DataApex
Clarity™
CHROMATOGRAPHY SOFTWARE

ZEBRICK

Clarity Hardware   ENG

Author: DR

Contents

To facilitate the orientation in the **Zebrick** 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 Zebrick Converter

The **Zebrick** is designed for controlling **LC pumps** (that can be steered by frequency or voltage) by means of the **Clarity** chromatography software.
It contains four 16-bit D/A converters and four 28-bit frequency (D/f) converters as well as eight auxiliary logical inputs and outputs. The device has been designed especially for control of analog-operated pumps by the **Clarity** chromatography stations.

Fig 1: Zebrick Converter

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Note: The **Zebrick** converter is a successor to the discontinued **CB20** PCI board.

Instrument control has been incorporated directly in the **Clarity** program. Control is accessible from the Method Setup – LC Control and Device Monitor dialogs accessible from the Instrument window to which the controlled instrument is connected. Detailed description of the **Clarity** LC Control environment is provided later in this manual.

2 Requirements

The **Zebrick** can be used with the **Clarity** software on PC's using the following operating systems: **MS Windows 10/8.1/7^{SP1}/XP^{SP3}**.

Tab 1: Hardware and Software Compatibility:

Software	Windows			
	11	**10 (32 and 64bit)**	**8.1/7^{SP1} (32 and 64bit)**	**XP^{SP3} (32bit)**
Clarity	Yes (from 8.7)	Yes (from 7.0)	Yes (from 7.0)	Yes (from 7.0 to 7.4.1)

The PC must have one free **USB** connector for your **Zebrick** converter. **Clarity** must have the LC Control module (p/n A24).

3 Installation

3.1 Zebrick installation

Caution: Ensure you have *Administrator* access rights in your system, before you proceed with the installation.

- Install **Clarity** software from the installation USB before connecting **Zebrick** to the PC.
- Plug the **Zebrick** converter into the **USB** port.
- The drivers were installed automatically during the installation of the **Clarity** software.

Note: The latest version of **Clarity** software can be downloaded for free (just after registration) from www.dataapex.com.

3.2 Device setup and wiring

Standard package is shipped with 3m cable for two frequency and two analog (voltage) outputs. A different cable can be provided upon request.
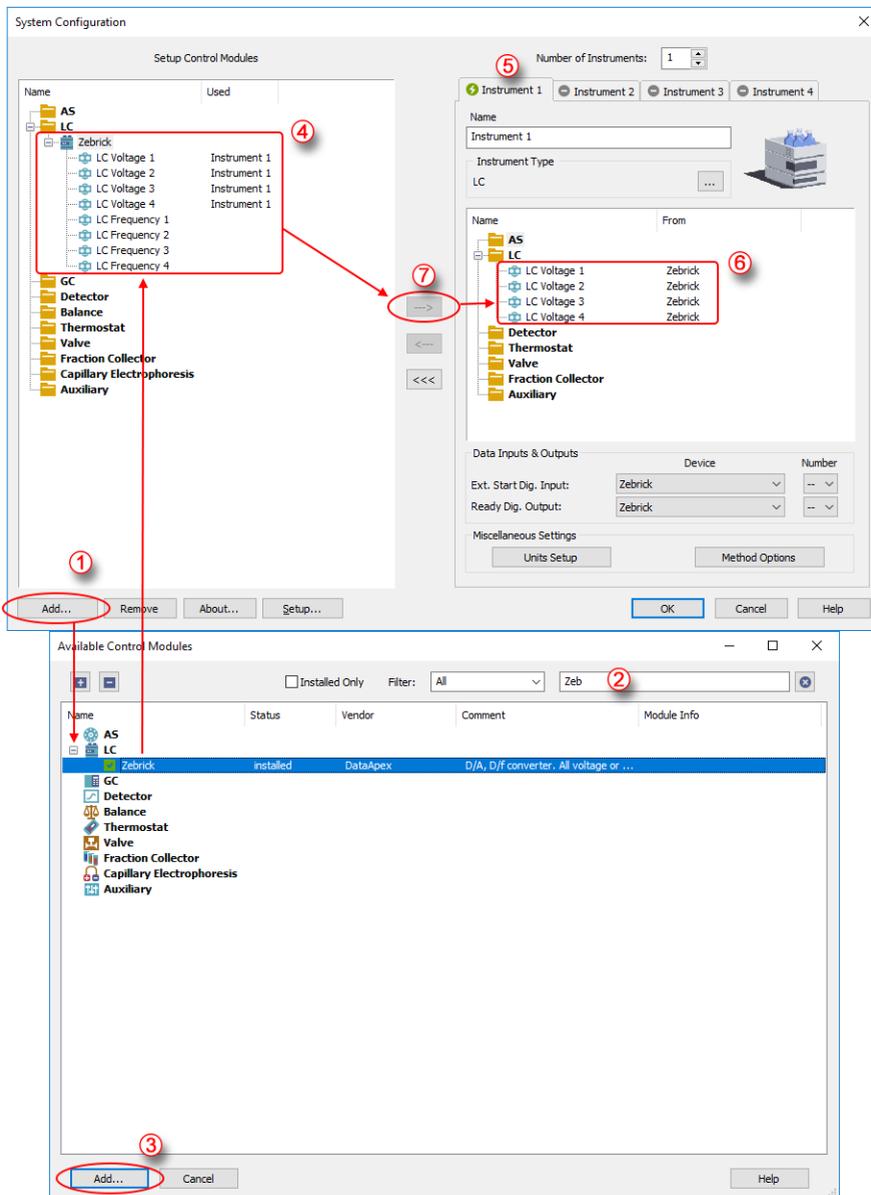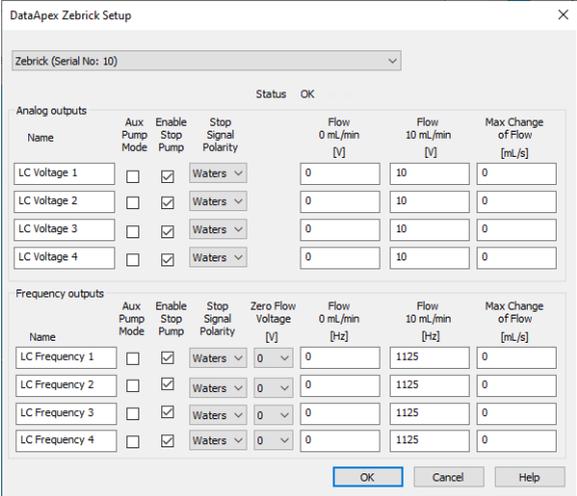
3.3 Clarity Configuration

Fig 2: System Configuration

- Start the **Clarity** station with the [icon] icon on the desktop.
- Invoke the System Configuration dialog accessible from the Clarity window using the *System – Configuration* command.
- Press the *Add* button ① (see **Fig 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.

- Go to the **LC** section, select the **Zebrick** and press the *Add* button ③.
- The DataApex Zebrick Setup dialog will appear.

*Fig 3: DataApex **Zebrick** Setup*

- Set the parameters of the **Voltage** or **Frequency** driven pumps (for more details see the chapter **DataApex Zebrick Setup** on pg **6**). and click **OK**.
- The **Zebrick** will appear in the *Setup Control Modules* list of the System Configuration dialog ④.
- Switch to the respective **Clarity** *Instrument* ⑤ tab where the LC control will be used. The *Instrument Type* must be set to **LC**.
- Drag the corresponding *LC Voltage* or *LC Frequency* control channels from the *Setup Control Modules* list on the left side ④ to the desired *Instrument* tab on the right side ⑥ (or use the [→] button ⑦ in the center).

Note: The individual LC control channels can be configured to separate instruments.

Note: The DataApex Zebrick Setup dialog can be displayed any time by double-clicking on the **Zebrick** icon or using the *Setup* button.

4 Using the Zebrick

New LC gradient tab appears in the Method Setup dialog, enabling the setting of the LC control method.

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Note: If the pump is set to auxiliary mode, the LC Gradient tab will be replaced by LC tab.

4.1 DataApex Zebrick Setup

The DataApex Zebrick Setup dialog sets the parameters of the **Zebrick** device. The dialog is accessible only from the System Configuration dialog, please see **Fig 2** on pg **4**.
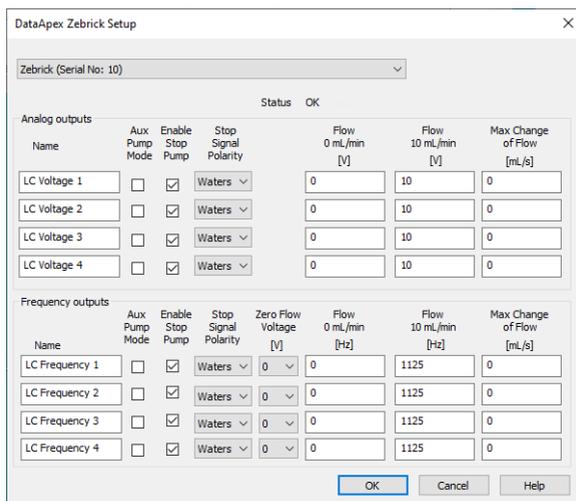

Fig 4: DataApex Zebrick Setup

Status

Describes the status of communication between the **Clarity** and the **Zebrick** converter.

Tab 2: Status of communication:

Status	Description
OK	The **Zebrick** has been detected and is functioning properly.
DEMO Mode	If you have installed **Clarity Demo** or **Clarity Offline** version, the driver will simulate **Zebrick**.

Analog and Frequency outputs

The **Zebrick** contains four converters for controlling HPLC pumps by means of voltage and another four capable of frequency control.

Name

You can set a custom name of the pump.

Aux Pump Mode

Sets the pump to auxiliary state, thus excluding it from the **Gradient Table**. Pumps with Aux Pump Mode enabled are controlled independently using separate LC tab in Method Setup (Idle Flow for each pump) and Event Table (flow change during analysis).

Enable Stop Pump

When checked, activation of the digital input will stop the pump (respective all pumps configured in a gradient on the instrument) by setting the flow to zero.

Stop Signal Polarity

This combo-box allows to select polarity when the pump will be stopped. By default, the pump is stopped when the digital input is switched to *LOW* (0 V).

- -

Note: This feature is utilized by Waters pumps. If you control Waters pumps, select the option Waters to set the pump correctly.

Zero Flow Voltage

Sets the voltage that will be laid on the frequency output when the pump is delivering zero flow. Some pumps require some voltage laid on the frequency output during zero frequency broadcast, while for most others the default *0 V* is sufficient. This option is available for *Frequency outputs* only.

Flow 0 mL/min

In this field you can set the frequency corresponding to the 0 mL/min flow.

Flow 10 mL/min

In this field you can set the frequency corresponding to the 10 mL/min flow.

Max change of Flow

Some pumps are not capable to handle commands for sudden change of flow rate (e.g. even switching the flow rate to zero at the end of the analysis could cause a problem). Here you can set the maximal change of flow rate that your pump would be able to process. All prospective sudden changes of flow in the gradient program will be automatically staggered into steps, thus protecting your pump (e.g. the empirical values for Waters 501-510 HPLC pumps have to be less than 1 mL/sec).

Note: Default 0 means unlimited change of flow.

4.2 Method Setup - LC Gradient

The Method Setup - LC Gradient tab is used for preparing and editing the instrument method used by the **Zebrick** - controlled pumps.
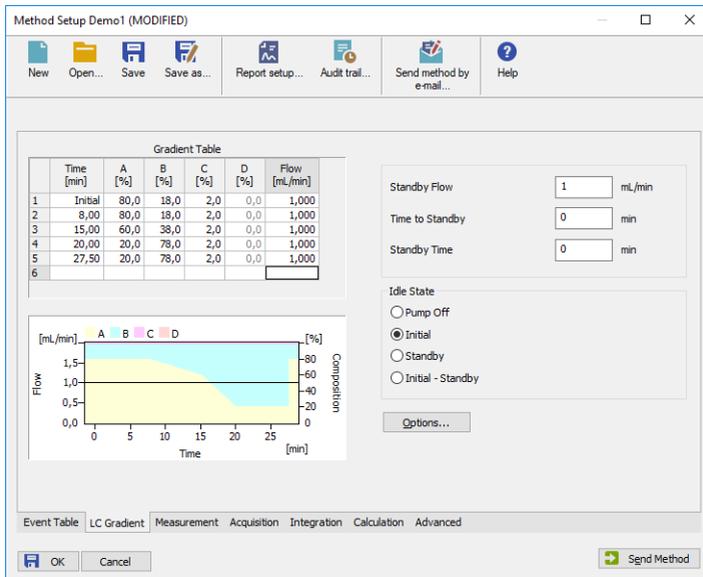
Fig 5: Method Setup - LC Gradient

Gradient Table

A table for setting the composition of the mobile phase and the overall flow rate as a function of time. Operation is analogous to that of spreadsheets (Excel, 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 corresponds 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). If you enter a component value such that the sum of all exceeds 100 %, the percentage in the last column will be automatically adjusted; if the percentage of the last compound is already zero, the value of the currently entered

component is adjusted instead. The flow rate of a compound is calculated by multiplying the overall flow rate (indicated in the *Flow* column) by the corresponding percentage divided by 100.

Flow [ml/min]

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

Graph

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

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

Parameters

Standby Flow

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

Time to Standby [min]

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

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

Standby Time [min]

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

Idle State

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

Pump Off

The flow rates of all components are zero.

- -

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

Initial

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

Standby

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

Initial - Standby

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

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

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

- -

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

4.2.1 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 and to switch whether they are used or not in the gradient.
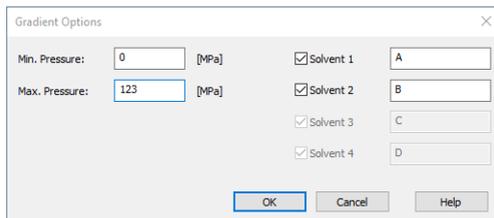
Fig 6: Gradient Options

Min. Pressure
The **Zebrick** does not support minimum pressure function.

Max. Pressure
The **Zebrick** does not support maximum pressure function.

Solvent 1 (..4)
It is possible to enable/disable particular solvent, as well as to set custom name to it.

4.3 Method Setup - LC - Auxiliary Pump

The Method Setup - LC dialog serves for setting up the LC related part of the template method opened in the Instrument window. This dialog is accessible when the pump is set to auxiliary state only (for more details see the chapter **DataApex Zebrick Setup** on pg **6**).

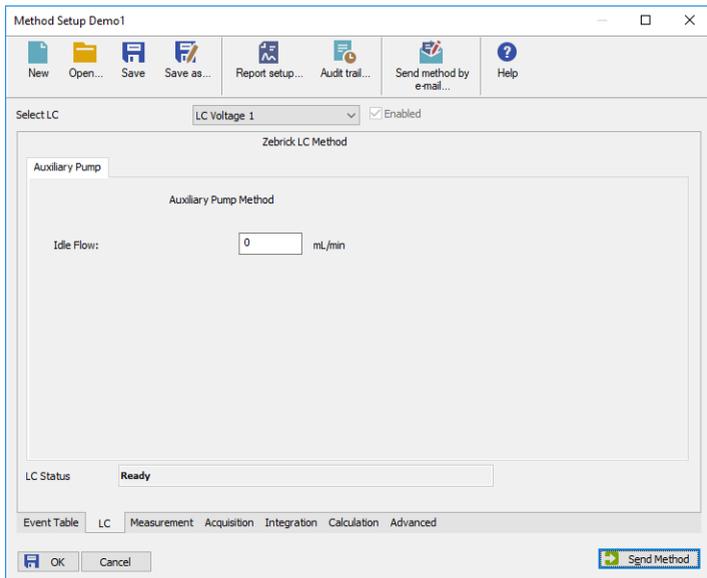*Fig 7: Method Setup – LC*

Idle Flow

Flow in ml/min in the idle state of the pump.

Status

When the **Zebrick** is correctly installed, the *READY* status is displayed. Otherwise see the chapter **"General troubleshooting"** on pg **24**.

4.4 Digital Inputs and Outputs

The **Zebrick** is equipped with eight digital TTL outputs and eight relay contacts. When *Enable Stop Pump* option is active in the Setup, assigned inputs are used for external pump stop.
Digital outputs can be controlled from the following places in **Clarity**:

- Digital Outputs of Zebrick dialog accessible from the Clarity window (for more details about Digital Outputs dialog refer to Clarity Main Help).

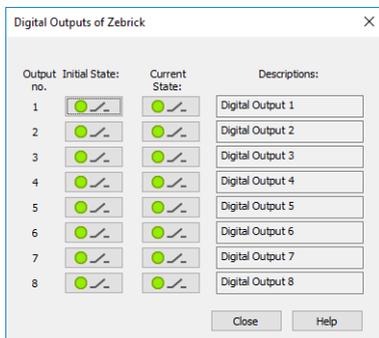*Fig 8: Digital outputs of Zebrick*

- The Event Table dialog accessible from the Instrument window using the *Method* command.
- The System Configuration dialog accessible from the Clarity window through *Ext. Start Dig. Input* and *Ready Dig. Output*.

Digital inputs allow remote stop of pumps. For more details see the chapter **DataApex Zebrick Setup** on pg **6**.

4.5 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 flows of particular solvents, as well as the total flow and the analysis time.

The individual solvent flow can be displayed either in flow units or as a percentage of total flow by checking the *View - Component flow in %* command.
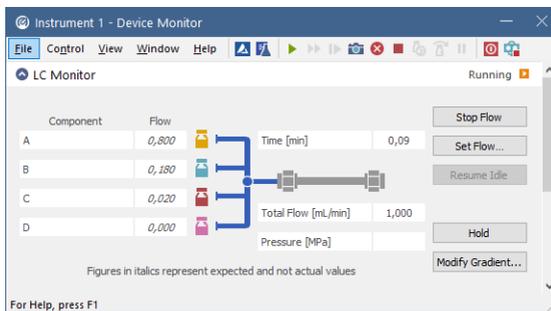

Fig 9: Device Monitor - Zebrick

Caution: *Pressure [MPa]* doesn't indicate any value when the pump is controlled using the **Zebrick** converter.

Stop Flow

The pumps can be stopped from this window using the *Stop Flow* button. This action stops the pump only, the analysis continues to run and must be stopped or aborted from the Data Acquisition window, Single Analysis or Sequence dialog.

Purge

The pumps may be purged by pressing this button. Set the desired total flow and solvent ratios in the opened Set Flow dialog.
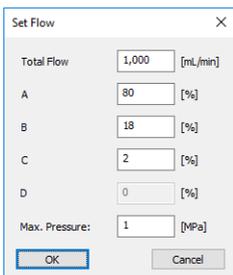

Fig 10: Set Flow

The number of solvents and their names displayed in the Set Flow dialog corresponds to the solvent number and names set in the Gradient Options dialog. The last available solvent field is always grayed out and is automatically counted as the rest of the percentage of the other solvents.

Resume Idle

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

Hold / Resume

Pauses / resumes the execution of the **Gradient Table** at the actual flow and mobile phase composition. The same flow and composition is maintained until the *Resume* button is pressed, which returns the method to the original **Gradient Table** again. The command is only available during the analysis run.

Manual Flow…

Opens the LC Control Manual Flow dialog allowing to set custom flow and mobile phase composition, disregarding the **Gradient Table** set in the method (for more details see the chapter **LC Control Manual Flow** on pg **17**).

4.5.1 Device Monitor - Auxiliary Pump

If the pump is set to *Aux Pump Mode* in the DataApex Zebrick Setup dialog, the Device Monitor for Auxiliary Pump is provided.

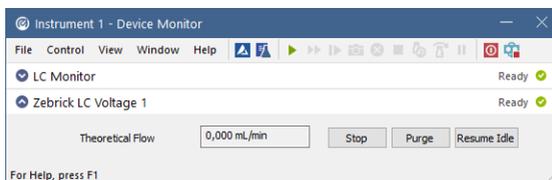*Fig 11: Device Monitor - Auxiliary Pump*

Stop

Stops the Purge operation.

Purge

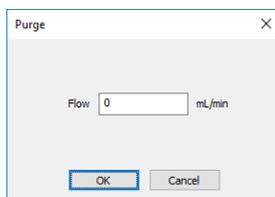Displays the Purge window that allows to set the flow during the Purge operation.

Fig 12: Purge

Resume Idle

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

4.5.2 LC Control Manual Flow

The LC Control Manual Flow dialog accessible through using the *Manual Flow…* 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.
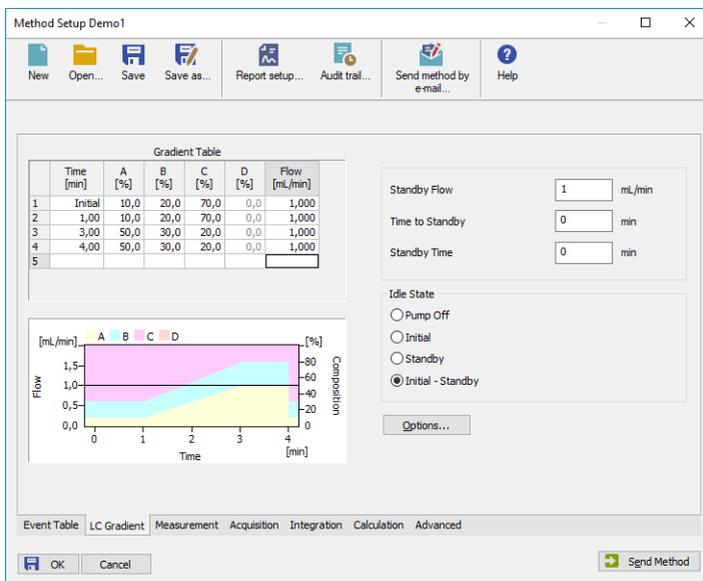
Fig 13: LC Control Manual Flow dialog

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 Tables and specifications

Tab 3: Voltage channels (outputs):

Parameter	Value
Voltage channels	4
Range	± 10 V
Resolution	16 bits
Monotonicity	16 bits
Linearity error max. (INL)	± 0,006 % FRS
Dif. linearity error max.	± 1 LSB
Accuracy typ	±1 mV
Temperature drift max.	480 µV/°C
Output impedance	< 1 Ω
Max. time of short circuit on output	not limited

Tab 4: Frequency channels (outputs):

Parameter	Value
Frequency channels	4
Range	0 Hz - 100 kHz
Used method of frequency creation	DDS (Direct Digital Synthesis)
Resolution	28 bits
Step	27.5 mHz (cca 36.4 steps/Hz)
Frequency tolerance	30 ppm
Frequency stability (-20- +70 °C)	30 ppm
Voltage level	TTL 5 V
Max. output current	10 mA
Output protecting serial resistor	33 Ω

Tab 5: Digital outputs:

Parameter	Value
Digital outputs	8
Voltage level	TTL 5 V
Max. output current	± 10 mA
Max. total outputs currents	50 mA
Output protecting serial resistor	33 Ω

Tab 6: Digital inputs:

Parameter	Value
Digital inputs	8
Voltage level	TTL 5 V
Pull-up resistor	10 kΩ (at + 5 V)
Input protecting serial resistor	10 kΩ

All inputs and outputs are protected against ESD.

5.1 Zebrick connector
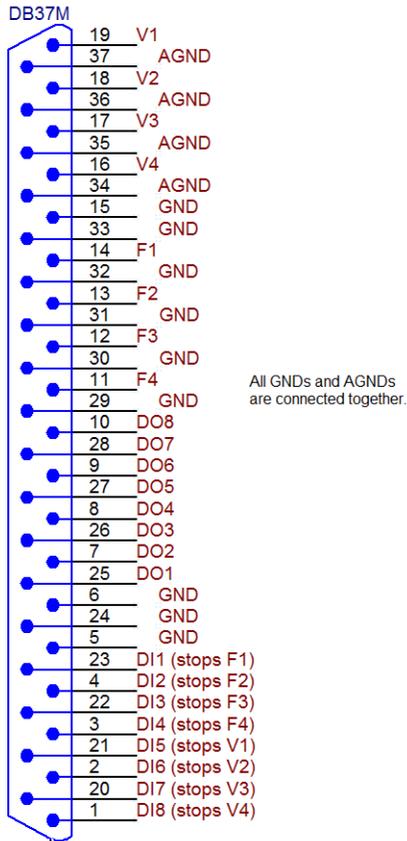
Fig 14: View of the back side of the cable connector

6 Troubleshooting

6.1 Problems with Zebrick driver

Problems with **Zebrick** driver are generally indicated by following problems:

- **Zebrick** cannot be added to the *Setup Control Modules* in the System Configuration dialog.
- Double-clicking on the device will not invoke the DataApex Zebrick Setup dialog.

6.1.1 How to check the Zebrick driver

Open the Device Manager (go to Control Panel - Hardware and Sound - Devices and Printers - Device Manager).

In the Device Manager window search for the item *"Chromatography Devices - DataApex Control Device, Model Zebrick"*.

Correctly installed driver can be seen in the following image:
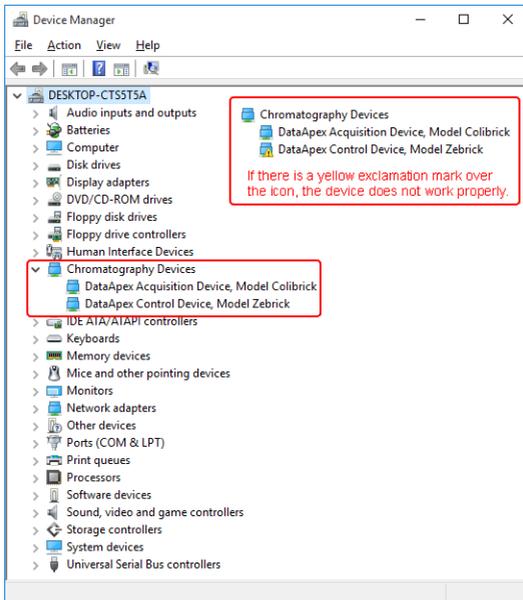
Fig 15: Device Manager in Windows 10

If the DataApex Control Device, Model Zebrick is missing then the driver has not been installed.

Solution: Reinstall the driver manually as described below.

If the driver is installed but there is a yellow exclamation symbol over its icon, or it does not behave as expected, the driver is probably incorrectly installed.

Solution: Uninstall the incorrect drivers and install the correct ones as described below.

6.1.2 Manual Installation of the Zebrick drivers

- During start-up, Windows should automatically recognize the new **Plug and Play** device and start the hardware installation Wizard.

- -

Note: If it does not, use the *Start - Control Panel - Add Hardware* to invoke it.

- Select: *Search for the best driver for your device*
- Select: *Specify a location*; here click the *Browse* button and select the path to the main folder of the **Clarity** station and corresponding subfolder (C:\CLARITY\BIN\HW_DRIVERS\ZEBRICK by default).

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Note: The driver is also located on the **Clarity** installation USB in the HW_ DRIVERS\ZEBRICK subfolder. Here, it is necessary to select the version corresponding to the version of your MS Windows.

- The rest of the installation is carried out automatically.

6.1.3 Reinstallation of incorrectly installed drivers

In certain situations (e.g. when you plugged the **Zebrick** converter before installing the **Clarity** software) Windows OS can accidentally use incorrect drivers.

Then there is a yellow exclamation mark next to the Chromatography device item in the Device manager. Updating the driver will not solve the situation. It is necessary to get rid of the incorrect drivers and then install the correct ones.

6.2 LC pumps

▌**The pump does not react to external control.**
Solution: Some pumps need to be switched to external control mode in order to be able to
control them using the **Zebrick** converter. This is usually done by closing dedicated
contacts. Consult the pump manual.

6.3 General troubleshooting

▌**The Zebrick is not listed in the *Setup Control Modules* list of the** System Configuration
dialog.
Solution: Follow the bullets ① and ② in the **Fig 2** on pg **4**. to add the **Zebrick** converter to
Clarity.

▌**There is not a LC Control tab in the** Method Setup **dialog.**
Solution: Verify that the relevant Voltage (Frequency) channels were configured to the
proper *Instrument* tab in the System Configuration dialog, see the bullets ④ and
⑥ in the **Fig 2** on pg **4**.
Verify that the station has unlocked LC Control module.
Contact us at support@dataapex.com. You will be asked to provide the Serial
Number of your station. This can be found in the About dialog - tab *System Files*,
item Serial number of application.

▌**There is Not Connected status in LC Control tab in the** Method Setup **dialog.**
Solution: Check that the **Zebrick** converter is plugged into the **USB** port.

▌**There is Not Ready (Method has not been sent) status in LC Control tab in the**
Method Setup **dialog.**
Solution: Prepare or load required method and press Send Method button.

▌**Orange and/or blue LED on the Zebrick is blinking and sometimes it cannot be added
in the System Configuration.**
Reason: Blinking of the orange (READY) and/or blue (DATA) LED is caused by decrease in
voltage on the **Zebrick** and that is why sometimes it cannot be added in the System
Configuration.
Solution: Check whether your **Zebrick** converter is connected to the PC via USB Hub. If that
is the case we recommend to connect **Zebrick** directly to the PC, this will ensure
that the voltage will not suddenly decrease when other device is plugged in.
Another option is to try a different USB cable. We have found out that USB cables
of low quality are responsible for observed behaviour.

7 Controlled devices

This section lists information related to selected controlled LC pumps.

Waters

The maximum speed of change of flow rate for Waters pumps is approximately 1 ml/s.

Note: DataApex is offering either customized (p/n KBSP) or extended cables (p/n KP) with appropriate connectors for M 45, 501, 510, 515 and 6000A Waters Pumps. For more information please contact sales@dataapex.com.