

TESTA ANALYTICAL FLOWMETER

Clarity Control Module

ENG

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Contents

1 Testa Analytical Flowmeter	1
2 Requirements	3
2.1 Software requirements	3
2.2 Hardware requirements	3
3 Installation procedure	5
3.1 Installing Correct Version of ICF	5
3.2 Local connection	7
3.3 Network Connection of Testa Flowmeter	7
3.4 Clarity Configuration	7
3.5 Installation Qualification of Testa Analytical Flowmeter	13
4 Using the Testa Analytical Flowmeter	15
4.1 Method Setup - Aux. Devices	15
4.2 Method Setup - Aux. Signals	17
4.3 Device Monitor	18
5 Troubleshooting	19
5.1 Specific Problems	19

To facilitate the orientation in the **Testa Analytical Flowmeter** manual and **Clarity** chromatography station, different fonts are used throughout the manual. Meanings of these fonts are:

Open File (italics) describes the commands and names of fields in **Clarity**, parameters that can be entered into them or a window or dialog name.

WORK1 (capitals) indicates the name of the file and/or directory.

ACTIVE (capital italics) marks the state of the station or its part.

Chromatogram (blue underlined) marks clickable links referring to related chapters.

The bold text is sometimes also used for important parts of the text and the name of the **Clarity** station. Moreover, some sections are written in format other than normal text. These sections are formatted as follows:

Note: Notifies the reader of relevant information.

Caution: Warns the user of possibly dangerous or very important information.

I Marks the problem statement or trouble question.

Description: Presents more detailed information on the problem, describes its causes, etc.

Solution: Marks the response to the question, presents a procedure how to remove it.

1 Testa Analytical Flowmeter

This manual provides guidance on the installation, configuration, and operation of the Testa Analytical Flowmeter Control Module within the Clarity software version 10.1.0.64 or later.



Fig. 1: Testa Analytical Flowmeter

This document refers to Testa analytical flowmeters designed for continuous measurement of flow rate without interference in liquid chromatography systems. These flowmeters are compatible with all HPLC and GPC/SEC solvents, are conveniently sized and powered from a USB connection.

The Testa analytical flowmeter continuously measures the flow rate of liquids using sensitive, non-invasive sensor technology and advanced electronics to make its operation robust, reliable, and easy.

Testa Analytical offers a full range of liquid flowmeters covering the measurement of liquid flows from nanoliters per minute to 650 milliliters per minute.

Tab. 1: Overview of Testa Analytical flowmeter models covered by this module

Product	Application Examples	Flow Range
μ-flowmeter	(U)HPLC, MS makeup flow	0.001 - 80 μL
analytical flowmeter	HPLC, FPLC, flow chemistry	0.001 - 5.0 mL
semi-prep flowmeter	prep HPLC, FPLC, purification, flow chemistry	0.01 - 40 mL
preparative flowmeter	prep HPLC, FPLC, purification, downstream processing	0.20 - 650 mL

The Testa liquid flowmeter can act as:

- an online flow monitoring device (HPLC, uHPLC, FPLC, GPC/SEC, LC/MS).
- a metrological tool for operational qualification of solvent delivery devices (pumps, syringes, etc.)
- a device to ensure proper chromatographic performance (flow verification)
- a device for verification of flow consistency
- a troubleshooting device for solvent delivery systems

2 Requirements

2.1 Software requirements

Agilent ICF and Testa Flowmeter Module require a Microsoft .Net Framework 3.5 or higher for correct installation and operation. This version is already installed on most PCs. If your PC is missing the required .NET version, the installation of Testa Analytical Flowmeter control module is not possible and the it will be disabled in the Components list. If the Testa Analytical Flowmeter was not installed because of missing .NET, uninstall Clarity, install needed version of .NET, and install Clarity again.

For a complete list of .NET requirements, refer to the .NET Framework System Requirements on the Microsoft website.

Supported operating systems:

- Windows 10 (64 bit)
- Windows 11 (64 bit)

Before installing Clarity or a Clarity Update, it is recommended to update your Windows operating system to the latest version.

The Testa Analytical liquid flowmeter is a Plug and Play (PnP) USB device, that means the required USB driver for communication with the Windows Operating System is installed automatically. Electrical power is also supplied via the USB cable.

2.2 Hardware requirements

Each Testa Analytical liquid flowmeter should be connected via the supplied USB-C cable to the computer controlling the instrument. The USB link acts as the power supply as well as for communication (device access, data capture, etc.).

If the host PC does not have enough USB ports to allow the connection of multiple Testa Analytical liquid flowmeters in a configuration, please use a USB-hub with sufficient USB ports capable to supply power to all connected Testa Analytical liquid flowmeters.

Refer to Table 2 for a list of firmware requirements for the Testa Flowmeter driver.

LAN interface installed on PC is required.

Tab. 2: Overview of Testa Analytical flowmeters covered by this module

Flowmeter	Product Part Number	Minimum Firmware	Flow Range
micro	AB-40004	1.3	0.001 - 80 $\mu\text{L}/\text{min}$
analytical	AB-40001	1.3	0.001 - 5.0 mL/min
semi-prep	AB-40002	1.3	0.01 - 40 mL/min
preparative	AB-40003	1.3	0.20 – 650 mL/min

3 Installation procedure

Testa Analytical Flowmeter is **not** part of the **Clarity Typical** installation.

To install it, select the *Full* installation or check the **Testa Analytical Flowmeter** in the *Choose Components* dialog in *Instrument Control Framework (ICF)* during the installation of **Clarity**. It is not possible to select it if the needed .NET version is not installed on the PC.

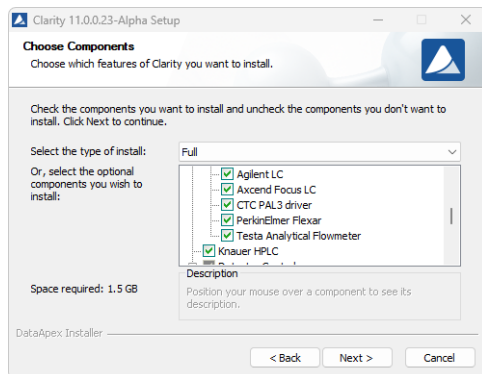


Fig. 2: Full installation of Clarity

3.1 Installing Correct Version of ICF

Clarity expects a specific version of Agilent ICF. Because other programs may also be using Agilent ICF, it is possible they've installed a different version than is supported by **Clarity**. In that case in the installation you will be prompted to reinstall it in order to install correct version. Going forward with this step is crucial for correct functionality of **Clarity** and **Testa Analytical Flowmeter**.

Note: This reinstallation of Agilent ICF may cause that other programs using it may not function properly.

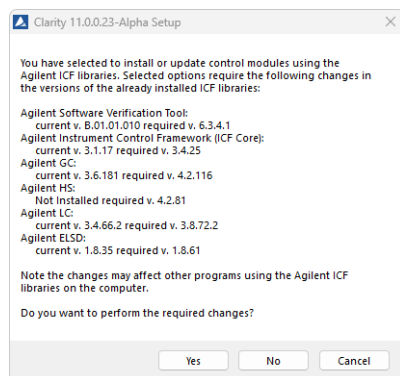


Fig. 3: Installing correct version of Agilent ICF

3.2 Local connection

Each Testa Analytical liquid flowmeter must be connected via the supplied USB-C cable to the computer controlling the instrument. Multiple Testa flowmeters can be connected to a single instrument. The USB link acts as the power supply as well as for communication (device access, data capture, etc.).

If the host PC does not have enough USB ports to allow the connection of multiple Testa Analytical liquid flowmeters in a configuration, please use a USB-hub with sufficient USB ports capable to supply power to all connected Testa Analytical liquid flowmeters.

3.3 Network Connection of Testa Flowmeter

If a Testa flowmeter must be connected to a remote host computer, the Testa flowmeter driver supports network connections via LAN. Testa recommends Silex DS-600 USB-LAN Servers to connect the Testa Flowmeters with USB interface to a (corporate) Ethernet-based network. Testa has verified Silex DS-600 performance, stability and data security in corporate environments. There are other products on the market which offer similar functionality but have not been tested by Testa.

Always consult your local network administrator for assistance for appropriate network configuration.

Caution: A cross-over LAN cable is primarily intended for direct connections between the instrument and the PC. While it can also be used to connect the device to a switch or network socket, some older switches may require a standard (straight-through) LAN cable.

LAN Settings:

- PC: Network card configured with TCP/IP protocol.

3.4 Clarity Configuration

- Start the **Clarity** station by clicking on the  icon on the desktop.
- Open the **System Configuration** dialog accessible from the **Clarity** window using the *System - Configuration...* command.

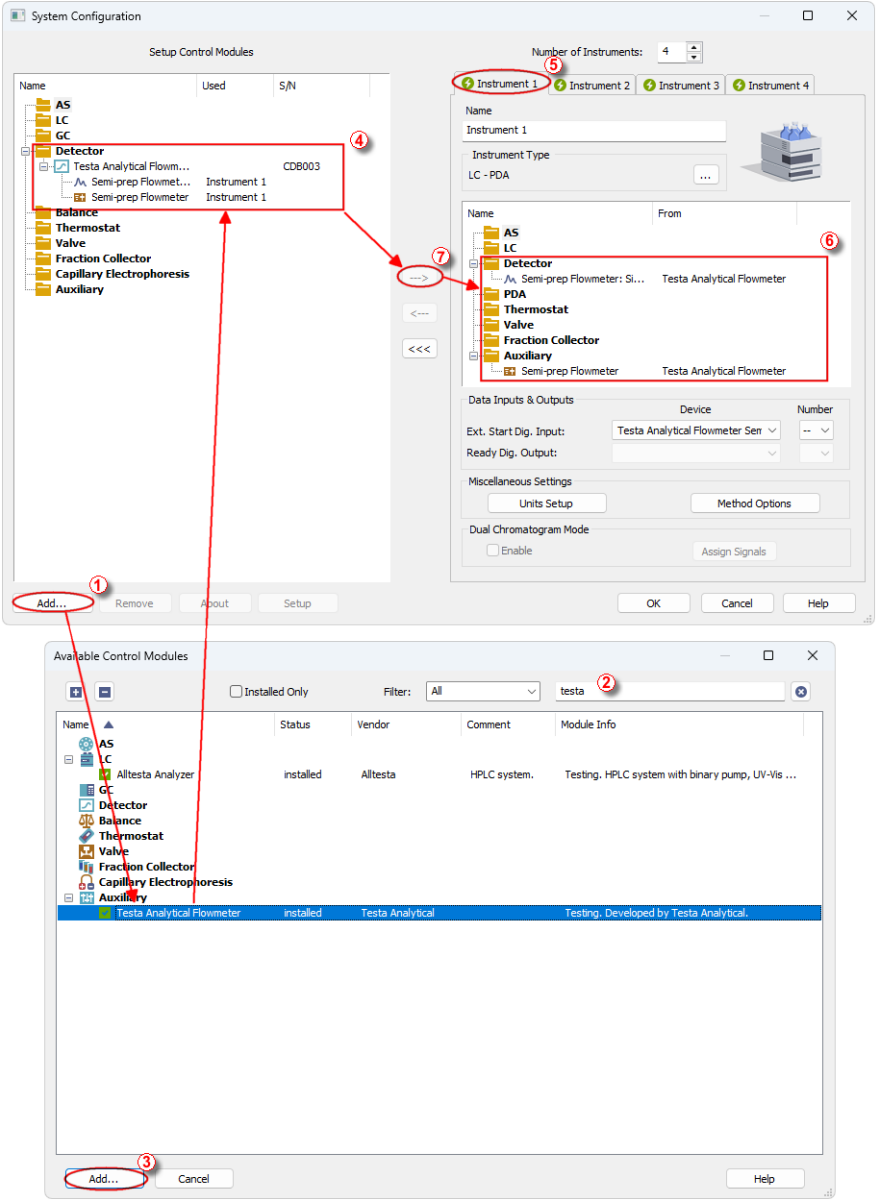


Fig. 4: System Configuration

- Click the **Add** button ① (See 3.4 on pg. 7.) to invoke the *Available Control Modules* dialog.

- You can specify the searching filter ② to simplify the finding of the driver.
- Select the **Testa Analytical Flowmeter** item and press the **Add** ③ button. The *Testa Analytical Flowmeter Setup* dialog will open.

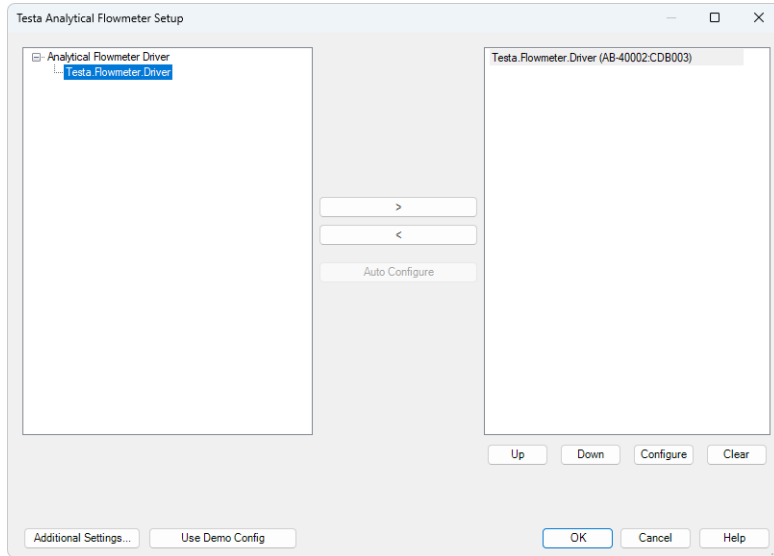


Fig. 5: Testa Analytical Flowmeter Setup

- In this dialog, select the Testa.Flowmeter.Driver entry in the list on the left side.
- Click the arrow button to move the selected driver to the list on the right. This will create an instance named Testa.Flowmeter.Driver
- Double click on Testa.Flowmeter.Driver to open the Testa Flowmeter configuration dialog.

The configuration dialog will appear:

Configure Testa.Flowmeter.Driver

Communication

Serial Port: 5 Auto-Detect

Load Configuration From Device

Device Information

Device Name: Semi-prep Flowmeter

Manufacturer: TESTA Analytical Solutions

Part Number: AB-40002

Serial Number: CDB003

Firmware Revision: 2.0

Installed Sensor

Sensor Serial: 23070-00380

Flow Unit: mL/min

Maximum Flow: 40 mL/min

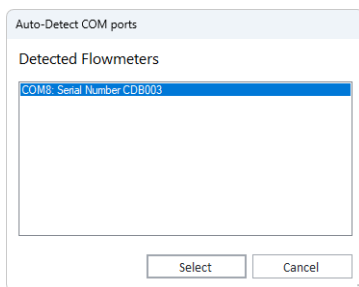
Help OK Cancel

- Select Auto Detect.

Note: The Device Name can be edited to include a meaningful description; non-Latin character sets are supported. The identification details of the flowmeter itself are detected automatically and cannot be changed.

Note: Press the F1 key to display the Testa Analytical Flowmeter help with detailed description of the dialog.

- The communication port will be recognized automatically. If more than one flowmeter is connected a selection dialog will pop up showing all available flowmeters. Click on the one you want to add to this instrument and click on Select. If you want to configure additional flowmeters, repeat the process by selecting the flowmeter from the Available Modules list and proceeding through configuration again.

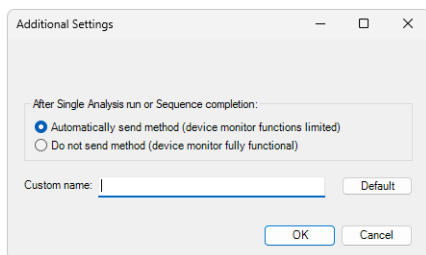


- When all flowmeters are configured, finish by pressing the OK button in the Instrument Configuration dialog.
- The Testa Analytical Flowmeter module will appear in the Setup Control Modules list ④ .
- Select the desired instrument tab ⑤ and set the Instrument Type to LC.
- Drag the Testa Analytical Flowmeter from the left pane ④ to the appropriate section on the right ⑥ , or use the arrow button to assign it ⑦ .
- Click OK to save the configuration.

Note: The configuration dialog of the Testa Analytical Flowmeter can be displayed any time by double-clicking on its icon or using the Setup button.

Additional Settings...

This dialog allows you to configure additional settings of the control module.



After Single Analysis run or Sequence completion

Choose how Clarity sends the method to the device:

- *Automatically send method* – Clarity sends the method after each single analysis run or after the sequence is finished automatically. *Device Monitor* functions after the method is sent may be limited in this mode. This mode is necessary if you want to run a continuous loop of Single Analysis measurements. It does not affect Sequence runs.
- *Do not send method* – The method is not sent automatically, allowing full access to *Device Monitor* functions even when method is sent to the device.

Custom name

Allows you to rename the module. The custom name will appear in the *System Configuration* dialog including the *Data Inputs & Outputs* section.

If left blank, the module will use its default name. Use the Default button to reset the name at any time.

3.5 Installation Qualification of Testa Analytical Flowmeter

Testa Analytical Flowmeter is controlled via **Agilent ICF**, an external program developed by Agilent, and for that reason it must be validated using their utility. If you have installed **Clarity** with Agilent ICF, **the IQ is valid only if successful validation of ICF is attached**.

The validation of ICF can be performed directly from the *IQ Report*.

Caution: When **Clarity** expects *Agilent ICF* is installed then **IQ** expects the same. If (due to any reason) the *Agilent ICF* installation is not found within **Clarity**, the *Installation Qualification Test* status is set by default to **FAILED**. To resolve this, it is necessary to re-install **Agilent ICF** through **Clarity** reinstallation and then perform **IQ** again.

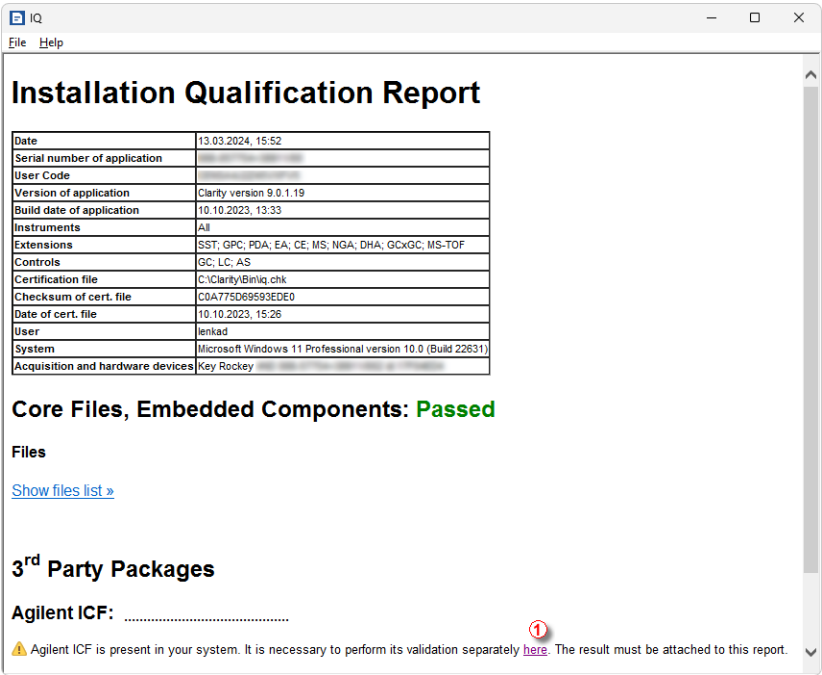


Fig. 6: IQ Report with ICF installation present

Click the link "here" ① , after that it is necessary to click Run in two pop-up windows. Agilent Software Verification Tool window will open. Select what report file type should be generated and define post-qualification actions. Click Qualify ② to run the IQ. The HTML reports are opened in the default browser if the Open reports option was enabled. Installed drivers and their versions are listed at the end of the report.

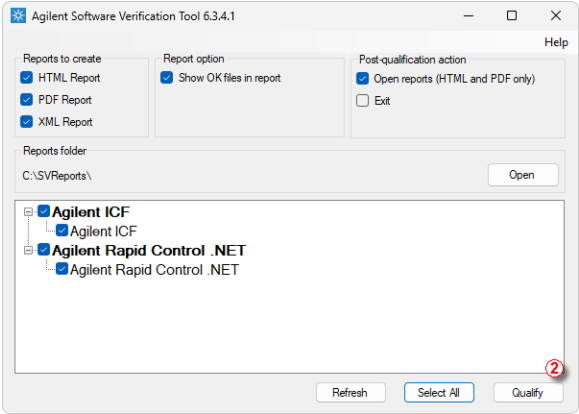


Fig. 7: Agilent Software Verification Tool

Address field of the generated report displays the location of the actual report.

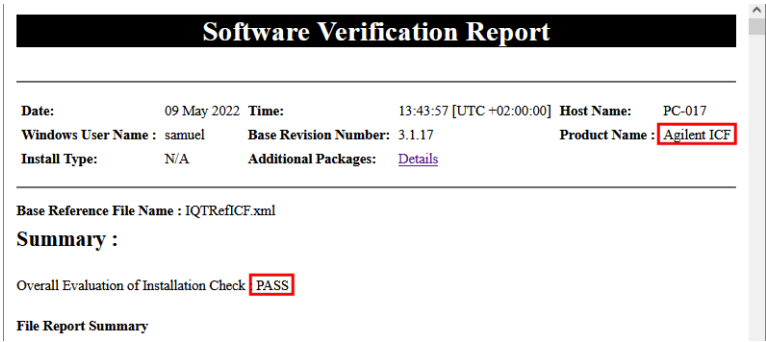


Fig. 8: ICF Report - PASS

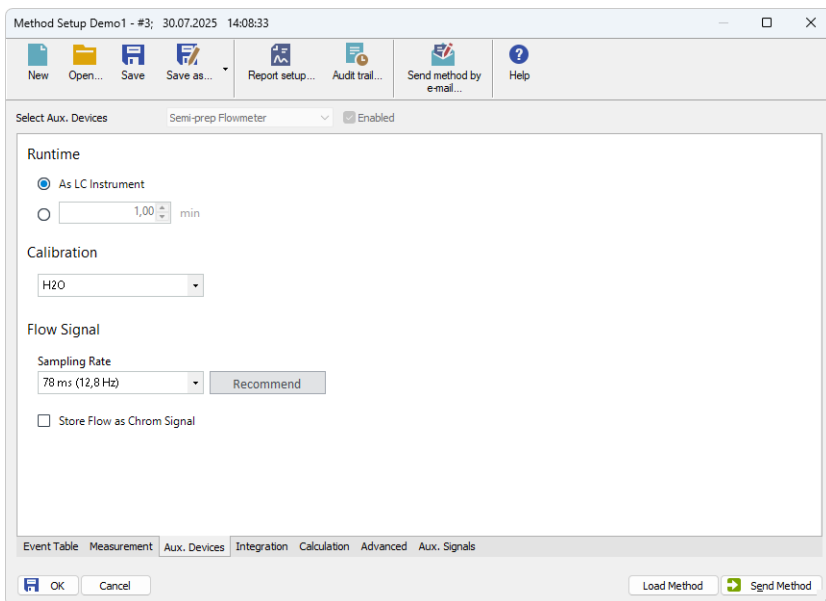
4 Using the Testa Analytical Flowmeter

Testa Analytical Flowmeter dedicated tabs in the *Method setup* and dedicated part of the *Device Monitor* are described here.

Caution: Before opening the *Instrument* window with **Testa Analytical Flowmeter** device configured, ensure that there is no other PC connected to the flowmeter, else a communication error appears.

4.1 Method Setup - Aux. Devices

The Aux. Devices tab in the Method Setup window allows you to configure the flowmeter parameters for each method.



- Select the length of the flowmeter run by
 - either using the run time of the LC instrument (default setting), or
 - specifying the run time individually and independently from the other modules in the instrument.

Note: If there is no LC instrument or standard run time provider present in the current configuration and the default method setting (As LC instrument) is not changed, the flowmeter will run indefinitely and must be stopped manually.

- Select the calibration solvent to be used in the analysis for flow rate monitoring.

All Testa Analytical liquid flowmeters are factory calibrated using pure distilled water and are supplied with additional calibration values to match other common

chromatographic solvents and solvent mixtures, such as methanol/water for reverse-phase HPLC or tetrahydrofuran (THF) for GPC/SEC analyses. You should select the calibration that best matches the eluent used in your separation.

- Select the sampling rate (data interval) for the flow rate measurement.
- The module offers a Recommended sampling rate setting based on the total run time of the analysis. This determines the data interval (frequency) and how long the flowmeter integrates the measured flow rates provided to the data system.

Tab. 1: Relationship between flowmeter run time and recommended data rate

Selected flowmeter device Run Time in Method	Flowmeter Data Rate [milliseconds] (frequency)
less than 2 min	78 (12.82 Hz)
from 2 min to 5.5 min	312 (3.20 Hz)
from 5.5 min to 14.2 min	1171 (0.83 Hz)
from 14.2 min to 150 min	5781 (0.17 Hz)
above 150 min	9843 (0.102 Hz)

Note: If a certain data rate is required to derive information or generate a specific flow pattern (for example to understand how your pump valves or pistons work), the runtime should be set independently from the LC instrument.

It is recommended to use high data rates for troubleshooting and identifying why results deviate from expected behavior. Longer run times allow the flowmeter to integrate the measured flow rate over a longer period, which will create results that are comparable to other traditional more time-consuming flow measurement technologies.

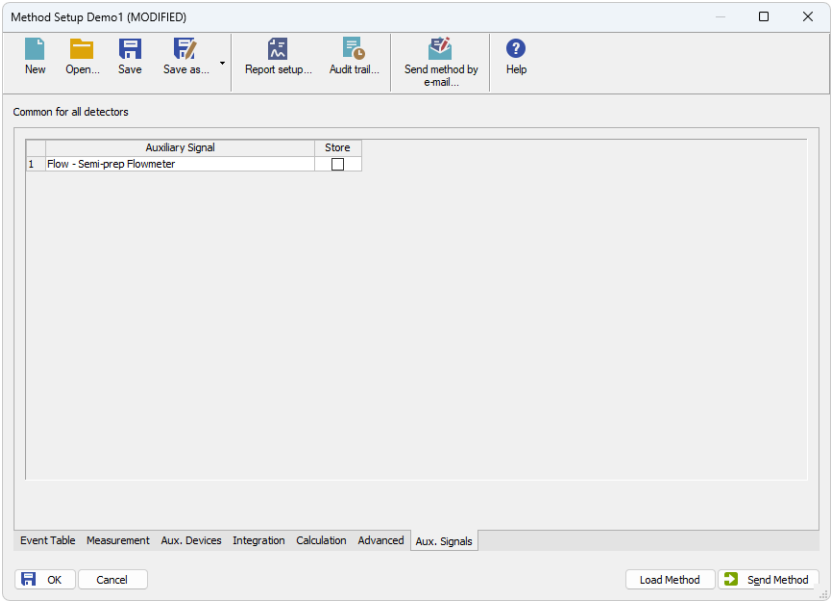
- Select the type of flow rate signals to be acquired. The flowmeter allows user to acquire data for data analysis (flow rate averages, min/max pulsation, drift, noise, wander, etc.) and/or for monitoring only by activating/deactivating the Store Flow as Chrom Signal control option in the method. The implications of this setting are summarized in the table below.

Tab. 2: How to benefit most from the "Store Flow as Chrom Signal"

Store Flow as Chrom Signal	Data Acquisition Mode	Usage and Benefits
Option disabled	AUX/Instrument signal only	If flow rate should only be saved as for visual inspection (flow monitoring).
Option enabled	chromatogram and AUX/ Instrument signals	Allows to integrate the flow rate signal together with other detector signals, including overlays and reporting numerical results. The flow rate data are handled in the same way as detector signals are reported.

4.2 Method Setup - Aux. Signals

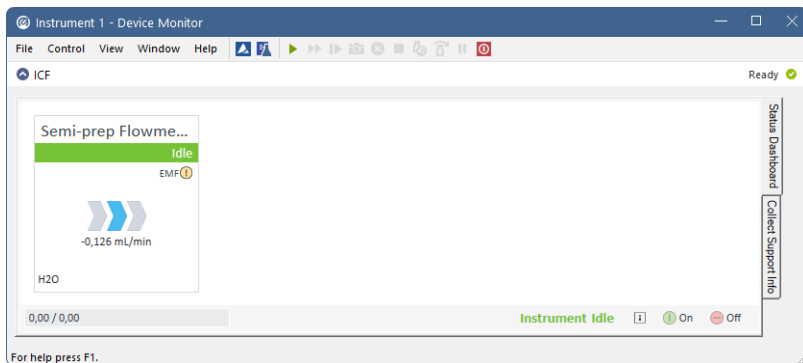
The Aux. Signals tab lets you select which auxiliary signals will be recorded together with the chromatographic data. In this dialog, you can see all available signals from connected devices, such as flow or pressure channels. To include the flowmeter signal in the data file, tick the Store checkbox next to Flow – Analyt. Flowmeter. This way, the flow readings will be saved for each run and available for review or reporting.



4.3 Device Monitor

The *Device Monitor* window can be opened by the *Device Monitor* command from the *Analysis* menu or using the **Device Monitor** icon in the *Instrument* window. You may use icon for accessing *Device Monitor* from all **Clarity** windows.

The Device Monitor window provides a real-time overview of the flowmeter status and current readings. In the upper right corner, a status indicator shows whether the instrument is *Ready*. The main display shows the current instrument state, such as *Idle*, *Run*, or *Not Ready*. The measured flow rate is displayed in real time. The solvent type used, in this case *H2O*, is shown below the flow reading.



5 Troubleshooting

When the solution for some problem cannot be discovered easily, the recording of communication between **Clarity** and **Testa Analytical Flowmeter** control module can significantly help the **DataApex** support to discover the cause of the problem. The created *.LOG files will greatly help in diagnosis of unrecognized errors and problems.

The recording is enabled by default and creates logs in Cfg section of the installation directory (C:\CLARITY\CFG\DEBUG_ LOGS\PGMLOG\ by default). The communication logs are quite verbose and older ones are removed, so in order to diagnose a problem, the log collected during that problem happening should be copied out soon after.

In case the flowmeter cannot be configured or opened online, verify the following:

- Ensure that the communication settings as documented in this guide are correct.
- Double-check that the flowmeter display is showing status information (powered on).
- Ensure that the firmware revision meets the minimum requirements for the device.

In case you cannot establish communication with instruments, please review the following issues:

Check the network connection using the Ping command

The problem in communication between **Clarity** and **Testa Analytical Flowmeter** may be caused by wrong network configuration, firewall preventing the connection, etc. Run the command line in Windows (for example by pressing the **Windows key** together with the **R** key, in the displayed *Run* window type *cmd* and press *Enter*).

In the command line type `ping <ip-address-of-instrument>` and press *Enter*. The *IP Address* is the same you entered during the configuration.

5.1 Specific Problems

Clarity can't be run and it displays "Agilent ICF is not installed correctly." message.

Cause: The cause of the problem is that the Agilent ICF has a different version than expected by **Clarity**. It can typically happen when other software also using Agilent ICF decides to reinstall it. Thus next time Clarity expects different version than is installed.

Solution: Solution is to reinstall Agilent ICF during **Clarity** installation. Follow steps described in the chapter "**Installation procedure**" on pg. 5.