Agilent PROstation Software for 990 Micro GC

User Manual

Notices

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Warranty

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Safety Notices

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

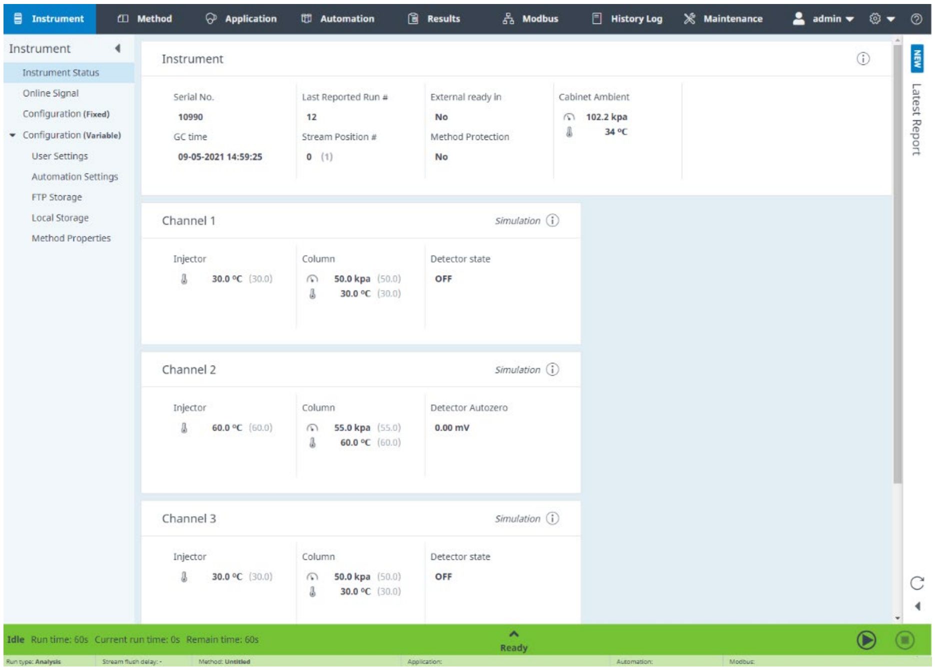
A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Table of Contents

1 Familiarization

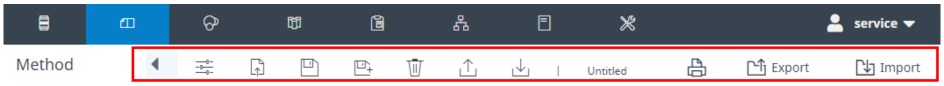
Browser Interface Overview

Connect to and operate the 990 Micro GC using the interface shown here. Sign In and use the tabs to navigate to each GC function. This section includes a PROstation Operation overview.



Navigate within a tab using the menu on the left, if available. You can also scroll the content using the control on the right.

Some tabs will display a row of icons for functions related to that tab, highlighted in the example below.



Explore Control bar features:

Wizards

Open/Load

Save, Save as

Upload

Download

Print

Import/Export

Explore interface tabs:

Instrument Tab

Method Tab

Application Tab

Automation Tab

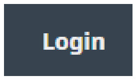
Results Tab

Modbus Tab

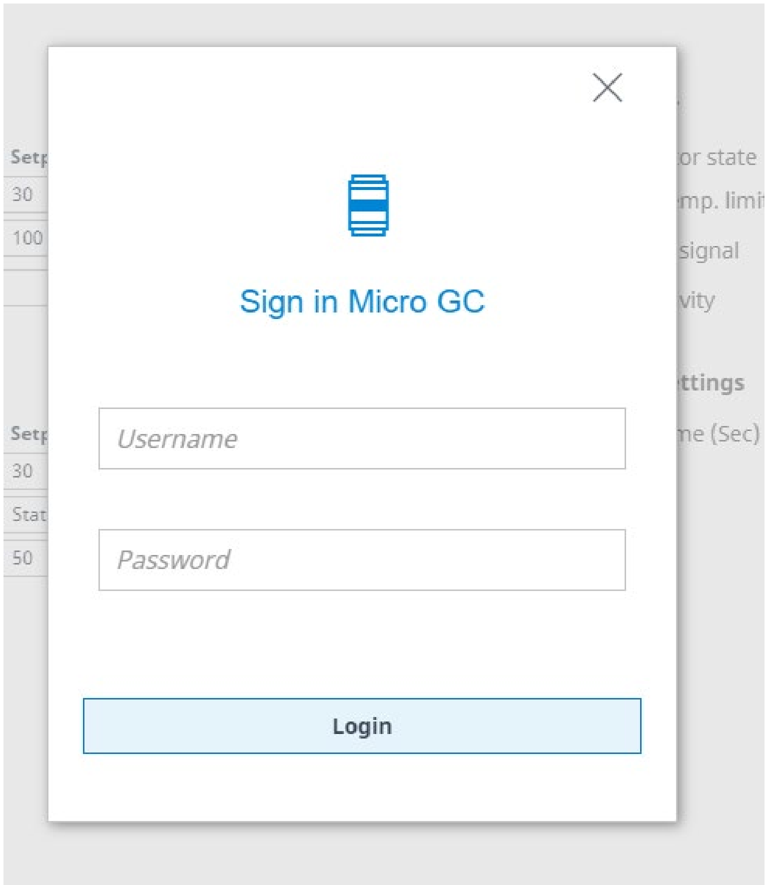
History Tab

Maintenance Tab

Sign In

Click 

at the upper right to enter the login screen.



On the login screen, enter your username and password, then click **Login**.

Depending on the username and password, you will access PROstation with one of the three default security levels.

The Read Only level is the default for the web browser user interface and does not require login credentials.

Security level	Username	Password
Administrator	admin	agilent
Service	service	agilent
Read only	n/a	n/a

For details on user permissions, see User Levels.

Note: Only administrators can change login user names and passwords. See User Levels for more information.

User levels

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

Operator (read only mode)

The authorization only includes viewing reports, chromatograms, method, instrument status, etc. User will not be able to change any parameters of the instrument when in operator role or read-only mode.

Service engineer (service)

Service engineers are authorized to change all parameters to perform chemical analysis and automation, unless the method protection jumper is placed. Once the method protection jumper is set, user will never be able to change any parameters if the instrument. Please consult Agilent representatives or your supplier for more details of this.

Administrator (admin)

Administrators have full control of the instrument. Besides the authorities that the service level has, the administrator has access to a few advanced maintenance features, such as account password management, log file cleanup, and etc.

See also

Settings Tab

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 browser interface.

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, as that is handled inside the 990 Micro GC.

PROstation is capable of showing results only. The data is stored on the instrument or can be transferred to external storage though FTP.

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.

Develop the chromatic 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 (optional).
5. Complete the identification table.
6. Set up calibration parameters.
7. Run the application wizard (optional).
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 on the instrument internally and can be exported 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.

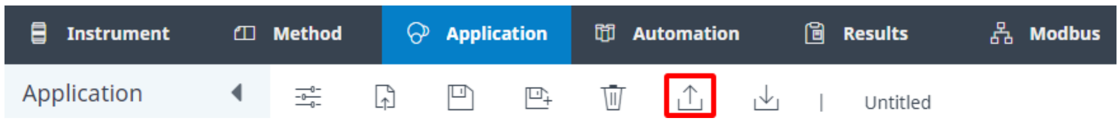
All details about peak calibration can be found in Multi Level Calibration.

Find a number of Input Output signal cases in IO Cases.

Upload/Retrieve

Uploading from the instrument.

Send and retrieve methods, applications, automation settings, and modbus parameters using the Upload and Download icons in the toolbar of each applicable section. The example below shows the toolbar in the Application tab. The Retrieve icon is highlighted in red.

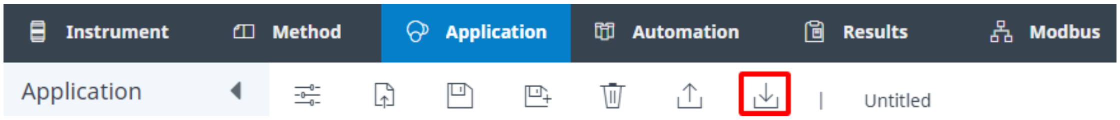


Download/Send

Downloading to the instrument.

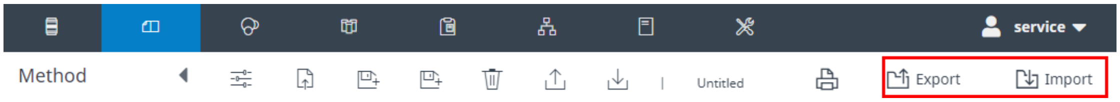
Send and retrieve methods, applications, automation settings, and modbus parameters using the Upload and Download icons in the toolbar of each applicable section.

The example below shows the toolbar in the Application tab. The Send icon is highlighted in red.



Import/Export

Use the icons in the toolbar to download and upload files between the instrument and a PC.



The Import and Export function is specific to each process. In the **Method** tab, Import will filter for method files (.wmet). In the **Application** tab, import filters for application files (.wapp). When in the **Automation** tab, Import will accept only sequence files (.wseq). Modbus files (.wmod) are imported from the **Modbus** tab. Import and export Chromatogram data files from the **Report** sidebar.

For detailed instructions on importing and exporting, refer to the section specific to that process.

To use a legacy method file (.pmed) or legacy application file (.papp), follow below steps to convert it to the compatible format:

1. Use the legacy PC PROstation for 990 to download the file to instrument.
2. Use the browser interface PROstation to upload the information to browser, review the parameters, and check if settings were imported accurately.
3. Save / Save as the file into the new format.

Grid Operation

Table options

Table contents are edited using the grid toolbar. Toolbar options vary depending on the table selections and function.

Append a row using the  **Append row** icon.

Insert and delete rows using the **Insert row**  and **Delete row**  icons.

To quickly copy data from one row into the rows below, select the row to copy and Use the **Fill Down**  icon.

License Definitions

Available features are determined by license. Refer to the table below for more details.

- When no license dongle is connected, the Micro GC Standard version features are available.
- When Express license dongle is connected, instrument has Micro GC Express version features.
- When PRO license dongle is connected, instrument has Micro GC PRO version features.

Available features will affect visibility of some menu items as well as the availability of certain features within menus.

Top Menu	Second Menu	Standard	Express	PRO
Instrument	Instrument Status	☑	☑	☑
	Online Signal	☑	☑	☑
	Configuration (Fixed)	☑	☑	☑
	Configuration (Variable)		☑	☑
Latest Report	Latest Report		☑	☑
Run Control	Start / Stop		☑	☑
Method	Instrument setup	☑	☑	☑
	Integration events		☑	☑
	Peak identification		☑	☑
	Calibration		☑	☑
Application	Normalization		☑	☑
	Calorific Power			☑
	Verification Check		☑	☑
	Alarm		☑	☑
	Timed Relays			☑
	Analog Inputs			☑
	Analog Outputs			☑
	Digital Inputs			☑
	LCD settings		☑	☑
Automation	Sequence		☑	☑
	Verification		☑	☑
	Calibration		☑	☑
Results	Data review		☑	☑
	Data reprocess		☑	☑
Modbus	Settings			☑

	Registers			☑
History Log	History Report		☑	☑
	Trend Analysis		☑	☑
Maintenance	Date & Time	☑	☑	☑
	Network	☑	☑	☑
	Network (WIFI)	☑	☑	☑
	Network Drive		☑	☑
	Debug IOs			☑
	Diagnostic Logs	☑	☑	☑
	License Dongle		☑	☑
	VICI Valve Config	☑	☑	☑
	System Reset	☑	☑	☑
Settings	Localization	☑	☑	☑
	Account Management	☑	☑	☑

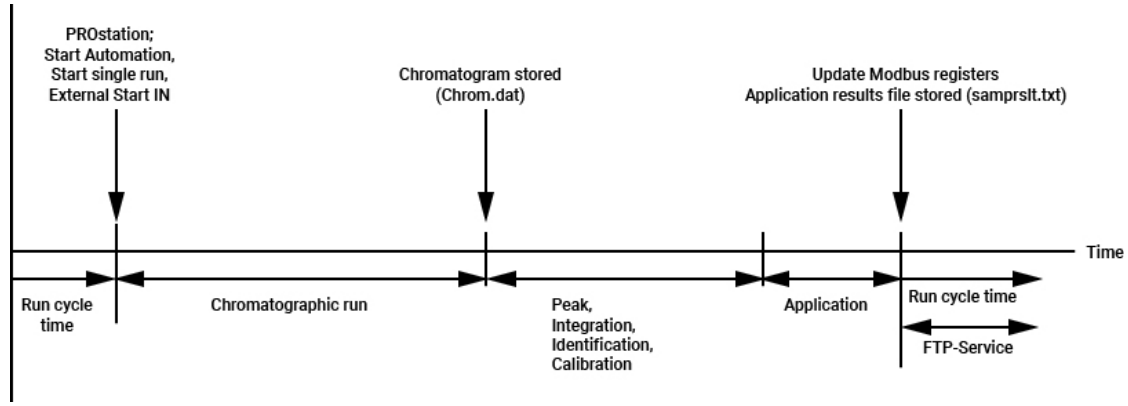
2 Cycle Scheme

990 Micro GC Cycle Scheme

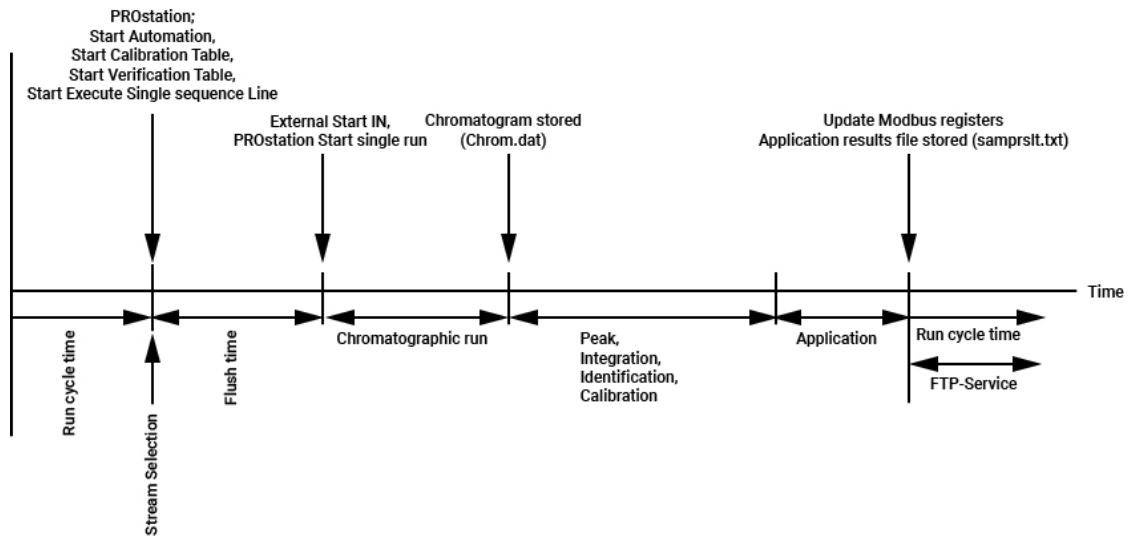
In this section

990 Micro GC Cycle and Stream Selector

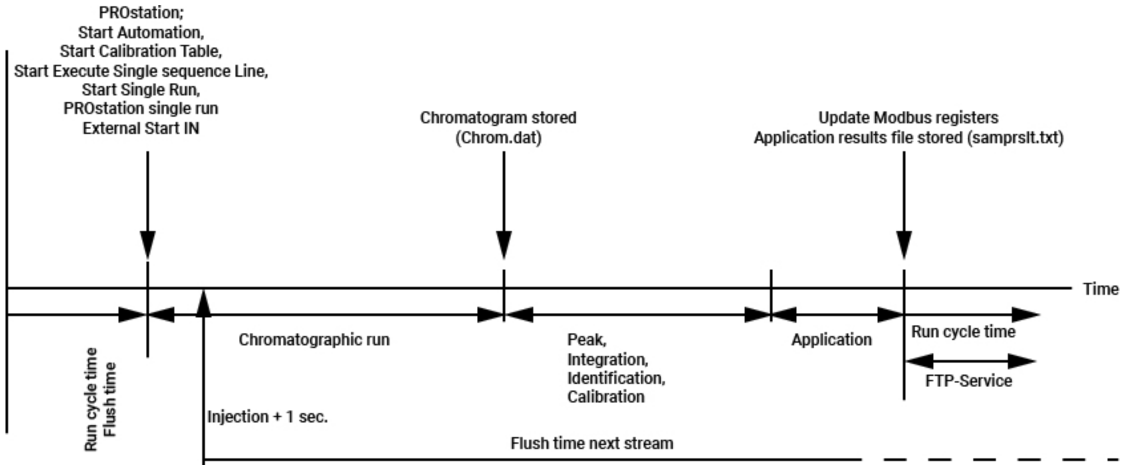
990 Micro GC without Stream Selector



990 Micro GC Cycle with Stream Select without Stream Ahead

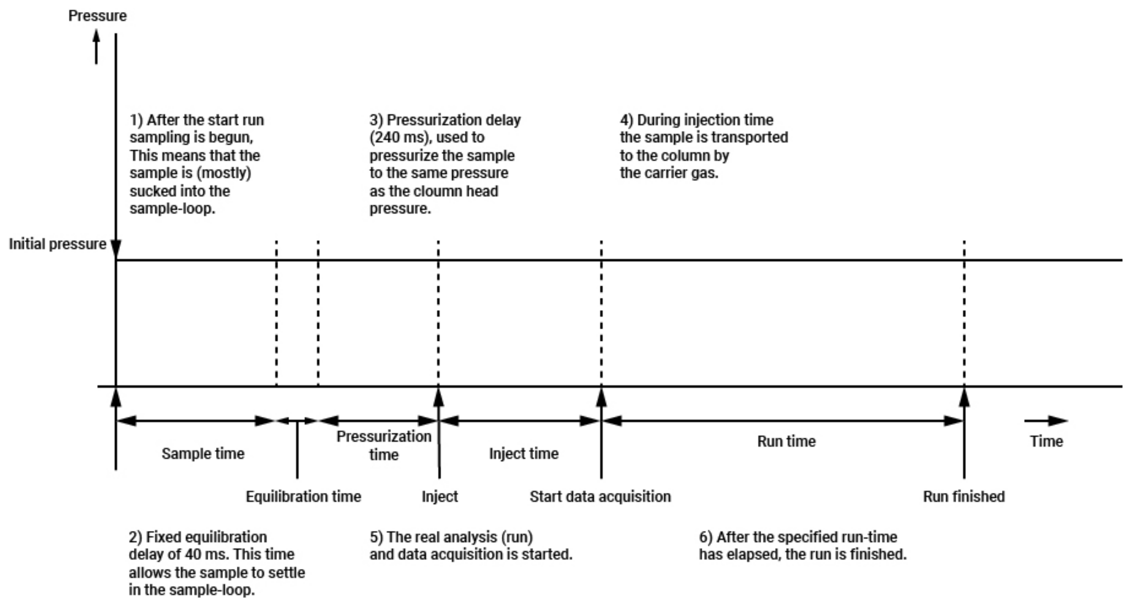


990 Micro GC Cycle with Stream Select with Stream Ahead



990 Micro GC Chromatographic Run and Electronic Pressure

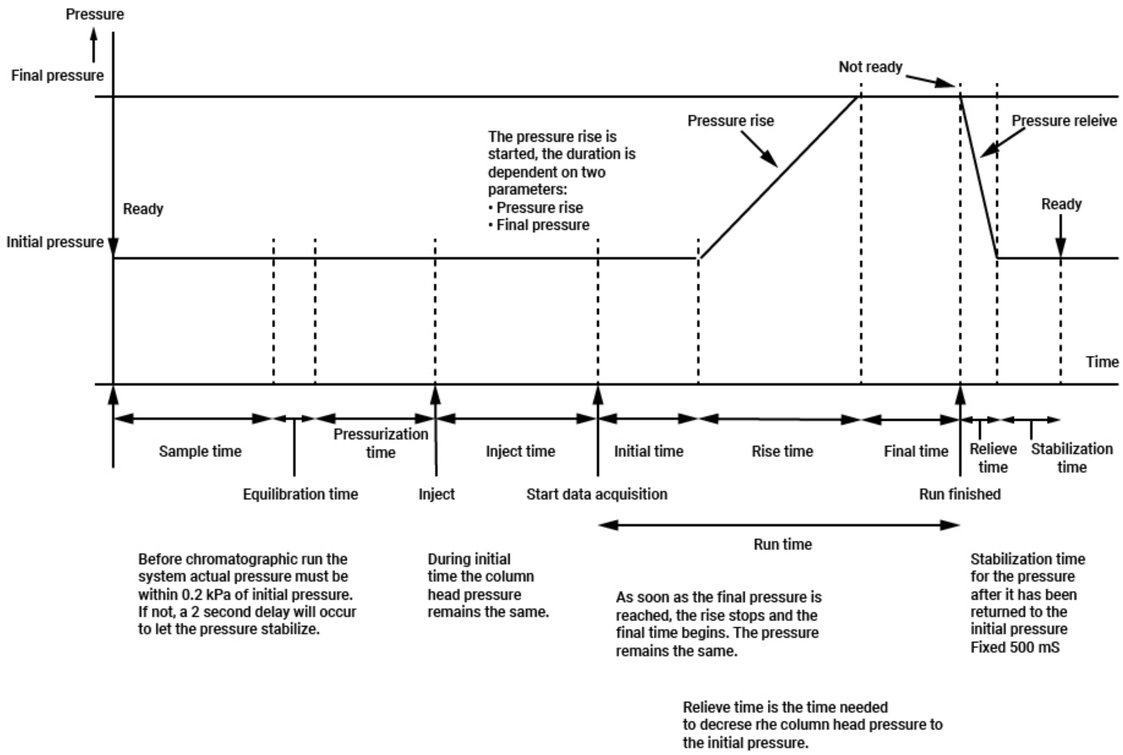
990 Micro GC Run with Static Pressure



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.

990 Micro GC Run with Electronic (Programmed) Pressure

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.



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.

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

3 Instrument Tab

Instrument Tab

Use the Instrument Tab to view and change settings for method development and monitoring analysis.

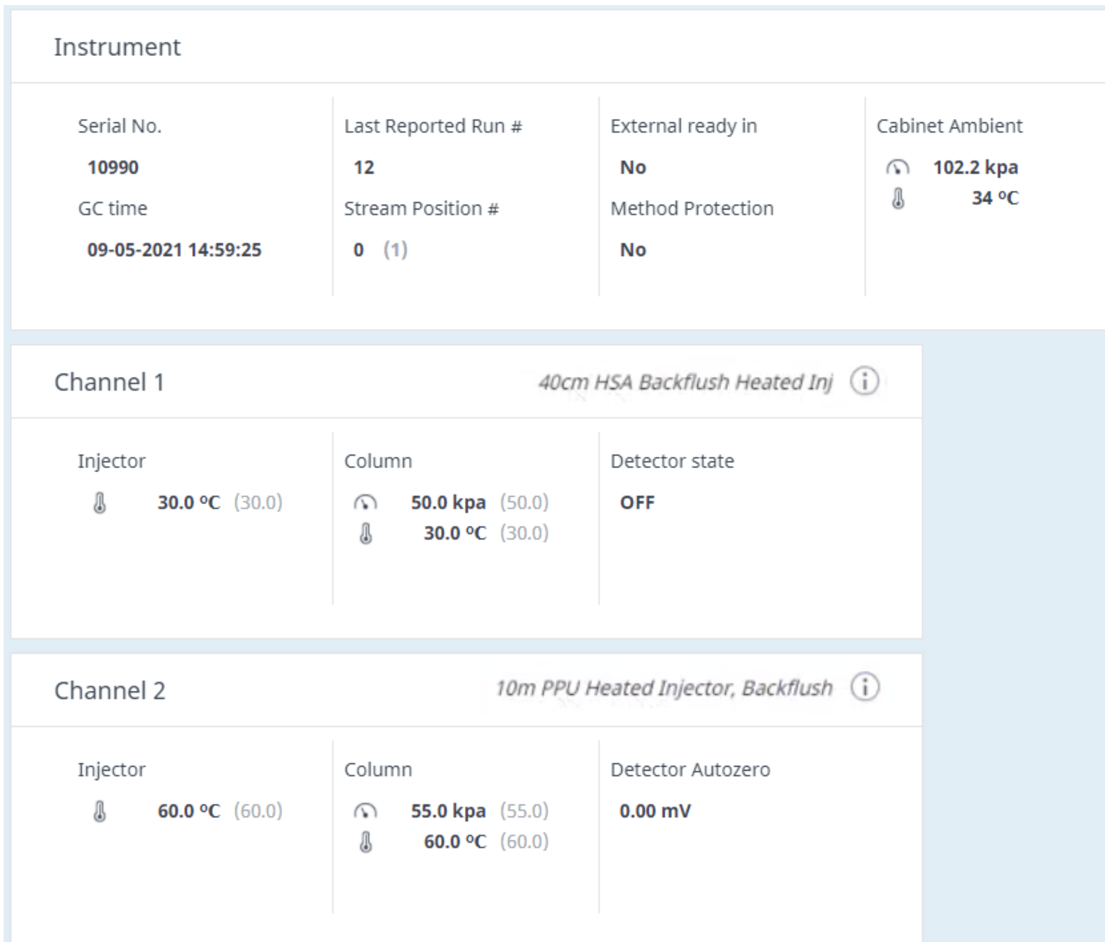
Instrument Status, Online Signal, and Configuration.

In this section

Instrument Status

View current instrument and channel information and status. Each channel shows the injector temperature, column pressure and temperature, as well as column details.

Clicking the info icon will display more channel information such as detector type and gas type.



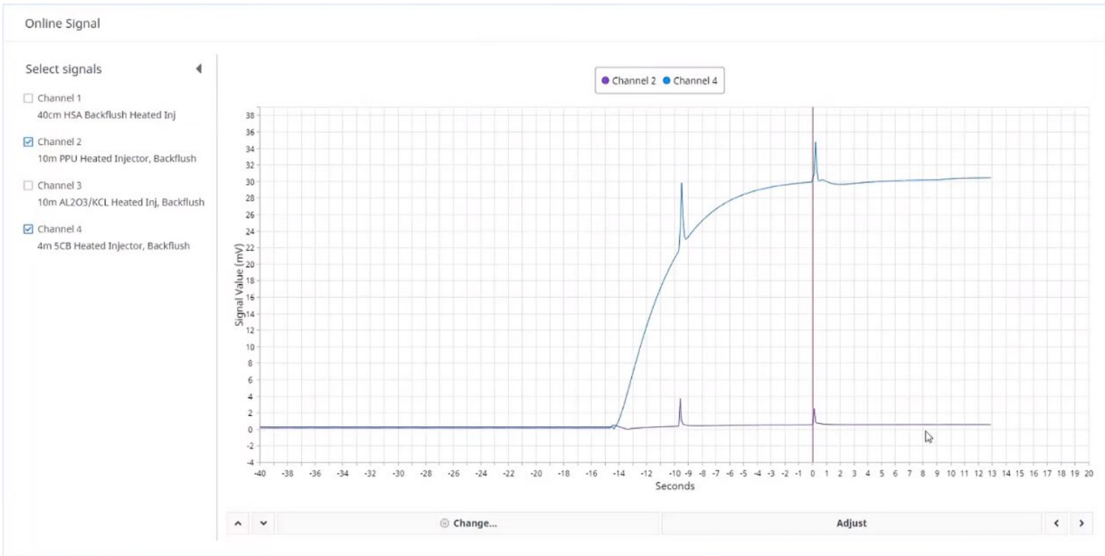
See also

[Status Panel]

[Instrument Control]

Online signal

View current instrument signals. Select signals to view from the list of online channels. You can show and hide selected signals by selecting the channel(s) from the graph key at the top of the chromatogram display.



The signal curve supports operations such as:

- Zoom - Use mouse on desktop PC browser to draw a rectangle on the curve to zoom in. Use finger pinch to zoom in / out on tablet.
- Pan - Hold ctrl key on desktop PC browser to pan the plot. Finger touch and move to pan the plot on tablet
- Reset - Double click on the curve to reset the zoom on desktop PC browser.

Select **Adjust** to zoom out to the default range. Select **Change** to enter specific x axis minimum range values, toggle y-axis auto-range, or enter y axis maximum and minimum range.

You can also tune the y-axis and x-axis using the arrow icons at the bottom left and right of the screen.

A red vertical line will indicate the start of the run.

Fixed Configurations

Instrument Configuration Settings

Select the **Instrument** tab. From the **Configuration** section, the following settings are available:

Fixed Configuration:

Hardware and Firmware overview

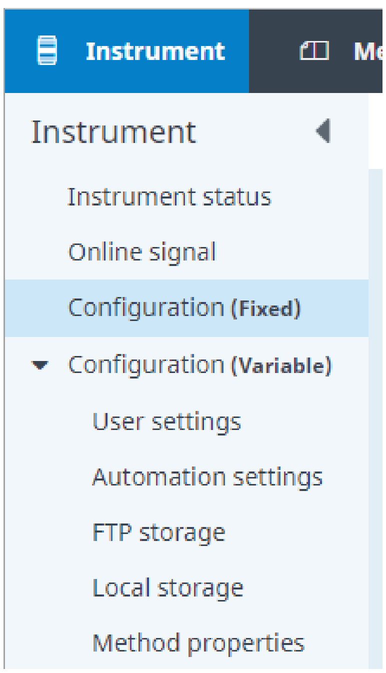
Variable Configuration:

User settings

Automation settings

Storage settings

Method properties

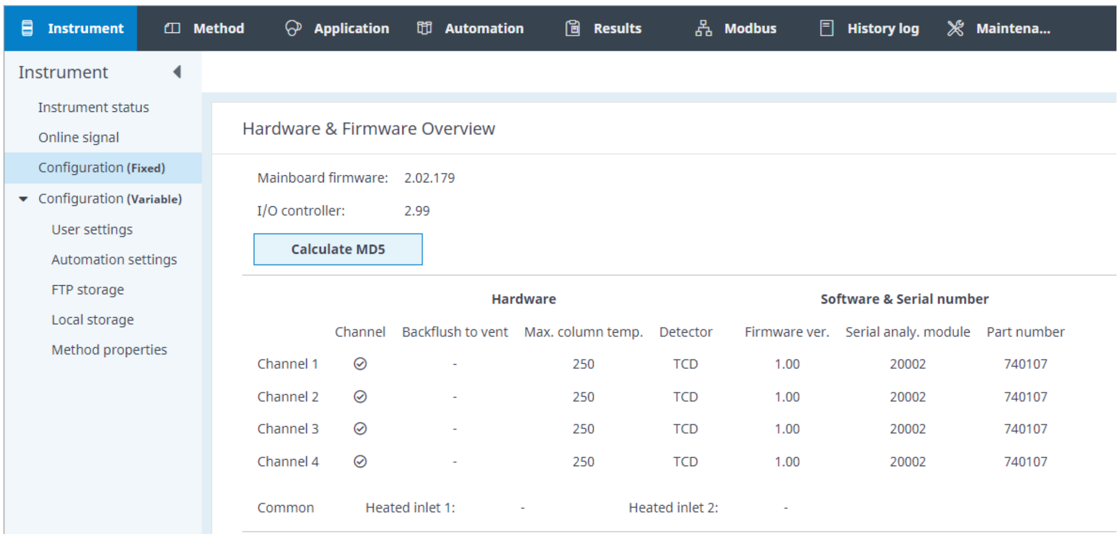


Always click the Upload Config button before editing the various tabs (except if you want to create a virtual instrument).

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 & Firmware Overview

The Hardware & Firmware Overview contains the hardware settings of the 990 Micro GC. These can be uploaded from the instrument by pressing the Upload From Instrument icon. This tab also contains information about the software version, GC type, and license. Channel firmware I/O and other module information is listed.



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.

Mainboard firmware

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

I/O Controller

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

Firmware ver.

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

Serial analy. 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.

Available Licenses and Options

After performing an upload, the available licenses in the 990 Micro GC will be visible. In addition to the basic license, you can have a PRO or Express license with additional options.

Available license options:

- 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.

Variable Configurations

Instrument Configuration Settings

Select the **Instrument** tab. From the **Configuration** section, the following settings are available:

Fixed Configuration:

Hardware and Firmware overview

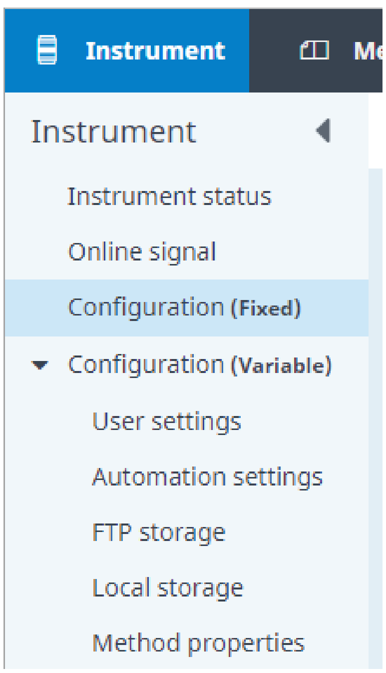
Variable Configuration:

User settings

Automation settings

Stotage settings

Method properties

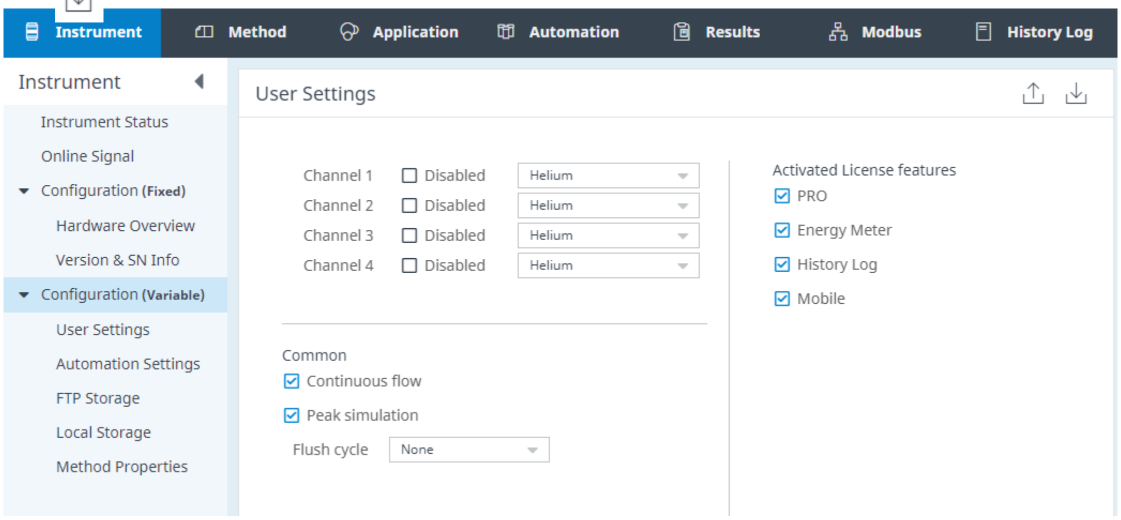


Always click the Upload Config button before editing the various tabs (except if you want to create a virtual instrument).

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.

User settings

The User settings tab contains user selectable parameters. Select the Download to instrument icon to download all changes to the 990 Micro GC.

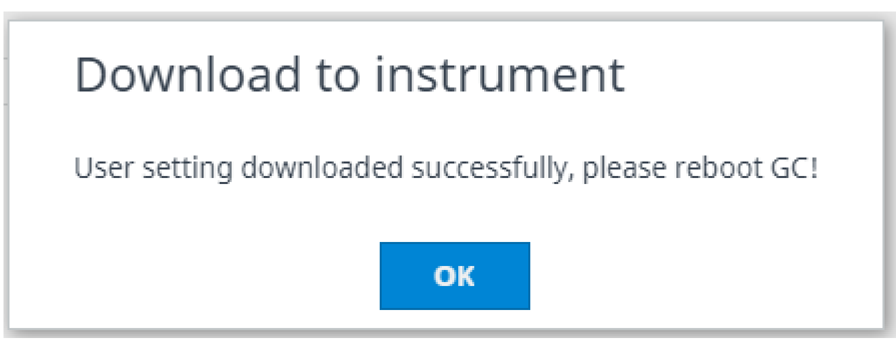


Carrier gas

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.

Download User Settings

Select the Download to instrument icon to download all 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.

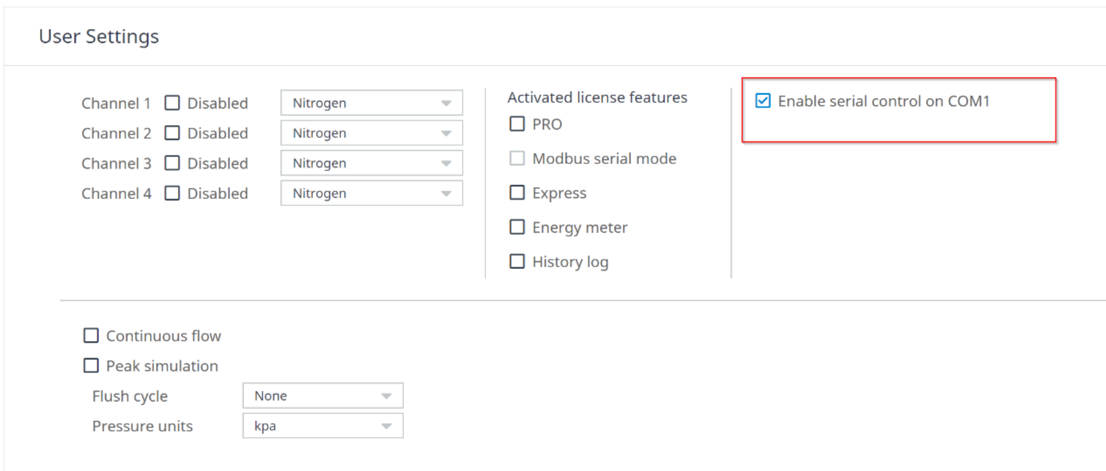
Flush cycles

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.

Enable serial control on COM1 (Standard version only)

By default, CP4900 serial communication protocol is disabled. This checkbox is to support legacy software using the CP4900 serial protocol.

This protocol can only be enabled in the standard version 990 Micro GC.



Automation settings

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

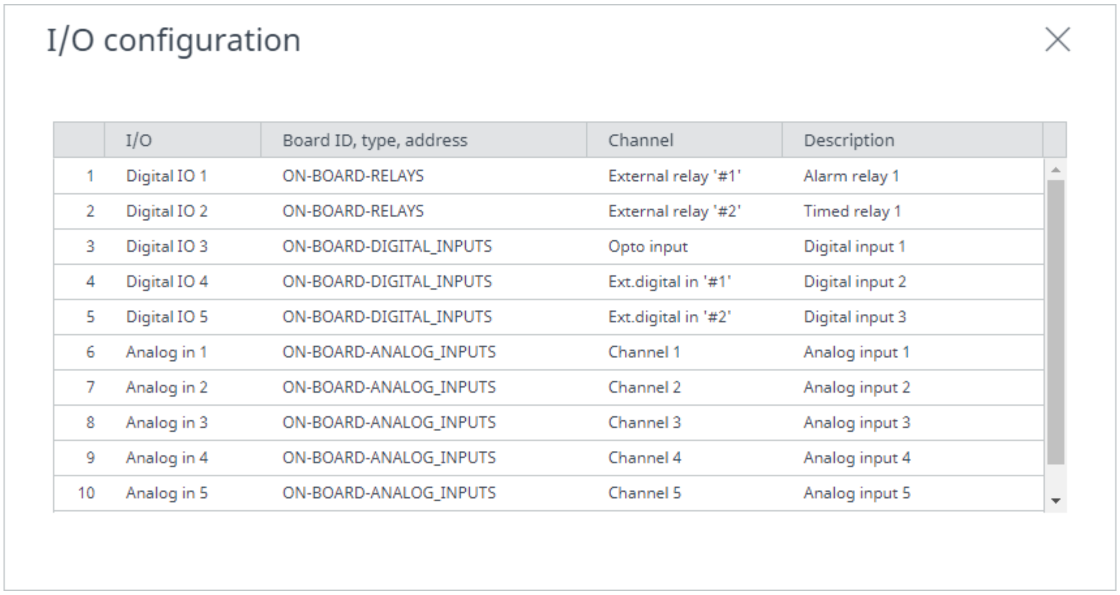
Analog inputs

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.

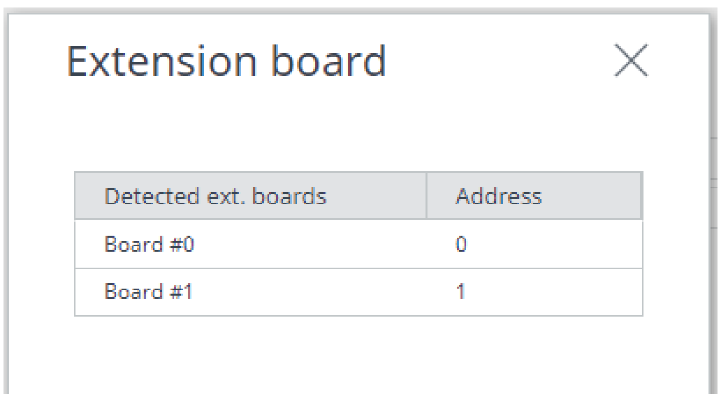
B. Extension board detection

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.

Click on "I/O config summary" button to display the summary table of how I/O's are configured and allocated.



Click on "Extension board" button to display all extension boards connected to 990 Micro GC.



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. 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 COM2. Only one COM-port can be used for a VICI Valco valve at a time. For connection through COM1 a Null modem adapter or a Vici Null cable (p/n VLI22697NULL) 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 and How to use a stream selector valve.

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. 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.

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.

After having chosen the Number of Streams, the availability of the remaining Relays and Inputs are visible in the I/O section. Select IO Configuration to observe the assignment of stream ID's to IO ports.

D. Communication port settings

The 990 Micro GC is equipped with three 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.
  Modbus connection using TCP/IP is implicitly available. No additional configuration is required.

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

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

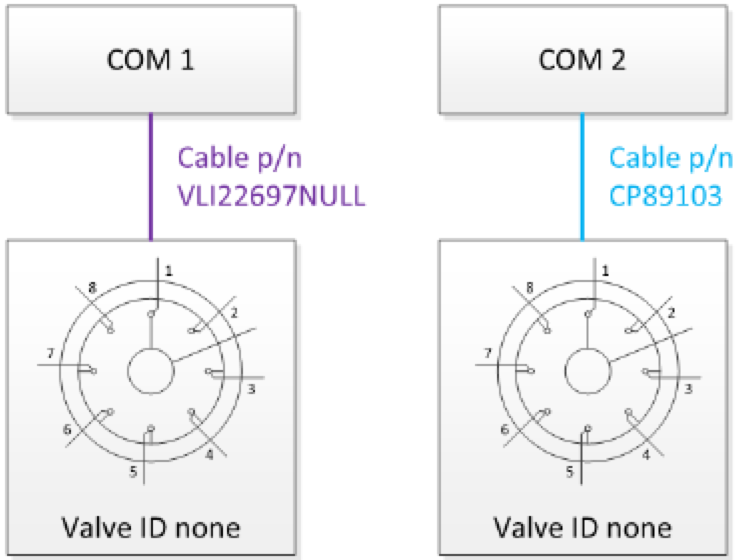
How to use a stream selector valve

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.

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). 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.



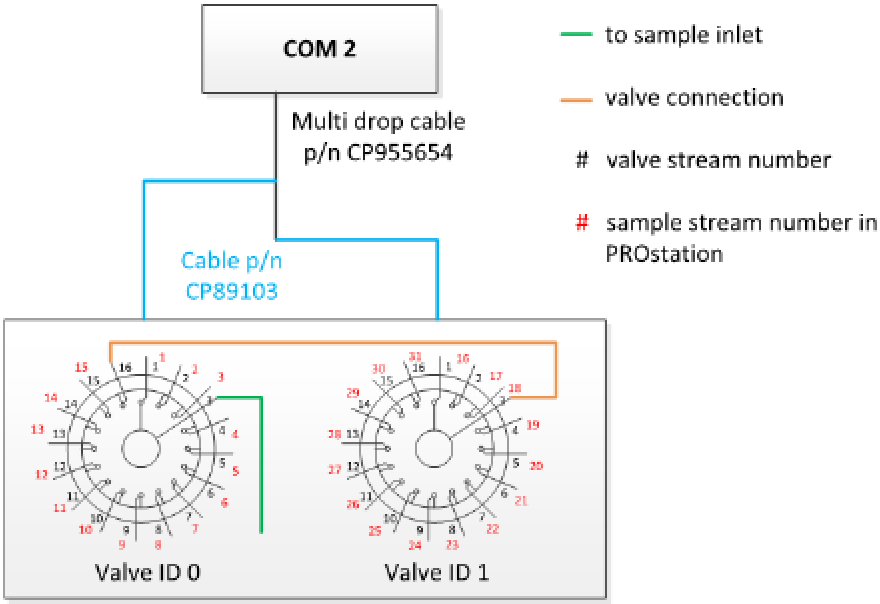
Multiple valves connected through USB

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.

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 the figure below 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.



Setup valve identity

To set or change the valve's identity, use the program VICI Valve configurator.exe. This program can be downloaded from Maintenance -> PC Tool Download. Simply unzip the file and it will be ready for use.

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.

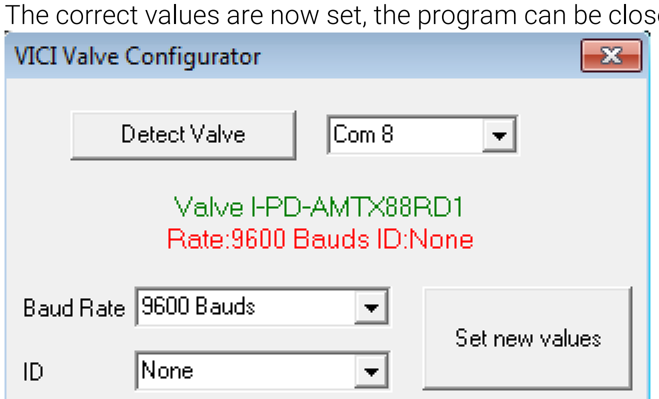
2 Click Detect Valve.

3 Set Baud Rate to 9600 Baud.

4 Set ID to desired number (see Single valve connected through serial com ports or Multiple valves connected through USB sections for correct setting for each scenario).

5 Click Set new values.

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



Another alternative to setup valve identity is by using the **Maintenance** -> **VICI Valve Config** page.

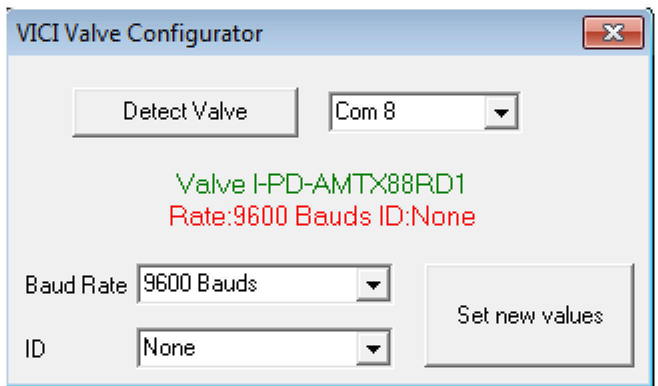
Stream Selection requests from host

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.



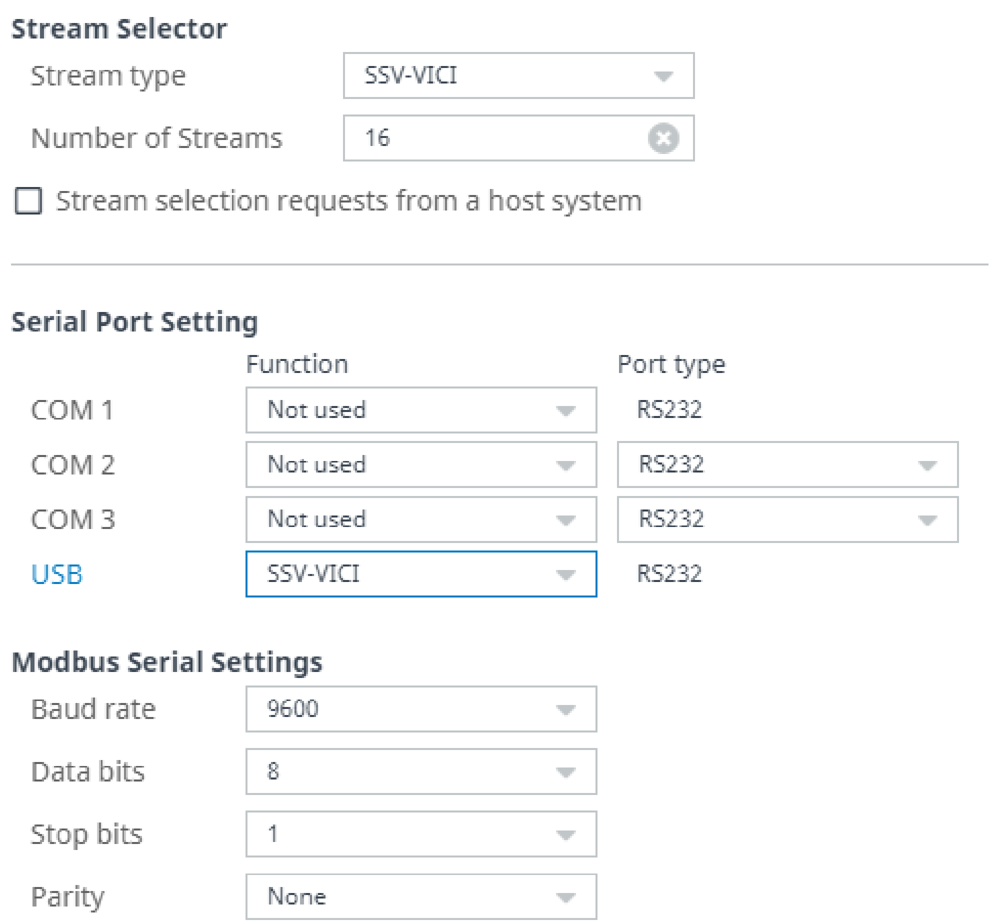
2 Connect the VICI Valve to your 990 Micro GC using either a USB-to-serial cable, or through a USB hub. We currently support the following two types of chipsets.

Prolific PL2303

FTDI FT232

3 Open PROstation.

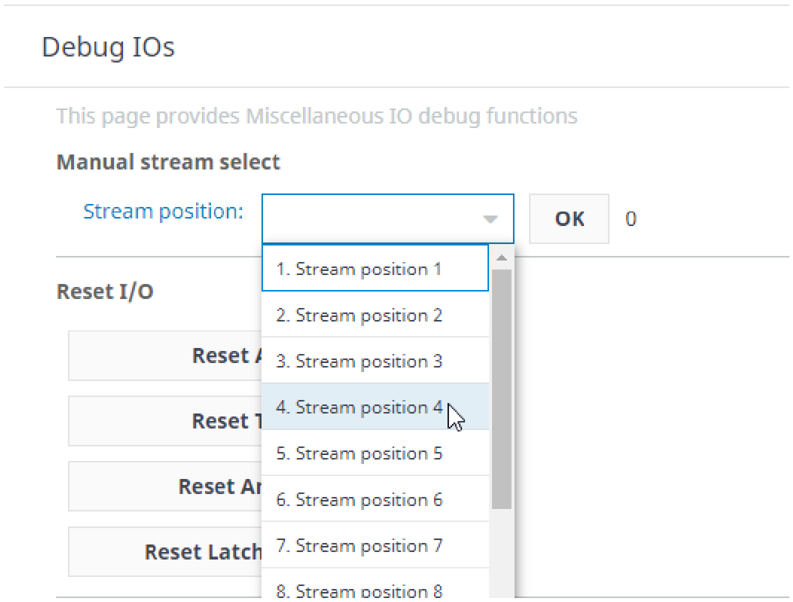
4 Configure your 990 Micro GC. For one VICI Valve, the number of streams is <= 16.



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, reopen PROstation.

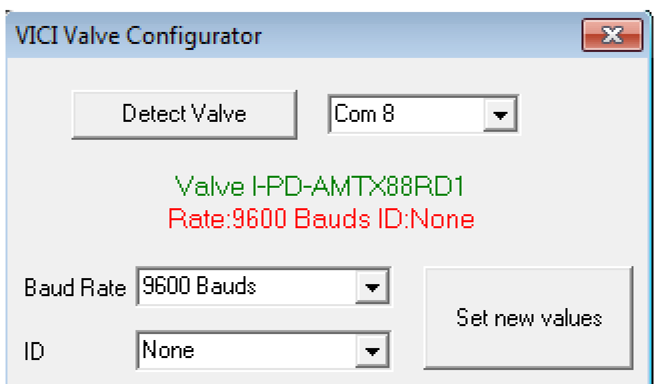
6 Go to Maintenance -> Debug IOs, choose the stream position you want to switch, and click OK. The VICI valve will switch to the target stream, and the number next to OK button will change to match.



Automated run via USB (one VICI)

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

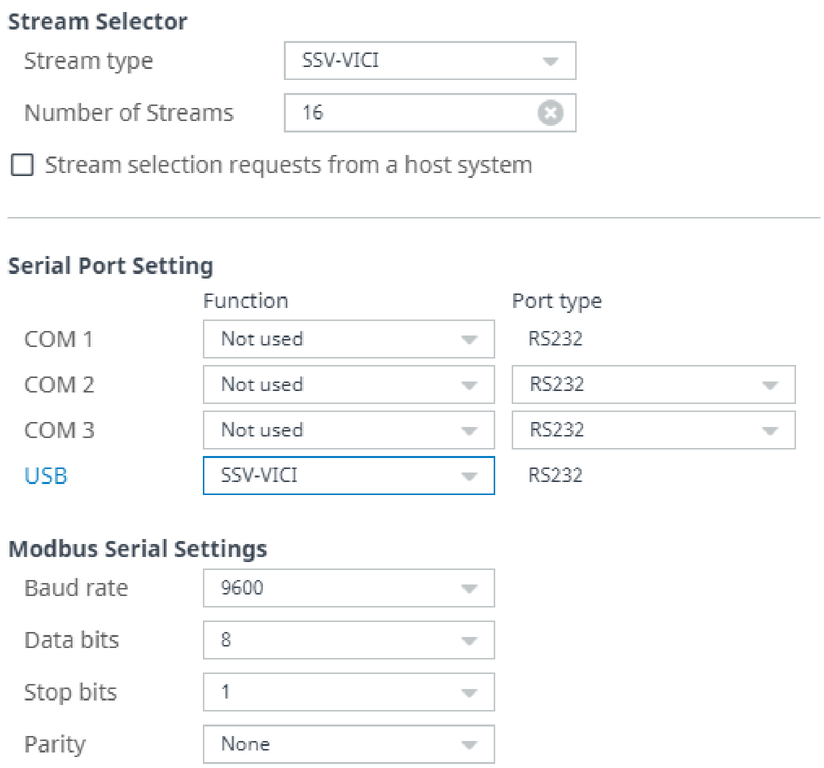
1 Open the VICI Valve configurator. Set the VICI ID to None.



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.

3 Open PROstation.

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



5 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.

6 After rebooting, reopen PROstation.

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

☐ Enable method switching

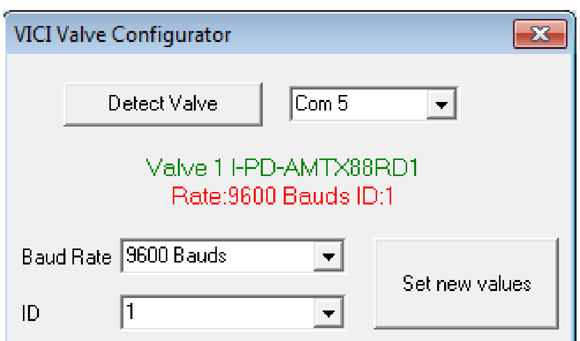
	#	Sample Type	Replicates	Calib. Level	Stream #	Flush Time[s]
☐	1	Analysis	1	1	1	3
☐	2	Analysis	1	1	2	3
☐	3	Analysis	1	2	16	3

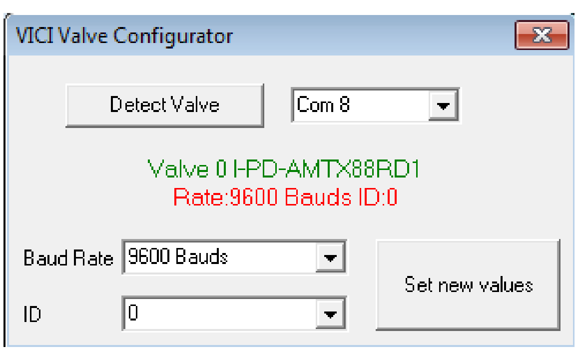
8 Start an automated run. The VICI valve will switch prior to each run, following the sequence table.

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.



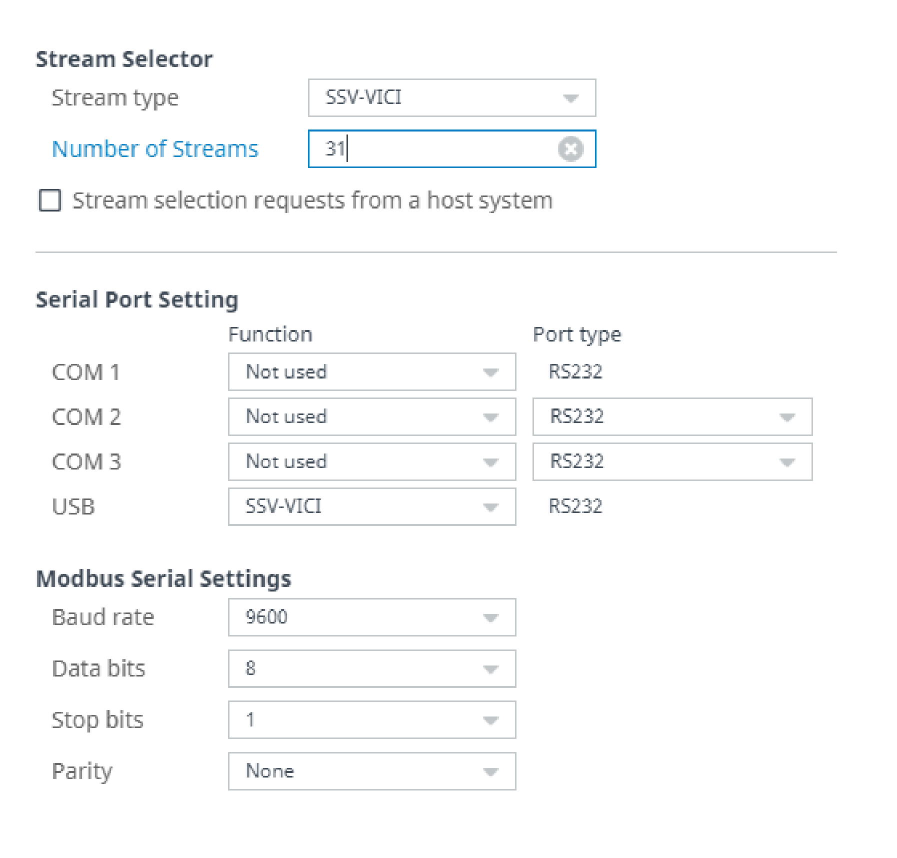


2 Attach the two VICIs to the 990 Micro GC through USB-to-serial converters and a USB hub.

3 Open PROstation.

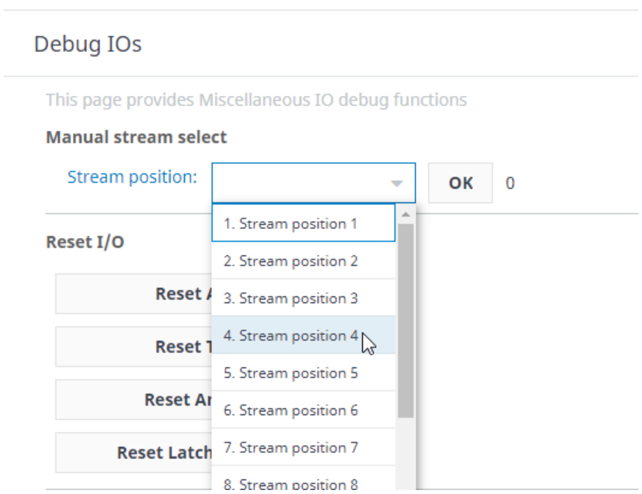
4 Configure the 990 Micro GC as follows: For two VICI Valves, the Number of Streams is <= 31. You can also click Configure USB to check whether the attached

USB-to-serial cable is recognized.



5 After rebooting, Reopen PROstation.

6 Go to Maintenance -> Debug IOs.



7 Choose Stream position 5 and click OK. The VICI0 switches to 5, and VICI1 does not change.

8 Choose Stream position 17 and click OK. The VICI0 switches to 16, and VICI1 switches to 2.

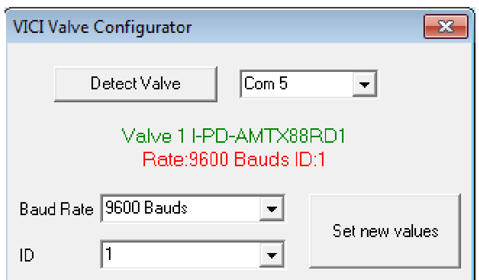
9 Choose Stream position 8 and click OK. The VICI0 switches to 8, and VICI1 does not change.

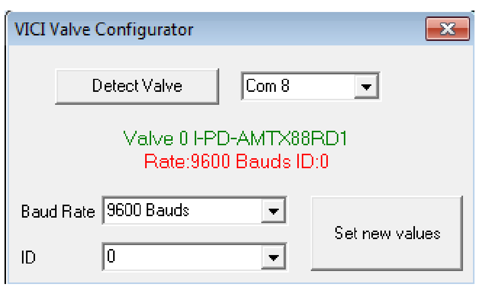
10 Choose Stream position 26 and click OK. The VICI0 switches to 16, and VICI1 switches to 11.

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.

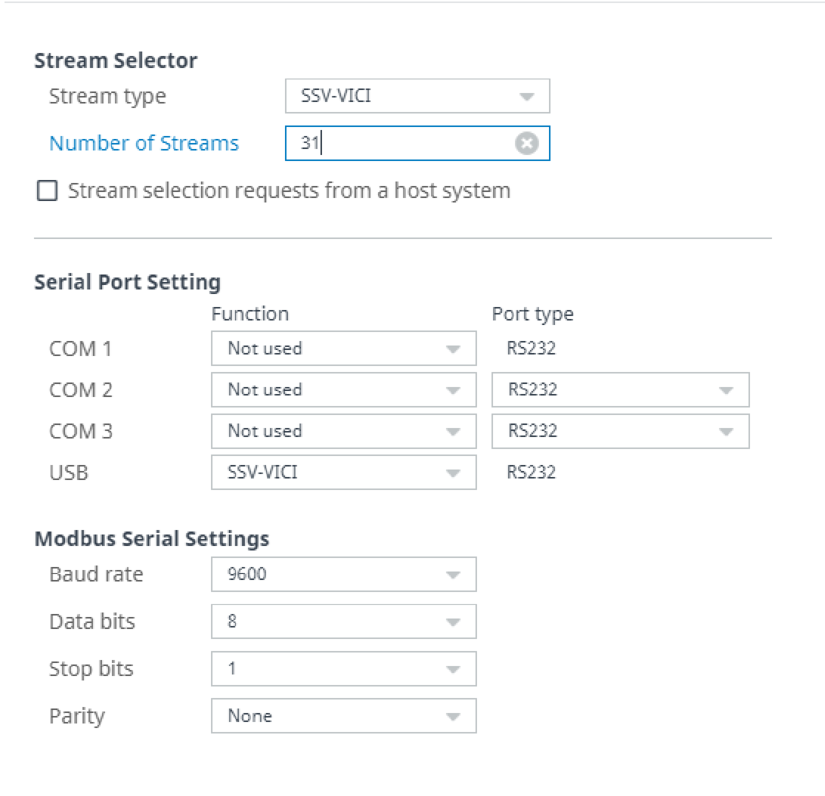




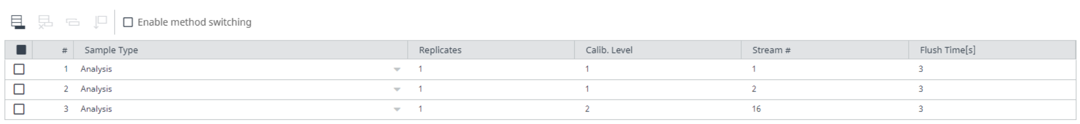
2 Attach the two VICIs to the 990 Micro GC through USB-to-serial converters and a USB hub.

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	Analysis	1	1	1	3
2	Analysis	1	1	2	3
3	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.

Modbus Serial Settings	
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.

Storage settings

Configure your storage settings from the Instrument Configuration options below.

- FTP storage: Assign an FTP site and options for storing chromatogram data. See Automation FTP Service.
- Local Storage: Assign file saving location on the GC or a connected USB disk. See USB Storage

Method Properties

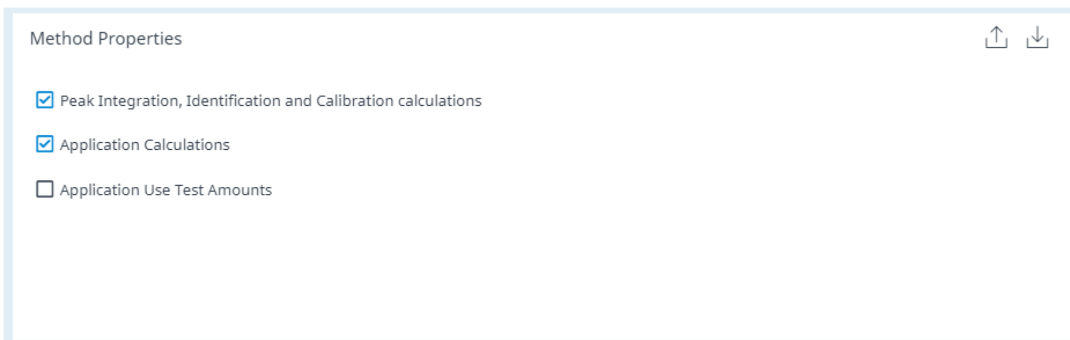
The method properties define what the instrument executes after the chromatographic run has ended. If **Peak integration**, **Identification and Calibration** calculations is disabled, all runs will be performed without calculations.

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.

From the Instrument tab, select Method Properties from the Configuration section on the left.

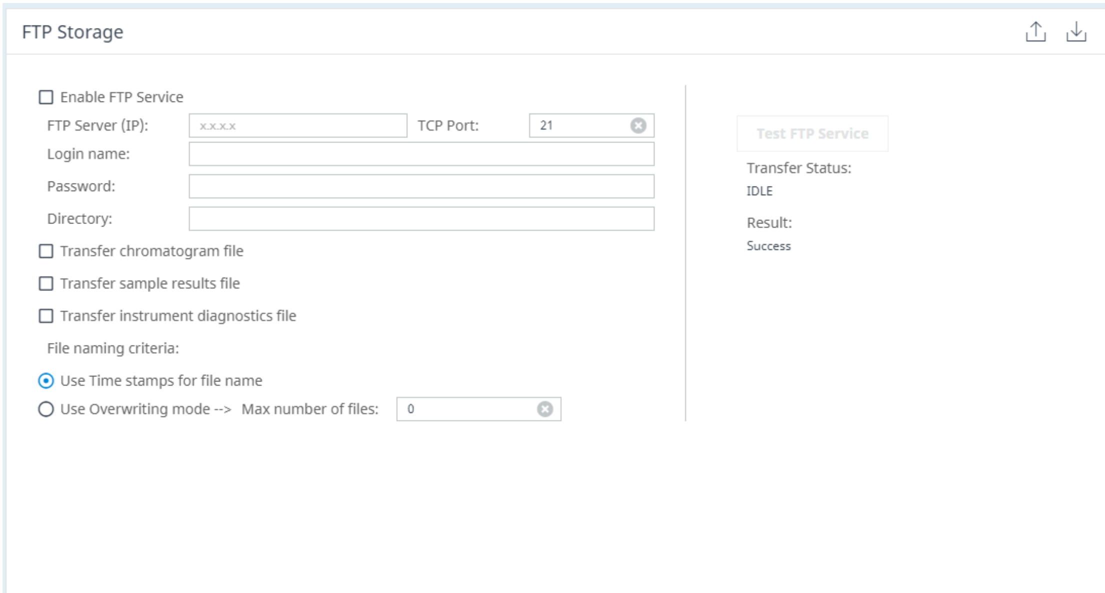


FTP Storage

From the **Instrument** tab, select **FTP Storage** from **Configuration** on the left.

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.



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.

Files are stored at the directory defined in the Directory: field, which can be a subdirectory of the default directory after logging in with an FTP client using the login name and password as defined above.

If **Enable FTP Storage** is selected, 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 SampRslt_[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.

Local Storage

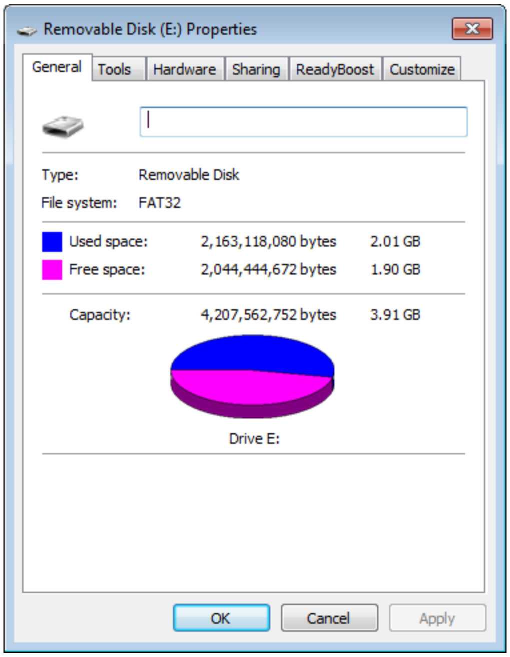
USB Storage

In this section

USB storage setup

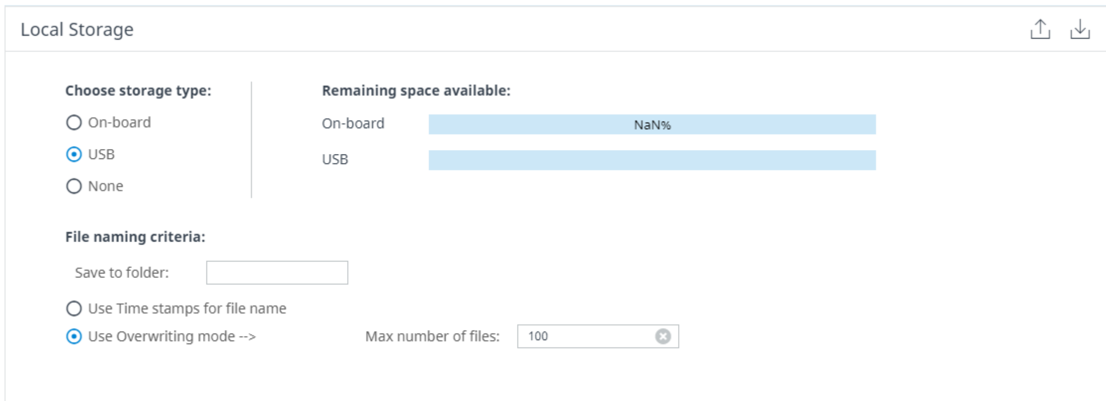
1 Ensure your USB has only one partition with FAT, FAT32, or exFAT format.

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.



USB storage settings

Select **Instrument > Configuration (Variable) > Local Storage**. The Local Storage options are displayed. You can select the storage type as **On-board**, **USB** or **None**. The settings for USB storage are similar to those of FTP.



Set file naming criteria, including whether to include **Time stamps** in file names, and overwriting preference.

The selected storage location is used to save data to a USB during **automated** runs.

Save data to USB during automated runs

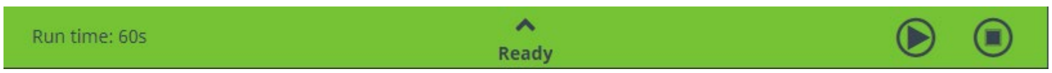
To save data to a USB during **automated** runs:

1. Saving the results of experiment runs to your USB requires the USB is selected as Local Stoarge, and that the **Application Calculations** in the **method properties** section of the **Instrument Configuration** tab is enabled. Once both are enabled, download the method.
2. Start an automated or a single run.
3. To check the content of the USB storage network mapping, from the **Results** tab, verify the root path folder.

4 Instrument Status and Control Bar

Instrument Control

The instrument control and status bar is shown at the bottom of the screen. From here you can start and stop runs and view current instrument status. The Run type, Method, Application, Automation, and Modbus files in use are shown as well.



Select the arrow icon 

in the status bar to expand the status panel and view detailed instrument status such as error states, activity logs, and Application alarm states.

The instrument method settings will only appear if a method is up or downloaded from/to the instrument.

The control and status bar color depends on the current state of the instrument. A table of color states is below:

Instrument: Ready	Instrument: Running	Instrument: Not Ready	Instrument: Error

In this section

Start a Run/ Automation/ Recalculate

Stop a Run/ Automation

Stop Column Reconditioning

Status Panel

Error states

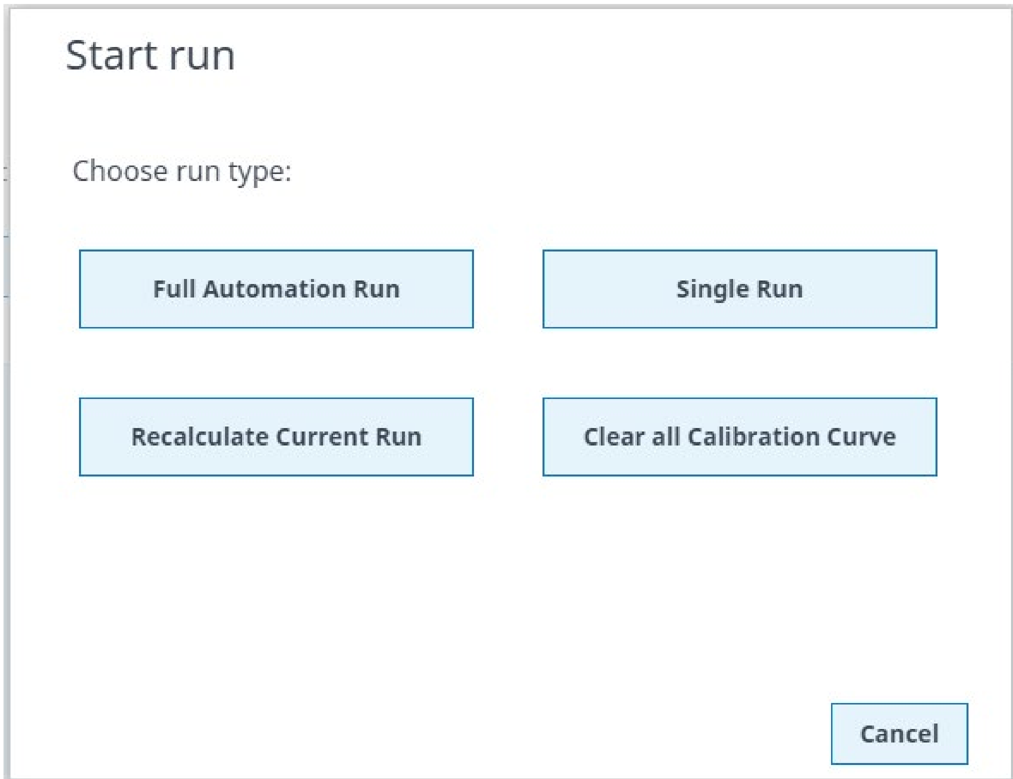
Activities log

Application alarm states

Start a Run

Start full Automation to test instrument performance.

- From the control bar, select the start icon.
- Chose the run type you would like to perform.



- Select **Full Automation** to test instrument performance.
- 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 **Start**.

Find detailed information about the [Automation Sequence] and [Sequence Table].

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.

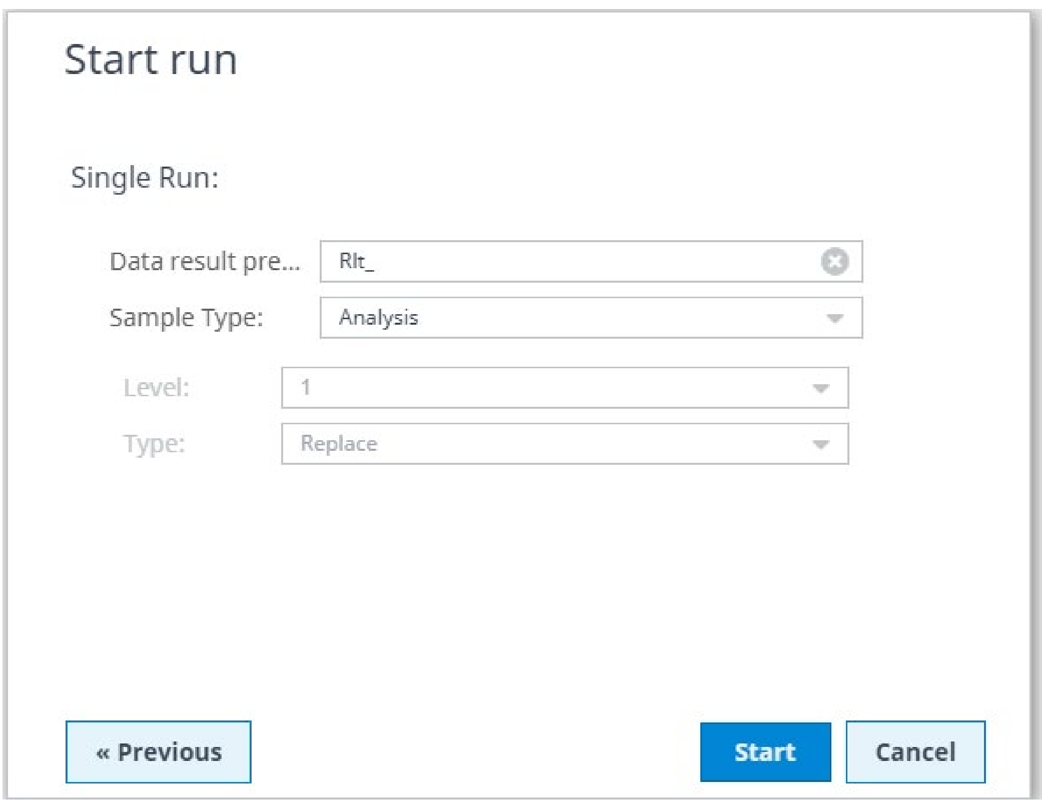
When **Automation** is running, do not open the export file. Instead, open a copy of this file.

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**.

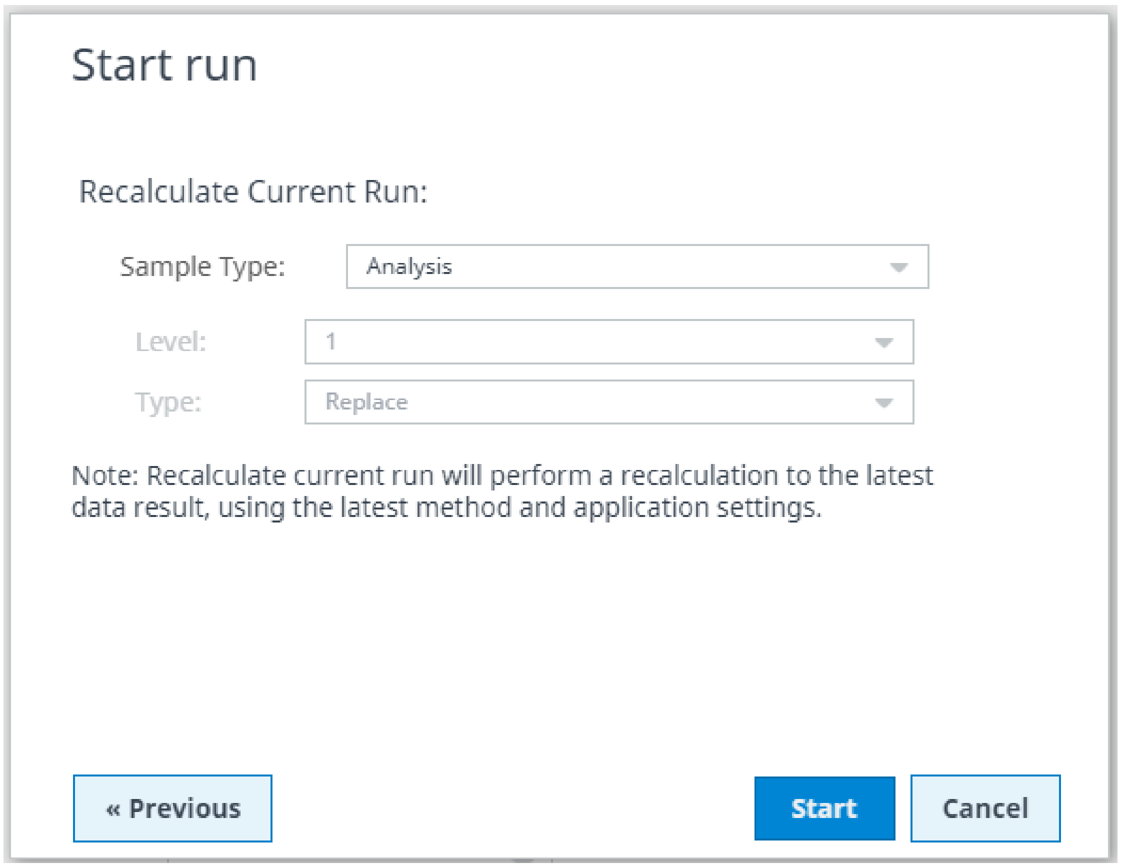
If a run is a calibration run, **Level** and **Type** must be filled in.



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.

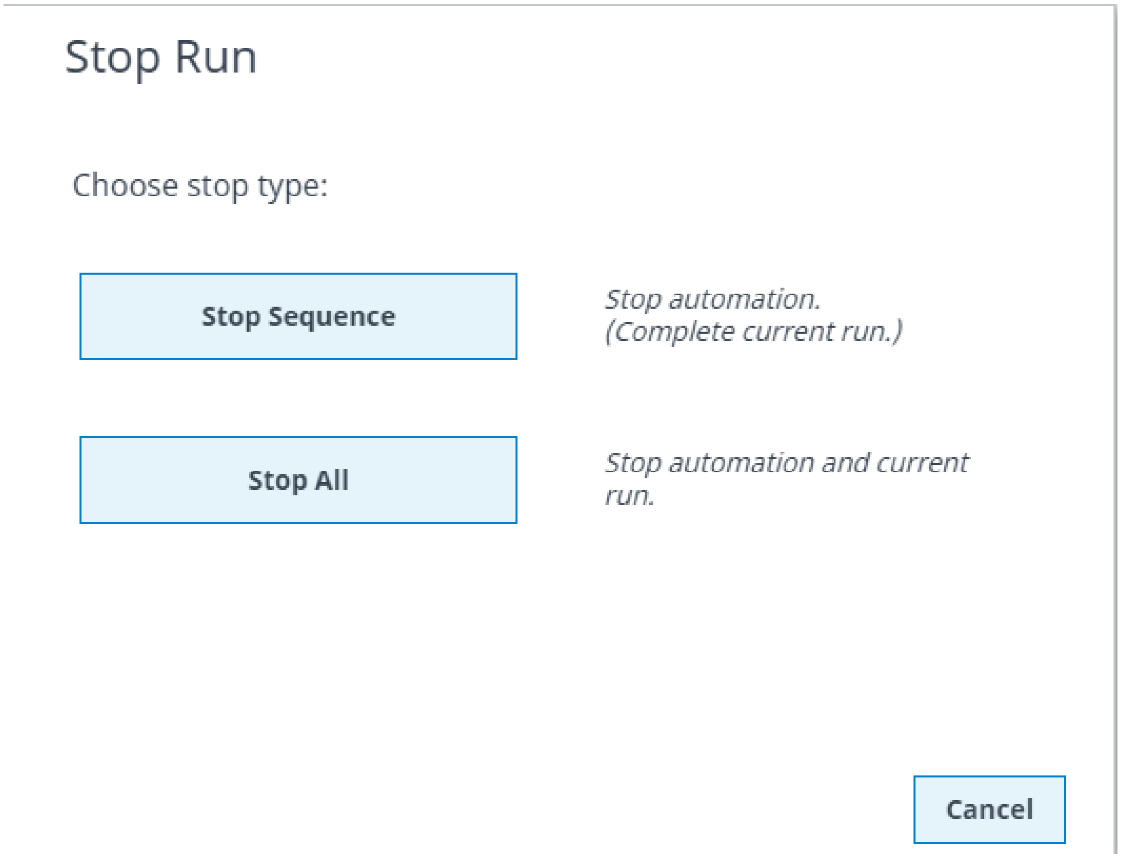


Clear all Calibration Curve

Reset the calibration settings and clear the calibration curve and table data.

Stop Run

To stop instrument activity, select the **Stop** icon from the instrument control bar.



When **Stop Sequecne** is selected, the current run will first be completed, before **Automation** is stopped.

When an **Stop All** is selected, the current run will be aborted immediately and the **Automation** will be stopped.

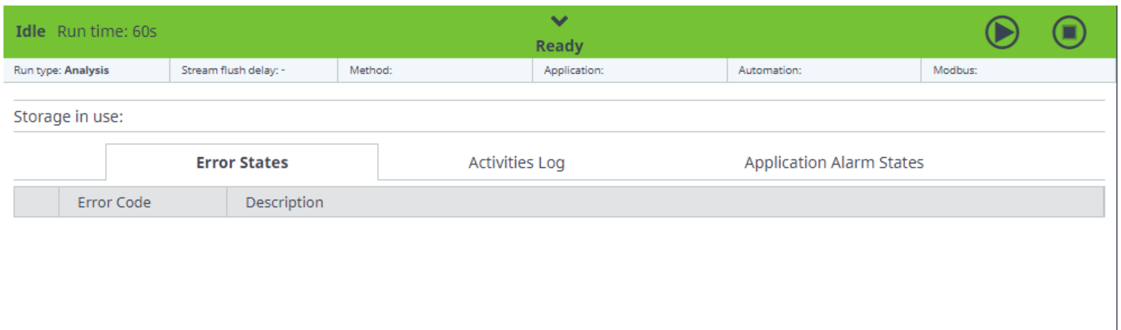
When **Automation** is stopped, all **Timed Relays** will be reset to their default state.

Status Panel

Status Panel

Select the arrow icon 

in the status bar to expand the status panel and view detailed instrument status.



The status Information available in the status bar remain, and additional information is made available in the panel.

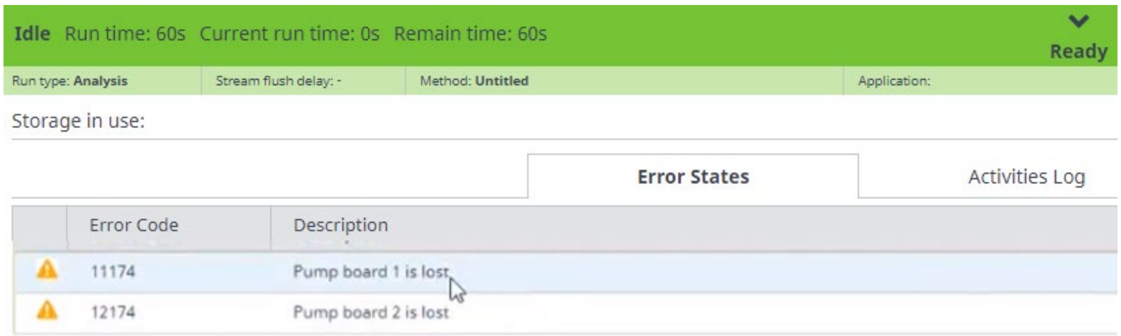
[Error States](#)

[Activities Log](#)

[Application Alarm States](#)

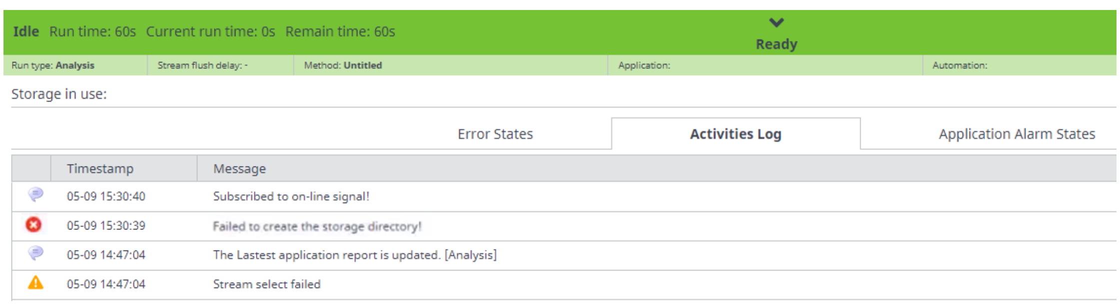
Error states

Instrument hardware error states will be posted here, such as pressure and temperature setpoint errors.



Activities log

Instrument activity messages are listed by time stamp are displayed here. Run start and completion, calibration activity, and other application events are listed. Error messages are indicated by a red x.



Application Alarm states

Record of alarm states triggered by alarm parameters set in the application alarm table. Any parameters that exceed alarm setpoints will be logged here.

5 Method Tab

Instrument Method Tab

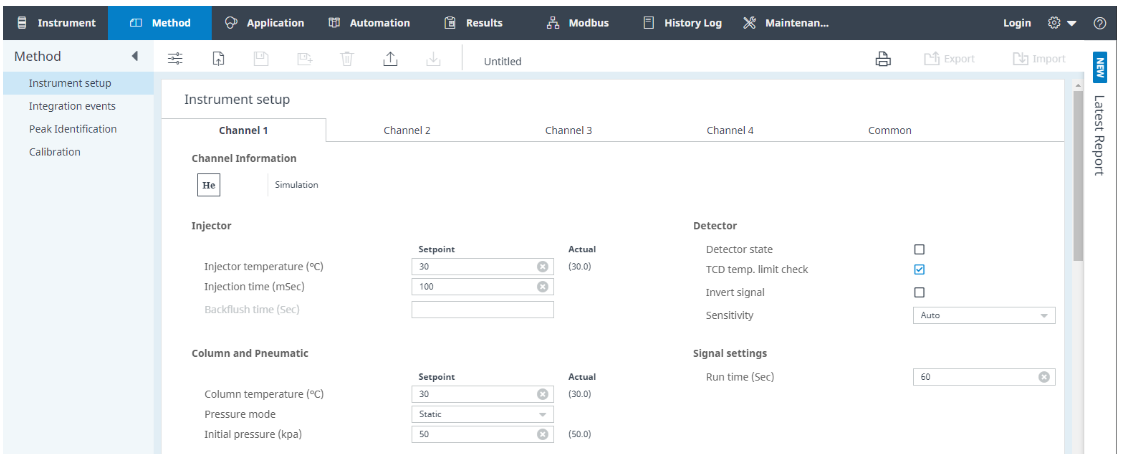
Use the **Method** tab for method development and monitoring analysis. The method consists of all settings found under the **Method** tab.

In this section

Instrument Setup

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**, click the **Method** tab and select **Instrument Setup** from the menu on the left. You can view, configure, and import and export methods from the Method tab.



In this section

Instrument Setup channel tabs

Instrument common tab

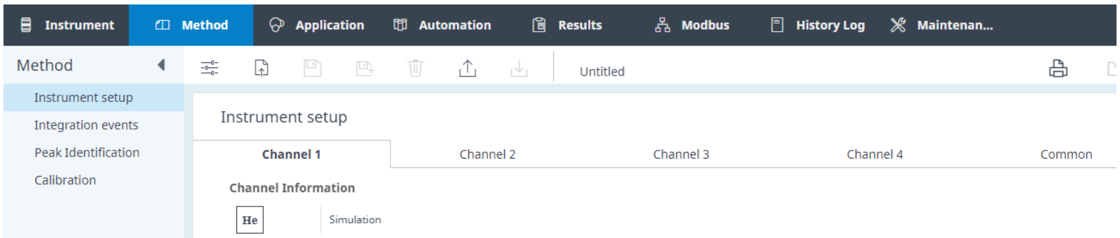
Instrument method channel tab

See also

Import/Export

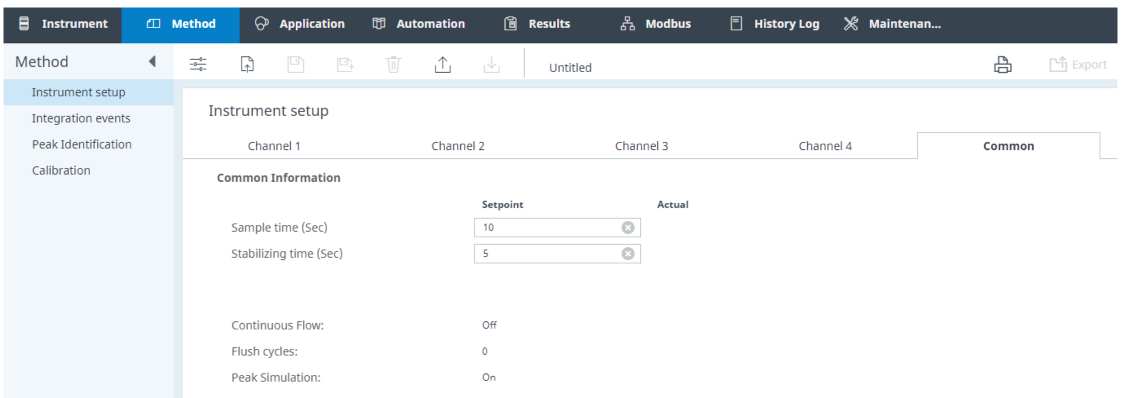
Instrument setup channel tabs

From the Method tab, select Instrument Setup from the left to view the **Channel** and **Common** tabs. 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.



Instrument method common tab

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



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.

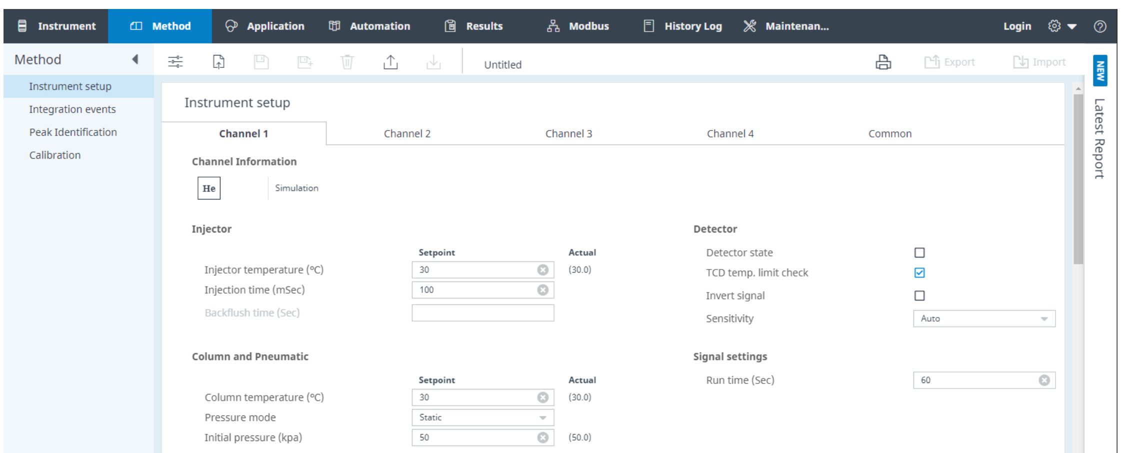
Stabilization Time

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 using instrument configuration (and not disabled in the User Settings section of the instrument configuration), a Channel tab appears.



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

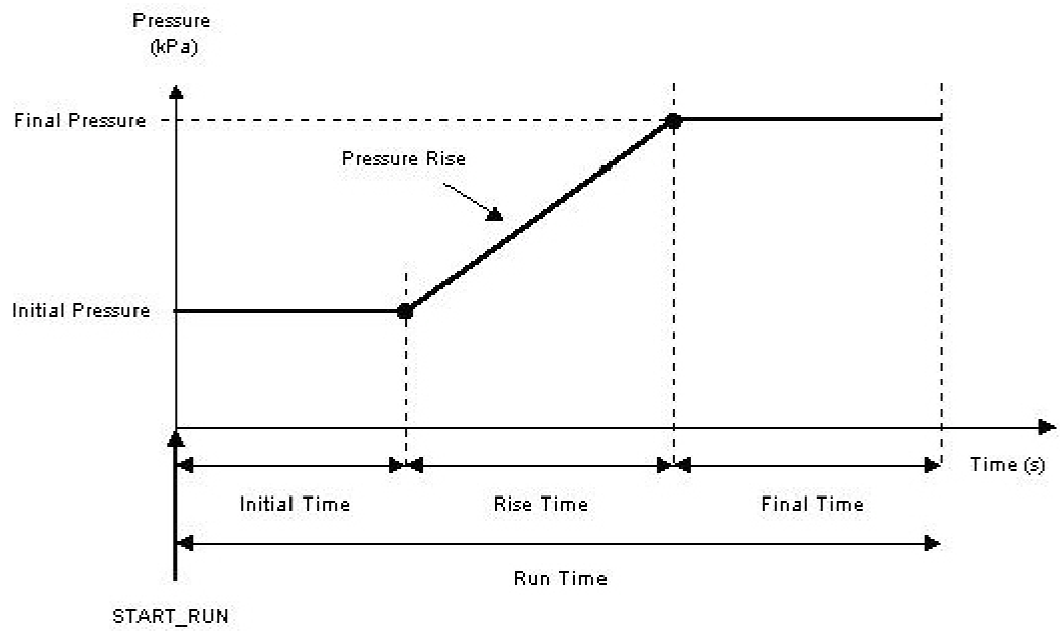
Enter the final pressure setting, in kPa or PSI (depending on configuration).

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.

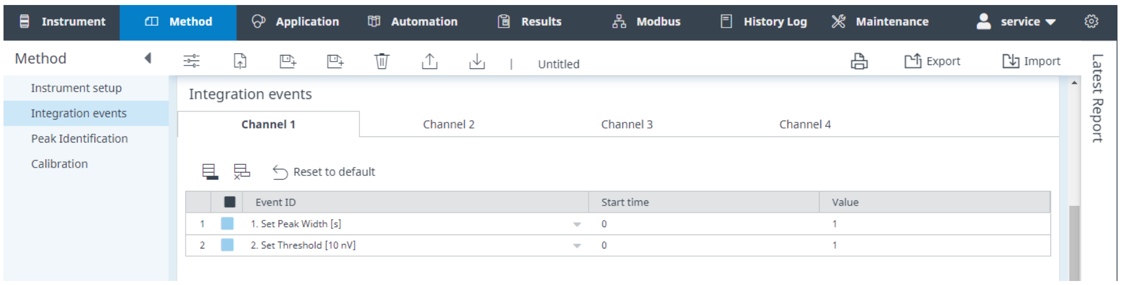
If you have entered an incorrect parameter for any of the above items, an error message will be displayed in this field to aid you in correcting the setting.


Pressure
(kPa)
Final Pressure
Pressure Rise
Initial Pressure
Time (s)
Initial Time
Rise Time
Final Time
Run Time
START_RUN

Integration Events

Integration Events

To access integration events, select the **Method** tab and select **Integration Events**. Integration events are specified for each individual channel. Integration events can be removed by selecting the event checkbox and clicking Delete icon. Add an integration event by clicking the Insert icon. Integration events are configured by selecting a function from the drop-down menu and entering the desired parameters. See the linked topics below for details.



Select **Reset to Default** to return all event settings to their default values.

In this section

[Chromatogram markers]

[Set peak width]

[Set threshold]

[Set solvent threshold]

[Estimate threshold]

[Set minimum height/area]

[Turn integration on/off]

[Start/Stop peak now]

[Add peaks/grouping]

[Split peak]

[Detect negative peaks on/off]

[Baseline processing]

[Shoulder peaks]

[Set skim ratio]

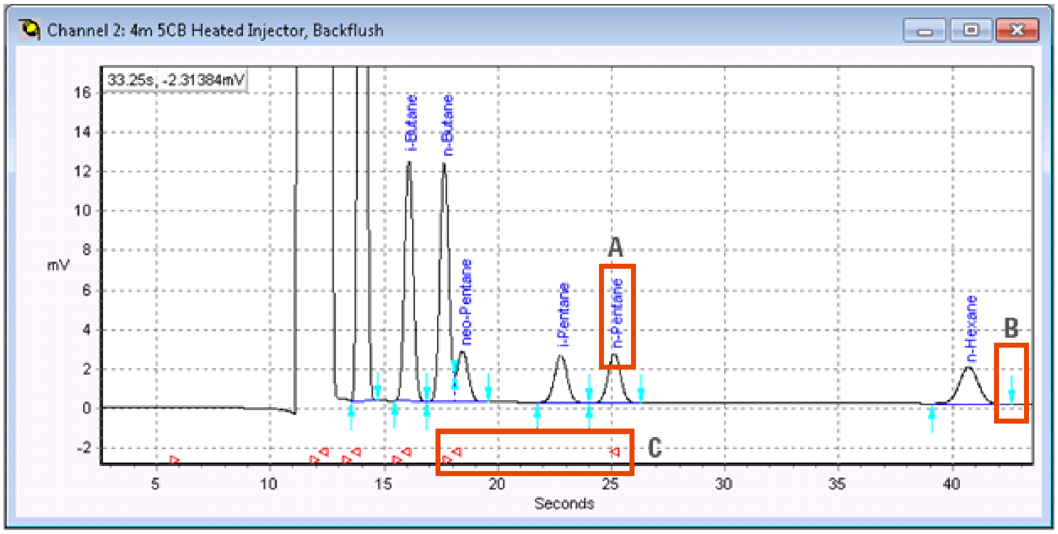
[Tangent skim next peaks on/off]

[Tangent skim rear/front]

[Exponential skim rear/front]

Chromatogram markers

Chromatograms collected from the instrument are presented to the user. These chromatograms are instrumented using several markers.



A. Component name

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

The component name is shown in the chromatogram above the identified peak.

B. Start / Stop baseline

The baseline of a peak is influenced by the shape of the peak and the integration parameters. The details of the baseline are presented 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 table.

The location of retention time windows can be inspected in the chromatogram. 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.

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.

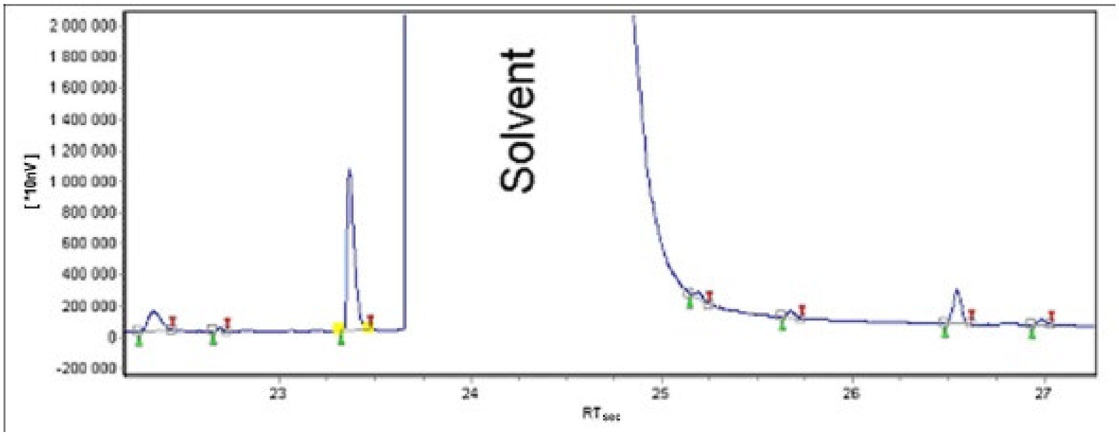
The value of the threshold is important. If a too high threshold value is defined, the peak starts will be detected too late and the peak ends too early. Moreover, small peaks could not be detected at all. If a too small threshold value is defined, the peak starts will be detected too early, and the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



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.

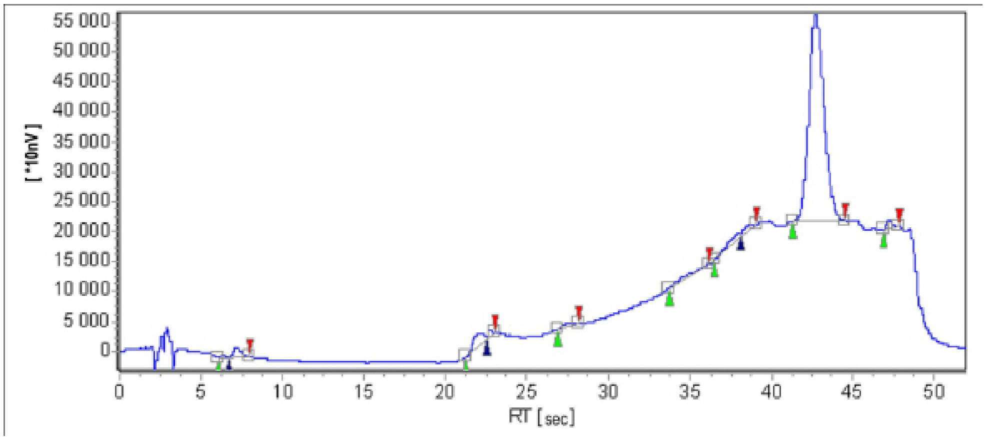
Set minimum height/area

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).

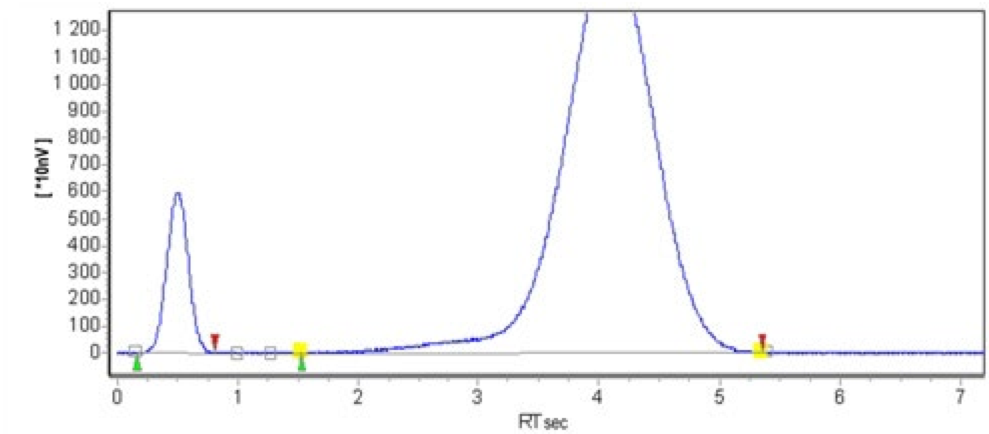


In the above example, integration has been deactivated during the first 5 seconds.

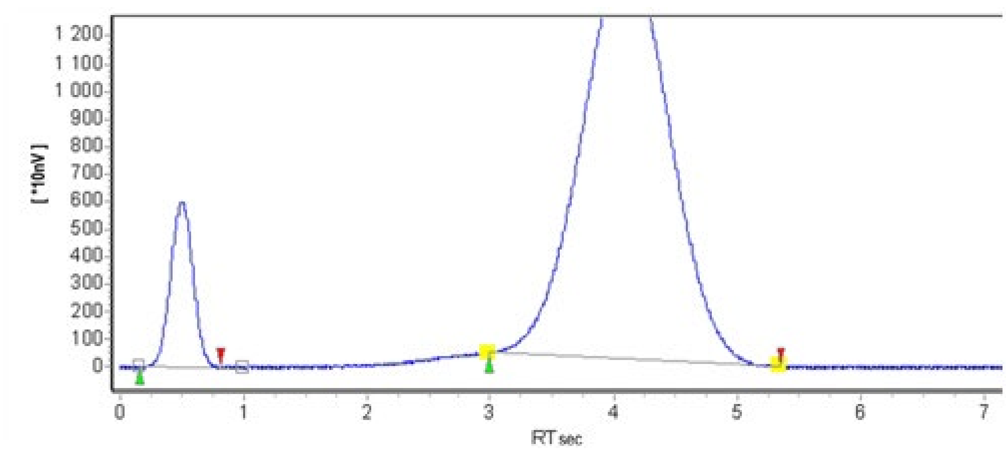
Start/Stop peak now

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:



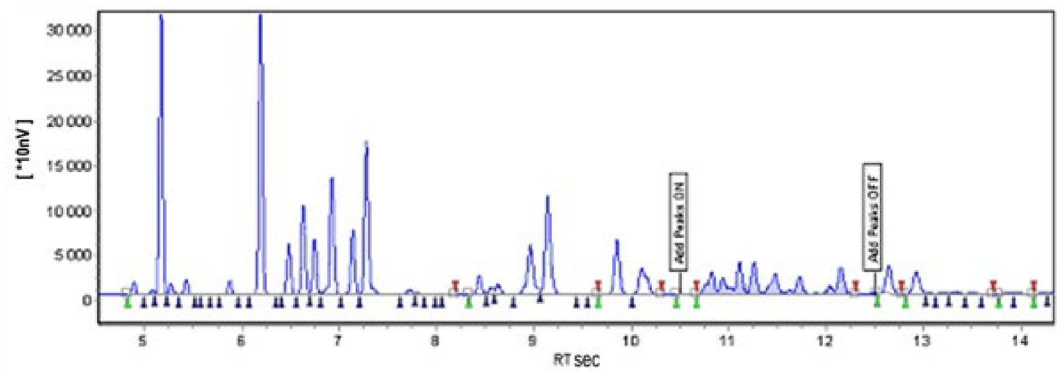
After:



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.

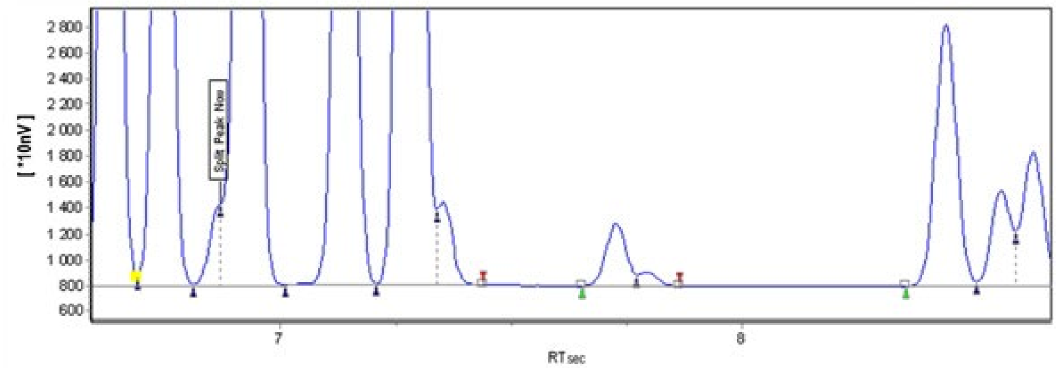


In the above example, the peaks between 10.5 and 12.5 seconds are added.

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.



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

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.

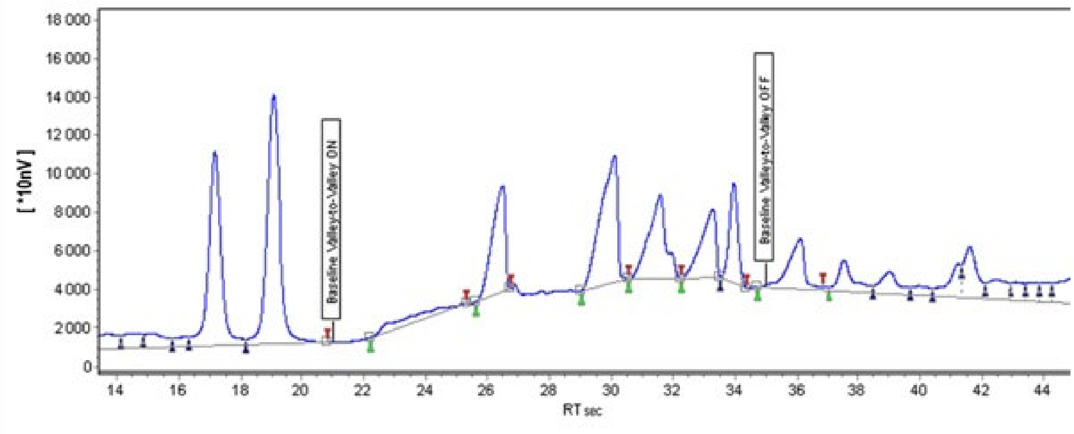
Detect negative Peaks on/off

Turn on detecting negative peaks at a certain time point A, and turn it off at time point B.

Baseline processing

Baseline valley to valley On/Off

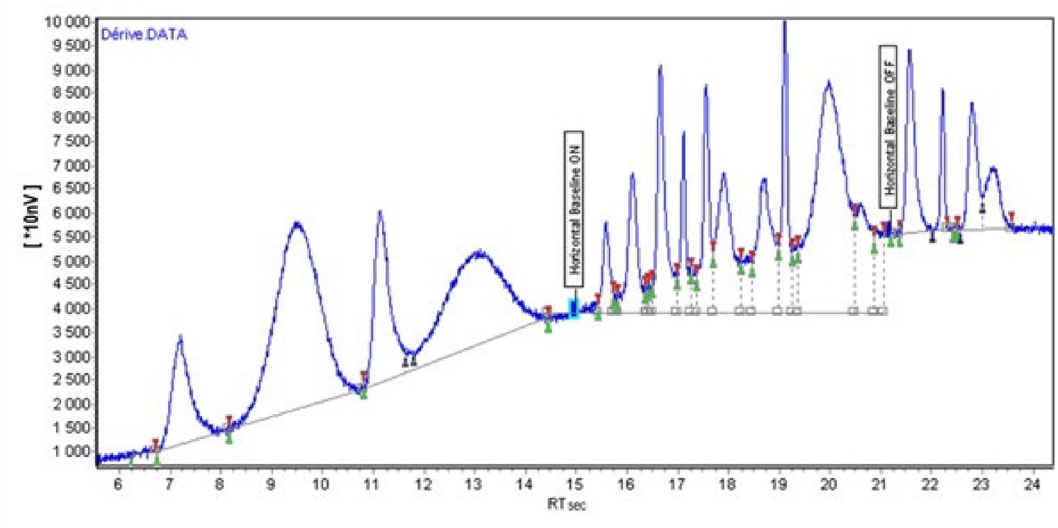
When this event is activated, the baseline passes through all the valleys.



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

Horizontal baseline

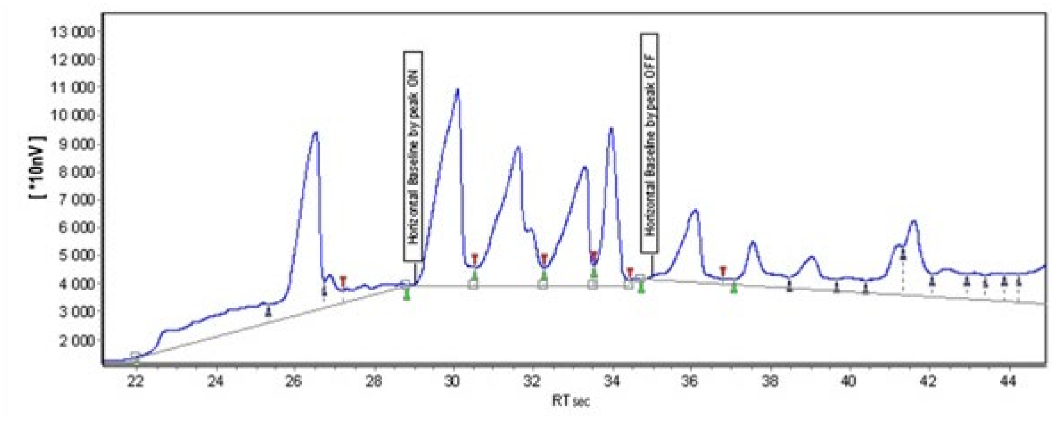
This event enables the definition of a horizontal baseline. A horizontal baseline is drawn from the activation of this event until its deactivation. It is imperative to define the event couple (ON and OFF) to apply this event.



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.

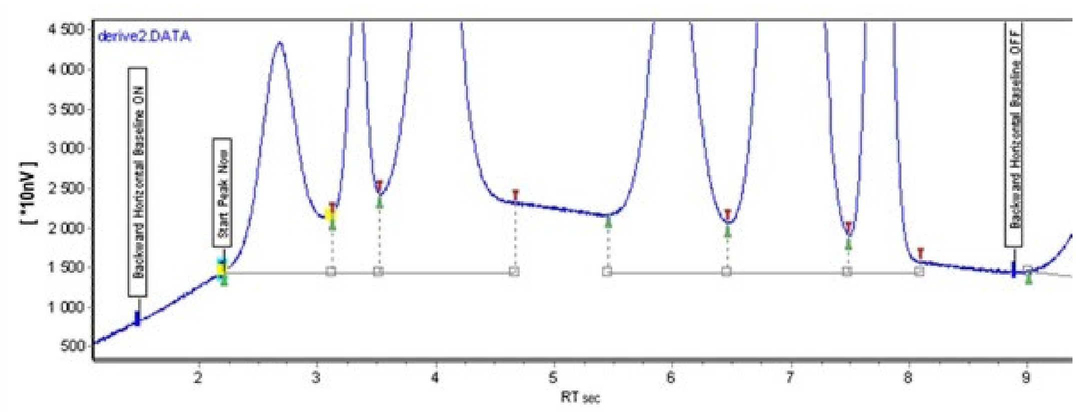


The horizontal baseline start or stop are not applied to the defined times, but to the nearest start or stop peak time.

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

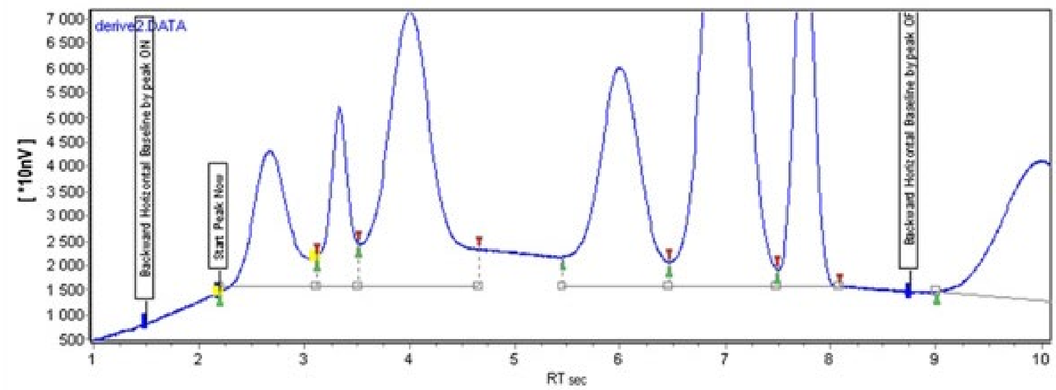
This event enables definition of a horizontal baseline at the level of the signal when this event is deactivated.



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

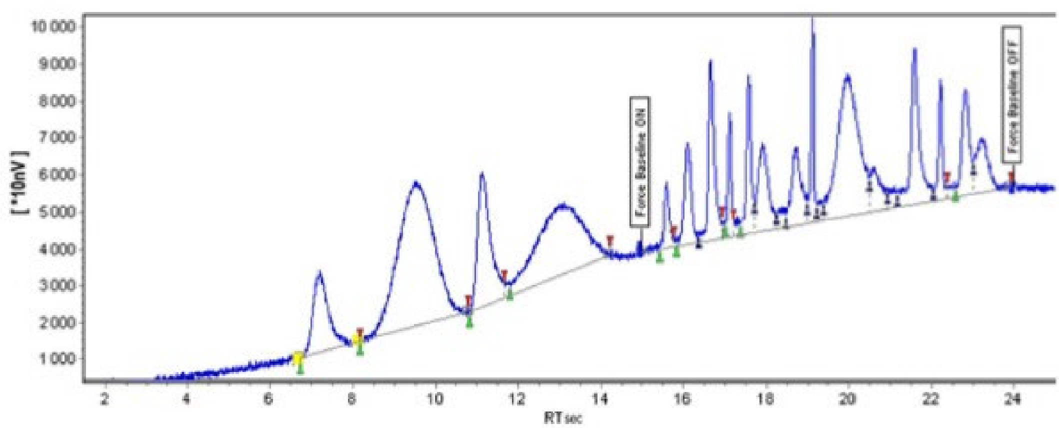
This event enables definition of a backward horizontal baseline. The horizontal baseline is drawn from the activation of the event until its deactivation. The baseline is drawn at the level of the signal at the stop marker of the peak preceding the event deactivation.



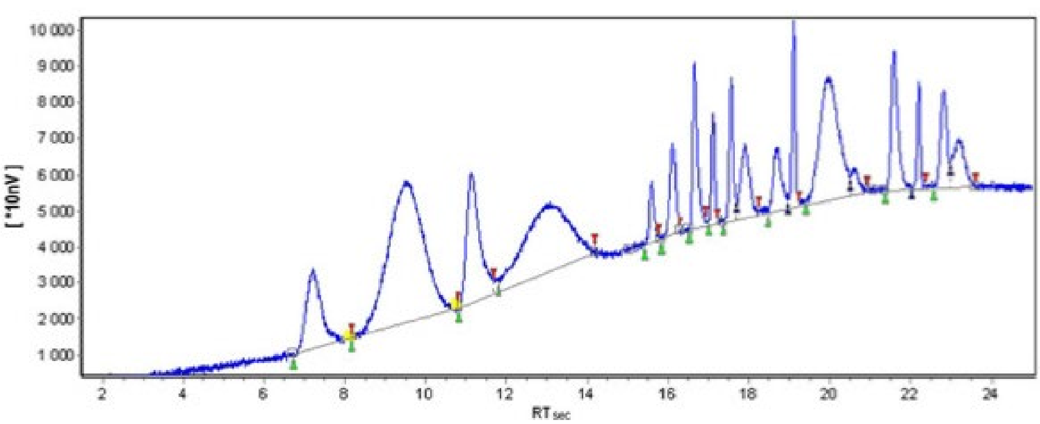
As a consequence, the two events Backward Horizontal Baseline by peak On and Backward Horizontal Baseline by peak Off must be defined.

Force baseline

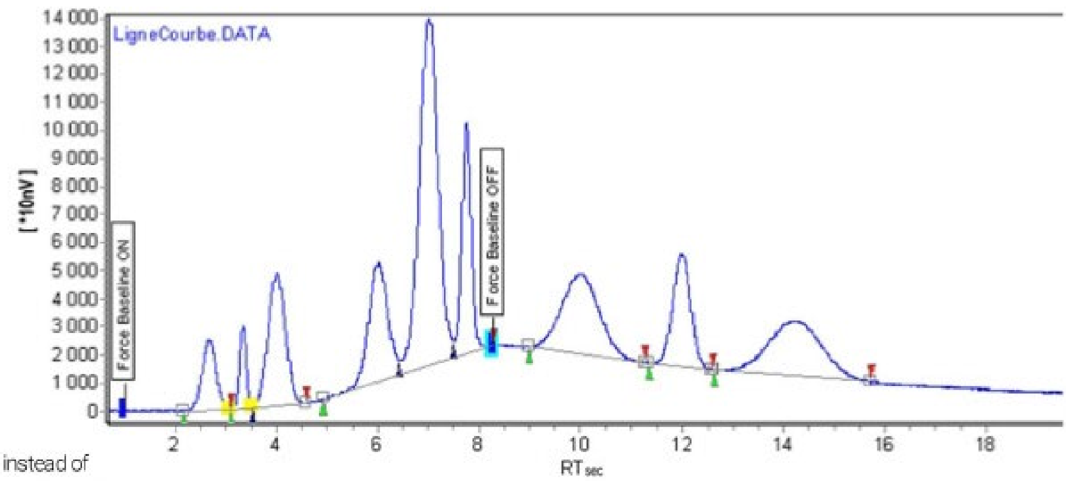
This event forces all the peaks between the events Force baseline On and Force baseline Off to have a common baseline. The peak markers of the first and last peaks are, therefore, modified by this event. To prevent modification of the first and last peak markers, the recommended event to use is Force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



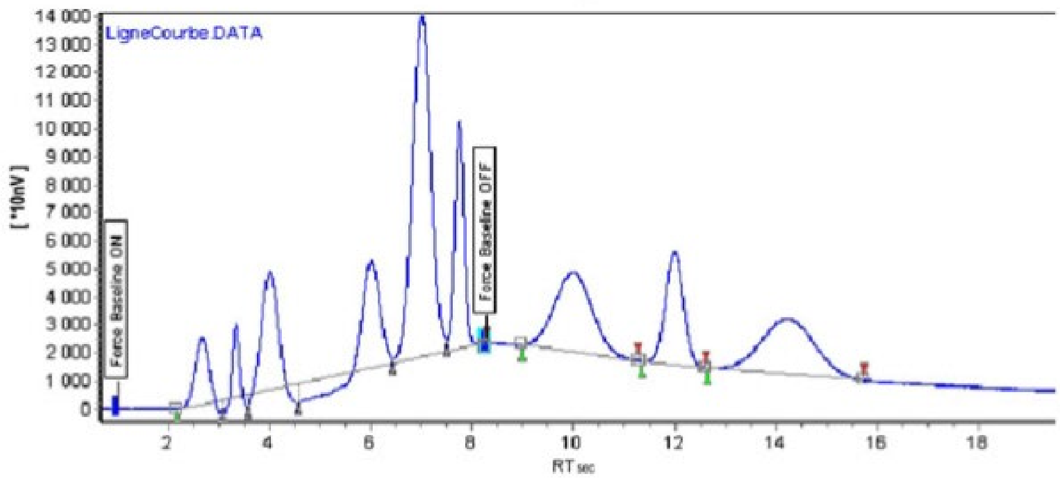
instead of



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



instead of

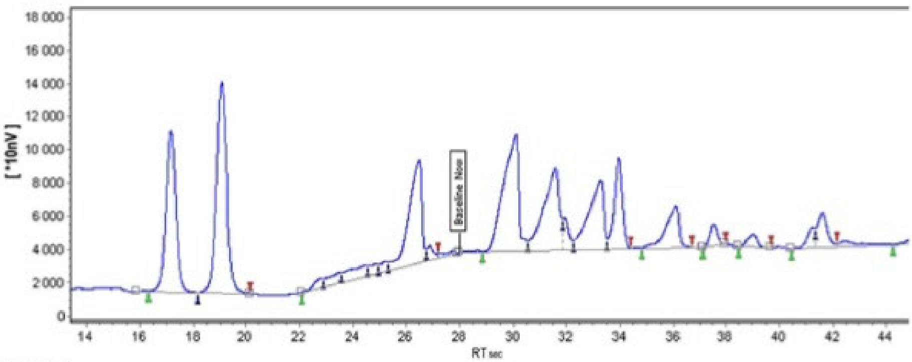


Force baseline by peak

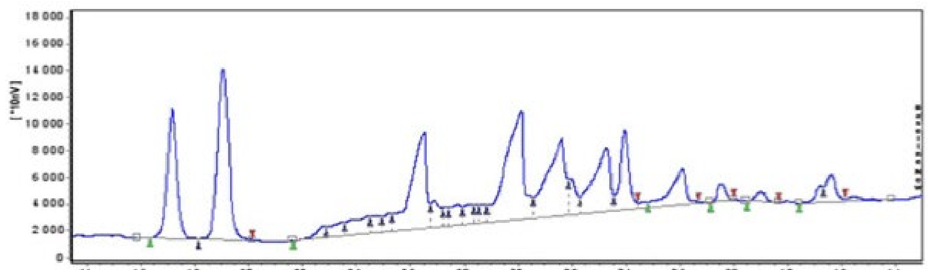
This event forces all the peaks between the events Force baseline by peak On and Force baseline by peak Off to have a common baseline. The difference with force baseline is that in this case, the markers of the first and the last peak are not modified.

Baseline now

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



instead of



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.

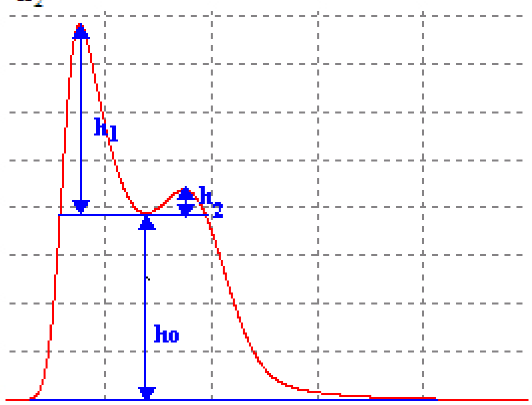
Shoulder peaks

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:

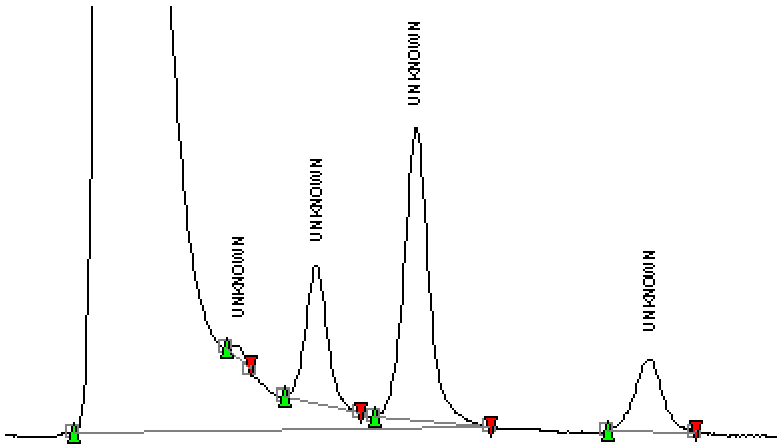
$$\frac{h_1}{h_2} \geq \text{parameter} \quad (ho \neq 0)$$



By default, this threshold is equal to 4.

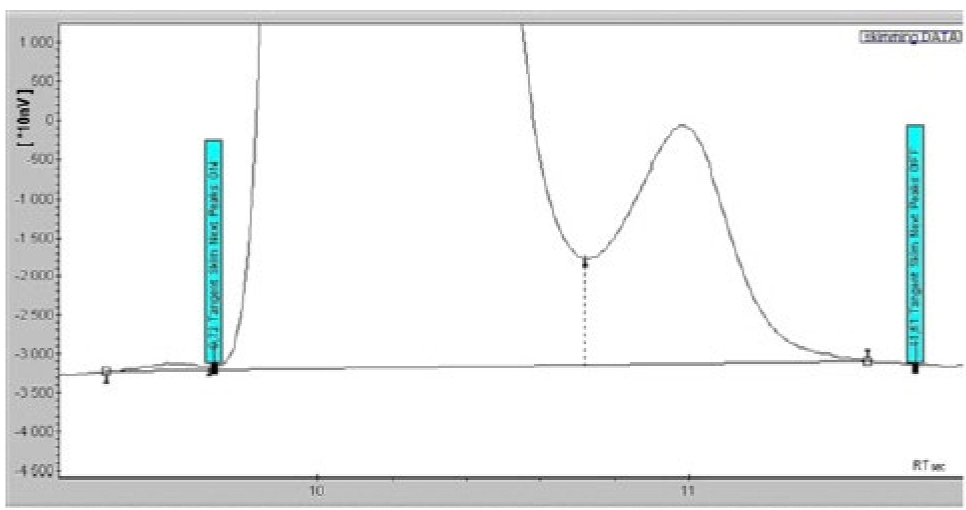
Tangent skim next peaks on/off

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.

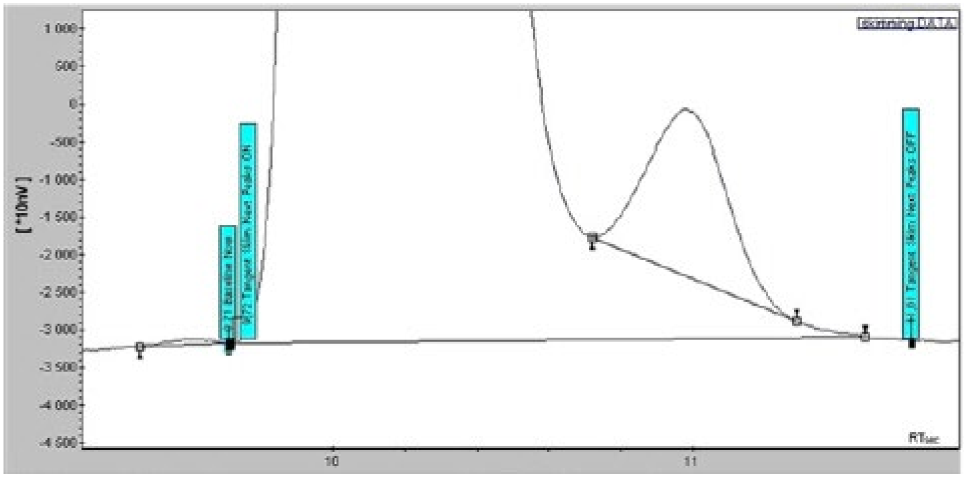


The **tangent skim Next Peaks** event does not work when the mother peak is not fully resolved (has a valley with the previous peak). The use of a **Baseline Now** event has the effect of removing the valley, and thus allows the skimming event to work properly.

Without the baseline now event, there is a group of three peaks sharing a common baseline:



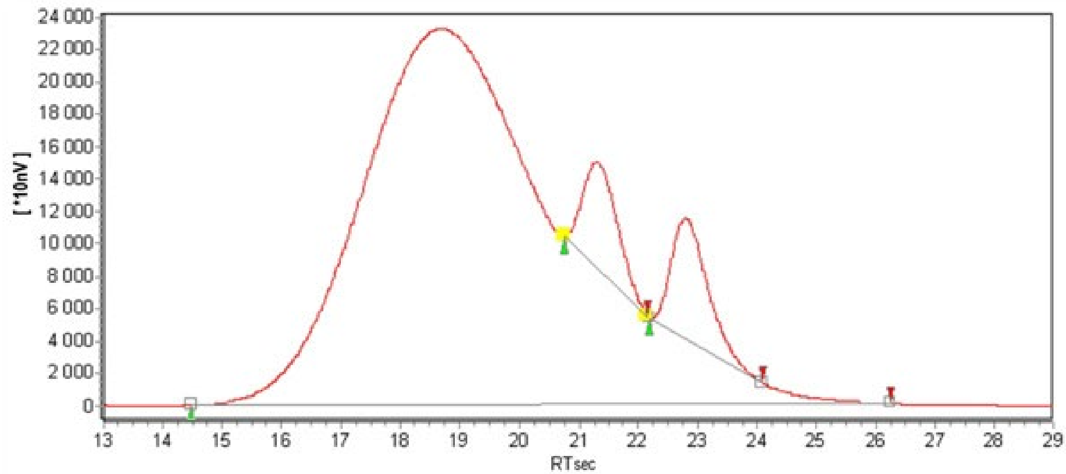
The baseline now event breaks the group of peaks:



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

Tangent skim rear/front

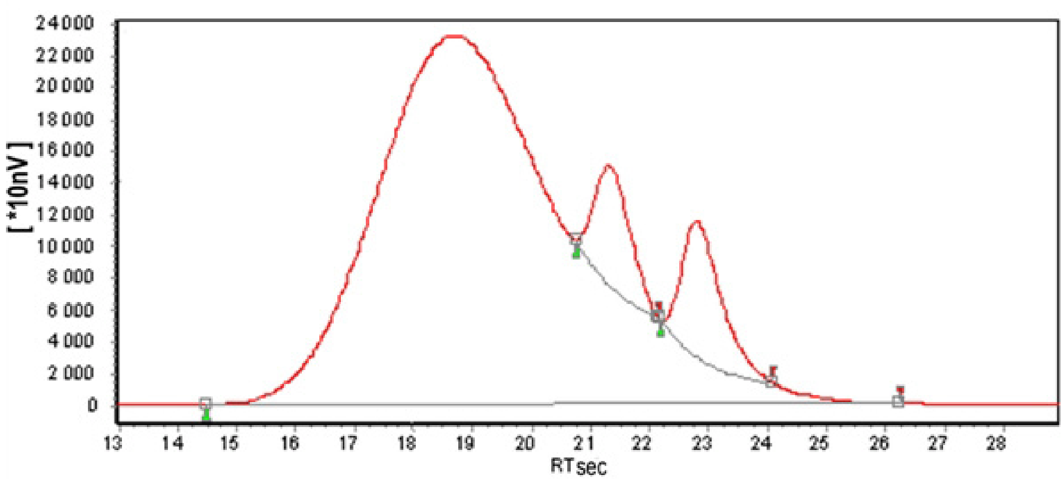
Select this event to integrate one or several peaks as shoulders on a mother peak with a tangent baseline. The instrument detects poorly resolved peaks whose heights satisfy the above height criterion and a tangent baseline is drawn underneath the shoulder peaks.



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, an exponential baseline is drawn underneath the shoulder peaks.

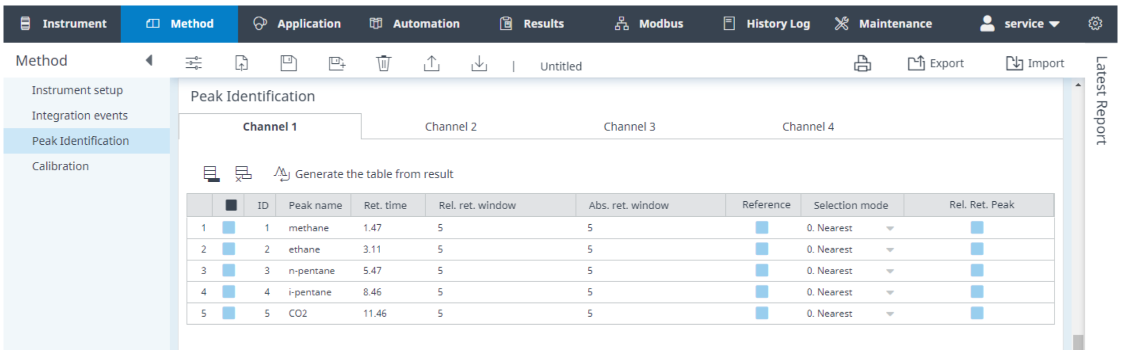


Peak Identification

Peak Identification

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

To access the **Peak Identification Table**, select the Method tab, 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.



In this section

Peak identification table

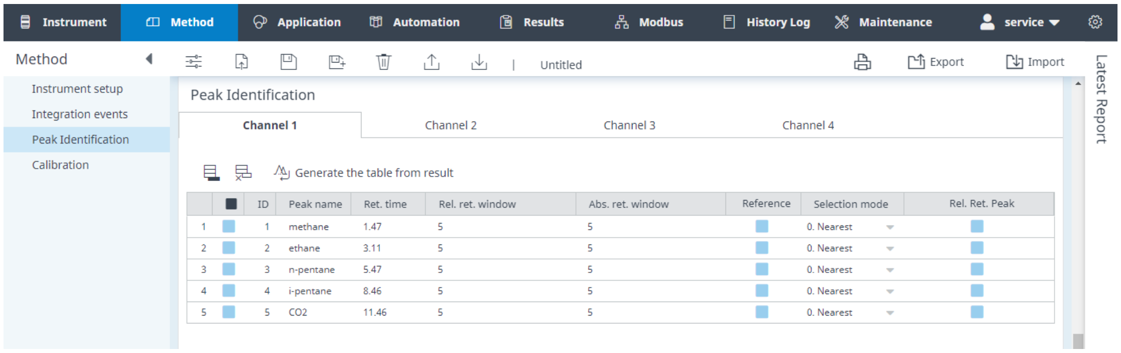
How to build an identification table

Identification table columns

Identification process

Moving retention window

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** box. These are then used for the peak identification when differences in the retention times due to analytical conditions occur.

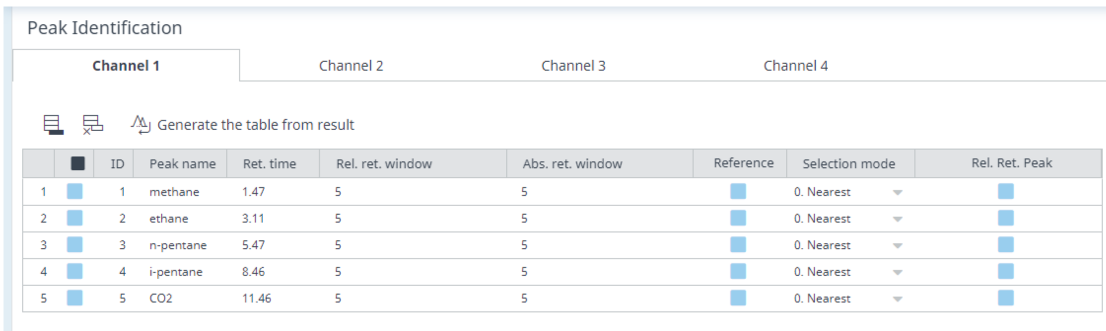
How to build an identification table

To fill a table, click the icon to 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 clicking at the beginning of the line that is to be removed, then click to delete the line.

Select **Generate the table from result** to fill the table with the integrated peaks.


Peak Identification

Channel 1 | Channel 2 | Channel 3 | Channel 4

Generate the table from result

		ID	Peak name	Ret. time	Rel. ret. window	Abs. ret. window	Reference	Selection mode	Rel. Ret. Peak
1		1	methane	1.47	5	5		0. Nearest	
2		2	ethane	3.11	5	5		0. Nearest	
3		3	n-pentane	5.47	5	5		0. Nearest	
4		4	i-pentane	8.46	5	5		0. Nearest	
5		5	CO2	11.46	5	5		0. Nearest	

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).

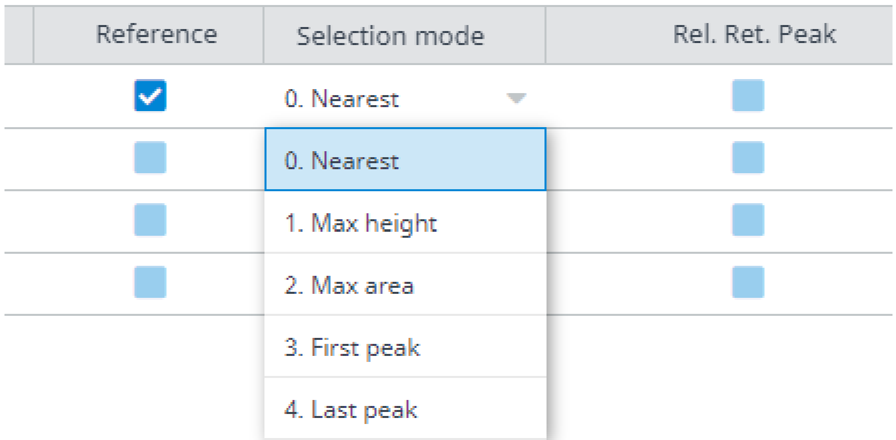
The reference peaks must be chosen carefully. Reference peaks must be common constituents that will always appear in the chromatogram.

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.



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.

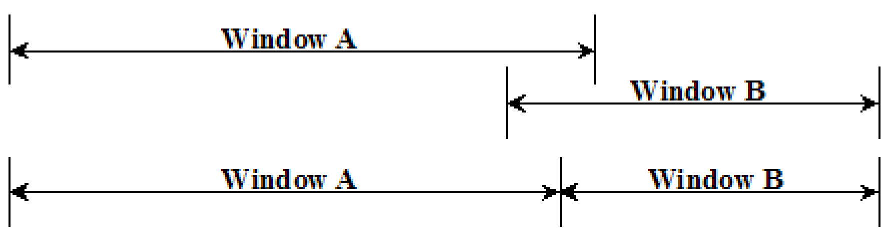
Using the experimental reference retention times, the instrument calculates the other expected retention times, resolves the nonreference peak window overlaps, and the nonreference peaks are identified with these retention times and windows.

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

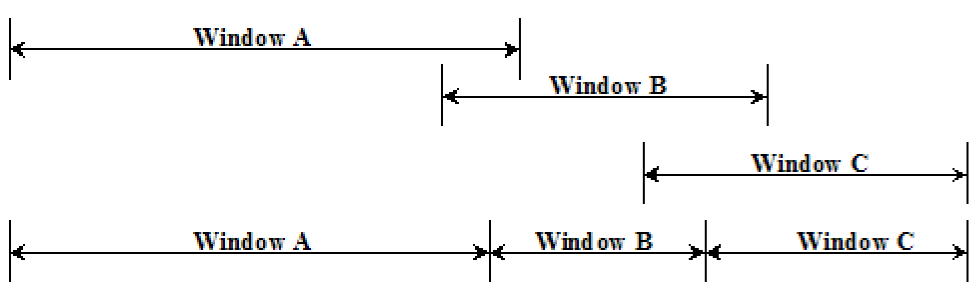
If peaks are very close together, windows can overlap. This means that the end of an identification window can occur after the beginning of the next one. To cope with this problem, the instrument considers the common part of the windows, splits it in two, and assigns half to each window.

For example:



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

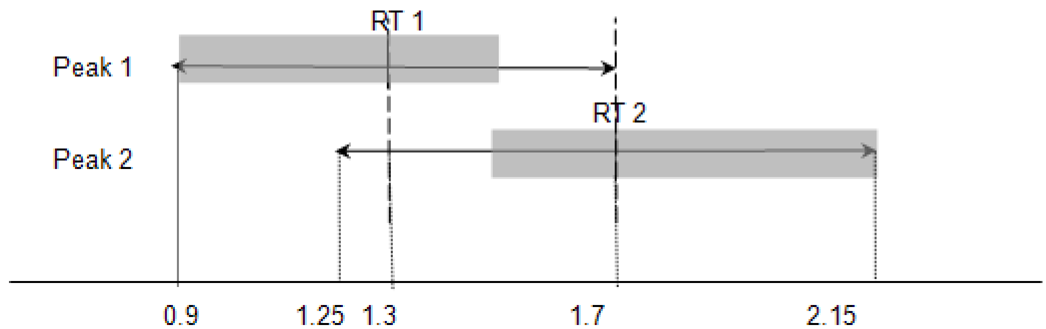
For example:



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.

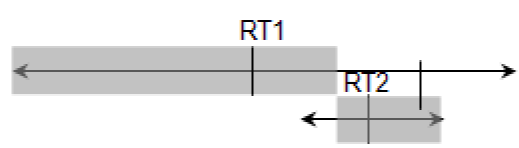
- General rule
  The window limit can not go beyond the retention time of the previous or of the next peak. In this case, the retention time of the previous/next peak is taken into account as the limit of the window, and the overlap is divided in two.
- Example 1
  A peak retention time belongs to the 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:

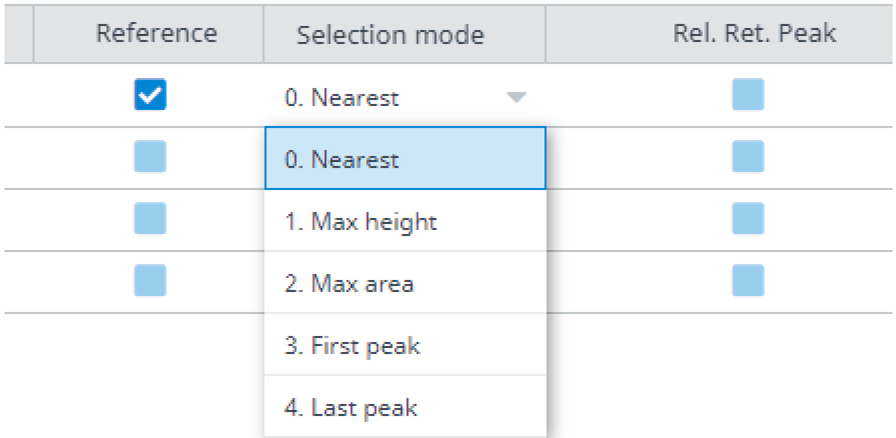
$$1.97 = RT1 + \left(RT2 - RT1 - \frac{W2}{2} \right)$$

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.



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: $5 \times 1.2 = 6$ seconds.

Second peak: $6 \times 1.2 = 7.2$ seconds.

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

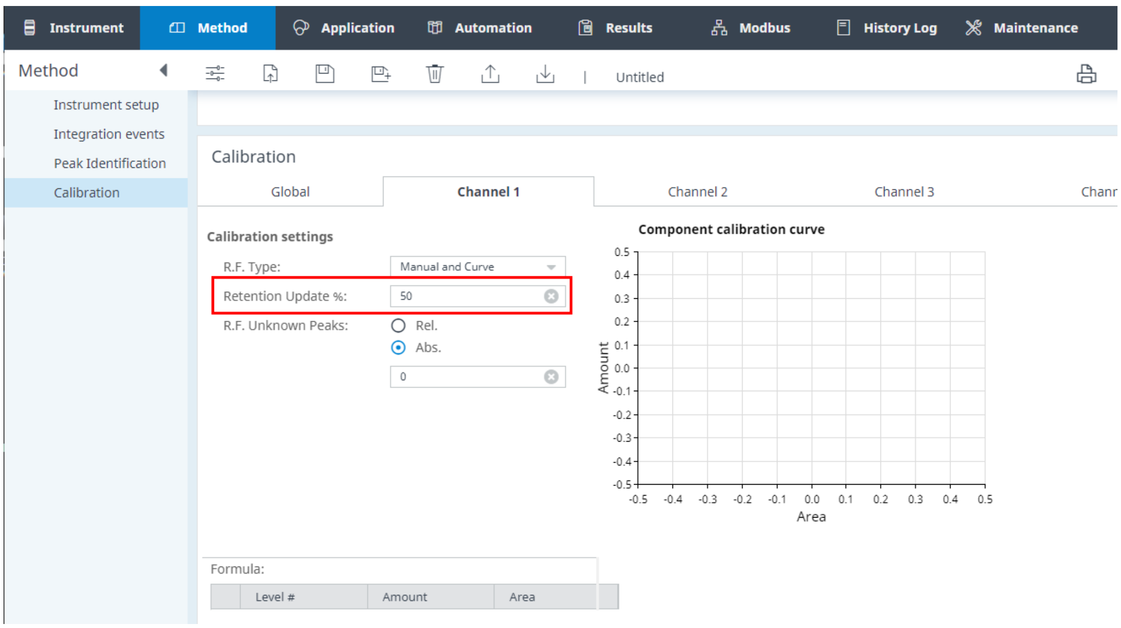
Moving retention window

The main peak identification is performed on retention window as defined in the Peak Identification. 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.

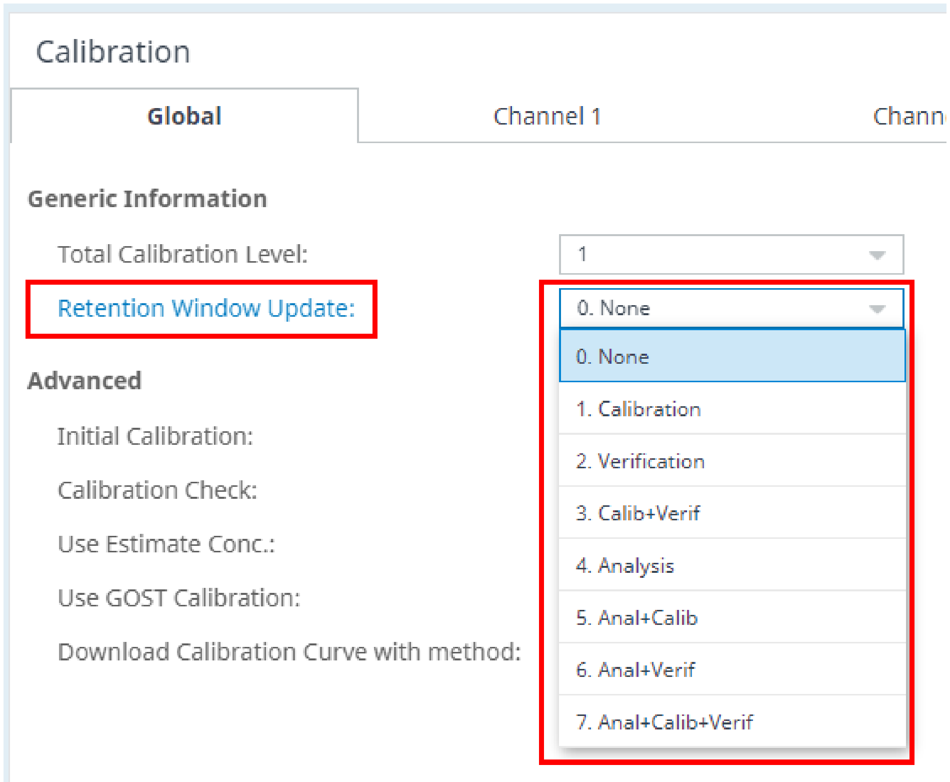


Use this parameter to use the optimum retention window for peak identification. A **peaks retention** can shift over a longer period. By setting a positive value in the Retention Update% the retention window will shift with the percentage the retention from a peak differs from the retention in the Peak 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

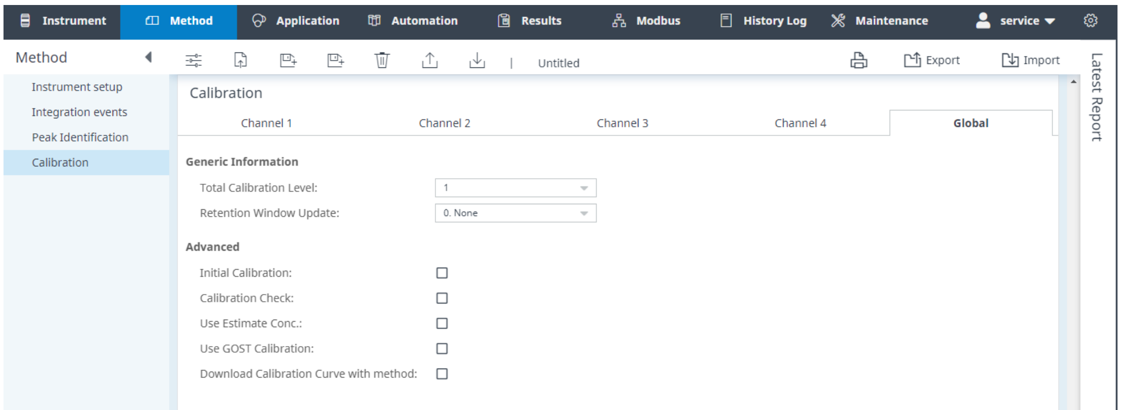
Select the type of runs on which the retention window must be updated for a GC channel.



Peak Calibration

Peak Calibration

The aim of this step is to define the calibration parameters. To define the calibration parameters, select the Method tab, and select Calibration.



Calibration options will appear, grouped for global as well as individual channels.

In this section

Calibration parameters (channel dependent)

Calibration parameters (channel independent)

Use GOST calibration

Initial calibration

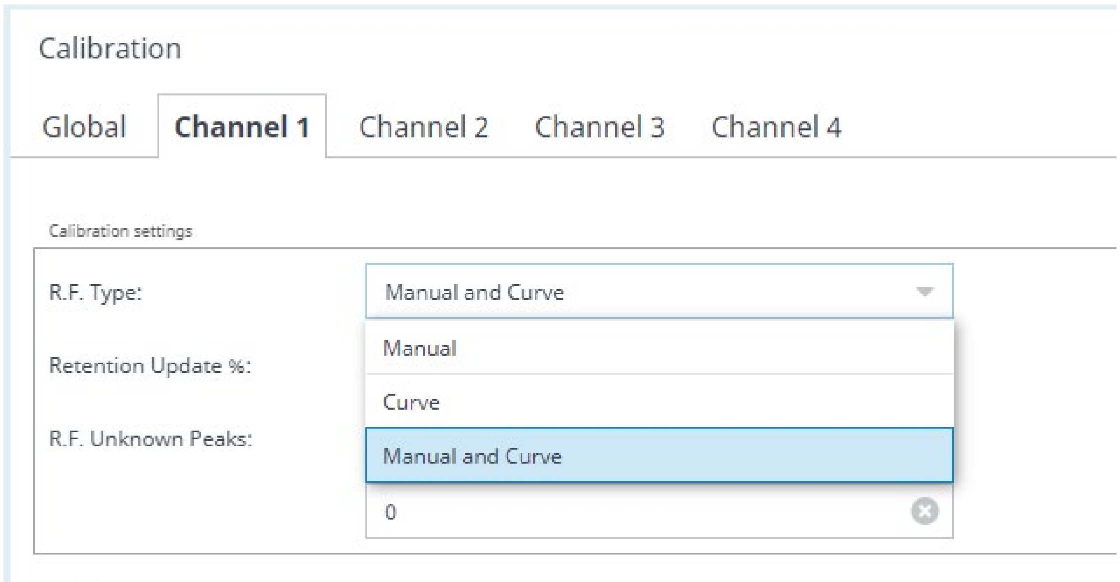
Prepare a calibration

Calibration parameters (channel dependent)

Channel unique calibration parameters.

R.F. type

Define how the Response factor should be determined.



There are three options.

- Manual
  If the components Response Factor cannot be determined from a calibration mixture, it must be set manually in the **Component list**.

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

  $Q= RF \times R$

  in which RF is the Manual R.F. of the component in the **Component list**. 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 **Component list** 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 **Component list**, x is the response (area or height) of the peak.

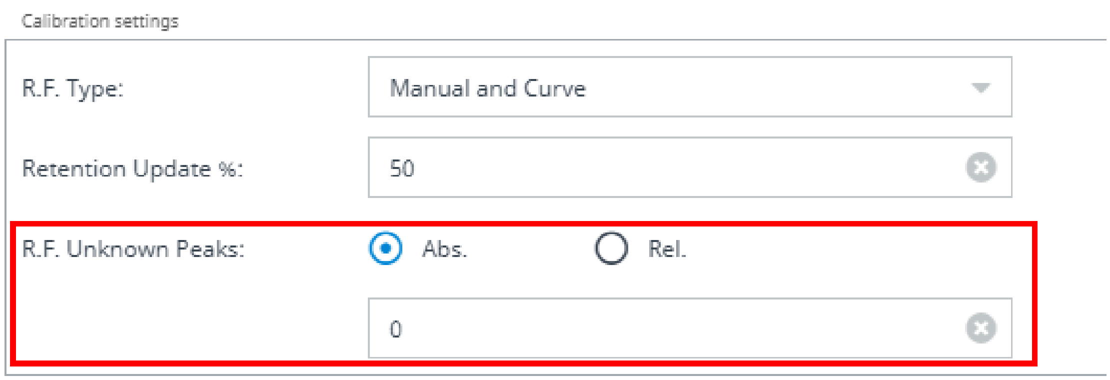
- Manual and Curve
  If both manual R.F. and determined R.F. by the instrument are performed in one GC channel, select this option. See the description for R.F. type Manual and Curve.

Retention Update %

Refer to Moving retention window for more details.

RF Unknown peaks

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



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:

  $Q= RF \times R$

  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:

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

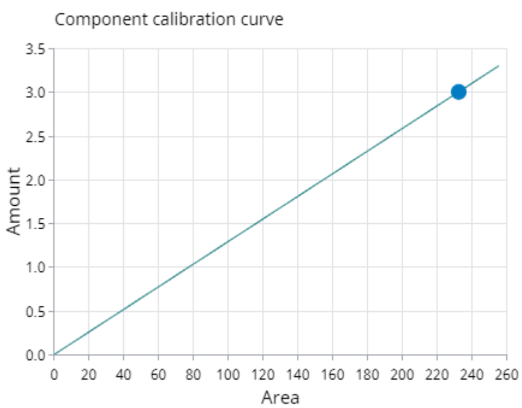
  in which a is the Cubic Coeff., b the Quadratic Coeff., and c the Linear Coeff. and the Intercept. From the Component list of the identified peak following (higher retention) the unidentified peak, x is the response (area or height) of the unidentified peak.

Component calibration curve, formula & calibration points

Calibration curve is drawn and built upon the Response Factors from the Component list table, the curve reflects the relationship between component's response amount and peak area.

The calibration curve supports operations such as:

- Zoom - Use mouse on desktop PC browser to draw a rectangle on the curve to zoom in. Use finger pinch to zoom in / out on tablet.
- Pan - Hold ctrl key on desktop PC browser to pan the plot. Finger touch and move to pan the plot on tablet
- Reset - Double click on the curve to reset the zoom on desktop PC browser.



Formula: y = 0.01292744x

	Level #	Amount	Area
1	1	3	232.064512513616...

The formula is the mathematical equation of the curve. The equation has the following format:

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

in which a is the Cubic Coeff., b the Quadratic Coeff., and c the Linear Coeff. and d the Intercept from the Component list.

Calibration points table lists all the points on the curve, and the response amount and peak area value for each point. Selecting each item in the list will highlight its corresponding point on the curve.

By selecting different component from the Component list, the calibration curve and formula and calibration points table will be updated accordingly.

Component list

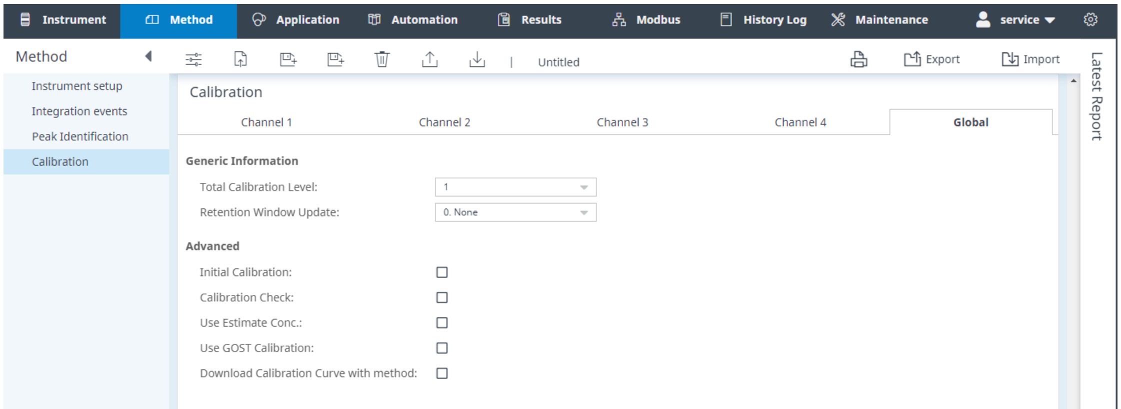
After the peak names are assigned & saved in the **Peak Identification** table, the component list will be automatically updated using the same set of peak names. The Peak name column in this list is read-only.

Component list provides calibration parameters for each component. These parameters affect the calibration curve and formula directly.

For a complete description of each column in the list, refer to Prepare a calibration for more details.

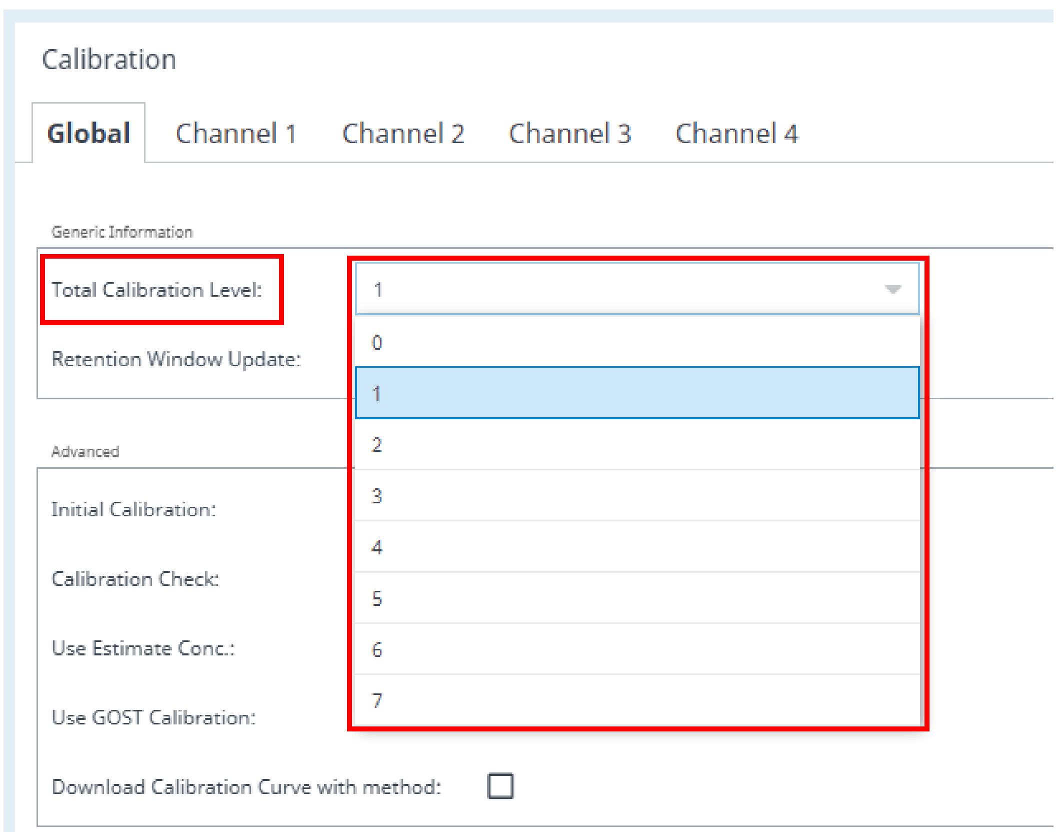
Calibration parameters (channel independent)

Calibration parameters common for all GC channels.



Total calibration level

Determines the Total Calibration Levels that are required.



If only a single level calibration is performed, select 1.

For Multilevel Calibration, define the total levels to be used (maximum seven levels).

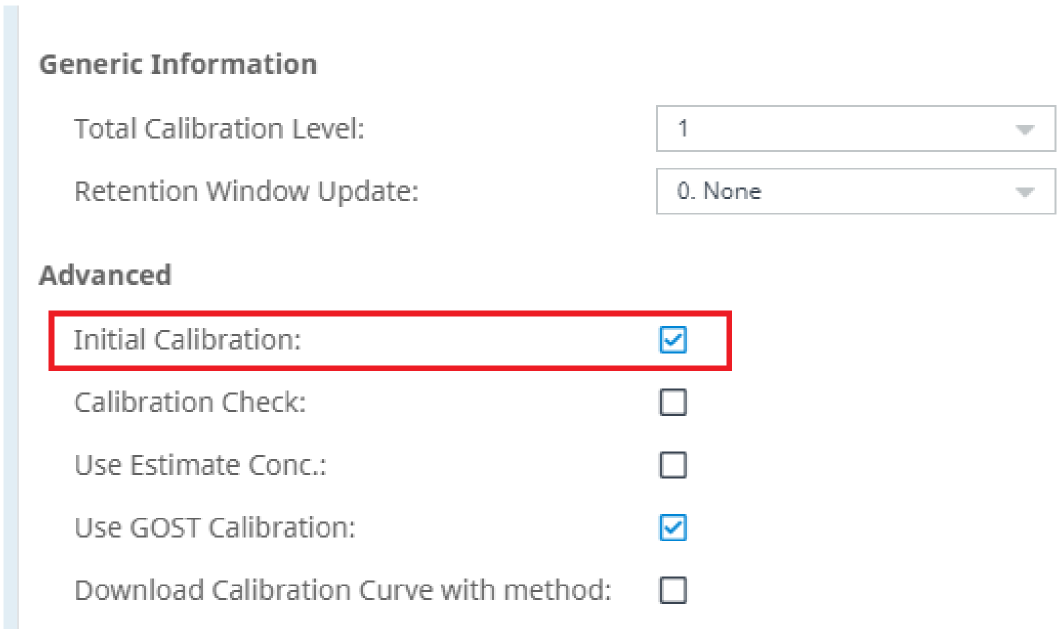
Detailed description of Multilevel Calibration is given in Setting Up a Typical Multilevel Calibration.

Retention Window Update

Refer to Moving retention window for more details.

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.



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.

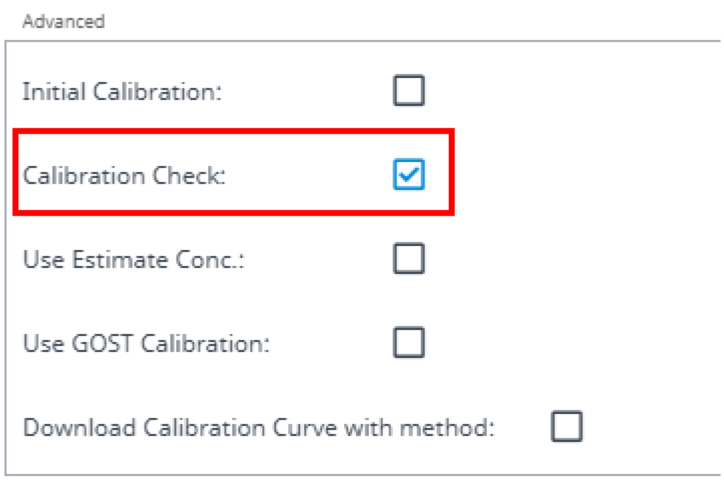
2 Deselect **Initial Calibration**. Download the method to the instrument.

3 In the **Calibration** -> **Component list** of each channel, enter percentages or **InitialRF%** and **CurrentRF%** attributes.

4 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.

Calibration Check

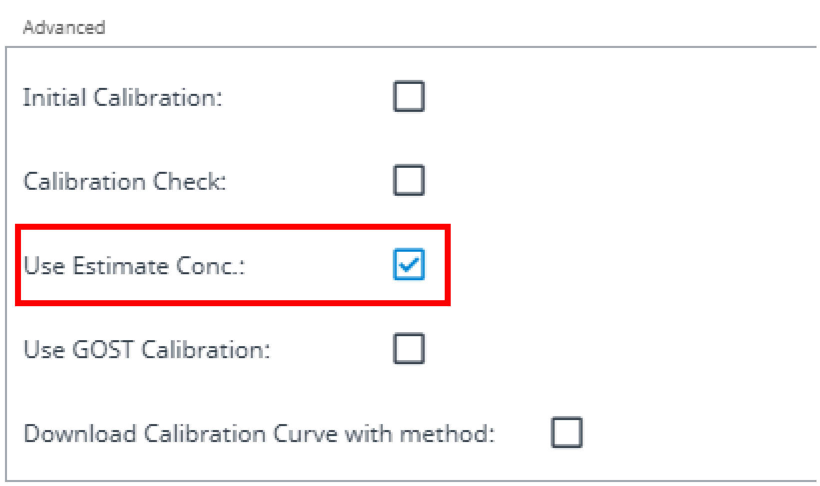
A calibration check is used to check whether the response factor (curve) drifts away in time after every new calibration.



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 **Calibration** -> **Component list** (**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



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.

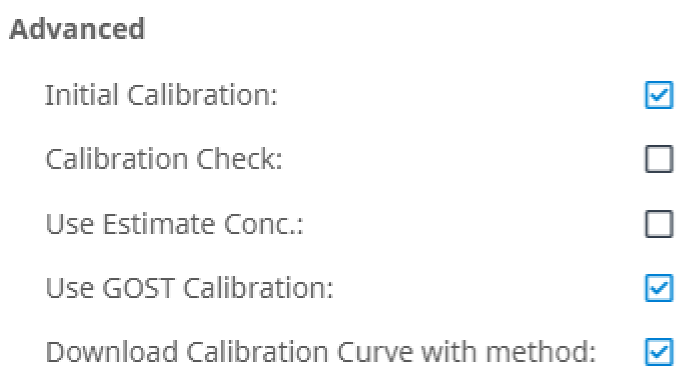
Use GOST Calibration

Refer to Use GOST calibration for more details.

By checking this option, four additional columns become available in the **Calibration** -> **Component list** table for each channel.

Download Calibration Curve with method

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



Enter the curve coefficients in the **Calibration** -> **Component list** . Find more information in Multi Level Calibration.

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

Use GOST calibration

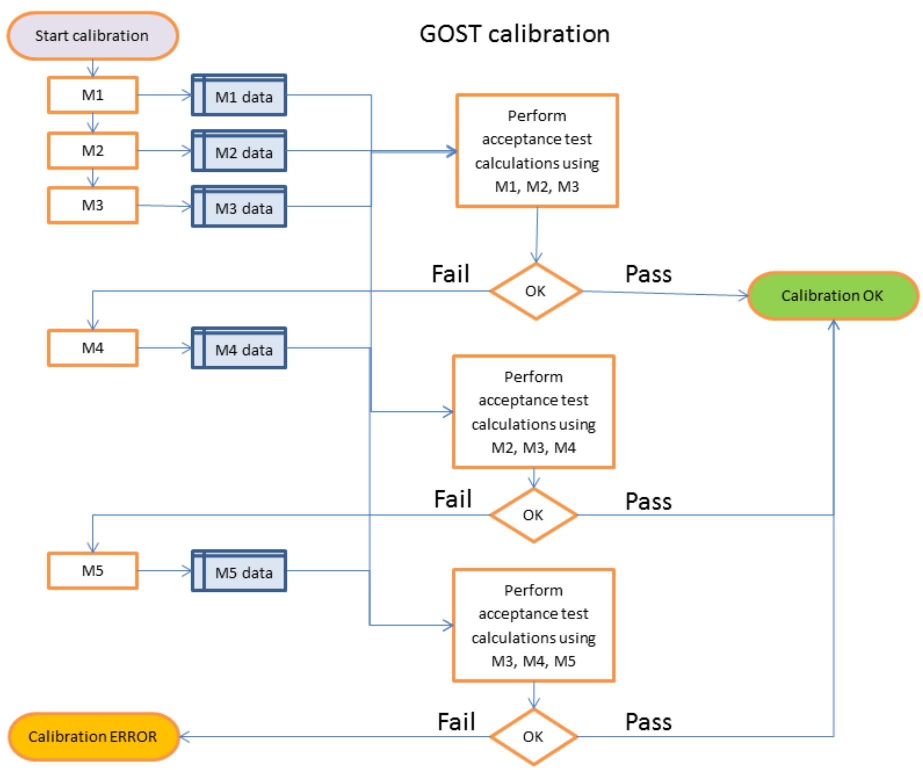
The energy calculation norms GOST 22667 and GOST31369 describe that the calibration of the Micro GC should be performed according to norm GOST31371.7. This norm describes that the Micro GC should be calibrated using a sequence of three calibration runs. The results of these three calibrations (M1, M2 and M3) 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

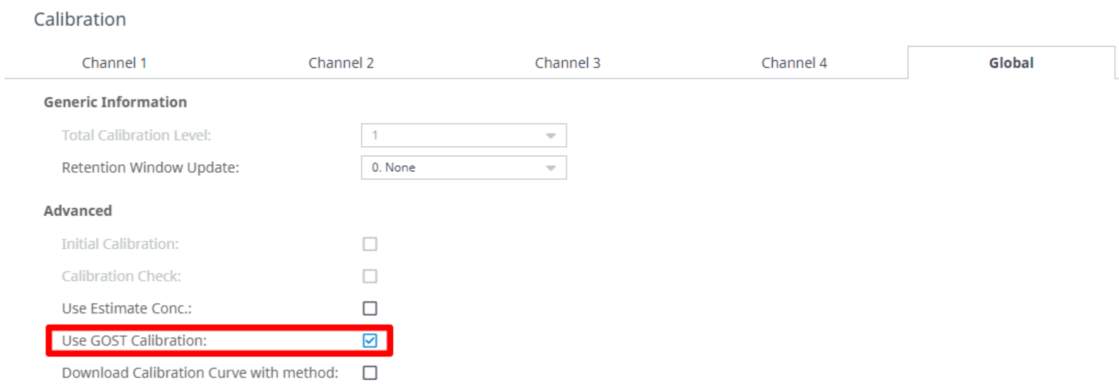
a and b are coefficients defined in the norm
x is the component concentration

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). A calibration alarm is generated if, after five calibration runs, the results are still not within the limits.

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.



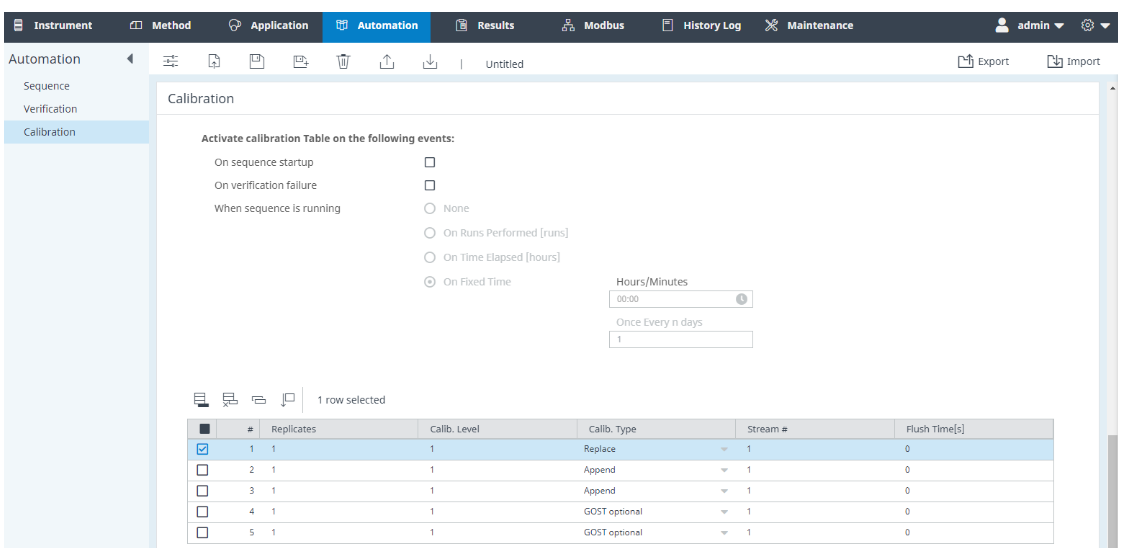
Below the user will find a guide to set up the GOST calibration for the instrument. From the **Method** tab, select **Calibration** and then **Global** settings.



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

- Method calibration global settings screen:
  - **Total Calibration Levels** is set to 1 and is grayed out
  - **Initial Calibration** and **Calibration Check** are unchecked and grayed out
- In the **Automation** tab **Calibration** screen:
  - **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

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



In the **Calibration -> Component list** table for each channel, four additional columns become available.

In the **Calibration -> Component list** table for each component, the calibration limit coefficients should be given the values according to the tables given in the GOST R7 calibration norm.

Component list

ID	Peak name	Level 1	Curve type	Thru origin	RF other peak	Rel. R.F.	Intercept coeff.	Linear coeff.
1	Oxygen	0.5	0. Linear	☐	0	0	0	3.2839451420345
2	Nitrogen	4.02	0. Linear	☐	0	0	0	3.11500028067...
3	Methane	88.441	0. Linear	☐	0	0		3.75380677369...
4	Ethane	4	0. Linear	☑	0	0	0	2.49534244730...

	GOST-R7 T2:A%	GOST-R7 T2:B%	GOST-R7 A.T1...	GOST-R7 A.T1...
	0.03	0.0004	0.015	0.0002
	0.02	0.0002	0.01	0.0001
	-0.0056	0.62	-0.0028	0.31
	0.02	0.0003	0.01	0.00015

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

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.

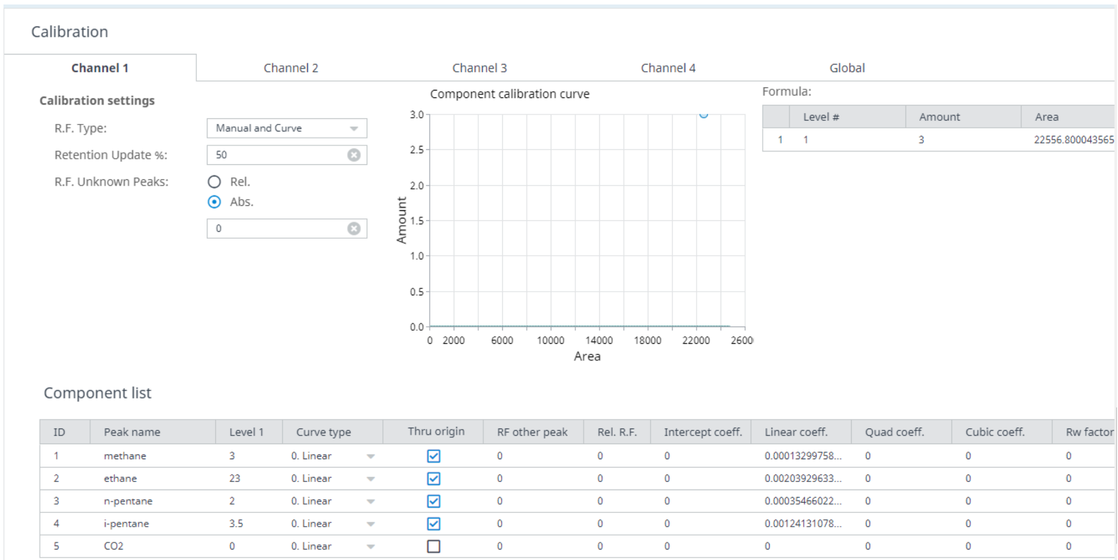
The integration report shows the alarms. If the calibration alarm is raised, the mean calibration values calculated over the calibration runs, are outside the calculated limits.

Prepare a calibration method

Setting up all parameters for a calibration.

Peak Calibration Table

This part defines how to prepare the calibration.



Open the **Calibration->Component list** table. Peaks are listed in order of their retention time and appropriate component name. Make sure the **Peak Identification** table is already completed and all peaks are assigned with the correct peak names.

- 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 Multi Level Calibration.
- 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.
- Curve Type
  Three types of mathematical regression models are available, see Multi Level Calibration.
- Thru origin
  The curve will be forced to go through the origin (0.0). Find more information in Multi Level Calibration.
- 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 and Download Calibration Curve with method.
- 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 and Download Calibration Curve with method.
- 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 and Download Calibration Curve with method.
- 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 and Download Calibration Curve with method.
- Rw factor
  The calculated Rw coefficient of the calibration curve. Only required if a multilevel calibration is performed with a field correction calibration.
- 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**.
- Manual RF value
  Enter a manual Response factor if **Manual RF** was selected in the previous column.
- 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 and Calibration Validation.
- 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 and Calibration Validation.

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.

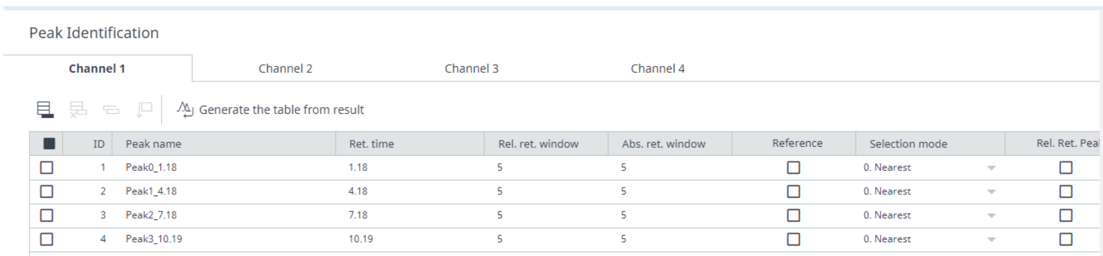
Running a new Calibration

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. To start a Calibration run, 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.

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 web interface. The updated calibration curve can be found in the Component Calibration Curve area.

The calibration curve coefficients can be found in the Peak Identification/Calibration window.



The Analysis results can be found in the Integration Report.

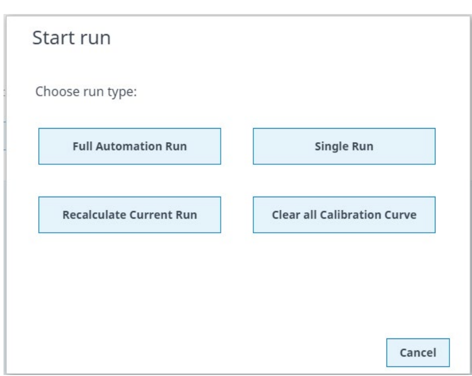
Integrated Peak List

#	Channel	Peak #	Peak name	ESTD Conc.	Retention[s]	Area[10nV.s]	H
1	1	1	methane	0.187500	1.18	1409.8000	20
2	1	2	ethane	1.437500	4.18	704.9000	10
3	1	3	i-pentane	3.500000	7.18	2819.6000	40
4	1	4	CO2	0.000000	10.19	704.9000	10

Recalibrating an existing Calibration run

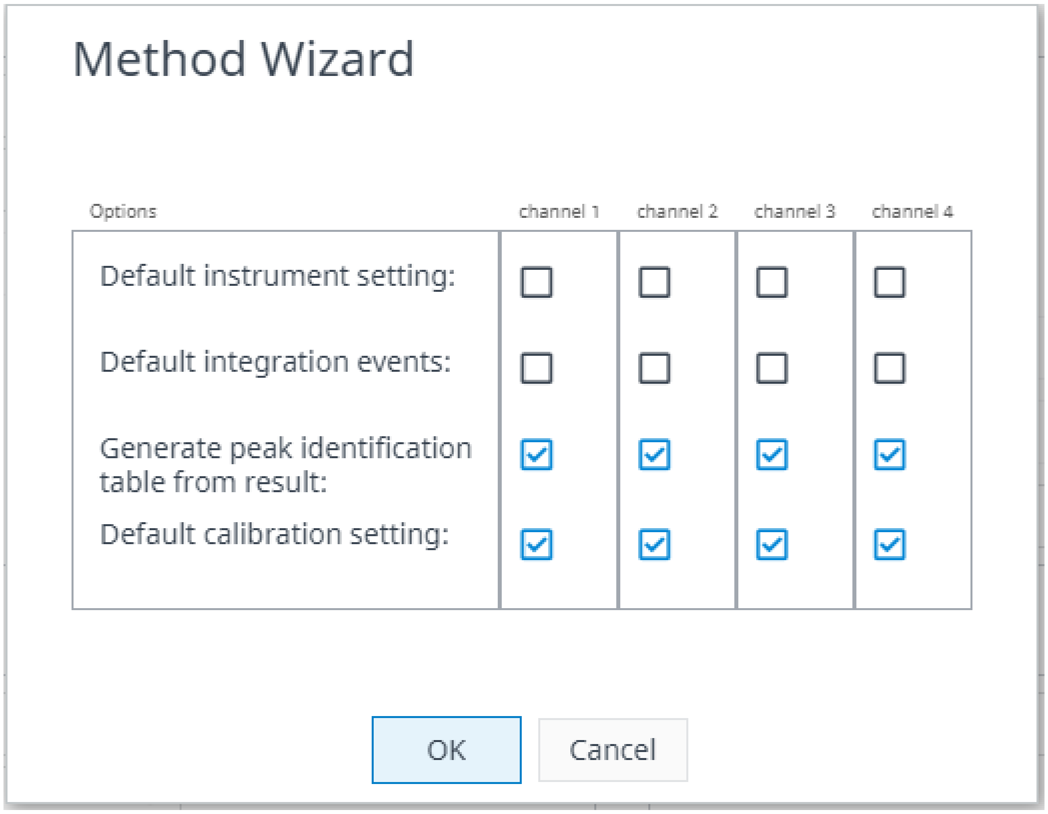
If a **Calibration** run (chromatogram) is already collected, reprocessing this data is sufficient to let the instrument determine the calibration curve. In all cases ensure the method is saved and method and chromatogram are downloaded to the instrument.

The chromatogram, method, and analysis results will be uploaded to PROstation web interface after the processing as described in Multi Level Calibration.



Method Wizard

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



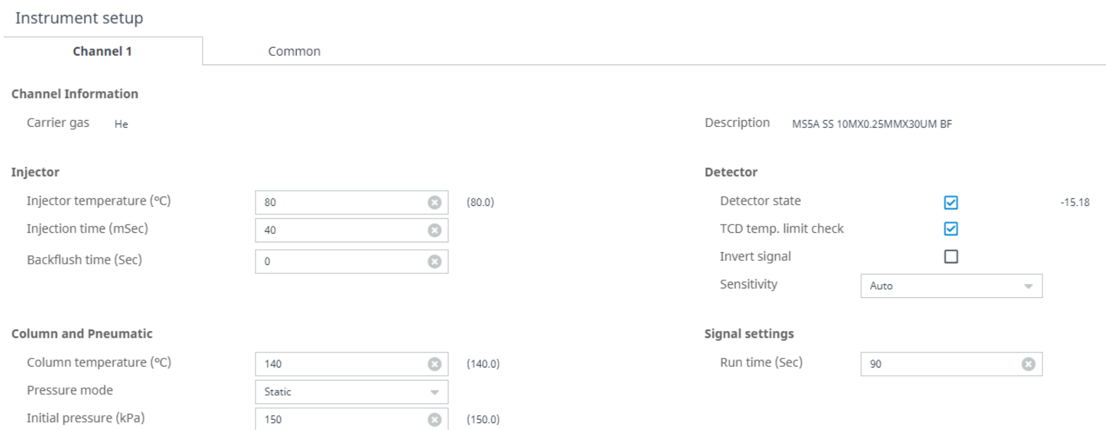
To activate the method wizard, from the Method tab, select the **Create New/Wizard**  icon.

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.

A Method case

Review the following example method settings.

Step 1. Instrument setup (channel)



common

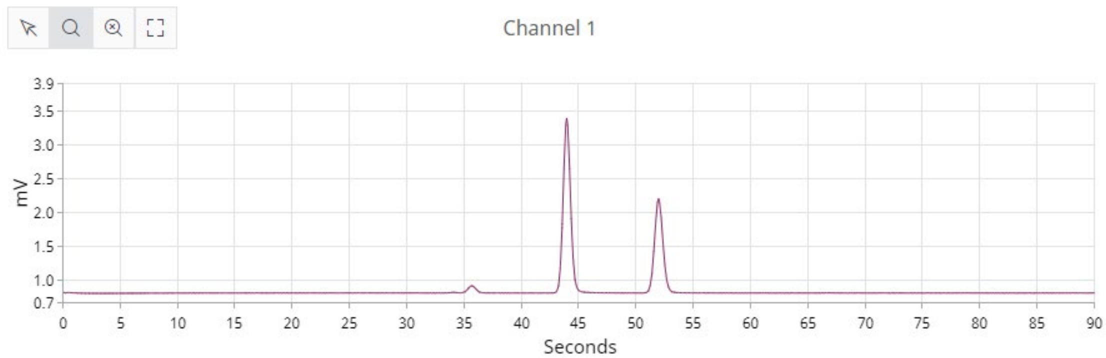
You may adjust the instrument setpoints according to the real application

select to download the method to the instrument.

Perform a trial run. See Start a Run.

After the run completes, view the chromatogram from the latest report screen.

In this example, the chromatogram is shown below:



Step 2. Integration events

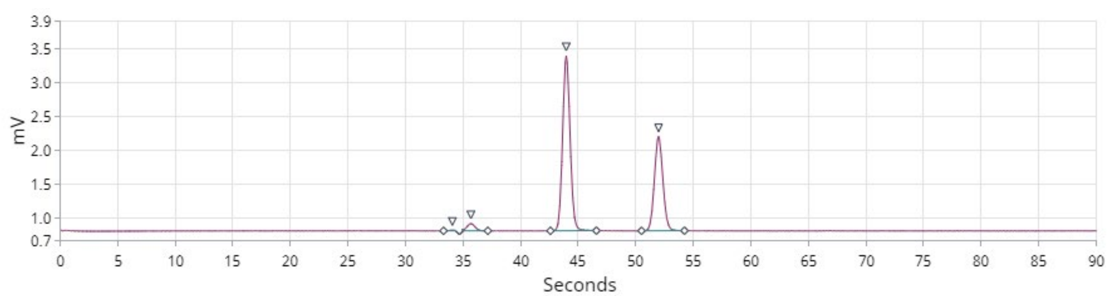
		Event ID	Start time	Value
1	☐	14. Turn Integration Off	0	1
2	☐	13. Turn Integration On	20	1
3	☐	1. Set Peak Width [s]	0	1
4	☐	2. Set Threshold [10 nV]	0	10

Setup the integration table and download to the instrument to apply the method again.

Check the result int the latest report screen.

Note that you need to adjust the integration events table for proper integration of the chromatogram. Adjust by changing threshold, toggle the integration on and off in certain time frame, etc.

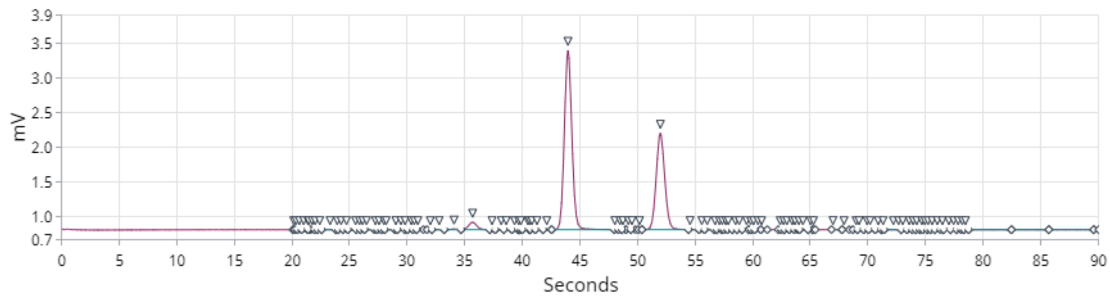
The integration settings above result in the chromatogram below:



If the threshold is set to 1 as below,

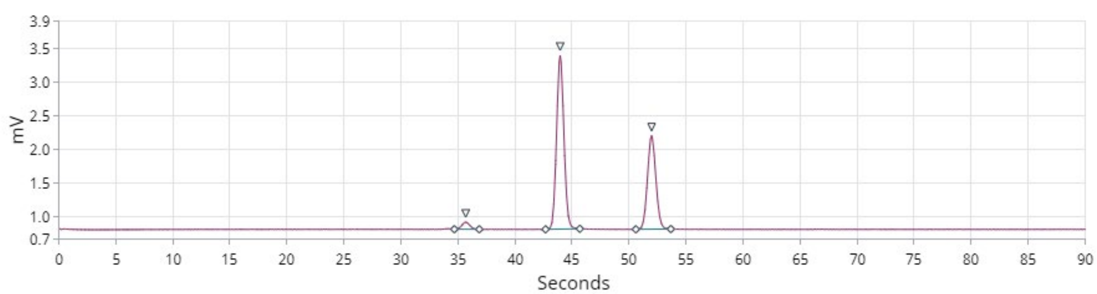
		Event ID	Start time	Value
1	☐	14. Turn Integration Off	0	1
2	☐	13. Turn Integration On	20	1
3	☐	1. Set Peak Width [s]	0	1
4	☐	2. Set Threshold [10 nV]	0	1

The resulting chromatogram below is calculated:



Experiment with using the Estimate Threshold event ID to let the instrument automatically choose a threshold. If the estimated threshold is not acceptable, choose a threshold manually.

		Event ID	Start time	Value
1	☐	14. Turn Integration Off	0	1
2	☐	13. Turn Integration On	20	1
3	☐	1. Set Peak Width [s]	0	1
4	☐	5. Estimate Threshold	0	1



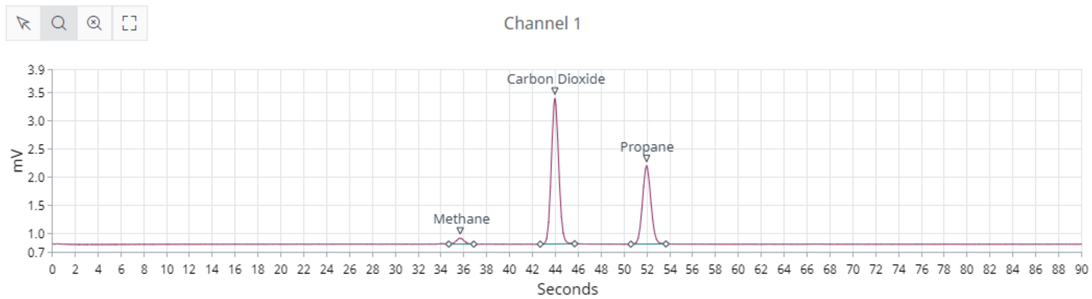
Step 3. Peak Identification

Set up the components names and retention times according to the integration result. An example is below:

☐	ID	Peak name	Ret. time	Rel. ret. window	Abs. ret. window	Reference	Selection mode	Rel. Ret. Peak
☐	1	Methane	35.62	5	5	☐	0. Nearest	☐
☐	2	Carbon Dioxide	43.89	5	5	☐	0. Nearest	☐
☐	3	Propane	51.9	5	5	☐	0. Nearest	☐

Apply the method to the instrument again by selecting download.

You will see the integrated peaks are annotated with the compound names. Note that the ESTD amounts are 0 due to the fact the calibration has not been performed.



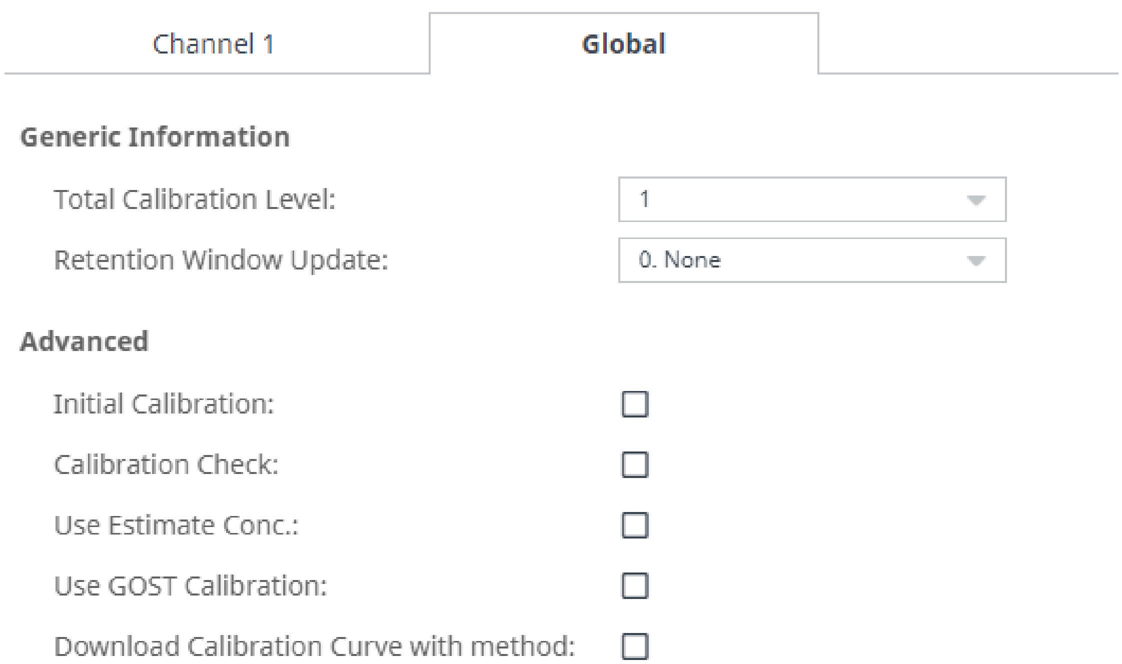
Integrated Peak List

#	Channel	Peak #	Peak name	ESTD Conc.	Retention[s]	PeakRR...	Area	Height	Width[s]	Separ.C...	Validation
1	1	1	Methane	0.000000	35.63	0.0000	139.0366	10465.86...	0.7536	BB	0
2	1	2	Carbon Dio...	0.000000	43.91	0.0000	3212.9248	257886.6...	0.6950	BB	0
3	1	3	Propane	0.000000	51.93	0.0000	1967.0090	138577.1...	0.7931	BB	0

Step 4. Calibration (single level)

For simplicity, here we use single level calibration for this example. For a detailed explanation of the calibration process (single level and multi-level) see the section on Peak Calibration.

In the case that the sample result above is the standard sample with known component concentrations, first set the calibration level to 1.



Set the level amount for the standard sample as below.

Component list

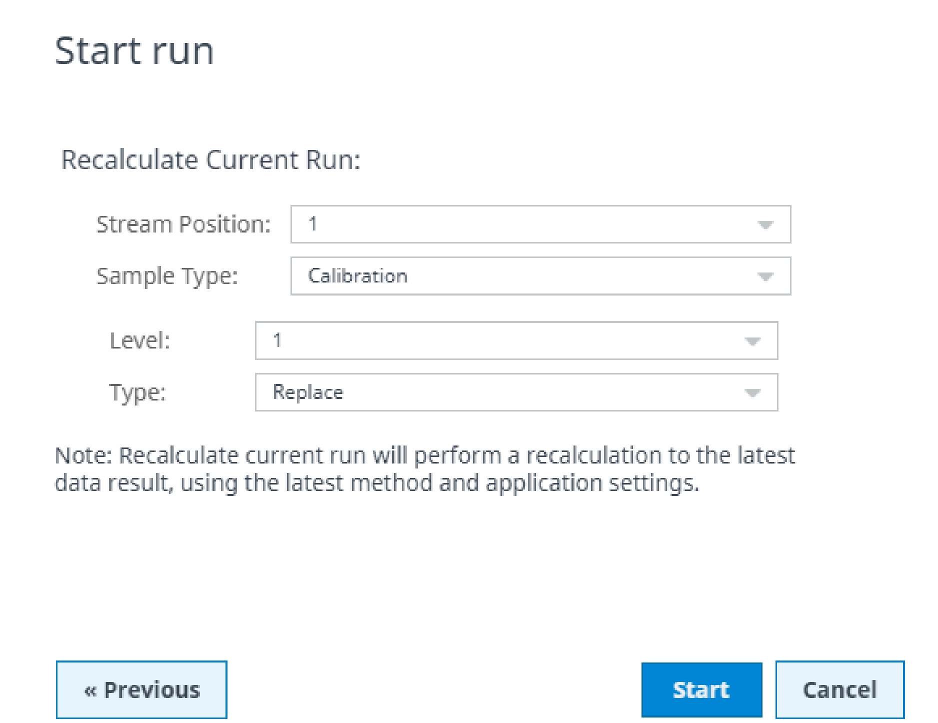
☐	ID	Peak name	Level 1	Curve type	Thru origin	RF other peak	Rel. R.F.	Intercept coeff.	Linear coeff.	Quad coeff.	Cubic coeff.
☐	1	Methane	0.200	0. Linear	☑	☐	0.000000	0	0	0	0
☐	2	Carbon Dioxide	1.100	0. Linear	☑	☐	0.000000	0	0	0	0
☐	3	Propane	0.720	0. Linear	☑	☐	0.000000	0	0	0	0

Note that for single level calibration, we almost always set the curve type to “Linear” and the “Thru origin” option selected for each component.

Apply the method to the instrument.

Manually perform a recalculation of calibration run type. See Start a Run.

You can either perform a real run or a recalculation because the standard chromatogram is already stored in the instrument due to the previous steps.



After the recalculation (or run) completes. The linear coefficient of component is updated, based on a single level calibration through the origin point.

Component list

☐	ID	Peak name	Level 1	Curve type	Thru origin	RF other peak	Rel. R.F.	Intercept coeff.	Linear coeff.	Quad coeff.	Cubic coeff.
☐	1	Methane	0.200	0. Linear	☑	☐	0.000000	0	0.00143847	0	0
☐	2	Carbon Dioxide	1.100	0. Linear	☑	☐	0.000000	0	0.000342367	0	0
☐	3	Propane	0.720	0. Linear	☑	☐	0.000000	0	0.000366038	0	0

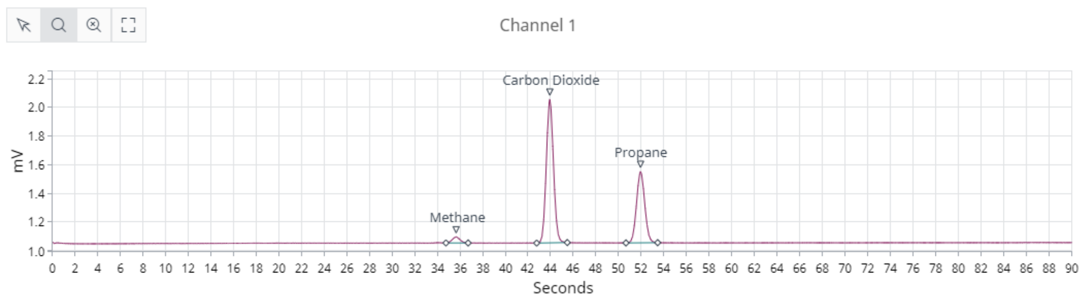
Select a row in the table to see the corresponding calibration curve plotted.

A single level calibration process is completed and therefore the method setup process is complete.

Step 5. Normal Analysis (verify the method)

Finally, let's use the method to analyze another 121omponents121m, with unknown 121omponent concentrations.

Performing a normal analysis run with a different sample source (a source with concentration different form the standard), could result in the example result below:



Integrated Peak List

#	Channel	Peak #	Peak name	ESTD Conc.	Retention[s]	PeakRR...	Area	Height	Width[s]	Separ.C...	Validation
1	1	1	Methane	0.078325	35.62	0.0000	54.4503	4175.0899	0.7398	BB	0
2	1	2	Carbon Dio...	0.420013	43.89	0.0000	1226.7916	100158.5...	0.6837	BB	0
3	1	3	Propane	0.254903	51.90	0.0000	696.3850	49770.03...	0.7832	BB	0

Note that the peak heights in the chromatogram are different from the standard chromatogram. The ESTD amount of 121omponents changes according to the integrated peak areas.

Multi Level Calibration

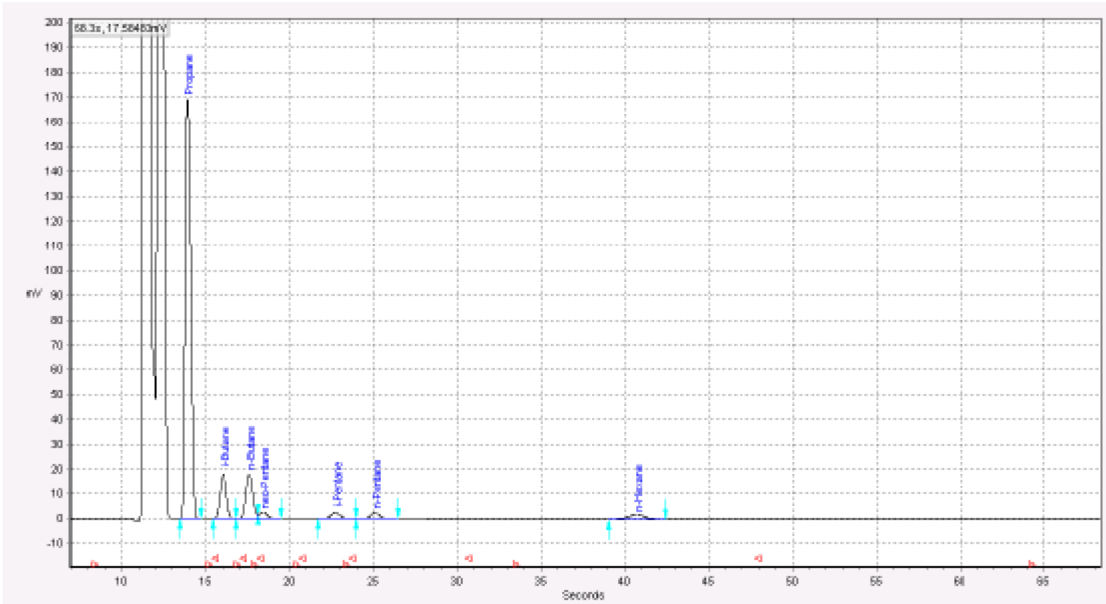
Multi Level Calibration

This section 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.

In this section

Chromatogram

The primary data from a GC is a chromatogram, as seen here.



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”.

In this section

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

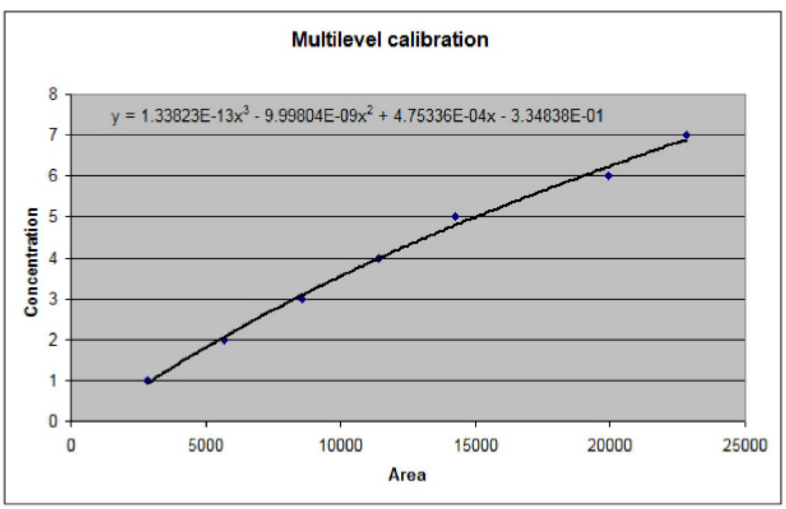
y represents the Concentration

Example:

Data set:

Level	Area	Concentration
1	2850	1.0
2	5700	2.0
3	8550	3.0
4	11400	4.0
5	14250	5.0
6	19950	6.0
7	22800	7.0

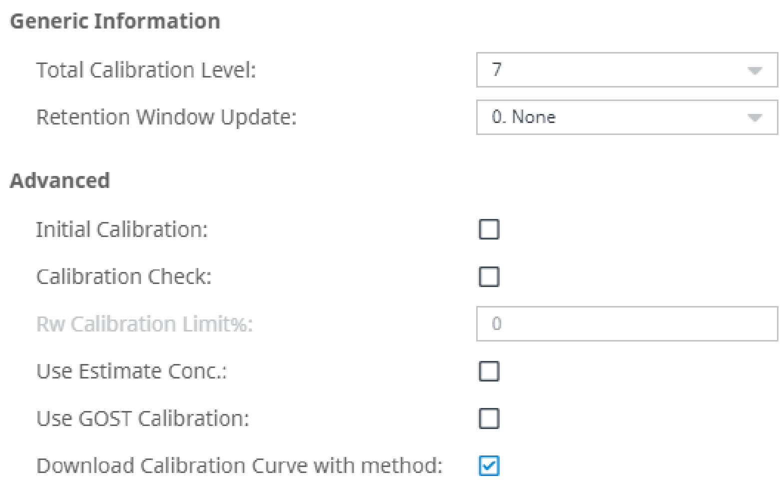
The data above has been used to fit a cubic curve.



Offline calibration

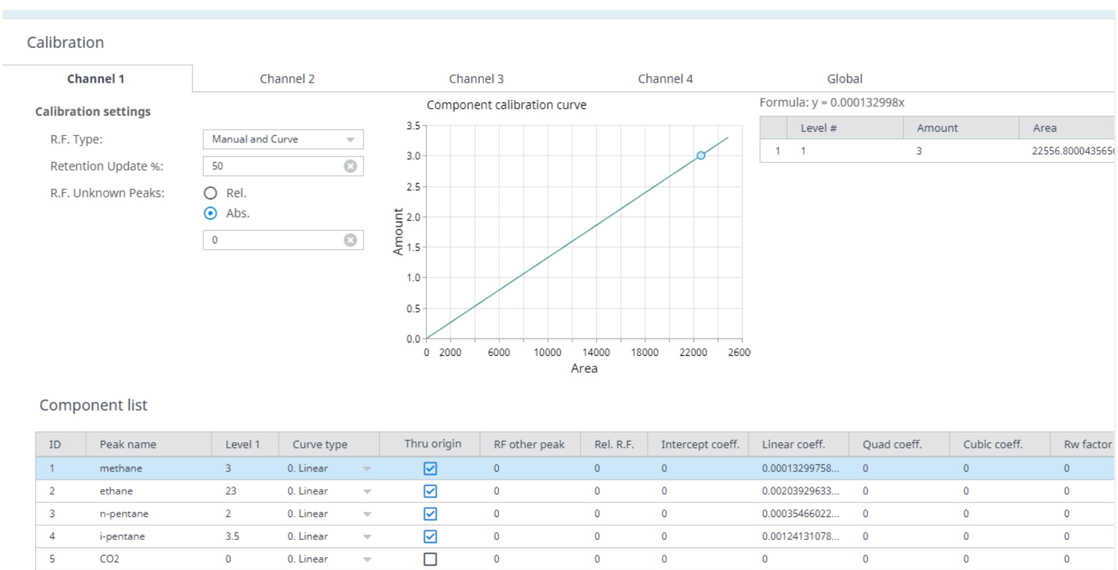
The coefficients of the polynomial equation can be determined in third party mathematical tools. This is called **Offline Calibration**.

The coefficients for the polynomial equation can only be set if the option **Download Calibration Curve with method** is enabled in the **Calibration** Global settings screen, see below.



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 **Calibration -> Component list** table.



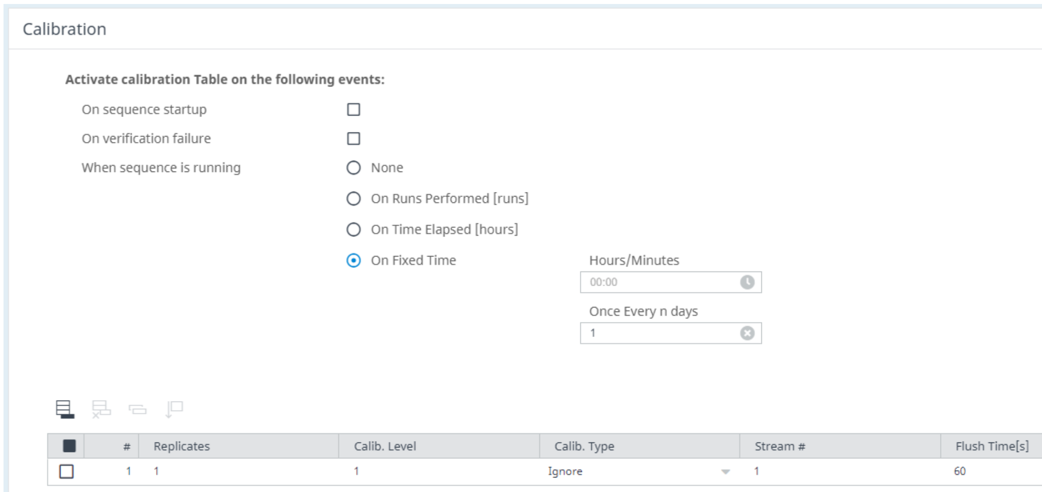
The coefficients of the polynomial curve y = a * x3 + b * x2 + c* x + d are defined as follows:

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:



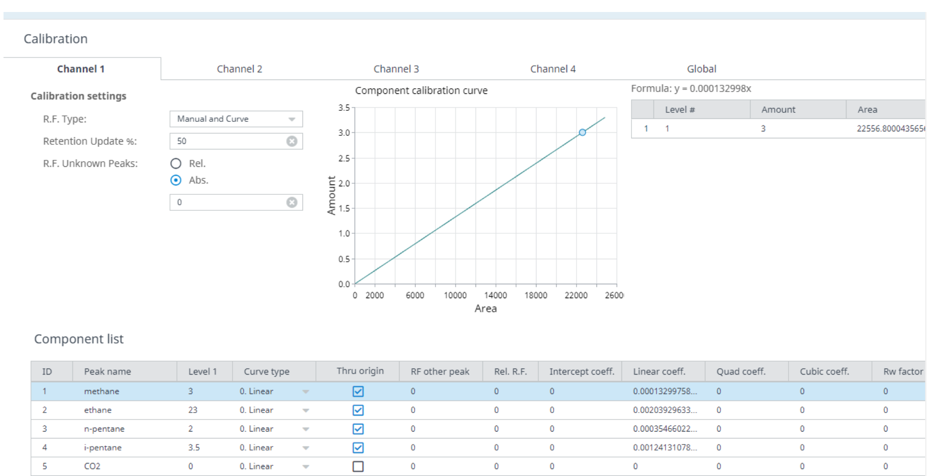
The 990 Micro GC is capable of calibrating up to seven levels. After each calibration run, the 990 Micro GC will perform a curve fit using the available calibration data.

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 **Component List**.

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 **Method**-> **Calibration**, the screen below is displayed.



The coefficients can be examined in the **Calibration** -> **Component list** after uploading the method.

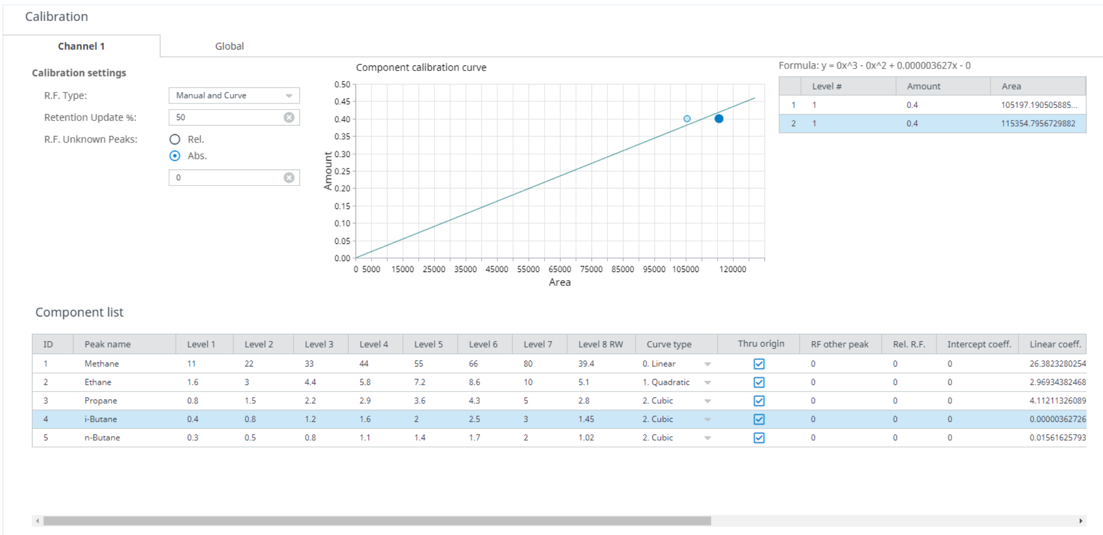
Rw Calibration

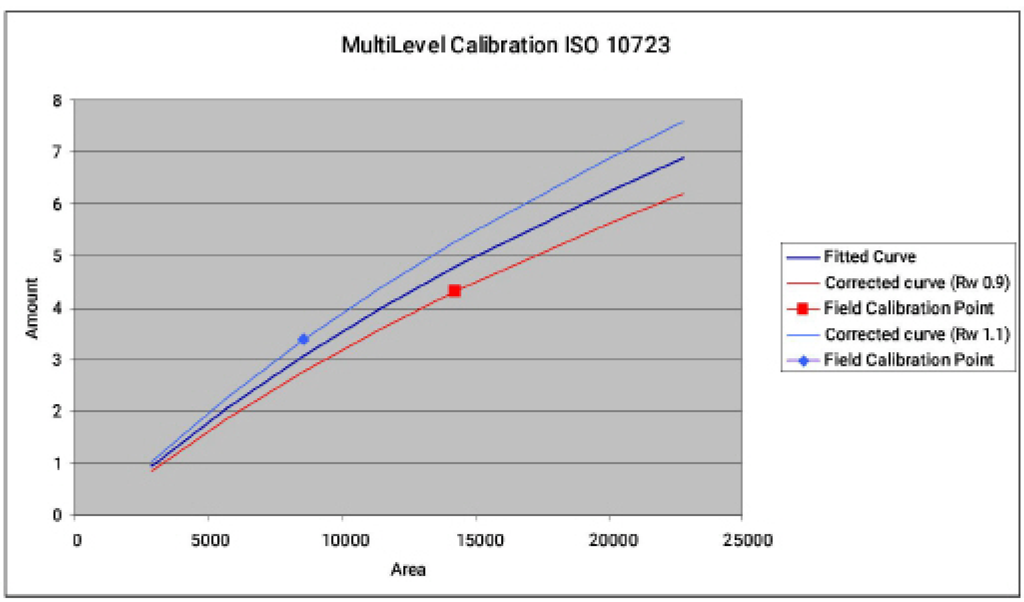
After determining the relation between the area and concentration through the fit, the validity of the curve should be checked periodically. Typically, a daily interval is chosen.

The ambient pressure and detector aging are factors for which a correction should be made.

The figure below 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. This factor is called the Rw factor.

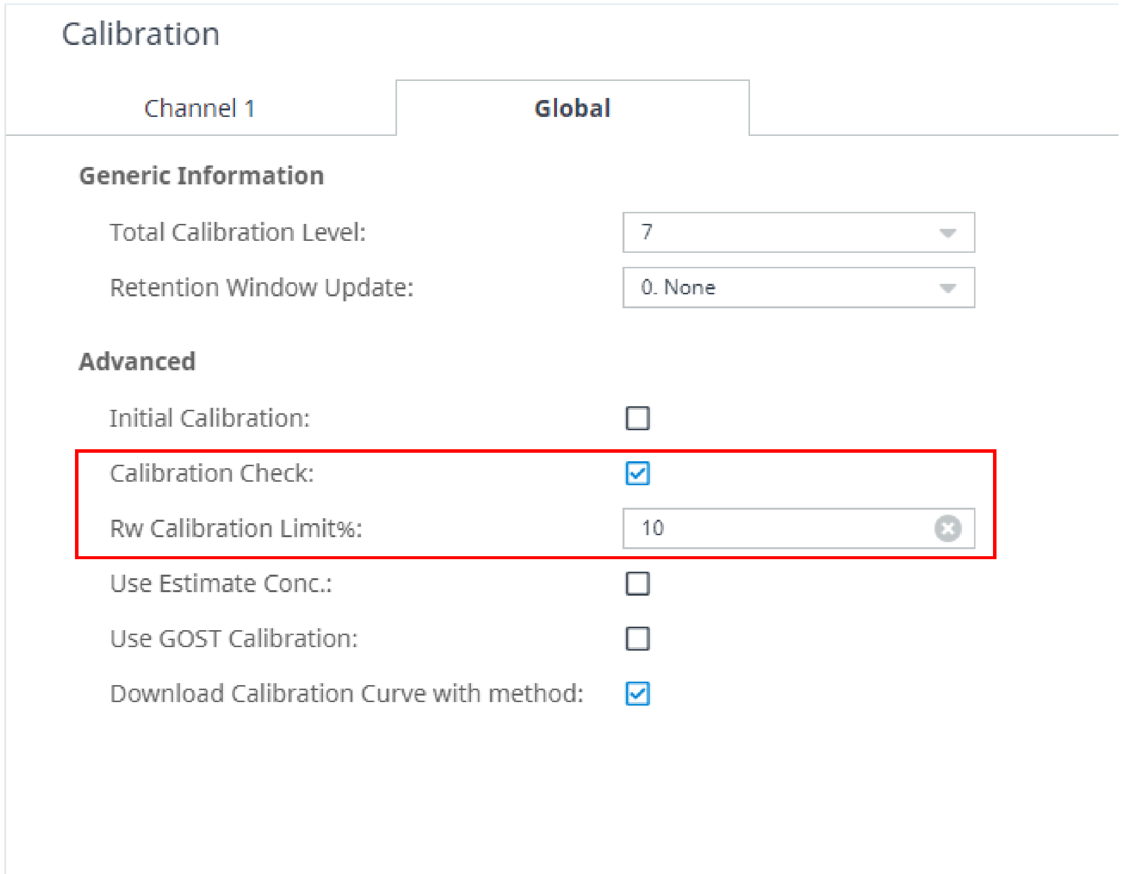




Typically, the Rw factor will vary around 1.

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.



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.

Component list

ID	Peak name	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	Methane	11	22	33	44	55	66	80	39.4	0. Linear	☑	3	2.5	0	26.3823280254
2	Ethane	1.6	3	4.4	5.8	7.2	8.6	10	5.1	1. Quadratic	☑	0	0	0	2.96934382468
3	Propane	0.8	1.5	2.2	2.9	3.6	4.3	5	2.8	2. Cubic	☑	0	0	0	4.11211326089
4	i-Butane	0.4	0.8	1.2	1.6	2	2.5	3	1.45	2. Cubic	☑	0	0	0	0.00000362726
5	n-Butane	0.3	0.5	0.8	1.1	1.4	1.7	2	1.02	2. Cubic	☑	0	0	0	0.01561625793

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.

In this section

Environment

The description of this section is based on the environment described in this paragraph.

Three streams to analyze continuously

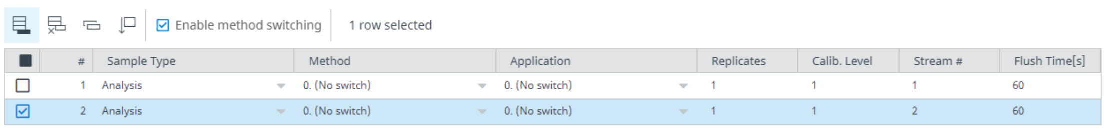
One calibration stream

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

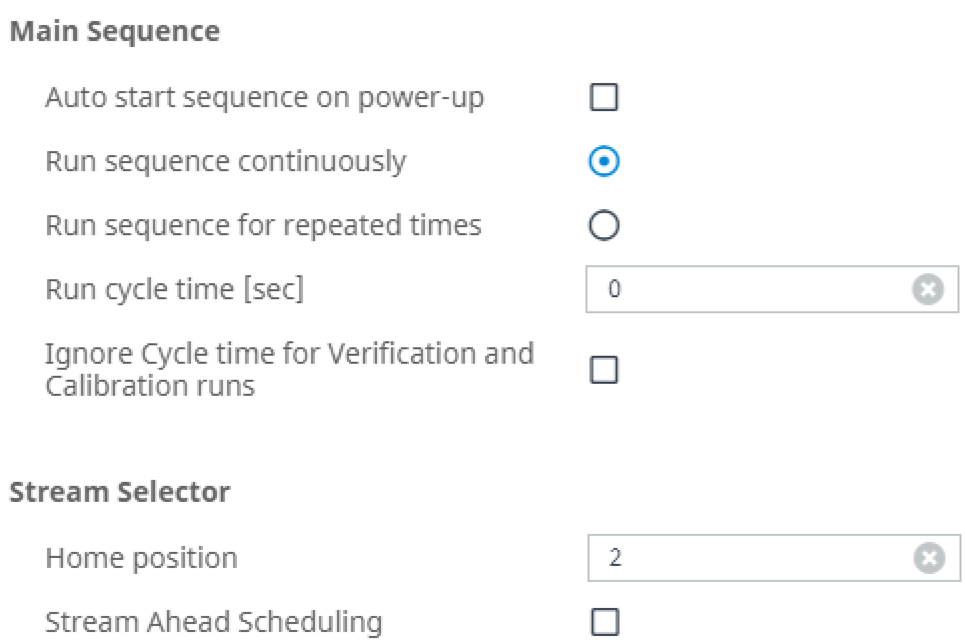
The Sequence Table defines which analyses should be run, and in what order. The figure below shows that three streams are to be analyzed, starting with stream 1, followed by stream 2 and then stream 3. Each stream starts with flushing for 60 seconds to prevent mixing of the different streams.



#	Sample Type	Method	Application	Replicates	Calib. Level	Stream #	Flush Time[s]
1	Analysis	0. (No switch)	0. (No switch)	1	1	1	60
2	Analysis	0. (No switch)	0. (No switch)	1	1	2	60

Sequence Properties

The sequence properties define how the Sequence Table is being used. The figure below 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.



Calibration Table

The Calibration Table defines how a calibration should be performed. In this example, the calibration mixture is connected to stream 1.

The concentration of the calibration level and curve type must be entered in the Component list table.

Component list

ID	Peak name	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8 RW	Curve type	Thru origin
1	methane	3	0	0	0	0	0	0	0	0. Linear	☑

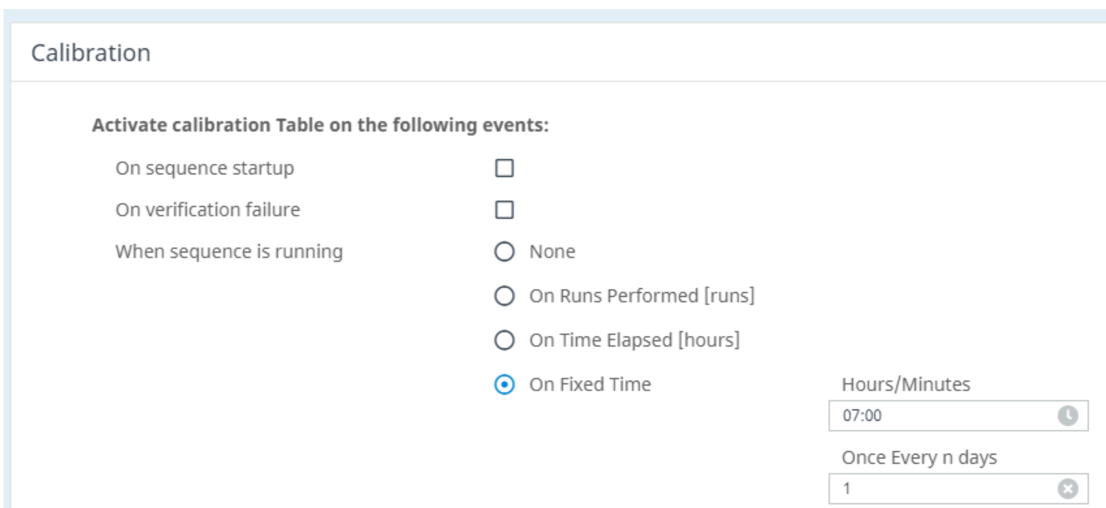
The calibration consists of two steps: the Ignore step and the Append step. The Ignore step is responsible for flushing the 990 Micro GC to ensure a reliable calibration. The Append step, with the number of replicates set to two, forces the 990 Micro GC to clear the previous calibration points and add two new calibration points. Based on these points, the coefficient of the linear curve is determined.

1 row selected

	#	Method	Application	Replicates	Calib. Level	Calib. Type	Stream #	Flush Time[s]
☑	1	0. (No switch)	0. (No switch)	1	1	Ignore	1	0
☐	2	0. (No switch)	0. (No switch)	1	1	Append	1	0

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.



Setting Up a Typical Multilevel Calibration

This section describes typical usage of the 990 Micro GC in combination with multilevel calibration.

In this section

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 Method->Calibration component list

ID	Peak name	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8 RW	Curve type	Thru origin
1	methane	3	2	3	4	5	6	7	3.5	2. Cubic	☑
2	ethane	23	2	3	4	5	6	7	3.5	2. Cubic	☑
3	n-pentane	2	2	3	4	5	6	7	3.5	2. Cubic	☑
4	i-pentane	3.5	2	3	4	5	6	7	3.5	2. Cubic	☑
5	CO2	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	☐

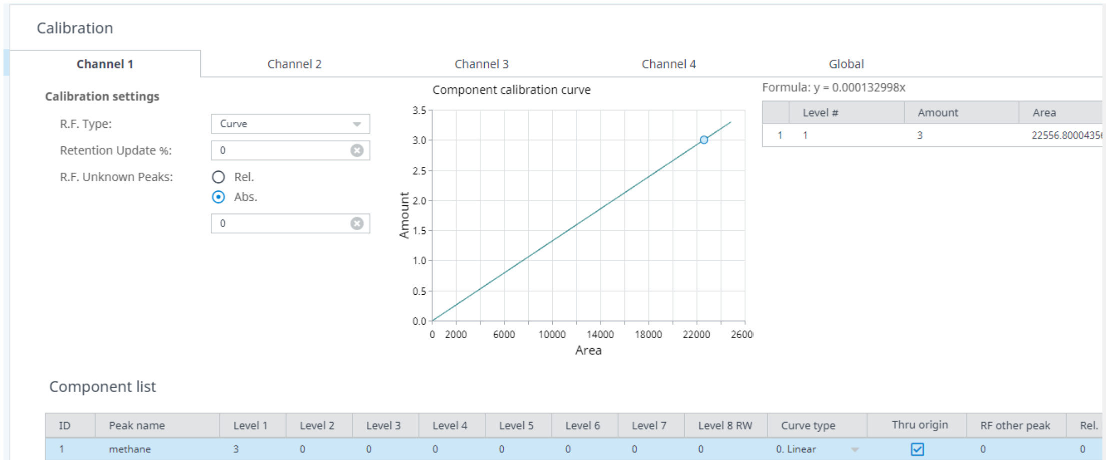
The figure below shows the Calibration Table for performing the calibration of level 1 to 7 and level 8 (Rw).

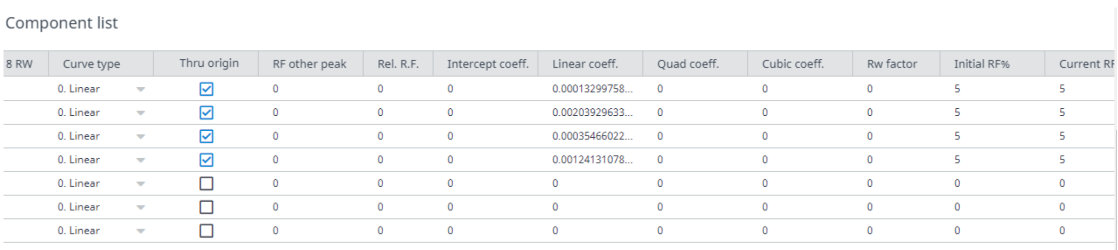
1 row selected

■	#	Replicates	Calib. Level	Calib. Type	Stream #	Flush Time[s]
☐	1	1	1	Ignore	1	60
☐	2	2	1	Append	1	0
☐	3	1	2	Ignore	2	60
☐	4	2	2	Append	2	0
☐	5	1	3	Ignore	3	60
☐	6	2	3	Append	3	0
☐	7	1	4	Ignore	4	60
☐	8	2	4	Append	4	0
☐	9	1	5	Ignore	5	60
☐	10	2	5	Append	5	0
☐	11	1	6	Ignore	6	60
☐	12	2	6	Append	6	0

The calibration can be started using the Start screen.

When the calibration sequence has finished, the derived curves and their coefficients can be examined in the Method -> Calibration screen and the Component list.



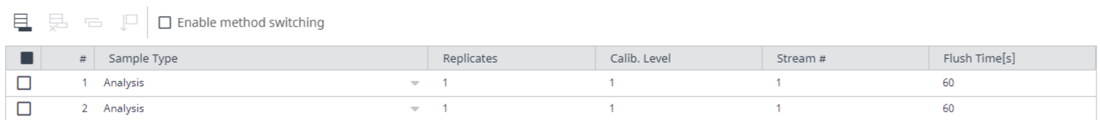


Sequence

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.

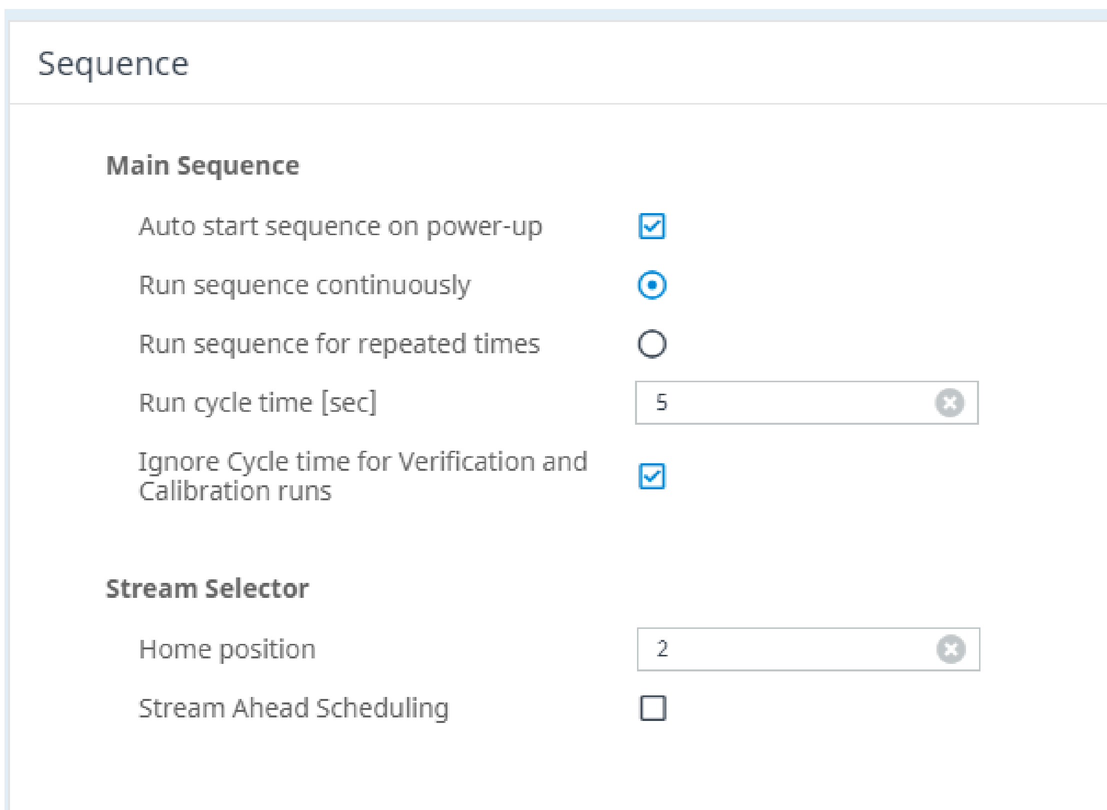


	#	Sample Type	Replicates	Calib. Level	Stream #	Flush Time[s]
	1	Analysis	1	1	1	60
	2	Analysis	1	1	1	60

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. The figure below 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.



Calibration Table

The Calibration Table defines how a calibration should be performed. In this example, the Rw calibration mixture is connected to stream 4.

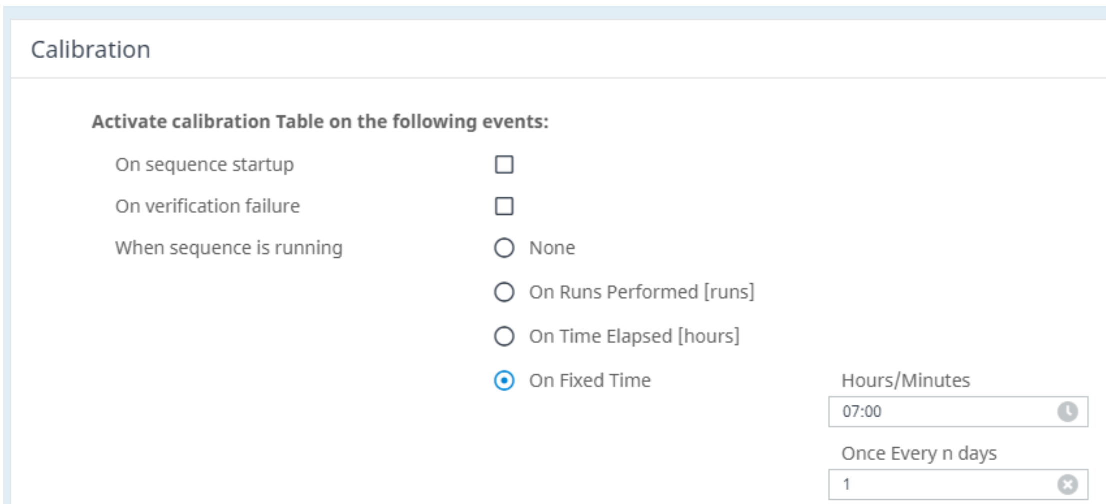
The calibration is set up with two steps: the Ignore step and the Replace step. The Ignore step is responsible for flushing the 990 Micro GC to ensure a reliable calibration. The Replace step forces the 990 Micro GC to clear the previous calibration points and add one new calibration point. Based on this point, the Rw factor is determined.

1 row selected

	#	Replicates	Calib. Level	Calib. Type	Stream #	Flush Time[s]
☐	1	1	1	Ignore	4	60
☑	2	1	0	Replace	4	0

Calibration properties

The calibration properties define how the Calibration Table is being used. The figure below defines that the calibration should start at 0700 every day.



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.

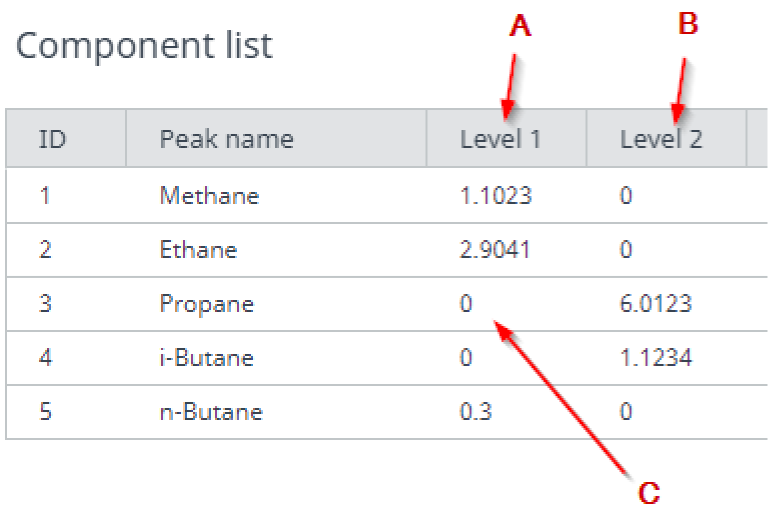
In this section

Two calibration mixtures

To setup a method and sequence with two calibration mixtures:

In the **Calibration**-> **Component list** table, set the level amounts for calibration mixture 1 (A). Put a zero for not existing components in mixture 1 (C).

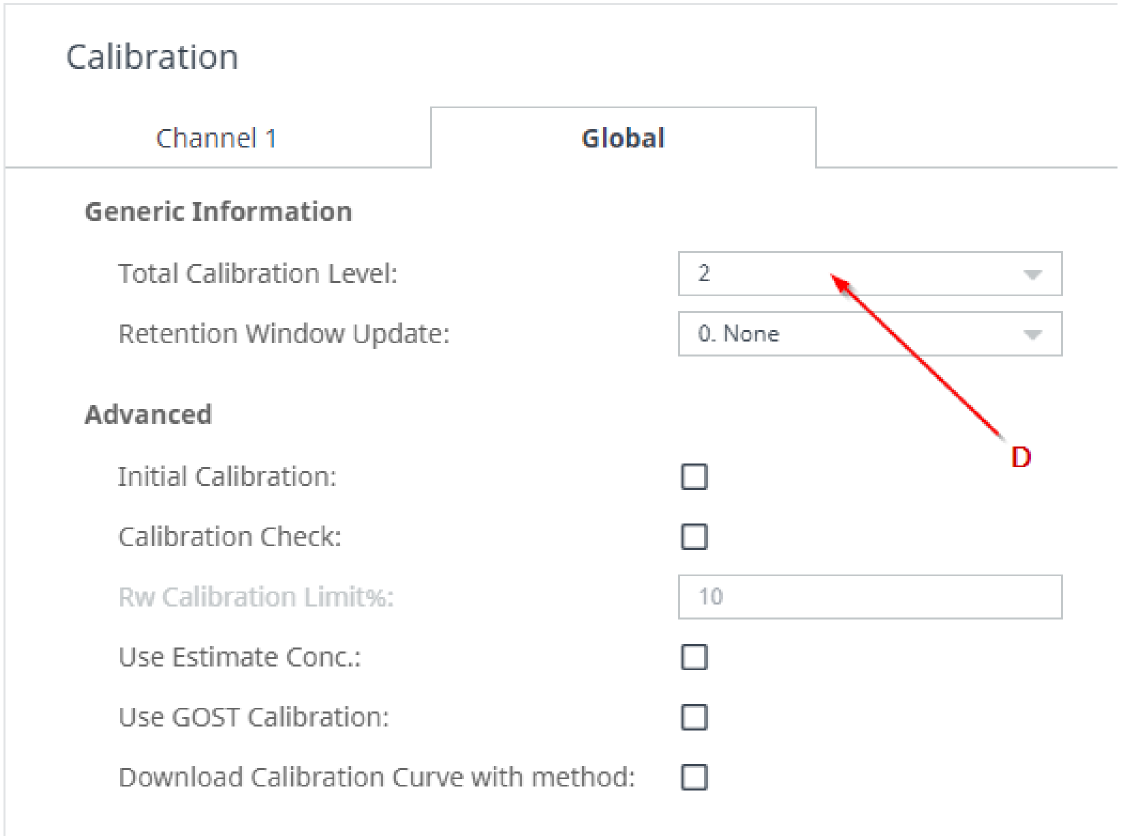
In the **Calibration**-> **Component list** table, set the level amounts for calibration mixture 2 (B). Put a zero for not existing components in mixture 2.



Component list

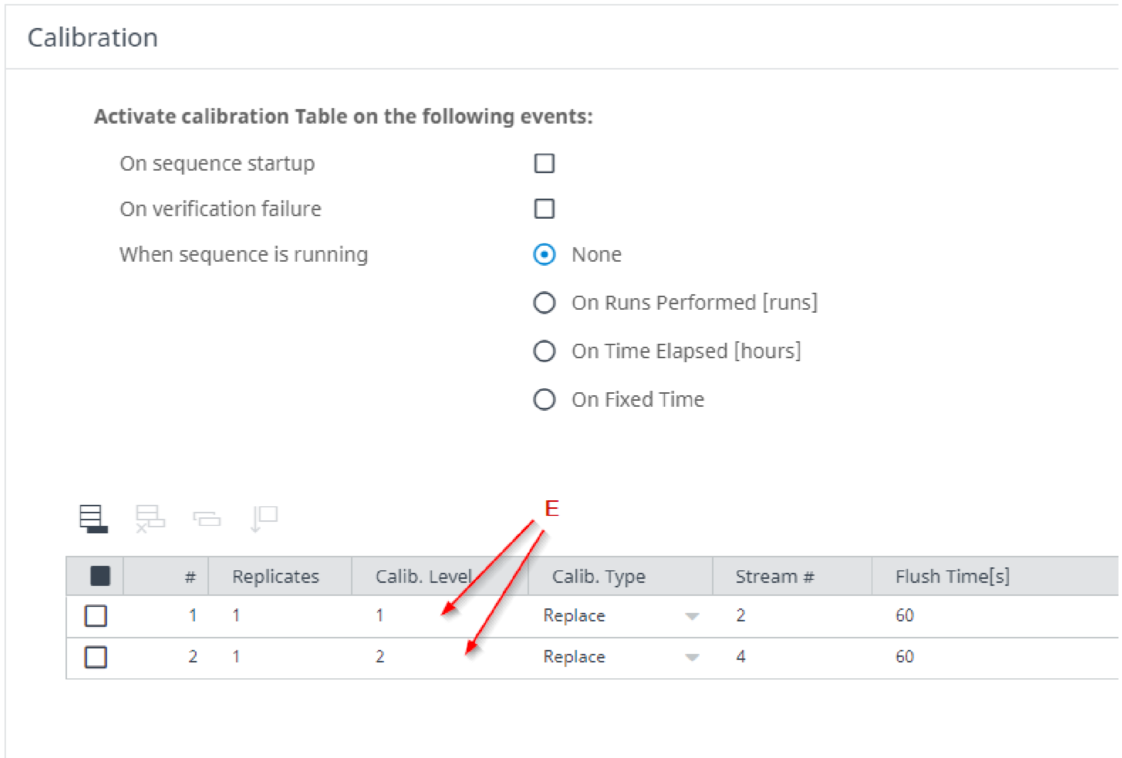
ID	Peak name	Level 1	Level 2
1	Methane	1.1023	0
2	Ethane	2.9041	0
3	Propane	0	6.0123
4	i-Butane	0	1.1234
5	n-Butane	0.3	0

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).



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.

Component list

ID	Peak name	Level 1	Level 2	Level 3	Level 4
1	Methane	1.1	0	3	0
2	Ethane	2.9	0	5.2	0
3	Propane	0	5.7	0	20.3
4	i-Butane	0	1.8	0	12.5
5	n-Butane	5.3	0	11.4	0

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.

In this section

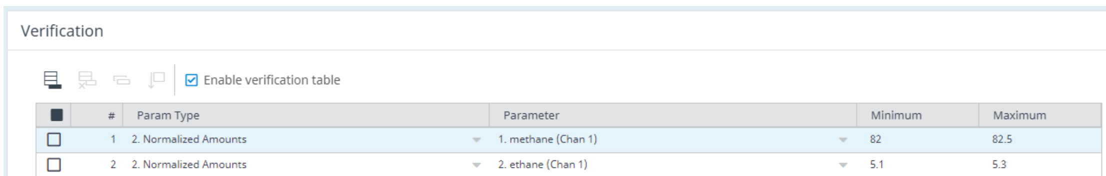
Verification run

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' tab.

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.

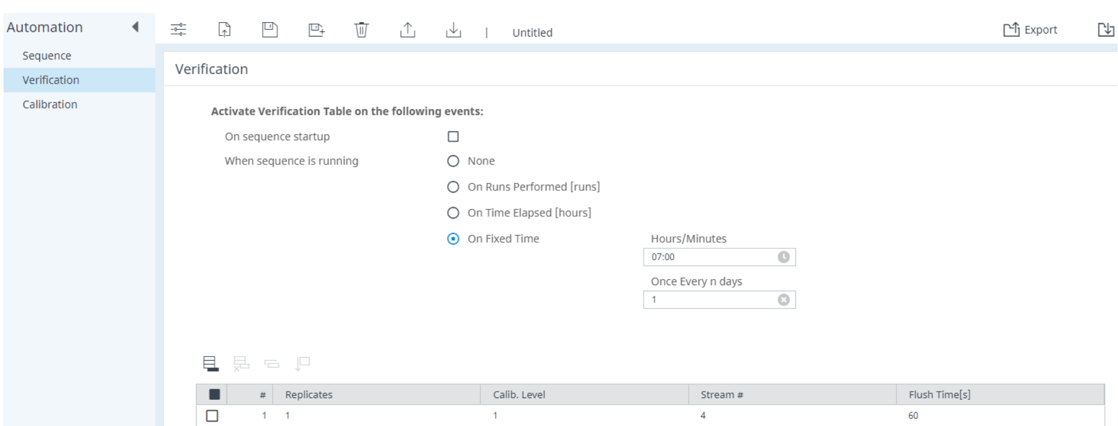


The verification criteria must be enabled. Select **Enable verification table**.

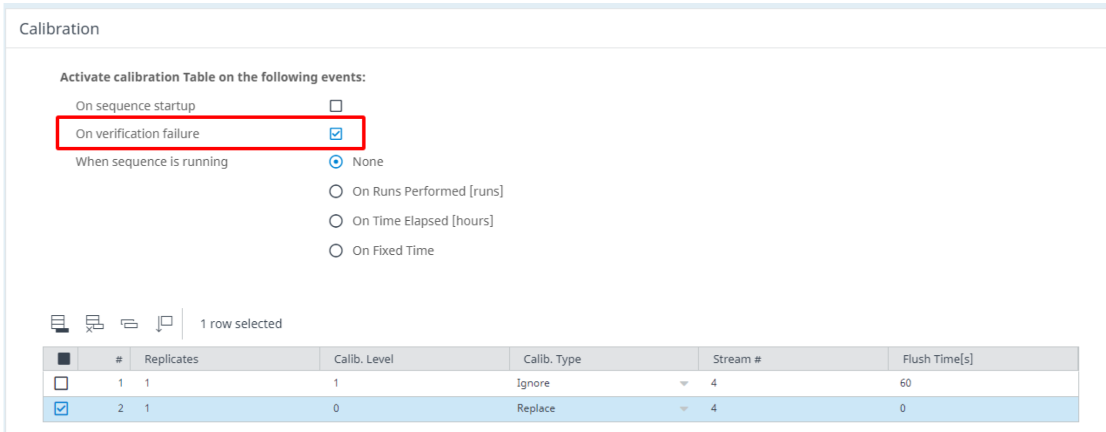
After defining the verification criteria the Verification sequence must be entered. Select Automation-.Verification.

In the Verification tab, define when to perform the verification while running full automation. The figure below shows that the verification should start at 0700 every day.

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.



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.



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.

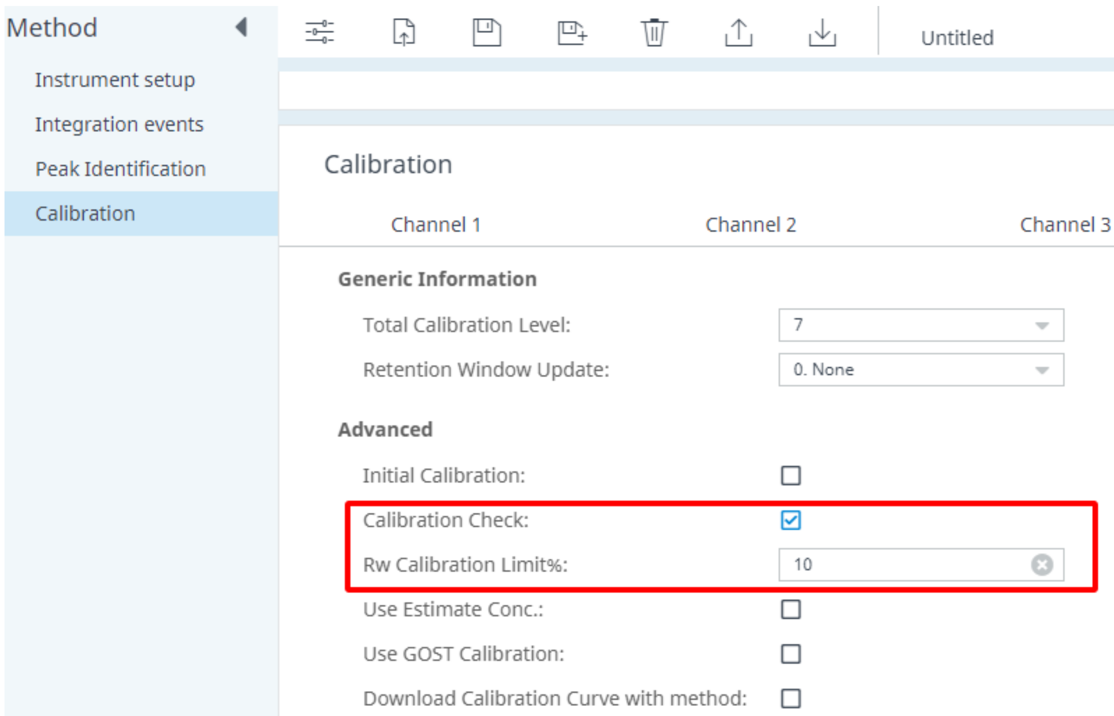
The settings from the screen below allow 5 % deviation from the Initial RF and 5 % deviation from the Current RF. These limits are only active when the option Calibration Check is enabled.

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.

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).



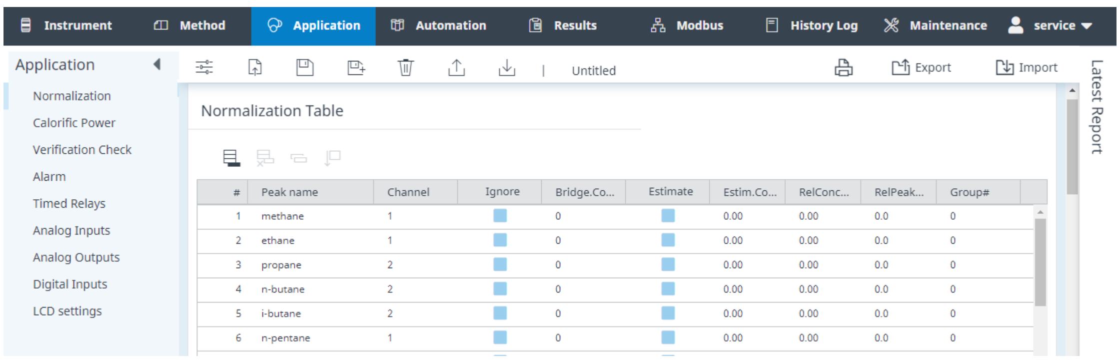
If any peak Rw exceeds its limit, the entire calibration for all peaks will be rejected and the 990 Micro GC will continue using the current Response Factors as determined in the last successful calibration run.

6 Application Tab

Instrument Application Tab

This section describes the Browser Interface **Application** tab. Its function is method development and monitoring analysis. You can import and export application settings files using the Import and Export icons. See Import/Export.

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.

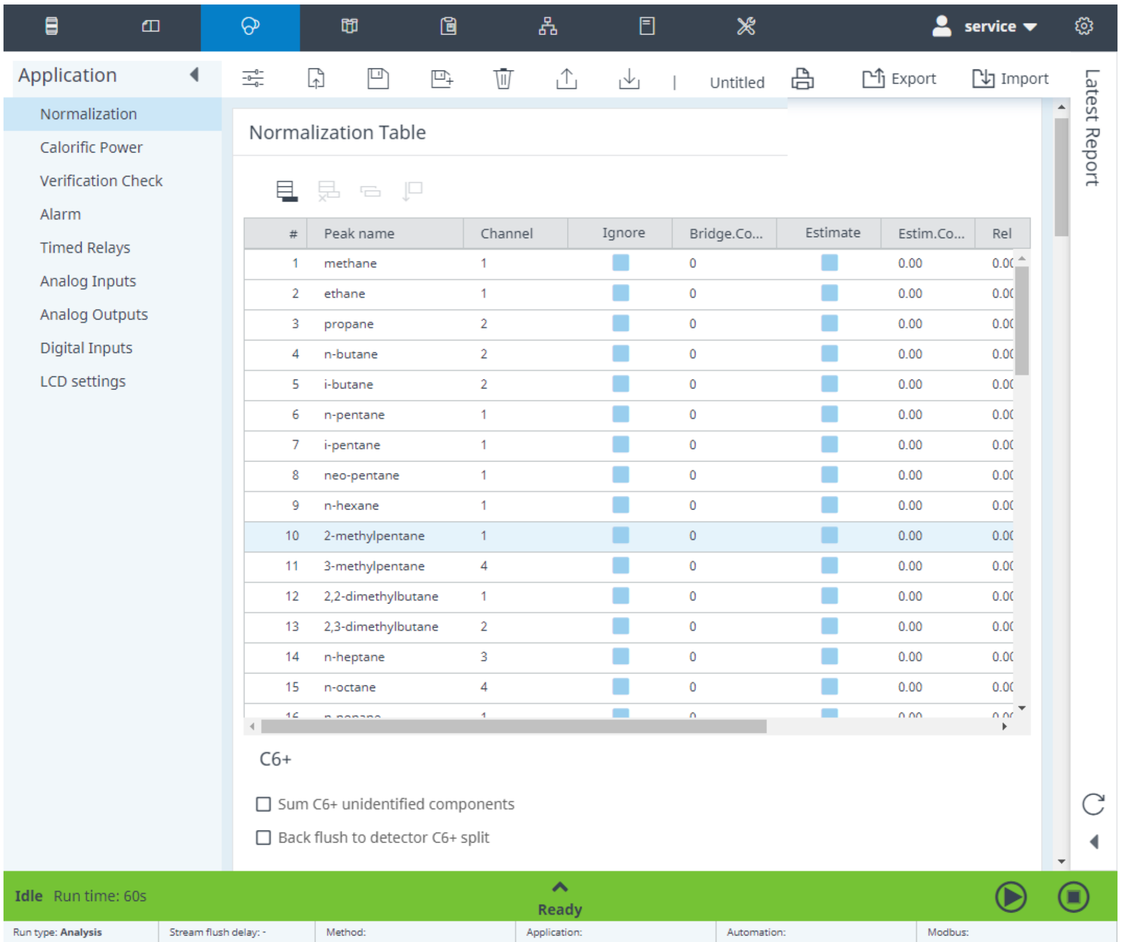


In this section

Application - Normalize

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

The Normalization table is activated under the **Application** tab. 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.



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

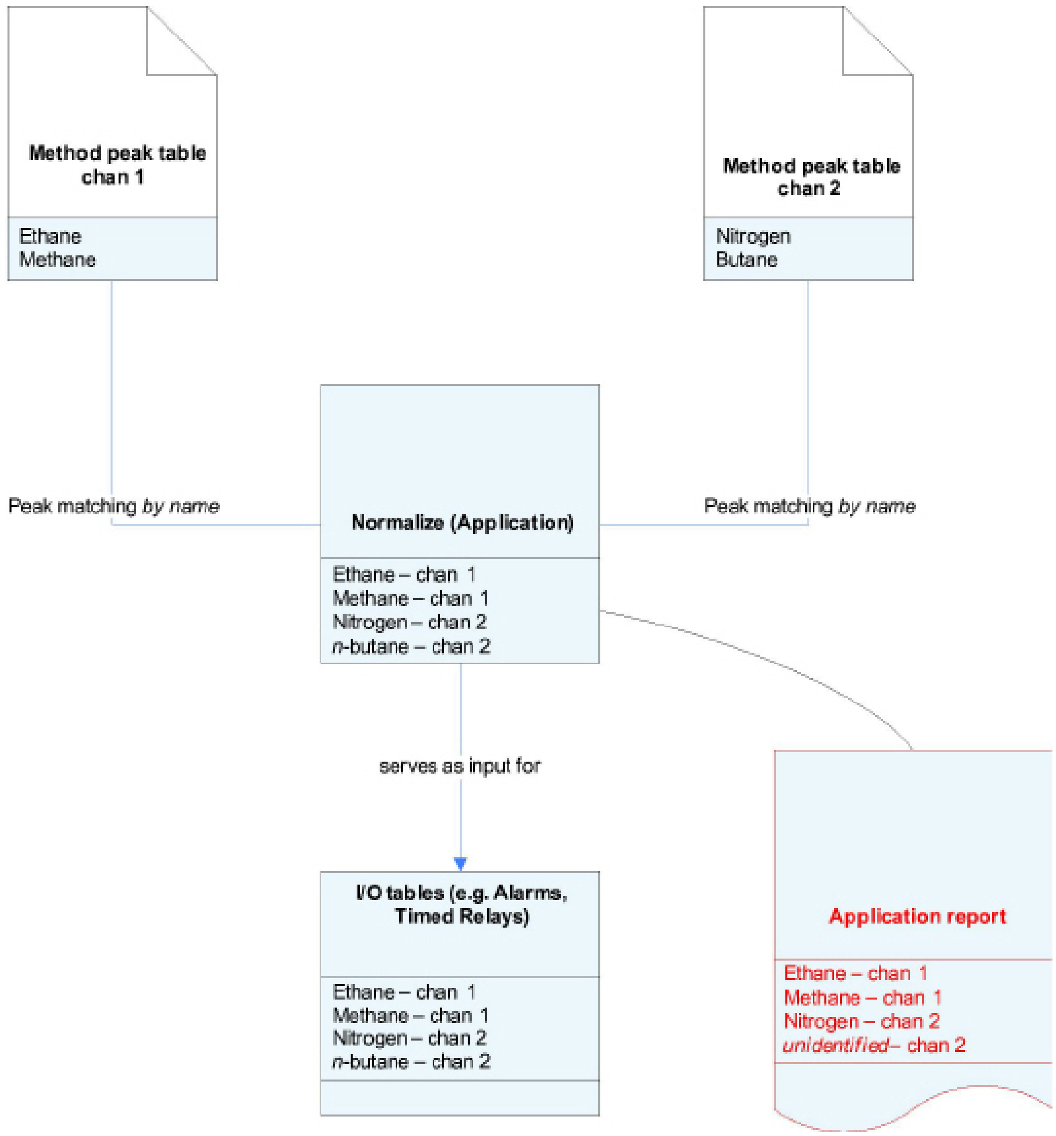
- **#:** Index number
- **Active:** If checked, the information of this peak will be downloaded to the instrument during a method download action.
- **Peak Name:** The name must be identical to the peak name in the Peak Identification/Calibration Table. It can also be filled in automatically using the **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 **Estimate 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.

Relationship to method peak tables

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:



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.

Synchronize to Calorific Power settings

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.

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.

Normalize

Normally, the normalization table is set up according to the peak identifications. Refer to Peak Identification.

#	Peak name	Channel	Ignore	Bridge.Comp#	Estimate	Estim.Conc	RelConcP...	RelPeakC...	Group#	Exclude C6
1	Methane	1	☐	0	☐	0.00	0.00	0.0	0	☐
2	Carbon Dioxide	1	☐	0	☐	0.00	0.00	0.0	0	☐
3	Ethane	1	☐	0	☐	0.00	0.00	0.0	0	☐

Alternatively, you may setup this table directly from a Calorific Power standard, .e.g. GPA 2172, if the Energy meter license is available on your instrument. Refer to Energy calculation setup.

■	#	Peak name	Channel	Ignore	Bridge.Comp#	Estimate	Estim.Co...	RelConc...	RelPeak...	Group#	Exclude
☐	1	Methane	1	☐	0	☐	0.00	0.00	0.0	0	☐
☐	2	Ethane	1	☐	0	☐	0.00	0.00	0.0	0	☐
☐	3	Propane	1	☐	0	☐	0.00	0.00	0.0	0	☐
☐	4	i-Butane	2	☐	0	☐	0.00	0.00	0.0	0	☐
☐	5	n-Butane	2	☐	0	☐	0.00	0.00	0.0	0	☐
☐	6	i-Pentane	2	☐	0	☐	0.00	0.00	0.0	0	☐
☐	7	n-Pentane	2	☐	0	☐	0.00	0.00	0.0	0	☐
☐	8	n-Hexane	2	☐	0	☐	0.00	0.00	0.0	0	☐
☐	9	n-Heptane	2	☐	0	☐	0.00	0.00	0.0	0	☐
☐	10	n-Octane	2	☐	0	☐	0.00	0.00	0.0	0	☐
☐	11	n-Nonane	2	☐	0	☐	0.00	0.00	0.0	0	☐
☐	12	n-Decane	2	☐	0	☐	0.00	0.00	0.0	0	☐
☐	13	Ethylene	1	☐	0	☐	0.00	0.00	0.0	0	☐
☐	14	Propylene	1	☐	0	☐	0.00	0.00	0.0	0	☐
☐	15	Carbon Dioxide	1	☐	0	☐	0.00	0.00	0.0	0	☐
☐	16	Hydrogen sulfide	1	☐	0	☐	0.00	0.00	0.0	0	☐

Generally, the components in this table is linked to that of the identification table via their peak names, see Peak identification table.

For example, if we only want to report the normalized concentrations of Methane and Ethane, but ignore Carbon Dioxide. We can just remove it from the normalization table.

#	Peak name	Channel	Ignore	Bridge.Comp#	Estimate	Estim.Conc	RelConcP...	RelPeakC...	Group#	Exclude C6
1	Methane	1	☐	0	☐	0.00	0.00	0.0	0	☐
2	Ethane	1	☐	0	☐	0.00	0.00	0.0	0	☐

Select download from the toolbar to Apply the application to the instrument.

Perform an analysis run (or recalculation if the chromatogram does already exist). Results will be similar to the example below:

Integration Report | **Application Report**

Normalized Component List

#	Component	Chan#	Retention[s]	Area	Height	ESTD	Norm.ESTD%	RF	Rw
1	Methane	1	35.62	54.4503	4175.0000	0.078325	23.504919	1.438470e-3	1
2		1	43.89	1226.7916	100159.0000	0.420013	0.000000	3.423672e-4	1
3	Propane	1	51.9	696.3850	49770.0000	0.254903	76.495081	3.660380e-4	1

Check the result from the 'Norm.ESTD%' grid column.

Note: In the above example, the second row is Carbon Dioxide. The name is omitted in this table because the normalization result is not taken into account. The peak will be identified if the integration report is viewed in another tab.

Application - Calorific Power

Application - Calorific Power

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.

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O + \text{heat}$

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.

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

where

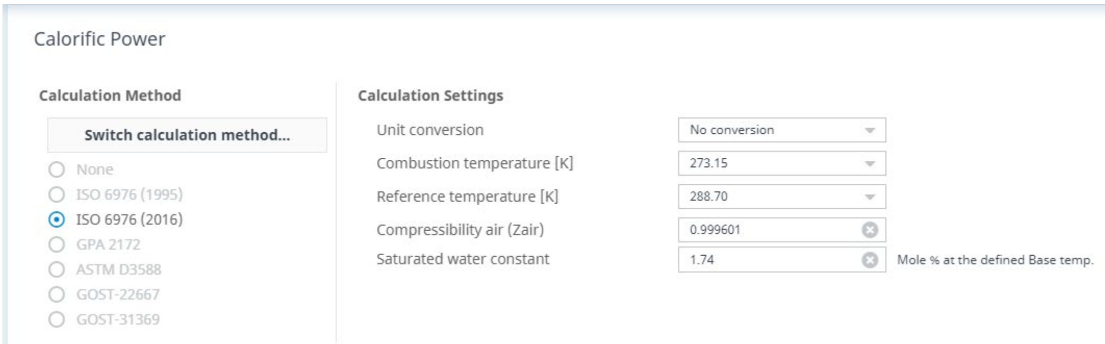
xj = mole fraction of compound j

$\beta jj = \frac{\sqrt{Bjj}}{R * T}$ 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.

In this section

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 settings tab. See Configuration Settings for additional information.

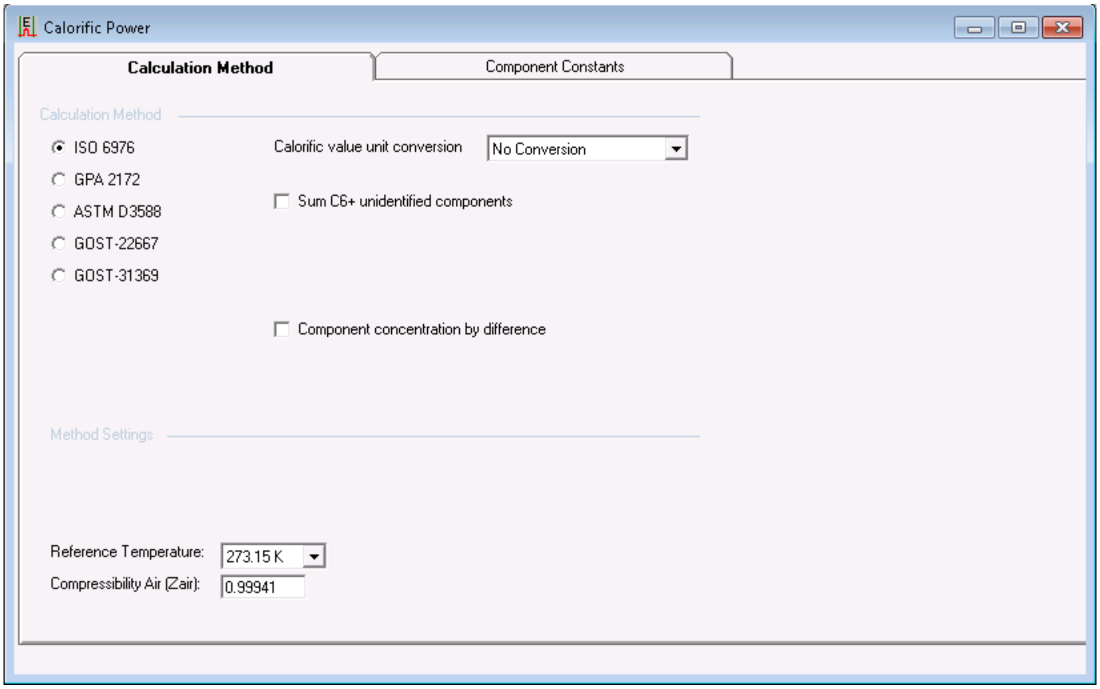
To calculate the physical properties of the (natural) gas confirm international standards ISO 6976, GPA 2172, ASTM D3588, GOST 22667 and GOST 31369 require five steps:

1. Select and optimize chromatographic conditions to provide sufficient separation of the components. Instrument Setup describes the instrument's parameter settings.
2. Correctly integrate and identify the peaks. For additional information, see Integration Events and Peak Identification.
3. Calibrate the instrument. The calibration procedure is given is section Peak Calibration. When GOST 22667 calculation is selected, the use of embedded GOST calibration procedure is required. See Use GOST calibration for additional information.
4. Normalize results from multiple channels. See Application - Normalize 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 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	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.
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.
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.
GOST 22667	GOST 20-0.papp and GOST 20-20.papp. These files are based on GOST 22667 published in 1982. See GOST 22667.
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.

ISO 6976 / GOST 31369



For the calculations based on ISO 6976, selection of the metering temperature and the combustion temperature are necessary. In **Calculation settings**, 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.

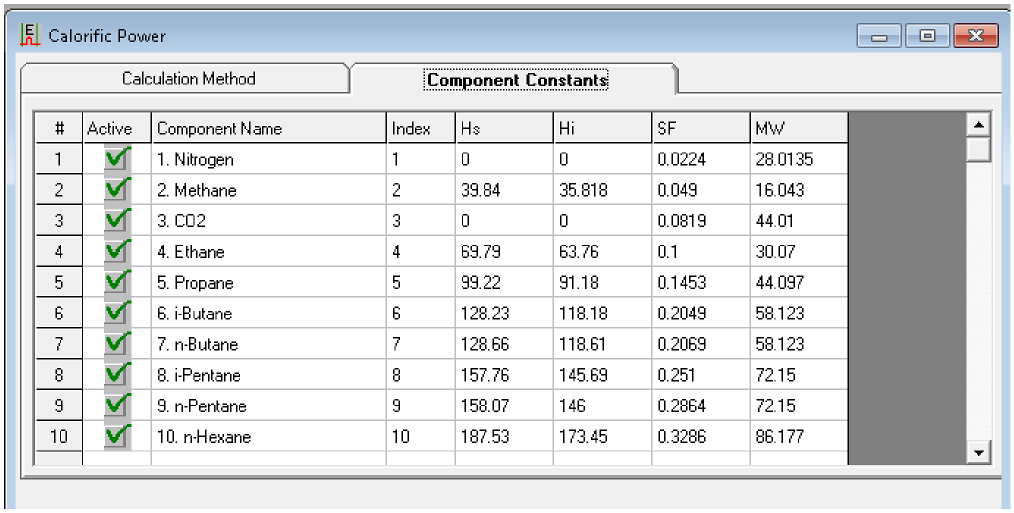
- 273.15 K (0.99941)
- 288.15 K (0.99958)
- 293.15 K (0.99963)

For more details see Sum C6+ unidentified components.

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

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/m³	$D1 = B1 \cdot \rho_{air} \cdot Z_{air}(t2,p2)$	$D2 = B2 \cdot \rho_{air} \cdot Z_{air}(t2,p2)$
Gas density real	kg/m³	$E1 = \frac{D1}{F1}$	$E2 = \frac{D2}{F2}$
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/m^3	$O1 = \frac{H1}{\sqrt{C1}}$	$O2 = \frac{H2}{\sqrt{C2}}$
Wobbe inferior	MJ/m^3	$Q1 = \frac{J1}{\sqrt{C1}}$	$Q2 = \frac{J2}{\sqrt{C2}}$



#	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:

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_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

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

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

Hi 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

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 (0.9
- 99645, 2.31 %)

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

Component Constants table

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

Name of parameter	Unit	Dry	Saturated
Compression factor Z (t2, p2)	-	A1=$1-(\frac{p_2}{p_0})[\sum x_j * s_j(t_2,p_0)]^2$	A2=$1-(\frac{p_2}{p_0})[\sum x_j * sj(t_2,p_0)(1-x_{water})+x_{water} * s_{j.water}]^2$
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 Go	-	C1 = $\frac{B1}{M_{air}}$	C2 = $\frac{B2}{M_{air}}$
Real-gas relative density G (t2, p2)	-	D1 = $\frac{C1 * Z_{air}(t_2,p_2)}{A1}$	D2 = $\frac{B2 * Z_{air}(t_2,p_2)}{A2}$
Ideal-gas density Do (t2, p2)	kg/m3	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 (t2, p2)	kg/m3	F1 = $\frac{E1}{A1}$	F2 = $\frac{E2}{A2}$
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/m3	$K1=\frac{G1}{V^0}$, 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/m3	$L1=\frac{H1}{V^0}$, 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/m3	$M1=\frac{G1}{V}$, 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/m3	$N1=\frac{H1}{V}$, V=A1*R* T_2/p_2	$N2=\frac{H2}{V}$, V=A2*R* T_2/p_2
Ideal-gas gross Wobbe index W0G(t1, t2, p2)	MJ/m3	$O1=\frac{K1}{\sqrt{C1}}$	$O2=\frac{K2}{\sqrt{C2}}$
Ideal-gas net Wobbe index W0N(t1, t2, p2)	MJ/m3	$P1=\frac{L1}{\sqrt{C1}}$	$P2=\frac{L2}{\sqrt{C2}}$
Real-gas gross Wobbe index WG(t1, t2, p2)	MJ/m3	$Q1 = \frac{M1}{\sqrt{D1}}$	$Q2 = \frac{M2}{\sqrt{D2}}$
Real-gas net Wobbe index WN(t1, t2, p2)	MJ/m3	$R1 = \frac{N1}{\sqrt{D1}}$	$R2 = \frac{N2}{\sqrt{D2}}$

Where R is molar gas constant and p2 is standard atmosphere pressure, R=8.3144621 J/(mol*K) and p2=14.696 psi.

ISO 6976-2016 is not supported in Application Wizard.

Name of parameter	Unit	Dry	Actual	Saturated
Molar mass	kg/kmol	$A1 = \frac{A2 - w\% \cdot Mwater}{(1 - w\%)}$	$A2 = \Sigma X_j \cdot M_j$	$A3 = A1(1 - 1.74\%) + 1.74\% \cdot M$
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/ft³	$D1 = A1 \cdot P/(RT)$	$D2 = A2 \cdot P/(RT)$	$D3 = A3 \cdot P/(RT)$
Gas density real	ibm/ft³	$E1 = \frac{D1}{F1}$	$E2 = \frac{D2}{F2}$	$E3 = \frac{D3}{F3}$
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/ft³	$G1 = \frac{G2 - w\% \cdot H_{wv}}{1 - w\%}$	$G2 = \Sigma X_j \cdot H_{s\_j}$	$G3 = G1 \cdot (1\text{-}1.74\%) + 1.74\% \cdot H_{wv}$
H gross volume real	BTU/ft³	$H1 = \frac{G1}{F1}$	$H2 = \frac{G2}{F2}$	$H3 = \frac{G3}{F3}$

H net volume ideal	BTU/ft³	$I1 = \frac{I2 - w\% \cdot H_w}{1 - w\%}$	$I2 = \Sigma X_j \cdot H_{i\_j}$	$I3 = I1 \cdot (1\text{-}1.74\%)$
H net volume real	BTU/ft³	$J1 = \frac{I1}{F1}$	$J2 = \frac{I2}{F2}$	$J3 = \frac{I3}{F3}$
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/ft³	$O1 = \frac{H1}{\sqrt{C1}}$	$O2 = \frac{H2}{\sqrt{C2}}$	$O3 = \frac{H3}{\sqrt{C3}}$
Spec. volume, real	ft³/ibm	$P1 = 1/(E1)$	$P2 = 1/(E2)$	$P3 = 1/(E3)$
GPM total, real	gal/1,000 ft³	$Q1 = \frac{Q_{act} - W\% \cdot GPM_w}{(1 - W\%)F1}$	$Q2 = \Sigma X_i \cdot (GPM_i)/(F2)$	$Q3 = \frac{Q_{dry} \cdot (1\text{-}1.74\%) + 1.74\% \cdot GPM_w}{F3}$

GPA2172 / ASTM-D3588

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: $A1 = \dfrac{A2 - w\% \cdot M_{water}}{(1 - w\%)}$

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:

$$L1 = \frac{L2 - w\% \cdot H_{wm} \cdot \frac{M_w}{M}}{1 - w\% \cdot \frac{M_w}{M}}$$

H Net Mass act:

$$L2 = \Sigma X_j \cdot \frac{M_j}{M} \cdot H_{i\_j.mass}$$

H Net Mass sat:

$$L3 = L1 \cdot \left(1\text{-}1.74\% \cdot \frac{M_w}{M}\right)$$

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: $M1 = \frac{M2 - w\% \cdot H_{wm}}{1 - w\%}$

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)

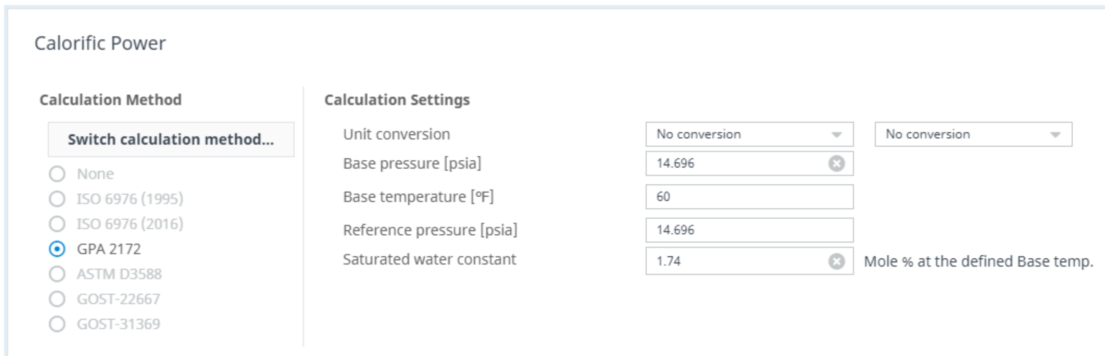
Pb = base pressure

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. The use of an estimate for air is highlighted in Using an estimate air concentration.

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 the table below.

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

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

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

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_I^{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 /Ft³ (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 /Ft³ (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

$h_i(t_i)$ = 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 /ft³ (Real gas dry gas)

Calculated as

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

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 /ft³ (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.

$d° = \sum x_j * [M_j / M_{air}]$

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

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

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

N

GPM = Σ (x_i *1000) * P_b) / (V_i *14.696)

I=1

x_i = mole fraction of compound I

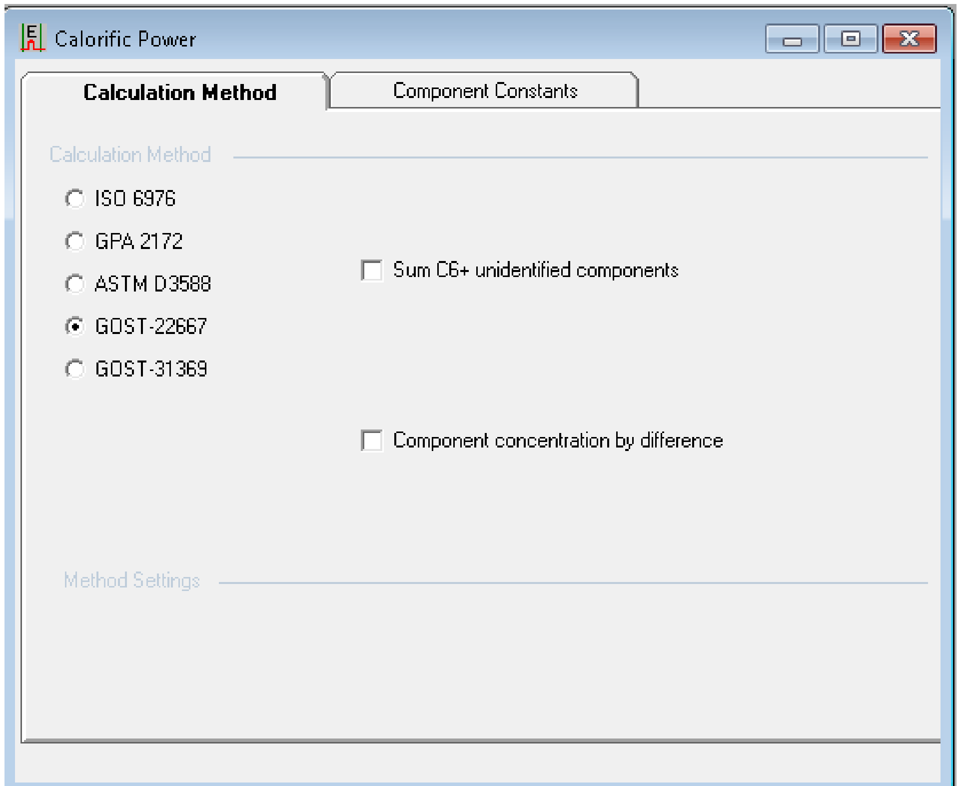
V_i = Cubic feet per gallon for compound I (this is shown as Vfact. in the Component Constants table)

P_b = Base pressure

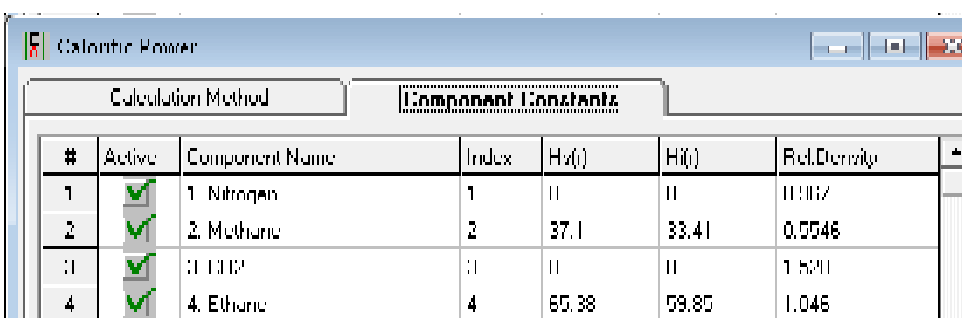
N = number of components

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.



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.



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 and Component concentration by difference 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

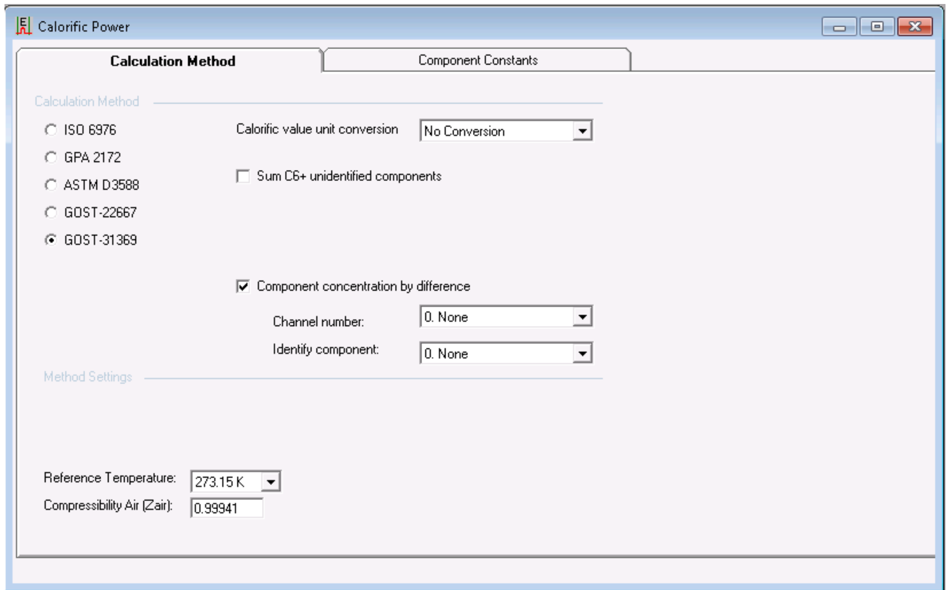
The Wobbe Index is calculated for the gas sample:

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.



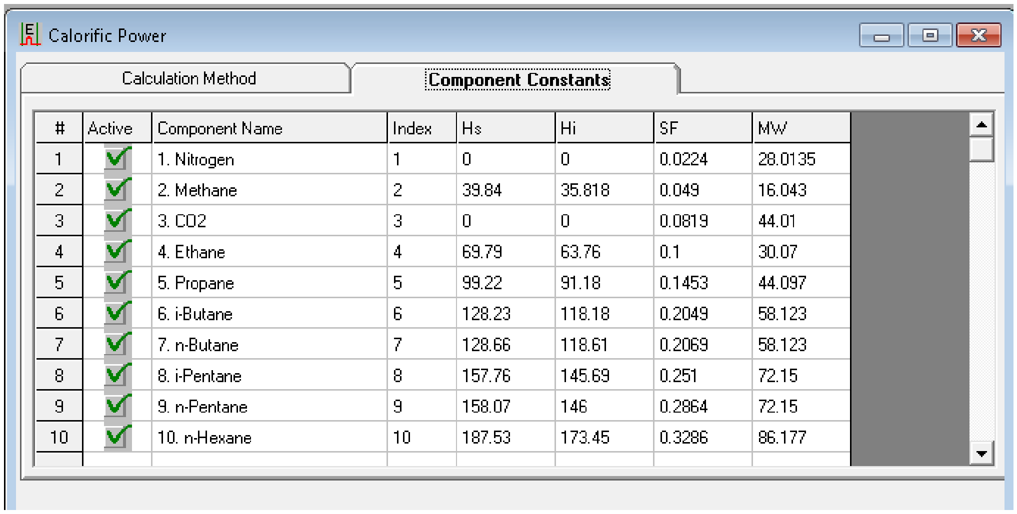
GOST 31369 Standard was published in 2008 and is substantially based on ISO 6976. Therefore, calculations require the selection of the metering temperature and the combustion temperature. On the Calculation Method screen, the Reference Temperature provides three choices of temperature:

- 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.



#	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 the table below 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:

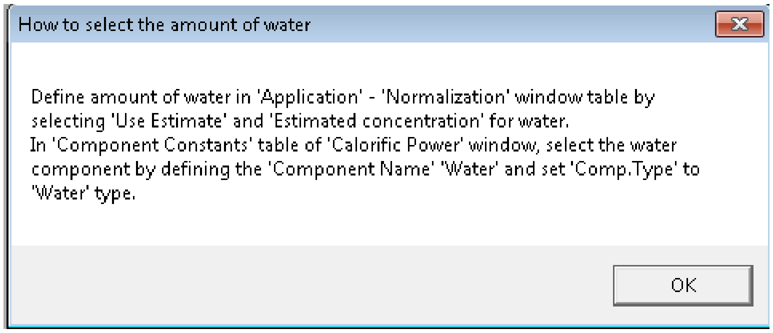
GOST 31369 Application report parameter	Unit*	Description (for the Natural Gas sample being tested, unless noted otherwise)
Compressibility		Departure from ideal gas behavior
Molar mass	kg/kmol	Molecular weight
Molar mass ratio		The ratio of the molar mass to the molecular weight of air
Relative density		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. See Sum C6+ unidentified components and Component concentration by difference for further discussion of these topics.

Accounting for water - partially saturated natural gas

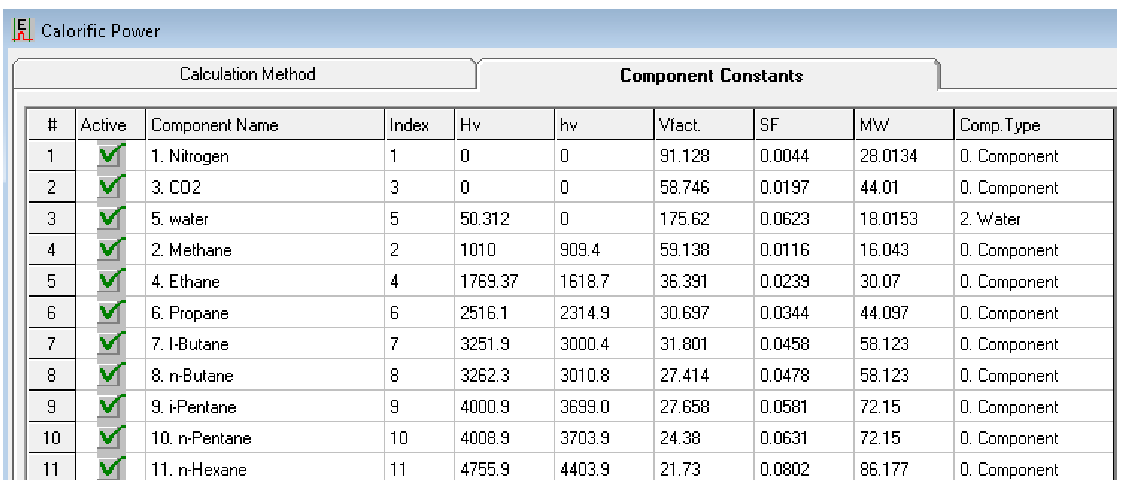
The PROstation also provides a means to use an estimated concentration of water. Selecting ASTM 3588 or GPA 2172 in the Calorific Power Calculation Method panel gives information on how to estimate the water.



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.



#	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

When the application report is displayed, the energy calculations show Hv act, Hv dry, and Hv wet.

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

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.

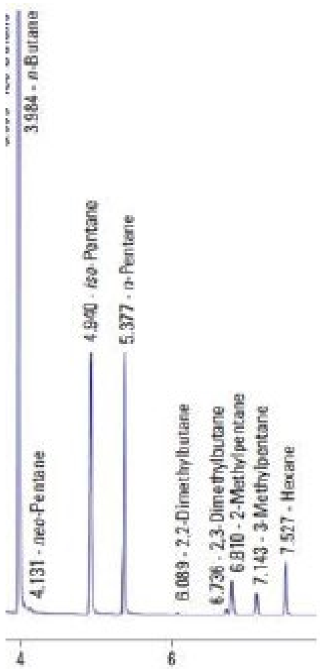
When **Calorific Power** is selected from the drop down for **Application**, the following screen appears. The top half of the screen under **Calculation Method** allows the user to select the calculation type. There is also a checkbox which can be selected to **Sum C6+ unidentified components**.

Hv act	1308.37164
Hv dry	1312.06626
Hv wet	1289.70388
hv act	1190.09155
hv dry	1193.59047
hv wet	1173.24734

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.

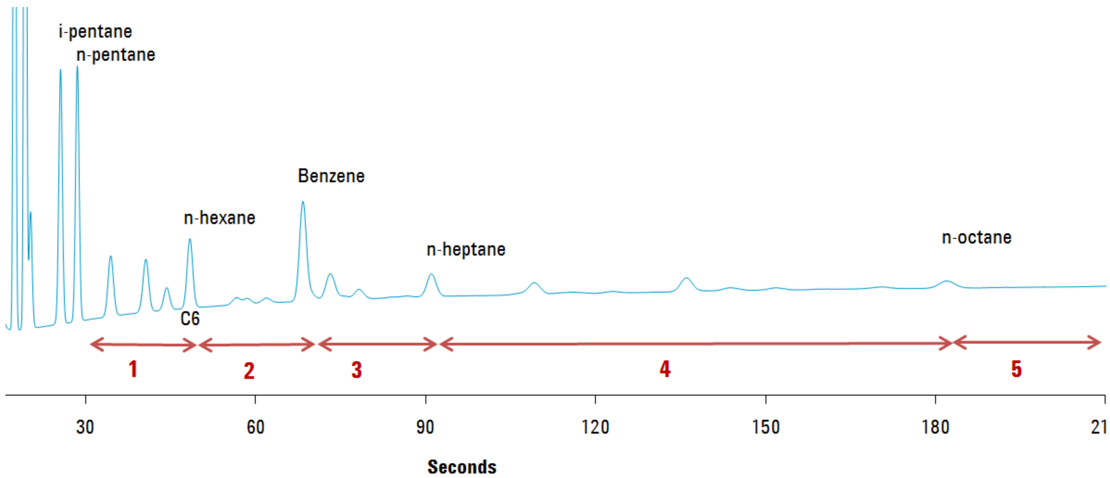
Typically, for saturated hydrocarbons, the isomers of the n-alkane elute prior to the respective n-alkane. For example, it would be appropriate to use the response factor for n-hexane for the hexane isomers, 2-methylpentane, 3-methylpentane, 2,2-dimethylbutane, and 2,3-dimethylbutane. The isomers of n-heptane would then use the response factor of n-heptane, etc.



However, if aromatic components are in the mixture, it is appropriate to exclude these components since the heating value is significantly different. The table below 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.

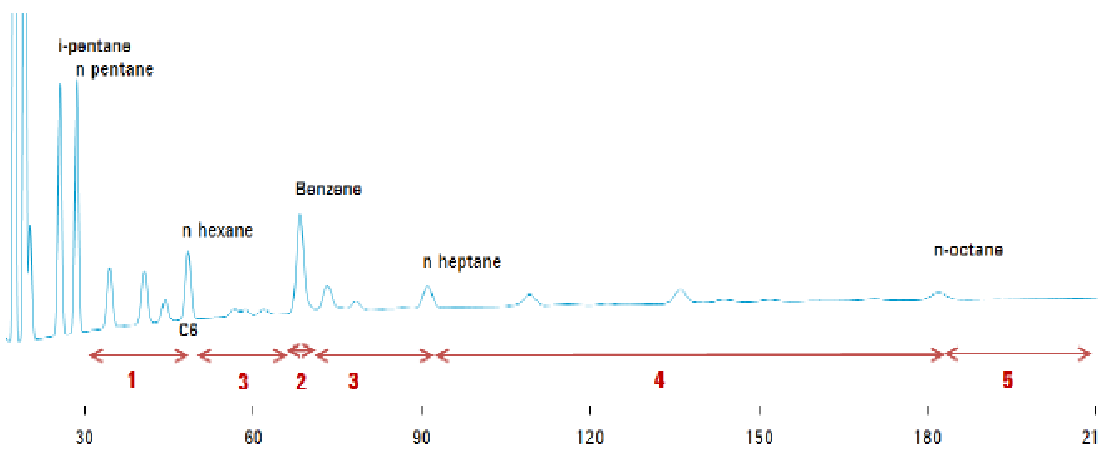
Compound	Carbon number	Superior 15 °/15 °C MJ/m³
n-Hexane	6	177.55
2-Methylpentane	6	177.23
3-Methylpentane	6	177.34
2,2-Dimethylbutane	6	176.82
2,3-Dimethylbutane	6	177.15
Benzene	6	139.69
n-Heptane	7	205.42
Toluene	7	167.05

n-Octane	8	233.28
Ethylbenzene	8	194.95
o-Xylene	8	194.49



This example 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.

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. 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.



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

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

Component concentration by difference

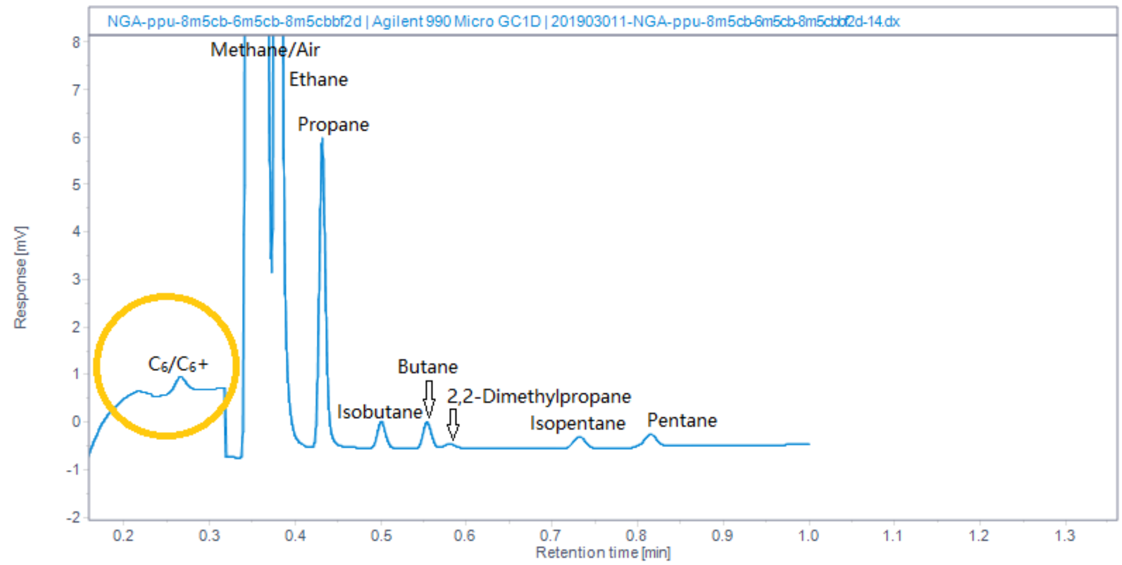
The availability of the Component Concentration by Difference option depends on your license. This option is used to normalize to 100 % using a selectable component. The concentration for the selected component is calculated using the following formula:

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.

Backflush to detector C6+ split

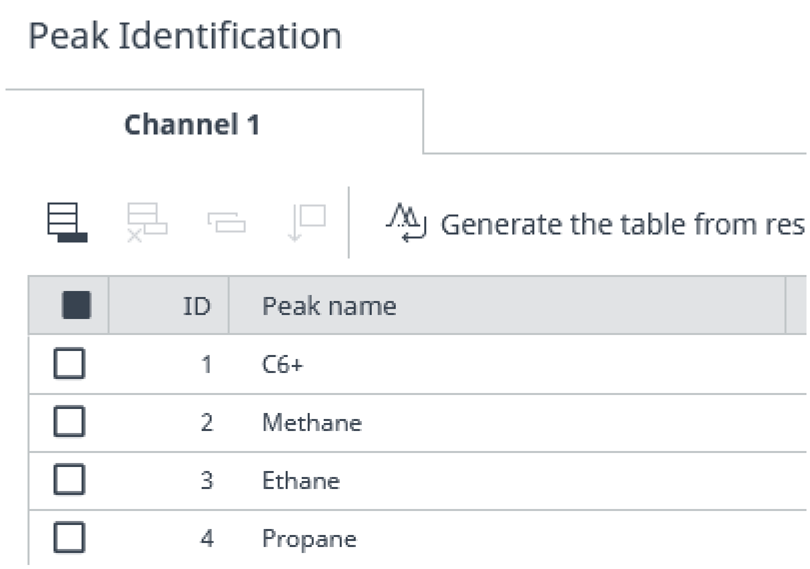
Since the Micro GC does have back flush-to-detector, so that the n-hexane, and all peaks that elute beyond the C6 can be backflushed, resulting a mixture C6/C6+ peak at the beginning of the chromatogram. See the chromatogram below as an example.



Note: A prerequisite of making use of the C6+ split feature is that, the concentration ratio of C6 (n-Hexane), C7 (n-Heptane), C8 (n-Octane), C9 (n-Nonane) in the C6/C6+ peak are already known.

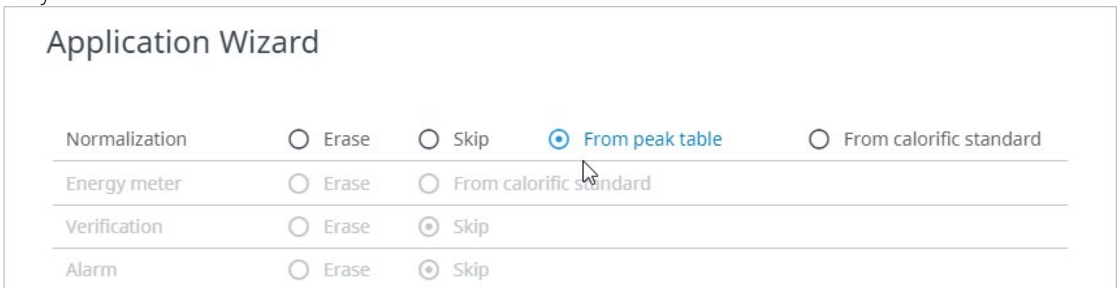
Below are some highlighted steps for making use of this feature.

1 Peak identification table **must** contain the peak named 'C6+', identifying the mixture peak.



2 Generate the normalization table either by choosing a desired calorific power calculation method (if Energy meter license is available) or create it from peak table as below.

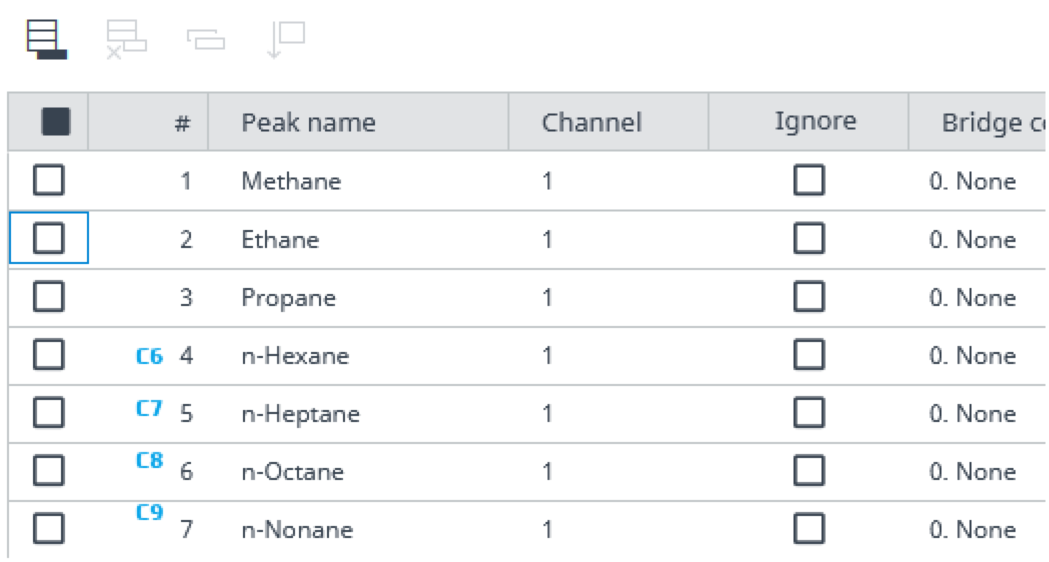
a. Using wizards from application, generate the Normalization table from peak table only.



b. Delete the C6+ component from Normalization table and manually add 4 new components, n-Hexane, n-Heptane, n-Octane, n-Nonane.

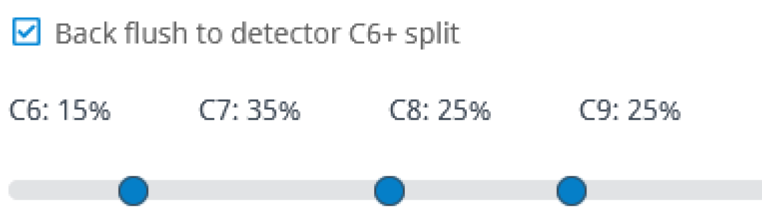
Note no matter by which way you setup the normalization table, the component list shall contain n-Hexane, n-Heptane, n-Octane, n-Nonane, but without C6+. See below.

Normalization table



☐	#	Peak name	Channel	Ignore	Bridge c
☐	1	Methane	1	☐	0. None
☐	2	Ethane	1	☐	0. None
☐	3	Propane	1	☐	0. None
☐	C6 4	n-Hexane	1	☐	0. None
☐	C7 5	n-Heptane	1	☐	0. None
☐	C8 6	n-Octane	1	☐	0. None
☐	C9 7	n-Nonane	1	☐	0. None

3 Enable 'Backflush to detector C6+ split', and set proper split ratio for C6+ groups



4 After analysis, a sample result may be as below. Note the ESTD of C6+ mixture peak (name not displayed) is split into 4 components with predefined ratio. The heating value is also calculated with the split components.

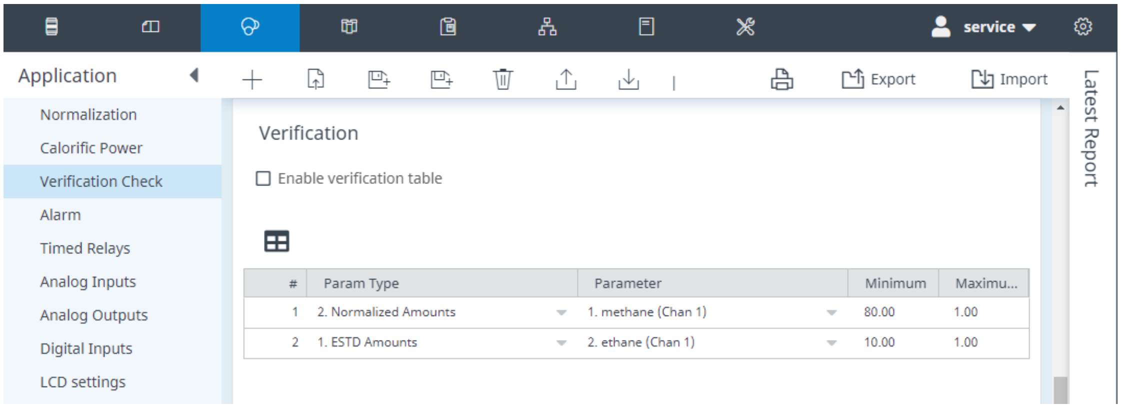
Integration report | **Application repo**

Normalized Component List

#	Chan#	Component	Norm co...	ESTD co...
1	1		-	3.000000
2	1	n-Hexane	2.812500	0.450000
3	1	n-Heptane	6.562500	1.050000
4	1	n-Octane	4.687500	0.750000
5	1	n-Nonane	4.687500	0.750000
6	1	Methane	25.000000	4.000000
7	1	Ethane	43.750000	7.000000
8	1	Propane	12.500000	2.000000

Application - Verification Check

As part of the automation, on the basis of time or number of runs passed, a verification block can be programmed.



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.

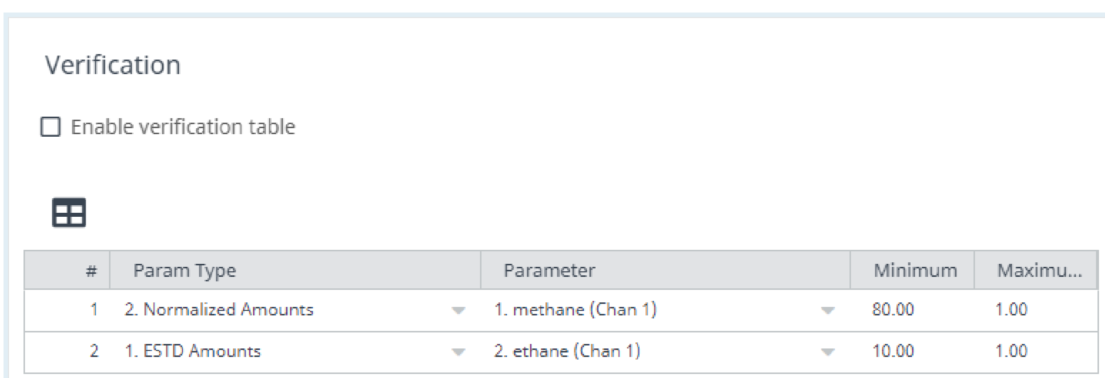
Note that the Verification Table must be set very carefully. Too many variables will likely result in unwanted and unnecessary calibrations. Too few variables might result in unwanted errors. During a verification run, it is possible to check whether parameters are within limits. Such as:

•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** tab).

•Analog Inputs using the (sampling) converted values as defined in the **Analog Input** window.

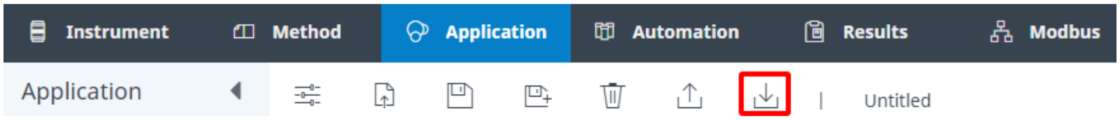
•Calorific Power results as defined in the **Energy Calculation** window (**Application** tab).



A verification check is only performed after the sample calculation of a verification run, either from the Sequence- or Verification Table or Single run.

To enable the Verification Table, click the **Enable the Verification Table** checkbox in the Verification tab.

Store Verification settings



Use the **Send Application Settings** icon from the toolbar to store the Verification settings to the instrument. Only the Activated lines in the Verification Table will be downloaded to the instrument.

For more information, see [Verification run].

Verification Case

Almost all application functions depend on the normalization table for component indexing.

Before setup, please make sure the normalization table is well established and applied to the instrument beforehand. An example is shown here:

#	Peak name	Channel	Ignore	Bridge.Comp#	Estimate	Esti
1	Methane	1	☐	0	☐	0.00
2	Carbon Dioxide	1	☐	0	☐	0.00
3	Propane	1	☐	0	☐	0.00

With the normalization table set up, the verification table can be set as shown below:

Verification

☑ Enable verification table

#	Param Type	Parameter	Minimum	Maximum
1	1. ESTD Amounts	1. Methane (Chan 1)	0.30	0.40
2	1. ESTD Amounts	3. Propane (Chan 1)	0.80	1.50
3	2. Normalized Amounts	1. Methane (Chan 1)	5.00	10.00
4	2. Normalized Amounts	3. Propane (Chan 1)	30.00	40.00
5	3. Sample results	1. Sum ESTD	2.00	5.00

Apply the application to the instrument and perform a verification run (either single run or automation run). The analysis result will be verified according to this table.

In the example,

- Row 1: The ESTD amount of Methane shall be between 0.3 to 0.4, otherwise verification check is failure.
- Row 2: The ESTD amount of Propane shall be between 0.8 to 1.5, otherwise verification check is failure.
- Bow 3: The normalized % of Methane shall be between 5 to 10, otherwise verification check is failure.
- Row 4: The normalized % of Propane shall be between 30 to 40, otherwise verification check is failure.
- Row 5: The sum of ESTD of all components shall between 2 to 5, otherwise verification check is failure.

The verification result will be included in the application report and can be used for triggering alarm relays or automation scheduling.

See also:

Application - Alarms

Application - Timed Relays

Parameters

The parameters for verifications, alarms, and analog output are listed below.

	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	
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	
Calorific Power (continued)	(7) ASTM/GPA Results (continued)	21. Dry.Molar Mass 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	Application report (Energy column)

		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	
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	

	(12*) Start Run Error	Start failure	Instrument Status (Common tab)
	(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 - 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.

Alarm

☐ Enable alarm table   1 row selected

■	#	Param Type	Parameter	Minimum	Maximum	Alarm on	Invert Alarm	Relay Alarm	Relay #	Invert Relay
☑	1	1. ESTD Amounts	2. Methane (Chan 1)	5	10	1. Analysis	☐	☑	1. Alarm relay 1	☐
☐	2	3. Sample results	2. Sum Estimates	35	45	1. Analysis	☐	☑	1. Alarm relay 1	☑
☐	3	5. Analog inputs	1. Analog In #1	3	8	1. Analysis	☐	☑	1. Alarm relay 1	☐
☐	4	6. ISO 6976 / GOST 31369 Results	4. Dry.Rel.Dens.Real	12	34	1. Analysis	☐	☑	1. Alarm relay 1	☐
☐	5	8. GC Status	2. Cabinet Temperature	22	67	1. Analysis	☐	☑	1. Alarm relay 1	☐

Some parameters do not need maximum and minimum such as digital inputs. In this case, the minimum and maximum column entries can be omitted (indicated as zero here).

Alarm

☐ Enable alarm table

■	#	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	☐	☑	1. Alarm relay 1	☐
☐	2	8. GC Status	1. Instrument Error	0	0	1. Analysis	☐	☑	1. Alarm relay 1	☑
☐	3	9. Digital Inputs	1. Digital In #1	0	0	1. Analysis	☑	☑	1. Alarm relay 1	☐
☐	4	10. Any Alarm	0. Any Alarm	0	0	1. Analysis	☑	☑	1. Alarm relay 1	☐
☐	5	12. Start Run Error	0. Start failure	0	0	1. Analysis	☐	☑	1. Alarm relay 1	☐

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.

Alarm

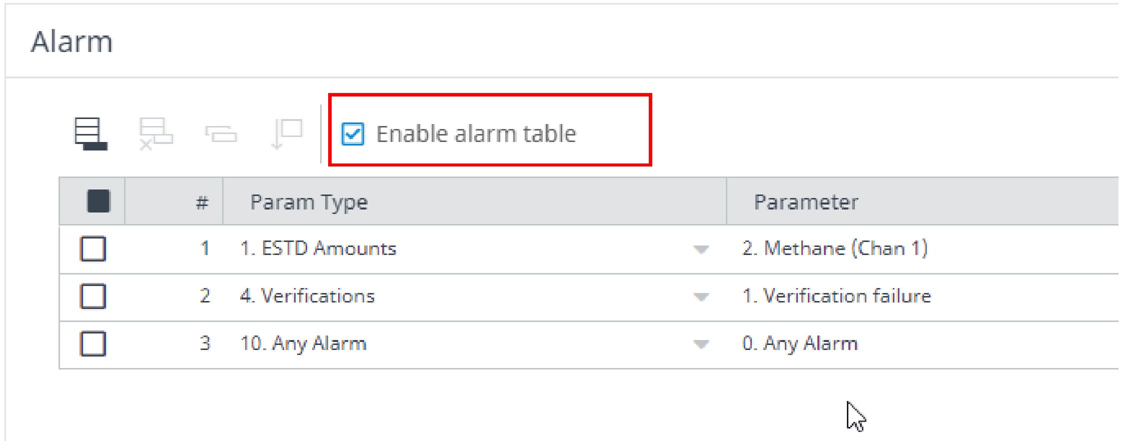
☐ Enable alarm table   1 row selected

■	#	Param Type	Parameter	Minimum	Maximum	Alarm on	Invert Alarm	Relay Alarm	Relay #	Invert Relay
☑	1	1. ESTD Amounts	2. Methane (Chan 1)	66	78	1. Analysis	☐	☐	0. None	☐
☐	2	4. Verifications	1. Verification failure	0	0	1. Analysis	☐	☐	0. None	☐
☐	3	10. Any Alarm	0. Any Alarm	0	0	1. Analysis	☐	☑	1. Alarm relay 1	☐

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

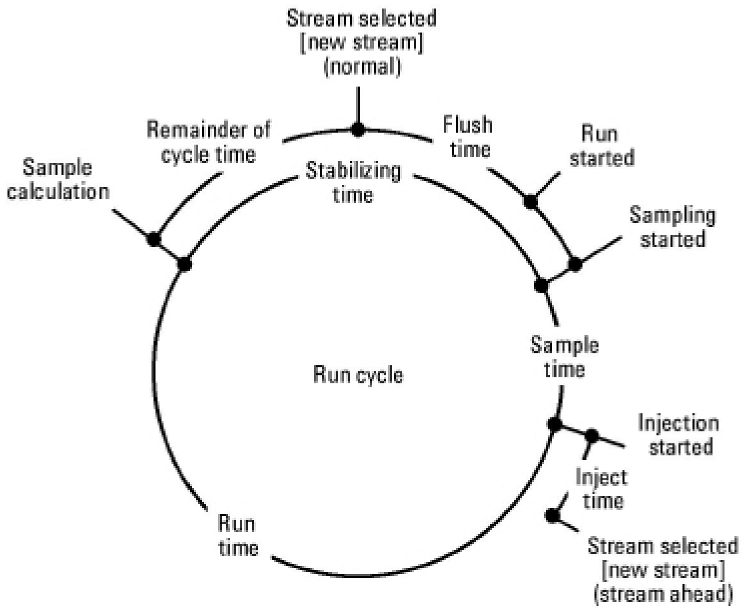
Enable the Alarm Table in the **Settings** tab.



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.

Application - Timed Relays

Timed relays are used to signal run sequence events or control external actuators.



The following events are available:

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

Time periods between events	defined in the Common tab of Instrument Method

Stabilizing time	
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

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	1. Timed relay 1	1. Energize
2	6. New stream	2	1. Timed relay 1	0. De-energize

Here, each time a new stream is selected, Timed Relay 2 is energized for 2 seconds.

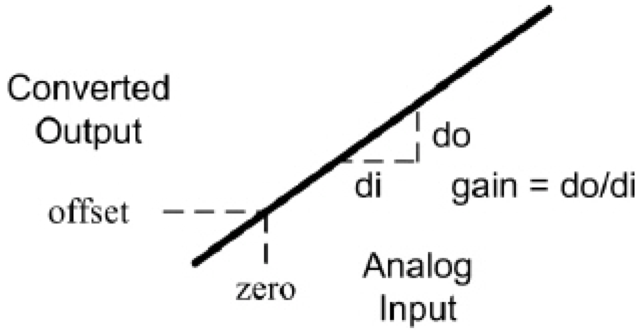
Note that a timed relay basically requires two definition lines in the table. The number of lines is limited to 6, thus 3 timed relays can be defined.

Use **Download Application** from the Control menu to store the Timed Relay settings to the instrument

Find more information in [Case 3: Timed Relays](#).

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:



- 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.

Analog inputs

Analog In #	Gain	Offset
Input 1	519.5	-259.7

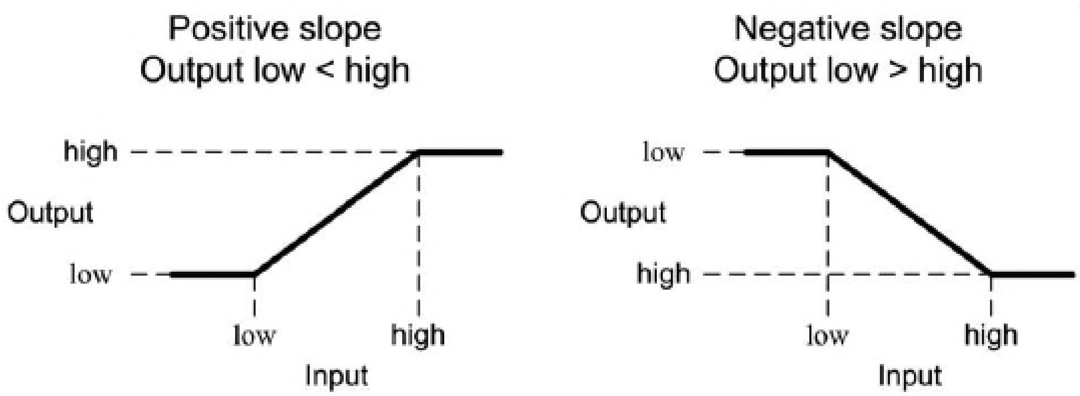
The analog inputs are displayed in the Application Report. Note that the inputs are measured at the start of the sampling period. The Application Report is updated after the sample calculation is finished.

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 - 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:



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 tab.
- Sample results like sum or group total and bridge component as defined in the Normalization window (Application tab).
- 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 tab).

Examples of these parameters and possible conversions are given below:

☑ Enabled

☐ Ignore Zero peak concentrations

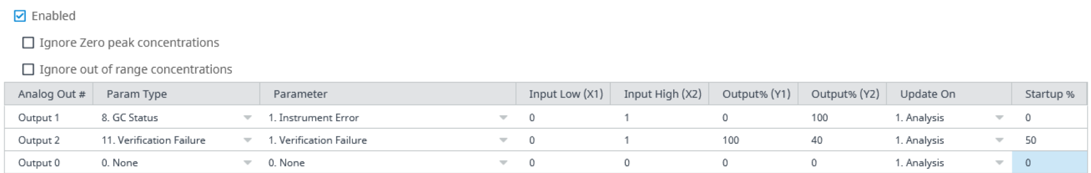
☐ Ignore out of range concentrations

Analog Out #	Param Type	Parameter	Input Low (X1)	Input High (X2)	Output% (Y1)	Output% (Y2)	Update On	Startup %
Output 1	1. ESTD Amounts	2. Methane (Chan 1)	0	100	0	100	1. Analysis	0
Output 2	5. Analog inputs	3. Sampling Analog Input 3	10	45	100	0	1. Analysis	50
Output 0	3. Sample results	1. Sum ESTD	90	110	50	20	1. Analysis	25

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.



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 by checking the **Enabled** checkbox.

Download to store the Analog Output settings to the instrument. Find more information in Case 1: Analog Output.

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 inputs

Digital In #	Function
Input 0	2.Start Automation
Input 1	3.Stop Automation

In addition, the Verification or Calibration Table can be started in idle or automation mode (priority run).

Digital inputs

Digital In #	Function
Input 0	4.Start Verification Table
Input 1	5.Start Calibration Table

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 inputs

Digital In #	Function
Input 0	31.Execute Seq.Line 1 (Neg.edge)
Input 1	24.Execute Seq.Line 2 (level)

During automation or a run, the digital inputs are scanned at the end of the run (event Sample Calculation).

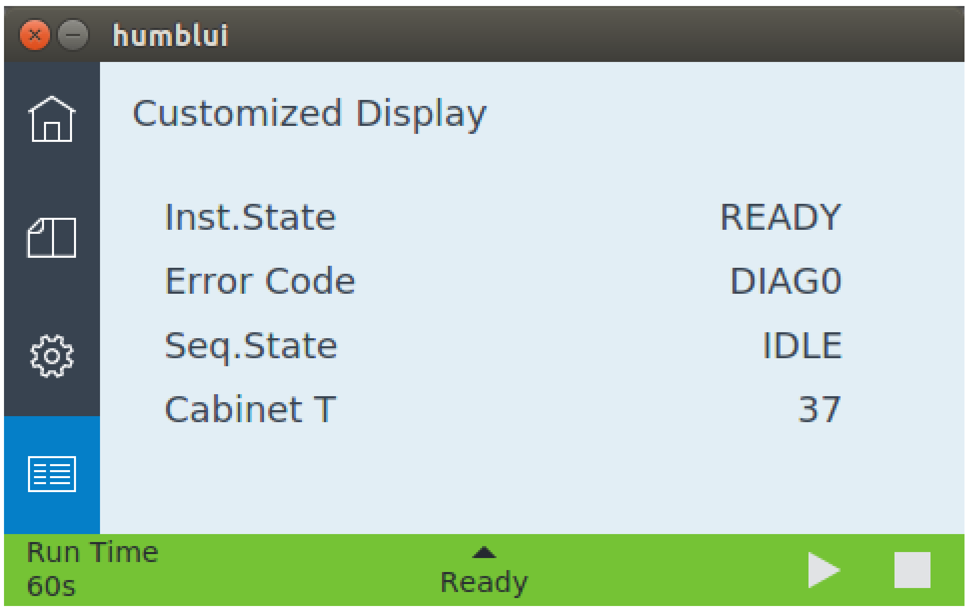
All digital inputs are edge sensitive, except for the (nonlatching) on-board digital inputs and level sensitive defined (execute) sequence lines. Find more information in Case 4: Digital Inputs.

Application - Local User Interface (LCD)

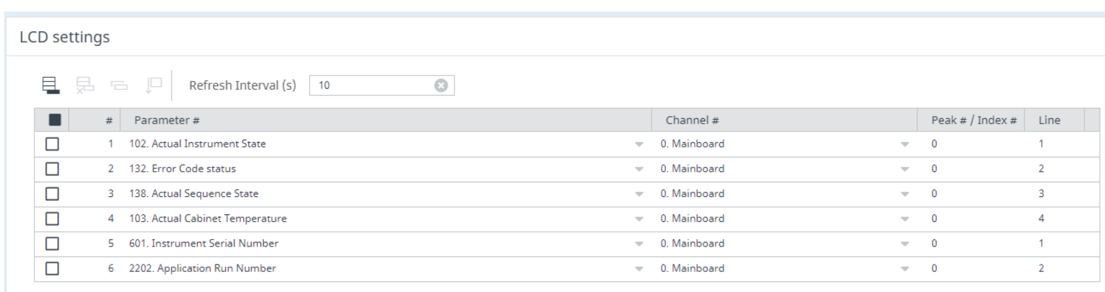
Application - Local User Interface (LCD)

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



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.



LCD settings

Refresh Interval (s) 10

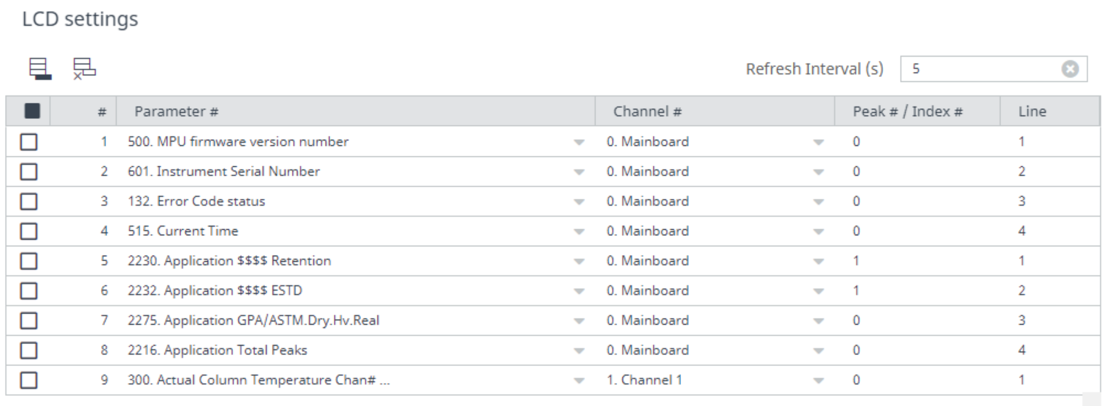
	#	Parameter #	Channel #	Peak # / Index #	Line
☐	1	102. Actual Instrument State	0. Mainboard	0	1
☐	2	132. Error Code status	0. Mainboard	0	2
☐	3	138. Actual Sequence State	0. Mainboard	0	3
☐	4	103. Actual Cabinet Temperature	0. Mainboard	0	4
☐	5	601. Instrument Serial Number	0. Mainboard	0	1
☐	6	2202. Application Run Number	0. Mainboard	0	2

For each parameter, assign a line number from 1 to 4. If multiple parameters are assigned to the same line number, on the LCD display, the line item will scroll among the parameters assigned. If only one parameter is assigned to a line, on the LCD display, the item on that line will remain fixed.

In this section

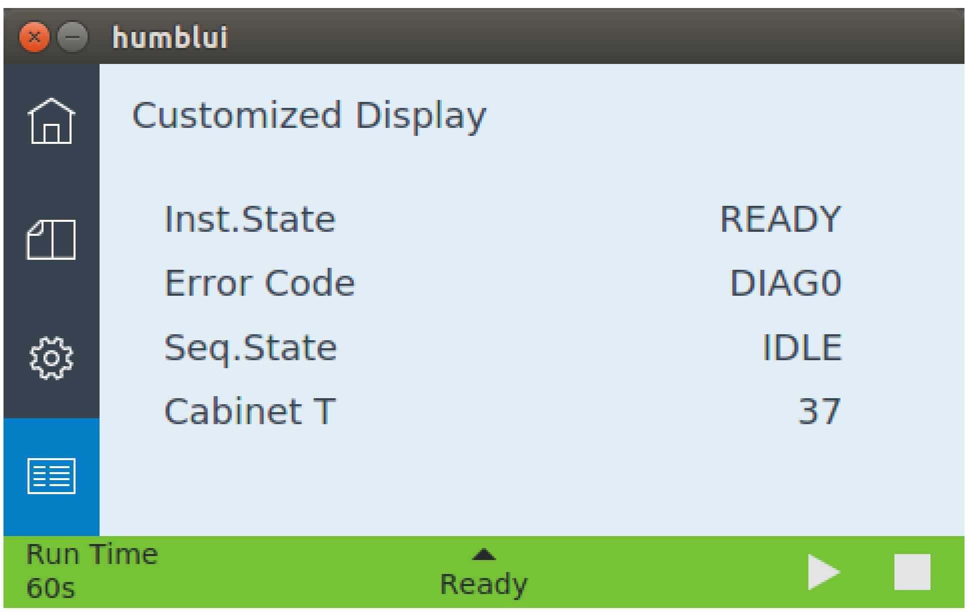
Local User Interface Example Case

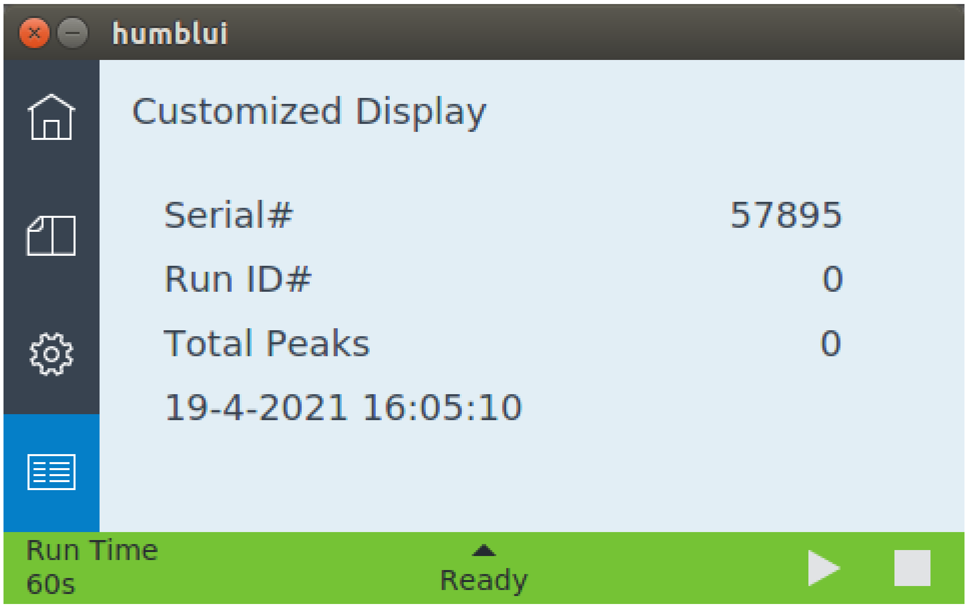
The touch LCD screen of micro GC (optionally equipped) has a special page for user customization. Its content can be configured here.

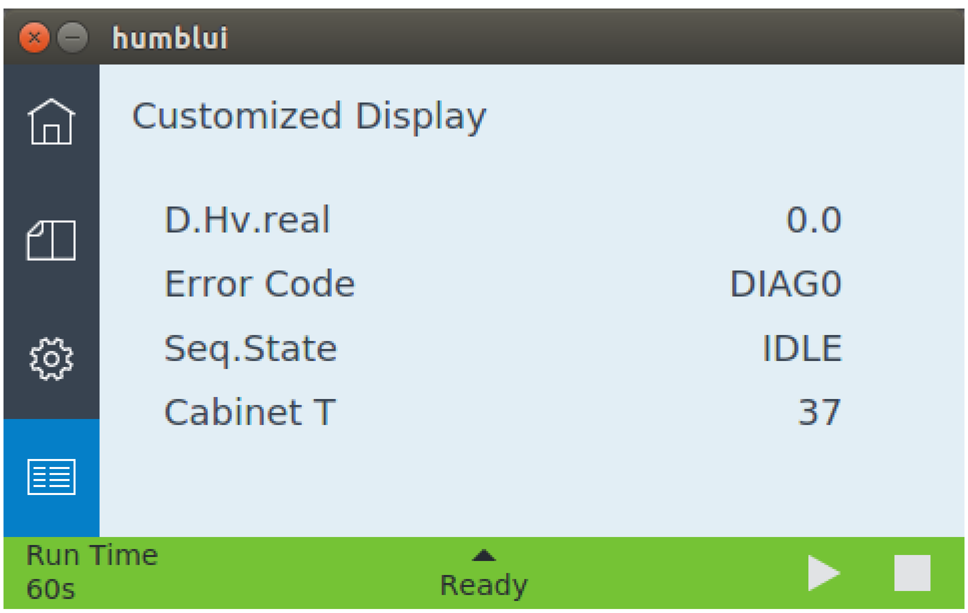


	#	Parameter #	Channel #	Peak # / Index #	Line
☐	1	500. MPU firmware version number	0. Mainboard	0	1
☐	2	601. Instrument Serial Number	0. Mainboard	0	2
☐	3	132. Error Code status	0. Mainboard	0	3
☐	4	515. Current Time	0. Mainboard	0	4
☐	5	2230. Application $$$$ Retention	0. Mainboard	1	1
☐	6	2232. Application $$$$ ESTD	0. Mainboard	1	2
☐	7	2275. Application GPA/ASTM.Dry.Hv.Real	0. Mainboard	0	3
☐	8	2216. Application Total Peaks	0. Mainboard	0	4
☐	9	300. Actual Column Temperature Chan# ...	1. Channel 1	0	1

After applying settings, the LCD screen will be automatically refreshed within 5 seconds.

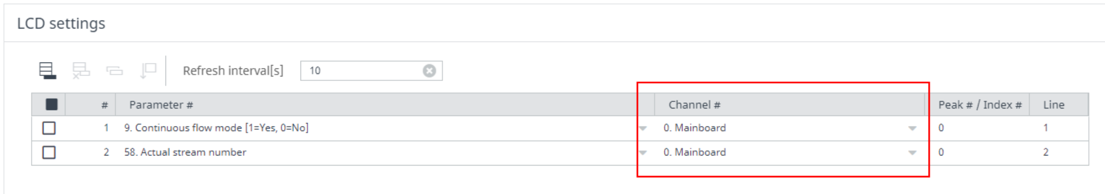



humblui
Customized Display
Serial# 57895
Run ID# 0
Total Peaks 0
19-4-2021 16:05:10
Run Time
60s
Ready


humblui
Customized Display
D.Hv.real 0.0
Error Code DIAG0
Seq.State IDLE
Cabinet T 37
Run Time
60s
Ready

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.



0. None

Display line is not configured, will result in empty line in LCD.

9. Continuous Flow mode [Continuous 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 [Stream#]

Displays the current selected stream position.

2205. Application Stream number [App. Stream#]

Displays stream position of the last finished run.

100. Actual Sample Inlet Temp [Inlet T (°C) #x]

Displays the current temperature of the sample inlet in degrees centigrade (°C).

[Inlet T (°C) #x]; x = sample inlet #

102. Actual Instrument State [Instrument 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 (°C)]

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 (kpa)]

Displays the ambient pressure in kilo Pascal (kPa), measure in the instrument cabinet.

105. External Power Supply Voltage [Supply voltage]

Display the actual power supply voltage in Volt (V).

106. External Started status [External 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. device ready]

Displays the ready status of possible external connected device.

0 = External device not ready
1 = 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).

Note: See parameter 152. GC Errors only [GC Errors].

134. Actual Flush time [Streamflush time (s)]

Displays remaining stream flush time in seconds.

138. Actual Sequence State [Sequence 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 [Calibration 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 Rw Calibration for more information.

2204. Application Calibration Level [Calibration 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 Rw Calibration 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 [Sample 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]. See also parameter 2212. Application Alarm on Index# ..." ' Step [Alarm Index#] and parameter 2211. Application Alarm Status [Alarm status].

153. Application Errors only [Application 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#].

154. GC or Application Errors [GC or app. 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 [Calibration 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#x]

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.

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 [Operation runs#]

Displays the total number of runs performed on the system.

612. Operating Time logging [Operation time]

Displays the total instrument up time in hours.

613. Operating Max Temperature logging [Operation max T (°C)]

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 [Verification 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 estimates]

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 [Injection day]

Displays the day of injection of the last finished run.

2226. Application Hour of Injection [Injection hour]

Displays the hour of injection of the last finished run.

2227. Application Minute of Injection [Injection min]

Displays the minute of injection of the last finished run.

2228. Application Second of Injection [Injection second]

Displays the second of injection of the last finished run.

2229. Application Total Unknown Peaks [Unknown peaks]

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.

300. Actual Column Temperature Chan# ... [Column T (°C) #x]

Displays the actual column temperature in degrees centigrade (°C) for the selected channel.

[Column T (°C) #x]; x = channel #

302. Actual Injector Temperature [Injector T (°C) #x]

Displays the actual injector temperature in degrees centigrade (°C) for the selected channel.

[Injector T (°C) #x]; x = channel #

304. Actual Column Pressure [Column P (kpa) #x]

Displays the actual column pressure in kilo Pascal (kPa) for the selected channel.

[Column P (kpa) #x]; x = channel #

308. Board Temperature Chan# ... [Board T (°C) #X]

Returns the actual channel board temperature in degrees centigrade (°C) for the selected channel.

[Board T (°C) #x]; x = channel #

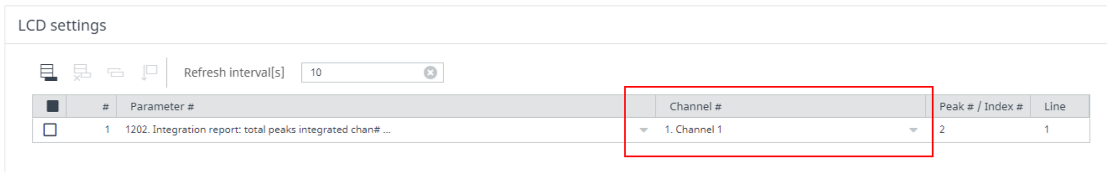
811. Operating Max Temperature logging Chan#... [Operation max T (°C) #x]

Displays the maximum operating column temperature in degrees centigrade (°C) for selected channel.

[Operation max T (°C) #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. The LCD will show the first 9 characters of the peak name, indicated as **$$$$$** in the parameters below.



1202. Integration Report: Total Peaks Integrated chan# ... [Integrated peaks #x]

Displays the total number of peaks (named and unnamed) for the selected channel.

[Integrated peaks #x]; x = channel #

1214. Integration Report: Identified peaks chan# ... [Identified peaks #x]

Displays the total number of identified peaks for the selected channel.

[Identified peaks #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#.. [$$$$$ height]

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.]

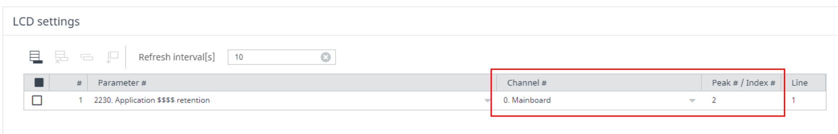
Returns the retention time in seconds (s) of the selected component.

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.

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 9 characters of the peak name, indicated as **$$$$$** in the parameters below.



2230. Application $$$$ Retention [$$$$$ ret.]

Displays the retention time in seconds of the selected component from the last finished run.

2231. Application $$$$ Height [$$$$$ height]

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]

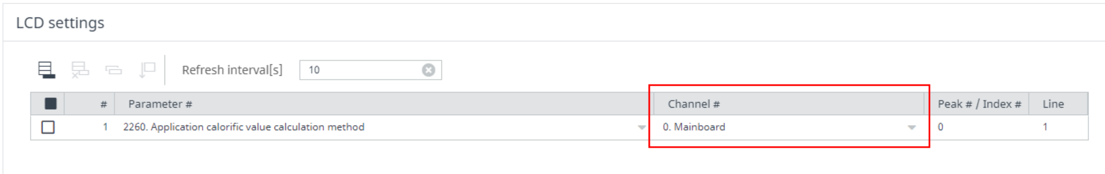
Displays the ideal GPM on component basis of the last run calculated according to the selected standard.

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. The results for these parameters are only available when calorific power calculation is enabled, see Application - Calorifc Power for more information.



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

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

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]

Displays the total ideal GPM of the last run calculated according to the selected standard.

2312. Application: Weight Percentage [%] #norm-peak

Displays the Weight Percentage [%] #norm-peak 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

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

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

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

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.

2378. Application: ISO2016.Dry.Wobbe.ideal

- 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

- 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

- 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)

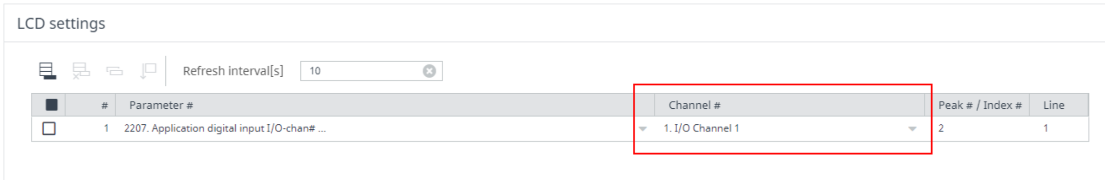
2381. Application: ISO2016.Sat.Wobbe.inferior.ideal

- 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)

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.



129. Digital Input #2 [Digital input opt.]

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 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 Computed 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 for more information. The value is measured only once during the run (at sampling) and directly displayed.

[S Anal.In#x] where x is the I/O channel number

API21 Parameters

API chapter 21 describes minimum specifications in the measurement and recording of flow parameters by electronic measurement systems as defined by the American Petroleum Institute.

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 the table below.

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.

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.
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 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 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 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 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 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 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 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 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 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.

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
...	...	First 5 characters of the component name
Concentration component 19	1019	First 5 characters of the component name

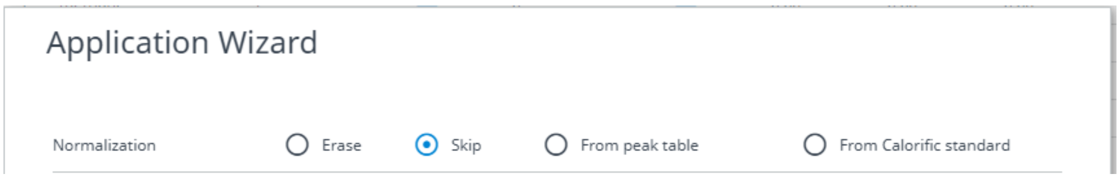
12015. API21: History Value #stream #norm-peak [“Display Text”]

Application Wizard

From the **Application tab, 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.

- From the Application tab, select the create new icon to open the **Application Wizard**.
- Select **Erase**, **Skip**, or define **Normalization From peak table** or **From calorific standard**.

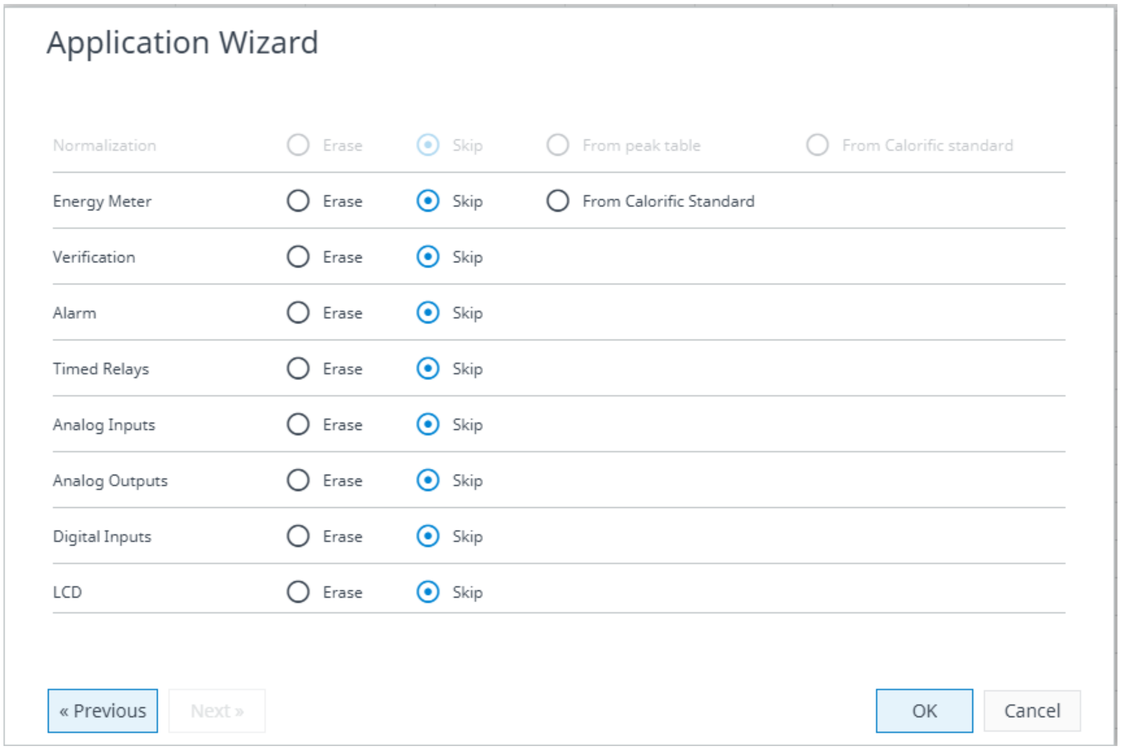


- Select **Next.**
- Select the options required for later instrument operation and click **OK**.
- Save Application (**Save as...** option). Edit a proper application file name.

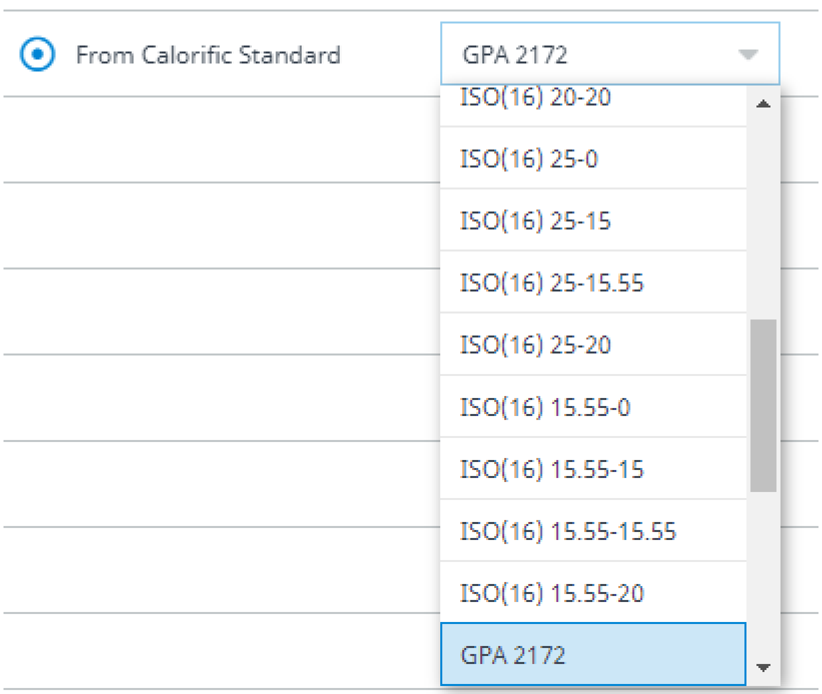
To access the sequence, select **Automation\Sequence**. Fine tune the sequence after the sequence wizard has created most of the parameters.

For information about Sequence setup, see Automation Tab.

Save sequence and download sequence to the instrument.



Calorific standard drop-down menu:



IO Cases

I/O Cases

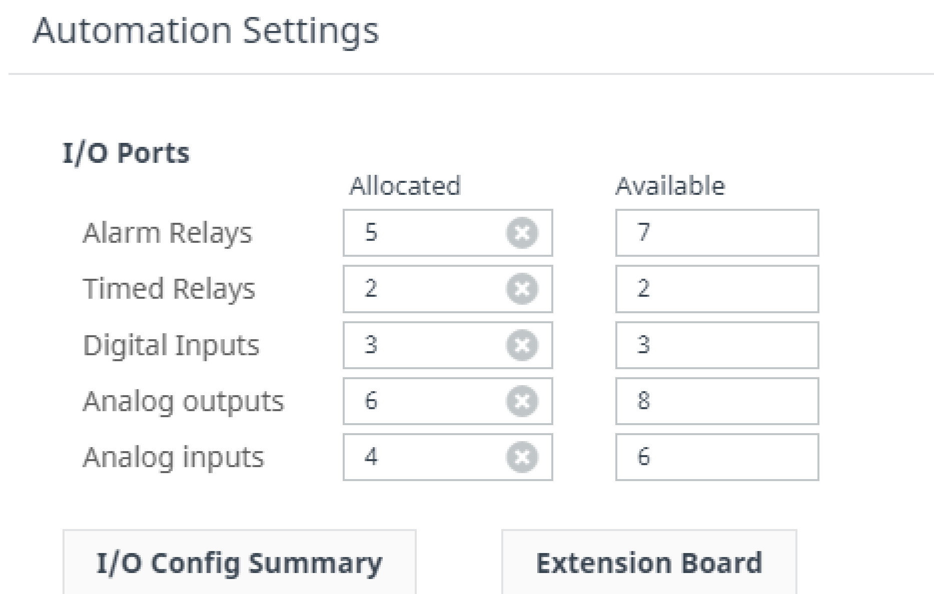
The cases below describe how all I/O's can be configured and used in a 990 Micro GC. The following hardware has been used for these cases:

- 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)

In this section

General Setup

The following 990 Micro GC setup has been configured:



the total number of I/O available depends on whether IO extension boards are attached to the instrument.

In this example, 5 alarm relays, 2 timed relays, 3 digital inputs, 6 analog outputs and 4 analog inputs are allocated for use.

In this section

[Cases preparation]

Cases preparation

1. Perform an analysis of gas sample and ensure peak integration and calculation is enabled.

Method Properties

- [x] Enable Peak Integration, Identification and Calibration calculations
- [x] Enable Application calculations
- [ ] Enable using test amounts in Appication

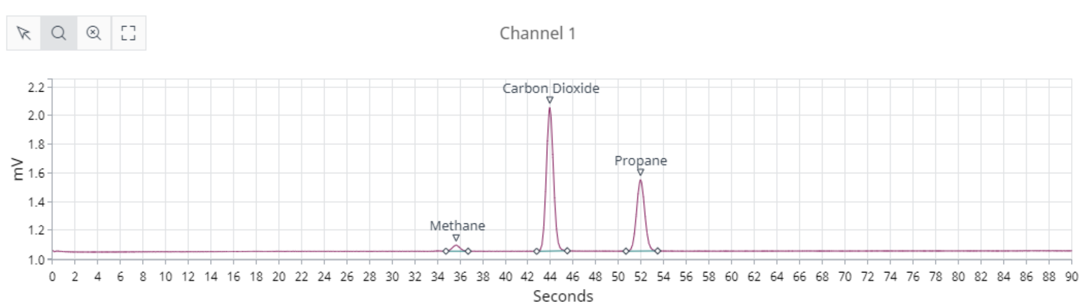
2. Enter some applicable integration events for the peaks to get properly identified.

	■	Event ID	Start time	Value
1	☐	14. Turn Integration Off	0	1
2	☐	13. Turn Integration On	20	1
3	☐	1. Set Peak Width [s]	0	1
4	☐	2. Set Threshold [10 nV]	0	10

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.
4. Name the identified peaks.

■	ID	Peak name	Ret. time	Rel. ret. window	Abs. ret. window	Reference	Selection mode	Rel. Ret. Peak
☐	1	Methane	35.62	5	5	☐	0. Nearest	☐
☐	2	Carbon Dioxide	43.89	5	5	☐	0. Nearest	☐
☐	3	Propane	51.9	5	5	☐	0. Nearest	☐

5. Perform a calibration run or recalculation. The integration report is generated.



Integrated Peak List

#	Channel	Peak #	Peak name	ESTD Conc.	Retention[s]	PeakRR...	Area	Height	Width[s]	Separ.C...	Validation
1	1	1	Methane	0.078325	35.62	0.0000	54.4503	4175.0899	0.7398	BB	0
2	1	2	Carbon Dio...	0.420013	43.89	0.0000	1226.7916	100158.5...	0.6837	BB	0
3	1	3	Propane	0.254903	51.90	0.0000	696.3850	49770.03...	0.7832	BB	0

Case 1: Analog Output

This case describes the use of analog outputs. As can be seen in the automation tab on the general setup, there are six analog outputs configured.

Ensure the analog outputs table is enabled by checking the checkbox.

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.


Analog outputs

Enabled

Ignore Zero peak concentrations

Ignore out of range concentrations

Anlog Out #	Param Type	Parameter	Input Low (X1)	Input High (X2)	Output% (Y1)	Output% (Y2)	Update On	Startup %
Output 1	2. Normalized Amounts	1. Methane (Chan 1)	0	100	0	100	1. Analysis	50
Output 2	2. Normalized Amounts	3. Propane (Chan 1)	0	100	0	100	1. Analysis	50
Output 3	7. ASTM / GPA Results	8. Act.Hv.Real	0	1000	0	100	1. Analysis	0
Output 4	7. ASTM / GPA Results	12. Act.hv.real	0	1000	0	100	1. Analysis	0
Output 5	3. Sample results	1. Sum ESTD	0	5	0	80	4. Verification	0
Output 6	5. Analog inputs	1. Sampling Analog Input 1	80	120	0	40	1. Analysis	0

Once the application analysis has been completed, the result items configured in above table will be properly scaled to set the specific analog output values.

Note: If the analysis result exceeds its input range, the outputs value will be clipped as well. For example, if the sum ESTD in application report is 8.5, then it results in a 80% clipped output value, because its input value was limited to 5.

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:

Alarm

☑ Enable alarm table

#	Param Type	Parameter	Minimum	Maximum	Alarm on	Invert Alarm	Relay Alarm	Relay #	Invert Relay
1	1. ESTD Amounts	1. Methane (Chan 1)	50	100	1. Analysis	☑	☐	0. None	☐
2	3. Sample results	1. Sum ESTD	80	90	2. Calibration	☐	☑	1. Alarm relay 1	☐
3	5. Analog inputs	1. Sampling Analog Input 1	95	105	4. Verification	☐	☐	0. None	☐

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. For example, if 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.

Analog inputs

Analog In #	Gain	Offset
Input 1	5	0
Input 2	0	0
Input 3	0	0
Input 4	0	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	3. Sampling started	0	1. Timed relay 1	1. Energize
☐	2	3. Sampling started	5	1. Timed relay 1	0. De-energize
☐	3	4. Injection started	1	2. Timed relay 2	1. Energize
☐	4	5. Sample calculation	1	2. Timed relay 2	0. De-energize
☐	5	0. None	0	0. None	0. De-energize
☐	6	0. None	0	0. None	0. De-energize

According to this table.

- The relay 1 is energized when sampling starts.
- The relay 1 is de-energized 5 seconds after sampling starts.
- The relay 2 is energized 1 second after injection starts.
- The relay 2 is de-energized 1 second after analysis is performed.

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
☐	1	2.Start Automation
☐	2	3.Stop Automation
☐	3	5.Start Calibration Table

7 Automation Tab

Automation Tab

To automate your instrument, configure your instrument as described in [Automation settings](#).

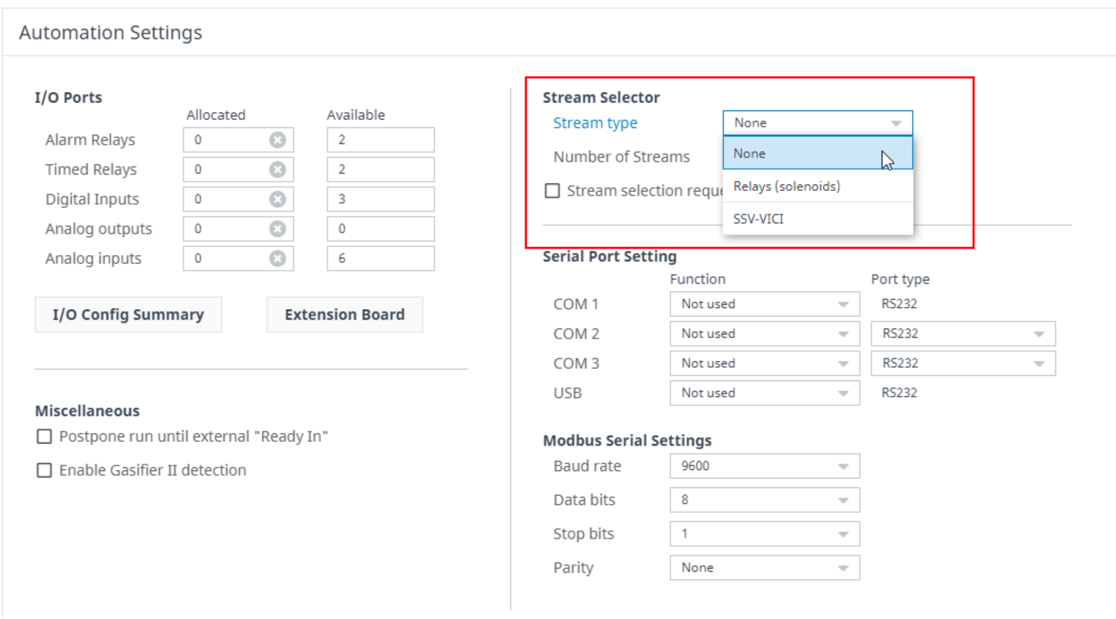
In this Configuration Setup, the user sets his I/O settings, Stream Selection hardware, Extension Boards and various other automation related parameters.

All settings in the Automation tab can be entered directly, or you can import sequence settings files using Import and Export icons. See [Import/Export](#).

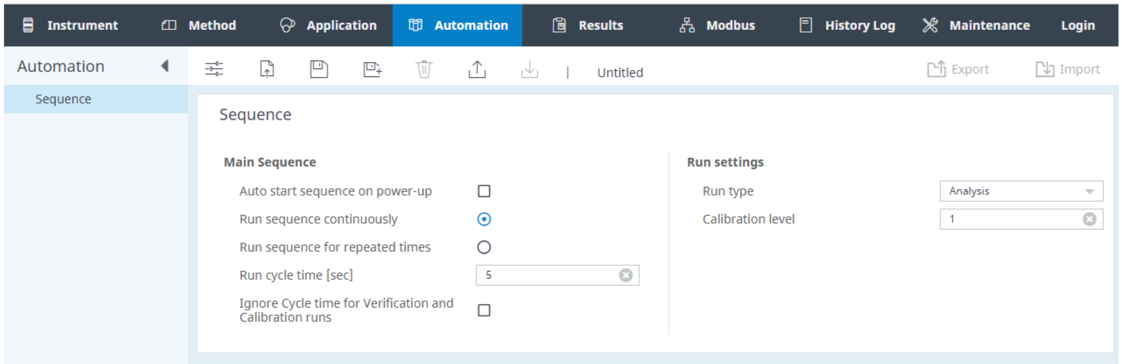
The **Automation** screen contains different settings depending on whether or not a stream selector is installed.

Without stream selector

Based on the Stream Selector configuration, if **Stream type** is set to **none**, only the **Sequence** settings will be available.



It is not possible to customize the sequence run table, as a hardware setup with no stream selection device is unable to switch to different sample streams, or select calibration- or verification gas streams. The **Automation** tab contains a single sequence setting page as seen here:

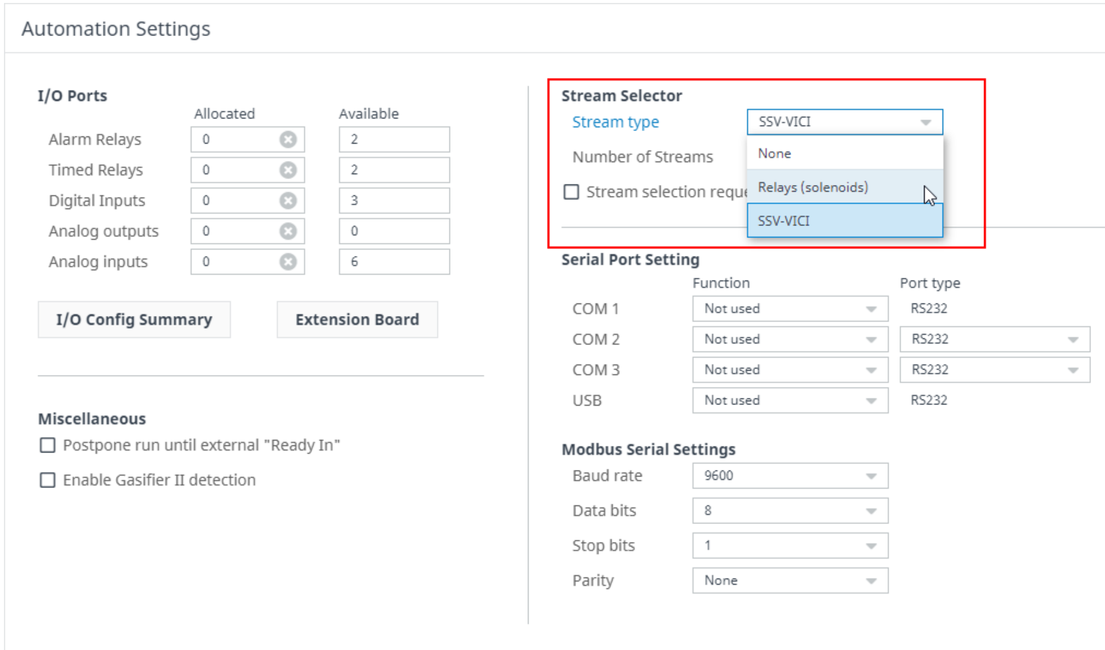


See Sequence Properties for information.

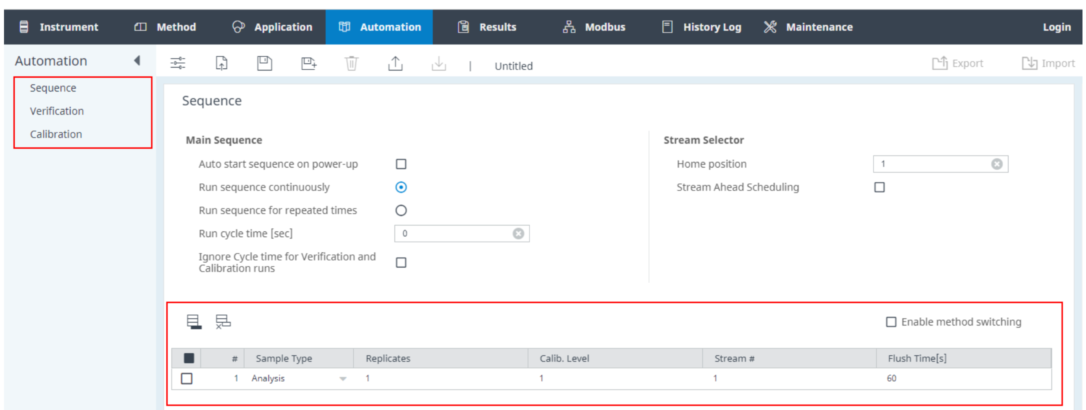
As only one single sample is connected, one run type can be performed. In case of a necessary calibration or verification, the sequence must be stopped, the appropriate sample connected, and either the Run Properties must be changed or another sequence opened and downloaded to the instrument. To resume normal operation again, the **Run type** must be reset to **Analysis**.

With stream selector (VICI or Relays) configured

If stream type is specified to either "Relays" or "SSV-VICI", the full functionality will be available under Automation tab. 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.



The **Automation** tab contains three settings sections: **Sequence**, **Verification**, and **Calibration**. Generally, more complex schedules can be configured because the sample stream position can be switched during the automation. For use-case examples, see Schedule Case 1 and Schedule Case 2.



In this section

See also

[Schedule Case 1](#)

[Schedule Case 2](#)

[Automation tab](#)

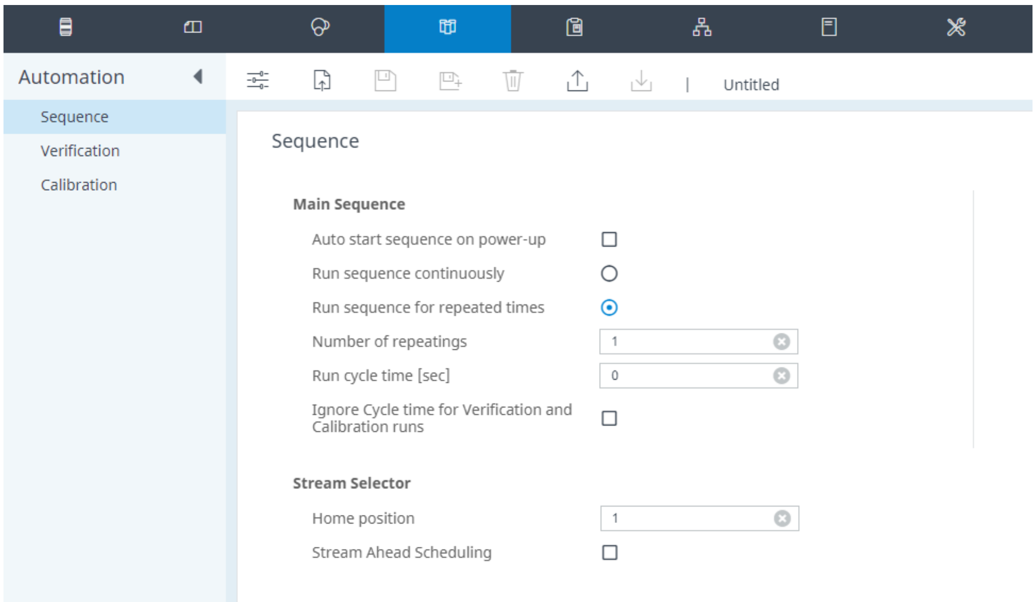
[Import/Export](#)

Sequence Properties

Using the Sequence Wizard will always help to quickly set up the sequence parameters. Refer to the Sequence Wizard topic.

To access Sequence, select the **Automation** tab and select **Sequence**.

The stream sequence properties screen is always available regardless of hardware setup.



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

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).

Ignore cycle time for verification and calibration runs

When this option is selected, verification runs and calibration runs will not be affected by the Run cycle time value. The system will proceed to next cycle right after the previous chromatographic cycle completed.

Run type (No stream selector)

When no stream selector specified, determine the run type of the sequence.

Calibration level (No stream selector)

When no stream selector specified, key in the calibration level that the sequence result may apply to.

Home position (Stream selector)

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.

The range of Home position is determined by the "Number of streams" defined in Automation settings.

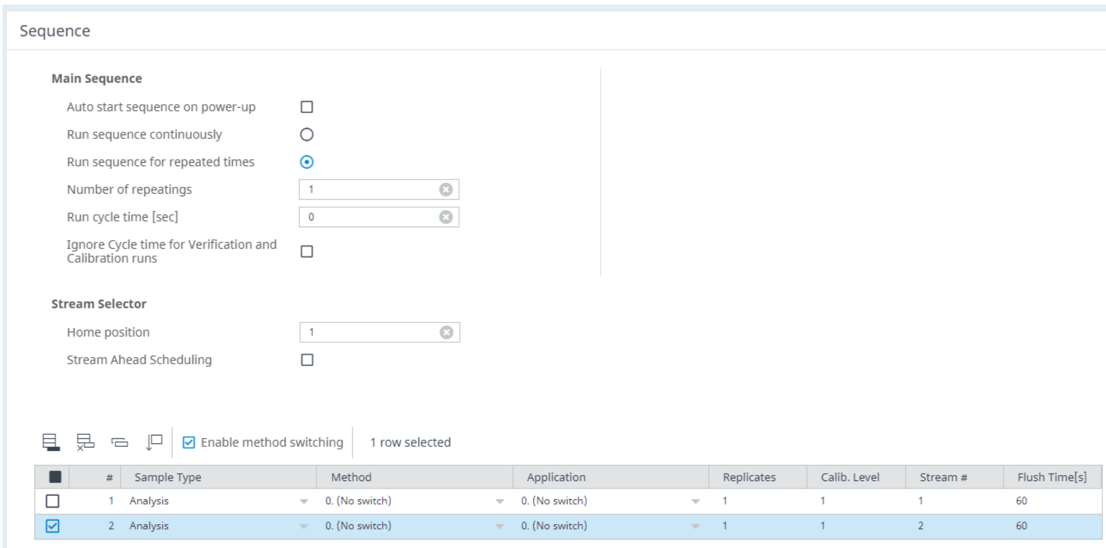
Home position assigned to 0 means the position of the stream selection device will remain unchanged in above cases.

Stream ahead scheduling (Stream selector)

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.



Enable method/application switching

Determines whether the method or application can be switched between sequence runs.

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.

Note: The flushing process runs only when the stream position needs switching before a run.

When Stream Ahead Scheduling is enabled, the flushing process of the next sample stream will be invoked five seconds after injection.

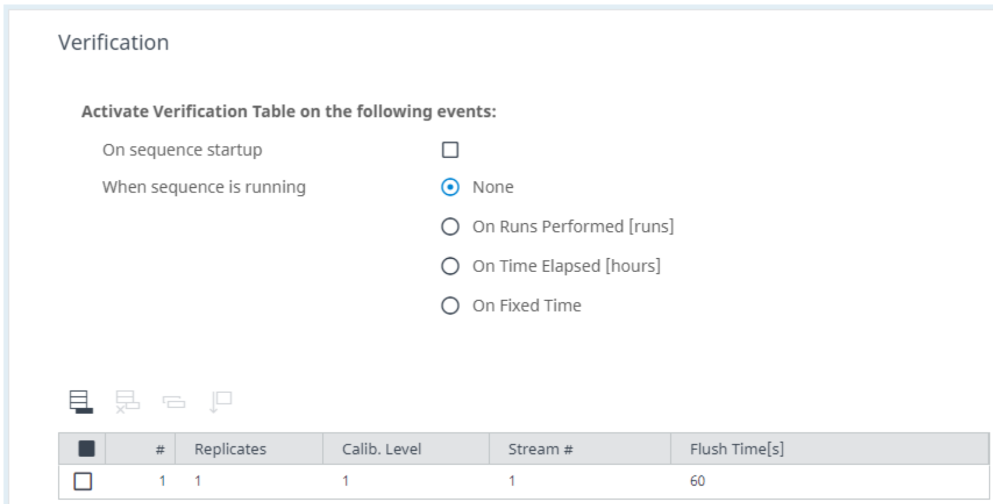
Method

Selected method settings. Select **Enable Method/Application Switching** to allow use of the drop down list for choosing a Method to associate with the corresponding run.

Application

Selected application settings. Select **Enable Method/Application Switching** to allow use of the drop down list for choosing an Application to associate with the corresponding run.

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)

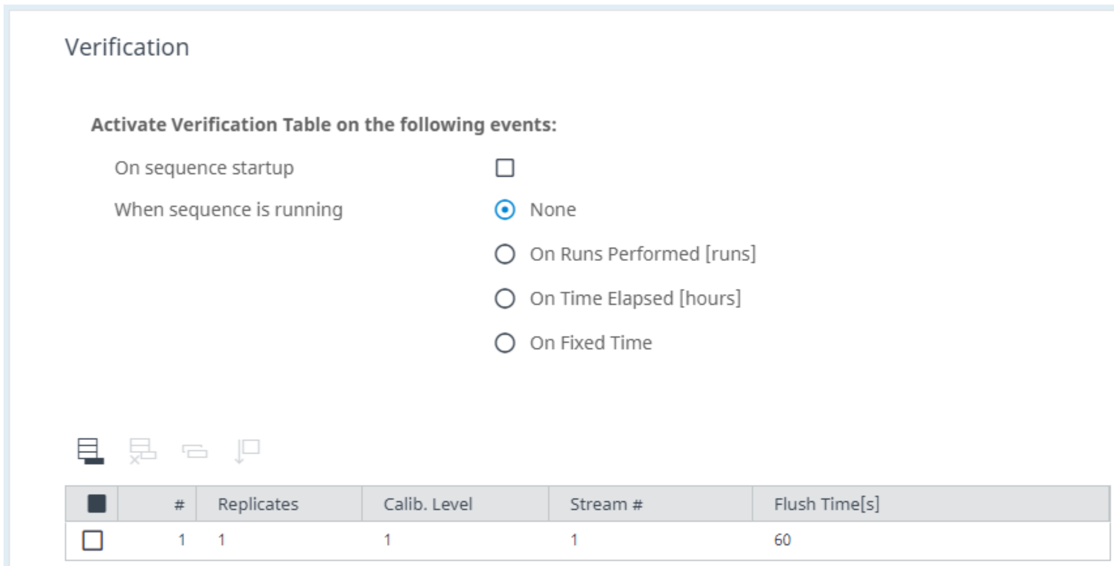
Selecting this option forces the Sequence Table to be interrupted every number of hours of runtime as indicated, and switch to the Verification Table. Once the Verification Table is completed, the system will revert back to the Sequence Table.

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



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

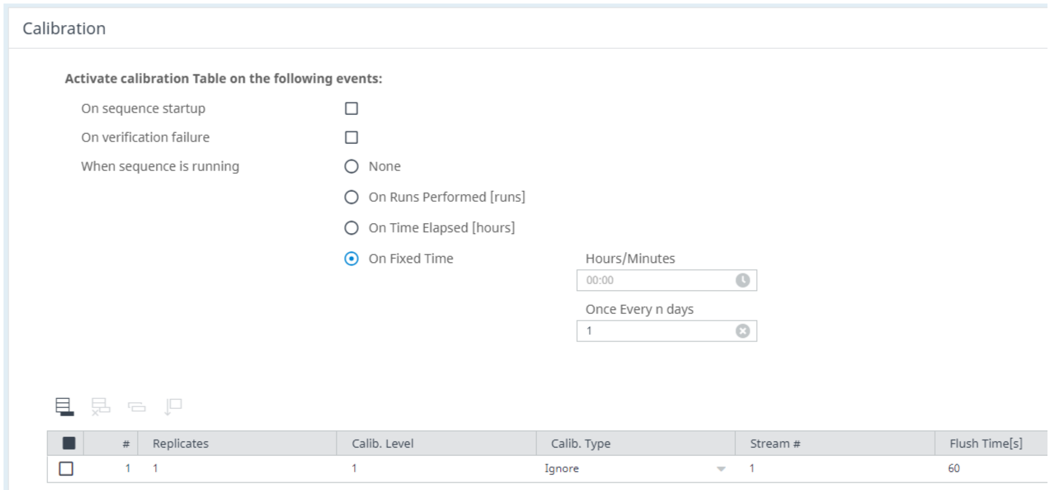
Stream

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



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

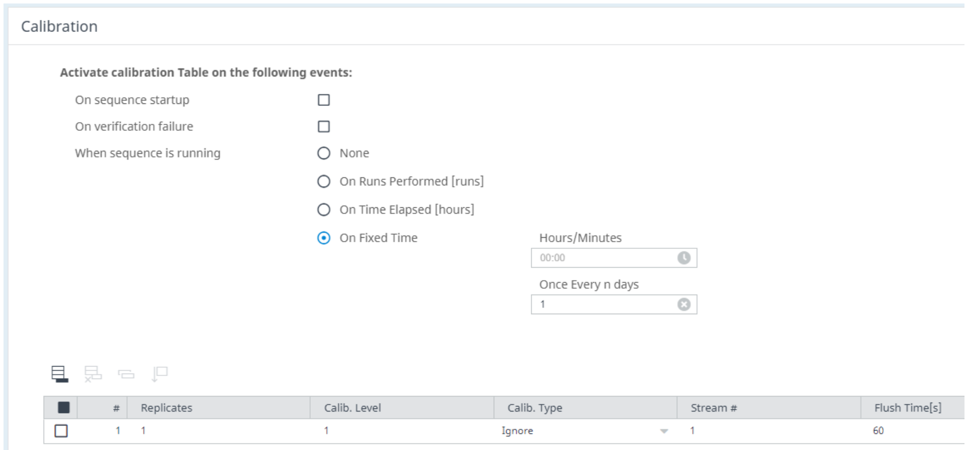
Selecting this option forces the Sequence Table to be interrupted at a fixed time every ‘n’ days, and switch to the Calibration Table. Once the Calibration Table is complete, the system will revert back to the Sequence Table.

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



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.

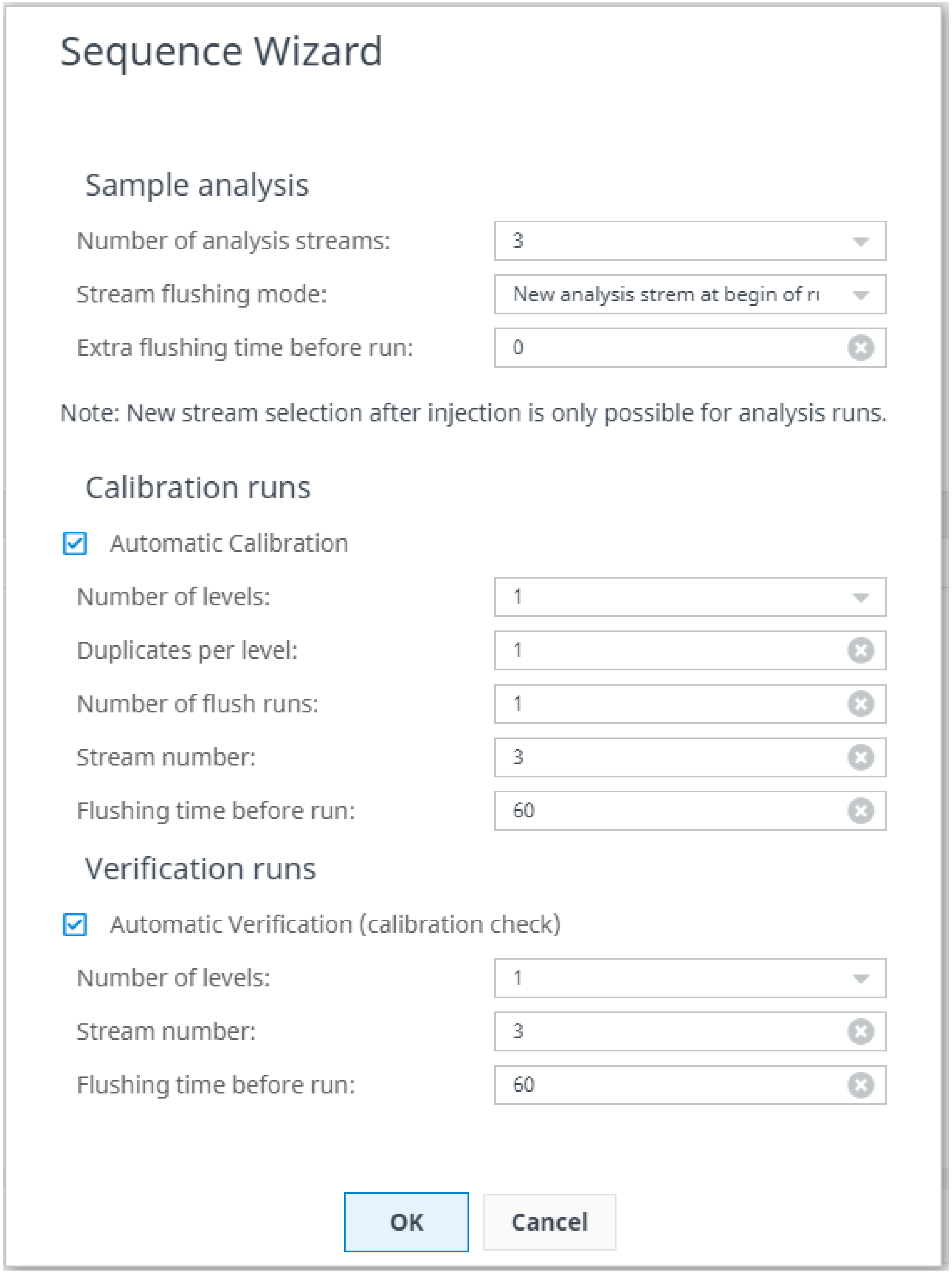
Flush time

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.

Sequence Wizard

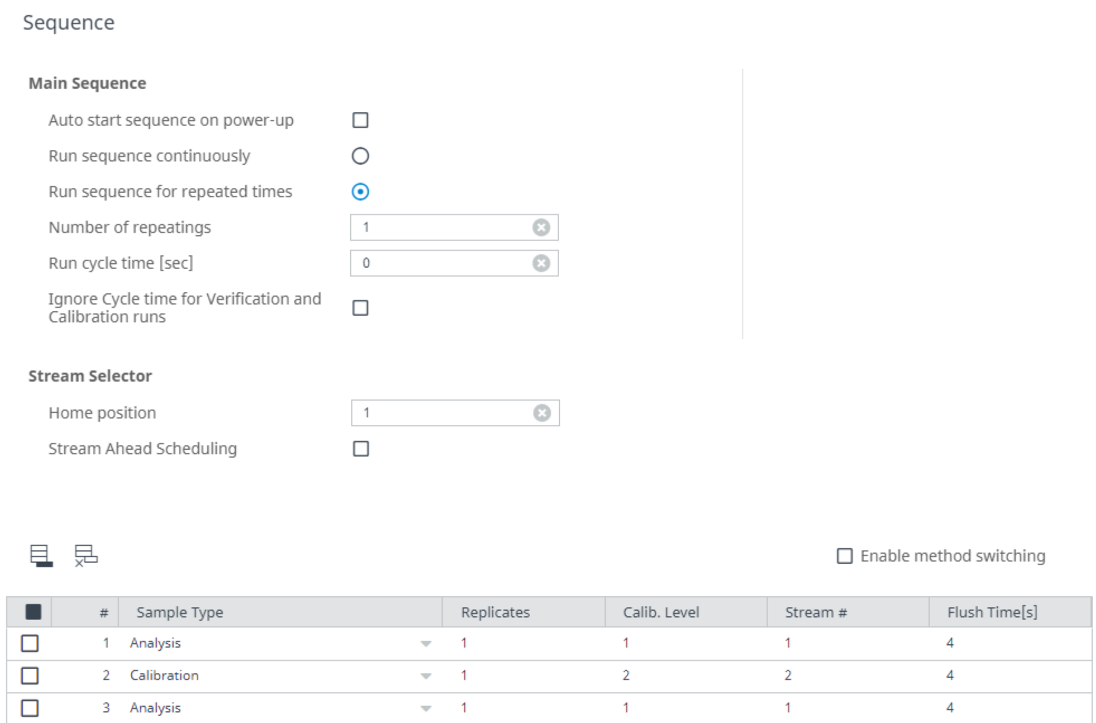
Select the sequence wizard to quickly set up a sequence from scratch. To activate the sequence wizard, from the Automation tab, select the Create new/Wizard icon.



Schedule Case 1

Prerequisite: Stream selector configured must be configured.

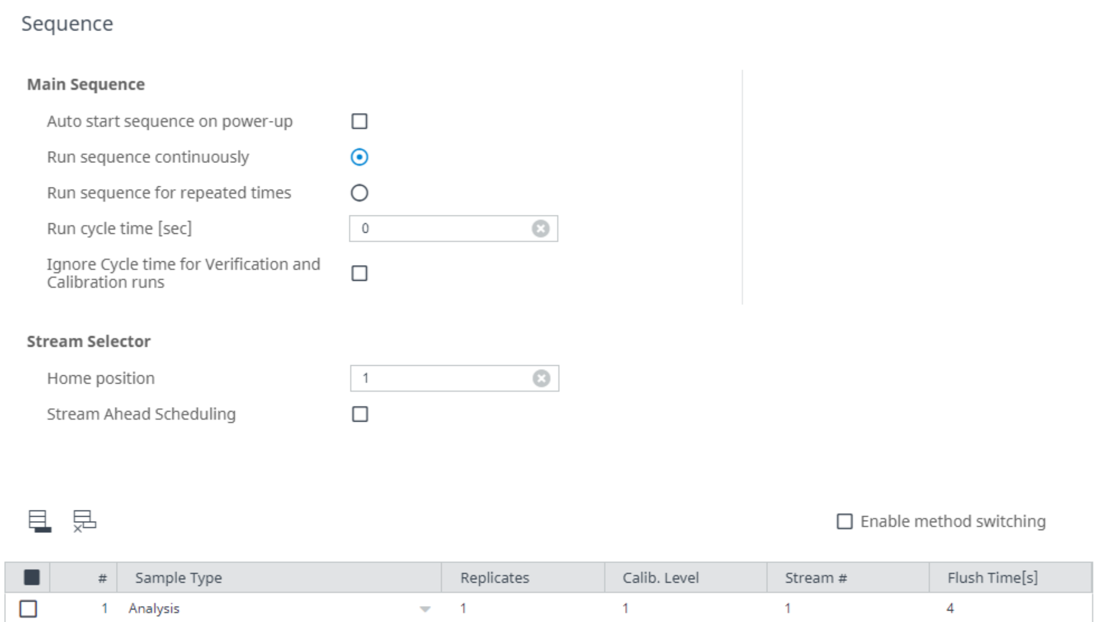
This is an automation example with sequence table only, however, both analysis runs and calibration runs are scheduled.



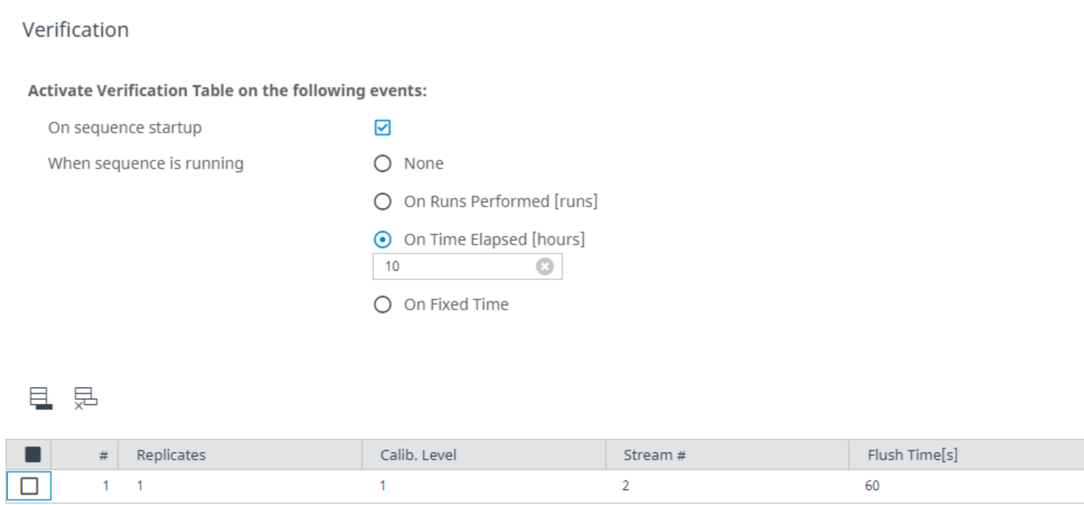
Schedule Case 2

Prerequisite: Stream selector configured must be configured.

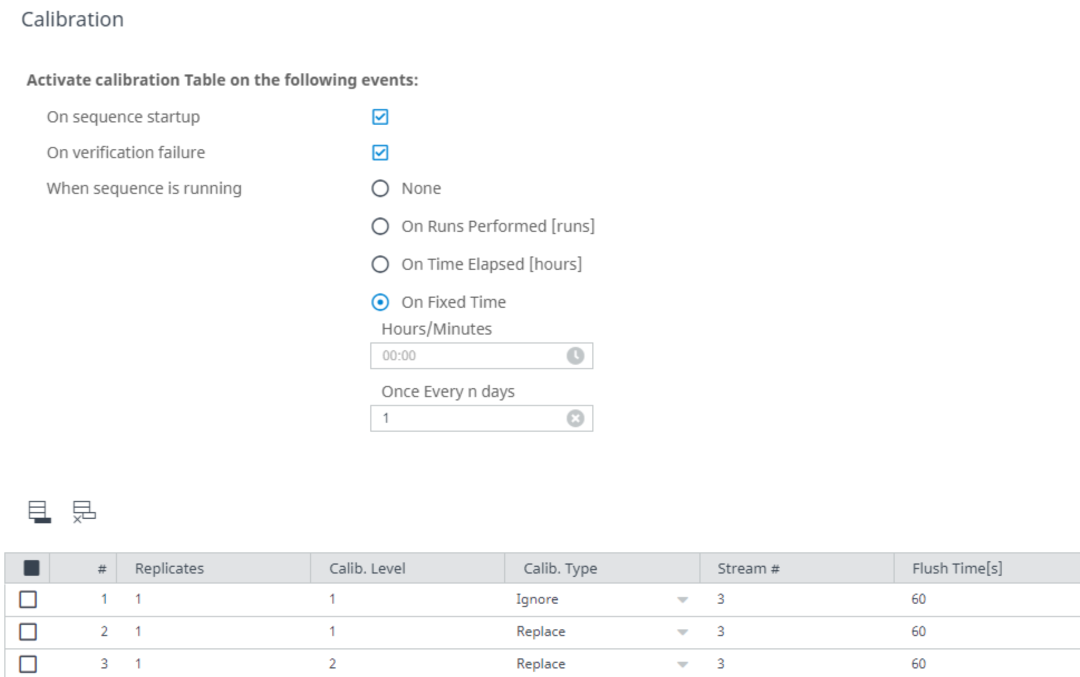
In this example, the sequence table only contains analysis runs. In addition, the verification table and calibration table are scheduled for inserting corresponding runs during automation.



Verification table configuration:



Calibration table configuration:


Calibration
Activate calibration Table on the following events:
On sequence startup
On verification failure
When sequence is running
None
On Runs Performed [runs]
On Time Elapsed [hours]
On Fixed Time
Hours/Minutes
00:00
Once Every n days
1
#
Replicates
Calib. Level
Calib. Type
Stream #
Flush Time[s]
1 1 1 Ignore 3 60
2 1 1 Replace 3 60
3 1 2 Replace 3 60

8 Data Results

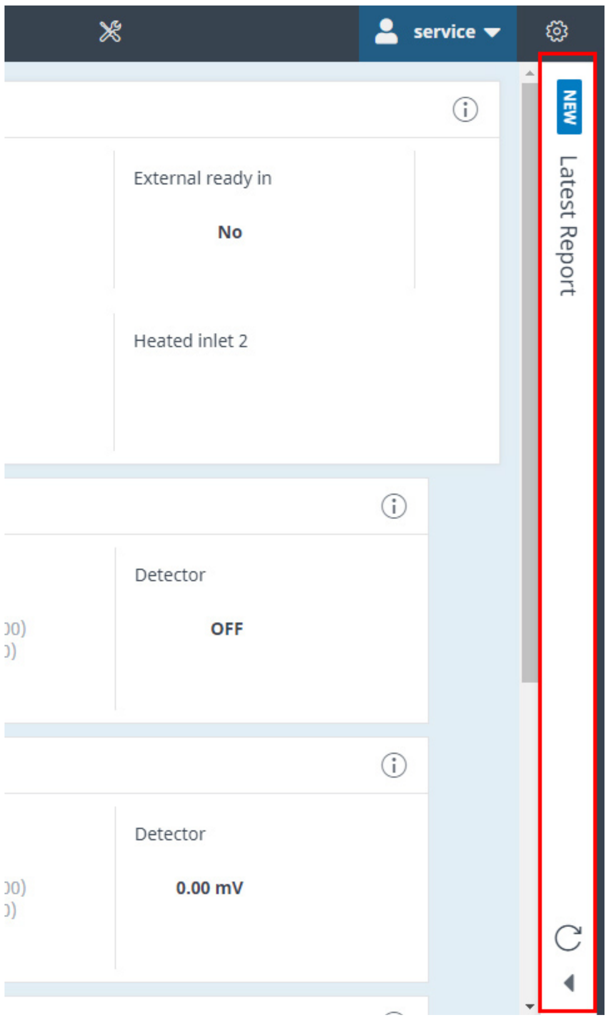
Data Results

In this section:

Latest Report

Latest Report

To access the reporting capabilities, select the expand panel arrow icon from the **Latest Report** toolbar on the right.



When the report is updated after a run, the panel will indicate that new results are available with the **NEW** indicator:

The report pane displays the latest report and access to the following functions:

- **Integration**, **Application** and **Stream Application Report** (displayed on screen)
- **Export** and **Import** Chromatogram .dat file
- **Refresh Report**
- **Print Report**

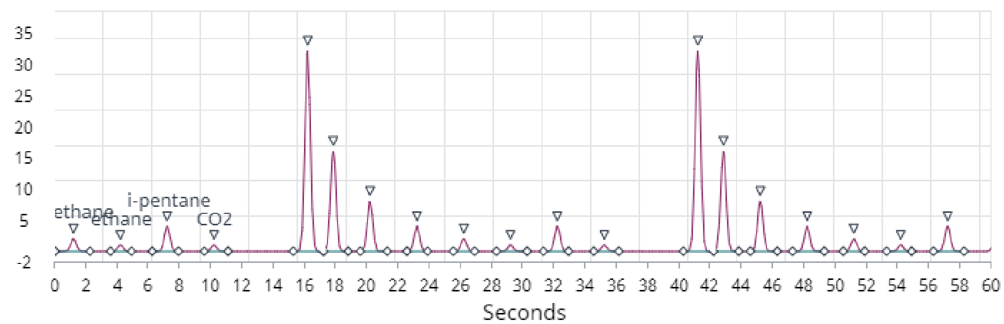
In this section

Integration Report

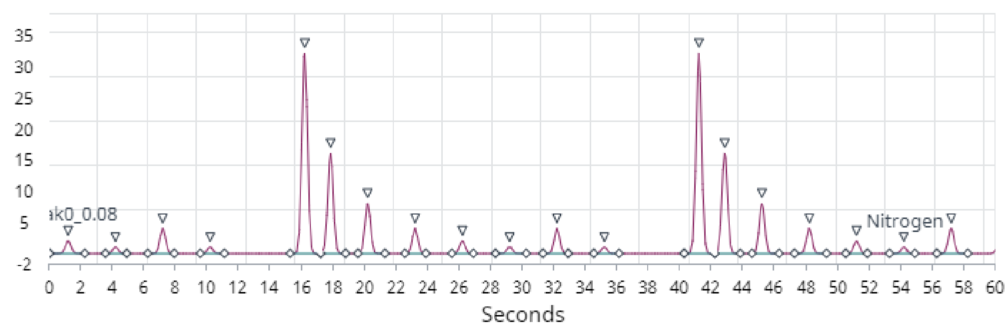
Export .dat file   Import .dat file

Integration Report | Application Report

Channel 1



Channel 2



Integrated Peak List

#	Channel	Peak #	Peak name	ESTD Conc.	Retention[s]	Area[10nV.s]	Height[10nV]	Width[s]	Separ.Code	Validation	Assymetry
1	1	1	methane	0.187500	1.18	1409.8000	200000.0000	0.3983	BB	0	1.0124
2	1	2	ethane	1.437500	4.18	704.9000	100000.0000	0.3983	BB	0	1.0124
3	1	3	i-pentane	3.500000	7.18	2819.6000	400000.0000	0.3983	BB	0	1.0124
4	1	4	CO2	0.000000	10.19	704.9000	100000.0000	0.3983	BB	0	0.9879
5	1	5	<Unknown>	0.000000	16.19	22556.8000	3200000.0000	0.3983	BV	0	0.9879
6	1	6	<Unknown>	0.000000	17.83	11278.4000	1600000.0000	0.3983	VB	0	0.9879
7	1	7	<Unknown>	0.000000	20.18	5639.2000	800000.0000	0.3983	BB	0	1.0124
8	1	8	<Unknown>	0.000000	23.19	2819.6000	400000.0000	0.3983	BB	0	0.9879
9	1	9	<Unknown>	0.000000	26.19	1409.8000	200000.0000	0.3983	BB	0	0.9879
1...	1	10	<Unknown>	0.000000	29.18	704.9000	100000.0000	0.3983	BB	0	1.0124
1...	1	11	<Unknown>	0.000000	32.18	2819.6000	400000.0000	0.3983	BB	0	1.0124
1...	1	12	<Unknown>	0.000000	35.19	704.9000	100000.0000	0.3983	BB	0	0.9879
1...	1	13	<Unknown>	0.000000	41.19	22556.8000	3200000.0000	0.3983	BV	0	0.9879

The **Integration Report** parameters are determined in the instrument at the end of a chromatographic run and uploaded to the PROstation user interface.

The following properties are part of the integration report:

- #: Line number

- **Channel:** GC channel
- **Peak #:** 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

The **Application Report** parameters are determined by the instrument at the end of a chromatographic run and uploaded to the PROstation browser interface.

The application report contains the results from all instrument-wide application related calculations: This includes normalization and calorific power calculation when applicable. The figures below show the report after instrument wide normalization. Scroll through the report to view each data table.

Components are identified by name as they are reported in the **Integration Report**. Find more information in the Normalization section.

Application Info

- **Sampling time**: The time the sample was injected according the instrument internal clock.
- **Report Time:** The time that the report is generated. This value might be different from the Sampling time above, as the user can recalculate a single data result and generate report multiple times.
- **Run Number**: 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.
- **Stream #**: The stream number from which sample gas is introduced and analyzed.
- **Stream OK**: Status of the stream valve or relay.
- **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.
- **Alarms Status**: All alarms, as defined in the Alarming window under the Application menu, are reported here on Alarm Index, if an alarm occurs.
- **Sampling Analog In #**: These are the converted analog input values as defined in **Analog Input** section of the **Application** tab. 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

Calorific calculation

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) from the **Application** tab.

Latest Report

Export .dat file Import .dat file

Integration Report | **Application Report**

Calorific calculation: ISO 6976:2016

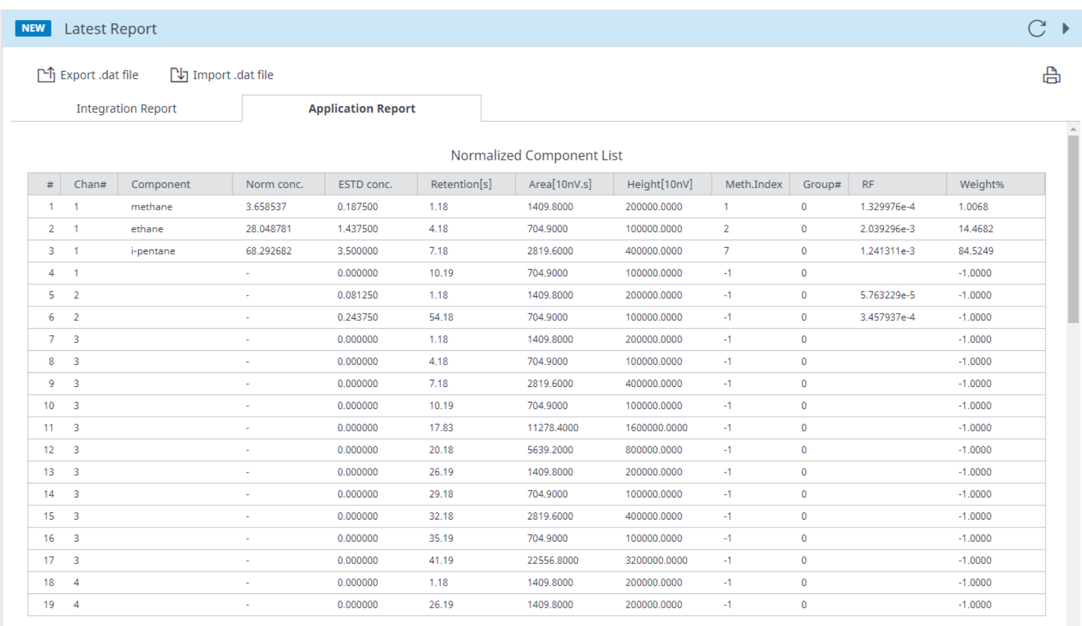
name	Dry	Saturated	Unit
Water Mole.	--	1.74	[%]
Compressibility	0.9674	0.9666	[-]
Molar Mass	58.2933	57.5924	[kg/kmol]
Relative Density Ideal	2.0125	1.9883	[-]
Relative Density Real	2.0795	2.0562	[-]
Gas Density Ideal	2.4607	2.4311	[kg/m3]
Gas Density Real	2.5436	2.5151	[kg/m3]
Superior Heating Vaule(Volume Real)	125.94	123.85	[MJ/m3]
Inferior Heating Vaule(Volume Real)	116.09	114.16	[MJ/m3]
Superior Heating Vaule(Volume Ideal)	121.84	119.72	[MJ/m3]
Inferior Heating Vaule(Volume Ideal)	112.30	110.35	[MJ/m3]
Superior Heating Vaule(Mass)	49.51	49.24	[MJ/kg]
Inferior Heating Vaule(Mass)	45.64	45.39	[MJ/kg]
Superior Heating Vaule(Molar)	2886.28	2836.06	[KJ/mol]
Inferior Heating Vaule(Molar)	2660.42	2614.12	[KJ/mol]
Wobbe Index(Real)	87.34	86.37	[MJ/m3]
Wobbe Index inferior	80.50	79.61	[MJ/m3]
Wobbe Index(Ideal)	85.88	84.90	[MJ/m3]
Wobbe Index inferior(Ideal)	79.16	78.26	[MJ/m3]

Normalized Component List

The component list contains the peaks as defined in the **Normalization** window found in the **Application** tab. It contains the parameters listed below. Some parameters are only available when used in certain conditions.

- **#**: Index number
- **Chan#**: The GC channel from which the peak was identified.
- **Component**: The name of the peak as defined in the Normalization table found under the Application tab.
- **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.

- **ESTD Conc**: The external standard concentration of the peak found in the integration report.
- **Retention[s]**: The retention of the peak found in the integration report
- **Area[10nV.s]**: The area of the peak found in the integration report
- **Height[10nV]**: 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.
- **RF% to Last RF (Last RF)**: The difference calculated in percentage between current RF and last RF. This parameter is only reported when **Calibration check** is enabled from the **Calibration** section of the **Method** tab.
- **RF% to Init RF (Init RF)**: The difference calculated in percentage between current RF and the Init RF. The Init RF should be generated first by enabling **Initial Calibration** from the **Calibration** section of the **Method** tab. This parameter is only reported when "Calibration check" is enabled under Method -> Calibration tab.
- **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.



Normalized Component List

#	Chan#	Component	Norm conc.	ESTD conc.	Retention[s]	Area[10nV.s]	Height[10nV]	Meth.Index	Group#	RF	Weight%
1	1	methane	3.658537	0.187500	1.18	1409.8000	200000.0000	1	0	1.329976e-4	1.0068
2	1	ethane	28.048781	1.437500	4.18	704.9000	100000.0000	2	0	2.039296e-3	14.4682
3	1	i-pentane	68.292682	3.500000	7.18	2819.6000	400000.0000	7	0	1.241311e-3	84.5249
4	1		-	0.000000	10.19	704.9000	100000.0000	-1	0		-1.0000
5	2		-	0.081250	1.18	1409.8000	200000.0000	-1	0	5.763229e-5	-1.0000
6	2		-	0.243750	54.18	704.9000	100000.0000	-1	0	3.457937e-4	-1.0000
7	3		-	0.000000	1.18	1409.8000	200000.0000	-1	0		-1.0000
8	3		-	0.000000	4.18	704.9000	100000.0000	-1	0		-1.0000
9	3		-	0.000000	7.18	2819.6000	400000.0000	-1	0		-1.0000
10	3		-	0.000000	10.19	704.9000	100000.0000	-1	0		-1.0000
11	3		-	0.000000	17.83	11278.4000	1600000.0000	-1	0		-1.0000
12	3		-	0.000000	20.18	5639.2000	800000.0000	-1	0		-1.0000
13	3		-	0.000000	26.19	1409.8000	200000.0000	-1	0		-1.0000
14	3		-	0.000000	29.18	704.9000	100000.0000	-1	0		-1.0000
15	3		-	0.000000	32.18	2819.6000	400000.0000	-1	0		-1.0000
16	3		-	0.000000	35.19	704.9000	100000.0000	-1	0		-1.0000
17	3		-	0.000000	41.19	22556.8000	3200000.0000	-1	0		-1.0000
18	4		-	0.000000	1.18	1409.8000	200000.0000	-1	0		-1.0000
19	4		-	0.000000	26.19	1409.8000	200000.0000	-1	0		-1.0000

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.

Print Integration/Application Report

After an upload of sample results, the integration report can be printed. From within the **Latest Report** screen, select the Print icon form the toolbar to print the Integration and Application report.

Results Tab

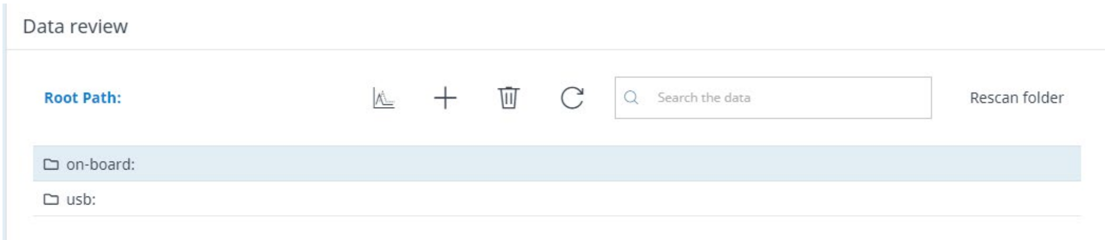
Results Tab

In this section:

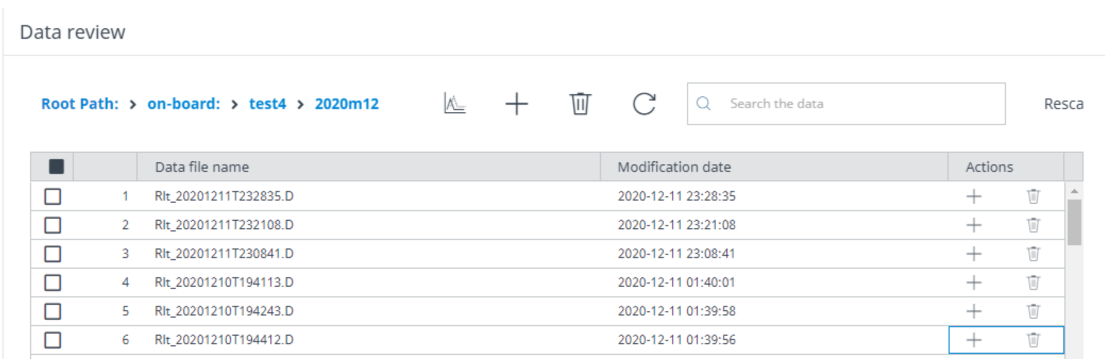
Data Viewer

From the **Results** tab, search and review data. Depending on the local [storage settings](), the data results will be automatically saved to either the on-board memory or an external USB storage disk.

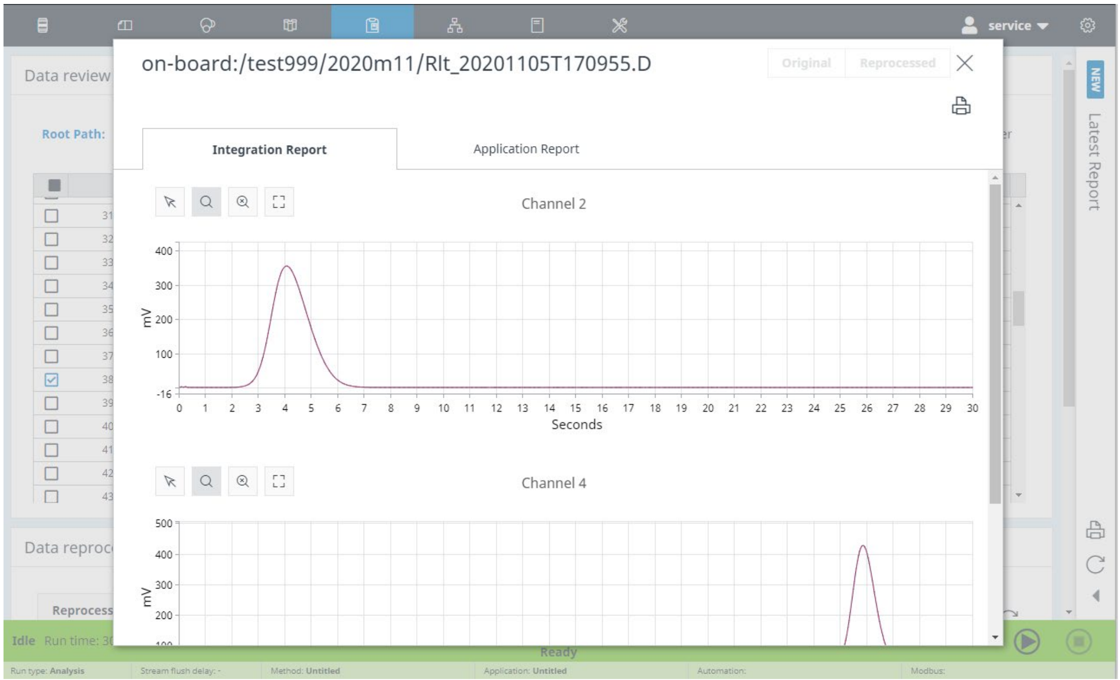
Data path is shown in **Root Path**.



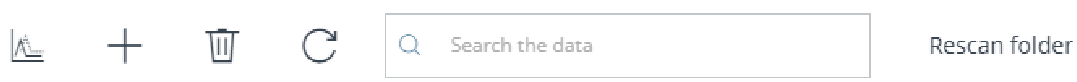
Click the folder in the list to navigate to the path where data results are stored. Or click the top path navigator to go backward.



Double click a .D file to view the content of this data result. The chromatograms and report will be displayed.



Toolbar operation



Chromatogram overlay: After selecting multiple data results in the list, click this tool button to show a dialog, where all the chromatograms are overlayed plotted by channel.

Add to reprocess list: After selecting multiple data results in the list, click this tool button to add them to the Reprocess list for further reprocessing, please refer to Reprocess List.

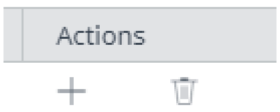
Delete data: After selecting multiple data results in the list, click this tool button to delete them from memory storage. Note the deleting operation is unrecoverable.

Refresh the list: When there are new results available, you might need click this tool button to refresh the data result list. The instrument store the file list of a folder in its cache. This button is used for manually reload the latest file list cache from the instrument to user interface.

Filter the list: This text box is used for displaying a filtered result list.

Rescan folder: Different from the refresh button, this operation will force instrument to rescan the content of the current folder to reestablish the cache. Note depending on the amount of result files in the folder, the scanning time may vary from a few seconds to dozen of seconds. As a result, you are always encouraged to use the refresh button first of all, instead of using this rescan.

Single file operation

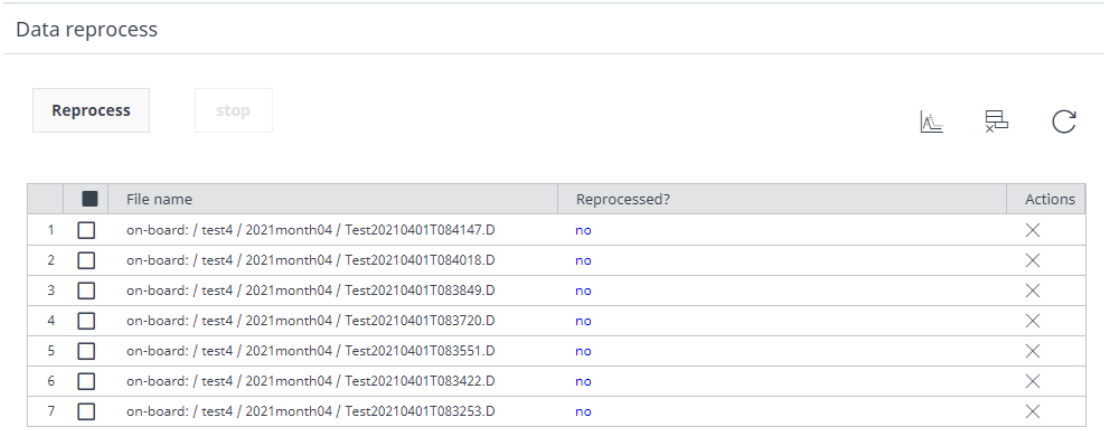


Each single data file can be operated by using the tool buttons in its corresponding table row. The actions include adding to reprocess list and deleting.

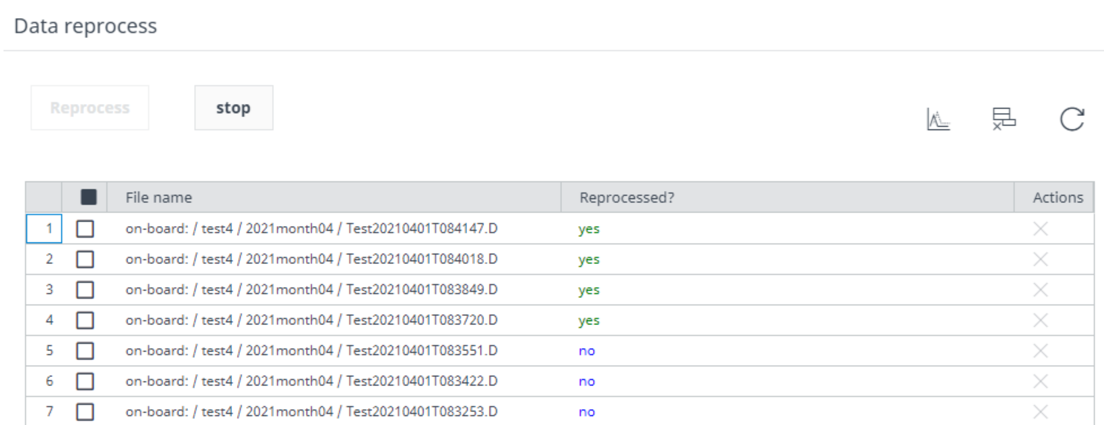
Data Reprocess

Data reprocess allows you to use the instrument's current active method and application to reprocess the stored data results.

From the **Results** tab, select files to reprocess and add them to the reprocess list as below.



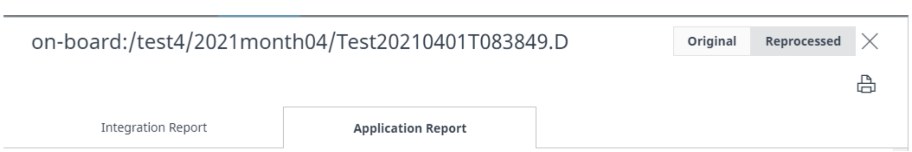
Click the **Reprocess** button. The first selected chromatogram from the list will download to the instrument and request the instrument to process this chromatogram. When the instrument completes the calculations, the state of 'reprocessed' column will be updated. Now the second chromatogram will be downloaded to the instrument. This will continue till the results of the last processed chromatogram are uploaded.



Note that you can only reprocess chromatograms on a nonrunning instrument.

You can view the reprocessed application report by double-clicking the data file at any time.

Tips: Two toggle buttons on the top right corner of the viewer dialog are used for switching between the **original** report (when the result is generated) and the **reprocessed** one.



9 Modbus Tab

Modbus Tab

In this section:

Modbus Setup

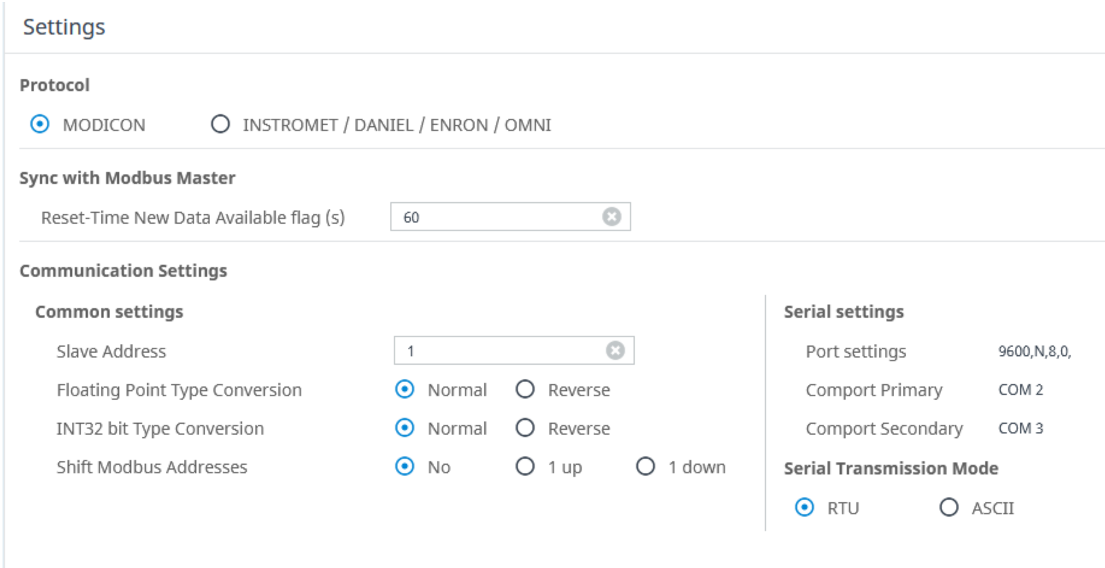
Modbus Setup

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.

You can also import Modbus settings files by selecting the Import icon and choosing an exisiting Modbus file (.wmod). See Import/Export.

In this section

Process settings tab



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).

Common 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.

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.

Serial communication settings

These settings only apply to Modbus serial communication and are ignored by Modbus TCP/IP.

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). This configuration is read-only here, but can set in D. Communication port settings.

Port settings

The port settings on which the primary and secondary comport are configured. This configuration is read-only here, but can set in D. Communication port settings.

Comport Primary

The Comport to which the first Modbus master is connected. This configuration is read-only here, but can set in D. Communication port settings.

Comport Secondary

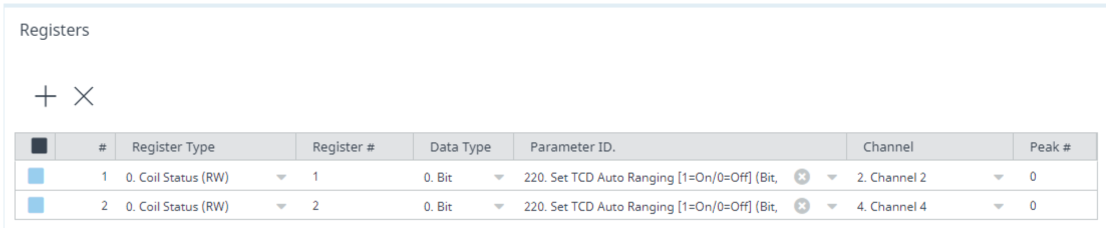
The Comport to which the second or redundant Modbus master is connected. This configuration is read-only here, but can set in D. Communication port settings.

Serial Transmission Mode

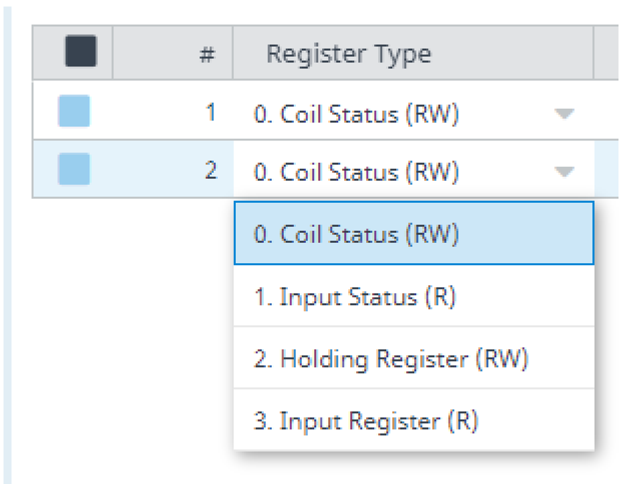
Remote Terminal Unit (RTU). RTU can only be used with 8 data bits serial communication. Note that with 8 data bits, 2 stop bits are not possible. ASCII is a standard for sending information (American Standard Code for Information Interchange). ASCII is standardized to 7 data bits serial communication, but if necessary can also be used on 8 data bits serial communication.

Registers setup tab

The Modbus Setup table is used to define the Modbus registers. Up to 1000 Modbus registers can be configured.



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

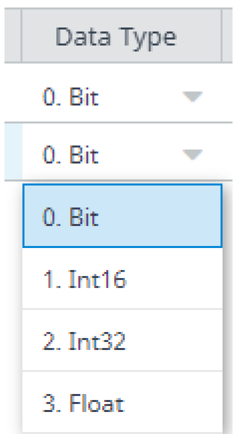
This is a 16 bit integer register. This register can only be read. Two registers grouped together can hold a 4 byte integer or 4 byte floating point value.

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.

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.

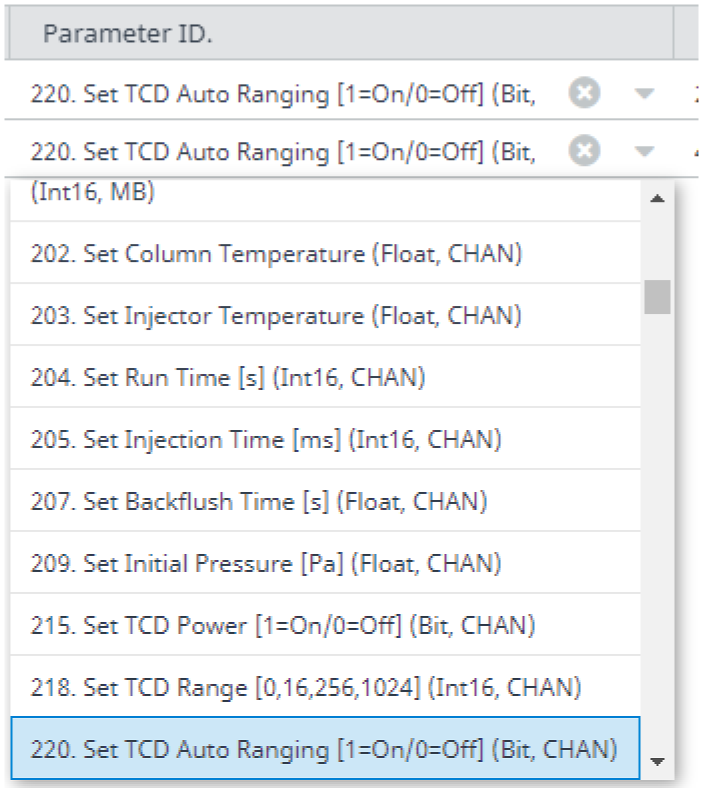
Data Type



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.

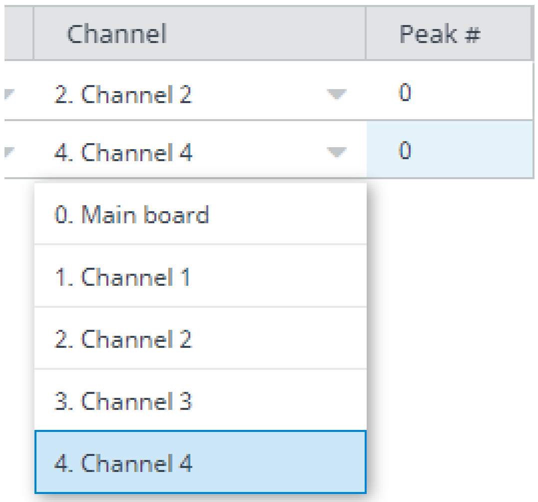
Parameter ID



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



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.

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.

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.

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.

Below are some examples of parameter usage. For a complete description of the full parameter list, please refer to Modbus Parameter ID Reference.

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)

25 Start Verification Table (execute CMD, MB) *

60 Set Manual Run Type (INT16, MB)

61 Set Manual Run Calibration level (INT16, MB)

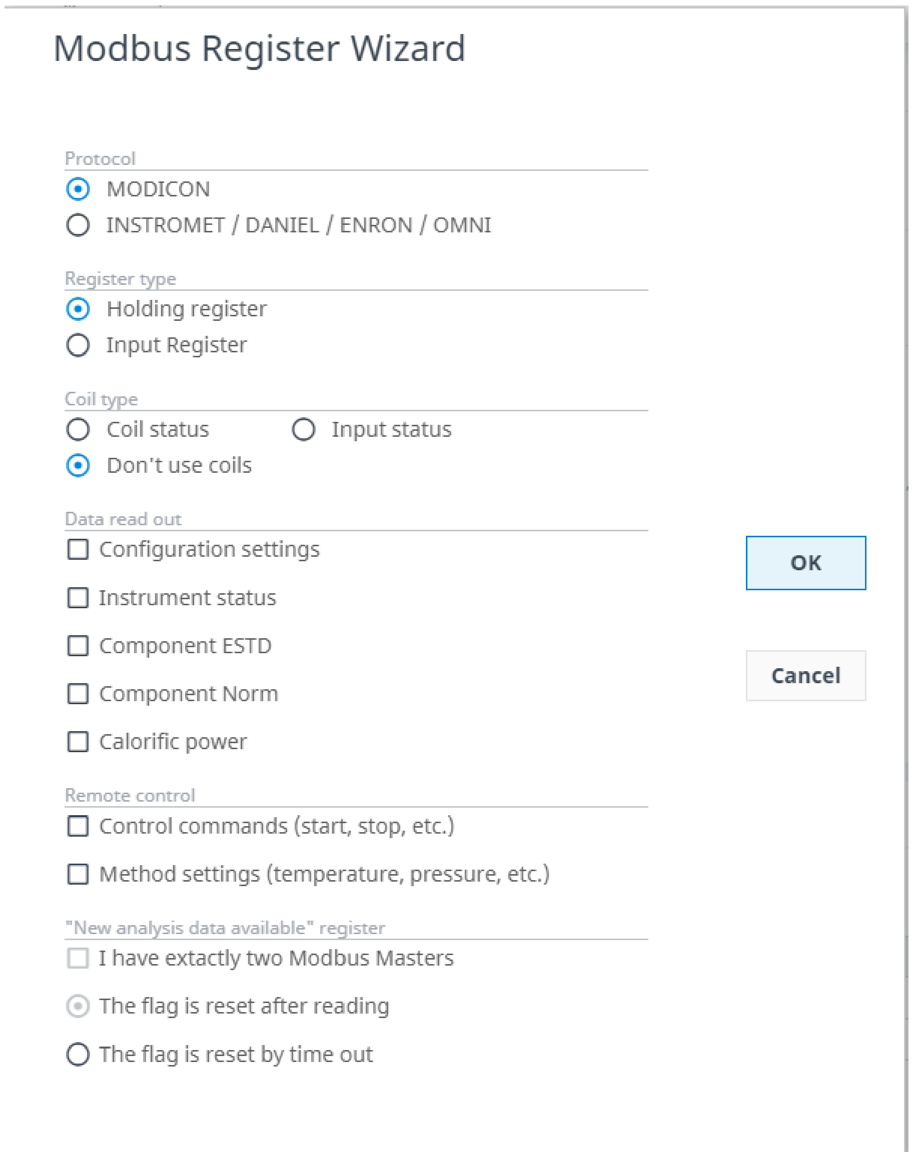
62 Set Manual Run Stream position (INT16, MB)

To prepare a new run, the Modbus master must set Run type, Calibration level and stream position, parameter ID's 60, 61, and 62, 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.

L ncat r V hy` qc

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 Modbus tab, select the Create new/Wizard icon .



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.

Note: The generated register addresses shall vary to be protocol compatible.

Modify, delete, or add lines to the generated Modbus table to fulfill the requirements.

Advanced Modbus Information

Advanced Modbus Information

In this section

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) 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**. 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) for additional information.

New Data available flag only accounts for result data

The new data available 2200. Sync: Data available (Bit, MB), 2201. Sync: Data available with reset(Bit, MB), or 2238. Sync: Data available2 with reset(Bit, MB) 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) 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

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.

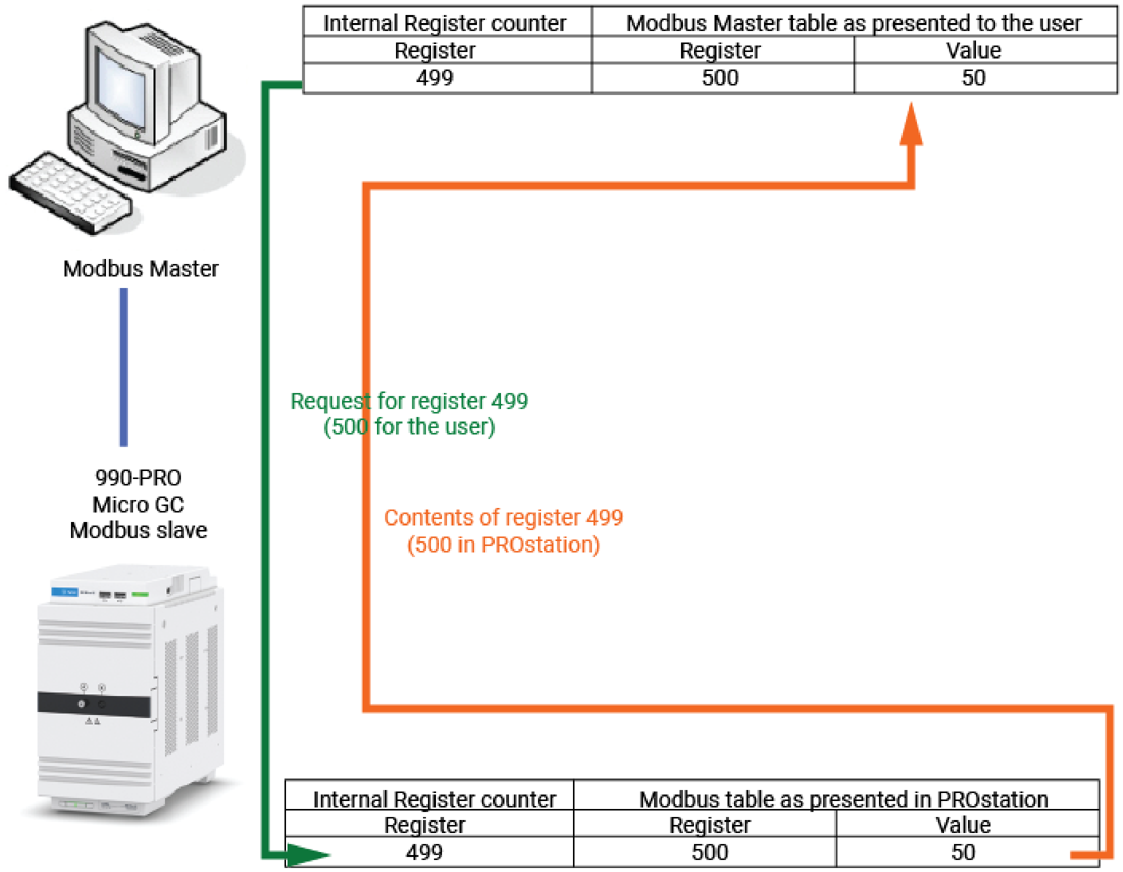
Modbus Elster-Instromet/Daniel/Enron/Omni Int32

Register	Register type	Data type	Parameter ID
7002	Holding register	Float	2232. Application : Comp. ESTD Conc.
7003	Holding register	Float	2237. Application : Comp. Area

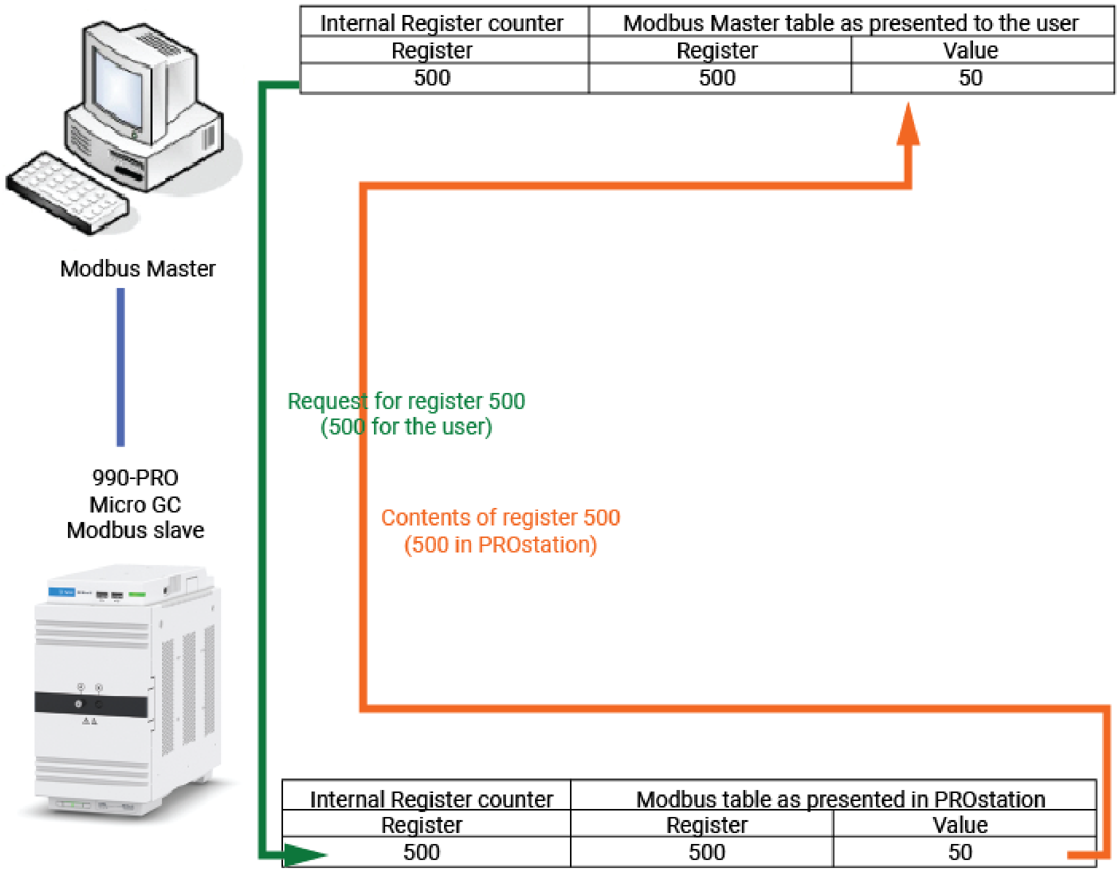
Modbus register address shift

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).

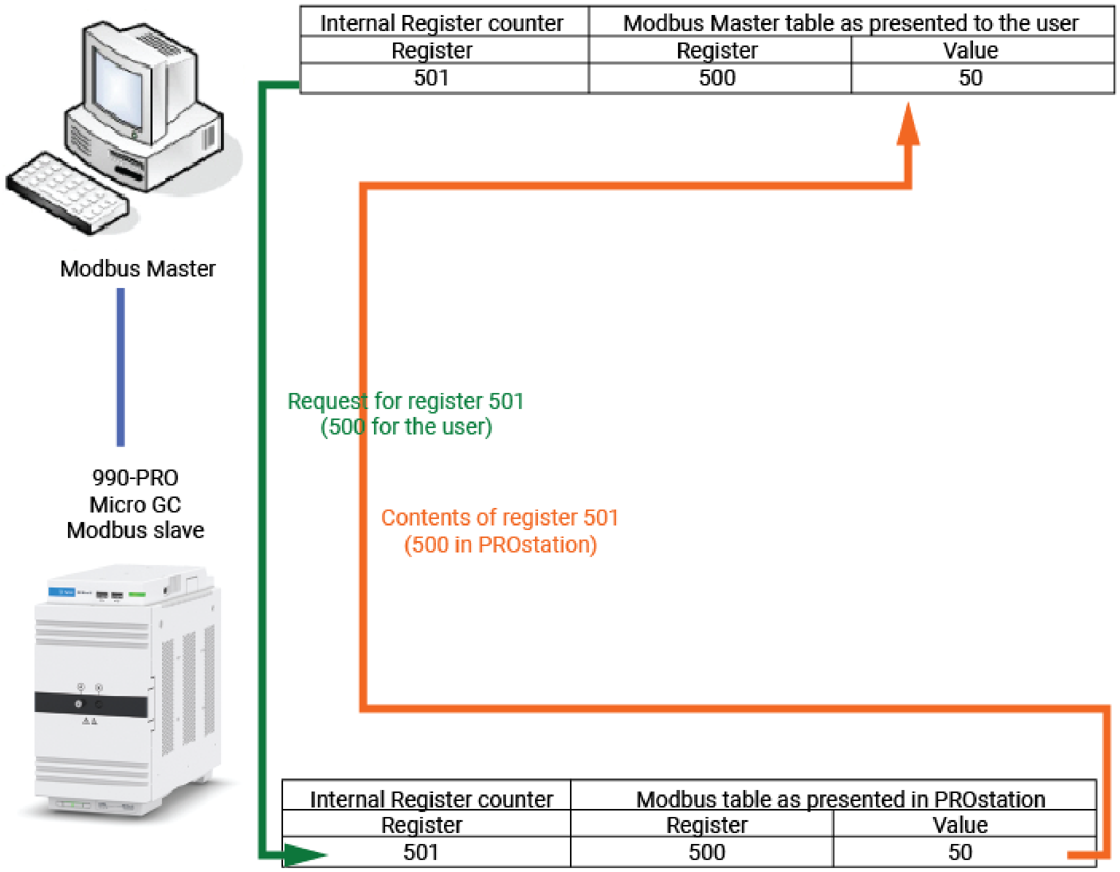
If the Modbus master (flow computer) internally starts counting the Modbus table at 0, the master requests register 499 if register 500 is defined in the Modbus table presented to the user of the Modbus Master. The instrument (Modbus slave) - if address shift configured correctly - returns the content 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.



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.



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.



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)

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.

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

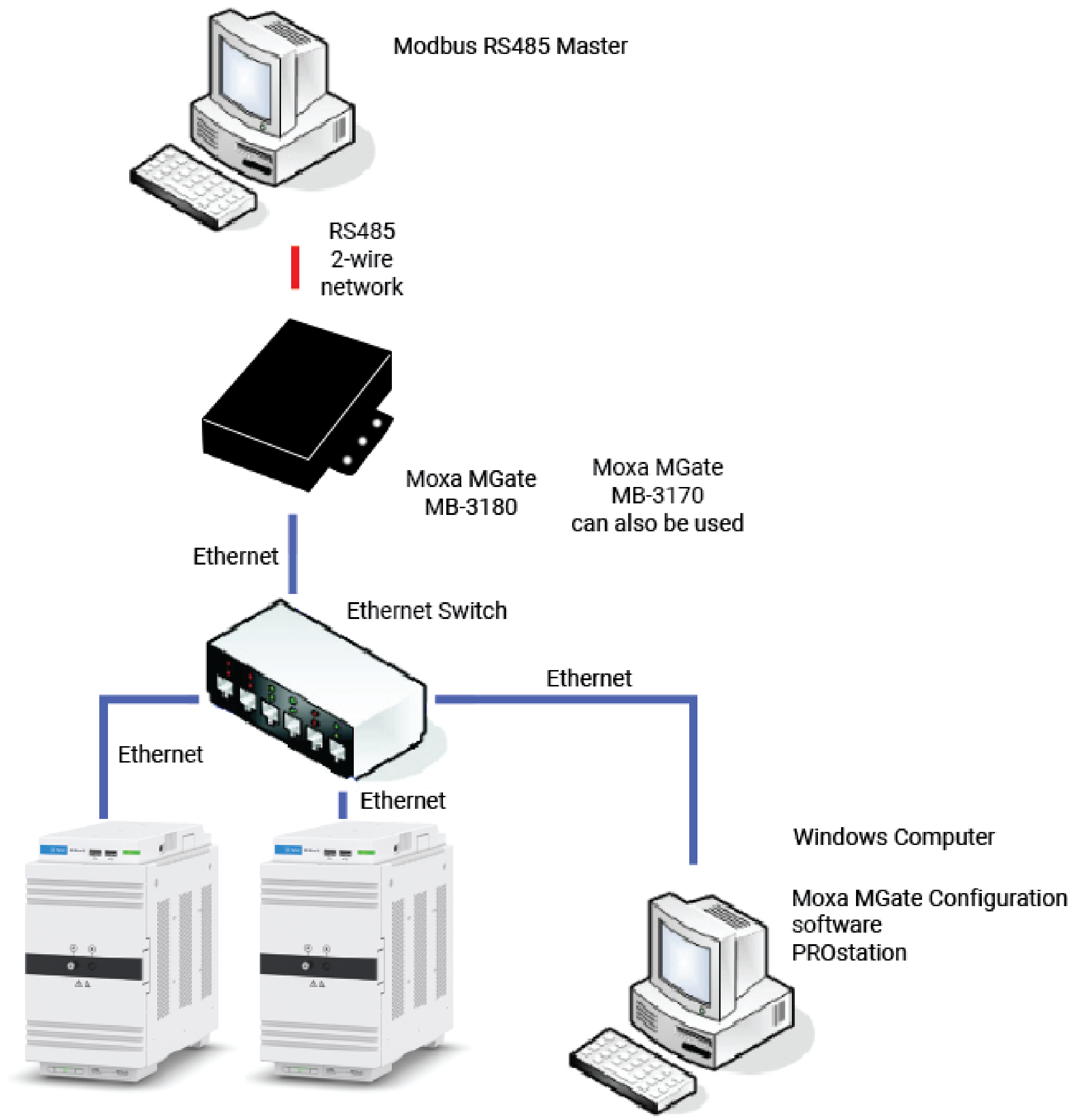
- Modbus RS485 2-wire serial network
- Any Modbus serial network where all serial ports of the instrument are in use
- Modbus RS422 serial network
- Modbus TCP/IP Master for some reason does not communicate with Modbus TCP/IP in the instrument

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.



Two 990-PRO Micro GC (Modbus TCP slaves)

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

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.

In this section

System method and configuration settings

1 Sample Inlet Setpoint (Float, MB)

- Description: Returns/sets the sample inlet 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): Position 1 (value = 1) or Position 2 (value = 2)
- Remarks: Before use, check if the heated sample inlet(s) is(are) installed.
- See also:
  - Sample inlet setpoint method screen
  - Heated sample inlet 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

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

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)
  - 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)
    - Parameter 95. Set Channel to clean, 1=On (Bit, CHAN)

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)
    - Execute command 10. De-energize Relay 1 (Execute Cmd, MB)
    - Execute command 11. Energize Relay 2 (Execute Cmd, MB)
    - Execute command 12. De-energize Relay 2 (Execute Cmd, MB)
    - Execute Command 31. Reset Timed Relays (Execute Cmd, MB)
    - Execute Command 32. Reset Alarm Relays (Execute Cmd, MB)
    - Execute Command 33. Reset Analog Outputs (Execute Cmd, MB)
    - Execute Command 35. Reset All Alarms (Execute Cmd, MB)

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 Inlet Temp. (Float, MB)

- Description: Returns the current temperature of the sample inlet.
- 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): Position 1 (value = 1) or Position 2 (value = 2)

101 Status: Sample Inlet Temp. State (Bit, MB)

- Description: Returns whether or not the heated sample inlet 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): Position 1 (value = 1) or Position 2 (value = 2)

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

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

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

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

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

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

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.
- 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)
  - Parameter 2211. Application: Overall Alarm status (Bit, MB)
  - Parameter 2402. Appl.: Stream Alarm on Index(Bit, CHAN=stream, PEAK=index)

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)
    - Parameter 2211. Application: Overall Alarm status (Bit, MB)
    - Parameter 2402. Appl.: Stream Alarm on Index(Bit, CHAN=stream, PEAK=index)
    - Parameter 2403. Appl.: Stream Overall Alarm Status (Bit, CHAN=stream)

154 GC or Application Errors (Bit, MB)

- Description: Displays whether or not there is a system or application error; combines parameter 152 and 153.
- Return value:
    - 0 = No error or alarm
    - 1 = Error or alarm

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): <ainboard (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: 1 to the maximum stream number
- 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.

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:
    - Instrument Configuration Settings

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).

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 pressure has not reached the channel's setpoint (Not Ready).
    - 1 = The actual column pressure 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)

540 GC Type (Int16, MB)

- Description: Returns the current model number of the instrument.
- Return value: For 990 Micro GC, it returns a fixed integer number 990.
- 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) can be used.
- See also:
  - Parameter 1214. Int.Rep.: Number of Named Peaks(Int16, CHAN)
  - Parameter 1215. Int.Rep.: Number of Unnamed Peaks(Int16, CHAN)
  - Parameter 2216. Application: Total Peaks (Int16, MB)
  - Parameter 2229. Application: Total Unknown peaks. (Int16, MB)

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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) can be used.

- See also
  - Parameter 1202. Int.Rep.: Number of Peaks, Named + Unnamed(Int16, CHAN)
  - Parameter 1215. Int.Rep.: Number of Unnamed Peaks(Int16, CHAN)
  - Parameter 2216. Application: Total Peaks (Int16, MB)
  - Parameter 2229. Application: Total Unknown peaks. (Int16, MB)

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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) can be used.
- See also:
  - Parameter 1202. Int.Rep.: Number of Peaks, Named + Unnamed(Int16, CHAN)
  - Parameter 1215. Int.Rep.: Number of Unnamed Peaks(Int16, CHAN)
  - Parameter 2216. Application: Total Peaks (Int16, MB)
  - Parameter 2229. Application: Total Unknown peaks. (Int16, MB)

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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),

2201. Sync: Data available with reset(Bit, MB), or
2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) can be used.

1383 Int.Rep.Named: Asym Named Peak (Float, CHAN, MetPEAK)

- Description: Returns the asym number 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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). 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) 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) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) 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),
2201. Sync: Data available with reset(Bit, MB), or
2238. Sync: Data available2 with reset(Bit, MB) 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),
  2201. Sync: Data available with reset(Bit, MB), or
  2238. Sync: Data available2 with reset(Bit, MB) can be used.
- See also:
  - Parameter 2212. Application: Alarm status On Index (Bit, MB, PEAK=Index)
  - Parameter 152. Status: Instrument Error Status(Bit, MB)
  - Parameter 2402. Appl.: Stream Alarm on Index(Bit, CHAN=stream, PEAK=index)
  - Parameter 2403. Appl.: Stream Overall Alarm Status (Bit, CHAN=stream)

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),
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)
  - Parameter 152. Status: Instrument Error Status(Bit, MB)
  - Parameter 2402. Appl.: Stream Alarm on Index(Bit, CHAN=stream, PEAK=index)
  - Parameter 2403. Appl.: Stream Overall Alarm Status (Bit, CHAN=stream)

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)
  - Parameter 152. Status: Instrument Error Status(Bit, MB)
  - Parameter 2402. Appl.: Stream Alarm on Index(Bit, CHAN=stream, PEAK=index)
  - Parameter 2403. Appl.: Stream Overall Alarm Status (Bit, CHAN=stream)

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 tne 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)

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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: Weight Percentage [%] #norm-peak (Float, MB)

- Displays the Weight Percentage [%] #norm-peak from the last run calculated according to selected standard.

2313 Application: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: ISO/GOST 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 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: 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, 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: 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, 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: 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, 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: 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, 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.

2333 Application: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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: 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, 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)
  - Parameter 2211. Application: Overall Alarm status (Bit, MB)
  - Parameter 2212. Application: Alarm status On Index (Bit, MB, PEAK=Index)
  - Parameter 152. Status: Instrument Error Status(Bit, MB)

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)
  - Parameter 2211. Application: Overall Alarm status (Bit, MB)
  - Parameter 2212. Application: Alarm status On Index (Bit, MB, PEAK=Index)
  - Parameter 152. Status: Instrument Error Status(Bit, MB)

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.

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.

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.

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.

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 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, 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 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, 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 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, 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 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, 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 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, 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.

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.

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.

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.

2427. Appl.: Stream 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, 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.

2429. Appl.: Stream 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, 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.

2428. Appl.: Stream 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, 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.

2480. Appl.: Stream 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, 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.

2424. Appl.: Stream 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, 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.:Steam 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, 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 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, 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.

2445. Appl.: Stream 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, 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.

2449. Appl.: Stream 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, 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.

2476. Appl.: Stream 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, 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 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, 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.

2450. Appl.: Stream 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, 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 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, 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 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, 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.

2442. Appl.: Stream 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, 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.

2448. Appl.: Stream 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, 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.

2434. Appl.: Stream 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, 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 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, 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.

2440. Appl.: Stream 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, 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 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, 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.

2432. Appl.: Stream 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, 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 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, 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.

2438. Appl.: Stream 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, 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 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, 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.

2430. Appl.: Stream 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, 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 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, 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.

2436. Appl.: Stream 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, 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 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, 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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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

API chapter 21 describes minimum specifications in the measurement and recording of flow parameters by electronic measurement systems as defined by the American Petroleum Institute.

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 the table below.

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.

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 the table below.

Description	API21-ParamID	Data type
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)
  - Parameter 24. Start Calibration Table (Execute Cmd, MB)
  - Parameter 25. Start Verification Table (Execute Cmd, MB)
  - Parameter 17. Stop Automation (Execute Cmd, MB)

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)

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)
    - Execute command 10. De-energize Relay 1 (Execute Cmd, MB)
    - Execute command 11. Energize Relay 2 (Execute Cmd, MB)

  - Execute Command [12. De-energize Relay 2 (Execute Cmd, MB)]
  - Execute Command [31. Reset Timed Relays (Execute Cmd, MB)]
  - Execute Command [32. Reset Alarm Relays (Execute Cmd, MB)]
  - Execute Command [33. Reset Analog Outputs (Execute Cmd, MB)]

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 267
  - Execute command 9. Energize Relay 1 (Execute Cmd, MB) on page 406
  - Execute command 10. De-energize Relay 1 (Execute Cmd, MB) on page 407
  - Execute Command 12. De-energize Relay 2 (Execute Cmd, MB) on page 408

- Execute Command 31. Reset Timed Relays (Execute Cmd, MB) on page 412
- Execute Command 32. Reset Alarm Relays (Execute Cmd, MB) on page 413
- Execute Command 33. Reset Analog Outputs (Execute Cmd, MB) on page 413
- Execute Command 35. Reset All Alarms (Execute Cmd, MB) on page 414

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 267
  - Execute command 9. Energize Relay 1 (Execute Cmd, MB) on page 406
  - Execute command 10. De-energize Relay 1 (Execute Cmd, MB) on page 407
  - Execute command 11. Energize Relay 2 (Execute Cmd, MB) on page 407
  - Execute Command 31. Reset Timed Relays (Execute Cmd, MB) on page 412
  - Execute Command 32. Reset Alarm Relays (Execute Cmd, MB) on page 413
  - Execute Command 33. Reset Analog Outputs (Execute Cmd, MB) on page 413
  - Execute Command 35. Reset All Alarms (Execute Cmd, MB) on page 414

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 410
  - Parameter 25. Start Verification Table (Execute Cmd, MB) on page 411
  - Parameter 17. Stop Automation (Execute Cmd, MB) on page 410

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 410
  - Parameter 24. Start Calibration Table (Execute Cmd, MB) on page 410
  - Parameter 25. Start Verification Table (Execute Cmd, MB) on page 411

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 410
  - Parameter 17. Stop Automation (Execute Cmd, MB) on page 410

    - Parameter 24. Start Calibration Table (Execute Cmd, MB) on page 410

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 267
    - Execute command 9. Energize Relay 1 (Execute Cmd, MB) on page 406
    - Execute command 10. De-energize Relay 1 (Execute Cmd, MB) on page 407
    - Execute command 11. Energize Relay 2 (Execute Cmd, MB) on page 407
    - Execute command 12. De-energize Relay 2 (Execute Cmd, MB) on page 408
    - Execute Command 32. Reset Alarm Relays (Execute Cmd, MB) on page 413
    - Execute Command 33. Reset Analog Outputs (Execute Cmd, MB) on page 413

- Execute Command 35. Reset All Alarms (Execute Cmd, MB) on page 414

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 267
  - Execute command 9. Energize Relay 1 (Execute Cmd, MB) on page 406
  - Execute command 10. De-energize Relay 1 (Execute Cmd, MB) on page 407
  - Execute command 11. Energize Relay 2 (Execute Cmd, MB) on page 407
  - Execute command 12. De-energize Relay 2 (Execute Cmd, MB) on page 408
  - Execute Command 31. Reset Timed Relays (Execute Cmd, MB) on page 412
  - Execute Command 33. Reset Analog Outputs (Execute Cmd, MB) on page 413
  - Execute Command 35. Reset All Alarms (Execute Cmd, MB) on page 414

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 267
  - Execute command 9. Energize Relay 1 (Execute Cmd, MB) on page 406
  - Execute command 10. De-energize Relay 1 (Execute Cmd, MB) on page 407
  - Execute command 11. Energize Relay 2 (Execute Cmd, MB) on page 407
  - Execute command 12. De-energize Relay 2 (Execute Cmd, MB) on page 408
  - Execute Command 31. Reset Timed Relays (Execute Cmd, MB) on page 412
  - Execute Command 32. Reset Alarm Relays (Execute Cmd, MB) on page 413
  - Execute Command 35. Reset All Alarms (Execute Cmd, MB) on page 414

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 267
  - Execute command 9. Energize Relay 1 (Execute Cmd, MB) on page 406
  - Execute command 10. De-energize Relay 1 (Execute Cmd, MB) on page 407

- Execute command 11. Energize Relay 2 (Execute Cmd, MB) on page 407
- Execute command 12. De-energize Relay 2 (Execute Cmd, MB) on page 408
- Execute Command 31. Reset Timed Relays (Execute Cmd, MB) on page 412
- Execute Command 32. Reset Alarm Relays (Execute Cmd, MB) on page 413
- Execute Command 33. Reset Analog Outputs (Execute Cmd, MB) on page 413

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.

10 Maintenance Tab

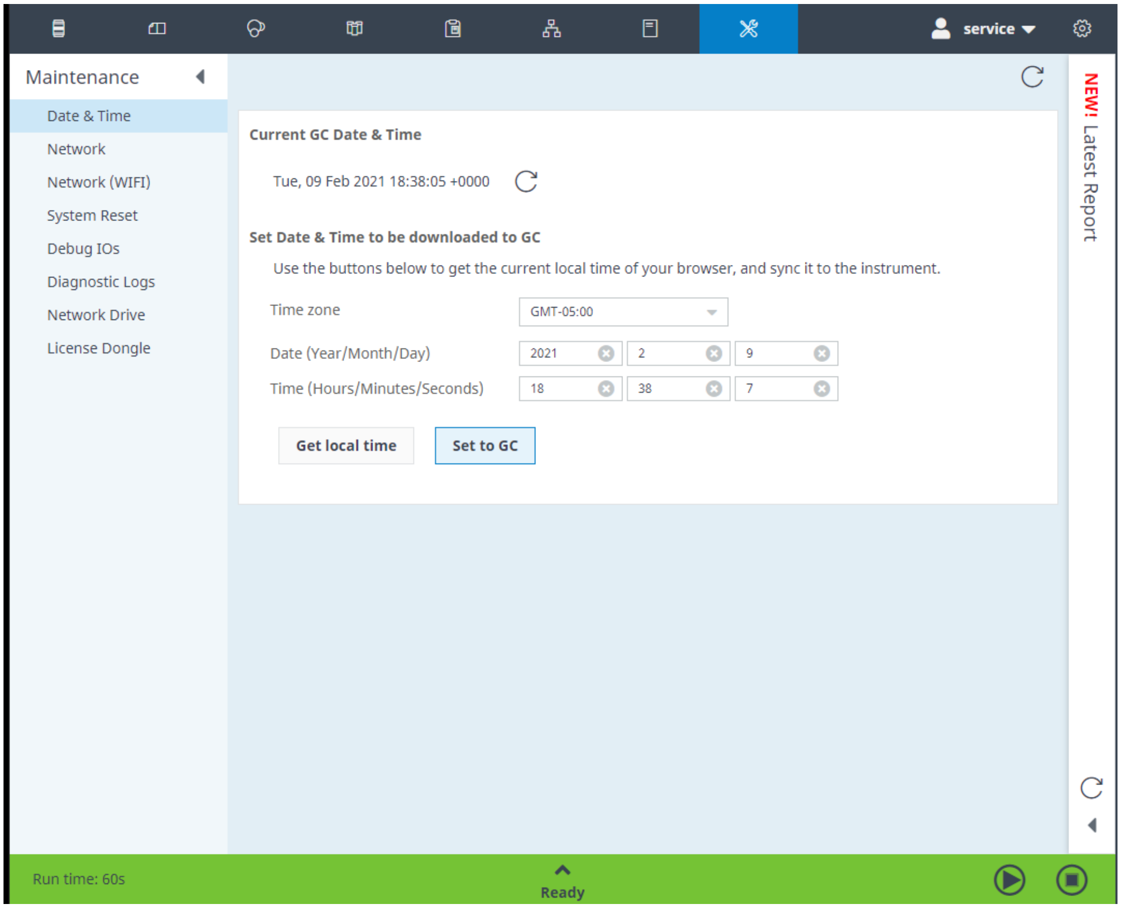
Maintenance tab

Select the Maintenance tab to view and modify system settings such as Date and Time, Network configuration, I/O tests, and Networks and Licenses.

In this section

Date & Time

Current Date and time is shown based on PC settings. Set the date and time to be downloaded to the GC. Select **Get local time** to copy the current date and time into the settings, or manually set the time using the provided fields. When finished, select **Set to GC** to set the GC time.

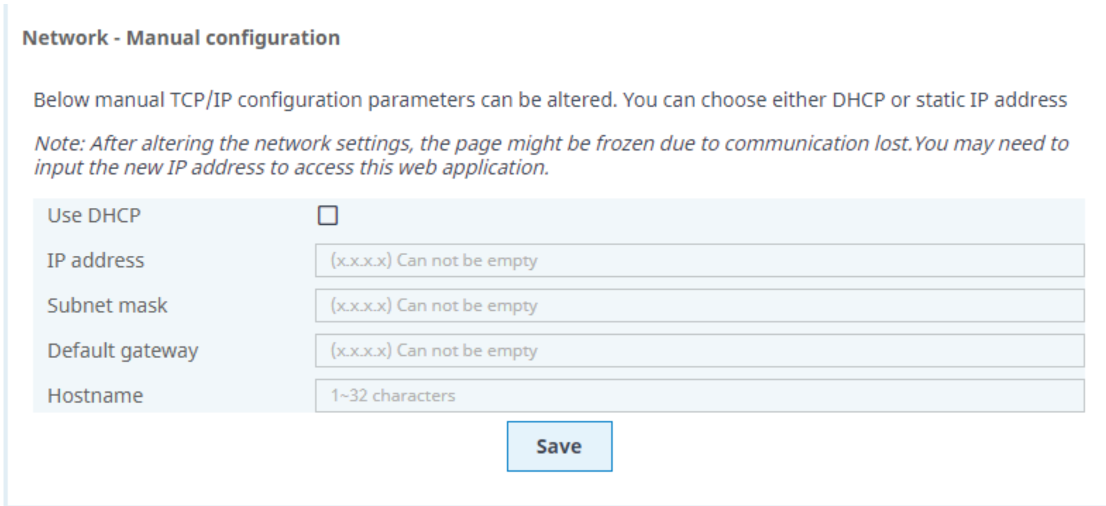


Network

View and configure IP and WIFI network configuration.

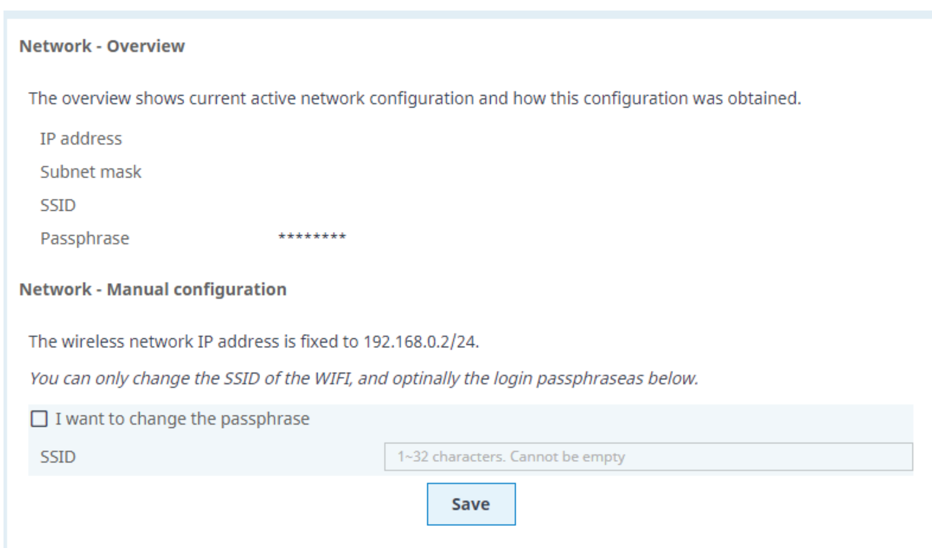
Manual configuration

From the **Maintenance** tab, select **Network** to view the current active network and configure network settings.



WIFI

Select **Network (WIFI)** form the **Maintenance** tab to view Wi-Fi network settings. You can edit the SSID of the WIFI and change passphrase.



Network mapping

You create a network drive mapped to the GC on-board/USB mass storage device.

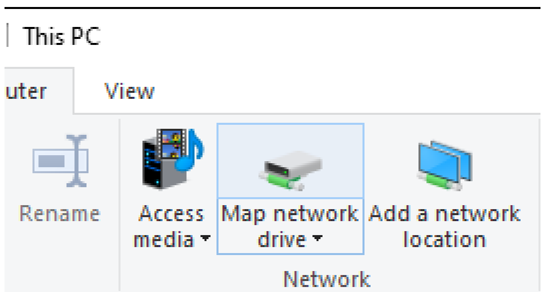
With the network drive, you can easily access user files on the instrument for backup purposes.

Note that mapped network drives are read-only.

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 Follow the prompt to map the network drive..

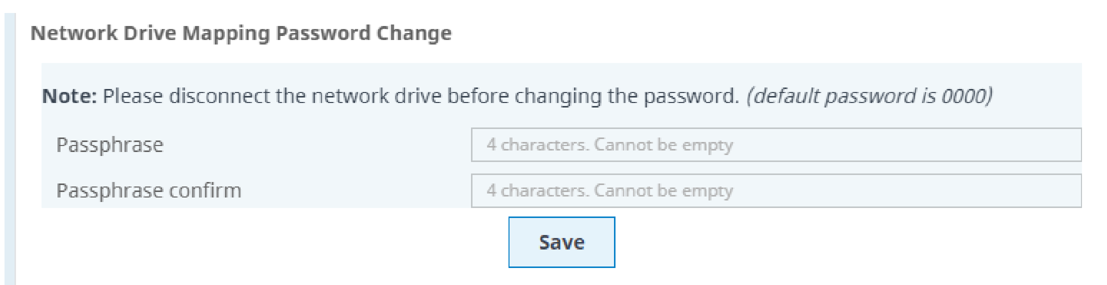
4 In the **Folder** box, type the path to the target GC. The format is *gcIPAddr**media*. *gcIPAddr* is the GC IP address, and media is the share folder name.

5 Check **Connect using different credentials**.

6 Then click **Finish**.

Network drive mapping password change

You can change the password used to access the network drive in the password change section of **Network Drive**.



Debug I/O

I/O debug functions are accessed from the **Maintenance** tab under **Debug IOs**.

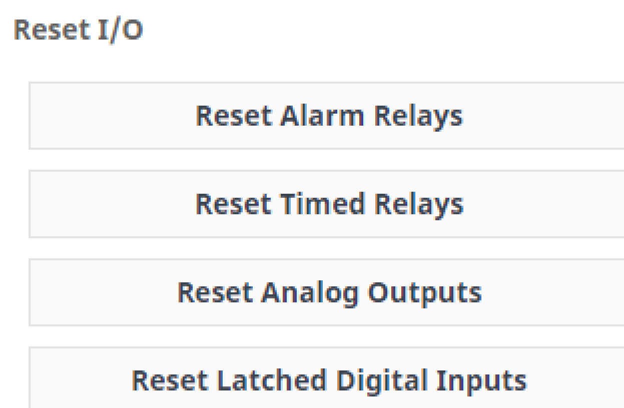
Manual Stream Select

Manually select a stream position from the dropdown and click OK.

Reset I/O

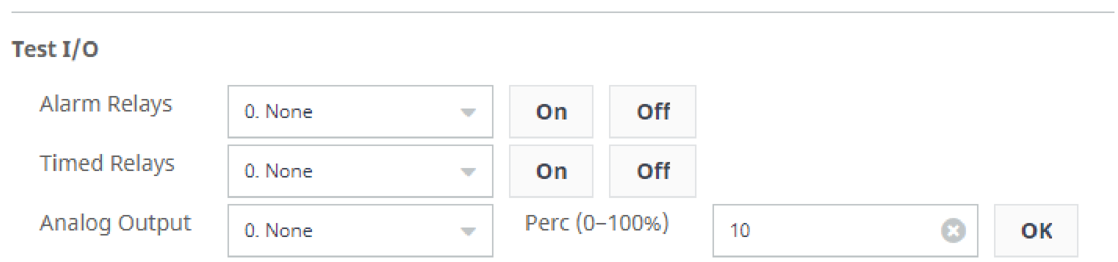
From the Maintenance tab, select Debug IOs and scroll to **Reset I/O**.

Select the type of I/O which should be reset and click **OK** to request the instrument to execute the selected options.



Test I/O

From the Maintenance tab, select Debug IOs and scroll to **Test 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**.

Digital Inputs

Check Digital input states from this panel.

Diagnostic Logs

Log files are stored on the instrument. To preview log files, from the **Maintenance** tab, select **Diagnostic logs.**

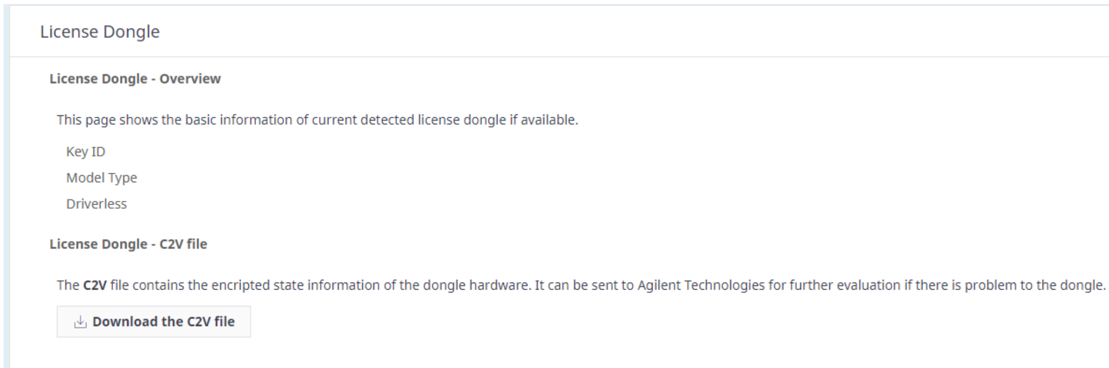
The System Log, Run Log, Firmware Log, and EMF Log are available to preview. To view the entire content of the log files, click **Download the diagnostic package**.

Clear error log

From the **Maintenance** tab, select **Diagnostic logs** and then **Clear Logs!** You must be logged in as an administrator.

Licenses

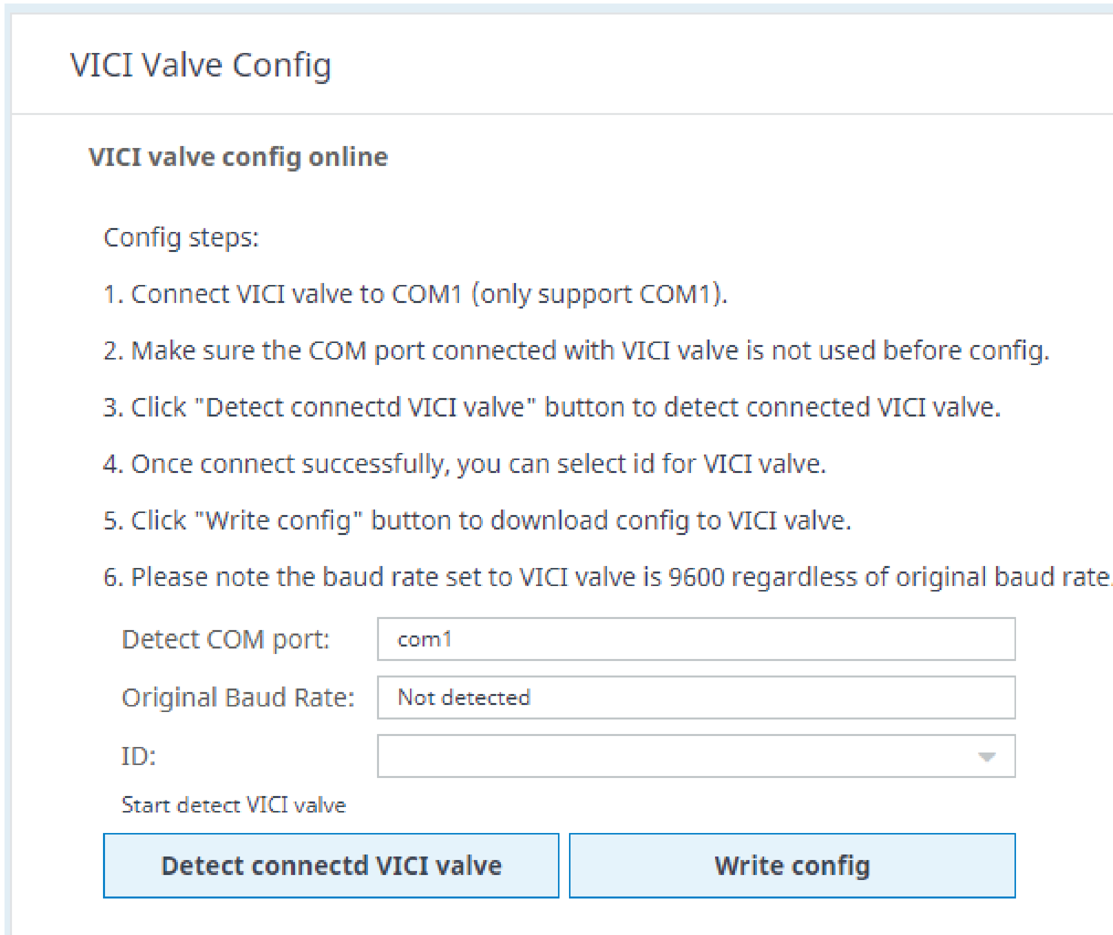
View information on the detected license dongle if installed. You can download the C2V file to send to Agilent in the case that license problems arise.



VICI Valve Configuration

Download the VICI Valve configuration tool.

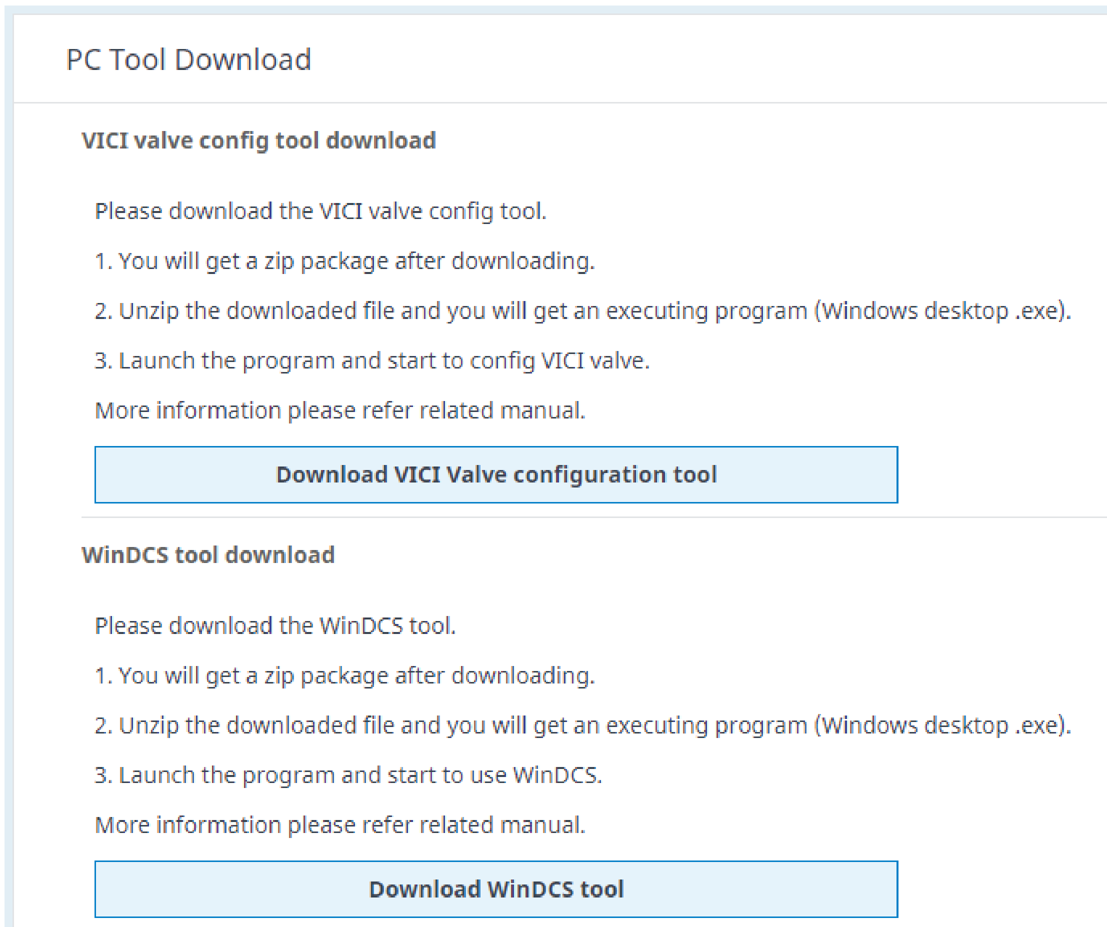
Configure from this section of the Maintenance Tab.



PC Tool Download

Download PC tools from the **Maintenance** tab. Available tools are the VICI valve config tool and WinDCS tool.

Follow the steps for each download below.



Reboot Instrument (System reset)

From the Maintenance tab, select **System Reset**.

Select **Warm Reset** or **Reset to Recovery Mode**. Recovery mode is used for firmware updates and other maintenance

11 History Log Tab

History Log Tab

The Hisotry Log feature requires a PRO or Express license to be active.

History Log was originally a PC software feature that retrieved history data results saved inside Micro GC instrument, and reformatted and organized the data into an HTML text report. With the PC software, report content had limited customization capabilities and range of data could be filtered.

History Log is now redesigned, inheriting the features from the legacy PC software, while expanding use of more graphical features in Trend Analysis.

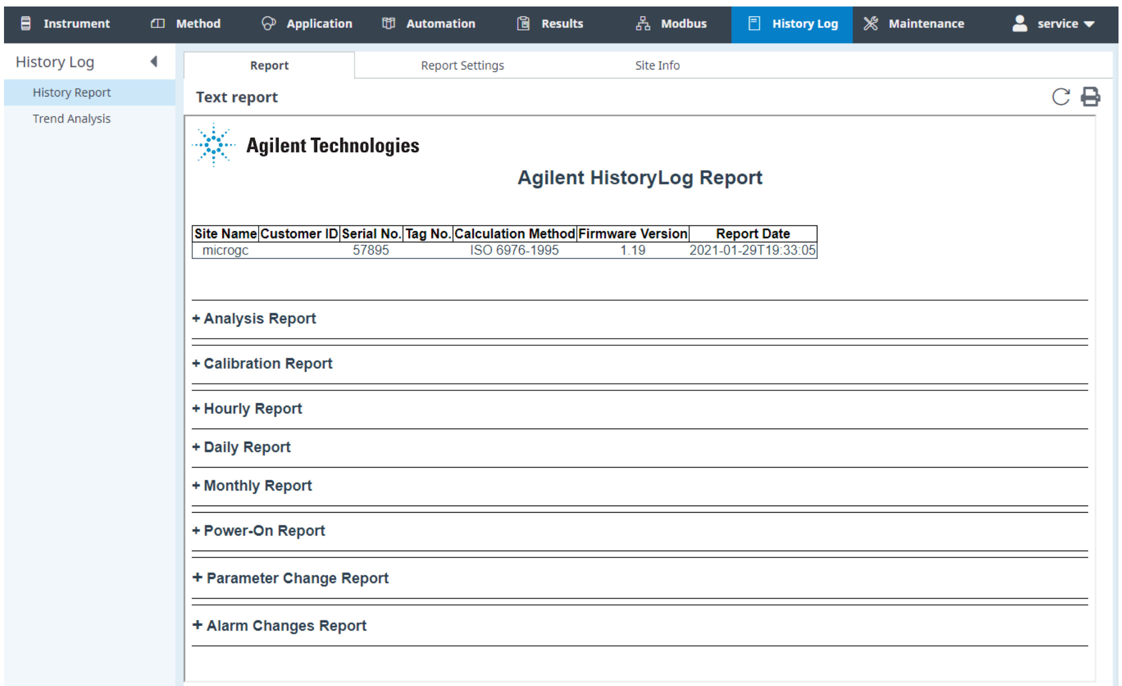
The History Log tab is divided into the subcategories **History Report** and **Trend Analysis**. Check each subsection for details.

In this section

History Report

History Report

Micro GC PRO/Express has the capability to run autonomously and record a maximum of 35 days of data information captured by the instrument. The **History Log** report summarizes all data information and presents it in HTML format. Information such as analysis data, calibration data, parameter change data, and alarm change data are included. See the example below.



In this section

View Report

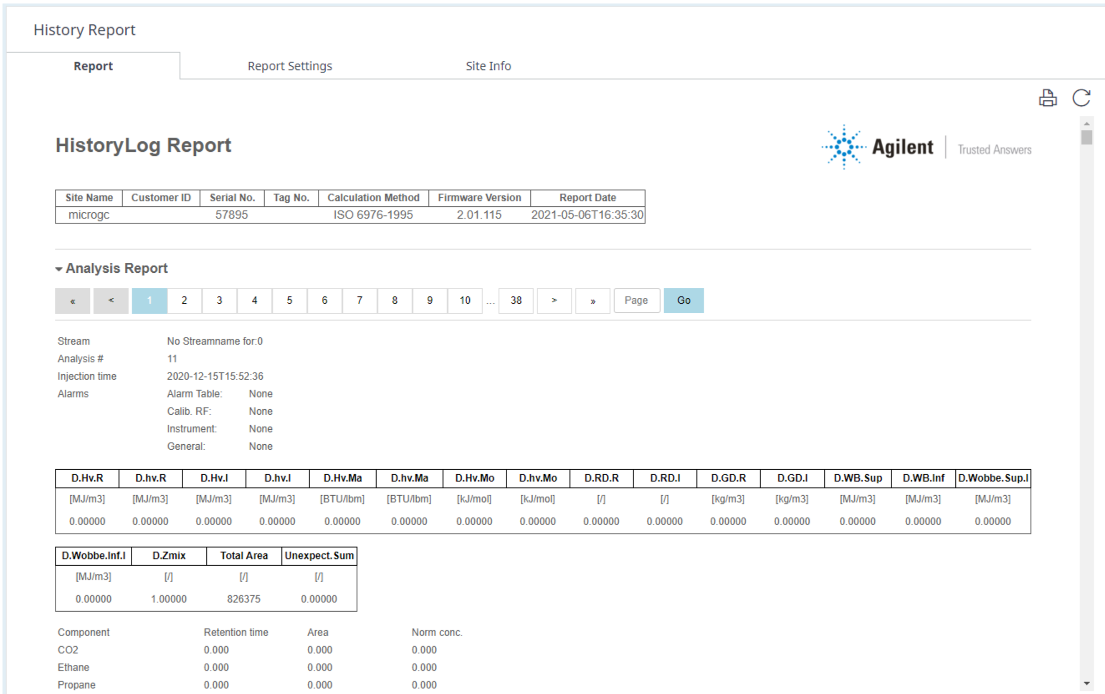
Report Data and Settings

Site info

View Report

In the History Log **Report** tab, you can review, print, and update the report based on report settings. Each section of the report can be filtered.

When viewing a report, expand a report section by selecting the report category. In the example below, Analysis report is expanded for viewing.

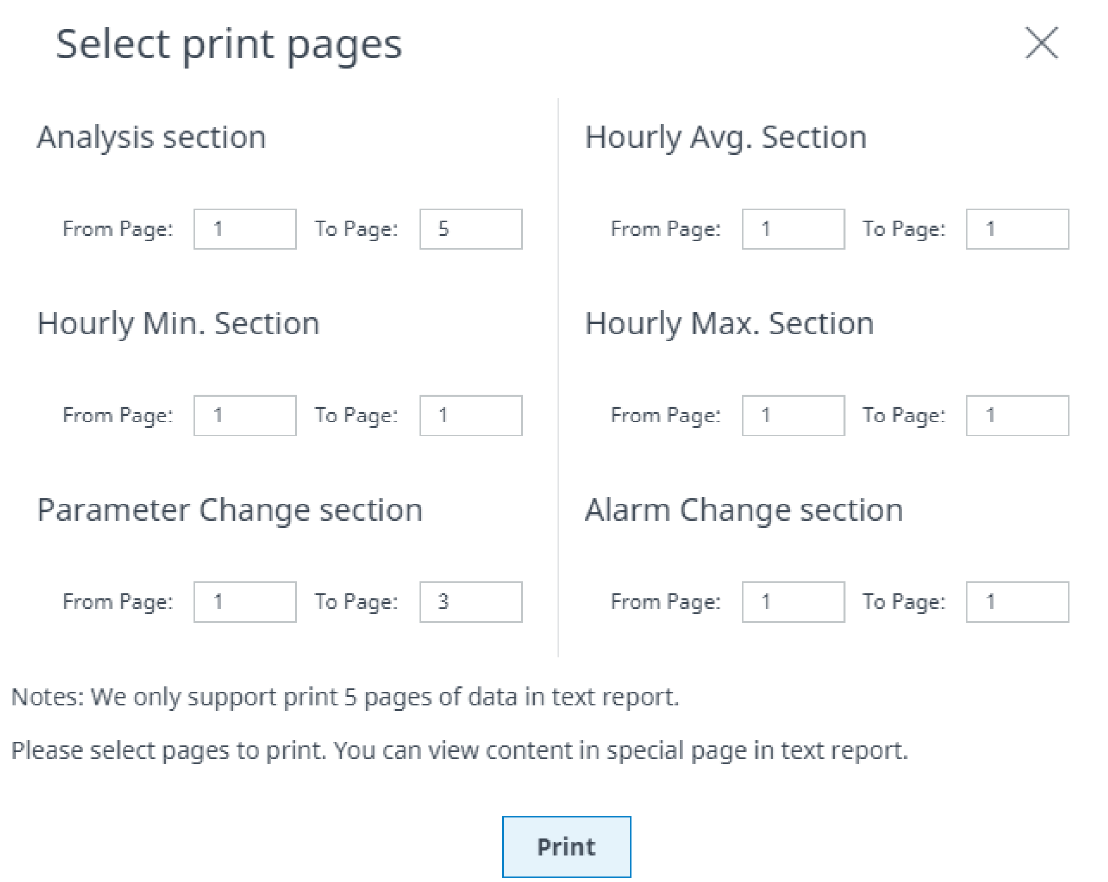


For multiple analyses, select the page to view from the number line.

Print Report

To print the report, select the print icon. A pop-up box appears as shown.

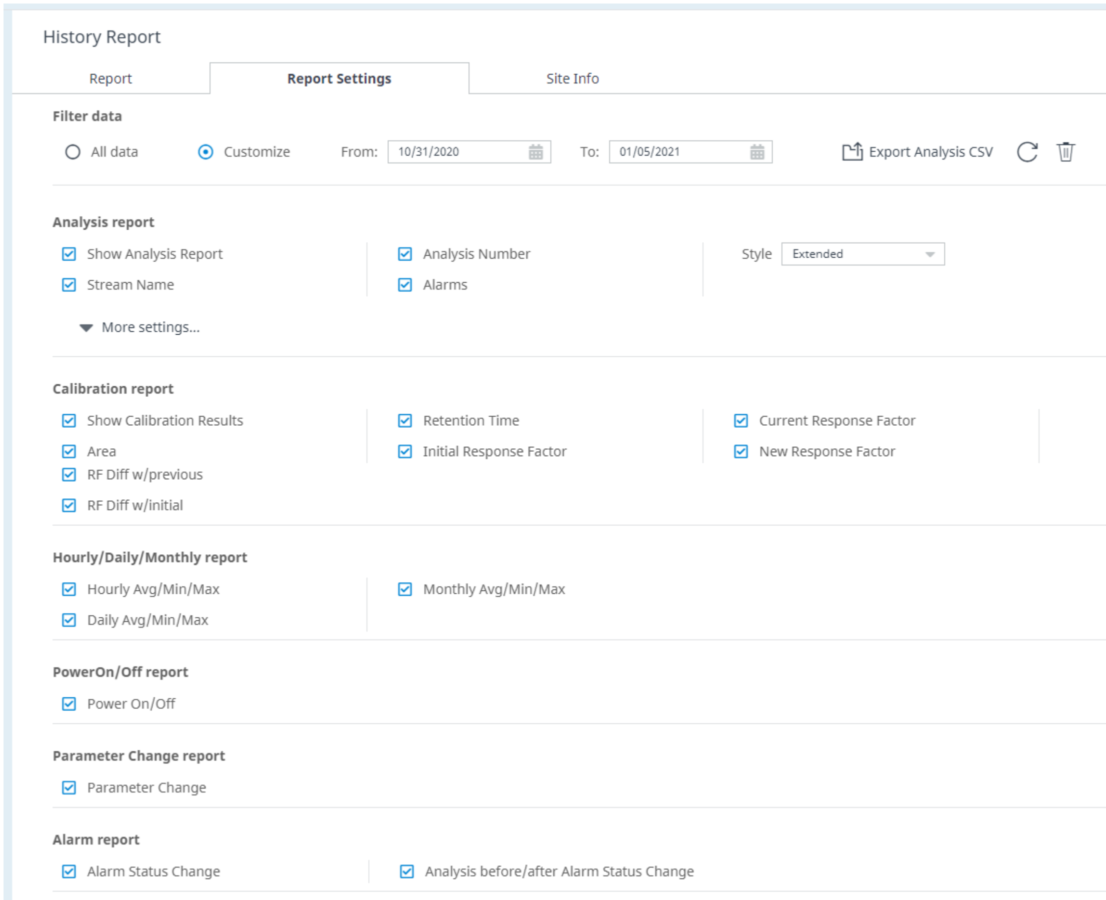
Enter report print settings. Each section can be filtered for the desired range of information.



Once you have entered your settings, select the print icon to Print. A print dialog secific to your PC will open. Confirm your printer settings and print the report. If your PC allows, you can print the report to a file using that method.

Report Data and Settings

History Log report data consists of the sections described below. The report content can be customized by changing the report settings. Below is an overview of the Report Settings tab. Changes made to configuration in Report Settings are automatically saved.



Filter Data (Report interval)

To filter the data to be included in your reports by date range, select **Customize** and enter a date range. If **All data** is selected, the data between the date and time of download (start) and 35 days before (end)data from all dates available will be included.

Export Analysis CSV

Clicking this button downloads the history data based on the time range selected, and the customization set in analysis report. The report is then exported in csv format.

Report Body

Select desired options for each report section;

- Analysis report
- Calibration report
- Hourly/ Daily/ Monthly report

- Power on/off report
- Parameter change report
- Alarm report

Header

Report header is always displayed, content such as **Site Name**, **Customer ID**, etc are configured from the **Site Info** tab.

Site Name	Customer ID	Serial No.	Tag No.	Calculation Method	Firmware Version	Report Date
microgc	dddc	57895	adb	ISO 6976-2016	2.01.114	2021-04-26T08:30:51

Analysis report

Analysis report is displayed by default, and can be toggled on/off from the report settings tab. When Analysis report is selected, the data can be displayed in either concentrated or extended form. In the concentrated view, all data is placed on one line. In the extended view, data is shown under separate headings, aiding in the review of the analysis. There are circumstances under which the concentrated report may be preferred.

In **Report Settings**, all options for general and component data for the analysis can be toggled on/off. All contents are displayed by default.

Analysis Report

« < 1 2 3 4 5 6 7 8 9 10 ... 60 > » Page Go

Stream	2221	
Analysis #	4	
Injection time	2020-12-11T23:20:07	
Alarms	Alarm Table:	(1). ------ ((Nr) = Alarmtable line number)
	Calib. RF:	None
	Instrument:	None
	General:	Power-On buf

D.Hv.R	D.hv.R	D.Hv.I	D.hv.I	D.Hv.Ma	D.hv.Ma	D.Hv.Mo	D.hv.Mo	D.RD.R	D.RD.I	D.GD.R	D.GD.I	D.WB.Sup	D.WB.Inf	D.Wobbe.Sup.I
[MJ/m3]	[MJ/m3]	[MJ/m3]	[MJ/m3]	[BTU/lbm]	[BTU/lbm]	[kJ/mol]	[kJ/mol]	[/]	[/]	[kg/m3]	[kg/m3]	[MJ/m3]	[MJ/m3]	[MJ/m3]
39.9359	35.9042	39.8400	35.8180	0.00000	0.00000	0.00000	0.00000	0.554927	0.553921	0.717478	0.715755	53.6100	48.1978	0.00000

D.Wobbe.Inf.I	D.Zmix	S.Hv.R	S.hv.R	S.Hv.I	S.hv.I	S.Hv.Ma	S.hv.Ma	S.Hv.Mo	S.hv.Mo	S.RD.R	S.RD.I	S.GD.R	S.GD.I	S.WB.Sup
[MJ/m3]	[/]	[MJ/m3]	[MJ/m3]	[MJ/m3]	[MJ/m3]	[BTU/lbm]	[BTU/lbm]	[kJ/mol]	[kJ/mol]	[/]	[/]	[kg/m3]	[kg/m3]	[MJ/m3]
0.00000	0.997599	39.0334	35.0929	38.9197	34.9906	0.00000	0.00000	0.00000	0.00000	0.556789	0.555494	0.719885	0.717788	52.3108

S.WB.Inf	S.Wobbe.Sup.I	S.Wobbe.Inf.I	S.Zmix	Total Area	Unexpect.Sum
[MJ/m3]	[MJ/m3]	[MJ/m3]	[/]	[/]	[/]
47.0298	0.00000	0.00000	0.997086	780906	21.0325

Component	Retention time	Area	Norm conc.
N2	0.000	0.000	0.000
Methane	25.80	7.786e+5	100.0
CO2	0.000	0.000	0.000
Ethane	0.000	0.000	0.000
Propane	0.000	0.000	0.000

Calibration report

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.

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

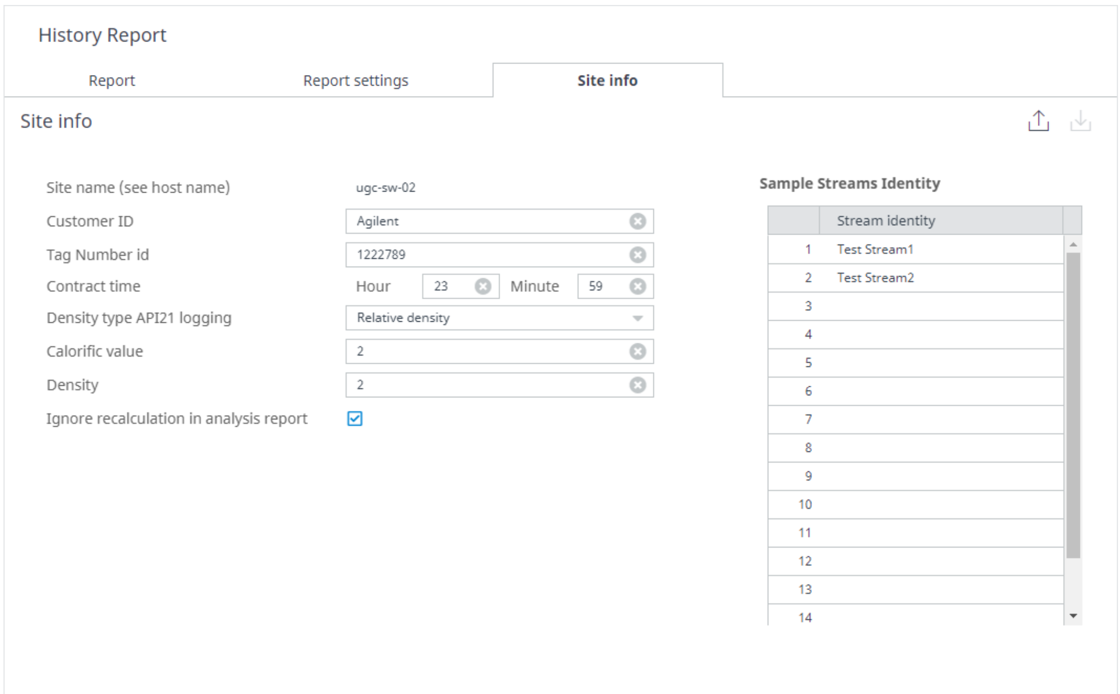
The option Alarm Status Change displays the status when an alarm occurs or is cleared. When the option Analysis before/after Alarm Status Change is checked the analysis is displayed before and after an alarm change. With this option it may be possible to see why an alarm is set or reset.

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.

Site info

From History Log tab, in **History Report**, select **Site Info**. Site info provides fields to customize the header information for History Report, such as Customer ID and Stream Identity, etc.



Trend Analysis

Trend Analysis

Trend Analysis is a feature that presents component concentration, area, retention time data, and energy meter data as a graph. The data used by trend analysis is the same used by **History Report**.

You can zoom in/out on each plot to check the data trend. A small toolbar on each plot helps to **Reset Zoom,** configure the data range, or view in **Maximize** Mode.

In this section

[Component trend](#)

[Energy Meter trend](#)

[Trend Analysis settings](#)

Component Trend

Filter the data included in Component trend graphs using the **Filter Data** options. To refresh the graphs, select the refresh icon.

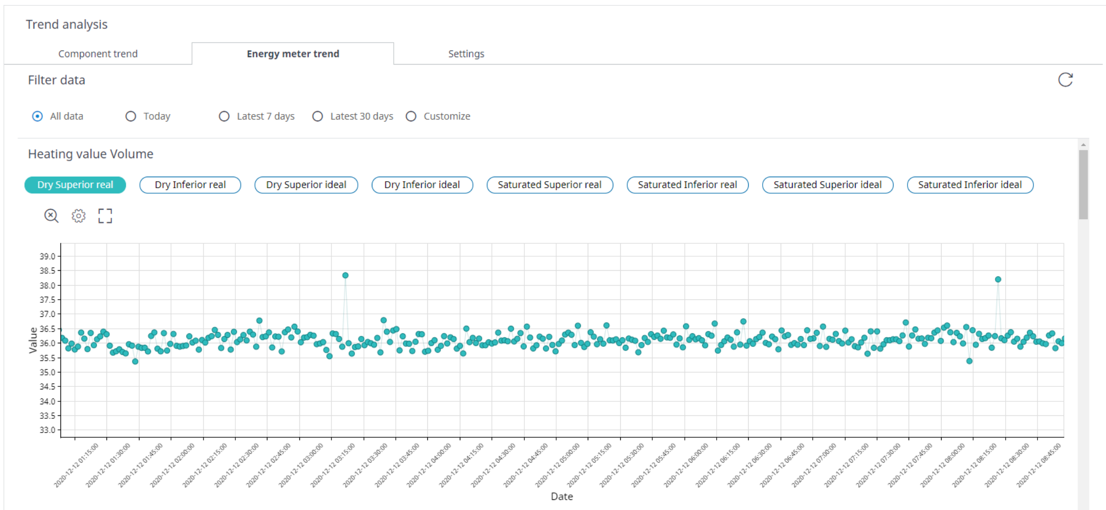
To select which components are included in your graphs, select [Settings](#).

Energy meter trend

Energy meter trend is organized by parameter type. Each group contains different parameters.

Filter the data included in **Energy meter trend** graphs using the Filter Data options. To refresh the graphs, select the refresh icon.

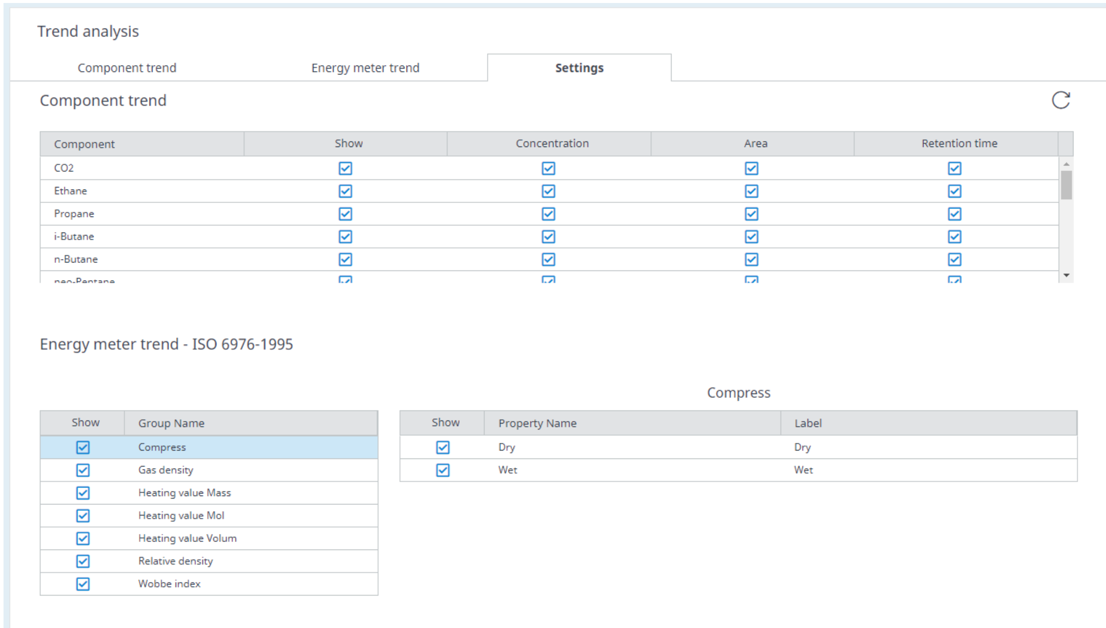
To select which parameters are included in your graphs, select Settings.



Filter data by time. Scroll to view Energy meter trend data categories. Drag over a graph region to zoom.

Trend Analysis settings

Select which components are included in trend graphs.



12 Miscellaneous

Install the GC Emulator

The 990 Micro GC Emulator is essentially a virtual machine that simulates the behavior of a 990 Micro GC. It provides almost the same features as a real 990 Micro GC instrument. It will be very helpful when you need to recalculate some data but have no instrument available.

The emulator is provided on demand. Contact an Agilent representative to request an emulator.

The emulator functions as read-only, and therefore does not support saving new files. Also note that the emulator does not provide features which require hardware connection such as Modbus, VICI and Extensions.

Overview of emulator installation

1. Download a virtualization application such as VirtualBox (www.virtualbox.org) and follow the instructions for installation on the PC you would like to use.
2. Load the GC emulator into the virtualization software.
3. Set up networking and other virtual instrument properties specific to your installation.
4. Launch the GC emulator and connect using a web browser.

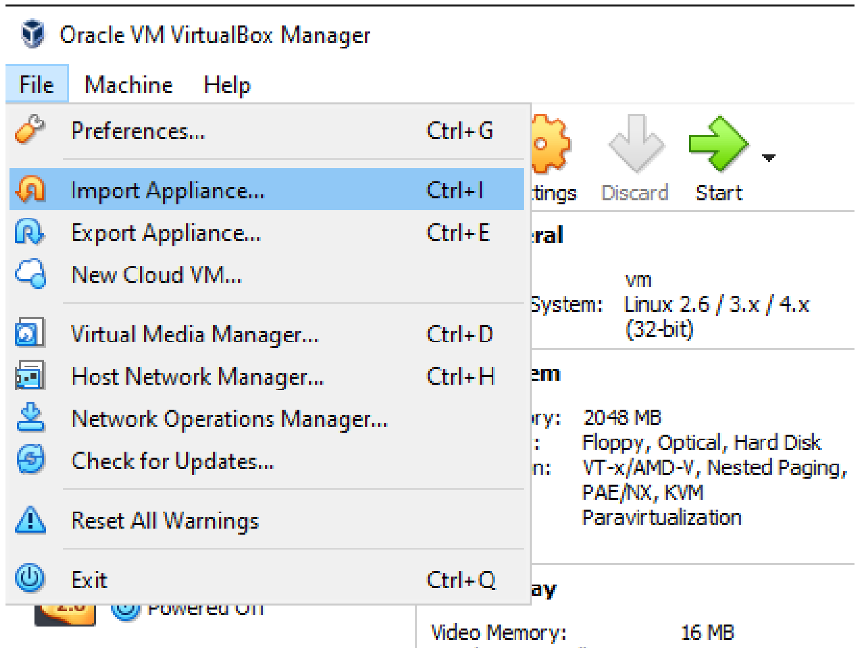
Download virtualization software (VirtualBox)

From a web browser, navigate to www.virtualbox.org and follow the steps to download and install the latest release of VirtualBox for your PC.

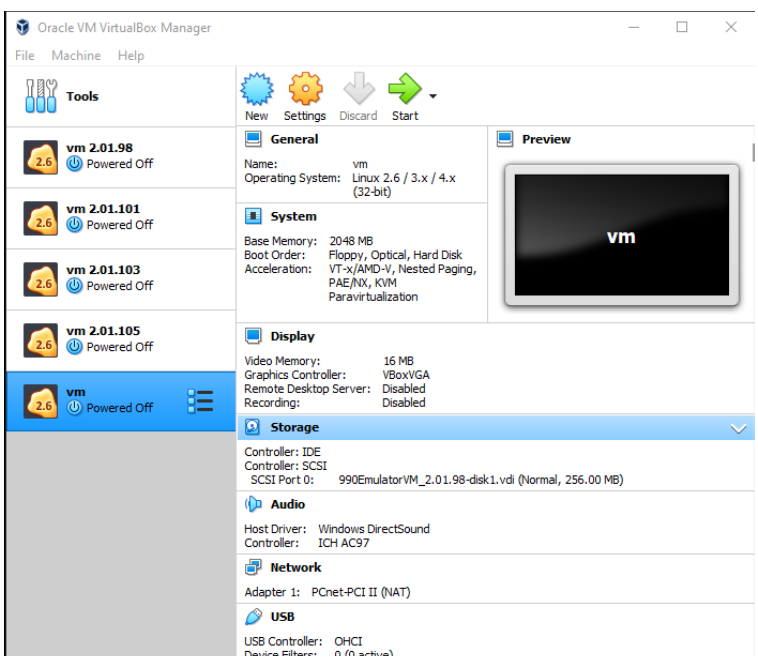
Import and configure the GC Emulator virtual machine

The GC Emulator file provided by Agilent is an OVF (Open Virtualization Format) virtual machine.

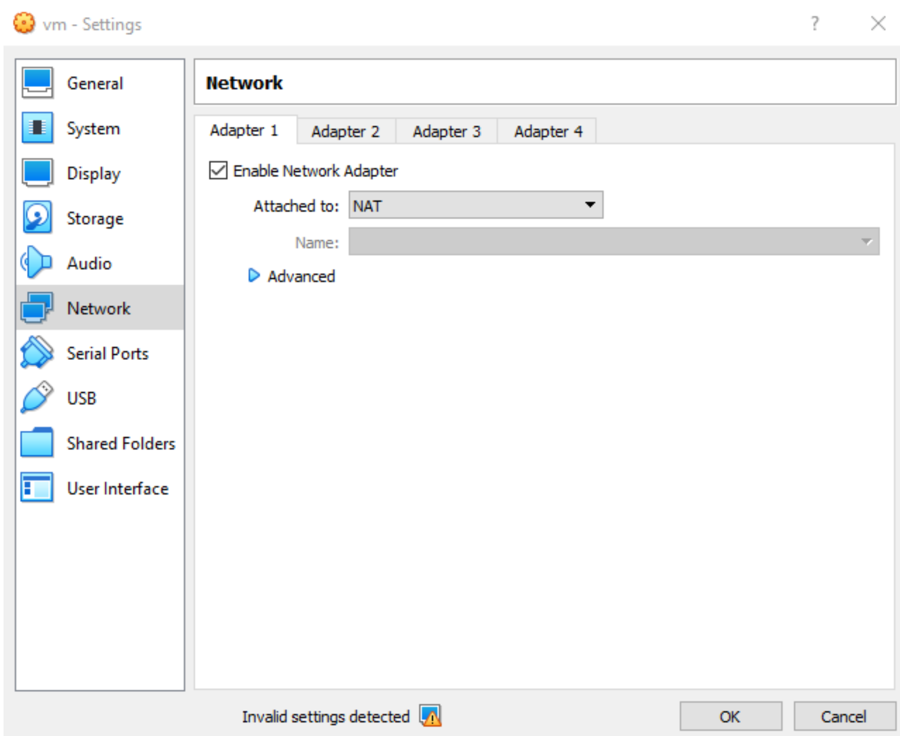
1. Launch VirtualBox and select Import appliance from the file menu to import the .ovf file into VirtualBox



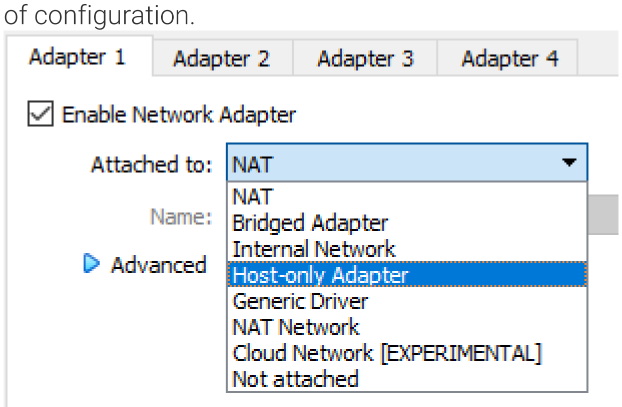
2. Navigate to the .ovf file and select Next.
3. The Appliance settings window displays an overview of the virtual system, including the name, CPU, Network adapter, etc. Select Import.
4. The virtual machine will appear in the machine list at the left of the screen. Right-click on the machine or select and the machine and click Settings to change settings.



5. Select Network from the settings list.

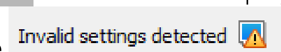


6. Change the network adapter to "bridged adapter" or "Host-only adapter" from the Attached to: list. NAT is the default network adapter and is not recommended due to the complexity of configuration.



7. Select OK.

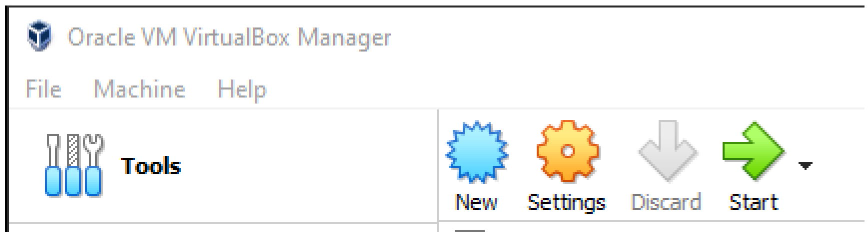
NOTE If you find no option available when choosing the “Host-only Adapter” mode, see the troubleshooting section.

NOTE VirtulaBox will display a warning for invalid settings. Hover the mouse over the 

warning to reveal detailed information on the issue(s) and remedy them in the affected settings category.

Launch the virtual GC Emulator

1. With the virtual configuration selected, from the control bar of VirtualBox, select Start. The virtual machine will load and a console window will appear to display the boot progress.



2. When the console reads "Please press Enter to activate the console", press Enter. The IP of the virtual machine will be displayed. Write this address down for the next step. You do **not** login to the console.
3. Launch your preferred web browser and enter the IP of the virtual machine into the address bar. You should now have the GC Emulator running in the web browser. If you do not have success, refer to the troubleshooting section.

Troubleshooting

If you cannot access the emulator from your browser:

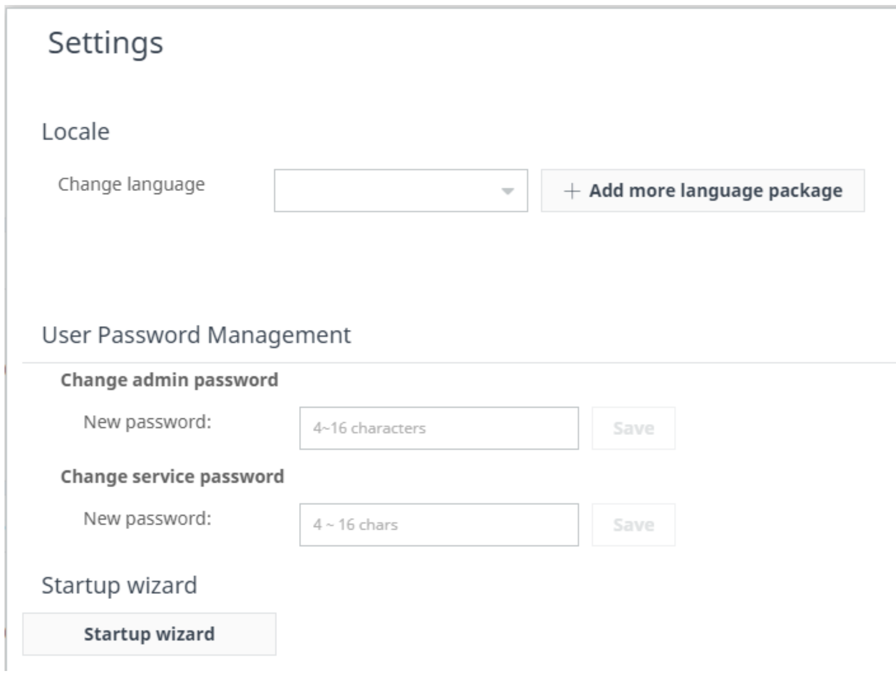
- Disconnect VPN if using a VPN connection.
- Delete and re-install the emulator configuration, this time using a different network configuration.

To create a Host only adapter:

1. Select "Host Network Manager..." from the File menu
2. Click Create. A new entry is created in the list of adapters. Ensure that "DHCP server" is checked. Leave all other info as default.
3. Select Apply.

Settings tab

Select the Settings tab to run the startup wizard, change user passwords, and configure localization settings.



Locale

Select a language from the drop-down menu to set the interface locale. You can import additional language packages by clicking **+ Add language package** and navigating to the package file.

User Password Management

When logged in as an Administrator, you can change the passwords for the admin and service accounts. Enter a new password in the password field and click **Save**.

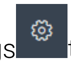
Startup Wizard

Review and set GC preferences for Hardware, User access, network configuration, and automation. See Startup Wizard for details.

See also

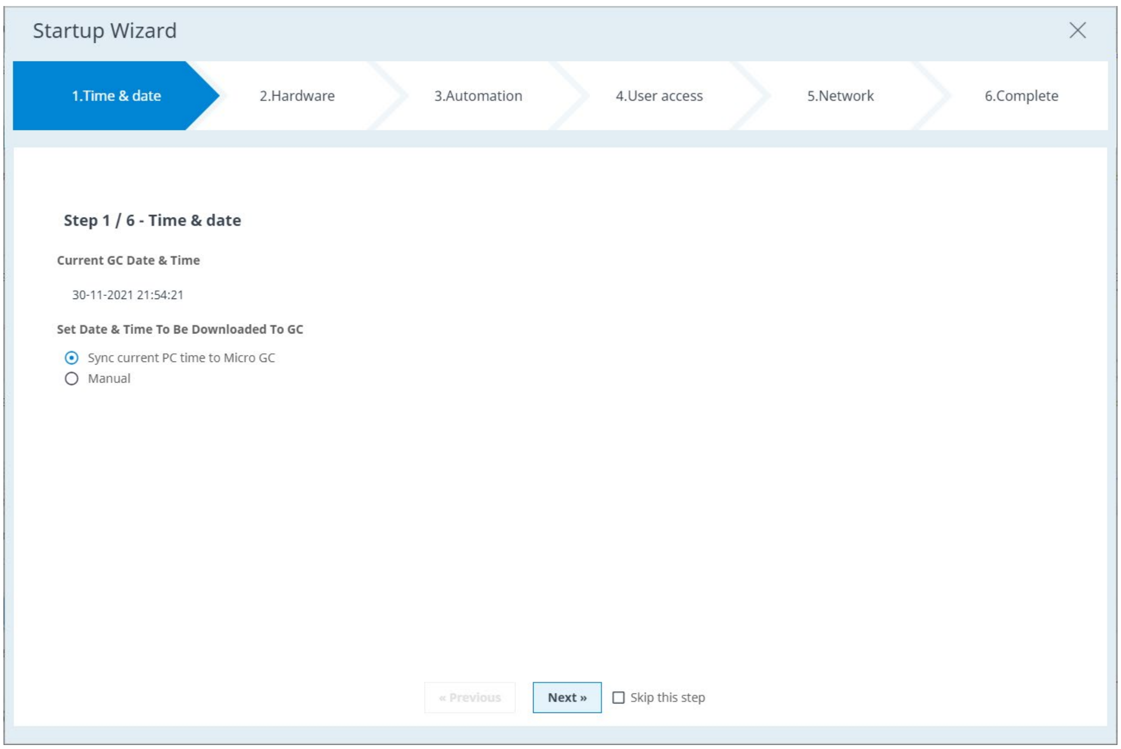
Startup Wizard

Startup Wizard

From the Settings  tab, choose **language and misc** and then select **startup wizard**.

Time and Date

Select the time and date settings preferences. Choose **Manual** to set the time on the GC manually. Select **Sync** to send the current PC time to the GC. Click **Next** to continue to the next step the startup wizard.



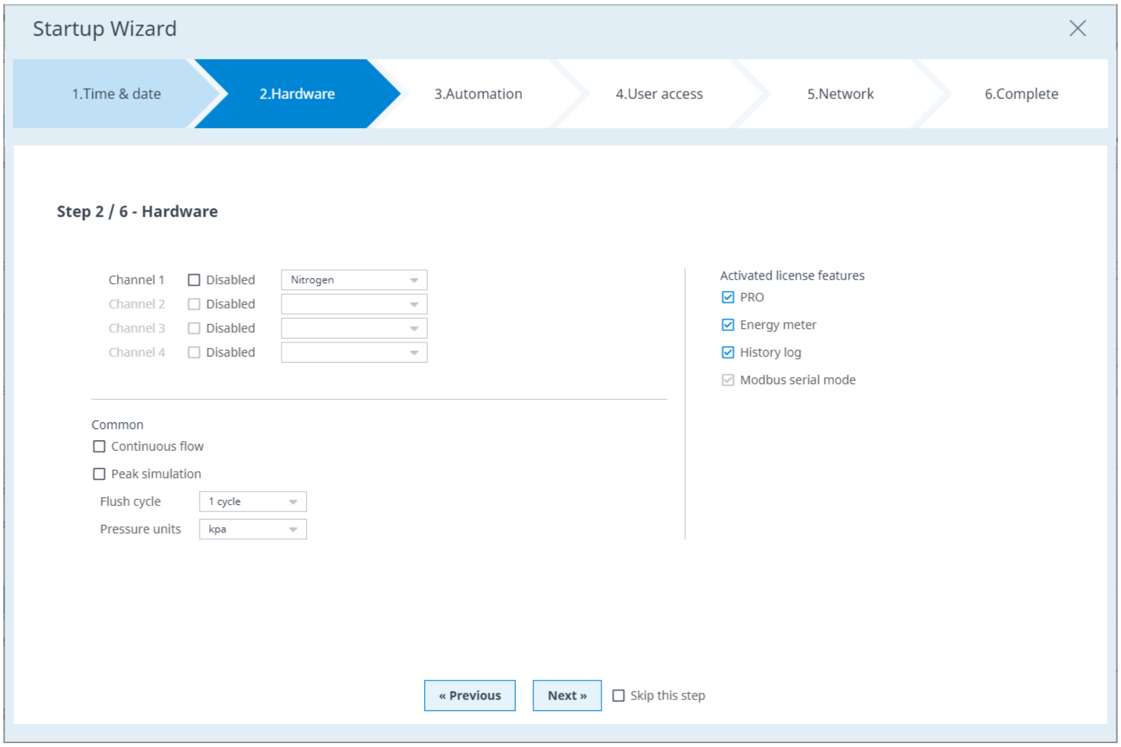
Hardware

Select the carrier gas from the drop-down menu for each installed channel. Click **Disabled** for any channel you wish to keep inactive.

Select preferences for flow and Peak simulation, as well as number of flush cycles.

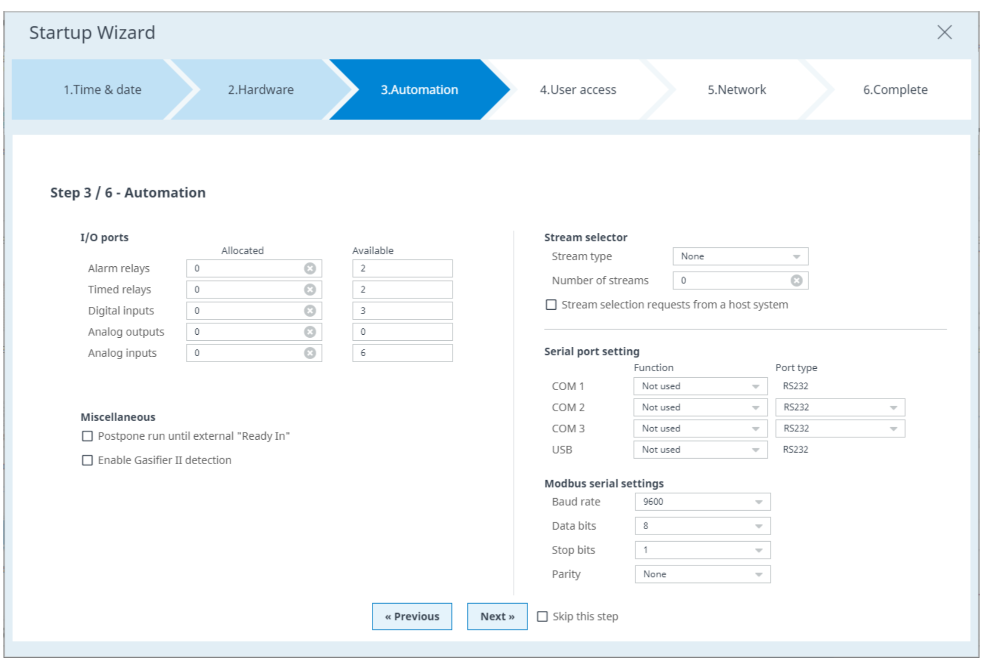
You can enable and disable license features of the current hardware and license available.

Click **Next** to continue to the next step the startup wizard.



Automation

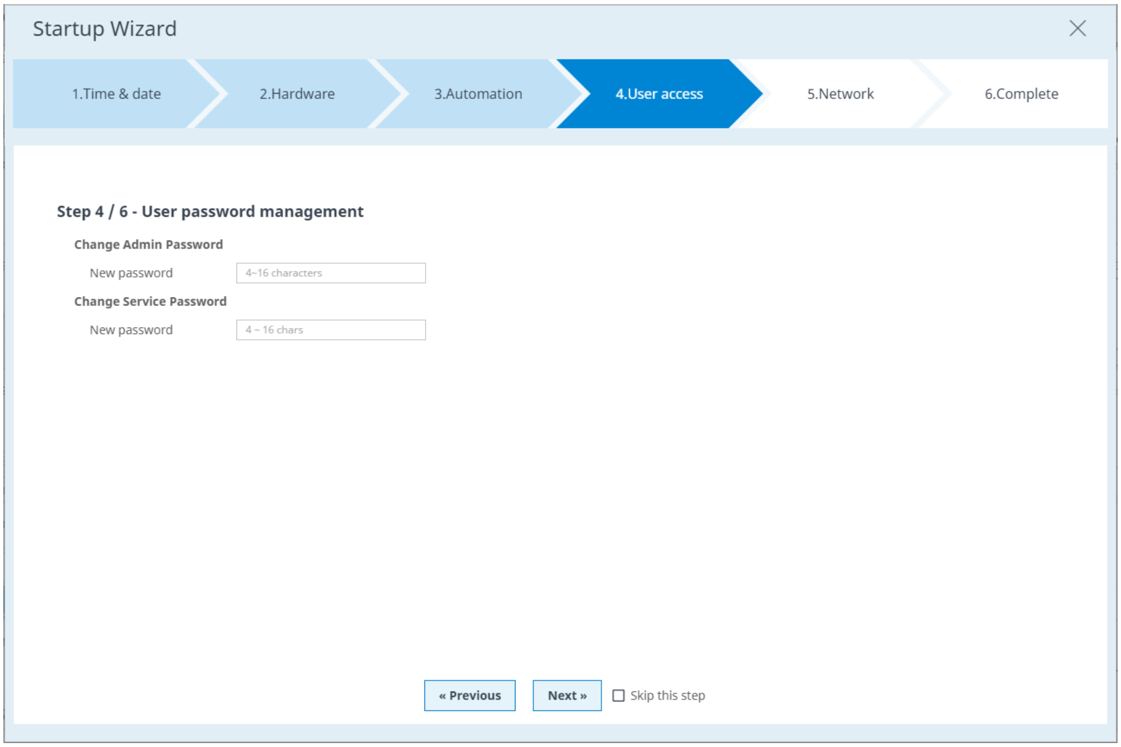
Configure I/O Ports, Stream selector, Serial ports, Modbus settings, etc. form the automation step of the Startup wizard.



Click **Next** to continue to the next step the startup wizard.

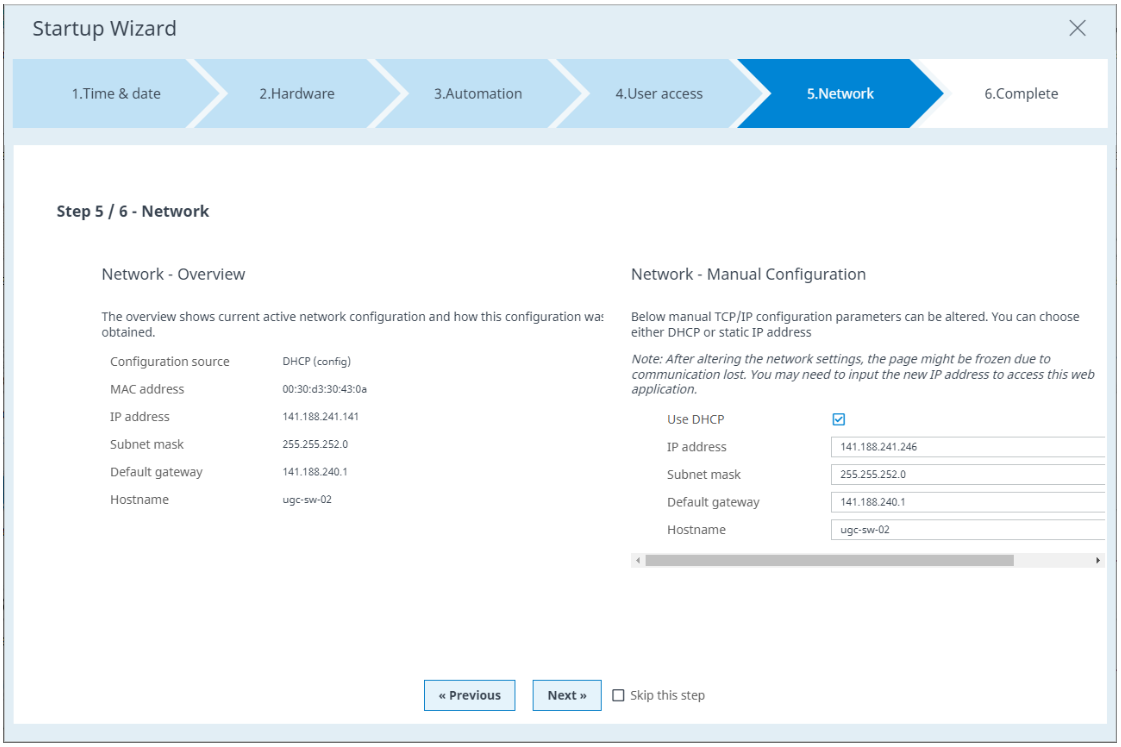
User access

Modify password for admin or service account where necessary (Optional).



Network

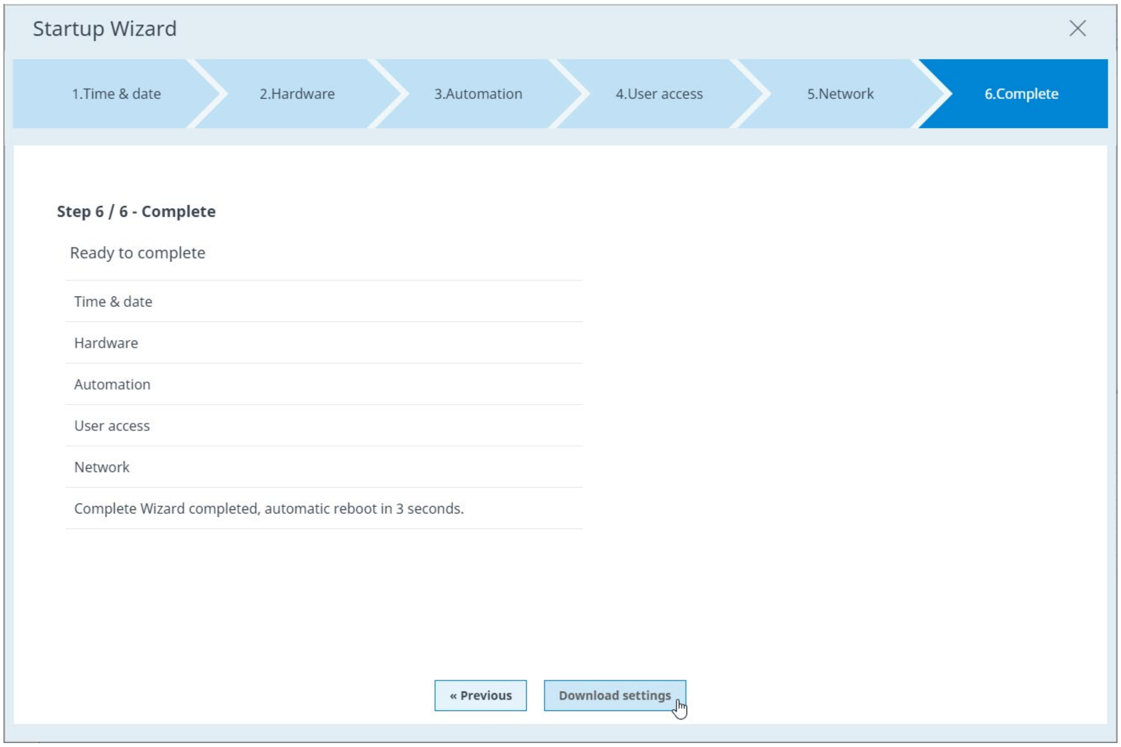
View active network configuration and manually configure network settings in this step of the startup wizard.

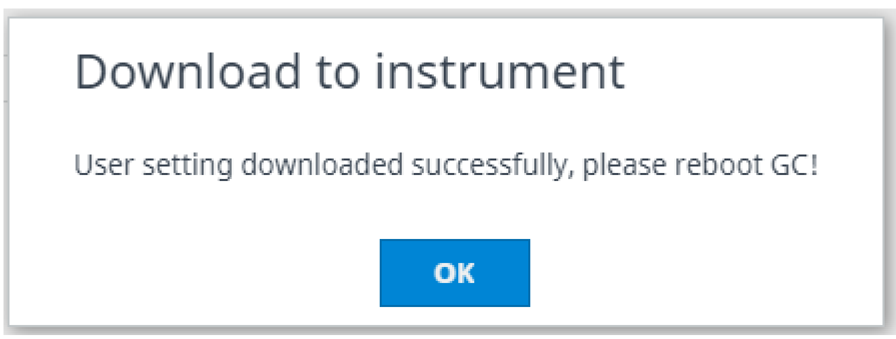


Click **Next** to continue to the next step the startup wizard.

Complete

Complete the setup and download to the instrument. Click **download settings**. You will receive a confirmation your settings were successfully downloaded.


Startup Wizard
1.Time & date
2.Hardware
3.Automation
4.User access
5.Network
6.Complete
Step 6 / 6 - Complete
Ready to complete
Time & date
Hardware
Automation
User access
Network
Complete Wizard completed, automatic reboot in 3 seconds.
« Previous
Download settings


Download to instrument
User setting downloaded successfully, please reboot GC!
OK

990 Hardware Manual

Follow the link in the help sidebar to view the Hardware User Manual for the 990 Micro GC.

www.agilent.com

Second edition, September 2022

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