DataApex
Clarity™
CHROMATOGRAPHY SOFTWARE

FC BY RHEODYNE VALVE

Clarity Control Module   ENG

Contents

To facilitate the orientation in the **FC by Rheodyne Valve** 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 FC by Rheodyne Valve Control Module

This describes the setting of the **FC by Rheodyne Valve** fraction collector. The control module enables direct control of the instrument over serial line or USB port .

Fig. 1: ***FC by Rheodyne Valve***

Direct control means that the fraction collector 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 script.

2 Requirements

- **Clarity** installation with appropriate control license allowed - LC Control (p/n A24).

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Caution: Minimal firmware version required is **Revision A**.

- Free USB port in the PC in case of the **MX II** series valves, or free COM port in case of the **Titan** series valves.

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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.

- USB A-B cable (p/n SK06) in case of the **MX II** series valves, or serial cable in case of the **Titan** series valves. This cable should be supplied by manufacturer as a part of the valve.

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Caution: The **Titan** series valves are not equipped with RS-232 interface natively, and the UART to RS-232 board has to be added to them. The cable used depends on the particular UART to RS-232 board used.

3 Installation Procedure

3.1 FC by Rheodyne Valve fraction collector communication

MX II Series valves

The **MX II Series** valves are controlled by USB communication. They use standard USB A-B cable provided by the valves manufacturer, which can be also, if it is necessary, ordered from **DataApex** company (p/n SK06).

It is not necessary to set anything in the valves configuration, but for the successful communication, the valve must be set to the remote control mode by pressing the *Remote* button on the front panel of the valve (diode next to the *Remote* button must be glowing).

Note: To connect the valve to the PC, follow the instruction in the valve's manual from the **Rheodyne** company.

Titan Series valves

The **Titan** series valves are not equipped with RS-232 interface natively and the UART to RS-232 board has to be added to them. The cable used depends on the particular UART to RS-232 board used.
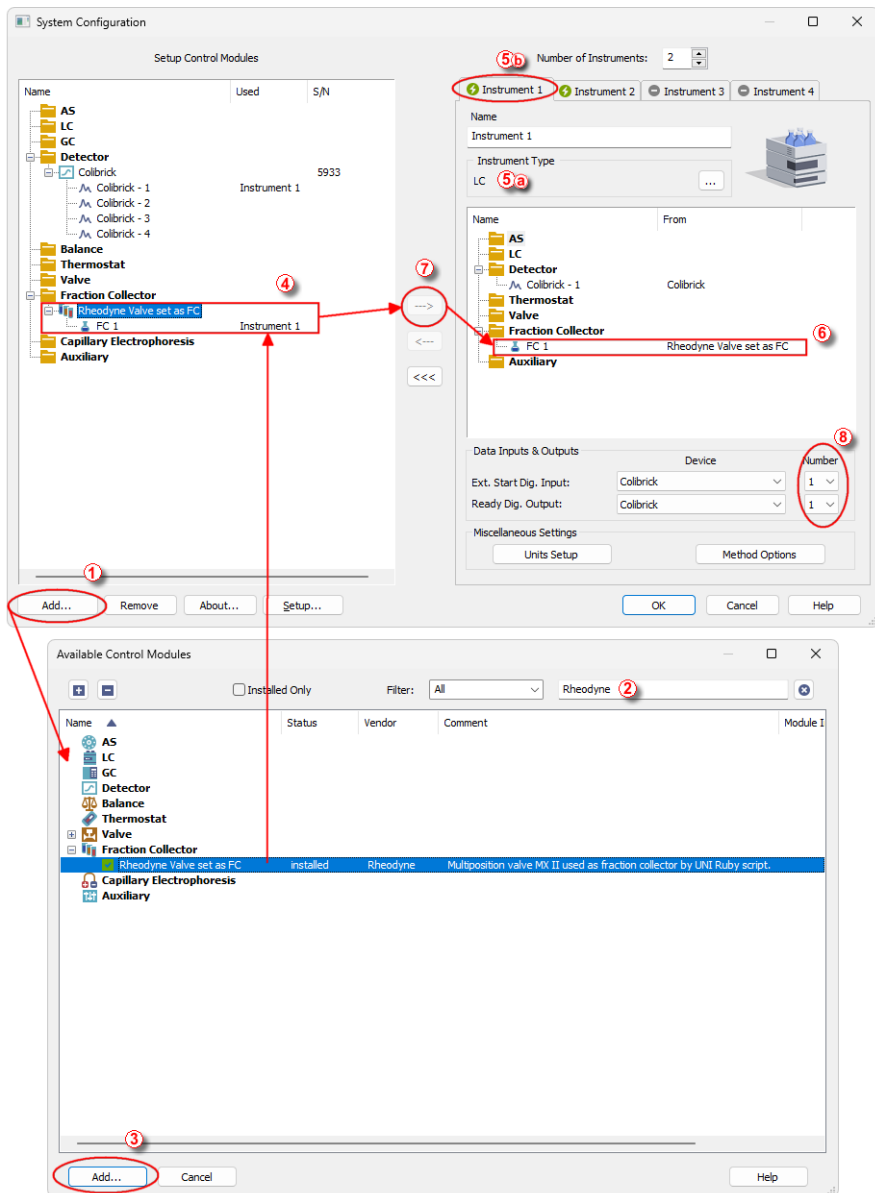
3.2 Clarity Configuration

Fig. 2: How to add FC by Rheodyne Valve

- 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. 2** 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. 2** on pg. **4**.) button. Each device with already created UNI profile should have its own item named accordingly in the *Available Control Modules* dialog.
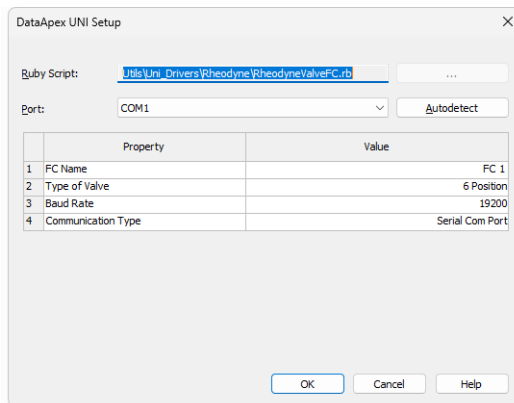- The *DataApex UNI Setup* dialog will appear.

Fig. 3: DataApex UNI Setup

- You may fill in the custom *Device Name*.

- The **FC by Rheodyne Valve** item ④ will appear in the *Setup Control Modules* list of the *System Configuration* dialog.
- Change the *Instrument Type* ⑤ ⓐ on the desired *Instrument* tab (missing or bad snippet) ⓑ to LC.
- Drag the appropriate item from the *Setup Control Modules* list on the left ④ to the *Instrument* tab on the right ⑥ , or use the ⟶ button ⑦ .
- Set the *Ext. Start Dig. Input* and *Ready Dig. Output* numbers ⑧ for your acquisition card according to the wires used for synchronization.

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 fraction collector section enabling the monitoring of the current fraction collector state will be also created in the *Device Monitor* window.

4.1 Method Setup - FC - Fraction Table

The *Method Setup - FC - Fraction Table* tab is used for setting the automatic fraction collection program of the **FC by Rheodyne Valve** fraction collector. The actions of the fraction collector can be displayed in *Data Acquisition* window or *Chromatogram* window, click the right mouse button on the graph, choose *Properties…* to open the *Graph Properties* dialog and check the *Show Events* option.
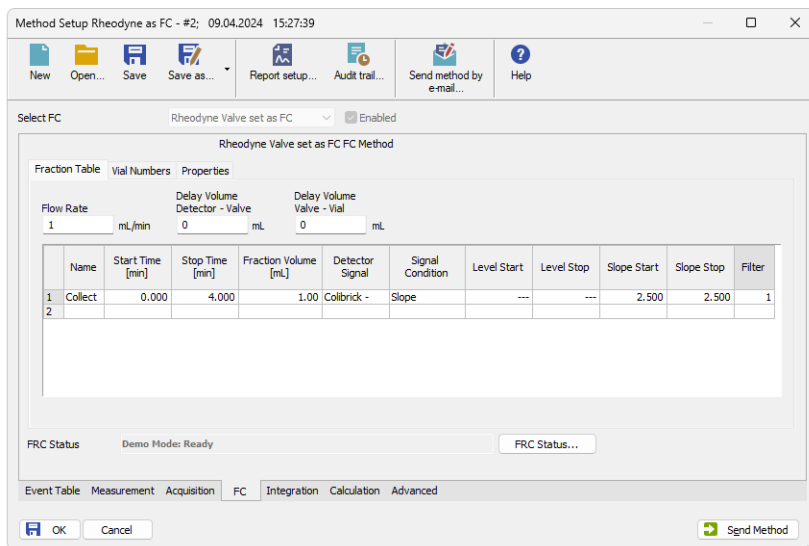

Fig. 4: Method Setup - FC - Fraction Table

Flow Rate

Sets the flow rate of the liquid phase going to the fraction collector. This parameter, together with the *Fraction Volume* parameter from the *Fraction Table*, helps to prevent collection vial overflowing. Flow rate units are taken from the Units Setup dialog.

Delay Volume Detector - Valve

Sets the volume of the tubing between the detector and waste/collect valve of the fraction collector. Volume units are devised from the *Flow Rate Units* set in the Units Setup dialog.

The delayed volume is displayed in the *Data Acquisition* window as a vertical line trailing the signal front.

Delay Volume Valve - Vial

Sets the volume of the tubing between the waste/collect valve and the vial in the fraction collector tray. Volume units are devised from the *Flow Rate Units* set in the *Units Setup* dialog. If the fraction collector has no waste/collect valve, this field should be left empty and the total tubing volume between the detector and fraction collector tray should be typed into the *Delay Volume Detector - Valve* field.

Fraction Table

Allows to set the fraction collector behavior. The table rows are run in time order, the time intervals should not overlap. If time interval on any row ends while the fraction collector is collecting, the collection will be terminated. Fraction collection based on negative peaks is not supported - in case you would like to perform such fraction collection it is necessary to invert the detector signal prior to setting up the method.

Name

This name will be displayed in the **Special Results** table for all fractions collected in the given interval.

Start Time [min]

Beginning of the time interval where the *Signal Condition* will be evaluated. See the description of *Signal Condition* below.

Stop Time [min]

End of the time interval where the *Signal Condition* will be evaluated. When the *Stop Time* is reached, the fraction collection will be terminated regardless on the current *Signal Condition* state. See the description of *Signal Condition* below.

Fraction Volume

Collected amount can be collected to one or more vials/fractions. The *Fraction Volume* value should be lower or equal to the vial volume to prevent vial overflow. If the collected volume exceeds the set value, the vial will be automatically changed. *Fraction Volume* units are devised from the *Flow Rate Units* set in the Units Setup dialog.

Detector Signal

Selects the detector used for triggering the collection of fractions according to the *Signal Condition* in the fraction table. Each row of the table can be related to a different detector signal. Only the signals that are enabled using the *Enabled* checkbox on the **Method Setup - Acquisition** tab of the particular detector will work in the *Fraction table*.

Signal Condition

Signal Condition is evaluated within time interval set for each row in the *Fraction Table*. If these conditions are met more than once in a given time interval, the fraction collection will be performed more than once swapping the vial after each collection stop. If the start conditions are not

met in the interval defined on fraction table row, the fraction collection will not occur in given time interval.

None - The fractions are collected in the defined time interval ruled by *Start Time* and *Stop Time* regardless of signal course.

Note: If the lines of the fractional table follow each other in time (Stop Time = Start Time) and *Signal Condition* is *None*for both, it would not be switched to Waste. The switch to Waste can only be skipped if the FC still has a free vial and if the Waste During option is not marked in the method Vial Change.

Level - The fraction collection:

- starts when the detector signal increases above the *Level Start*
- stops when the detector signal decreases below the *Level Stop*

Slope - The fraction collection:

- starts when the first derivative of the detector signal increases above the *Slope Start*
- stops when the first derivative of the detector signal first decreases and then increases above the negative of the *Slope Stop*. Following image displays the course of the first derivative of the signal and demonstrates *Slope Stop* activation. Read carefully the values of the slope in all *End Fraction* points and the course of the first derivative before it reaches these *End Fraction* points.
- it is necessary to know that for fraction collection stop that should caused by *Slope Stop* value is applied a multiplying coefficient 1.05 to entered slope value (entered value 0.100 recalculated to 0.105)
- this multiplication of *Slope Stop* value (i.e. inflection point on the falling edge of the peak) is applied in order to have correct end of the fraction where the *Slope Stop* condition is fulfilled
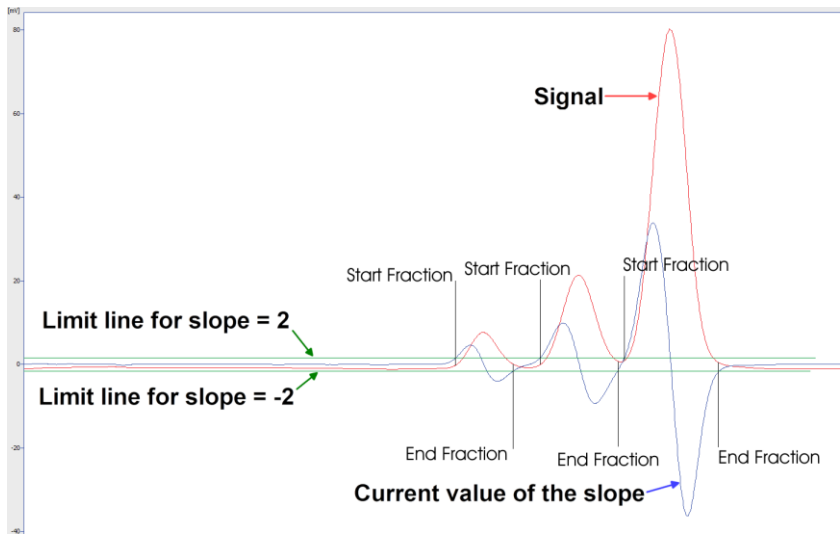- for easier understanding how *Slope Stop* value is applied in chromatogram refer to next image

Fig. 5: Fist derivate course

Note: It is strongly recommended not to use *Slope Signal Condition* for fraction collection based on noisy detector signal.

Start L+S End L+S - The fraction collection:

- starts when both start signal conditions are fulfilled simultaneously, detector signal increases above *Level Start* value and also the first derivative of the detector signal increases above *Slope Start* value. If only one of the start signal conditions is fulfilled the fraction collection will not start.
- stops when both stop signal conditions are fulfilled simultaneously, detector signal decreases below *Level Stop*value and also the first derivative of the detector signal first decreases and then increases above the negative of the *Slope Stop* value. If only one of the stop signal conditions is fulfilled the fraction collection will not stop.

Start L+S End L or S - The fraction collection:

- starts when both start signal conditions are fulfilled simultaneously, detector signal increases above *Level Start* value and also the first derivative of the detector signal increases above *Slope Start* value. If only one of the start signal conditions is fulfilled the fraction collection will not start.
- stops when any of the stop signal conditions is fulfilled (whatever occurs first), detector signal decreases below *Level Stop* value or the first derivative of the detector signal first decreases and then increases above the negative of the *Slope Stop* value. If none of the stop signal

conditions is fulfilled the fraction collection will not stop before *Stop Time* is reached.

Start L or S End L+S - The fraction collection:

- starts when any of the start signal conditions is fulfilled (whatever occurs first), detector signal increases above *Level Start* value or the first derivative of the detector signal increases above *Slope Start* value. If none of the start signal conditions is fulfilled the fraction collection does not start.
- stops when both stop signal conditions are fulfilled simultaneously, detector signal decreases below *Level Stop*value and also the first derivative of the detector signal first decreases and then increases above the negative of the *Slope Stop* value. If only one of the stop signal conditions is fulfilled the fraction collection does not stop.

Start L or S End L or S - The fraction collection:

- starts when any of the start signal conditions is fulfilled (whatever occurs first), detector signal increases above *Level Start* value or the first derivative of the detector signal increases above *Slope Start* value. If none of the start signal conditions is fulfilled the fraction collection does not start.
- stops when any of the stop signal conditions is fulfilled (whatever occurs first), detector signal decreases below *Level Stop* value or the first derivative of the detector signal first decreases and then increases above the negative of the *Slope Stop* value. If none of the stop signal conditions is fulfilled the fraction collection does not stop before *Stop Time* is reached.

Filter

Sets the data filter on the detector signal defined on the given row of the fraction table. Default value of *1* means no filtering of data will be performed, value of *X* means each X data points received will be averaged to 1 point used for fraction start/end conditions detection. The reaction to the fulfilled start/stop signal condition will be delayed the higher the *Filter* value is set, mainly on detectors with low data rate.

Note: Filter settings influence the value that should be set to the *Slope Start* and *Slope Stop* columns. To get the correct trigger value for the *Slope Start* or *Slope Stop* using the *Show Slope/Level* tool in the **Chromatogram** window, it is necessary to set the *Global Bunching* value in the **Integration Table** to the same value as the desired filter.

Note: The values coming from *Detector Signal* are evaluated in bunch approximately every 300 milliseconds with respect to Start of Stop values inserted in *Fraction Table*. It means that the positions of fraction collection Start and Stop events in consecutive chromatograms with exactly the same signal curve can differ ± 300 milliseconds. In case of usage of the detector with high sampling rate (for example 50 Hz) the difference of fraction collection events between two consecutive chromatograms with exactly the same signal curve can be up to ± 15 datapoints (50 Hz is 50 datapoints per second, thus 15 datapoints per 300 milliseconds).

4.2 Method Setup - FC - Vial Numbers

The *Method Setup - FC - Vial Numbers* tab is used for setting the behavior of the **FC by Rheodyne Valve** fraction collector.
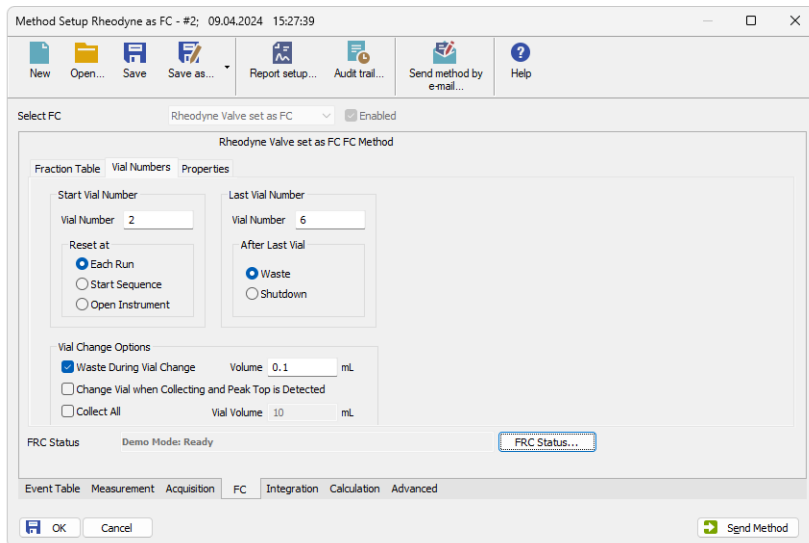

Fig. 6: Method Setup - FC - Vial Numbers

Start Vial Number

Vial Number
Sets the number of the vial where the first collected fraction will be stored. The current vial number is incremented each time the *Next* signal is activated. The vial number is stored in the *Results Table*.

Reset at
Specifies the conditions of the current vial number setting to *Start Vial Number* in three different situations:

- Each Run - the vial number is reset at the start of each acquisition.
- Start Sequence - the vial number is reset only at the start of a sequence.
- Open Instrument - the vial number is reset only once, when the Instrument is opened.

Last Vial Number

Vial Number
Sets the number of the last available vial.

After Last Vial
Specifies the action executed when current vial number exceeds the *Last Vial Number*.

- Waste - the acquisition continues, but the fraction table is ignored and the samples are automatically discarded.
- Shutdown - the acquisition is immediately stopped and the analysis aborted.

Vial Change Options

Waste During Vial Change

This option prevents spilling when the vial is changed during collection. It temporary stops the fraction collection before changing the vial and restarts it again when the vial is swapped. The vial is changed in the middle of the wasting interval; the volume wasted during vial change can be specified in the *Volume* field. Volume units are the ones set in the *Instrument Method Sending* dialog. This functionality is not applicable (even if checked) when *Collect All* option is selected.

Change Vial when Collecting and Peak Top is Detected

If enabled, the vial is automatically swapped when the peak top is detected during collection. Be aware this option is not applied if the active row in the *Fraction Table* is set to *None* in the *Signal Condition* column.

Collect All

When checked, fractions are collected during the whole course of the analysis, regardless of the settings in the *Fraction Table*. The FC module then sends the *Next Vial* command **only**, which makes this mode of operation suitable for a fraction collector without a waste position. *Collect All* mode does not permit *Waste During Vial Change*.

The maximum amount of eluent collected in a single vial is limited by the value in *Vial Volume* field. Once this volume is filled, it begins collecting into the next successive vial.

Note: With Collect All option the valve is not controlled.

Warning: Once error message "*Vial number exceeded last vial number*" is displayed, it means that the FC was already at the last position when command *Next Vial* was received. Collecting stops at position which is equal to the **Last Vial Number - 1** because it's the last possible position to collect (due to Waste). Correct appropriately your method.

4.3 Method Setup - FC - Properties

The *Method Setup - FC - Properties* tab is used for setting the waste position on the **FC by Rheodyne Valve** fraction collector.
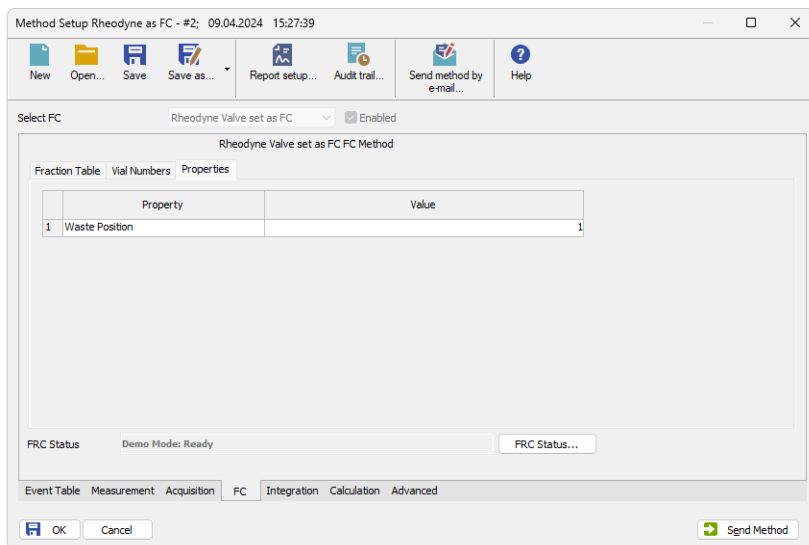

Fig. 7: Method Setup - FC - Properties

Waste Position

The Value column allows to set the port used for releasing the waste.

4.4 Hardware Configuration

The *Hardware Configuration* dialog (invoked by using the *FC Status* button from the Method Setup - LC *Method Setup - FC* Method Setup - Valves dialog) displays the configuration of the **FC by Rheodyne Valve**, namely the communication type and its parameters.
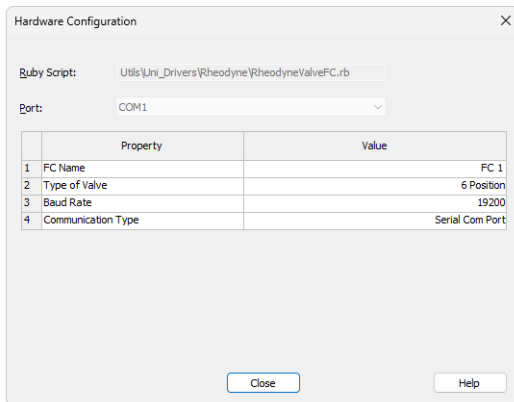
Fig. 8: Hardware Configuration

4.5 Device Monitor

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

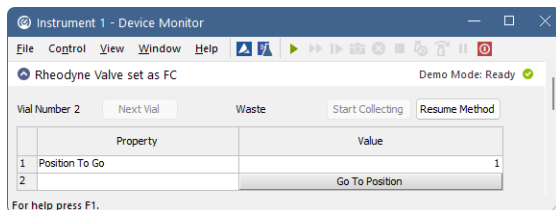### Device Monitor - Fraction Collector

Fig. 9: Device Monitor - Fraction Collector

Next Vial

Moves the collection vessel one vial forward. Using this button while the collector is performing its program set on the *Method Setup - FC - Fraction Table* tab during an analysis run immediately overrides the automatic collection program. To return to the automatic program, use the *Resume Method* button.

Start Collecting / Stop Collecting

The description on the button changes according to the state in which the fraction collector is - while it is collecting, the *Stop Collecting* button forces the fraction collector to stop collecting, while it is in a waste cycle, the *Start Collecting* button will force the collector to start collecting. Using any of the two actions while the collector is performing the program set on the *Method Setup - FC - Fraction Table* tab during an analysis run, immediately overrides the automatic collection program. To return to the automatic program, use the *Resume Method* button.

Position To Go

Allows to set the position to which the fraction collector should be switched. The switching itself is performed using the *Go To Position* button.

Note: The button only functions when the fraction collector is not wasting.

Resume Method

Resumes the actions of the automatic fraction table set on the *Method Setup - FC - Fraction Table* tab. If the fraction collector is collecting at that moment, it will start a waste cycle and then resume the function of the fraction table.
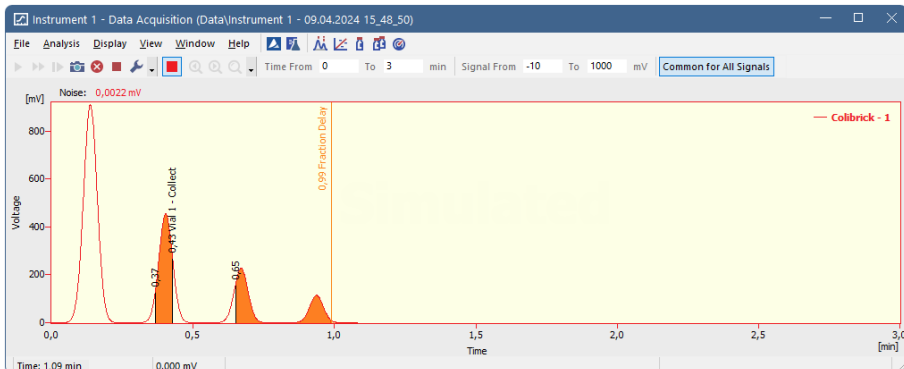
4.6 Data Acquisition window

Fig. 10: Data Acquisition window

The **Data Acquisition** window can display the fractions in the graph using the background color and also the start and stop fraction events and marker of the Fraction Delay. To see the fractions and markers right click on the graph, select *Properties…* to open the *Graph Properties* dialog and check the *Show Events* checkbox.

When the Fraction Delay is set, there will be two colors present in the graph - lighter and darker red. The lighter red color shows the expected duration of the fraction (which **Clarity** only presumes based on data points it got so far), while the darker red color shows the placement of the real fractions.

Note: The Fraction Delay in the picture will appear if the *Delay Volume* field in the *Method Setup - FC - Fraction Table* dialog is set to a nonzero value.

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.
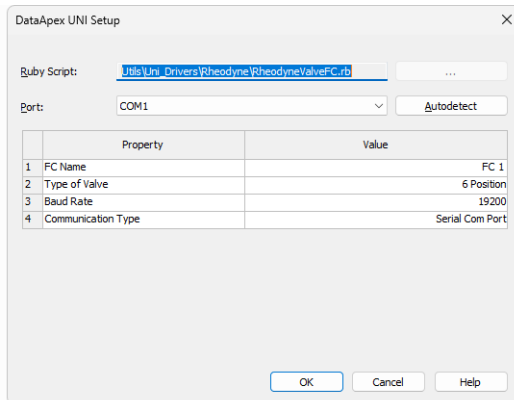

Fig. 11: DataApex UNI Setup

Ruby Script
Displays the selected Ruby Script. The correct script depends on the valve manufacturer - for **Rheodyne** valves, the RHEODYNEVALVEFC.RB script can be found in the UTILS/UNI_DRIVERS/RHEODYNE 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.

Device Type
Displays the subtype of the valve used as fraction collector.
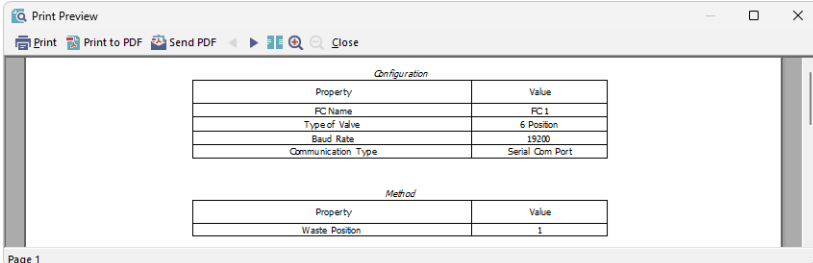
Baud Rate
Sets the Baud Rate communication parameter for the **FC by Rheodyne Valve** fraction collector. Available values are *4800*, *9600* and *19200* baud. Please note that the value set in the *DataApex UNI Setup* dialog must be the same as the one set on the fraction collector.

Communication Type
Here you can select either the Serial or USB communication protocol.

5 Report Setup

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

Fig. 12: Report Setup

All of the parameters set in the *Method Setup - FC - Fraction Table* and *Method Setup - FC - Vial Numbers* tabs are reported, as well as the custom *FC Name* and other parameters set in the *DataApex UNI Setup* dialog.

6 Troubleshooting

When the solution to a problem cannot be found easily, a recording of the communication between **Clarity** and the fraction collector 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 fraction collector. This port number is displayed when the *FC Status* button in the [Method Setup - FC](#) 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.