

FLOM AI-12 SERIES

Clarity Control Module

ENG

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To facilitate the orientation in the **Flom AI-12 series** 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 Flom AI-12 series Control Module

This manual describes the setting of the **Flom AI-12 series** and the **301M** pump. The control module enables direct control of the instrument over serial line.



Fig. 1: Flom AI-12 series pump

Direct control means that the pump can be completely controlled from the **Clarity** environment. The Instrument method controlling the analysis conditions will be saved in the measured chromatograms.

The control is performed via the **UNI Ruby** control module and the **Flom AI-12 series** script.

2 Requirements

- **Clarity** Installation USB with appropriate control license allowed - LC Control (p/n A24) for pumps.
- Free serial COM port in the PC.

Note: Modern computers usually have only one (if any) serial (COM) port installed. To use more devices requiring the RS232 port, the **MultiCOM** adapter (p/n MC01) is available. Currently this module does not support the connection of several pumps in a daisy chain and therefore, each one of them must be connected directly to the computer.

- Serial DB9F-DB9F cross cable (p/n SK01).

Note: Cables are not part of **Clarity** Control Module. It is strongly recommended that you order the required cables together with the Control Module.

3 Installation Procedure

3.1 Flom AI-12 series pump communication

The **Flom AI-12 series** is controlled by serial (RS232) communication.

It uses a standard serial DB9F-DB9F cross cable (p/n SK01) described in the picture below.

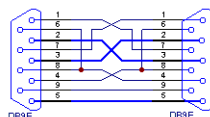


Fig. 2: Serial DB9F-DB9F cross

3.2 Clarity Configuration

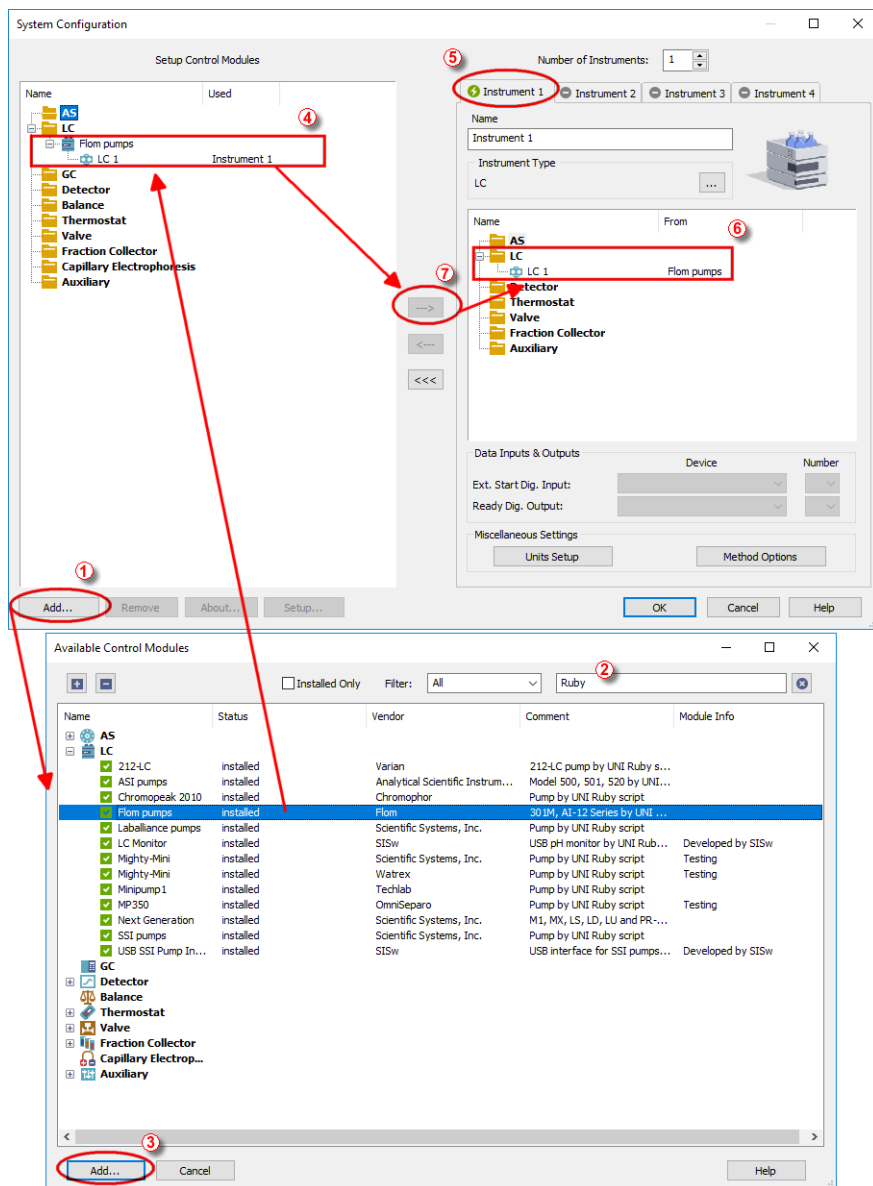

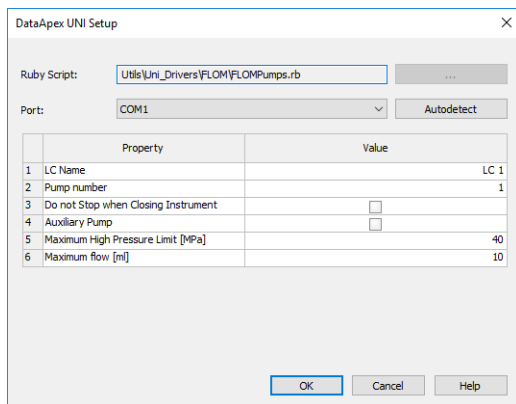


Fig. 3: How to Add Flom pumps module

- Start the **Clarity** station by clicking on the  icon on the desktop.
- Invoke the *System Configuration* dialog accessible from the *Clarity* window using the *System - Configuration...* command.
- Press the **Add** button (① on Fig. 3 on pg. 4.) to invoke the *Available Control Modules* dialog.
- You can specify the search filter ② to simplify the finding of the driver.
- Select the correct item and press the **Add** (③ on Fig. 3 on pg. 4.) button. Each device with already created UNI profile should have its own item named accordingly in the *Available Control Modules* dialog.
- The *DataApex UNI Setup* dialog will appear.



The dialog box titled "DataApex UNI Setup" contains the following fields and controls:


- Ruby Script:** A text field containing "Utils\Uni_Drivers\FLOM\FLOMPumps.rb" and a browse button (...).
- Port:** A dropdown menu showing "COM1" and an "Autodetect" button.
- Properties Table:**

	Property	Value
1	LC Name	LC 1
2	Pump number	1
3	Do not Stop when Closing Instrument	<input type="checkbox"/>
4	Auxiliary Pump	<input type="checkbox"/>
5	Maximum High Pressure Limit [MPa]	40
6	Maximum flow [ml]	10
- Buttons:** "OK", "Cancel", and "Help" at the bottom right.

Fig. 4: DataApex UNI Setup

- Set the correct communication *Port* and click on the *Autodetect* button to establish communication with the device.
- You may fill in the custom *Device Name*.

Note: The *DataApex UNI Setup* dialog is described in detail in the chapter "**DataApex UNI Setup**" on pg. 19.

- The **Flom AI-12 series** item ④ will appear in the *Setup Control Modules* list of the *System Configuration* dialog.
- Drag the appropriate item from the *Setup Control Modules* list on the left side to the desired *Instrument* tab ⑤ on the right side ⑥, or click on the  button ⑦.

4 Using the control module

After adding and setting up the new device one or more new tabs will appear in the *Method Setup* dialog depending on the type of the instrument. A new **Flom AI-12 series** pump section enabling the monitoring of the current pump state will be also created in the *Device Monitor* window.

4.1 Method Setup - LC Gradient

The *Method Setup - LC Gradient* tab is used for preparing and editing the instrument method used by the **Flom AI-12 series** pump.

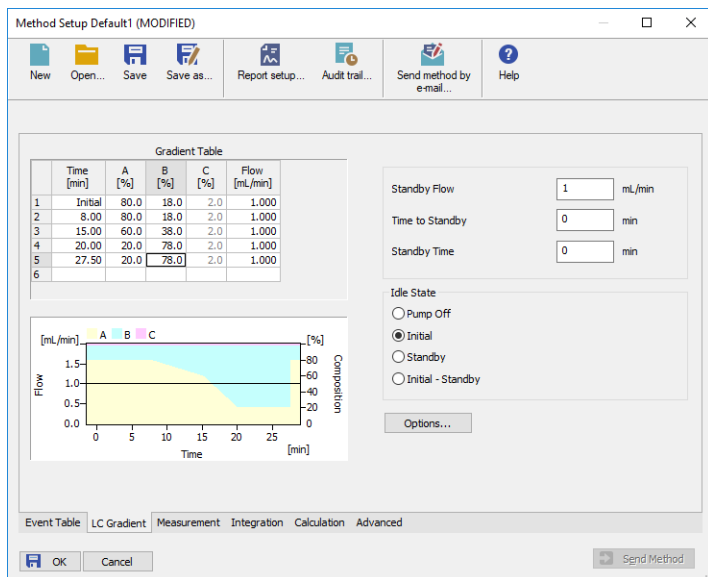


Fig. 5: Method Setup - LC Gradient

Gradient Table

A table for setting the composition of the mobile phase and the overall flow rate as a function of time. Operation is analogous to that of spreadsheets (Excel, Quatro Pro, etc.). To prepare the cell to receive values, click it by the left mouse button; the cell will highlight by dots. A cell that fails to highlight is not available for editing.

Time [min.]

Sets the time at which the ratio of flow rates and the overall flow rate correspond to the values entered in the corresponding row. (These values vary continuously from one time to the next in a manner ensuring that the conditions specified in the next row are satisfied).

XXX1 (..4) [%]

Represents the percentage of a component. The designation **XXX1-4** is in fact replaced by the name of the component (items *Solvent 1 - 4* in the *Gradient Options* dialog). Should you enter a component value such that the sum of all values exceeds 100 %, the percentage in the last column is automatically adjusted; if the percentage of the last compound is already zero, the value of the currently entered component is adjusted instead. The flow rate of a compound is calculated by multiplying the overall flow

rate (indicated in the *Flow* column) by the corresponding percentage divided by 100.

Flow [ml/min]

Indicates the overall flow rate through the column. The entered value applies to the time specified in the corresponding row. The range for *Flow* values is 0 - 5 ml/min.

Graph

The graph depicts the percentage of components as a function of time together with the overall flow rate. Data are taken over from the **Gradient Table**. Changes effected in this table are immediately reflected in the graph. Legend in the header of the graph indicates the assignment of colors to individual components. The assignment is fixed and individual components are displayed in the graph from bottom to top. The flow rate is displayed as a black line.

The graph has two vertical axes: the axis on the left refers to the overall flow rate, the one on the right to the mixing ratio.

Parameters**Standby Flow**

Sets the overall flow rate through the column in the *STANDBY* state reached after the last row of the table has been performed and the time period defined in the *Time to Standby* field has passed. The duration of this state is defined by the *Standby Time* item. The ratio of individual components in the respective *STANDBY* and *IDLE* states is given by the first row of the **Gradient Table** (the *Initial* row).

Time to Standby [min]

Indicates the time during which the flow rate and mobile phase composition changes continuously between the last values entered in the table and the values defined by *Standby Flow* field and the *Initial* row mobile phase composition.

This time is included in the analysis time (the Instrument is in the *CONTROL* state). In case when the *Time to Standby* is zero, there is step change from flow and components percentage specified on the last row of gradient table to that specified for *STANDBY* state.

Standby Time [min]

The time during which the flow rate is maintained at *Standby Flow*. This time is included in the analysis time (the Instrument is in the *CONTROL* state).

Idle State

An item specifying the overall flow rate through the column outside the instrument method. The following options are possible:

Pump Off

The flow rates of all components are zero.

Caution: Be careful as this setting may damage the column in some cases.

Initial

The flow rate is defined by the first row of the gradient table (the *Initial* row).

Standby

The flow rate is the same as in the *STANDBY* mode and, accordingly, corresponds to the value entered in *Standby Flow* field.

Initial - Standby

The flow is defined by the first row of the gradient table (the *Initial* row) after the method is sent, or by the value entered in the *Standby Flow* field after the method finishes.

The *IDLE* state comes into effect each time an Instrument is opened, at the end or after abortion of an analysis by the *Abort* command, and is also maintained after the **Clarity** program is shut down.

The mixing ratio of individual components in both the *IDLE* and *STANDBY* states is given by the first row of the **Gradient Table** (the *Initial* row).

Note: There is a step change in the flow and components percentage from the values specified for the *STANDBY* state to those specified for the *IDLE* state if the *Idle State* field is not set to *Standby*.

4.1.1 Gradient Options

Invoke the *Options...* button in the *Method Setup - LC Gradient* dialog to open the *Gradient Options* dialog. This dialog allows to set the custom name for particular solvents, to switch whether they are used or not in the gradient and to set the warning levels for pressure to prevent the damage to hardware.

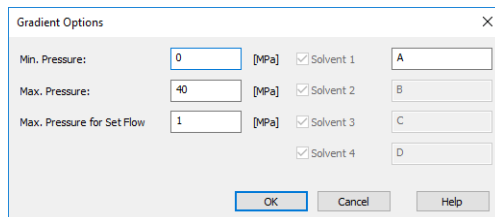


Fig. 6: Gradient Options

Min. Pressure

Sets the minimum pressure for the given pump. When pressure drops to the set value, the pump will shut down. This prevents the solvent leakage. The range for *Min. Pressure* values is 0 - 123.1 MPa.

Max. Pressure

Sets the maximum pressure for the given pump. When pressure reaches the set value, the pump will shut down. This serves to prevent the damage to the pump when the column is blocked. The range for *Max. Pressure* values is 1 - 124.1 MPa, where the *Max. Pressure* must also be at least 1 MPa higher than the *Min. Pressure*.

Note: Pressure limits are checked in the pump hardware. Pressure checking doesn't start immediately after the pump is started, but with a few minutes delay. During this delay the pressure in chromatographic system can stabilize.

Max. Pressure for Set Flow

Sets the maximum pressure to be used in the *Set Flow* dialog in the [Device Monitor](#). Initial value is 1 MPa.

Solvent 1 (..4)

It is possible to enable/disable particular solvent, as well as to set custom name to it.

4.2 Method Setup - LC

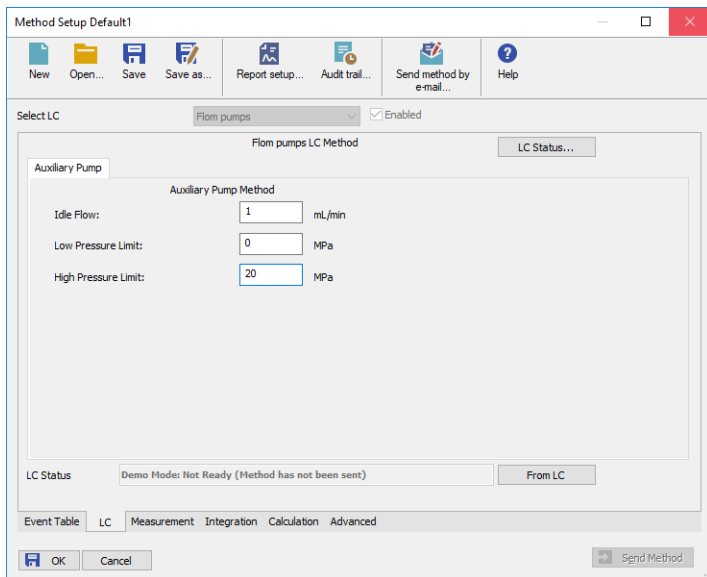


Fig. 7: Method Setup - LC - Auxiliary Pump

This tab defines the properties of the **Flom AI-12 series** set as auxiliary.

Idle Flow

Sets the flow of the pump used outside of the run. The flow of the pump that should be used during the run can be defined in the *Event Table*.

Low Pressure Limit

Sets the minimum pressure for the given auxiliary pump. When pressure reaches the set value, the pump will shut down. This prevents the solvent leakage.

High Pressure Limit

Sets the maximum pressure for the given auxiliary pump. When pressure reaches the set value, the pump will shut down. This serves to prevent the damage to the pump when the column is blocked.

4.3 Method Setup - Event Table

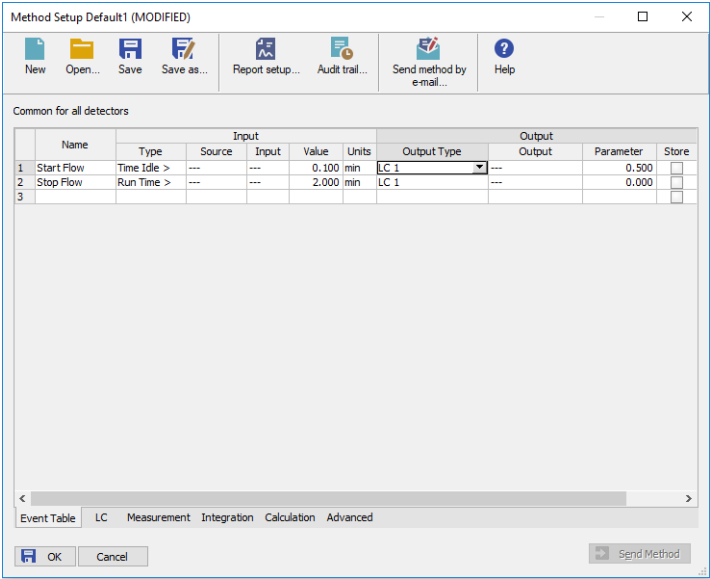


Fig. 8: Method Setup - Event Table

The *Method Setup - Event Table* tab can be, apart from other things, also used for switching the flow of the **Flom AI-12 series** set as auxiliary pump and switching the auxiliary output on the auxiliary pump.

Note: It is not possible to switch auxiliary output or change flow on a pump that is part of the gradient from the **Event Table**.

4.4 Method Setup - Advanced

The *Method Setup - Advanced* tab serves for setting the usage of auxiliary signals of the **Flom AI-12 series** pump.

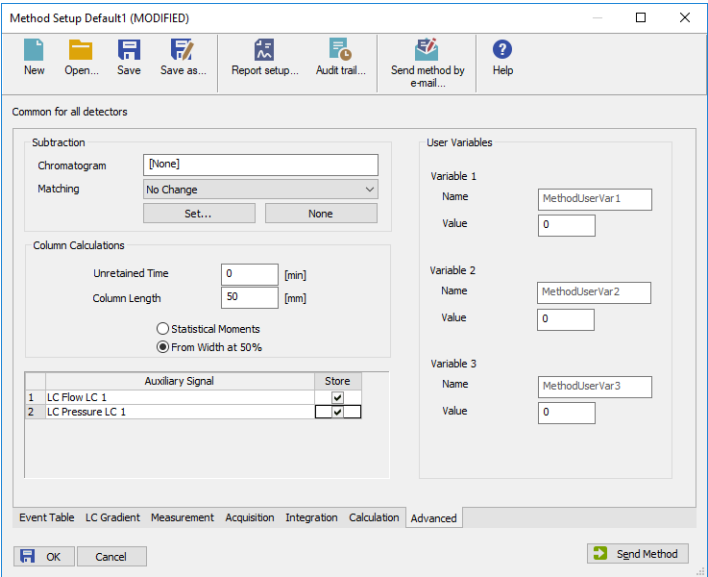


Fig. 9: Method Setup - Advanced

The list of available auxiliary signals is shown in the table in the lower part of the dialog. By checking the checkbox in the *Store* column for the particular row, the given auxiliary signal will be stored into the measured chromatogram.

4.5 Hardware Configuration

The *Hardware Configuration* dialog (invoked by using the *LC Status* button from the *Method Setup - LC* dialog) displays the configuration of the **Flom AI-12 series**, namely the communication type and its parameters.

Hardware Configuration

Ruby Script:

Utils\Uni_Drivers\FLOM\FLOMPumps.rb

Port:

COM1


	Property	Value
1	LC Name	LC 1
2	Pump number	1
3	Do not Stop when Closing Instrument	<input type="checkbox"/>
4	Auxiliary Pump	<input checked="" type="checkbox"/>
5	Maximum High Pressure Limit [MPa]	40
6	Maximum flow [ml]	10

Close

Help

Fig. 10: Hardware Configuration

4.6 Device Monitor

The window with the pump status can be invoked by the *Monitor - Device Monitor* command from the *Instrument* window or using the  *Device Monitor* icon.

Device Monitor - LC Monitor

For gradient pumps, the monitor consists of the section common to all pumps present in the gradient.

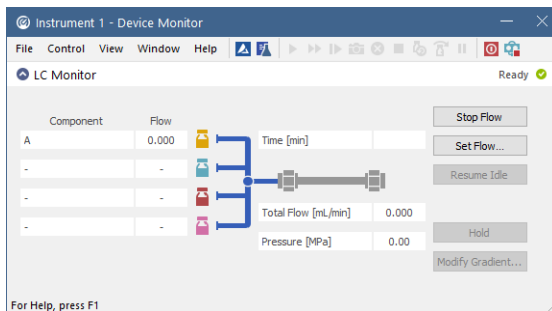


Fig. 11: Pump - Device Monitor

Stop Flow

The pumps can be stopped from this window using the *Stop Flow* button. This action will stop the pump only, the analysis run will continue and must be stopped or aborted separately by the *Stop/Abort* button in the toolbar.

Set Flow

Sets the desired total flow and solvent ratios in the opened *Set Flow* dialog. *Max. Pressure* sets the maximum pressure to be used. Initial value is 1 MPa.

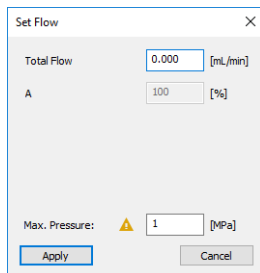


Fig. 12: Set Flow

Resume Idle

Returns the pumps to *IDLE* state as defined in the appropriate field on the *LC Gradient* tab of the *Method Setup* dialog.

Hold/Resume

Clicking on the *Hold* button will keep the current gradient conditions until *Resume* is clicked.

Modify Gradient...

Opens the [LC Control Manual Flow](#) dialog allowing to set custom flow and mobile phase composition, disregarding the **Gradient Table** set in the method. The command is only available during the analysis run.

Device Monitor - Auxiliary Pump

Each Auxiliary pump has its own device monitor displaying the actual flow and pressure on the device. This separate monitor mimics the operations of *Stop Flow*, *Purge* and *Resume Idle* from the gradient *Device Monitor*, but can also be used during the analysis run.

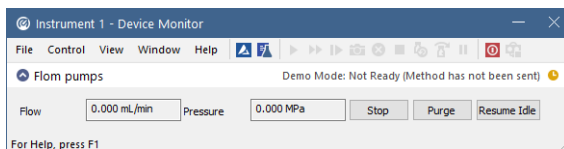


Fig. 13: Device Monitor - Auxiliary pump

Note: Please note that the separate *Purge* dialog is present for each auxiliary pump. Auxiliary pumps must thus be purged manually one at a time.

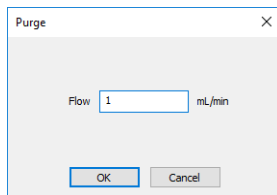


Fig. 14: Purge - Auxiliary pump

4.6.1 LC Control Manual Flow

The *LC Control Manual Flow* dialog accessible through using the *Modify Gradient ...* button from [Device Monitor](#) window allows the user to set a custom mobile phase composition and flow while the analysis is running. It resembles the [Method Setup - LC Gradient](#) tab in functionality.

LC Control Manual Flow

Gradient Table						
	Time [min]	A [%]	B [%]	C [%]	D [%]	Flow [mL/min]
1	Initial	10,0	10,0	20,0	60,0	1,000
2	1,00	10,0	10,0	20,0	60,0	1,000
3	3,00	50,0	20,0	30,0	0,0	1,000
4	4,00	50,0	20,0	30,0	0,0	1,000
5						

Standby Flow: 1 mL/min
 Time to Standby: 0 min
 Standby Time: 0 min

Idle State:
☐ Pump Off
☒ Initial
☐ Standby
☐ Initial - Standby

Flow [mL/min] vs Time [min] graph showing composition A (yellow), B (pink), C (light blue), and D (red) over time. The flow rate is constant at 1.0 mL/min.

OK Cancel

Fig. 15: LC Control Manual Flow dialog

The *LC Control Manual Flow* dialog is only available during the analysis run. When it is invoked and the **OK** button is pressed, the original **Gradient Table** from the acquisition method is discarded and replaced by the **Gradient Table** from the *LC Control Manual Flow* dialog. Any such operation is recorded in the audit trail of the measured chromatogram.

Caution: After the analysis run which used manual flow changes ends, the original method is automatically sent to all controlled devices to make sure **Clarity** station returns to the original method.

4.7 DataApex UNI Setup

The appearance of the *DataApex UNI Setup* dialog depends on the presence of the selected Ruby Script - if the script is not present, only the *Ruby Script* field is visible.

	Property	Value
1	LC Name	LC 1
2	Pump number	1
3	Do not Stop when Closing Instrument	<input type="checkbox"/>
4	Auxiliary Pump	<input type="checkbox"/>
5	Maximum High Pressure Limit [MPa]	40
6	Maximum flow [ml]	10

Fig. 16: DataApex UNI Setup

Ruby Script

Displays the selected Ruby Script. The correct FLOMPUMPS.RB script for the **Flom AI-12 series** instrument can be found in the UTILS/UNI_DRIVERS/FLOM subdirectory (accessible through the button) of the **Clarity** installation folder (C:\CLARITY\BIN by default).

Port

Defines the communication port used, possible values dependent on the type of communication of the device and/or available ports in the PC.

AutoDetect

It is used for verifying the device communication over the serial port selected above.

Instrument Name

Allows you to set the custom name of the instrument. This name (entered into the *Value* column) will be used throughout the **Clarity** station.

Pump Number

Here you can set the number corresponding to the selected pump (from 0 to 9).

Do not Stop when Closing Instrument

The pumps will not be shut down when closing the **Clarity** Instrument if this option is ticked.

Auxiliary Pump

The selected pump will be set as an auxiliary pump when ticking this box.

Maximum High Pressure Limit [MPa].

It sets a limit to the High Pressure value set on the Method.

Maximum Flow [ml].

It sets a limit to the Maximum Flow value set on the Method.

5 Report Setup

The pump section on the method report can be enabled by checking the *Instrument Control* checkbox on the *Method* tab of the *Report Setup* dialog.

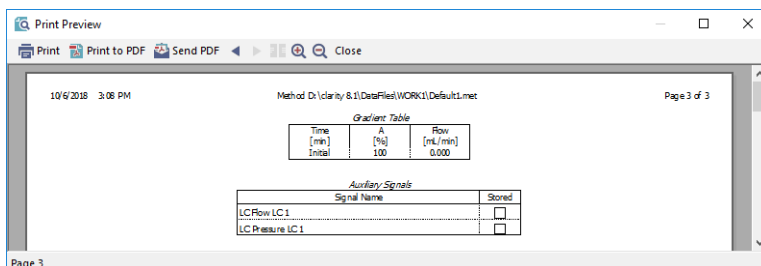


Fig. 17: Report Setup

All of the parameters set in the *Method Setup - LC Gradient* dialog are reported, as well as the custom *Pump Name* and other parameters set in the *DataApex UNI Setup* dialog. If the pump is configured as an Auxiliary Pump, the parameters set in the *Method Setup - LC* dialog are reported instead.

6 Troubleshooting

When the solution to a problem cannot be found easily, a recording of the communication between **Clarity** and the pump will significantly help **DataApex** support.

The data recording can be enabled by adding or amending the COMMDRV.INI file in the **Clarity** installation directory (C:\CLARITY\CFG by default). The file can be edited in any text editor (e.g. Notepad). The following section should be edited or added:

```
[COM1]
echo=on
textmode=on
filename=CommDrvCOM1_%D.txt
reset=off
```

Note: Instead of COM1, type the communication port used to communicate with the **Flom AI-12 series** pump. This port number is displayed when the *LC Status* button in the [Method Setup - LC](#) dialog is invoked.

Note: %D (or %d) in the filename parameter means that the log will be created separately for each day. The *reset=off* parameter disables deleting the content of the log each time the station is started during the same day.

The created *.TXT files will be of great help in the diagnosis of not documented errors and communication issues.