the Ignore step and the Replace step. The Ignore step is responsible for flushing the 990 Micro GC to ensure a reliable calibration. The Replace step forces the 990 Micro GC to clear the previous calibration points and add one new calibration point. Based on this point, the Rw factor is determined.

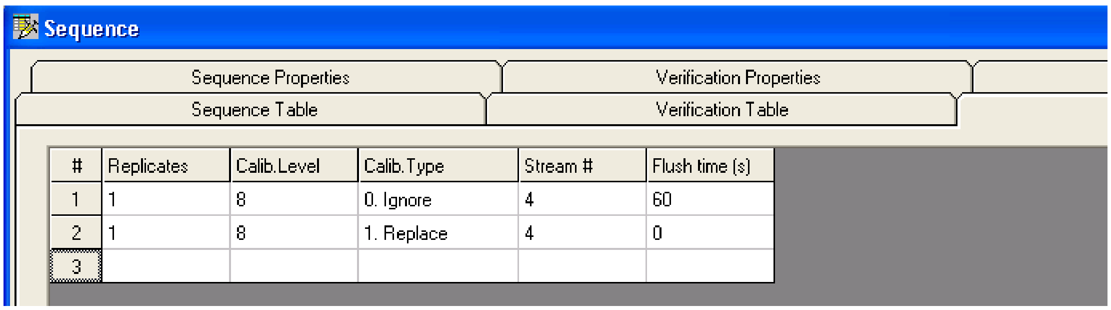


Figure 246. Calibration Table

Calibration properties

The calibration properties define how the Calibration Table is being used. **Figure 247** on page 482 defines that the calibration should start at 0700 every day.

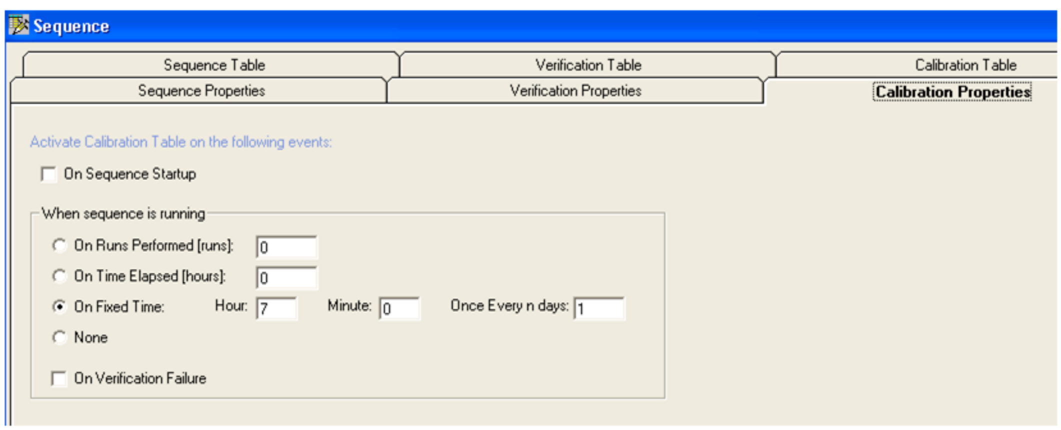


Figure 247. Calibration properties

Single Point Calibration with Multiple Calibration Mixtures

If multiple calibration mixtures are required because not all components are available in one calibration mixture, use multiple calibration levels. Every level represents a calibration mixture

Two calibration mixtures

To setup a method and sequence with two calibration mixtures:

In the Peak identification table set the level amounts for calibration mixture 1 (A). Put a zero for not existing components in mixture 1 (C).

In the Peak identification table set the level amounts for calibration mixture 2 (B). Put a zero for not existing components in mixture 2.

In the Peak Calibration window set the “Total Calibration Levels” to 2 (D).

Save and download the method.

Setup a sequence and use the “Cal.Level” parameter to distinguish between the two calibration mixtures (E).

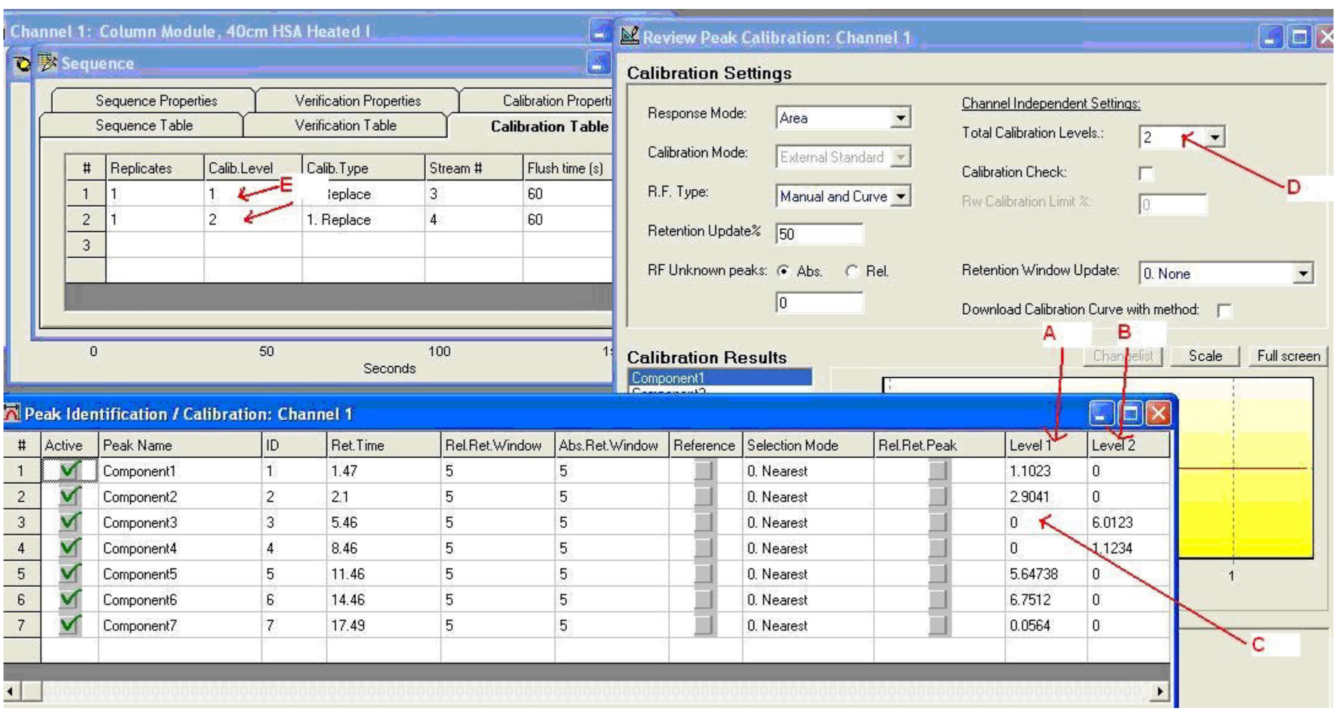


Figure 248. Calibration Module

More than two calibration mixtures

This is identical to two calibration mixtures. Set the Total Calibration levels equal to the number of calibration mixtures. Fill in the level amounts in the Peak identification table and extend the Calibration Table of the sequence with more levels.

Multiple Point Calibration with Multiple Calibration Mixtures

A combination of multiple calibration points per peak and multiple calibration mixtures containing only a subset of components as identified in the peak identification table can be handled, see picture below.

The 990 Micro GC will handle the amounts in Level 3 and 4 as the second calibration point of a component, because zero values are ignored. The calibration curve will end up with two calibration points for every component.

A combination of single and multiple calibration points per peak is also possible. The 990 Micro GC will count the number of positive values in all level columns for a component.

Peak Identification / Calibration: Channel 1

#	Active	Peak Name	ID	Level 1	Level 2	Level 3	Level 4
1	✓	Component1	1	1.1	0	3.0	0
2	✓	Component2	2	2.9	0	5.2	0
3	✓	Component3	3	0	6.7	0	20.3
4	✓	Component4	4	0	1.8	0	12.5
5	✓	Component5	5	5.3	0	11.4	0
6	✓	Component6	6	6.9	0	15.7	0
7	✓	Component7	7	7.1	0	16.3	0

Figure 249. Peak Identification/Calibration:Channel 1

Calibration Validation

There are two distinct methods available for validating the calibration in the 990 Micro GC: the verification run and response factor (R.F.) limit checking during a new calibration run.

Verification run

The Verification run can be used to verify whether the calibration curve for every component is still valid. Typically the calibration gas mixture is used for this verification, although it might be another gas sample.

The validation criteria (defined lower and upper limits) for the Verification run are configured in the 'Verification Check' window found in the 'Application' menu.

The window below contains two criteria: the Normalized Amount of Methane must be within 82.0 and 82.5, the Normalized Amount of Ethane must be within 5.1 and 5.3.

The components used in this table must be defined in the 'Normalize' window part of the Application. Also ESTD concentrations refer to the Normalize window. Also calorific values can be checked in energy meter configurations.

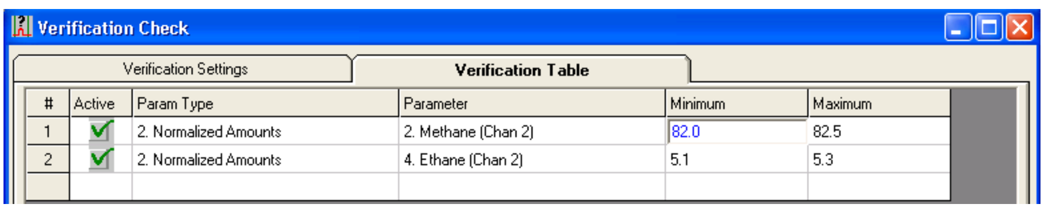


Figure 250. Verification Table

The verification criteria must be enabled in the Verification Settings tab, see **Figure 251**.

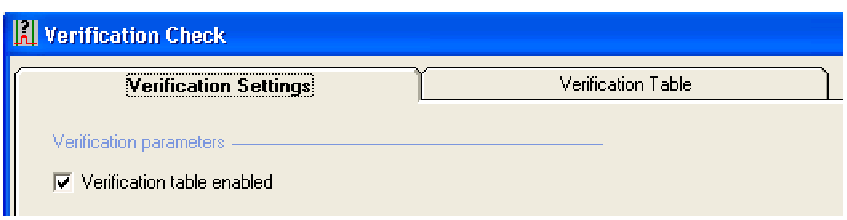


Figure 251. Verification Settings

After defining the verification criteria the Verification sequence must be entered. Select the menu option Sequence.

The Verification Table contains the run (sequence of runs) parameters for a verification run. In this example the calibration mixture is sampled from stream 4. First an extra flushing of 60 seconds is performed to flush away sample from a previous run.

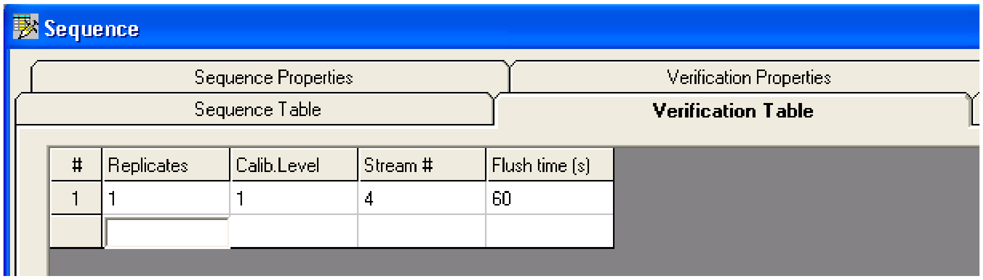


Figure 252. Verification Table

In the Verification Properties tab, define when to perform the verification while running full automation. **Figure 253** shows that the verification should start at 0700 every day.

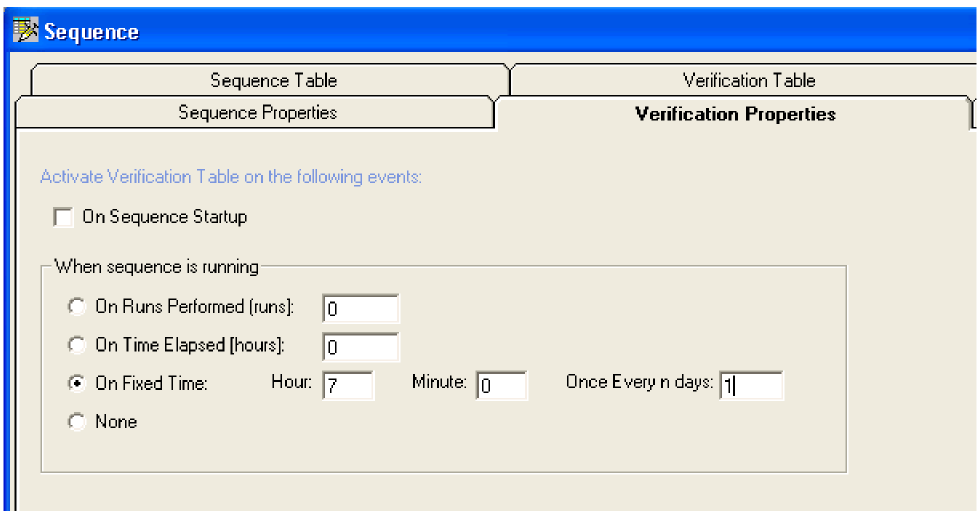


Figure 253. Verification properties

The result of a verification run is either pass or fail. This is reported in the Application Report. The result can be read by Modbus protocol. It is possible to use a verification failure after a verification run as a trigger to start the Calibration Table automatically, see **Figure 254** on page 487.

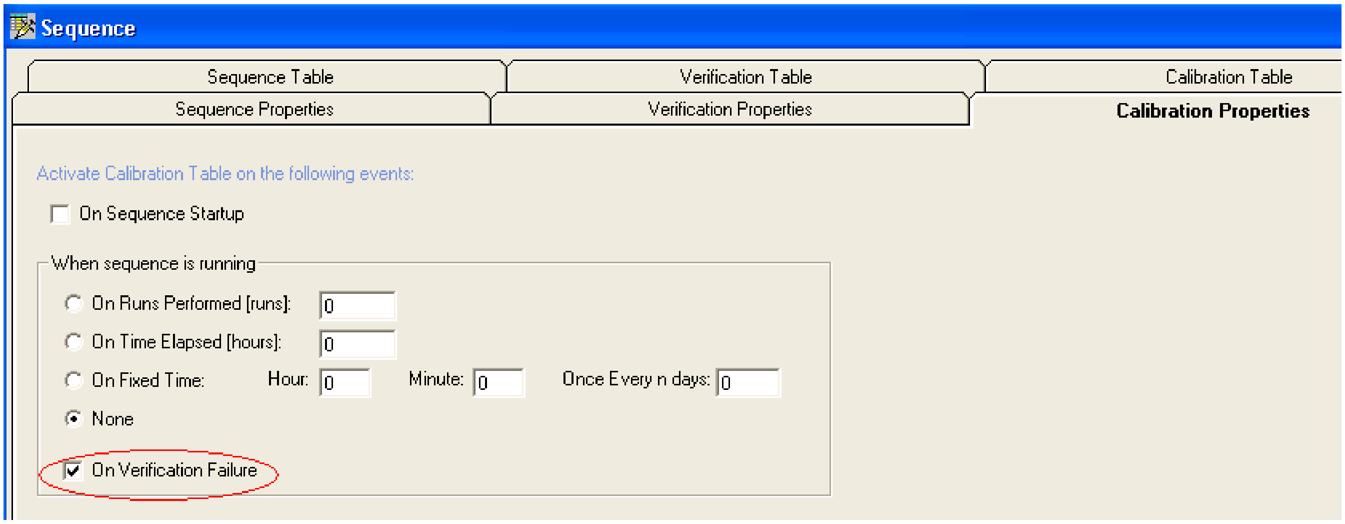


Figure 254. Option to start calibrating On Verification Failure

Calibration limits

The 990 Micro GC has multiple options for checking the calibration values, before accepting them.

Checking the Response Factor (RF) against the initial RF and current RF is called RF checking see **RF checking**. This is used in single level calibration.

Multilevel calibration is used in combination with the so called Rw factor. The Rw factor is determined using an Rw calibration (Level 8) and tested against the Rw limit, see **Rw Limit**.

RF checking

RF checking against the initial RF requires the determination of the initial RF. The initial RF can be determined like a normal calibration, only with the option Calibration Check and Initial Calibration enabled followed by a download of the Application.

After running an Initial Calibration, the 990 Micro GC will store the value of the Initial RF for every component. In the Peak Identification table, limits can be entered for a calibration.

The settings from the screen below allow 5 % deviation from the Initial RF and 5 % deviation from the Current RF. These limits are only active when the option Calibration Check is enabled.

Each component can have its own InitialRF% and CurrentRF%.

If any peak fails for Initial-- or Current R.F. validation, the entire calibration will be rejected for all peaks and the 990 Micro GC will continue using the current Response Factors determined in the last successful calibration run.

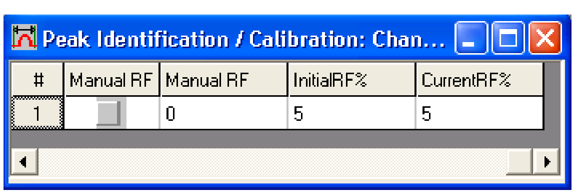


Figure 255. Peak Identification, limits RF

Rw Limit

An Rw calibration can be performed when a multilevel calibration curve has been determined. Typically this is used in non linear calibration curves. When the multilevel calibration curve is accurate, the value of the Rw factor should be approximately 1.0. The 990 Micro GC can be configured to test the Rw factor before accepting it. The settings of the screens below enable the testing of the Rw Limit (Calibration Check) and allow a value of 1.0 ± 10 % (0.9 to 1.1).

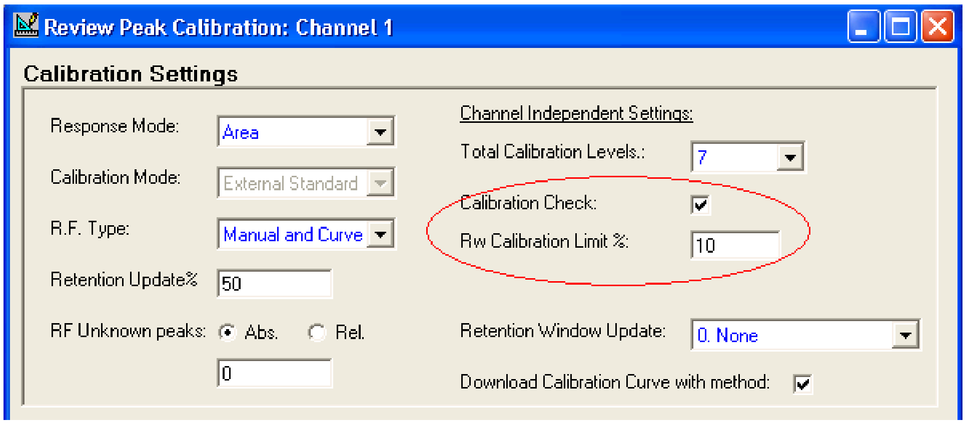


Figure 256. Rw Calibration Limit %

If any peak Rw exceeds its limit, the entire calibration for all peaks will be rejected and the 990 Micro GC will continue using the current Response Factors as determined in the last successful calibration run.

13 GC Emulator

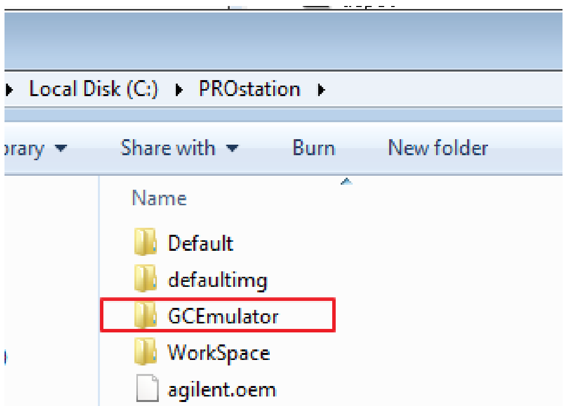
The GC Emulator is a Microsoft Windows application and an optional component of PROstation that reproduces the behavior of a 990 Micro GC.

The GC Emulator can be thought of as the Windows version of the Micro GC firmware. The GC Emulator works like a virtual 990 Micro GC.

Install GC Emulator

The GC Emulator is installed by default during the steps in **Install PROstation** on page 14. If you have PROstation installed, but not the GC Emulator, repeat the steps in **Install PROstation** on page 14 and ensure that the checkbox to install the GC Emulator in **step 10** is filled.

When the installation is complete, the GC emulator will be installed in a directory relative to the PROstation installation directory as shown below.

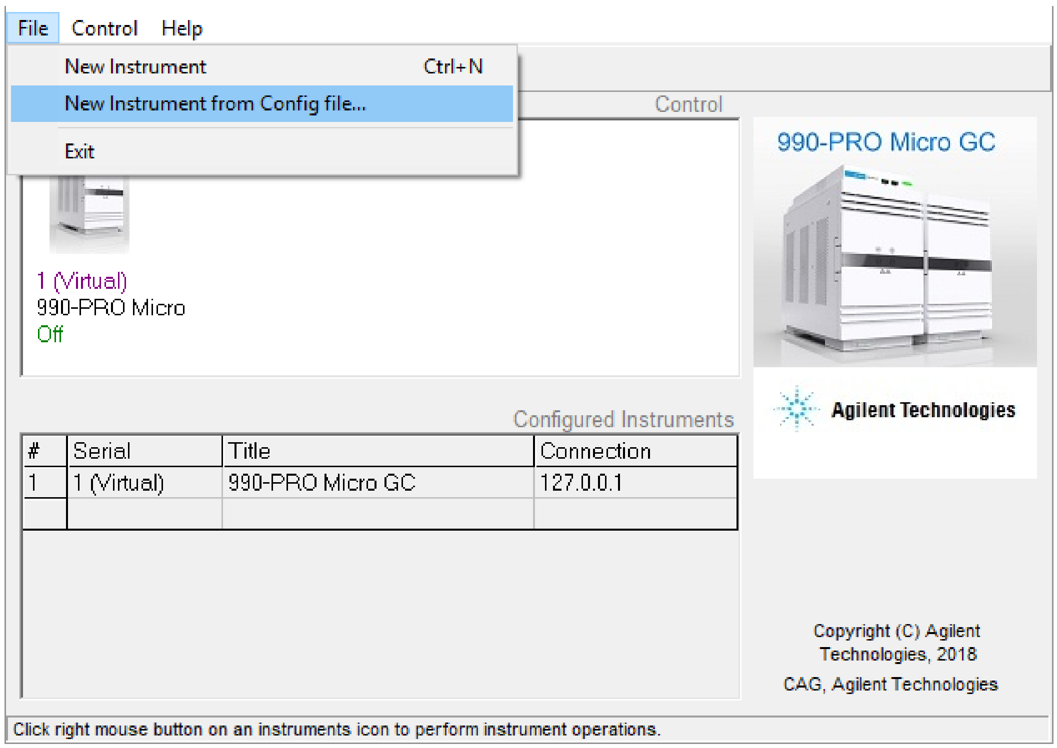


Create a new instrument by importing a configuration file

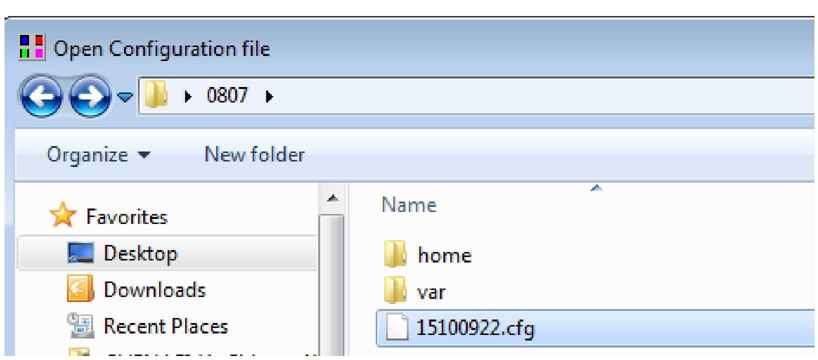
Creating a new instrument by importing a configuration file is a PROstation feature that is useful when using the GC Emulator. Specifically, this procedure is helpful when you are unable to configure the instrument by connecting to the physical device, but you do ave a preconfigured standalone configuration file. Often, the configuration file is a copy of the configuration of another PROstation.

To create a new instrument by importing a configuration file:

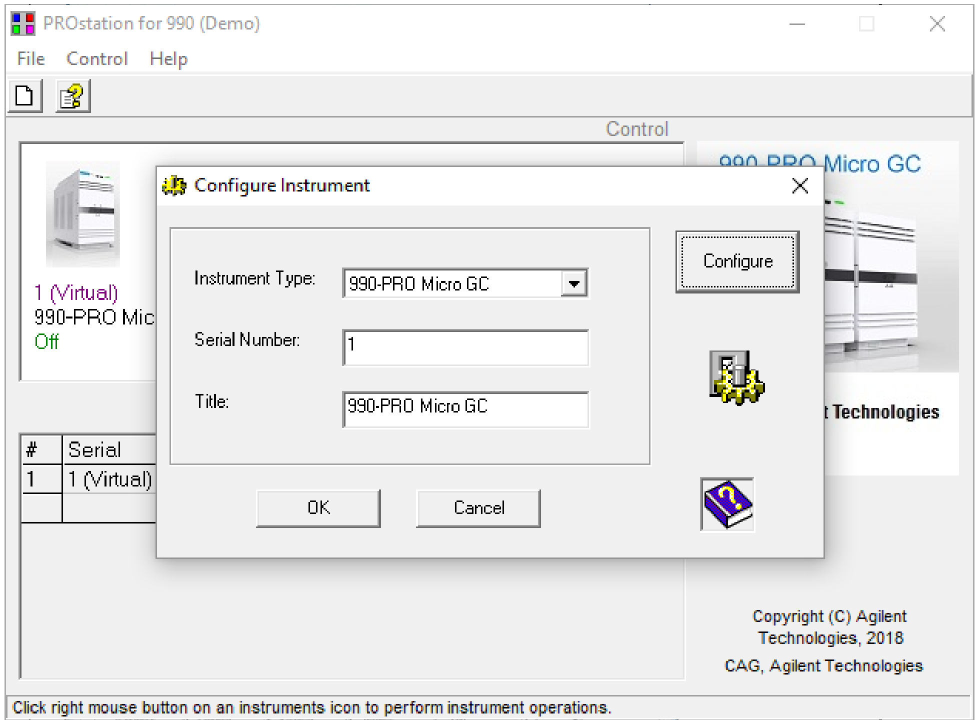
1 Open PGCMain. Click **File > New Instrument from Config file...**

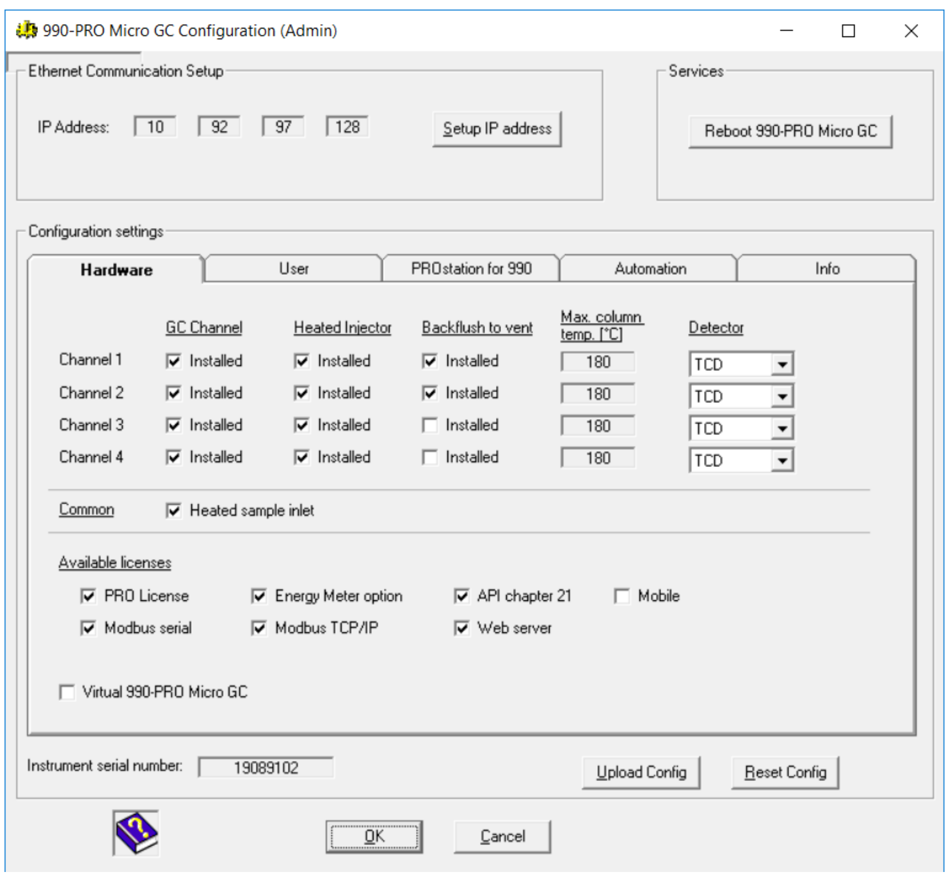


2 Select the configuration file you want to import into PROstation. Configuration files have a .cfg extension.
Click **Open** to import the selected file.

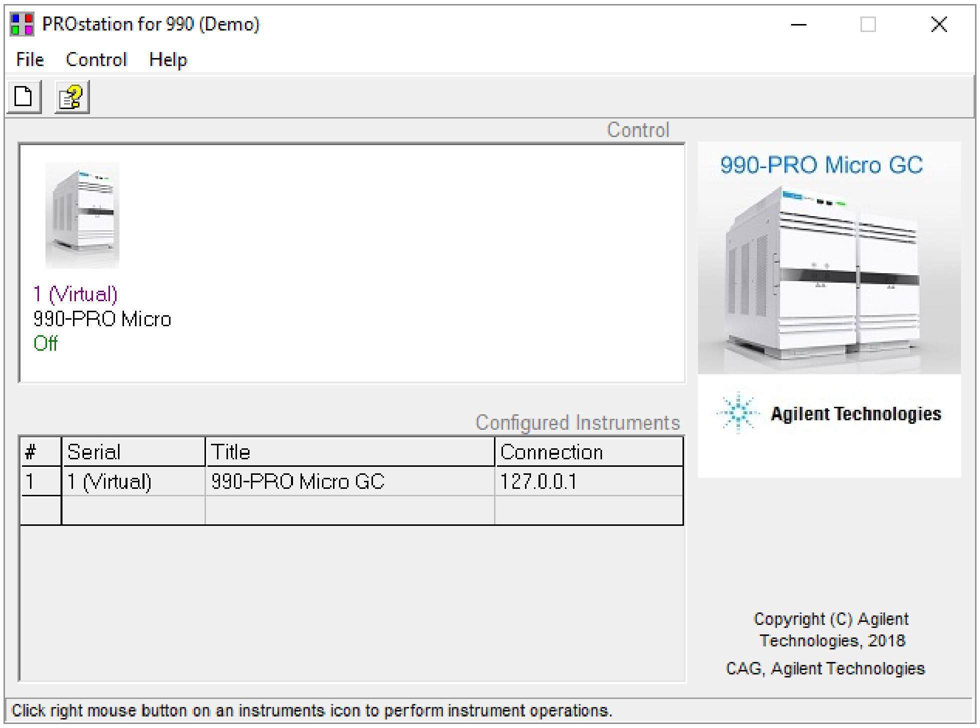


3 Click **OK** to import the configuration file, or click **Configure** to further review the instrument settings





4 The imported instrument will be displayed in the PROstation window. The new instrument can be used for GC emulation.



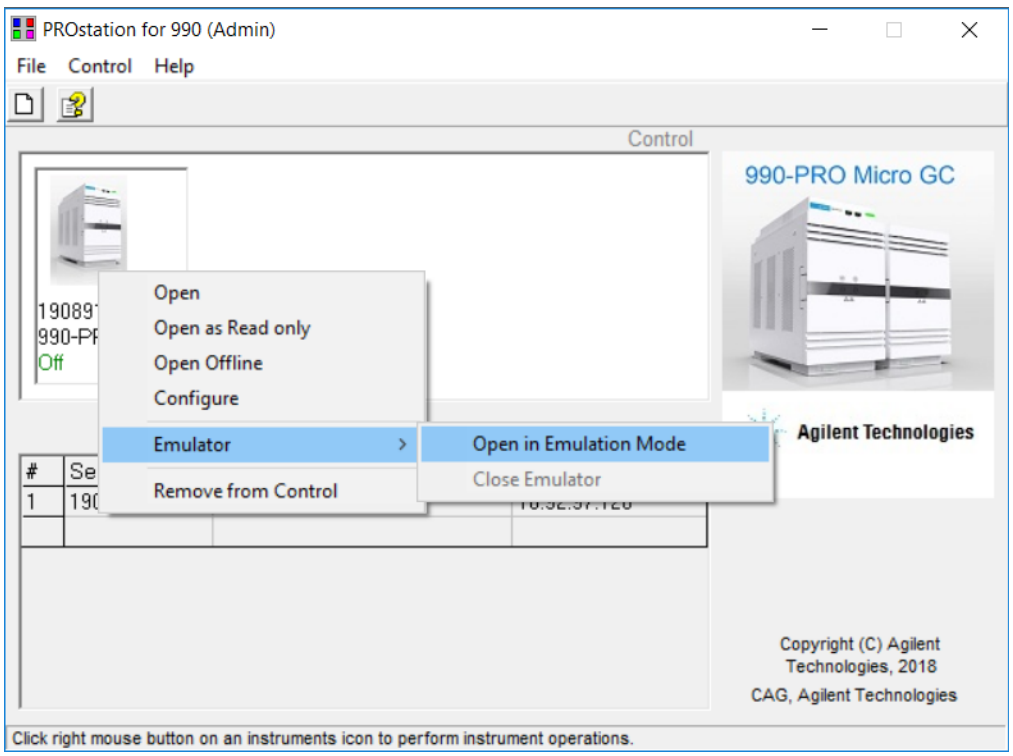
Open Emulation Mode

Emulation mode mimics the behavior of a 990 Micro GC when a physical Micro GC is not available.

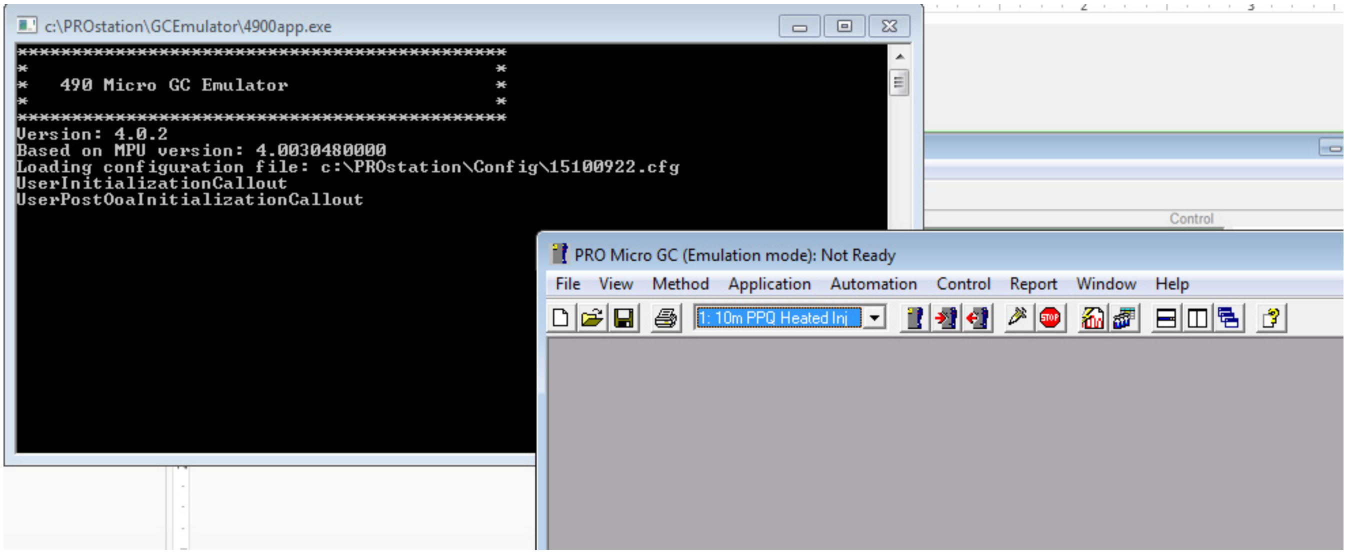
To open an instrument in the emulation mode:

1 Right-click the desired instrument and select **Emulator > Open in Emulation Mode**. This instrument may be a preconfigured instrument or an imported one.

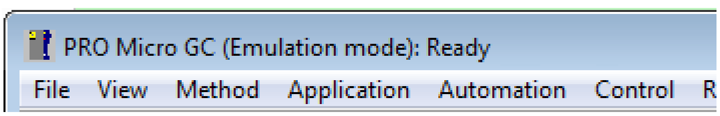
The 990 Micro GC emulator can only mimic one instrument at a time. If an emulator is already open and running, close it before opening a new emulator. See **Close an Emulated Instrument** on page 499 for more details.

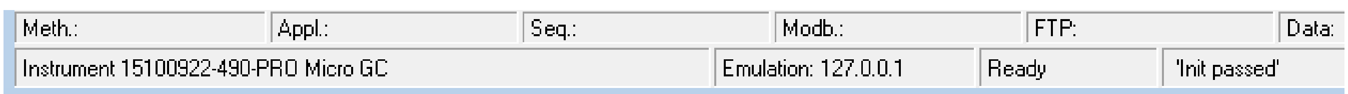


The emulated instrument opens in a command window. The PGCInst window appears and automatically connects to the virtual machine. The emulated GC has the same configuration settings as the preconfigured one used to launch it, such as channel number and types.



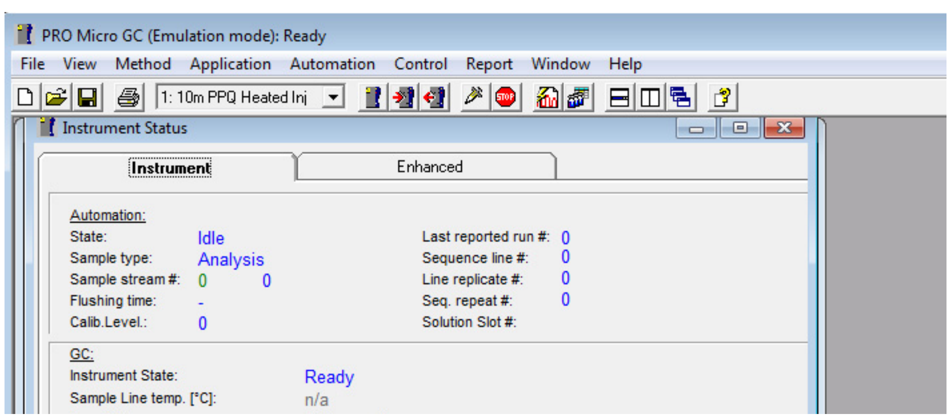
The title bar and status bar indicate that the instrument is emulated.

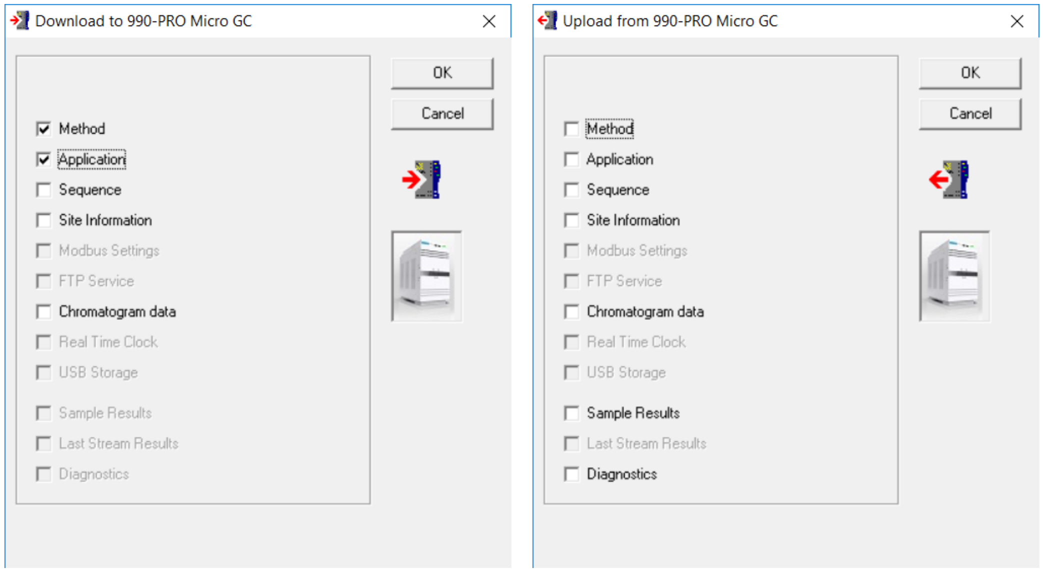




2 You are now able to control the emulated Micro GC as if it were a real one. You can upload, download, and change methods, start a run or a sequence, or do reprocessing.

Note: Some features are disabled in the emulation mode. The Peak simulation, however, is always enabled. The peaks displayed are for demonstration purposes only.




Download to 990-PRO Micro GC
OK
Cancel
Method
Application
Sequence
Site Information
Modbus Settings
FTP Service
Chromatogram data
Real Time Clock
USB Storage
Sample Results
Last Stream Results
Diagnostics
Upload from 990-PRO Micro GC
OK
Cancel
Method
Application
Sequence
Site Information
Modbus Settings
FTP Service
Chromatogram data
Real Time Clock
USB Storage
Sample Results
Last Stream Results
Diagnostics

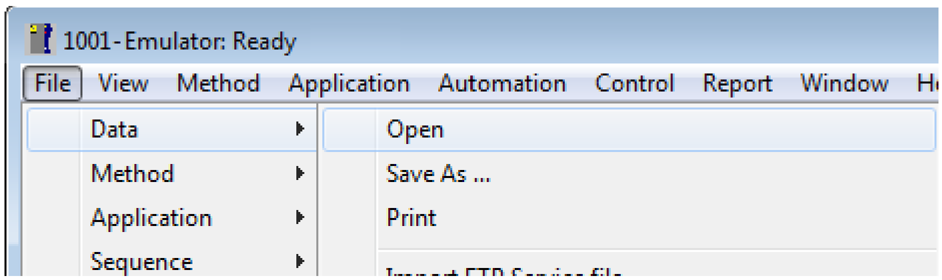
Offline Data Processing

The GC Emulator can be used to provide PROstation's offline data processing function without connecting to a real Micro GC, or as a demonstration tool (for example, for teaching).

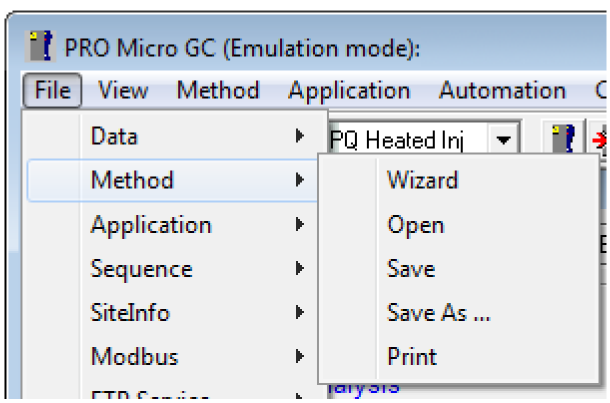
To process data using the GC emulator:

1 Right-click the desired instrument and select **Emulator > Open in Emulation Mode**.

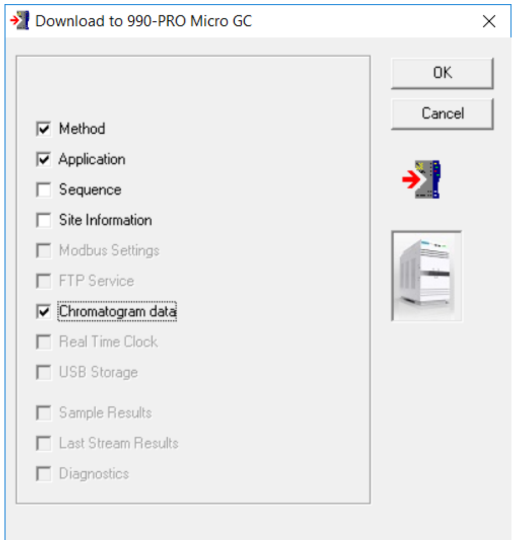
2 Open the data that you want to reprocess.



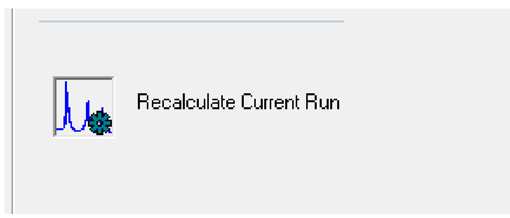
3 Apply the method you wish to use. You may create a new method, or modify an existing method, by opening the existing file and manually changing it or using the wizard (**File > Method > Wizard**).



4 Download the data, method, and application to the emulated GC.

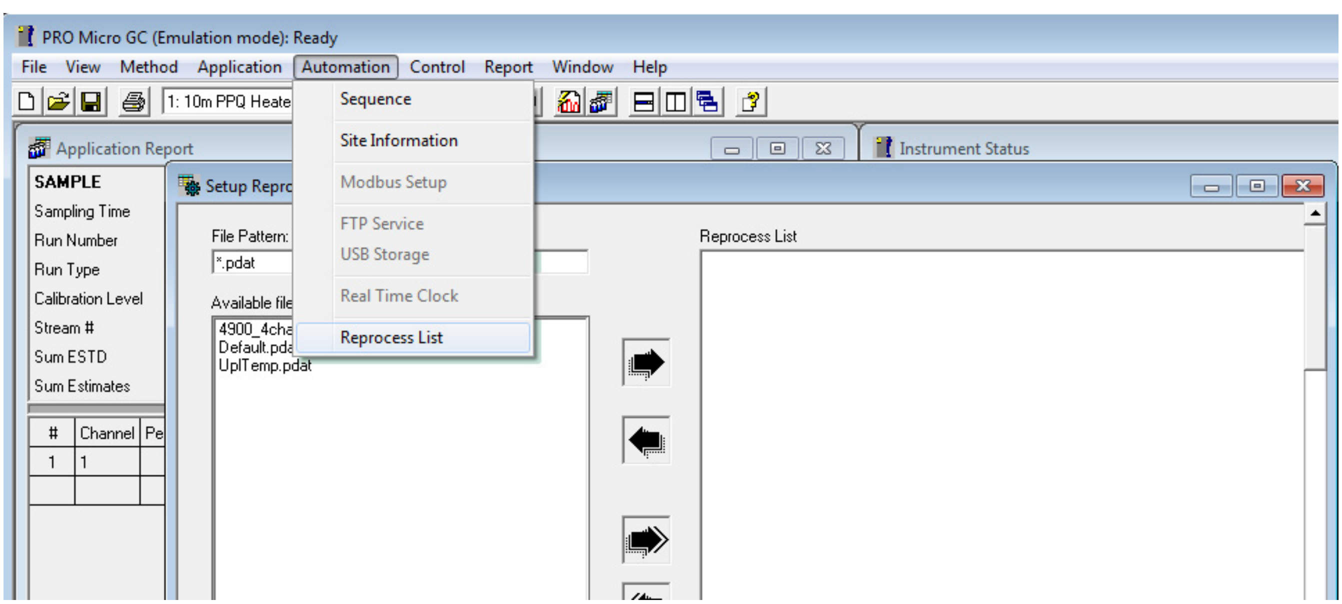


5 Recalculate the run



6 The calculated application result displays. The result is exactly the same as downloading the data to a real 990 Micro GC. If needed, save the result.

7 Besides the single recalculation, you may also make use of the reprocess list feature of PROstation (**Automation > Reprocess List**). This operation is the same as working with a real instrument.



Close an Emulated Instrument

Only one instrument emulation may be running at a time.

If you attempt to open another instrument in emulation mode without properly terminating the previous one, you will see a warning message.

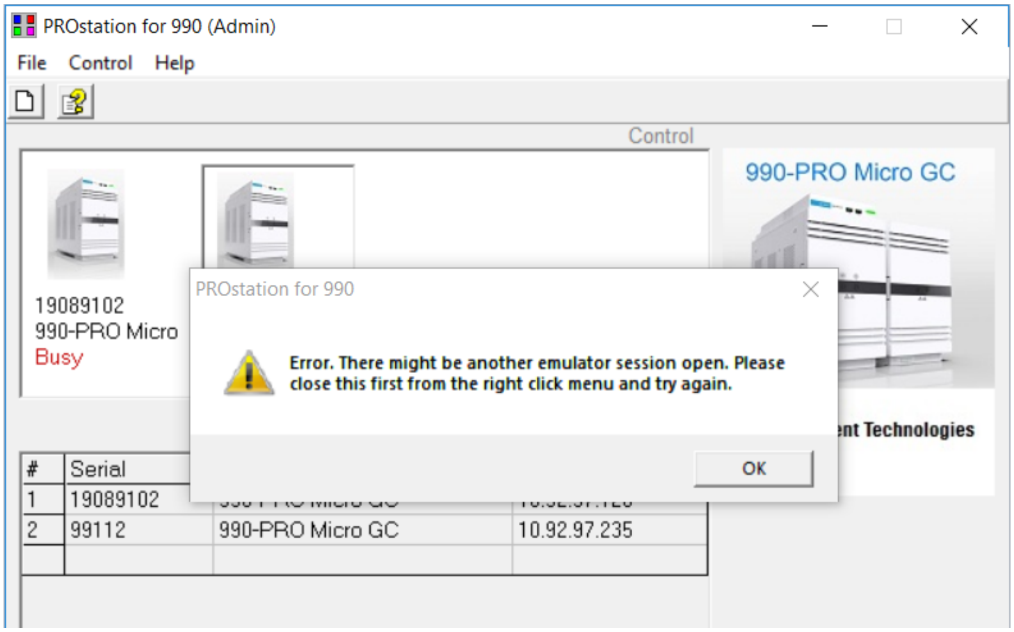


Figure 257. Error message upon attempting to open a second emulator

To close an emulated instrument session, right click the instrument you are emulating and select **Emulator > Close Emulator**.

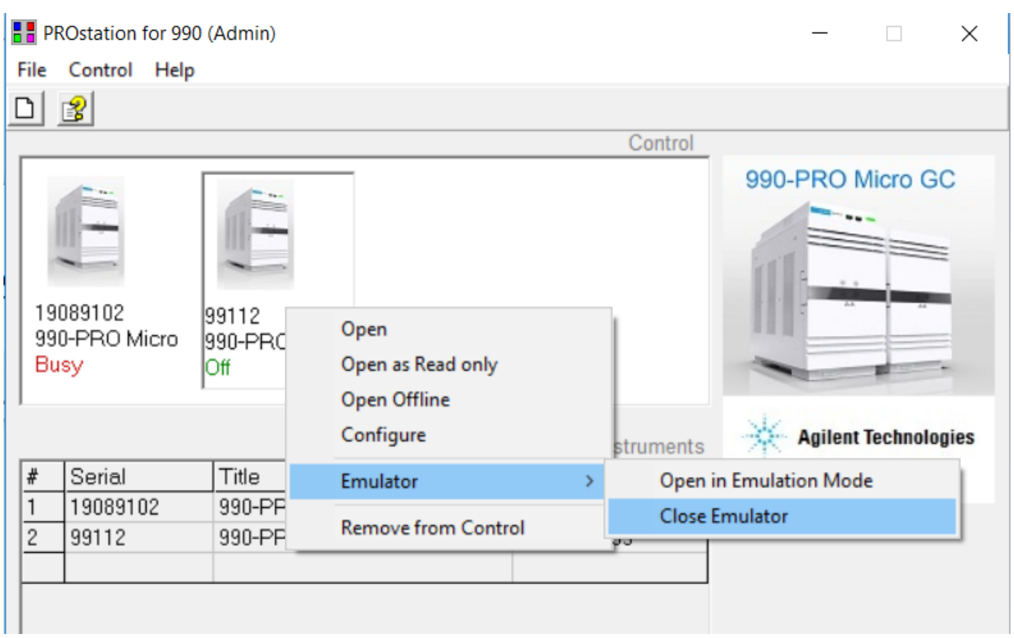


Figure 258. Closing an emulator

14 I/O Cases

The cases below describe how all I/O's can be configured and used in a 990 Micro GC. The following hardware has been used for these cases:

- Extension boards: basic extension board (CP741116), analog output board (CP741117), digital extension board (CP741118)
- 25-pin digital I/O interface cable and 15-pin analog I/O interface cable (CP741120)

General Setup

The Hardware tab:

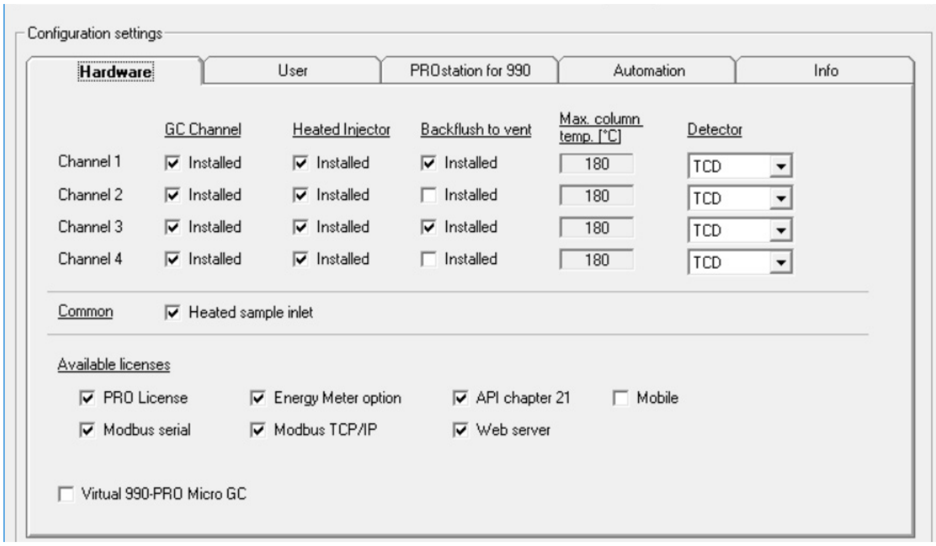


Figure 259. Hardware tab

The following licenses have been activated:

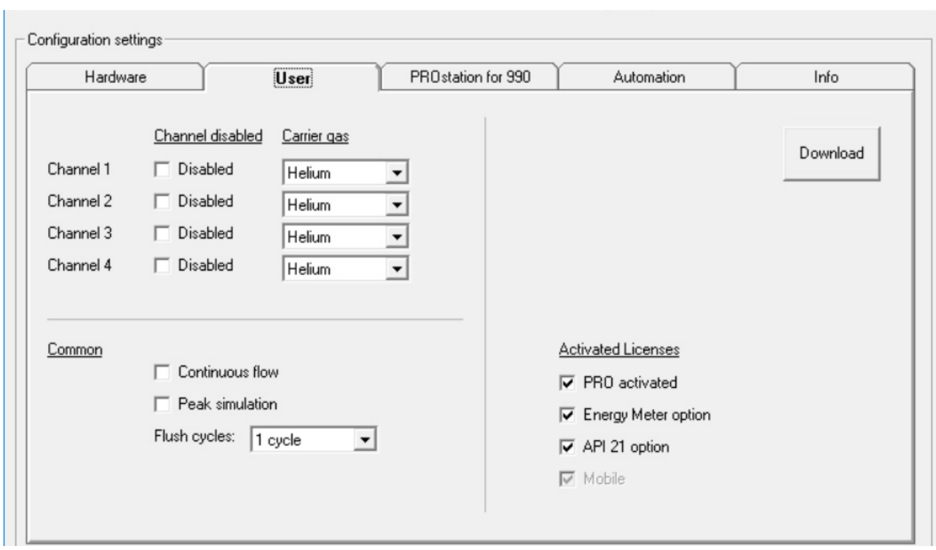


Figure 260. User tab

The following 990 Micro GC setup has been configured:

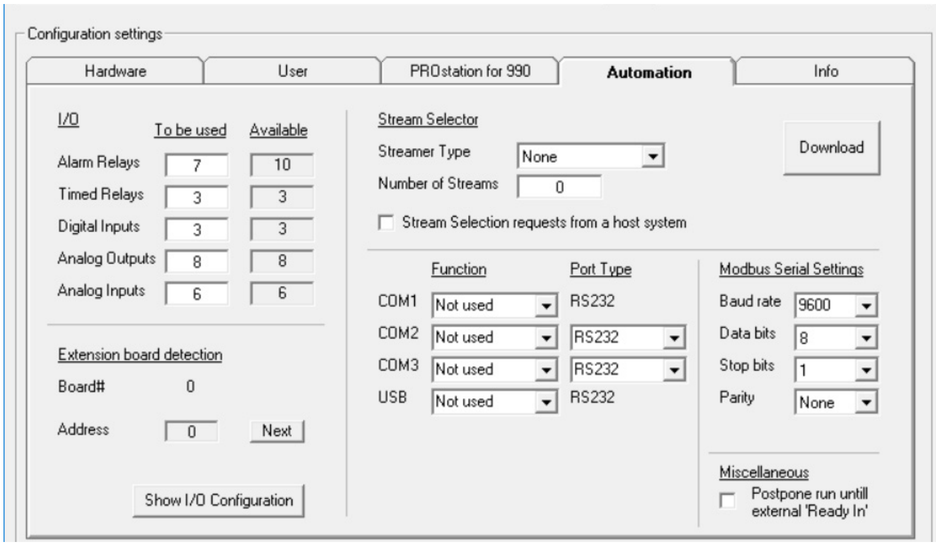
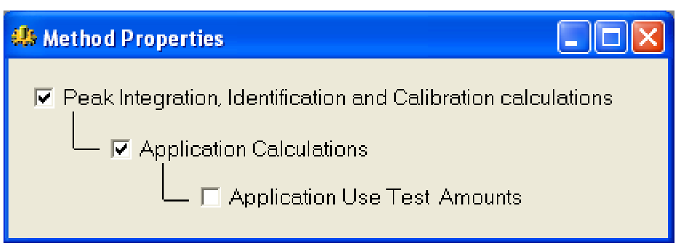


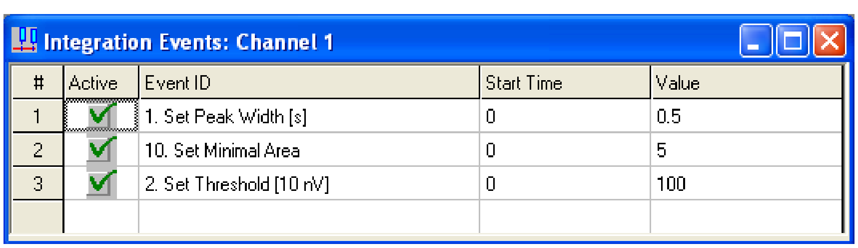
Figure 261. Automation tab

Cases preparation

1 Perform an analysis of gas sample and ensure peak integration and calculation is enabled.



2 Enter some applicable integration events for the peaks to get properly identified.



3 After the run has finished, all detected peaks should be visible in the chromatogram, and the peak identification table should be filled with all detected peaks.

Peak Identification / Calibration: Channel 1

#	Active	Peak Name	ID	Ret.Time	Rel.Ret.Window	Abs.Ret.Window	Reference	Selection Mode
1	✓	Peak1_1.35	1	1.35	5	5		0. Nearest
2	✓	Peak2_1.98	2	1.98	5	5		0. Nearest
3	✓	Peak3_5.35	3	5.35	5	5		0. Nearest

4 Name the identified peaks.

Peak Identification / Calibration: Channel 1

#	Active	Peak Name	ID	Ret.Time	Rel.Ret.Window	Abs.Ret.Window	Reference	Selection Mode
1	✓	Methane	1	1.35	5	5		0. Nearest
2	✓	Ethane	2	1.98	5	5		0. Nearest
3	✓	Nitrogen	3	5.35	5	5		0. Nearest

Integration report

After analysis or recalculation, the integration report is generated.

Integration Report

#	Channel	Peak #	Peakname	ESTD Conc.	Retention [s]	PeakRRT [s]	Area	Height	Width[s]	Separ.Code	Validation
1	1	1	Methane	80.500000	1.35	0.0000	2850.0000	400000.0000	0.4028	BV	0
2	1	2	Ethane	8.250000	1.98	0.0000	1379.4000	200000.0000	0.4247	VB	0
3	1	3	Nitrogen	2.110000	5.35	0.0000	704.9000	100000.0000	0.3983	BB	0

Figure 262. Integration Report

Case 1: Analog Output

This case describes the use of analog outputs. As can be seen in the automation tab on the last picture, there are eight analog outputs configured.

In PROstation, go to **Application** in menubar and select **Analog Outputs**.

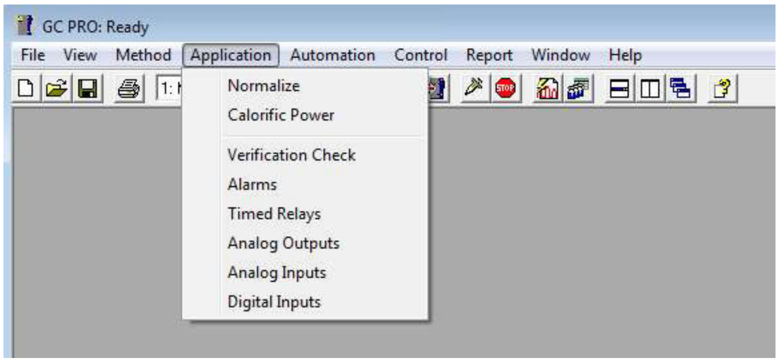


Figure 263. PROstation

Ensure the analog outputs table is enabled by checking the checkbox.

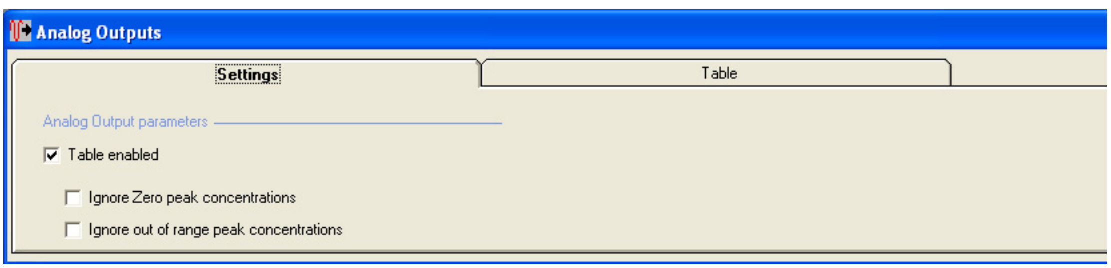


Figure 264. Analog outputs

You can now scale lower and upper input values (X1, X2) to lower and upper output values (Y1, Y2) and select an occasion on which the outputs are updated.

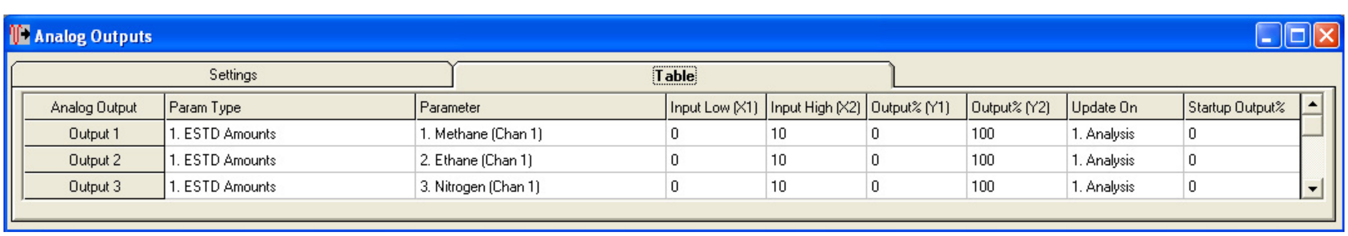
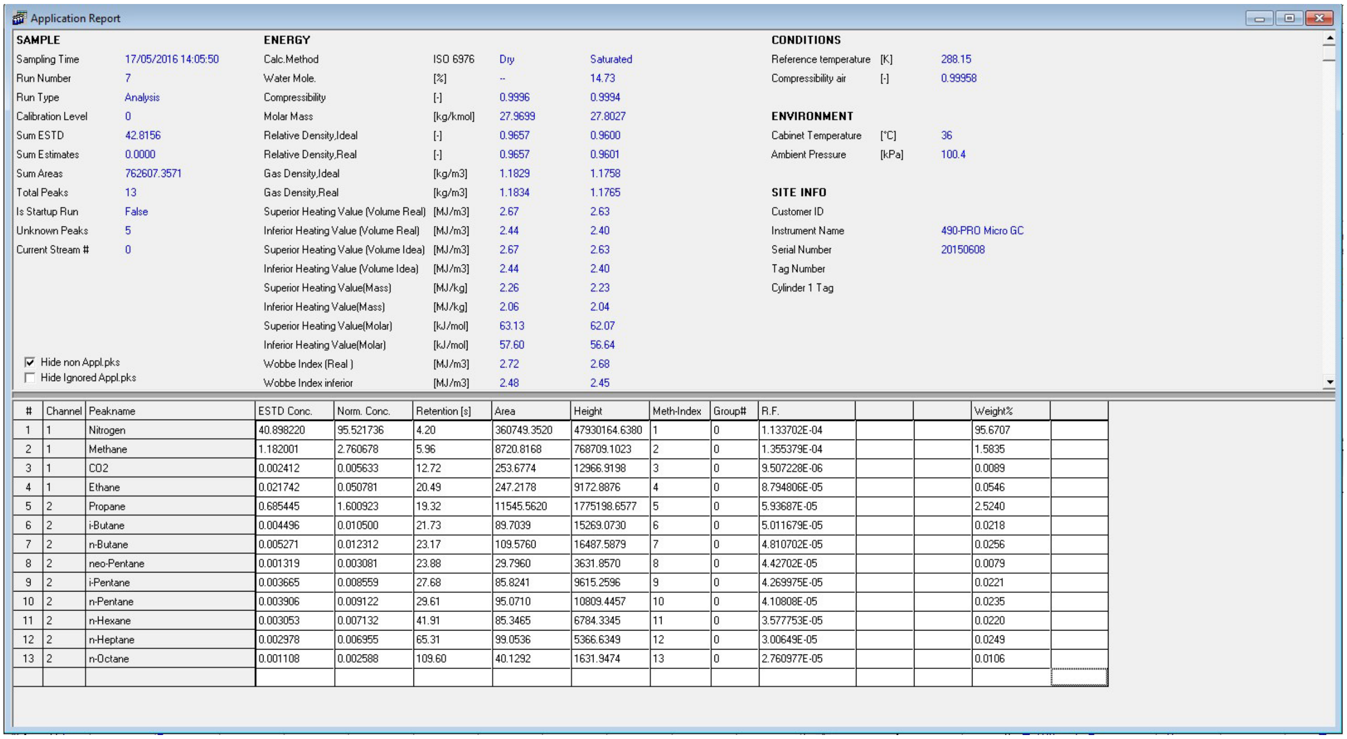


Figure 265. Setting outputs

The application report shows that the ESTD concentrations are properly scaled to set the specific analog output values; note that 80.5 ESTD concentration of Methane results in a 100 % clipped output value, because the ESTD input value was limited to 10.



#	Channel	Peakname	ESTD Conc.	Norm. Conc.	Retention [s]	Area	Height	Meth-Index	Group#	R.F.			Weight%	
1	1	Nitrogen	40.898220	95.521736	4.20	360749.3520	47930164.6380	1	0	1.133702E-04			95.6707	
2	1	Methane	1.182001	2.760678	5.96	8720.8168	768709.1023	2	0	1.355379E-04			1.5835	
3	1	CO2	0.002412	0.005633	12.72	253.6774	12966.9198	3	0	9.507228E-06			0.0089	
4	1	Ethane	0.021742	0.050781	20.49	247.2178	9172.8876	4	0	8.794806E-05			0.0546	
5	2	Propane	0.685445	1.600923	19.32	11545.5620	1775198.6577	5	0	5.93687E-05			2.5240	
6	2	i-Butane	0.004496	0.010500	21.73	89.7039	15269.0730	6	0	5.011679E-05			0.0218	
7	2	n-Butane	0.005271	0.012312	23.17	109.5760	16487.5879	7	0	4.810702E-05			0.0256	
8	2	neo-Pentane	0.001319	0.003081	23.88	29.7960	3631.8570	8	0	4.42702E-05			0.0079	
9	2	i-Pentane	0.003665	0.008559	27.68	85.8241	9615.2596	9	0	4.269975E-05			0.0221	
10	2	n-Pentane	0.003906	0.009122	29.61	95.0710	10809.4457	10	0	4.10808E-05			0.0235	
11	2	n-Hexane	0.003053	0.007132	41.91	85.3465	6784.3345	11	0	3.577753E-05			0.0220	
12	2	n-Heptane	0.002978	0.006955	65.31	99.0536	5366.6349	12	0	3.00649E-05			0.0249	
13	2	n-Octane	0.001108	0.002588	109.60	40.1292	1631.9474	13	0	2.760977E-05			0.0106	

Figure 266. Application Report

The link between the method peak tables and the Application Report is defined by the normalization table. This table holds all system-wide parameters and defines which parameters are shown in the Application Report. On its turn, the normalization table serves as an input to all I/O tables, including peak naming.

See the schematic overview of and interaction between various tables/processes:

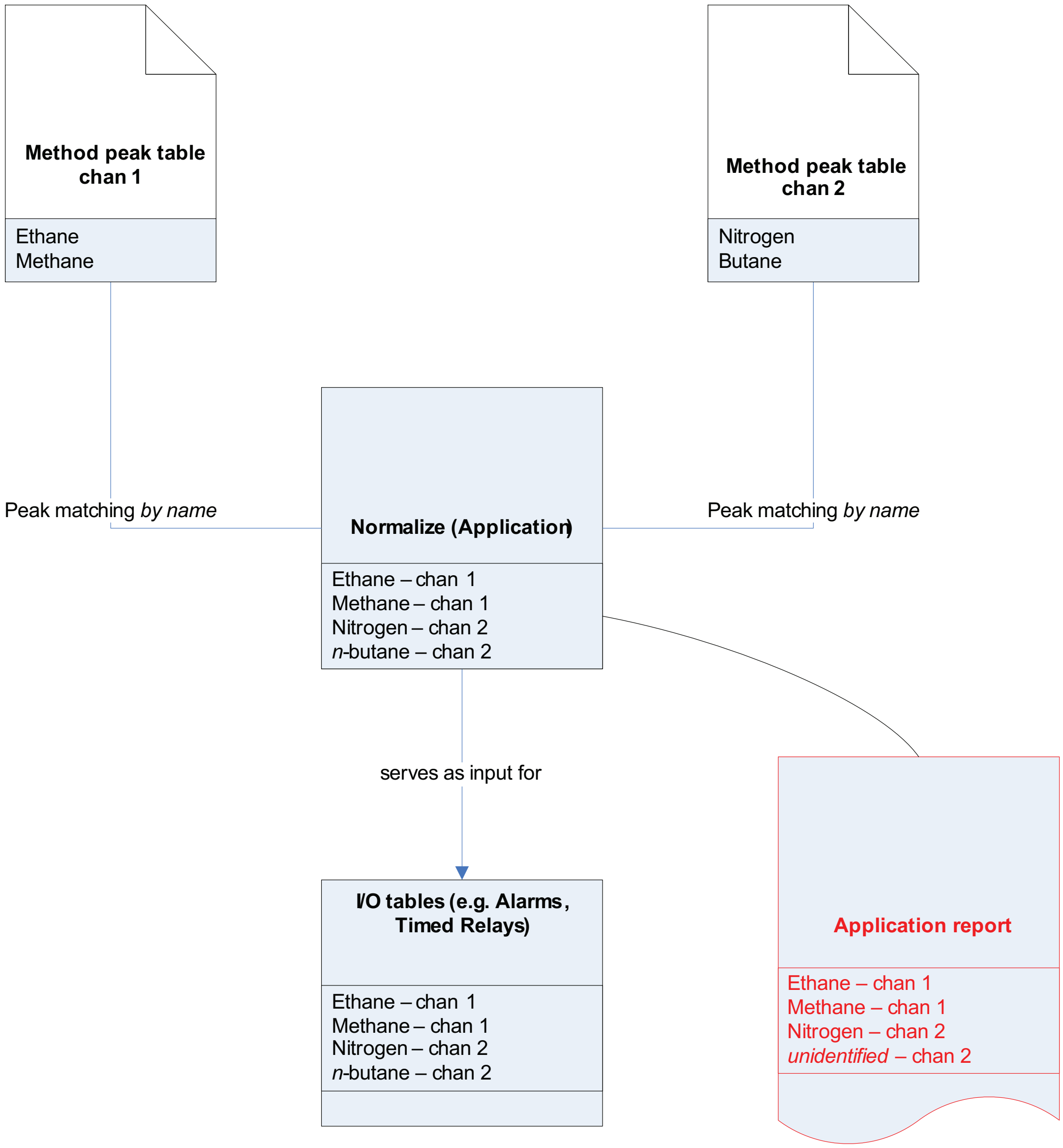
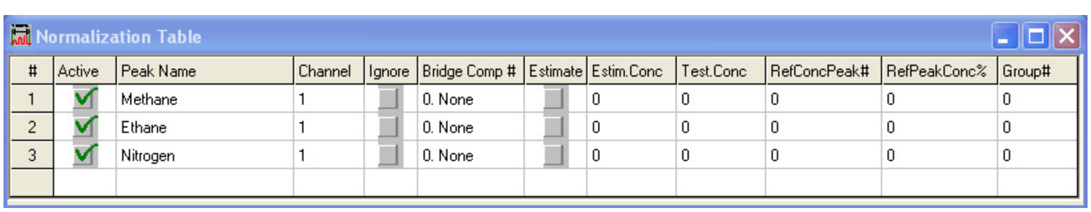


Figure 267. Relationships



Normalization Table

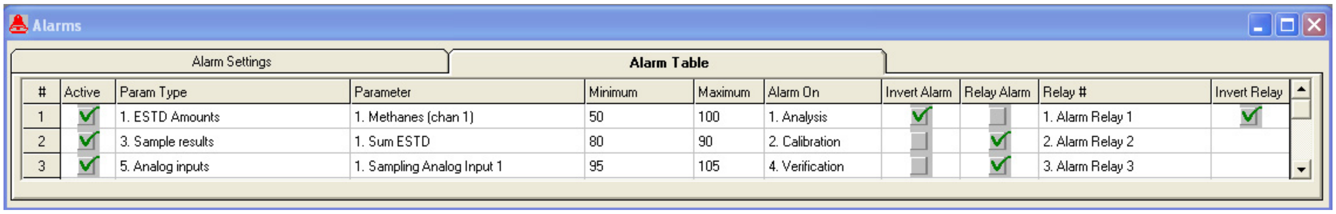
#	Active	Peak Name	Channel	Ignore	Bridge Comp #	Estimate	Estim.Conc	Test.Conc	RefConcPeak#	RefPeakConc%	Group#
1	✓	Methane	1		0. None		0	0	0	0	0
2	✓	Ethane	1		0. None		0	0	0	0	0
3	✓	Nitrogen	1		0. None		0	0	0	0	0

Figure 268. Normalization table

The names in the normalization table must match the names in the peak table, otherwise wrongly named peaks (a.k.a. nonapplication peaks) will not show up in the report. These nonapplication peaks can be hidden by checking the **Hide non Appl.pks** checkbox in the Application Report.

Case 2: Alarms

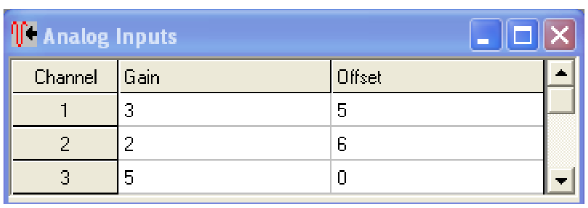
Alarming can be used to inform the user (or a subsystem) that certain parameters are in or out of range. See table below as an example:



#	Active	Param Type	Parameter	Minimum	Maximum	Alarm On	Invert Alarm	Relay Alarm	Relay #	Invert Relay
1	✓	1. ESTD Amounts	1. Methanes (chan 1)	50	100	1. Analysis	✓	☐	1. Alarm Relay 1	✓
2	✓	3. Sample results	1. Sum ESTD	80	90	2. Calibration	☐	✓	2. Alarm Relay 2	
3	✓	5. Analog inputs	1. Sampling Analog Input 1	95	105	4. Verification	☐	✓	3. Alarm Relay 3	

Figure 269. Alarms

1. The ESTD amount of Methane should be greater than 50 and less than 100. In our example, the ESTD of Methane is 80.5, which is within range, and no alarming will occur.
2. The sum of all ESTD's should be greater than 80 and less than 90. The actual sum is 90.86, so the alarming condition is met and the alarm will be set.
3. Analog input #1 should be greater than 95 and less than 105. By using the analog input table, the equation for the input value can be defined. As an example, the following 'Analog Inputs' table has been defined.



Channel	Gain	Offset
1	3	5
2	2	6
3	5	0

Input x is tied to output value y by this formula: $y = ax + b$, where a matches the 'Gain' factor and b matches the offset. If, for example, the analog input x (voltage) resembles the ambient pressure at time of sampling, we need to define the equation for converting Volts to Pa (or mbar if more suitable). In this specific Alarms table, line 3 should be interpreted the following way:

If at time of sampling, pressure is less than 95 Pa or greater than 105 Pa on a verification analysis, Alarm Relay 3 will be energized. To get from input x [volts] to output value y [Pa], according to 'Analog Inputs' table the following equation should be used: $y = 5x$

Case 3: Timed Relays

Timed relays are relays that can be configured to switch on expiration of a selectable delay. Consider this example:

Timed Relays

#	Event	Delay [s]	Timed Relay	Relay State
1	4. Injection Started	20	1. Timed Relay 1	1. Energize
2	4. Injection Started	25	1. Timed Relay 1	0. De-energize
3	3. Sampling started	30	2. Timed Relay 2	1. Energize
4	3. Sampling started	35	2. Timed Relay 2	0. De-energize

Figure 270. Timed relays

Explanation:

1 20 seconds after injection started, Timed Relay 1 will be energized.

2 25 seconds after injection started, Timed Relay 1 will be de-energized.

This shows that:

Relay 1 is energized for a period of 5 seconds from 20 to 25 seconds after start of injection.

3 30 seconds after sampling started, Timed Relay 2 will be energized.

4 35 seconds after sampling started, Timed Relay 2 will be de-energized.

This shows that:

Relay 2 is energized for a period of 5 seconds from 30 to 35 seconds after start of sampling.

This table does NOT force the relays to an initial state before they are energized, so it could well be the case that both timed relays are already energized before they are energized after expiration of the delay timer.

Case 4: Digital Inputs

Digital inputs can be used to start a function upon receiving a high-to-low transition on the input (pull to ground) or to monitor some external device status and display this status info in some report.

Digital Inputs

Digital Input	Function
Digital Input 1	4. Start Verification Table
Digital Input 2	5. Start Calibration Table
Digital Input 3	3. Stop Automation

Figure 271. Digital inputs

A maximum of three digital inputs can be configured. In the table above, an example is shown how these inputs could be set up. The descriptions are self explanatory.

15 WinDCS

The 990 Micro GC can be connected to a Distributed Control System (DCS) using Modbus.

Before connecting, check if the Modbus table downloaded to the 990 Micro GC is correct and communication parameters as well as communication hardware are correct. WinDCS simulates a Modbus master. By running WinDCS, real 990 Micro GC data provided through Modbus can be validated.

WinDCS must not be used to prove modbus communication stability.

WinDCS must not be used to continuously monitor analysis results.

WinDCS is only designed to validate registers.

First, set up the Modbus table in PROstation, containing all the Modbus registers you want to provide to a DCS. Second, set up the identical register numbers in WinDCS.

The WinDCS program consists of two parts; a communication part and a table part. Both parts are discussed in the following sections.

Setting up the WinDCS Communication

To show the communication part, click **Connect** or select **Start** communication from the **command** menu.

Win DCS has two communication modes: Modbus Serial and Modbus TCP/IP. Also an offline mode is available.

Serial communication settings

The following serial port parameter can be set:

- **Comport**
  Any of the PC comports can be selected to communicate with the instrument.
- **Baudrate**
  Baudrate of the serial connection. The speed in characters per second in which data is transmitted over the serial connection between the GC and the DCS system.
- **Slave address**
  The Slave address of the 990 Micro GC as set up in PROstation.
- **Serial Protocol Mode**

  RTU
  RTU (Remote Terminal Unit)

  ASCII
  ASCII is a standard for sending information (American Standard Code for Information Interchange).

  Ensure this is identical to the Modbus setting as selected in PROstation.

Ethernet communication settings

When selecting Ethernet communication settings, some fields in the layout of the communication settings will change and some will be disabled, since they are only valid when using **Serial Communication**. Modbus ASCII and Modbus RTU do not exist in Modbus TCP/IP.

IPAddress

Fill in the IP address of the 990 Micro GC you want to connect to.

Slave Address

The Slave address in Modbus TCP/IP is only used if a modbus bridge is used to convert Modbus TCP/IP to serial. If this is not used, select 1.

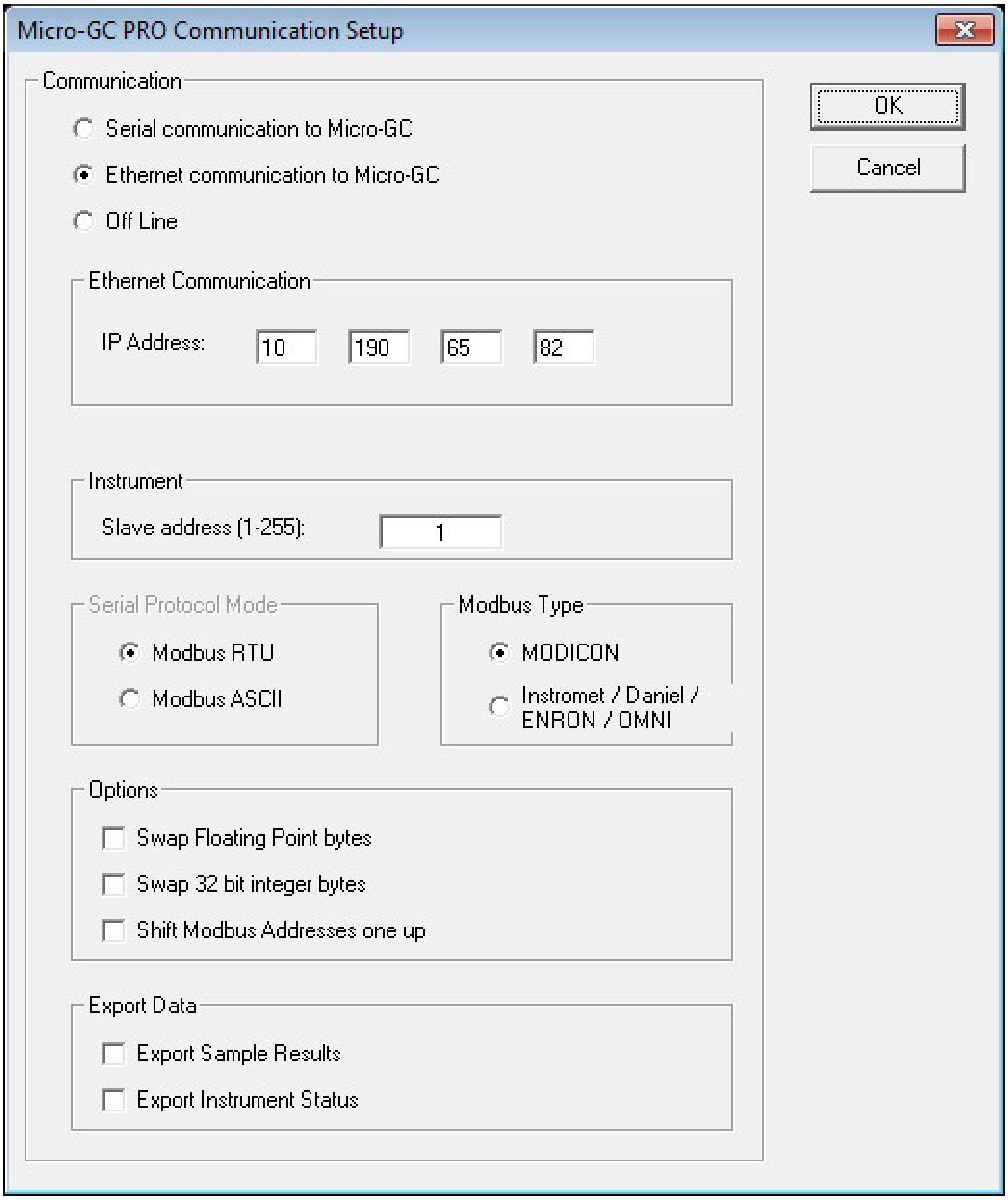


Figure 272.

General Modbus communication settings

If communication is set to a mode other than **Offline**, WinDCS will try to connect to the 990 Micro GC as soon as the **OK** button is clicked.

ModbusType

MODICON/Daniel and others

Change the protocol from standard MODICON to other derived protocols.

Difference will only be found in the holding and input registers above the address 5000 range and above the 7000 range. Above address 4999 the non-MODICON protocol will return 4 byte integers, above 6999 the protocol will provide 4 bytes floating point values.

Options

- **Swap Floating-Point bytes**
  A floating point consists of four bytes. Swapping floating points means that the first two bytes are swapped with the last two bytes. This option will not be needed for connecting to the 990 Micro GC.
- **Swap 32 bit integer bytes**
  A 32-bit integer consists of 4 bytes. Swapping 32 bit integers means that the first 2 bytes are swapped with the last 2 bytes. This option will not be needed for connecting to the 990 Micro GC.
- **Shift Modbus register one up**
  Some Modbus applications or Modbus devices count Modbus registers starting with 0 instead of 1, while the register count shown to the user starts at 1. When the Modbus table in such an application or device shows Register 7001, it will send a request for register 7000. This option will not be needed for connecting to the 990 Micro GC.

Export Data

- **Export Sample Results**
  With selecting this option, Sample results recorded from the 990 Micro GC are stored on disk in the file WinDCS_Analysis.txt, located in the directory where WinDCS is installed.
- **Export Instrument Status**
  With selecting this option, Instrument Status recorded from the 990 Micro GC is stored on disk in the file WinDCS_Status.txt, located in the directory where WinDCS is installed.

WinDCS Modbus Table

The Modbus table of WinDCS is quite similar to the Modbus table in the 990 Micro GC and PROstation or to any other Modbus table, but there are some differences.

Register type

In the WinDCS Modbus Table, four types of Modbus registers can be used in the Register type column:

Input status(R):	This is a single bit. Can only be read from the 990 Micro GC.
Coil status (RW):	This is a single bit. Can be read from and written to the 990 Micro GC.
Input register (R):	This is an integer register; Can only be read from the 990 Micro GC
Holding register (RW):	This is an integer register; Can be read from and written to the 990 Micro GC.

Data type

In the WinDCS Modbus Table, four Datatypes can be used in the Date Type column:

Bit:	a single 0 or 1 value
Int16:	16-bit integer value.
Int32:	32-bit integer value.
Float:	4-byte floating-point value.

Ensure the data type used is identical to the data type used in the PROstation table.

WinDCS Modbus table setup

Register Type	Register #	Data Type	Parameter ID.	Channel	Peak#
0. Coil Status (RW)	1	0. Bit	16. Start Automation (Execute Cmd, MB)	0. Main board	0
0. Coil Status (RW)	2	0. Bit	17. Stop Automation (Execute Cmd, MB)	0. Main board	0
0. Coil Status (RW)	3	0. Bit	25. Start Verification Table (Execute Cmd, MB)	0. Main board	0
3. Input Register (R)	1	2. Int32	102. Status: Instrument State (Int32, MB)	0. Main board	0
3. Input Register (R)	3	2. Int32	103. Status: Cabinet Temperature (Int32, MB)	0. Main board	0
3. Input Register (R)	5	3. Float	104. Status: Ambient Pressure (Double, MB)	0. Main board	0
3. Input Register (R)	7	2. Int32	132. Status: Error Number (Int32, MB)	0. Main board	0
3. Input Register (R)	9	3. Float	105. Status: Power Supply Voltage (Double, MB)	0. Main board	0
3. Input Register (R)	11	2. Int32	2205. Application: Stream Position (Int32, MB)	0. Main board	0
2. Holding Register (RW)	13	2. Int32	2202. Sync: Data available counter (Int32, MB)	0. Main board	0
2. Holding Register (RW)	15	2. Int32	2201. Sync: Data available with reset(Int32, MB)	0. Main board	0
2. Holding Register (RW)	17	2. Int32	2216. Application: Total Peaks (Int32, MB)	0. Main board	0
2. Holding Register (RW)	19	2. Int32	2400. Appl.: Stream Component ESTD(Double, CHAN=stream, PEAK)	1. Stream 1	2
2. Holding Register (RW)	21	2. Int32	2400. Appl.: Stream Component ESTD(Double, CHAN=stream, PEAK)	2. Stream 2	2

Figure 273. WinDCS Modbus Table setup

All Modbus registers that are defined in the Modbus Table in PROstation, should also be defined in the Modbus Table of WinDCS (or at least the ones you want to test). Ensure that address, type and datatype of all registers are the same as the registers in the Modbus table of the 990 Micro GC.

Unlike the table in the 990 Micro GC, the registers are divided over the different parts of the WinDCS Modbus Table. The Register table of WinDCS consists of four parts. All registers in each part have a particular meaning. This way WinDCS is a neat testing tool. Registers used for GC Status are put in the yellow part.

Registers used for sending commands are put in the pink part, new analysis data trigger in the green part and analysis results in the purple part.

GC Status - Yellow section

The yellow section should contain instrument status, and it will be requested every 2 seconds.

The clear button resets all the actual values that were received the last cycle. The clear button does not reset the counter. The counter is reset each time the connection is closed and re-established again.

Commands - Pink section

The pink section should contain commands that can be sent to the 990 Micro GC.

New sample data detection - Green section

The green section should contain the data available trigger as specified in the 990 Micro GC Modbus table. Ensure that both 990 Micro GC and WinDCS have the same setting for resetting. In the example, WinDCS has a trigger that will be reset after reading, and the 990 Micro GC knows that by means of the parameter selected (Modbus register 15 - Parameter ID 2201)

Sample results - Purple section

The purple section should contain sample data and it will be updated every time the data available trigger (in the green part) gets the trigger value as specified (equals value).

Note that editing the Modbus table of WinDCS is only possible when WinDCS is not connected (or trying to connect) to a 990 Micro GC or other device.

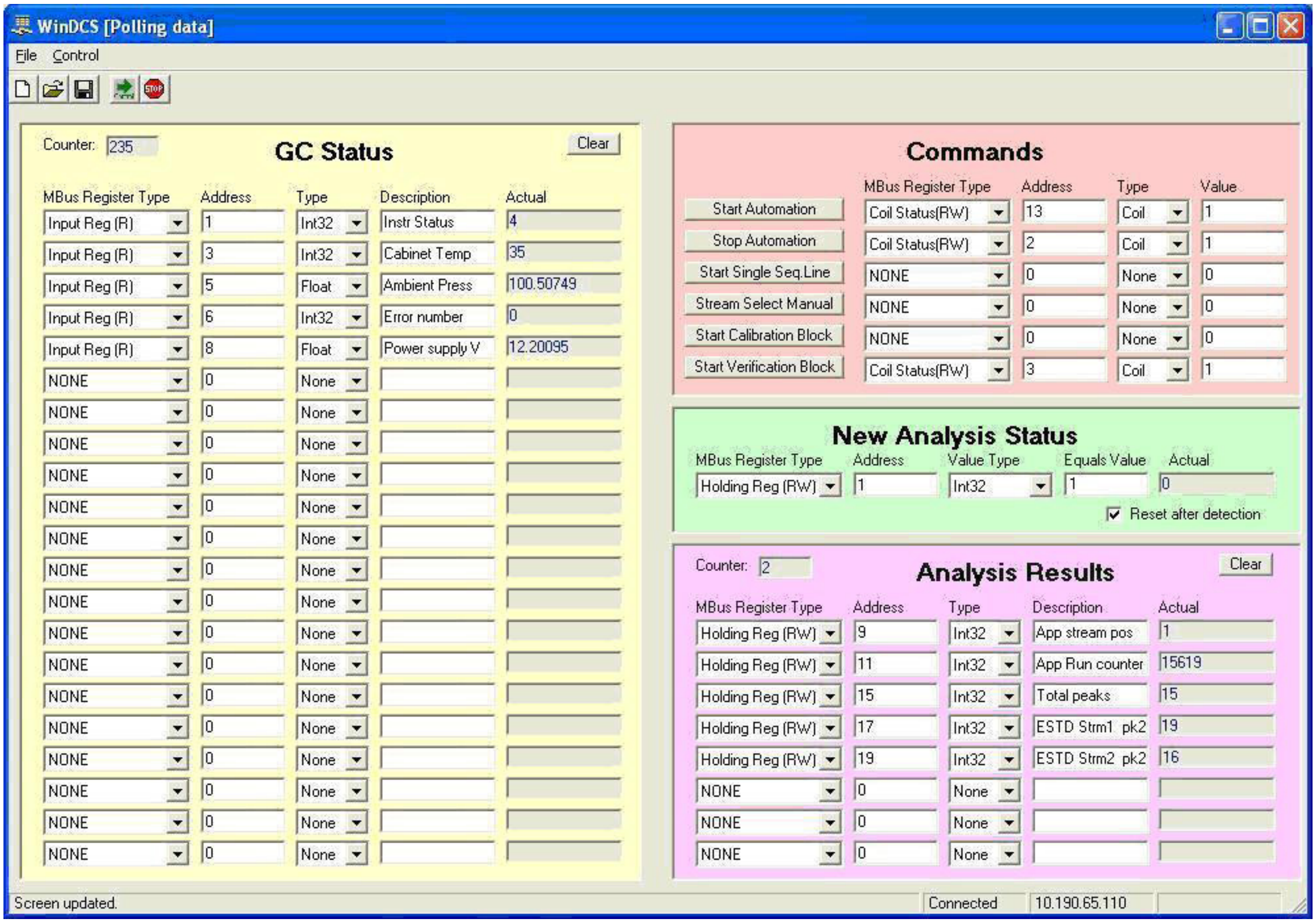


Figure 274. WinDCS table

16 History Log

This software will only run with the appropriate license installed.

Operation

To use the History Log, see:

Starting the application

When the application **History Log** is started for the first time, default settings are used. A default IP-address is selected. After saving a configuration, **History Log** will start with the last configuration used. The warning **no data available** indicates that no data is downloaded from the GC yet.

History Log is also started with default settings when no configuration file is found.

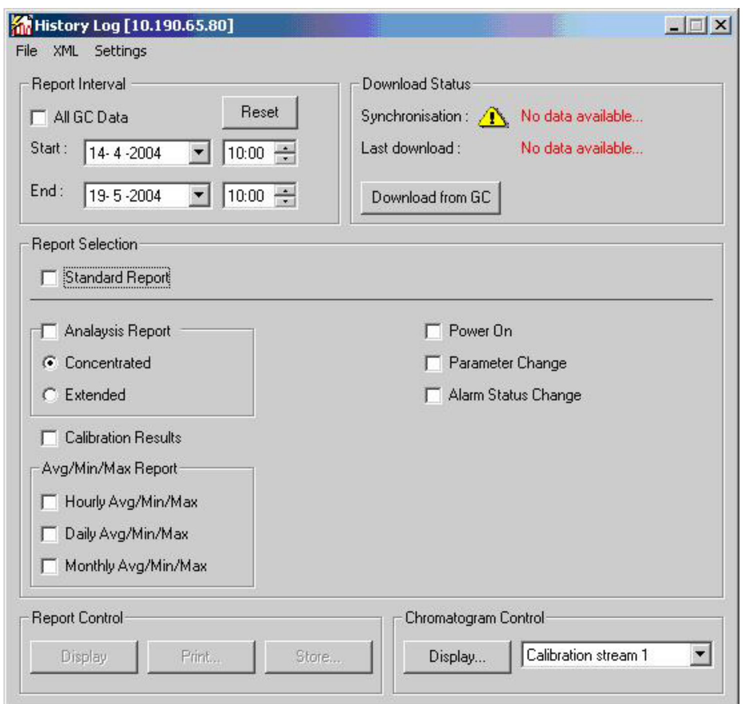


Figure 275. History Log

Setup for data download

To download information from the instrument, it is necessary to configure the application. Configure the IP-address where the instrument is located by selecting: **Settings/GC**.

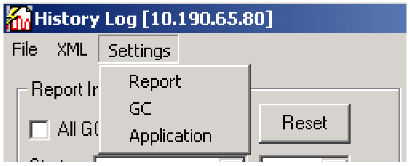


Figure 276. History Log settings

Select the IP-address where the instrument is located in your network (**Settings...GC**). The IP-address is also shown in the titlebar of **History Log**.

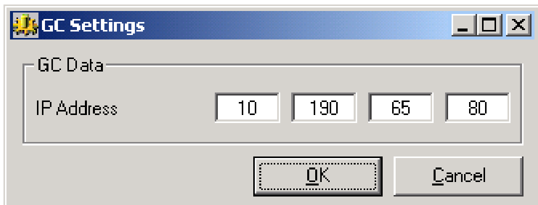


Figure 277. GC settings

To select the files which are necessary for proper operation of **History Log**, select **Settings/Applications**.

In the **Binary Data** window, two fields can be configured: the folder where the binary data is stored after a download. Location can be changed by pressing the button at the end of the input line.

You can also set the number of minutes after which **History Log** will display a warning message, reminding you that data is older than the entered number of minutes.

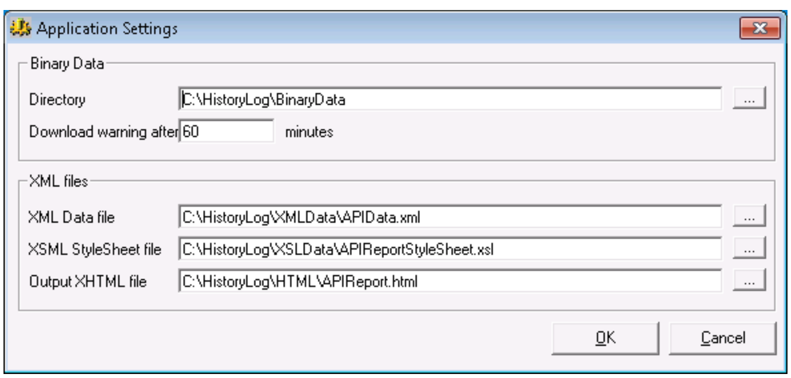


Figure 278. Application settings

In the XML files box, the file for data storage is selected. When a non existing *.xml file is typed, **History Log** will generate this file.

The **XSML Style Sheet** file is selected. This file is responsible for the layout of the output document. The XSML file is supplied with the installation.

When a report is generated, it is stored in the XHTML output file. This file has an *.html extension. This file will also be generated by **History Log** if it does not exist.

Data download

When everything is properly configured, a download can be performed. Press **Start Download from GC**. When **Yes** is selected, a **Processing bar** will appear and the data is stored in the selected XML file under **Settings/Application**.

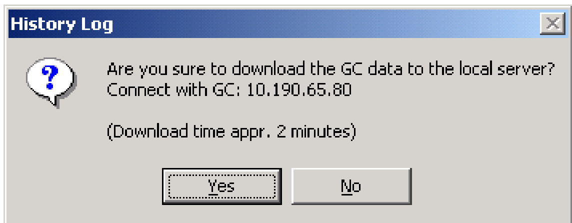


Figure 279. Data download

With each new download, the XML file with data from the last download is cleared and new data is stored in this file. When the last download has important data, it is possible to save this data first with the **XML/Save As** option.

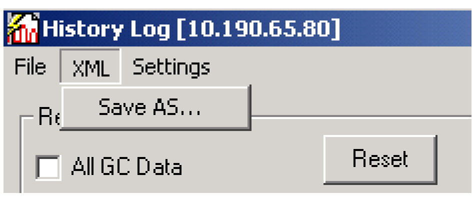


Figure 280. Save XML

After downloading the instrument data, the screen will show that data is available and how old the data is. If the last data download exceeds the time selected in **Settings/Application** a warning will appear. The text will become red and a warning icon is blinking.

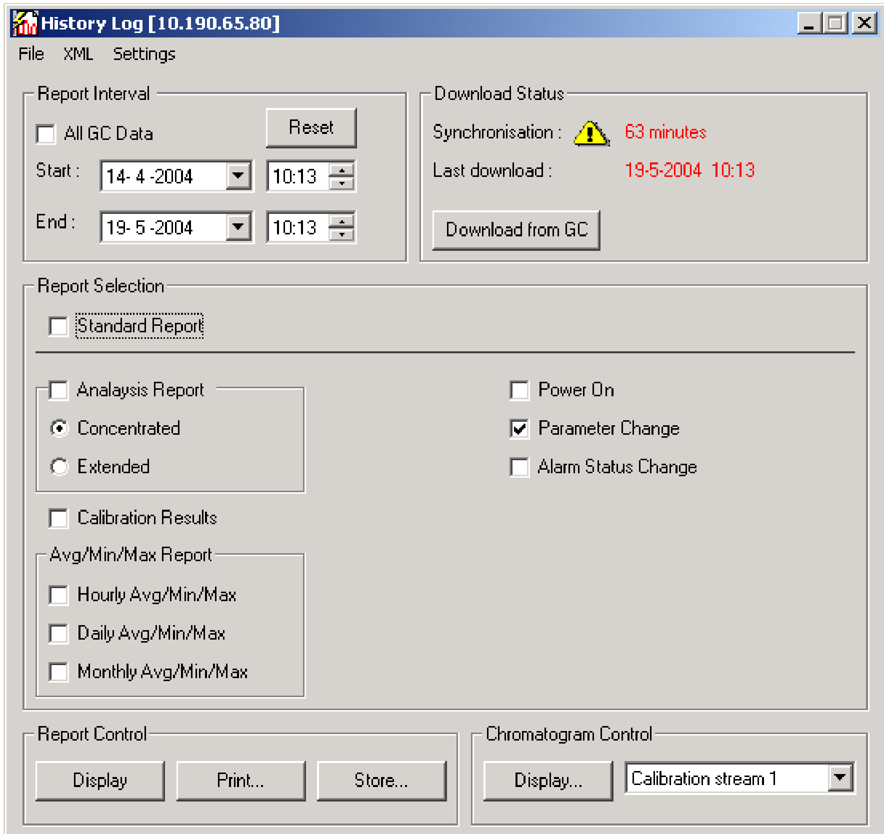


Figure 281. Download with error warning

Setup for report

To mold the data of the *.xml file into an output *.html file with preferred data for the user, different options can be selected.

Report interval

The data which is selected as a standard of the **History Log** is between the date and time of download (start) and 35 days before (end)

Use the arrows next to the **time box** to change the time, or click **time** and enter a new time with the keyboard. To change the **date**, click the arrow and a calendar is shown, It is also possible to change the date by clicking in the box and change the date by entering a number with the keyboard.

Figure 282. Calendar

When the selected time exceeds the end date of the download, a warning appears, because no data is available after your last download. If you want this data, a new download is necessary.

Figure 283. No data

When the selected time in the start box lies before 35 days, a warning will appear. However, it is still possible that this data is available. The instrument buffers all its data and when the instrument was shutdown for a few days, it is possible that data from 36 days ago is still available, because its buffer was not full yet.

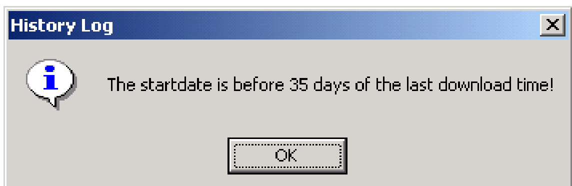


Figure 284. Startdate possible error

Another option is to select all data available. With this option all the data stored until the last download is used for the report. It is possible that data older than 35 days is displayed, because the buffer of the instrument was not full yet.

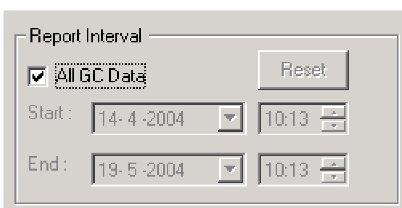


Figure 285. All GC Data

The **reset** button restores the original start and end dates.

Report selection

Two types of report selection are possible: a standard report selection or a report selection for one time purpose.

When the standard selection is not used, the user can rapidly select the options he/she wants. For example, if for some reason the instrument stops working now and then, it is possible to only select **power on** events to see when and in what condition the instrument stopped. But also other analysis options can be selected see **Figure 286** on page 525.

With the standard selection checkbox enabled, the options selected in Settings/Report are used. See **Figure 287** on page 526.

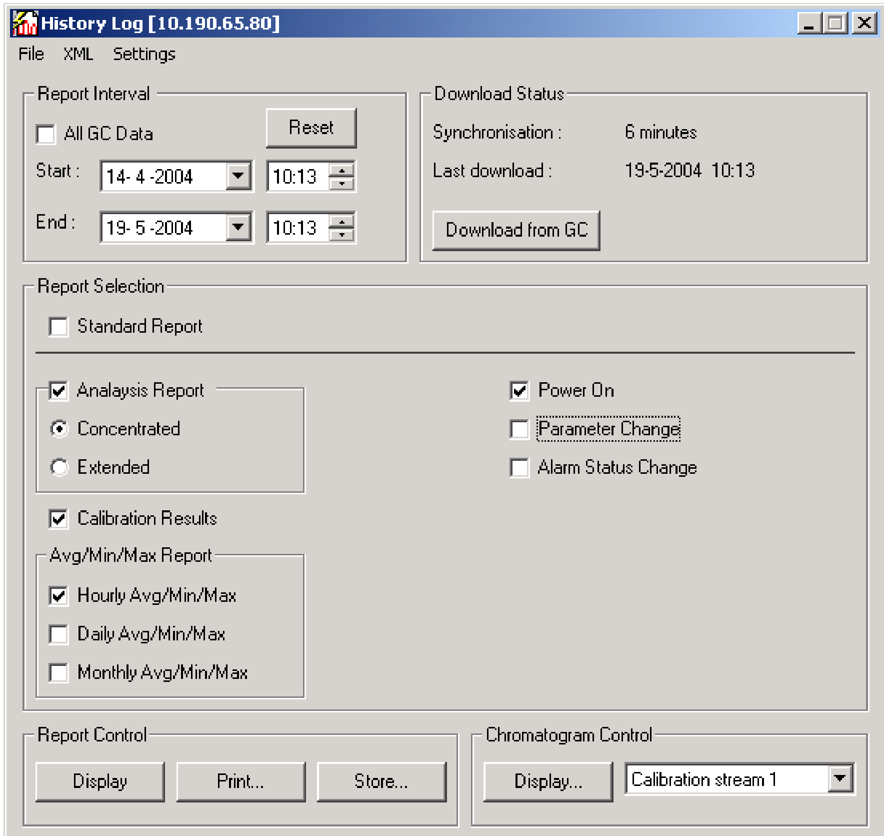


Figure 286. One time report selection

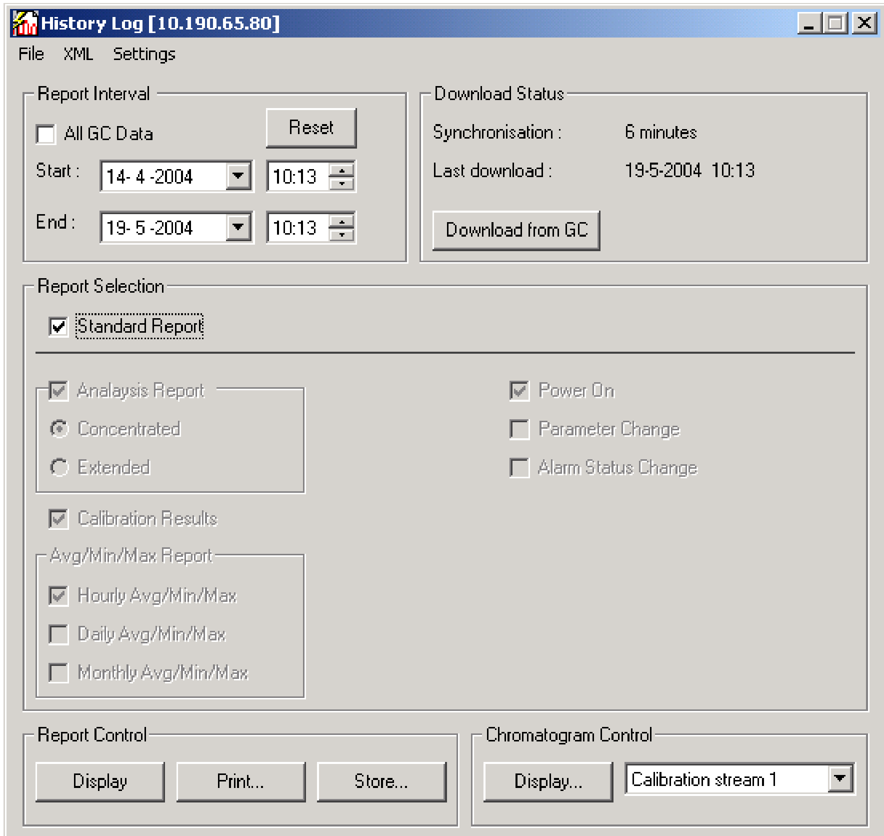


Figure 287. Standard report selection

It is possible to change the standard report options in the menu **Settings/Report**.

By default all options are selected with the exception of **Power On & Last Analysis** and **Alarm Status Change** ? **Analysis before/after Alarm status change**.

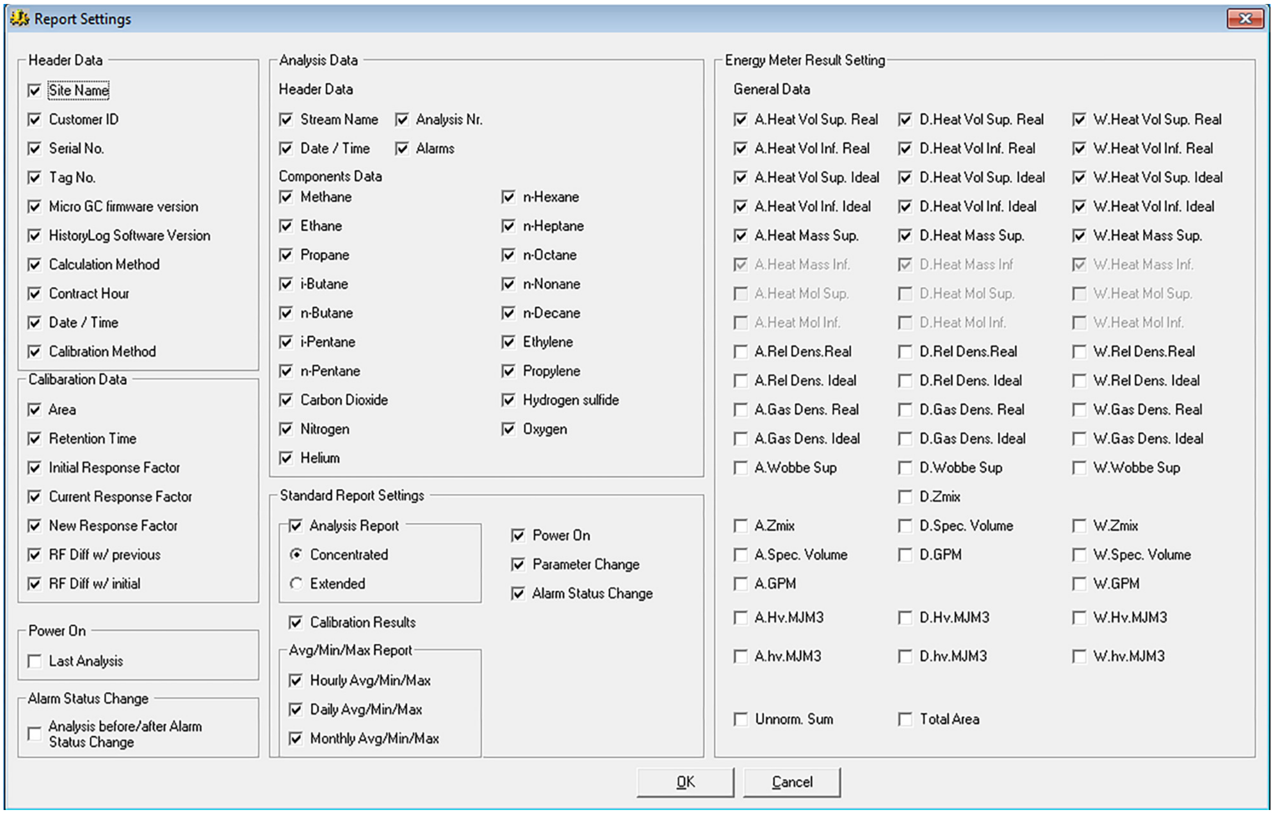


Figure 288. Default report settings

The **Standard Report Settings** resembles the settings for the one time report configuration.

In the **Header Data, Calibration Data, Power On, Alarm Status Change** and **Analysis Data** all options desired can be selected. These options are used in both the **one time report** as in the **standard report**.

For **Analysis Data** you can select the number of decimal places used.

With the **free** parameter, all decimals available in the data from the instrument are used.

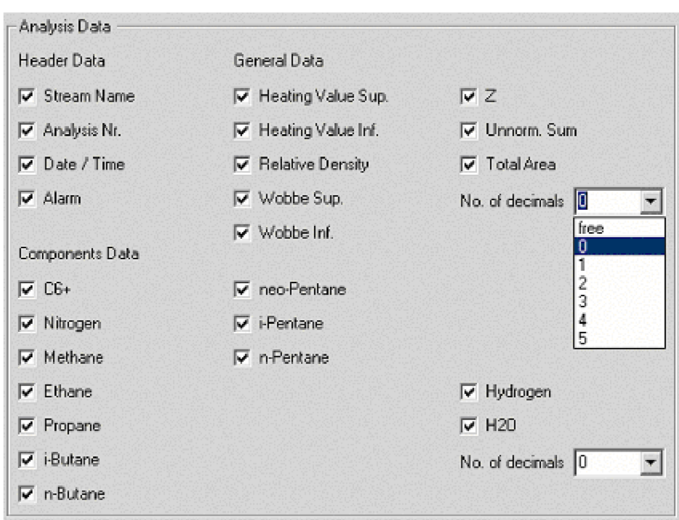


Figure 289. Report options

When all selections for the reports are made and confirmed with **OK**, save the configuration. Go to **File/Save As**.

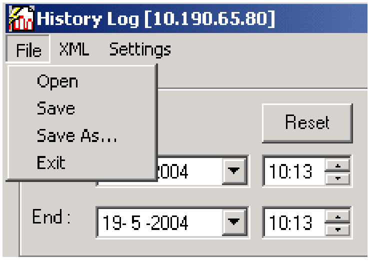


Figure 290. Saving the configuration

Select the directory where the configuration file (in this example the name **sample.cfg** is used) will be saved.

After saving the file, the next time the **History Log** is started this configuration is loaded. In the title bar **sample.cfg** and the IP-address are shown.

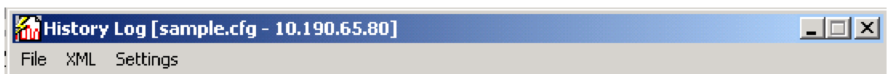


Figure 291. History Log startup

To open a configuration which was previously saved, select **File/Open** and select the configuration you want to use.

When the configuration you are working with is modified, the user can save any changes by selecting **File/Save**.

Report control

In the **Report Control** box three options are available; **display**, **print** and **store report**. When the user wants to display the report, a pop-up box appears:

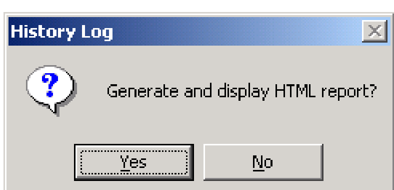


Figure 292. Report control box

After confirmation, the processing bar will be shown and in your web browser the data is shown as an *.html file.

To print the report, a pop-up box appears as shown. When **Yes** is selected, the default printer screen is shown (see **Figure 294** on page 529). This screen could differ for every computer.

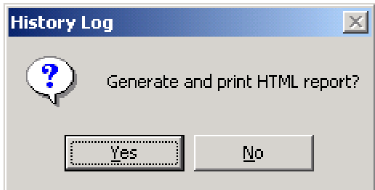


Figure 293. Report print box

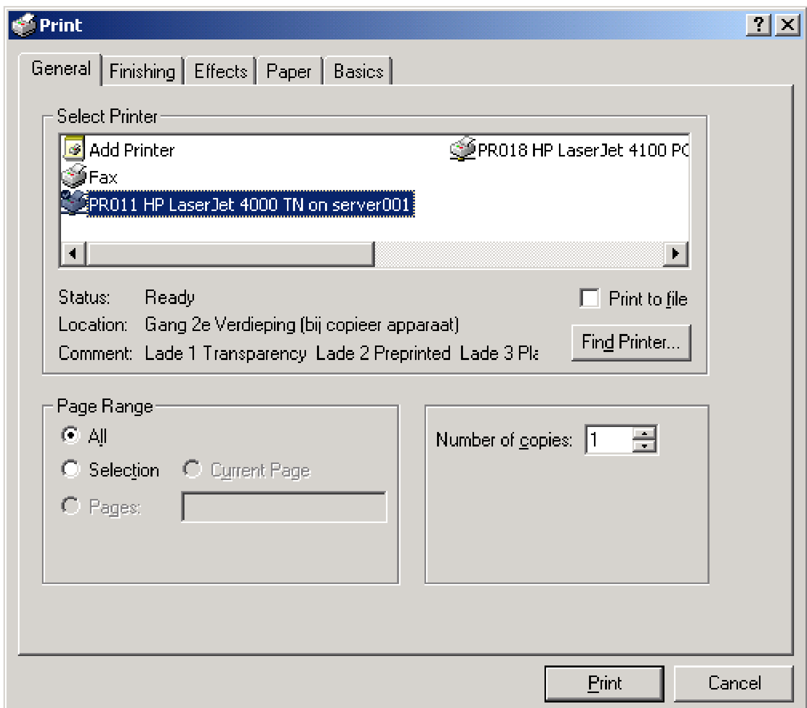


Figure 294. Default printer screen

After selecting **Print**, the report is printed.

The last option is to store the report. By clicking **store**, the pop-up will appear. After confirmation the file can be stored in the selected directory.

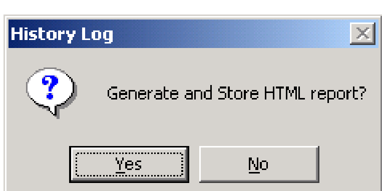


Figure 295. Storing control

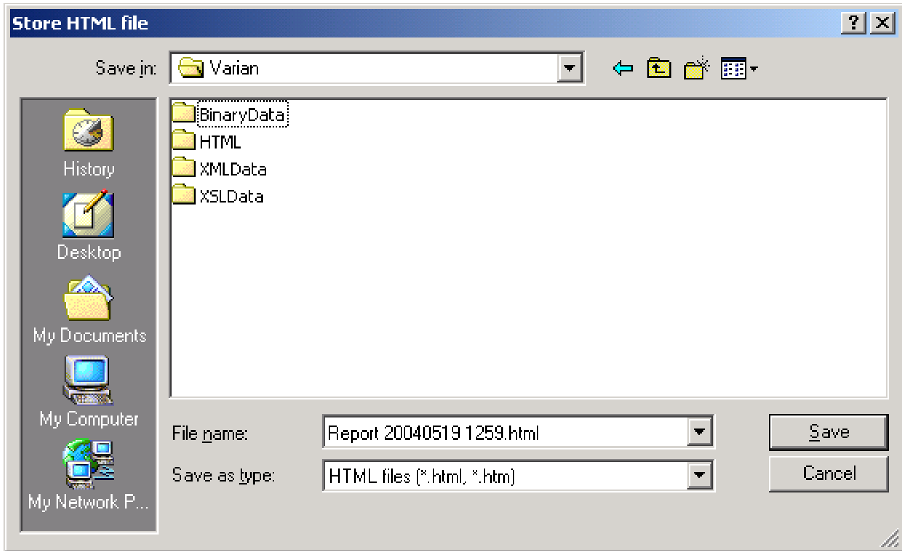


Figure 296. Storing the report

The file is stored in *.html format and gets a date and time stamp automatically. The name can be changed to a more intuitive name, like **power on events 20040519 1259.html**.

Chromatogram control

Chromatogram Control can show the analysis chromatogram for:

The last five alarms;

The last calibration for all two calibration streams;

The last sample stream for all four sample streams.

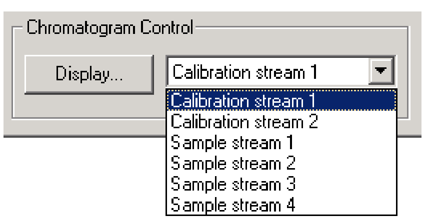


Figure 297. Chromatogram control

After the selection shown and the **Display** button is pressed, the **Processing** bar will appear and the chromatogram for the selected option is shown.

Exit history log

To exit the **History Log**, select **File/Exit**. The application will exit. When a change is made to the configuration, a pop-up box will appear.

Figure 298. Save settings

To save the settings, click **Yes**, to ignore the changes, click **No**, to stop exiting, click **Cancel**.

Report Data

HistoryLog can generate several types of reports.

Header

Every report has a header. It contains information about the company selected in report settings. For example, when the checkboxes **Site Name, Company ID** and **Software Version** are selected, these items are shown in the header.

Calibration results

If the checkbox **Calibration Results** is selected, calibration data is shown. Use the report settings to select the options to appear in the report, for example **Area**, **Retention Time** and **Initial Response** factor.

Analysis data

When **Analysis Data** is selected, the data can be displayed in either concentrated or extended form. In the concentrated version, all data is placed on one line after each other. In the extended version, all data is stretched out in separate headers. This makes it easier to read one analysis. However for a lot of analyses the concentrated report is preferred.

In the **Report Settings**, all options for general and component data for the analysis can be selected, including the number of digitals. When **free** is selected, all digitals available are shown in the analysis data.

Avg/Min/Max

The **Avg/Min/Max** shows the average, minimum and maximum values of all selected general and component analysis for every stream.

There are three types of **Avg/Min/Max**:

Hourly

Daily

Monthly

When an **Hourly Avg/Min/Max** is selected and two days are filtered, then 48 separate data of **Average**, **Minimum** and **Maximum** are shown. For each stream there is also an **Average**, **Minimum** and **Maximum** available, which means that 4 * 48 analyses are shown.

The **Avg/Min/Max** report depends on the contract hour. For example, the contract hour is set on 06:00:00 and the filter is between 12 May 07:00 and 17 May 07:00, then for a daily report 13, 15, 16 and 17 may are displayed (until 18 May 05:59). The selection is **ON** 06:00 AM.

The monthly report starts on the first day of the month. When the filter is selected between 02 March and 02 May, 2 months will be displayed, April and May. March is not displayed because the trigger is set on the first day of the month.

For an hourly report the contract hour is not used.

In the instrument no distinction is made between standard time and daylight saving time, so mind out that the time stamp of the data in this switch is not changed and might have a different time stamp than you expect.

Power on

With the **Power On** option it is possible to see when the instrument was started. Only the last 10 Power On events are stored. In the report settings it is possible to enable the **Last Analysis** at the power on events. With this option selected the power on event and its last known analysis is shown. The user might find a reason why the Micro GC shut itself down, in case of malfunctioning.

Alarm status change

The option **Alarm Status Change** displays the status when an alarm occurs or is cleared. When the option **Analysis before/after Alarm Status Change** is checked the analysis is displayed before and after an alarm change. With this option it may be possible to see why an alarm is set or reset.

Parameter change

With **Parameter Change** selected all parameters changed in the instrument are shown with their old and new value. Parameters are some of the header values like contract hour, *Date/Time of GC*, **Calculation Method**, **Tag No.** and so forth. But also **Pressure** and **Temperature** settings, which are changed with the PROStation tool are displayed.

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