DataApex
Clarity™
CHROMATOGRAPHY SOFTWARE

HITACHI LACHROM ELITE

Clarity Control Module ENG

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To facilitate the orientation in the **Hitachi LaChrom Elite** manual and **Clarity** chromatography station, different fonts are used throughout the manual. Meanings of these fonts are:

Instrument (blue text) marks the name of the window to which the text refers.

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 (when you already are in the topic describing the window).

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

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

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 Hitachi LaChrom Elite Control module

This manual describes the setting of the **Hitachi LaChrom Elite** HPLC system. The control module enables direct control of the instrument over the USB port.

Fig 1: Hitachi LaChrom Elite

This control module operates the whole system (including detectors, autosampler, column ovens, etc.), not just the pump. Direct control means that the system can be completely controlled from the **Clarity** environment. Instrument method controlling the analysis conditions will be saved in the measured chromatograms.

Clarity can currently control following modules:
Pumps: L-2100 SMASH, L-2130 HTA
Detector: L-2400 UV
Autosampler: L-2200
Column Oven: L-2300
The number of controlled modules continues to extend, for up to date list see the web site www.dataapex.com.

2 Requirements

- **Clarity** installation CD ROM with **LC control** module (p/n A24) allowed. Other parts of the system may need other modules or extensions, namely the autosampler will need the **AS control** module (p/n A26).
- **Hitachi LaChrom Elite** control module is not part of the *Typical* installation. Please check the module in the *LC* section in the component selection during the installation of **Clarity**.

Note: Cables are not part of the **Clarity** Control Module. If you don't have the USB cable for connecting the Interface Board with the PC, you can order it as p/n SK06.

Caution: **USB-IF Board** supplied by the system manufacturer (P/N 890-0709) must be installed in one of the modules. This board is connected to the computer over the USB port.

Caution: On **Windows XP SP3** the latest supported **Clarity** version is **7.4.1**. In **Windows 7**, **8.1** and **10**, in some cases, the initialization of the communication with the devices has very long period (in hours). This affects the *Autodetect* function in the Setup dialog and opening the Instrument window. Then the control module is working correctly.

3 Hitachi LaChrom Elite installation

Hitachi LaChrom Elite is not part of the **Clarity** Typical installation. To install it, select the *Full* installation or select the *Hitachi LaChrom Elite* in the *Choose Components* window.

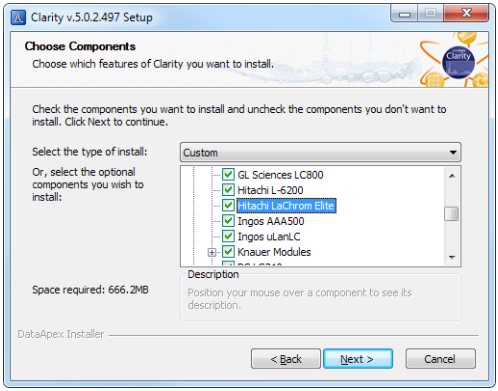

Fig 2: Selecting the Hitachi LaChrom Elite in the Choose Components window

3.1 Hitachi LaChrom Elite communication

Caution: **Hitachi LaChrom Elite** system can communicate with only one Instrument of **Clarity** Chromatography Station.

Note: Despite that it is possible to configure up to 2 **Hitachi LaChrom Elite** systems on two different Instruments always just one of them will communicate with **Clarity** at the moment. It is necessary to set the switch on the first **USB-IF Board** to *Sys1* and on the second one to the *Sys2*. Consult the **USB-IF Board** manual.

3.2 Clarity Configuration

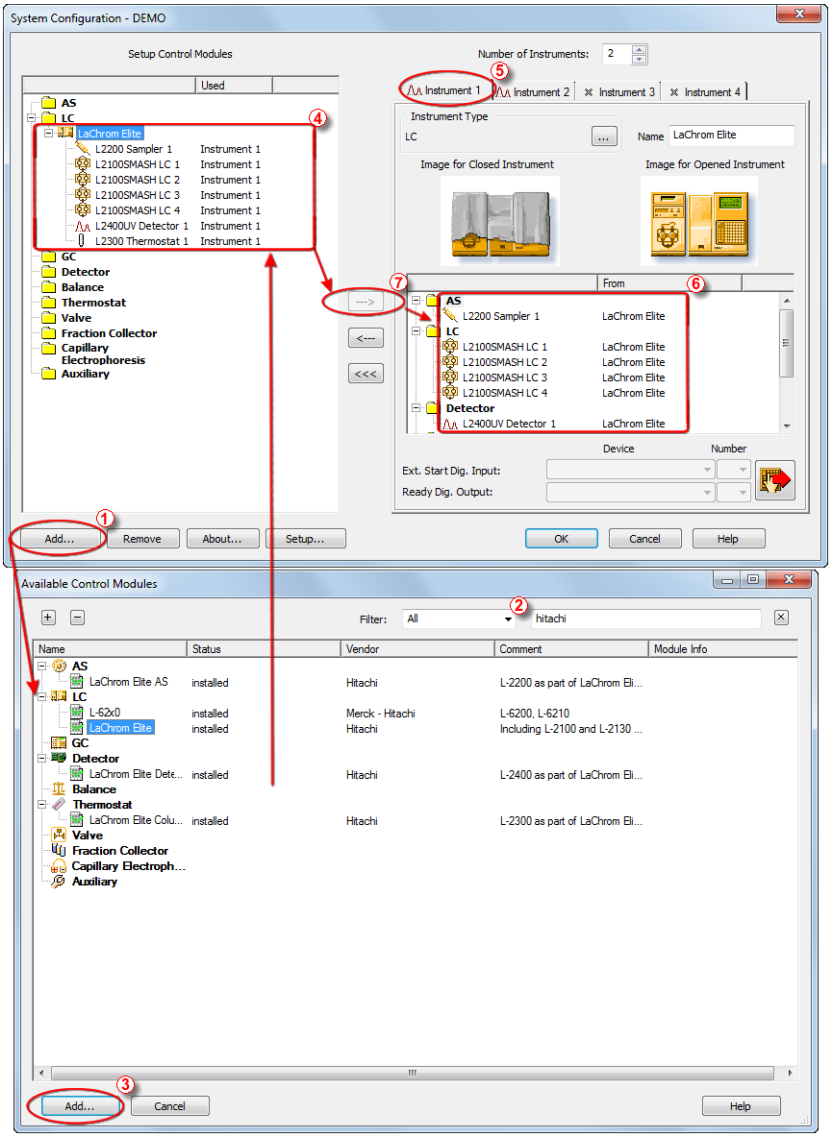

Fig 3: Adding Hitachi LaChrom Elite module

- Press the *Add* button ① in the System Configuration dialog to invoke the Available Control Modules dialog.

- You can use the filter ② to simplify the searching of the control module.
- Select the *LaChrom Elite* and click the *Add* ③ button. The Hitachi LaChrom Elite Setup dialog will appear.

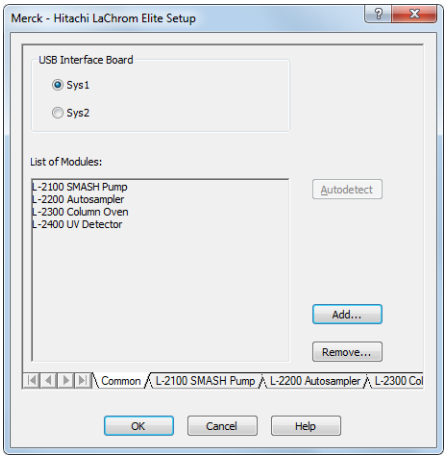

Fig 4: Hitachi LaChrom Elite Setup

- Select proper *USB Interface Board* and by clicking the *Autodetect* button all modules are detected including the *Serial* and *Program Numbers* of the modules. Alternatively you can click the *Add…* button and add the available modules manually. Each module will add its own tab to the Hitachi LaChrom Elite Setup dialog. It will be described in the manual later.

- After clicking the *OK* button, the **Hitachi LaChrom Elite** item ④ will appear in the *Setup Control Modules* list of the System Configuration dialog.
- Set the *Instrument Type* on the desired Instrument tab ⑤ to **LC**.
- Drag the LC chromatograph icon from the *Setup Control Modules* list on the left side to the desired *Instrument* tab ⑤ on the right side ⑥, or use the ---> button ⑦ to do so.

4 Using the control module

Several new tabs appear in the Method Setup dialog, based on the settings performed in the Hitachi LaChrom Elite Setup dialog. These new tabs enable the setting of the **Hitachi** system operation program.

Note: The instrument method is always sent to the **Hitachi LaChrom Elite** as a whole.

4.1 Hitachi LaChrom Elite Setup - Common

The *Common* tab serves for configuration of the communication with the **Hitachi LaChrom Elite** system and for adding its modules you want to control.

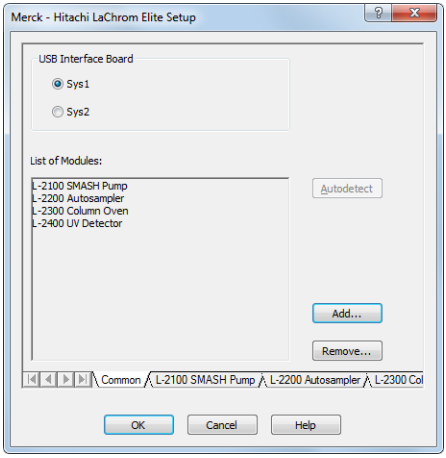

Fig 5: Hitachi LaChrom Elite Setup - Common tab

USB Interface Board

Depending on the switch configured on the **USB-IF Board** in the **Hitachi LaChrom Elite** system, this options allow to select the matching *Sys1* or *Sys2* setting.

List of Modules

Shows the list of modules autodetected or manually added to the setup.

Autodetect

When used, this button automatically detects modules and their serial and program numbers installed in your **Hitachi LaChrom Elite** system and lists them in the *List of Modules* section.

Add...

Opens the Add Module dialog, which is used to select the added *Module Type* together with the *Serial Number* and *Program Number*. The added

module is then listed in the *List of Modules* and has its own tab in the lower part of the Hitachi LaChrom Elite Setup dialog.

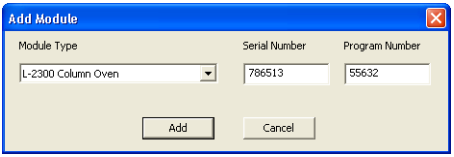

Fig 6: Add Module dialog

Remove...

Open the Remove Module dialog, which is used to select the removed *Module Type*.

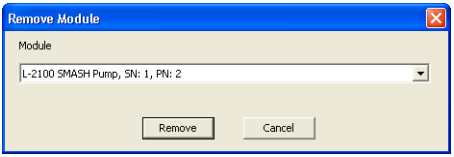

Fig 7: Remove Module dialog

4.2 Pump

The Method Setup - LC Gradient tab serves for setting the gradients of the pumps configured in the Hitachi LaChrom Elite Setup - SMASH/HTA Pump dialog.

4.2.1 Hitachi LaChrom Elite Setup - SMASH/HTA Pump

This tab of the Hitachi LaChrom Elite Setup dialog allows to set the parameters of the SMASH or HTA pump. Both of the pumps have the same options in their tabs. The only one difference between these pumps is in the maximum flow rate. Please, see the manual of the pump.

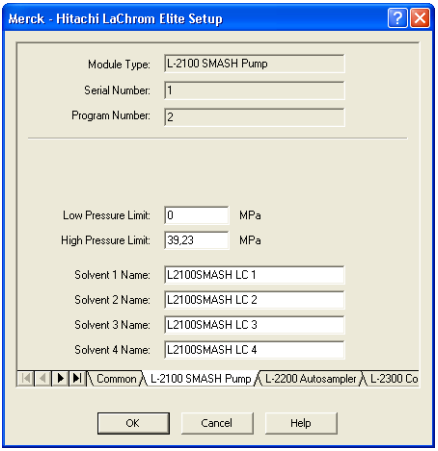

Fig 8: Hitachi LaChrom Elite Setup - SMASH/HTA Pump

Module Type

Displays the *Module Type* you have added. The *L-2100 SMASH* Pump or the *L-2130 HTA Pump* is possible.

Serial Number

Displays the Serial Number you have entered for the module.

Program Number

Displays the Program Number you have entered for the module.

Low Pressure Limit

Lower pressure limit. Number entered will be sent to the pump and checked by the pump firmware.

High Pressure Limit

Upper pressure limit. Number entered will be sent to the pump and checked by the pump firmware.

Solvent 1 (...4) Name

Change names for the particular solvent.

4.2.2 Method Setup - LC Gradient

The Method Setup - LC Gradient dialog serves for setting up the LC instrument method.

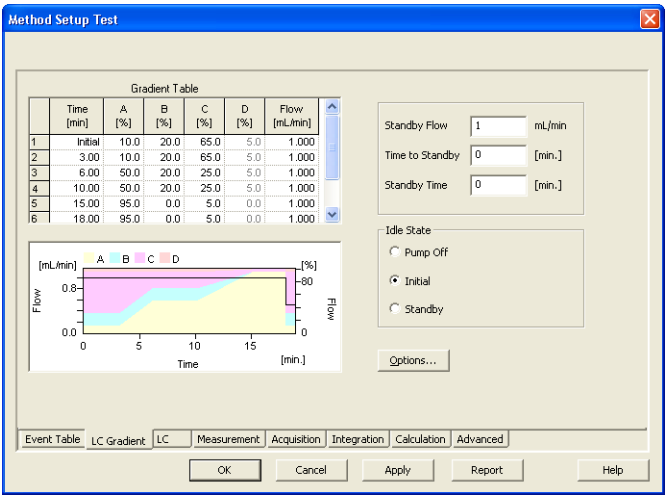

Fig 9: Method Setup - LC Gradient

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.

Caution: The maximum flow may vary according to the pump type you have installed. Check the pump's manual.

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 mixing ratio, the one on the right to the overall flow rate.

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.

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

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.

The abovementioned pressure limits are checked in the software. Pressure check for low pressure limit doesn't start immediately after pump is started, but with few minutes delay. During this delay the pressure in chromatographic system can stabilize.

In addition to those limits, a pressure limits are set in the Hitachi LaChrom Elite Setup - Pump dialog. Those limits are checked in the pump firmware. As they will cause a system error, they should be set outside the limits defined here in the Gradient Options dialog.

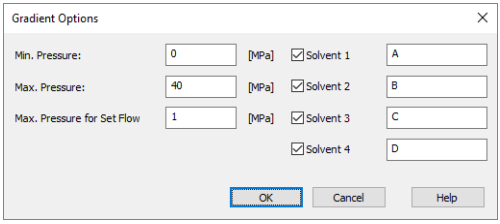

Fig 10: Gradient Options

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.

Max. Pressure

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

Note: *Min. Pressure* and *Max. Pressure* for the **Hitachi LaChrom Elite** pumps vary in certain range according to the type of the pump and valves used. Check the device manual for valid values for your pump.

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 - Advanced

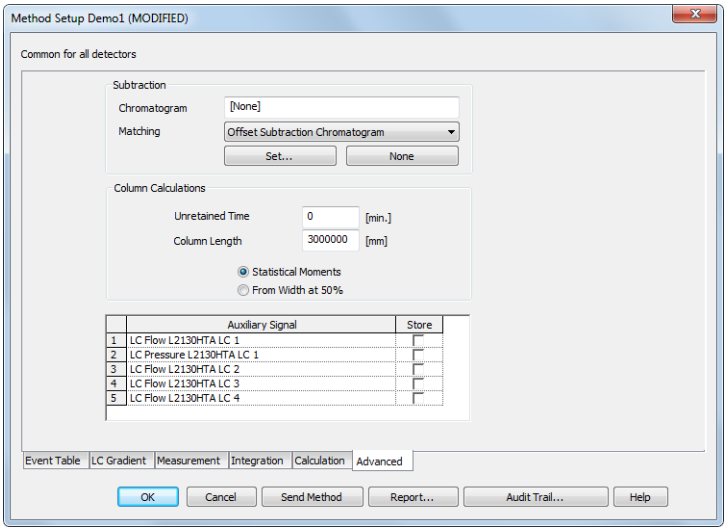

Fig 11: Method Setup - Advanced

Hitachi LaChrom Elite provides the pump flow and pressure auxiliary signals for use in **Clarity**. To save the auxiliary signals into each chromatogram measured according to the given method, check the particular checkbox in the lower section of the Method Setup - Advanced dialog.

4.2.4 Device Monitor

The pump status dialog can be invoked by the *Monitor - Device Monitor* command from the Instrument window or using the LC Monitor icon. It displays the actual flows of particular solvents, as well as the total flow, the total pressure and the analysis time.

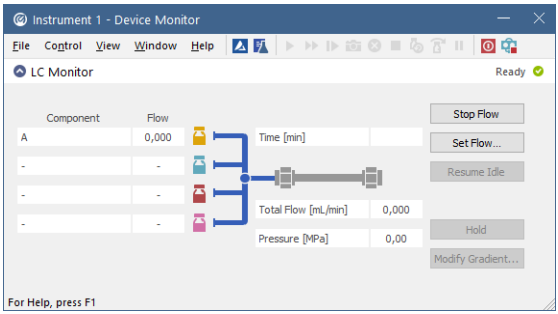

Fig 12: LC Monitor

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* allows to set a different pressure than set in the "Gradient Options" on page 12 of a given method.

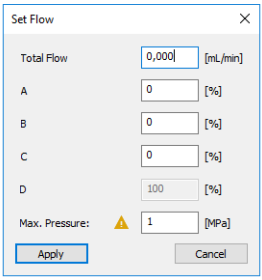

Fig 13: Set Flow

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.

4.2.4.1 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.

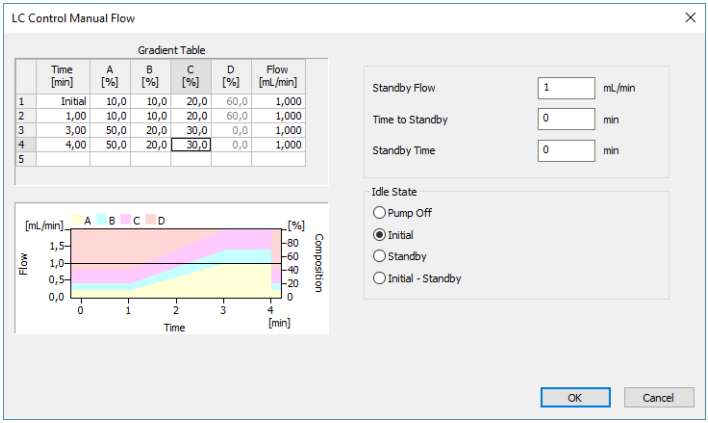

Fig 14: LC Control Manual Flow dialog

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.

4.2.5 Report Setup

All of the pump settings accessible on the Method Setup - LC Gradient tab and in the Gradient Options dialog are reported, if the pump is configured as the part of the gradient. To do so, the *Instrument Control* parameter on the Method tab of the Report Setup dialog must be checked.

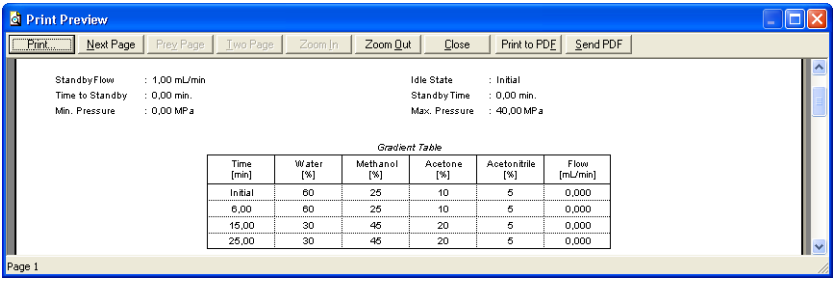

Fig 15: Report - pump part of the gradient

4.3 Autosampler

The autosampler used with the **Hitachi LaChrom Elite** allows for automated injection of samples. This can only be performed from the Sequence window, not from the Single Analysis dialog (where it is impossible to specify from which position the injection will be performed).

4.3.1 Hitachi LaChrom Elite Setup - Autosampler

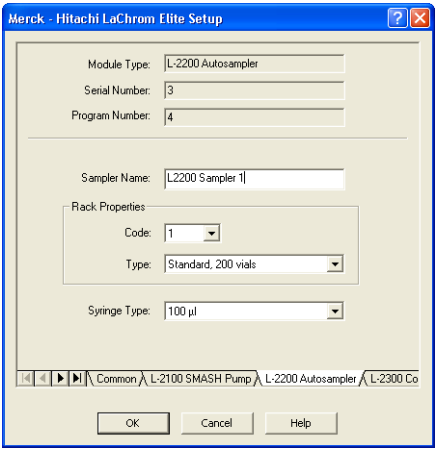

Fig 16: Hitachi LaChrom Elite Setup - Autosampler

Module Type

Displays the *Module Type* you have added. The *L-2100 SMASH* Pump or the *L-2130 HTA Pump* is possible.

Serial Number

Displays the Serial number you have entered for the module.

Program Number

Displays the Program Number you have entered for the module.

Sampler Name

Sets the name of the autosampler.

Rack Properties

Code

Sets the proper code of the rack.

Type

Sets the proper type of the rack.

Syringe Type

Sets the proper type of the syringe depending on its volume.

4.3.2 Method Setup - AS

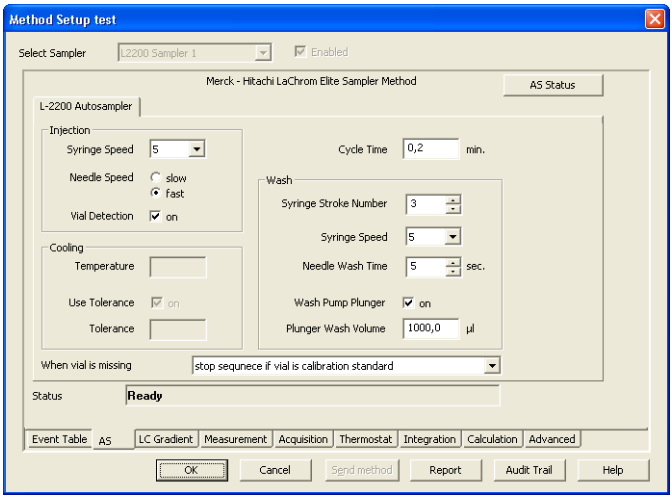

Fig 17: Method Setup - AS

Injection

Syringe Speed
Sets the speed of the syringe.

Needle Speed
Sets the speed of the needle.

Vial Detection
Checks whether the vial is in the position or not.

Cooling
This section is enabled, if the autosampler have installed the Thermo Unit.

Temperature
Sets the target temperature of the cooling.

Use Tolerance
Sets whether to use the tolerance.

Tolerance
If the *Use Tolerance* is checked, sets the tolerance.

Cycle Time
Sets the cycle time for analysis of one vial. After the Cycle Time is finished, the autosampler is ready for next vial analysis.

Wash
Parameters used during the washing.

Syringe Stroke Number
Sets the stroke number of the syringe.

Syringe Speed
Sets the speed of the syringe.

Needle Wash Time
Set the period of washing time of the needle.

Wash Pump Plunger
Sets whether to wash the plunger.

Plunger Wash Volume
Volume for plunger washing.

When vial is missing
Sets the behavior when the vial is missing.

4.3.3 Device Monitor

The Device Monitor window can be invoked by the *Monitor - Device Monitor* command from the Instrument window or using the Device Monitor icon. It displays the actual cooler temperature (if configured) and allows to perform the *Purge* and *Rinse* actions.

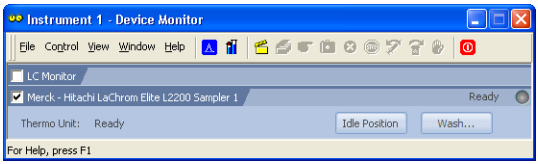

Fig 18: Device Monitor - Autosampler

Idle Position
Move the autosampler to the initial position.

Wash
Displays the Wash dialog allowing a user to wash.

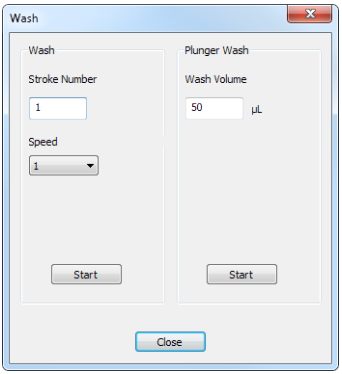

Fig 19: Wash dialog of the autosampler

Wash section

Stroke Number
Number of strokes performed when washing.

Speed
Allows to enter a number of speed between *1…5*.

Plunger wash

Wash Volume
Allows to enter volume used for plunger wash.

Start
Starts the wash or plunger wash using the entered parameters.

4.3.4 Report Setup

The autosampler settings accessible from the Method Setup - AS tab and Hitachi LaChrom Elite Setup - Autosampler dialog may also be included in the report. To do so, the *Injection Control* parameter on the Method tab of the Report Setup dialog must be checked.

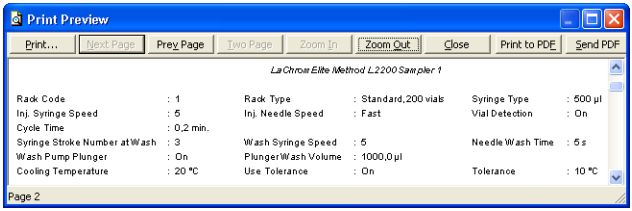

Fig 20: Report - Autosampler

The first part of the parameters is taken from the Hitachi LaChrom Elite Setup - Autosampler dialog settings, the second part contains parameters set on the Method Setup - AS tab.

4.4 Column Oven

The Method Setup - Thermostat tab serves for setting the temperature program of the analysis using the thermostat (column oven) configured in the Hitachi LaChrom Elite Setup - Column Oven dialog.

4.4.1 Hitachi LaChrom Elite Setup - Column Oven

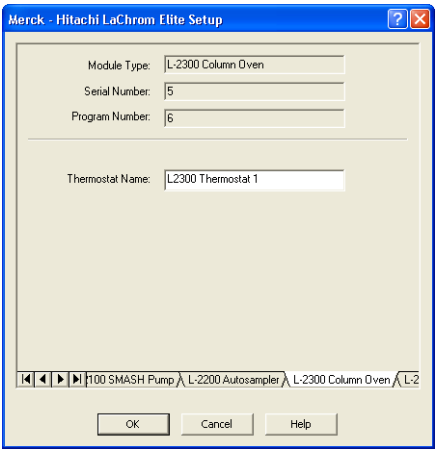

Fig 21: Hitachi LaChrom Elite Setup - Thermostat

Thermostat Name

Defines the name of the thermostat to be shown in the Method Setup dialog and on other places.

4.4.2 Method Setup - Thermostat

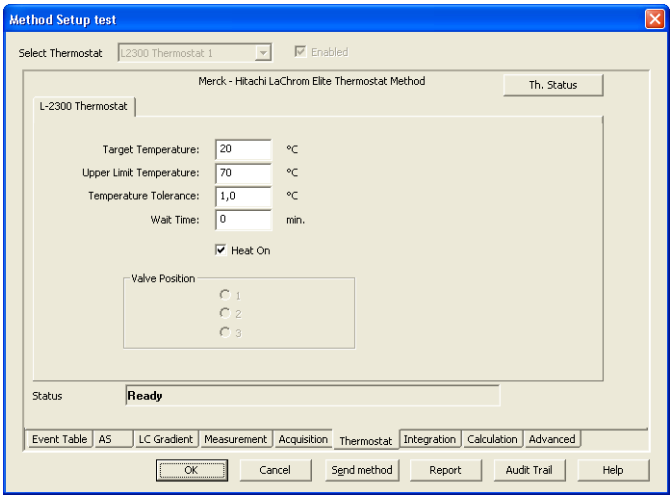

Fig 22: Method Setup - Thermostat

Target Temperature

Sets the target temperature.

Upper Limit Temperature

Sets the maximal allowed temperature. When the temperature in the thermostat exceeds the value entered here, the controller will report error and the analysis will stop.

Temperature Tolerance

The control module will not switch to the *READY* state until the actual temperature is not in the temperature tolerance and the *Wait Time* has elapsed.

Wait Time

Sets the time in min. until the Thermostat will report *READY* status.

Heat On

Swith the thermostat on/off.

Valve Position

Sets the initial position of the valves (if there are any installed).

4.4.3 Device Monitor

The Device Monitor window can be invoked by the *Monitor - Device Monitor* command from the Instrument window or using the Device Monitor icon. Thermostat Device Monitor serves for monitoring the actual thermostat temperature and allows to switch the thermostat on and off.

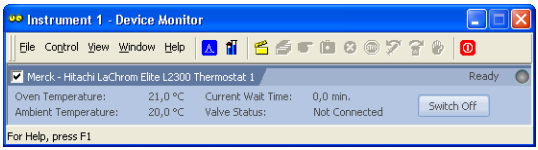

Fig 23: Device Monitor - Thermostat

Oven Temperature
Information about the oven temperature.

Ambient Temperature
Field displaying the actual thermostat temperature.

Current Wait Time
Information about the actual wait time duration.

Valve Status
Information about the valve status.

Switch On (Off)
Toggles the thermostat program (as set on the Method Setup - Thermostat tab) on and off.

4.4.4 Report Setup

Both parameters set on the Hitachi LaChrom Elite Setup - Thermostat tab (valve types used) and parameters set on the Method Setup - Thermostat tab can be printed. To do so, it is necessary to check the *Instrument Control* option on the Method tab of the Report Setup dialog.

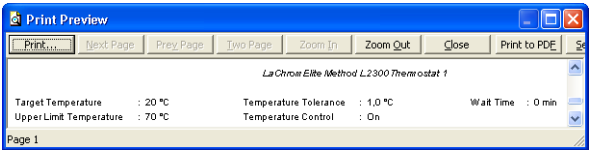

Fig 24: Report - Thermostat

4.5 UV Detector

The Method Setup - Column Oven tab and its sub-tabs serves for setting the UV Detector parameters configured in the Hitachi LaChrom Elite Setup - Column Oven dialog.

4.5.1 Hitachi LaChrom Elite Setup - Detector

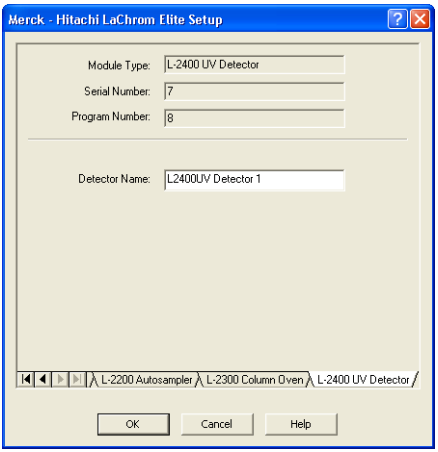

Fig 25: Hitachi LaChrom Elite Setup - UV Detector

Module Type
Displays the *Module Type* you have added.

Serial Number
Displays the Serial number you have entered for the module.

Program Number
Displays the Program Number you have entered for the module.

Detector Name
Sets the Name of the Detector.

4.5.2 Method Setup - Acquisition - Detector Settings

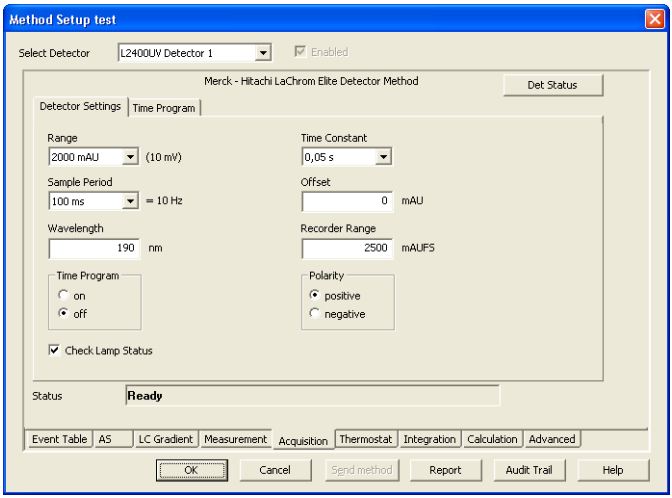

Fig 26: Method Setup - Acquisition - Detector Settings

Range
Sets the range of the detector.

Sample Period
Sets the period time in ms.

Wavelength
Sets the wavelength the detector is measuring on.

Time Program
Sets whether the Time Program is turned on/off.

Check Lamp Status
If Checked, the status of the lamp will be detected.

Time Constant
Defines the Time Constant of the detector's filter.

Offset
Sets the offset of the signal output.

Recorder Range
Sets the Recorder Range of the signal output.

Polarity
Sets whether the Polarity is positive/negative.

4.5.3 Method Setup - Acquisition - Time Program

This sub-tab allows to set the detector wavelength parameter defined on other tabs based on the analysis time.

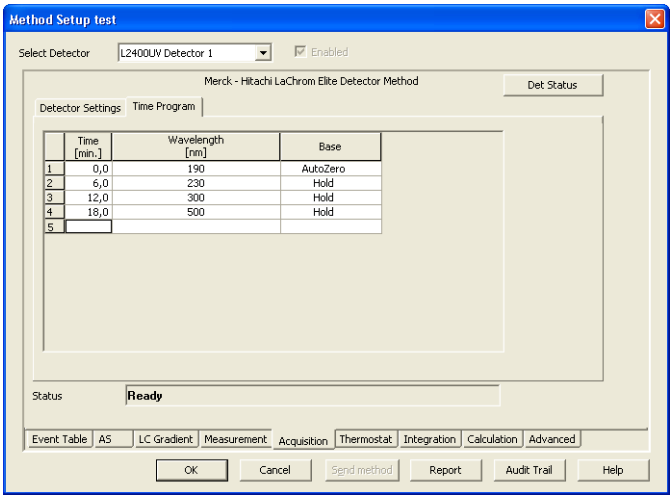

Fig 27: Method Setup - Acquisition - Time Program

Time Table

The wavelength settings defined on the Detector Settings sub-tab can be changed during the analysis by events programmed in the **Time Table**.

Time [min.]

Sets the time of the wavelength change in min.

Wavelength

Sets the wavelength which will be set in the defined time.

Base

Choose the *AutoZero* if you want to reset the Detector to zero or *Hold* if you want to keep the current value.

4.5.4 Device Monitor

The Device Monitor window can be invoked by the *Monitor - Device Monitor* command from the Instrument window or using the Device Monitor icon. It displays the actual wavelength and also allows to perform the *Zero Detector* action and switch the lamp off.

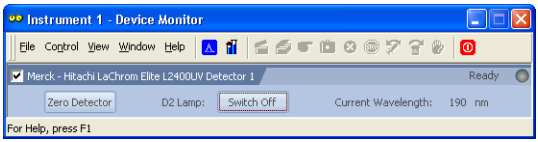

Fig 28: Device Monitor - UV Detector

It is possible to control the detector operation during the analysis in the Device Monitor window.

Zero Detector

Sets the response of the detector to *0*.

Switch On (Off)

Turns the D2 Lamp on/off.

Current Wavelength

Current wavelength retrieved from the UV Detector.

4.5.5 Report Setup

All detector settings accessible on the Method Setup - Acquisition tab (including sub-tabs) are reported if the *Instrument Control* parameter on the Method tab of the Report Setup dialog is checked.

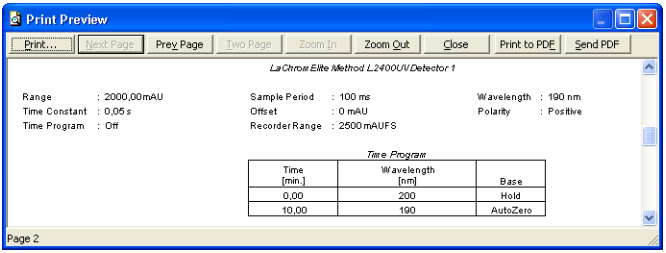

Fig 29: Report - UV Detector

Two groups of parameters are then printed, one common to all channels of a given detector, the other specific to particular channels. The first section also includes the **Time Table** from the Method Setup - Acquisition - Time Program tab. The other part of the report is the detector specific parameters.

5 Troubleshooting

It is not possible to start Acquisition from Clarity when used the detector without the included autosampler.

Solution: When used the detector itself without internal autosampler, start *Acquisition* by the external start from your autosampler (set properly *Ext. Start Dig. Input* of the detector in the **Clarity**Configuration).