DataApex
Clarity™
CHROMATOGRAPHY SOFTWARE

SPARK SPH1299

Clarity Control Module   ENG

Contents

To facilitate the orientation in the **Spark SPH1299** 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.

▌**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 Spark SPH1299 control module

This manual describes the setup of the **Spark SPH1299** pump, including both the binary model (*SPH1299*) and the quaternary variant (*SPH1299Q*). The control module enables direct control of the instrument.

Fig. 1: Spark SPH1299

Note: It is recommended to check the user manual of the pump for its operating principles and restrictions.

2 Requirements

- Clarity installation with LC Control module (p/n A24).
- A communication cable according to the selected communication type:
    - Serial communication - straight DB9F-DB9M cable (p/n SK02)
    - LAN communication - LAN cross cable (p/n SK08)
    - USB communication - USB A-B cable (p/n SK06)

Note: Cables are not part of Clarity Control Module. It is strongly recommended to order required cables together with the software. The maximum recommended cable length for USB, serial, or input/output connections is 3 m.

- Free communication port in the PC, based on the type of communication used - free serial COM port in case of serial communication, free ethernet port in case of LAN communication or free USB port in case of the USB communication.

Note: Modern computers usually have only 1 (if any) serial (COM) port installed. To use more devices requiring the port, the MultiCOM adapter (p/n MC01) is available for purchase.

3 Installation Procedure

3.1 Spark SPH1299 setup - communication

Before configuring the pump in Clarity, ensure that the communication cable is properly connected between the pump and the PC according to the selected communication type (for detailed information, please see Requirements).

3.1.1 Digital Inputs and outputs

The **Spark SPH1299** pump is equipped with one I/O connector located on the rear panel of the instrument. This connector can be used for TTL input/output signals and relay output synchronization.

The pump has 2 TTL conections that can be configured to act as an input or output and 2 Relay output connections. The pin mapping is as follows:

Tab. 1: External I/O connector - pins mapping

Pin	Function	Comment
1	TTL 1 (input/output)	
2	GND	
3	TTL 2 (input/output)	
4	GND	
5	Relay output 1 (normally open)	When defined action is triggered, the Relay output is closed provided that the Relay output 1 (common) is connected together with Relay output 1 (normally open)
6	Relay output 1 (common)	
7	Relay output 2 (normally closed)	When defined action is triggered, the Relay output is opened provided that the Relay output 2 (common) is connected together with Relay output 2 (normally open)
8	Relay output 2 (common)	

3.2 Clarity Configuration

- Start the Clarity.
- Invoke the *System Configuration* dialog from the Clarity main window using the *System - Configuration…* command.
- Press the *Add* button ① (see **3.2** on pg. **4**.) to invoke the *Available Control Modules* dialog.
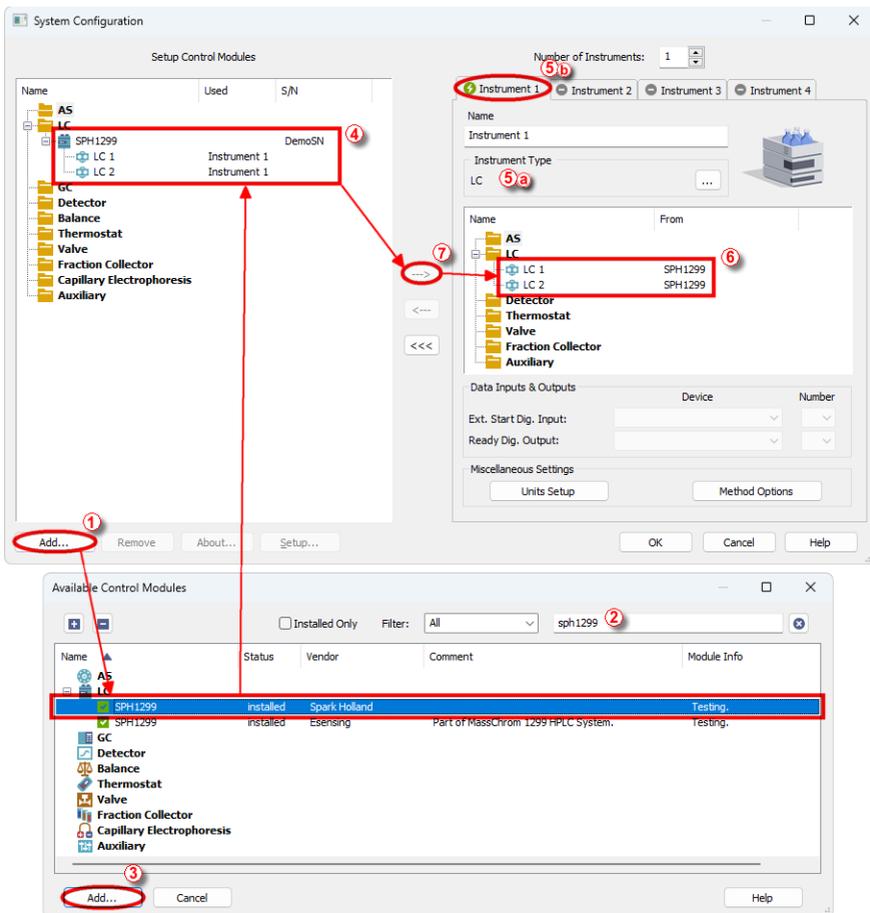
- You can specify the searching filter ② to simplify the finding of the driver.
- Select the **SPH1299** pump and press the *Add* ③ button.

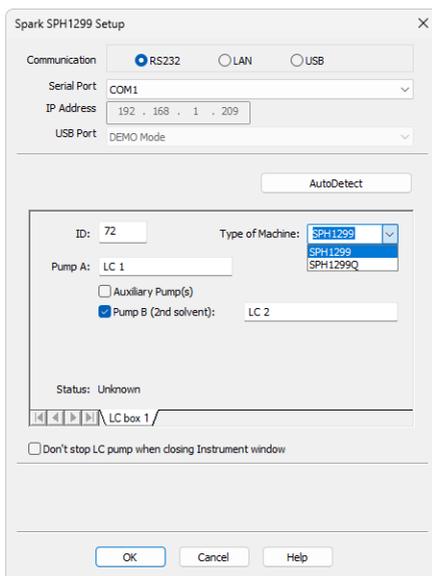The Spark SPH1299 Setup dialog will appear.

Fig. 2: Spark SPH1299 Setup

- Select the used communication type.
- Enter the appropriate communication parameters.
- Click Autodetect, to read parameters from the device.
  - If communication is successful, the *Status* row displays *Connected* together with the firmware version and serial number of the pump.
  - The device *ID* must match the identifier configured on the pump (typically set on the pump rear panel).
  - The *Type of Machine* (either the binary *SPH1299* or quaternary *SPH1299Q*) and other parameters are autodetected.

Note: The Spark SPH1299 Setup dialog is more closely described in the chapter **"Spark SPH1299 Setup"** on pg. **6**.

After successful configuration, the selected pump (*SPH1299* or *SPH1299Q*) will appert will appear in the *Setup Control Modules* list of the *System Configuration* dialog.

- Change the *Instrument Type*⑤ ⓐ on the desired *Instrument* tab ⑤ ⓑ to LC.
- Drag pump from the *Setup Control Modules* list on the left ④ to the *Instrument* tab on the right ⑥ , or use the ⟶ button ⑦ .

4 Using the control module

New LC Gradient and LC tabs appear in the *Method Setup* dialog, enabling the setting of the *LC gradient* program.

A new *SPH1299* series pump section enabling the monitoring of the current pump state will be also created in the Device Monitor window.

4.1 Spark SPH1299 Setup

Spark SPH1299 Setup dialog (accessible through the *System Configuration* dialog) allows to manually set the parameters needed for the communication with the pump.

Fig. 3: Spark SPH1299 Setup

Communication

Specifies the communication type used to connect the pump to Clarity. The possible options are *RS232*, *LAN* or *USB*. The selection influences the fields available in the *Spark SPH1299 Setup* dialog.

Serial Port

In case of serial (RS232) communication sets the COM Port used for the communication between the pump and Clarity.

IP Address

In case of LAN communication sets the IP address of the pump connected to the computer via network.

USB Port

In case of the USB communication sets the particular USB port used to communicate with the pump.

Type of Machine

Specifies the pump model. Available options: *SPH1299* and *SPH1299Q*. The selected type must correspond to the actual pump model. Incorrect selection may result in improper configuration of solvent channels and related method parameters.

Autodetect

Checks for the presence of the pump using the selected communication parameters. The *ID* is also checked for the successful communication attempt. The result of the autodetection is then displayed in the *Status* row.

ID

Sets the device identifier of the pump. By default the *ID* is set to *72*, using *AutoDetect* the connection is tried to devices with all *ID*s though. The valid range is *70 - 79*.

Name

Sets the name of the pump.

Auxiliary Pump(s)

Auxiliary mode is available only for the binary model *SPH1299*. It configures whether the pump is used as part of the gradient or as an auxiliary pump.

If enabled:

- only one solvent is supported,
- the pump is not included in the gradient table,
- its flow and auxiliary digital output can be controlled via the Event Table,
- the auxiliary digital output can also be used as a *Ready Digital Output* in the *System Configuration* dialog.

Solvent configuration

The solvent configuration fields depend on the selected pump model.

For *SPH1299*, the second solvent is enabled using the *Pump B (2nd solvent)* option.

For *SPH1299Q*, up to four solvent channels (*Solvent A–D*) are available.

Status

Displays the result of the *AutoDetect* operation. The displayed information, in case of the successful communication attempt, includes the version of the firmware in the pump and the pump's serial number.

Don't stop LC pump when closing Instrument window

When checked, causes the pump not being stopped when the *Instrument* window is closed. Default behavior in Clarity causes all devices to be stopped when the *Instrument* window is closed.

Digital Output Names

This option is available only when the pump is configured as an auxiliary pump.

When is *Change* pressed, the *Digital Output Names* dialog is opened and can be used to assign custom names to the auxiliary digital output.
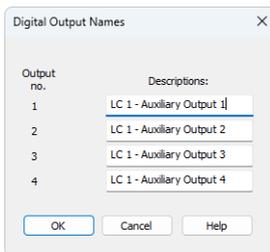
Fig. 4: Digital Output Names

Note: The initial state of the output may then be changed in the Digital Outputs of SPH1299 dialog accessible from the main Clarity window via the *System - Digital Outputs…* menu command.

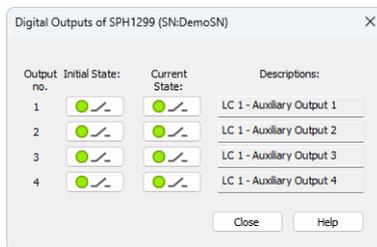## 4.1.1 Digital Outputs of SPH1299

Fig. 5: Digital Outputs of SPH1299

Serves for setting the initial and actual state of the **Spark SPH1299** pump's auxiliary output. The output is only available when the pump is set to the *Auxiliary* mode.

4.2 Method Setup

The following sections describe the individual tabs available for the Spark SPH1299 pump.

4.2.1 Method Setup - LC

4.2.1.1 Time Table

This tab defines the behavior of the digital output placed on the pump set as a part of the gradient.

For such pump, the output may only be switched during a run based on the pre-set time table. In contrast, for pumps configured as auxiliary pumps, the auxiliary output can only be controlled via the Event Table.
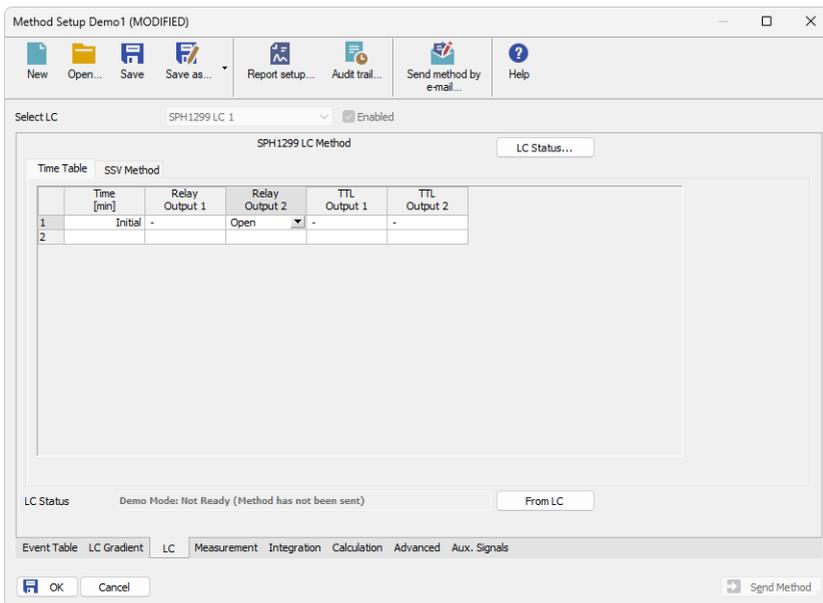
Fig. 6: Method Setup - LC - Time Table

4.2.1.2 SSV Method

This tab is available only for the binary pump model *SPH1299*.

This pump is equipped with two solvent selection valves (SSV), which can be configured in this tab.
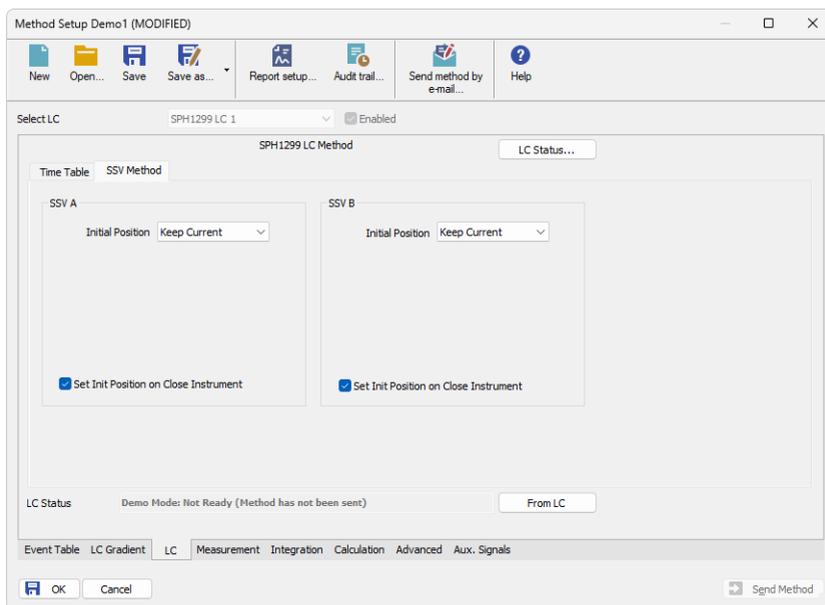
Fig. 7: Method Setup - LC - SSV Method

Initial Position

Specifies the initial position to which the valve is switched when a method is send. Possible values for the valve are: *Keep Current*, *Position 1* and *Position 2*. *Keep Current* option does not change the valve position when the method is sent.

Set Init Position on Close Instrument

When this option is checked, the valve returns to the position specified in the *Initial Position* field after the *Instrument* window is closed. When unchecked, the valve will stay in current position or move to position set in the Event Table. Default state is "checked".

4.2.2 Method Setup - LC Gradient

The *Method Setup - LC Gradient* dialog is used to define the LC instrument method. For both pump models, the dialog layout is the same; the only difference is the number of available solvent channels.
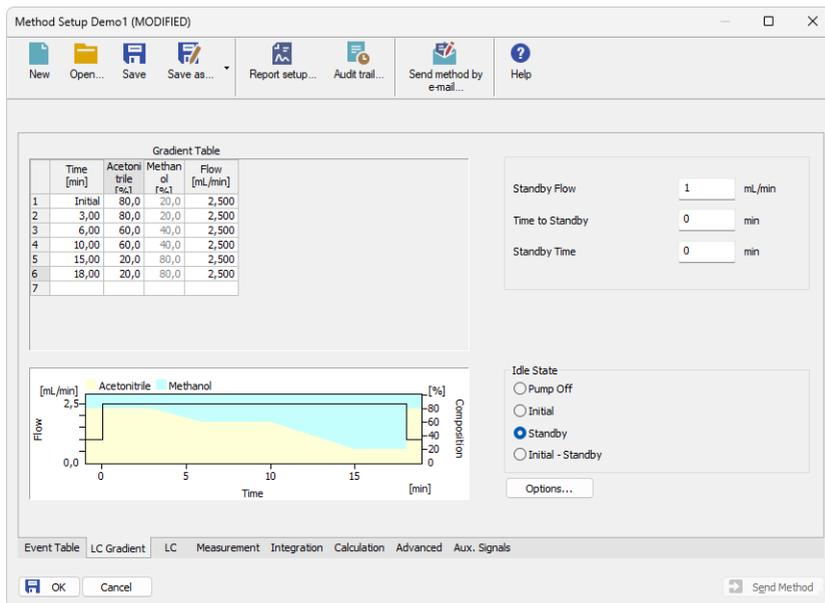
Fig. 8: Method Setup - LC Gradient

Gradient Table

Defines the composition of the mobile phase and the total flow rate as a function of time.

The table operates similarly to common spreadsheet applications (e.g. Excel). To edit a cell, click it with the left mouse button. Cells that are not available for editing are displayed with greyed-out text.

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. Between defined time points, the flow rate and solvent composition change continuously to reach the conditions specified in the next row.

XXX1 (..4) [%]

Represents the percentage of an individual solvent in the mobile phase. The number of available solvent columns depends on the selected pump model (*SPH1299*: 2 solvents, *SPH1299Q*: up to 4 solvents).

The solvent columns are labeled A, B, C, and D by default. The labels can be modified in the Gradient Options dialog).

If the total percentage exceeds 100%, the value in the last active solvent column is automatically adjusted. If the percentage in the last column is already zero, the currently edited value 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 at the time defined in the corresponding row.

Graph

The graph displays the solvent percentages as a function of time together with the overall flow rate. Data are taken over from the *Gradient Table*. Any changes in the 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

Defines the flow behavior 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*.

4.2.2.1 Gradient Options

The *Gradient Options* dialog (accessible via the *Options…* button in the Method Setup - LC Gradient dialog) allows the user to:

- customize solvent names,
- enable or disable individual solvents,
- set pressure limits to protect the hardware.

The number of configurable solvents depends on the selected pump model (*SPH1299* or *SPH1299Q*).
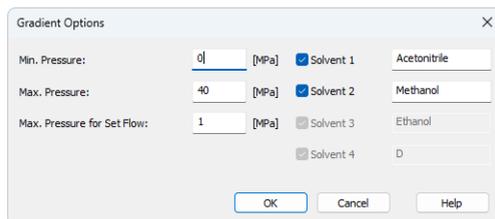

Fig. 9: Gradient Options

Min. Pressure

Sets the minimum pressure for the given pump. When pressure drops to the set value, the pump will shut down to prevent solvent leakage. The range for *Min. Pressure* values is *0 - 129* MPa.

Max. Pressure

Sets the maximum pressure for the given pump. When pressure reaches the set value, the pump will shut down to prevent hardware damage. The range for *Max. Pressure* values is *1 - 130* 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.

4.2.3 Method Setup - Auxiliary Signals

The *Method Setup – Aux. Signals* tab enables the configuration of pump flow and pressure auxiliary signals. When checked, these signals are stored in the chromatogram acquired with the method.
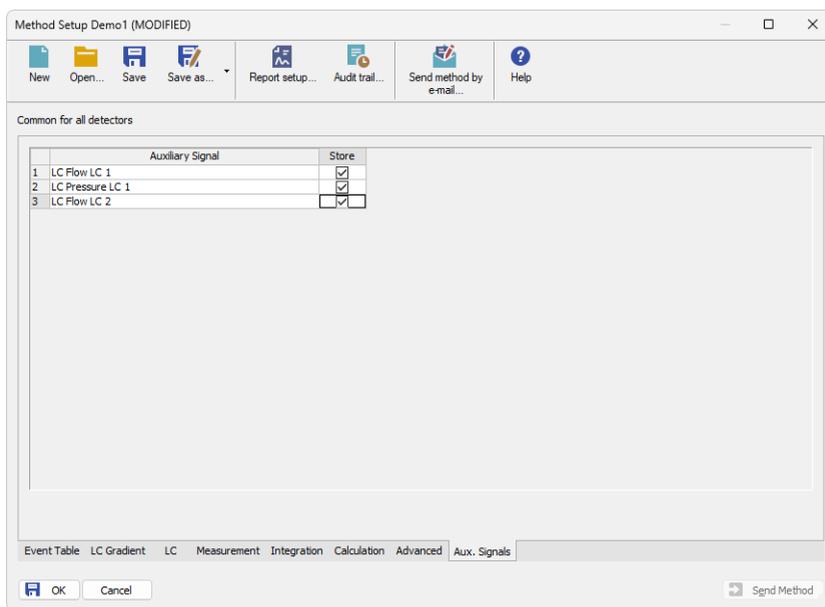

Fig. 10: Method Setup - Aux. Signals

4.2.4 Method Setup - Auxiliary Pump

This section describes the configuration and control of the pump when it is set as an auxiliary pump. The auxiliary mode is available only for the binary model *SPH1299*.

When the pump is set to auxiliary mode, the *Auxiliary Pump* tab becomes available on the *LC* tab and allows the configuration of its operating parameters.
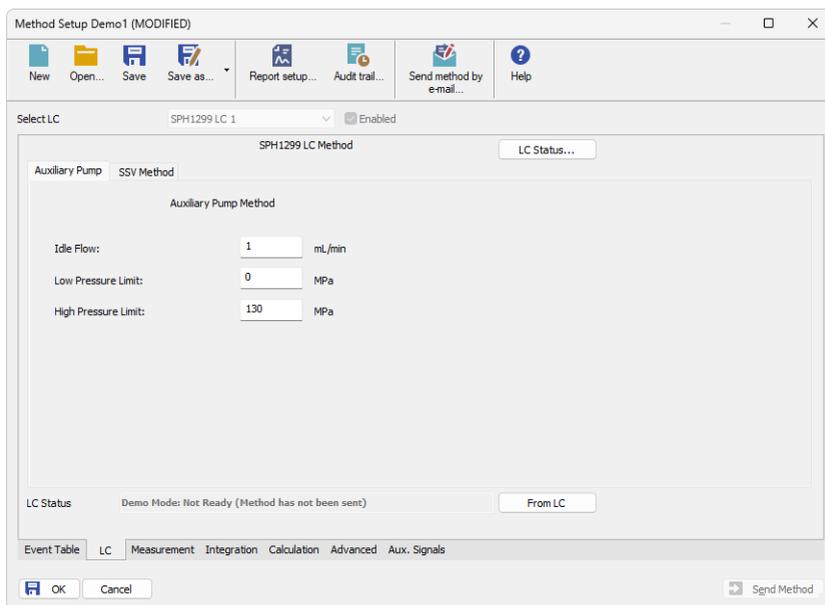
Fig. 11: Method Setup - LC - Auxiliary Pump

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.

4.2.4.1 Method Setup - Event Table

The *Method Setup - Event Table* tab allows control of an auxiliary pump during a run.

For pumps configured as auxiliary (*SPH1299* only), the following actions can be defined:

- switching the auxiliary pump flow,
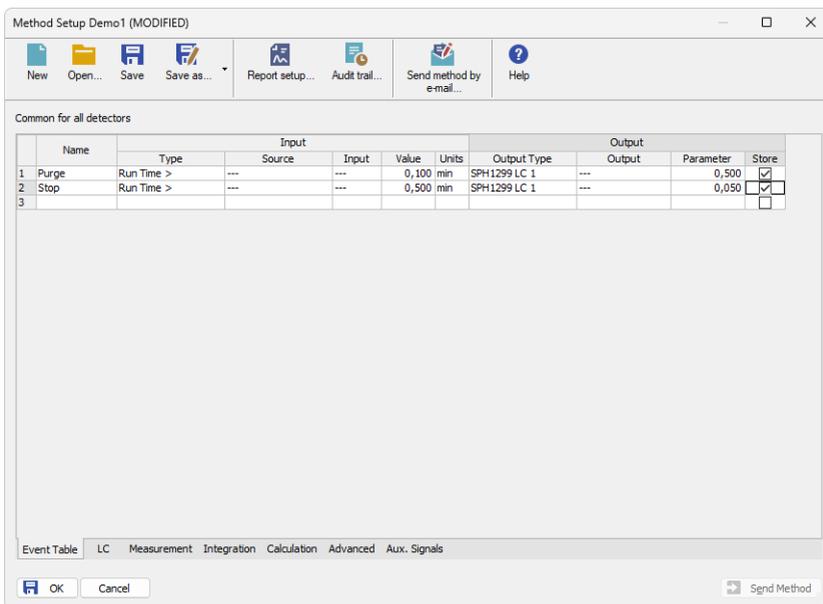- switching the auxiliary digital output.

Fig. 12: Method Setup - Event Table

4.3 Hardware Configuration

The *Hardware Configuration* dialog (accessible from *Method Setup - LC* tab via the *LC Status* button) displays instrument-level information and configuration parameters of the Spark *SPH1299* pumps.

In the full version, this dialog displays pump model, data on the communication used, firmware revision and the presence of optional parts of the pumps. In the demo version the presence of the particular options can be set to demonstrate the possibilities of the pump with selected configuration.
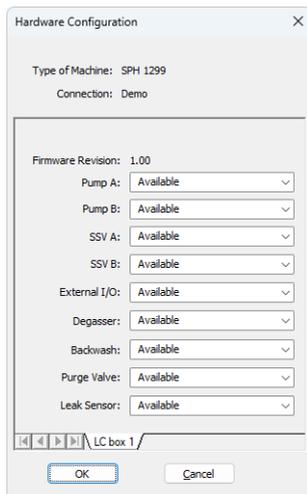
Fig. 13: Hardware Configuration

Type of Machine
  Specifies the pump model connected to the system.

Connection
  Shows the communication port as detected from the pump.

Firmware Revision
  Shows the firmware revision loaded into the pump.

Pump
  Shows pumps available.

SSV
  Shows whether the pump is equipped with the solvent selection valve option.

External I/O
  Shows whether the pump is equipped with the I/O connector for hardware synchronization.

Degasser
  Shows whether the pump is equipped with the degasser option.

Backwash
  Shows whether the pump is equipped with the backwash option.

Purge Valve
  Shows whether the pump is equipped with the Purge Valve.

Leak Sensor
  Shows whether the pump is equipped with the Leak Sensor.

4.4 Device Monitor

The *Device Monitor* dialog provides real-time control and status information for the pump. It can be opened from the *Instrument* window using the *Monitor - Device Monitor* command or by clicking on the *LC Monitor* icon.

4.4.1 Device Monitor - LC Monitor

For pumps operating as part of the gradient, the *Device Monitor* displays the current flow, pressure, and gradient status information.
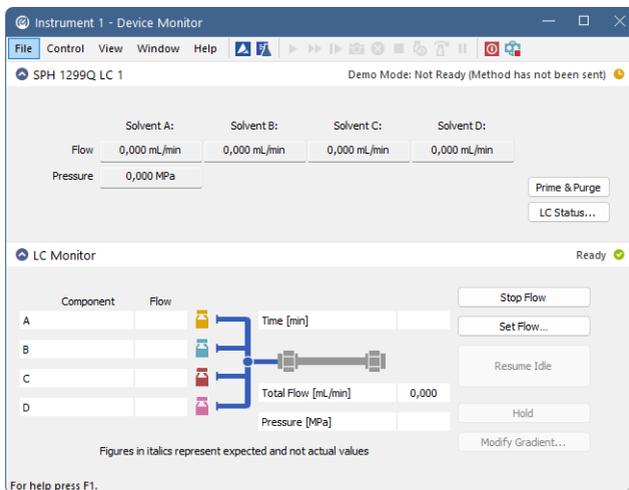

Fig. 14: Spark SPH1299 Device Monitor

Stop Flow

Stops the pump immediately. The analysis run continues and must be stopped separately using the *Stop* or *Abort* command.

Set Flow...

Opens the *Set Flow* dialog, allowing the user to set custom total flow and solvent ratios. The *Max. Pressure* field in this dialog allows temporary override of the pressure limit defined in Gradient Options.
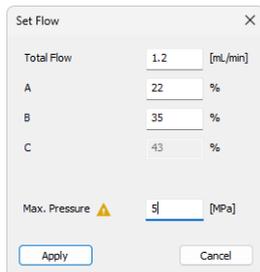
Fig. 15: Set Flow

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 temporary modification of flow and mobile phase composition during an active run.

Flow A; Flow B; Flow C; Flow D

Displays the flow on pump solvents. The values are read out from the pump over communication line.

Pressure

Displays the pressure on the pump pressure reader.

SSV A; SSV B

Allows to switch the *SSV* valve *A* or *B* in the pump (if present) to the desired position. This action can only be performed outside of the analysis run and is available only for the binary pump model.

Prime & Purge

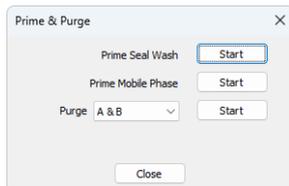Opens the *Prime & Purge* dialog serving to operate the pump outside of the run:

Fig. 16: Prime & Purge

The dialog allows

- *Prime Seal Wash*
- *Prime Mobile Phase*

- *Purge*

Each operation runs for a predefined time (*25s* for *Prime Seal Wash*, *95s* for *Prime Mobile Phase* and *120s* for *Purge*) and can be stopped manually using the *Stop* button. Both *Prime* and *Purge* command allows to set the solvents to be primed/purged using the drop-down menu, *A*, *B*, *C* and *D* and *A, B, C & D* variants are possible.

LC Status

Displays the Hardware Configuration dialog for the pump.

4.4.2 Device Monitor - Auxiliary Pump

Auxiliary pump has its own *Device Monitor* dialog displaying the actual flow and pressure on the device. This separate monitor mimics the operations of *Stop Flow*, *Set Flow*, *Resume Idle*, *SSV A* (or *B*), *Prime & Purge* and *LC Status* from the gradient *Device Monitor*, but can also be used during the analysis run.
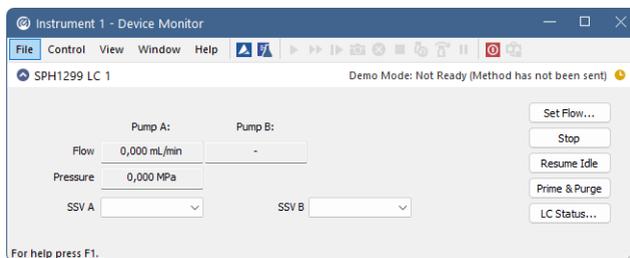

Fig. 17: Device Monitor - Auxiliary pump

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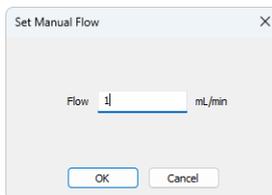

Fig. 18: Set Manual Flow - SPH1299 Auxiliary pump

4.4.3 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.
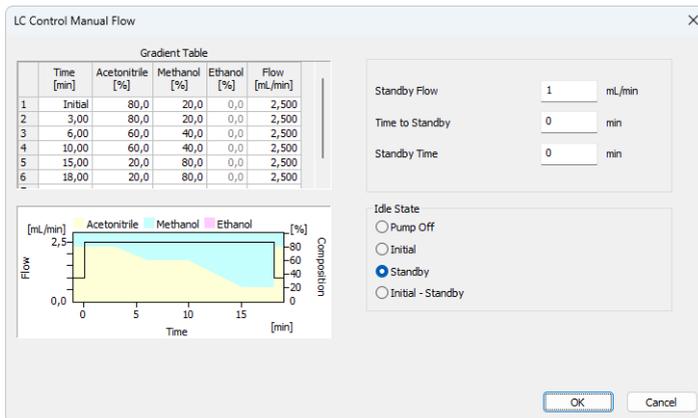
Fig. 19: LC Control Manual Flow dialog

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.

5 Report Setup

All pump-specific settings (that means the data from both sub-tabs of the *Method Setup - LC* tab) and gradient-specific settings (from the Method Setup - LC Gradient tab) are reported as a part of the data displayed by the use of *Instrument Control* checkbox of the **Report Setup - Method** dialog.

Fig. 20: Spark SPH1299 report preview

6 Troubleshooting

When the remedy for some problem cannot be discovered easily, the recording of communication between Clarity and the pump can significantly help the **DataApex** support to discover the cause of the problem.

The 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). Following section should be edited or added:

> [COM1]
> echo=on
> textmode=on
> filename=Spark_SPH1299_%D.txt
> reset=off

Note: Instead of COM1 type the correct port used to communicate with the **Spark SPH1299** pump. This information is displayed when the *LC Status* button in the Method Setup - LC dialog is invoked or in the Spark SPH1299 Setup dialog.

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 greatly help in diagnosis of unrecognized errors and problems in communication. Note that the file size may be quite significant, so in case the error occurs on a regular basis, it might be better to set the Reset=on, start Clarity, invoke the error, close Clarity and send the diagnostics file (the file will be once more reset during the next start of Clarity).

6.1 Specific Problems

▌ **An error message "Cannot establish communication with …" appears when opening Clarity Instrument.**

Solution: Check the power cable (**Spark SPH1299** pump must be switched on), communication cable and communication settings in the Spark SPH1299 Setup dialog.