

FC BY UPCHURCH VALVE

Clarity Control Module

ENG

Code/Rev.: M237/100A

Date: 2025-10-22

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Contents

- 1 FC by Upchurch Valve Control Module 1**
- 2 Requirements 2**
- 3 Installation Procedure 3**
 - 3.1 FC by Upchurch Valve fraction collector communication 3
 - 3.2 Clarity Configuration 4
- 4 Using the control module 6**
 - 4.1 Method Setup - FC - Fraction Table 6
 - 4.2 Method Setup - FC - Vial Numbers 10
 - 4.3 Method Setup - FC - Properties 11
 - 4.4 Hardware Configuration 12
 - 4.5 Device Monitor 13
 - 4.6 Data Acquisition window 14
 - 4.7 DataApex UNI Setup 15
- 5 Report Setup 16**
- 6 Troubleshooting 17**

To facilitate the orientation in the **FC by Upchurch 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.

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 FC by Upchurch Valve Control Module

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

The **FC by Upchurch Valve** is controlled by the serial (RS232) or USB communication, but the exact cable type depends on the actual type of the valve. On the computer side, it bears standard DB9F connector, on the valve's side there is usually S-video connector, though this may change with the type of the valve.



Fig. 1: FC by Upchurch 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) for pumps and fraction collectors.
- Free USB or 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.

3 Installation Procedure

3.1 FC by Upchurch Valve fraction collector communication

The **FC by Upchurch Valve** is controlled by the serial (RS232) communication, but the exact cable type depends on the actual type of the valve. On the computer side, it bears standard DB9F connector, on the valve's side there is usually S-video connector, though this may change with the type of the valve.

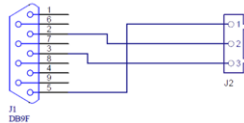


Fig. 2: DB9F-3 pin straight cable

3.2 Clarity Configuration

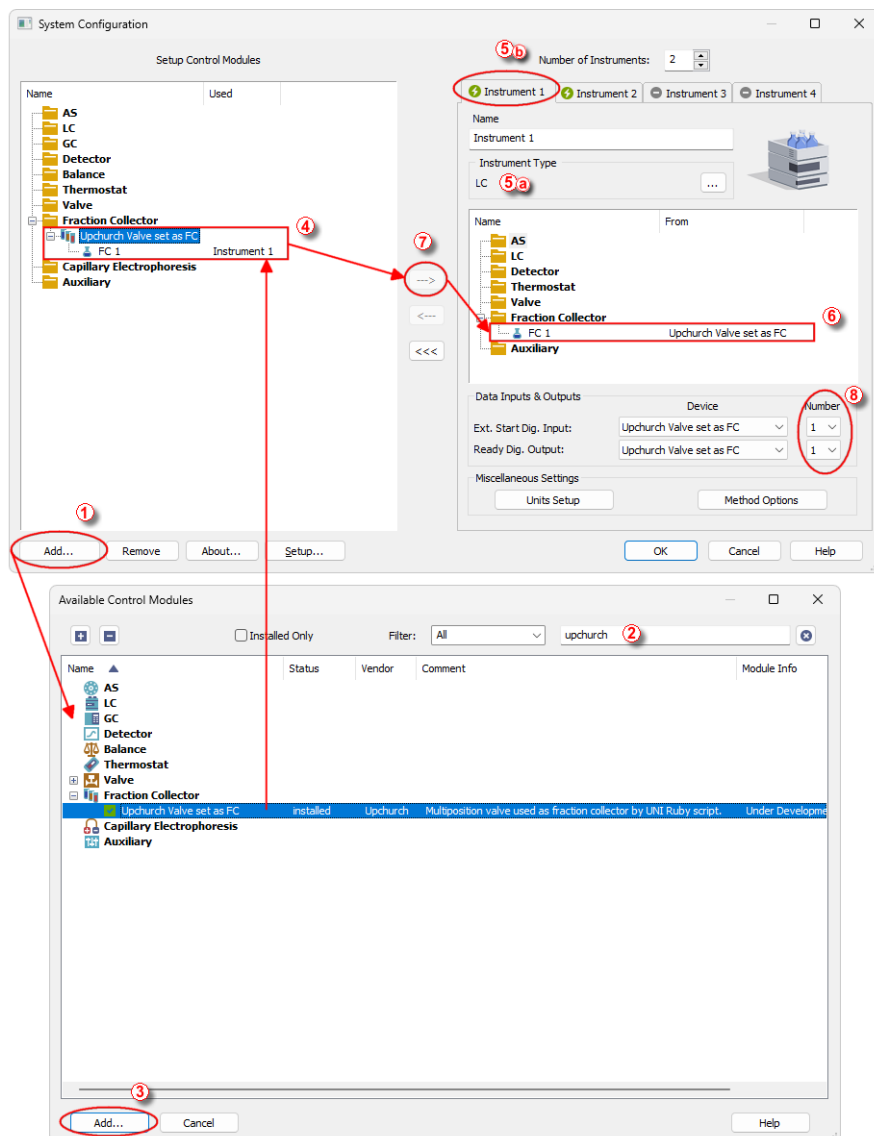


Fig. 3: How to add FC by Upchurch Valve

- 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. 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.

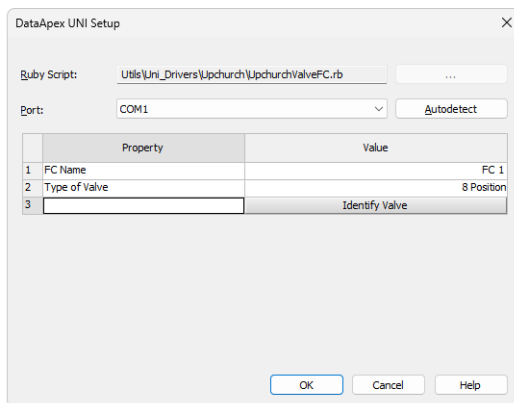


Fig. 4: DataApex UNI Setup

- You may fill in the custom *Device Name*.
- The **FC by Upchurch Valve** item ④ will appear in the *Setup Control Modules* list of the *System Configuration* dialog.
- Change the *Instrument Type* ⑤ a on the desired *Instrument* tab ⑤ b 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 Upchurch Valve** fraction collector. To display the actions of the fraction collector 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.

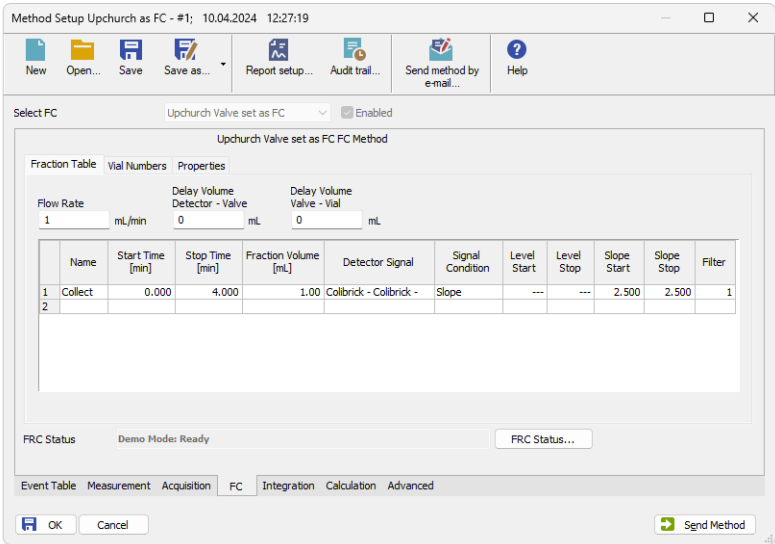


Fig. 5: Method Setup - FC - Fraction Table

Flow Rate

Specifies the flow rate of the liquid going to the fraction collector. Together with *Fraction Volume* parameter from the *Fraction Table* it is used to prevent vial overflow.

Delay Volume Detector - Valve

Defines the volume of tubing between the detector and the fraction collector's waste/collect valve.

The delayed volume is displayed in the *Data Acquisition* window as a vertical line trailing the signal front. Choose *Properties...* to open the *Graph Properties* dialog and check the *Show Events* checkbox.

Delay Volume Valve - Vial

Defines the tubing volume between the waste/collect valve and the vial in the fraction collector tray. If the fraction collector has no waste/collect valve, leave this field empty and enter the total tubing volume from the detector and fraction collector tray in the *Delay Volume Detector - Valve* field.

Fraction Table

Sets up the fraction collector behavior. The table rows run in chronological order and time intervals should not overlap. If a collection is active when the interval ends, it stops immediately. Collection based on negative peaks is not supported; to collect such peaks, invert the detector signal before 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.

Stop Time [min]

End of the time interval where the *Signal Condition* will be evaluated.

Fraction Volume

Defines the volume assigned to a single fraction. The value should not exceed the physical vial capacity to avoid overflow. When the collected volume reaches the set value, the fraction collector automatically switches to the next vial.

Detector Signal

Specifies the detector signal used to trigger fraction collection according to the *Signal Condition* in the *Fraction Table*. Each row of the table can be linked to a different detector signal. Only detector signals that are enabled for acquisition are available for use in the *Fraction Table*.

Signal Condition

Signal Condition is evaluated within the time interval defined for each row in the *Fraction Table*. If the condition is met multiple times during the interval, fraction collection starts each time, with the vial automatically changed after every stop. If the condition is not met at all, no collection is performed for that interval.

None - The fractions are collected for the entire time interval defined by *Start Time* and *Stop Time* regardless of the detector signal.

Note: If two *Fraction Table* rows follow each other directly in time (Stop Time = Start Time) and both have the *Signal Condition* = *None*, the FC does not switch to Waste between the rows. Skipping the switch to Waste is possible only if the collector still has a free vial available and the *Waste During* option in the *Vial Change* method is not selected.

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 value of the *Slope Stop*. The following image displays the course of the first derivative and demonstrates *Slope Stop* activation. Carefully read the slope values at all *End Fraction* points and observe the course of the first derivative before it reaches these points.

For accuracy, the *Slope Stop* condition is applied with a tolerance of 5%. The entered value is multiplied by 1.05 (e.g., an entered value of 0.100 is evaluated as 0.105).

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

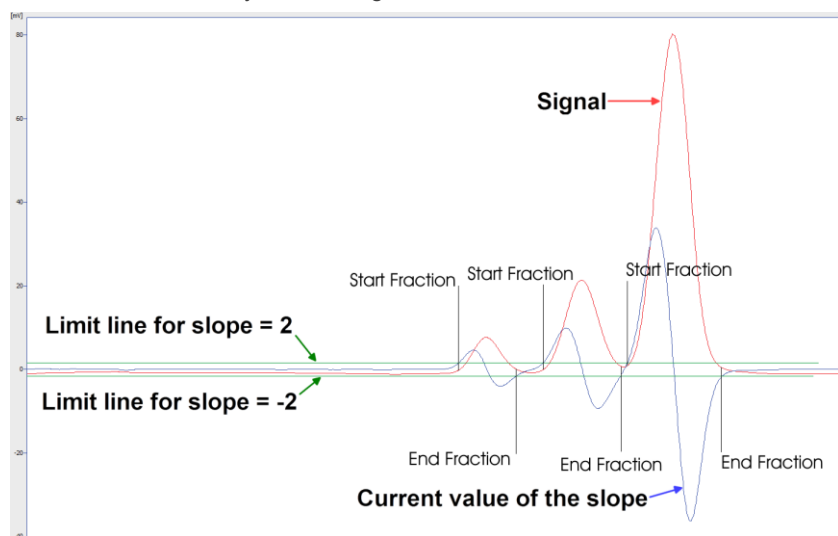


Fig. 6: First derivative course

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.
- 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 until *Stop Time* is reached.

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.
- 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 until *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.
- 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 until *Stop Time* is reached.

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.
- 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 until *Stop Time* is reached.

Filter

Sets the data filter for the detector signal defined in the corresponding row of the *Fraction Table*. The default value of 1 means no filtering, value of X means that every X incoming data points are averaged into one point used for evaluating fraction start/stop conditions. The higher the *Filter* value, the greater the delay in responding to signal conditions, especially with detectors that have a low data rate.

Filter settings influence the value that should be set to the *Slope Start* and *Slope Stop* columns. To determine the correct trigger values for the *Slope Start* or *Slope Stop* with the *Show Slope/Level* tool in the *Chromatogram* window, the *Global Filter* – *Bunching* value in the *Integration Table* should match the *Filter* value set here.

The values coming from *Detector Signal* are evaluated in bunch approximately every 300 milliseconds with respect to Start and Stop values inserted in the *Fraction Table*. As a result, the positions of fraction collection start and stop events may vary by ± 300 ms between chromatograms with identical signal

curves. For detectors with a high sampling rate (e.g., 50 Hz), this corresponds to a variation of up to ± 15 data points (50 Hz = 50 points per second; 300 ms $\approx$ 15 points).

4.2 Method Setup - FC - Vial Numbers

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

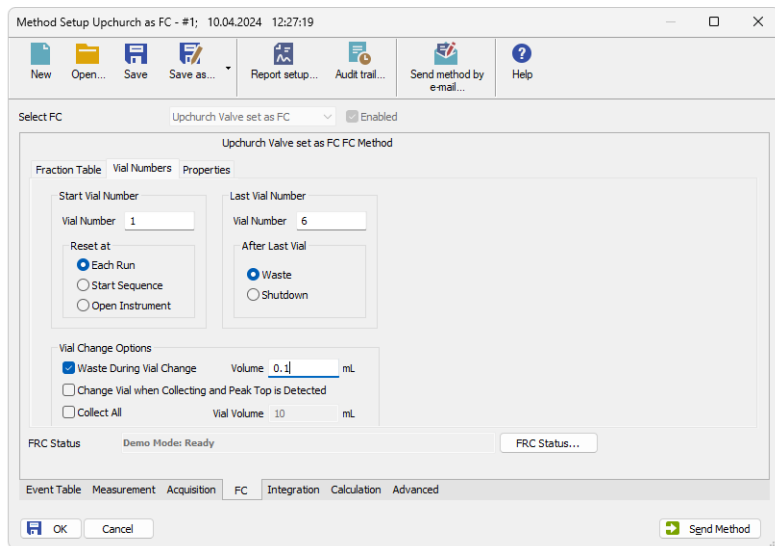


Fig. 7: Method Setup - FC - Vial Numbers

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 temporarily 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 Upchurch Valve** fraction collector.

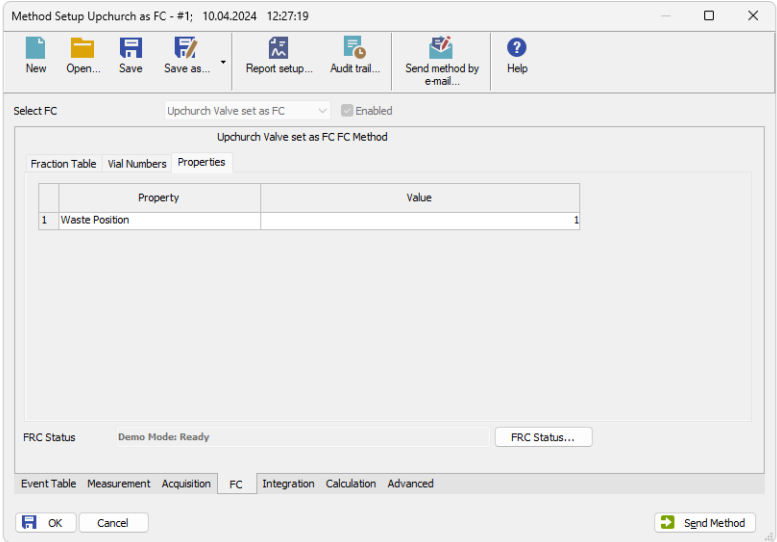


Fig. 8: Method Setup - FC - Properties

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 Upchurch Valve**, namely the communication type and its parameters.

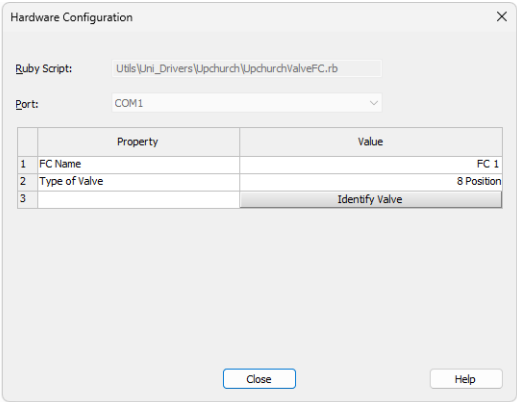


Fig. 9: Hardware Configuration

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

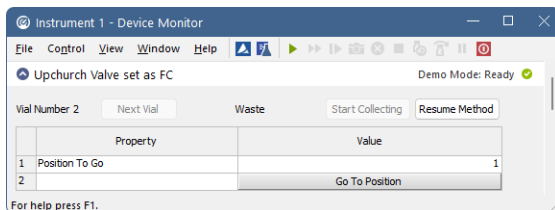


Fig. 10: Device Monitor - Fraction Collector

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

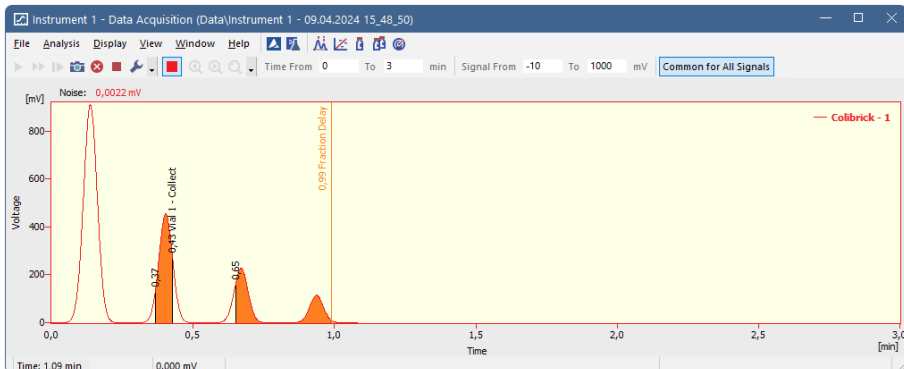


Fig. 11: Data Acquisition window

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.

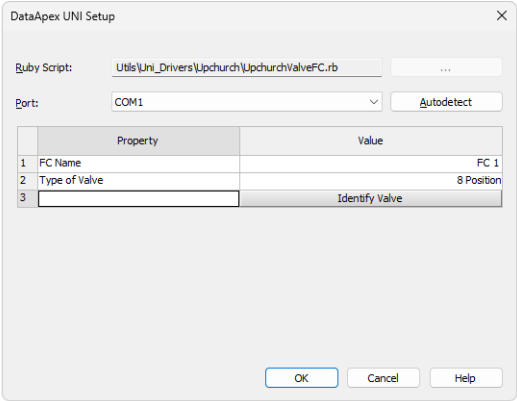


Fig. 12: DataApex UNI Setup

Ruby Script

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

Identify Valve

Allows to detect the number of positions set in the valve actuator.

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.

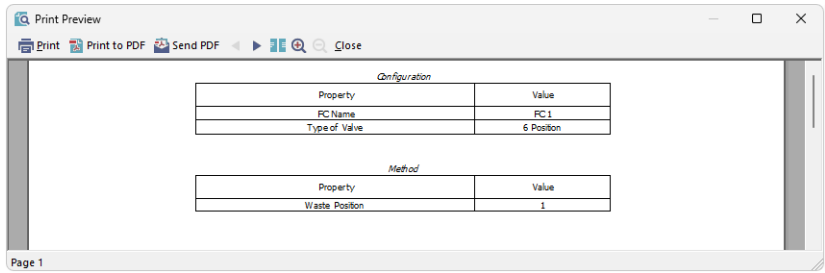


Fig. 13: Report Setup

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.