DataApex

Clarity™

CHROMATOGRAPHY SOFTWARE

ESA COULOCHEM III

Clarity Control Module   ENG

Code/Rev.: M145/50B
Date: 8/24/2020

Author: DM

Contents

To facilitate the orientation in the **ESA Coulochem III** 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 ESA Coulochem III Control Module

This manual describes the setting of the **ESA Coulochem III** detector. The control module enables direct control of the instrument over USB.

. . . .

Caution: **ESA Coulochem III** is only supported on 32-bit Windows OS. This is caused by the Motorola drivers for USB port in the detector, which are not available in 64-bit OS version.

. . . .

Caution: A single **Clarity** station can only control one ESA Coulochem III detector. This is the restriction of communication libraries used to perform the instrument control.

Fig 1: ESA Coulochem III detector

Direct control means that the detector can be completely controlled from the **Clarity** environment. Instrument method controlling the analysis conditions will be saved in the measured chromatograms.

2 Requirements

- **Clarity** Installation CD ROM with LC Control module (p/n A24).
- PC with 32-bit Windows OS (drivers for USB port are not available for 64-bit OS).
- Free USB port in the PC.
- USB A-B cable (p/n SK06).

Note: Cables are not part of **Clarity** Control Module. It is strongly recommended to order required cables together with the Control Module.

3 Installation Procedure

3.1 Hardware - Wiring

The **ESA Coulochem III** detector is controlled by RS232 communication via USB. The detector has also serial port available on the back panel, but this cannot be used for control. The communication is performed via standard USB A-B cable.

3.2 Clarity Installation

The **ESA Coulochem III** detector control module is not a part of the **Clarity** typical installation. During the installation process, the user is eventually asked to choose the Components of the installation - *Typical*, *Full*, *Minimal* or *Custom*. It is either necessary to select the *Full* installation, or a *Custom* one while adding the **ESA Coulochem III** detector from the *Detector* section (check the checkbox before the item) in order to install the **ESA Coulochem III** detector driver.

- -

Note: During the installation process, the error message about the hardware drivers not being signed may appear. In such case, choose to install the drivers anyways.
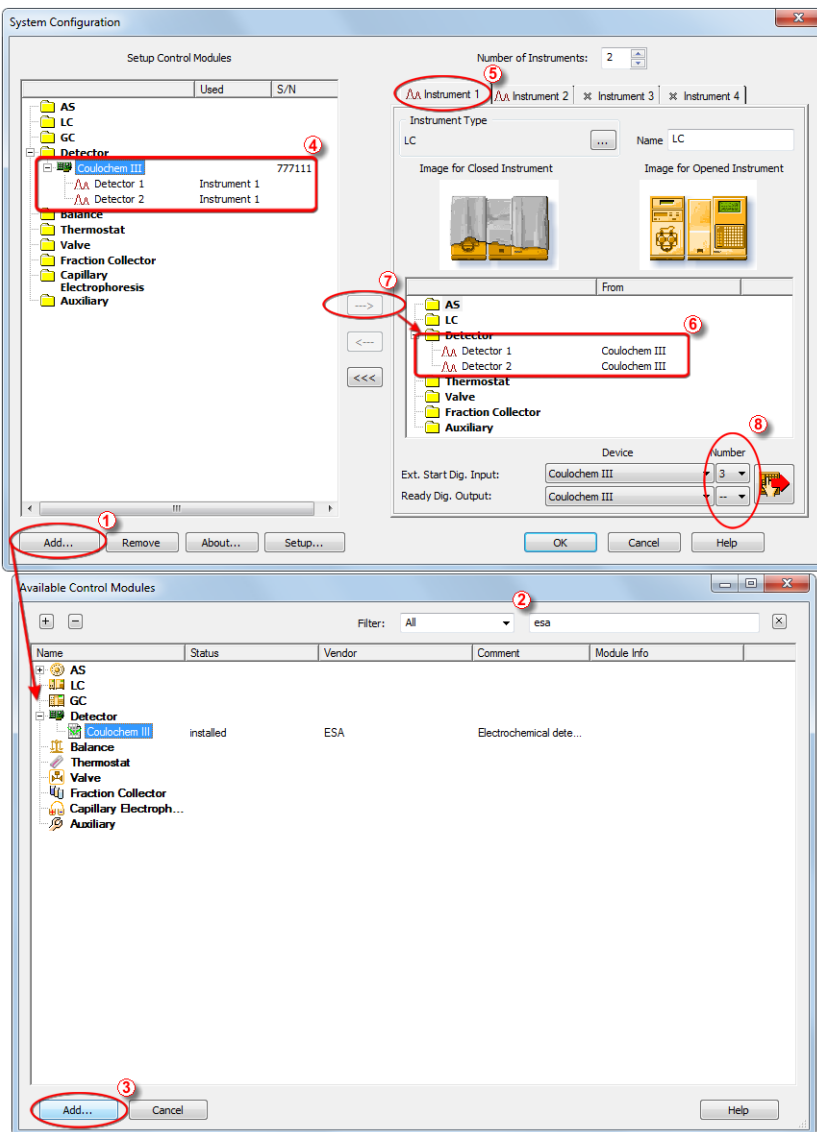
3.3 Clarity Configuration

Fig 2: System Configuration

- 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 (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.
- Select the **Coulochem III** detector and press the *Add* ③ button.
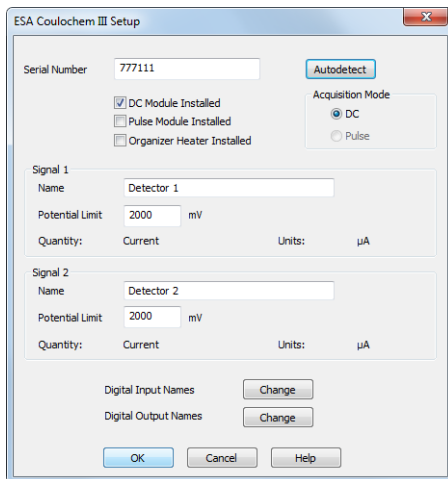
The ESA Coulochem III Setup dialog will appear.

Fig 3: ESA Coulochem III Setup

- Press the *Autodetect* button to find the **ESA Coulochem III** detector, the installed options will be autodetected and pre-filled. Exit the dialog by pressing the *OK* button.

. . . .

Note: The ESA Coulochem III Setup dialog is more closely described in the chapter **"ESA Coulochem III Setup"** on pg **17**.

The **Coulochem III** detector item will appear in the *Setup Control Modules* list of the System Configuration dialog.

- Drag and drop the **Coulochem III** icon from the *Setup Control Modules* ④ list on the left side of the System Configuration dialog to the desired *Instrument* ⑤ tab on the right side ⑥ (or use the ⟶ button ⑦ to do so).
- Set the *Ext. Start Dig. Input* and *Ready Dig. Output* numbers ⑧ for your system according to the wires being used for synchronization with other devices.

4 Using the control module

New Acquisition tabs (one for each detector signal assigned to the Instrument) are created in the Method Setup dialog. They can be accessed by switching to the desired signal in the *Select Detector* section on the top of the dialog.

4.1 Method Setup - Acquisition

The Method Setup - Acquisition tab is present in one copy for each signal of the **ESA Coulochem III** detector. The number of signals and the appearance of the tabs is dependent on the mode the detector is switched in - in the DC mode, two DC Mode Method tabs are present, while in the Pulse mode one Pulse Mode Method tab is present. In the right section on all Method Setup - Acquisition sub-tabs for **ESA Coulochem III** detectors two buttons are placed:

From Det

Pressing the button loads all detector parameters as they are set in the **ESA Coulochem III** detector. These parameters are set in appropriate fields of the Method Setup - Acquisition dialog.
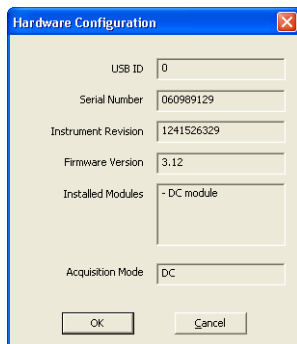
Det Status

Fig 4: Hardware Configuration

After pressing the *Det Status* button the Hardware Configuration dialog opens. When the detector is not in demo mode, it displays the internal detector *USB ID*, its *Serial Number*, *Instrument Revision* and *Firmware Version*. Moreover, it shows the installed parts and selected operation mode in the *Installed Modules* and *Acquisition Mode* fields, as set in the ESA Coulochem III Setup dialog. In the demo mode, only the *Installed Modules* and *Acquisition Mode* values are shown, other fields are displayed with the *Demo* inscription.

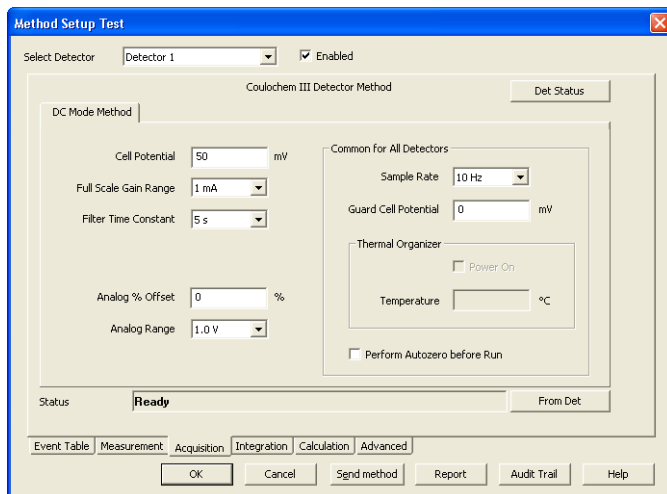## 4.1.1 Method Setup - Acquisition - DC Mode Method

Fig 5: Method Setup - Acquisition - DC Mode Method

The DC Mode Method sub-tab of the Method Setup - Acquisition dialog is used to specify the detector program when the detector is switched to the DC mode (uses the DC Module card).

Cell Potential

Sets the potential of the measurement cell. The allowed range for the *Cell Potential* is defined by the value set in the *Potential Limit* field in the ESA Coulochem III Setup dialog, which delimits the absolute value of the possible *Cell Potential*.

Full Scale Gain Range

Sets the signal range of the **ESA Coulochem III** detector, which should be set above the highest current expected for the analyte of interest over the course of the experiment. It ranges from *10 pA* to *1 mA* in steps of 1, 2, 5, 10, 20, 50, 100, 200 and 500.

Filter Time Constant

Sets the filter on the data gained from the **ESA Coulochem III** detector. Possible values are *none*, *0.2 s*, *0.5 s*, *1.0 s*, *2.0 s*, *5.0 s* and *10.0 s*. The higher the filter will be, the smoother the data will be, but at the cost of the signal precision. For very sensitive analyses, the value should be set as low as possible.

- -

Note: Another filter is afterwards applied in **Clarity** as a part of the *Global Peak Width* integration function.

Analog % Offset

Defines the offset (shift of the signal on the y-axis) of the analog signal. Possible values range between *-50* and *50* per cent, applied on the *Analog Range* set. Thus, when *1.0 V Analog Range* is selected, the signal can be shifted by ±0.5 V via the *Analog % Offset* function.

Analog Range

Defines the voltage range that will be set on the analog output on the back of the **ESA Coulochem III** detector. Possible values are *-1.0 V*, *-0.1 V*, *0.1 V* and *1.0 V*.

Common for All Detectors

Fields and items in the following section are common for both signals of the same detector - when both cells from the DC mode are configured in the **Clarity** Instrument, the parameters in question will influence both cells in the same way.

Sample Rate

Sets the sample rate of the **ESA Coulochem III** detector.

Guard Cell Potential

Sets the potential on the **Guard Cell**, if it is installed. The field is enabled and editable regardless or the guard cell's actual presence, the possible Potentials range from *-2000* to *2000* mV.

Thermal Organizer

Sets the Thermal Organizer Module power on or off, if it is installed. Furthermore, allows to set the temperature that should be maintained in the organizer.

Perform Autozero Before Run

When checked, performs the autozero operation on the beginning of the analysis run. Both detectors are zeroed this way.

- -

Note: Autozero operation takes a lot of time to perform - around half a minute or so. It is not advisable to use the *Perform Autozero Before Run* checkbox in shorter analyses, and the integration interval should be adjusted accordingly.

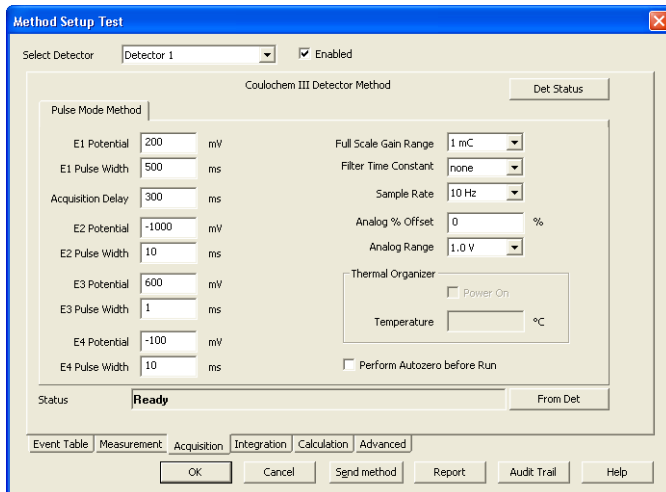## 4.1.2 Method Setup - Acquisition - Pulse Mode Method

Fig 6: Method Setup - Acquisition - Pulse Mode Method

E1 Potential
   Defines the measurement potential.

E1 Pulse Width
   Sets the time for which the measurement potential will be maintained.

Acquisition Delay
   Sets the time that will be used to establish the correct value of *E1 Potential* , before the measurement itself starts. The time difference between *E1 Pulse Width* and *Acquisition Delay* values is the measurement time.

E2 (..E4) Potential
   Sets the potential value for the *E2 Pulse Width* (*E3 Pulse Width*, *E4 Pulse Width*) time interval. The field is only informative as the value can not be sent to the detector (limitation of the detector firmware).

E2 (..E4) Pulse Width
   Defines the duration of the interval for which the *E2 Potential* (*E3 Potential*, *E4 Potential*) will be set. The field is only informative as the value can not be sent to the detector (limitation of the detector firmware).
   Whole measurement procedure performed during the Pulse mode is described by the **Fig 7** on pg **11**.

Note: The potentials set during the T2, T3 and T4 time intervals are used to renew the surface of the electrodes. The *E4 Potential* and *E4 Pulse Width* stages are not described on the **Fig 7** on pg **11**.
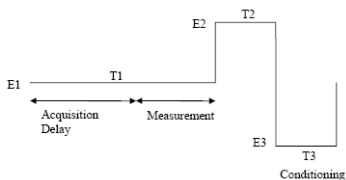
Fig 7: Pulse mode

Full Scale Gain Range
Sets the signal range of the **ESA Coulochem III** detector, which should be set above the highest charge expected for the analyte of interest over the course of the experiment. It ranges from *10 pC* to *10 mC* in steps of 1, 2, 5, 10, 20, 50, 100, 200 and 500.

Filter Time Constant
Sets the filter on the data gained from the **ESA Coulochem III** detector. Possible values are *none*, *low*, *medium* and *high*. The higher the filter will be, the smoother the data will be, but at the cost of the signal precision. For very sensitive analyses, the value should be set as low as possible.

Note: Another filter is afterwards applied in **Clarity** as a part of the *Global Peak Width* integration function.

Sample Rate
Sets the sample rate of the **ESA Coulochem III** detector. When the sample rate is greater than the rate of changing pulses, the data will still be given, although the **ESA Coulochem III** detector will interpolate them from the real pulse data.

Analog % Offset
Defines the offset (shift of the signal on the y-axis) of the analog signal. Possible values range between *-50* and *50* per cent, applied on the *Analog Range* set. Thus, when *1.0 V Analog Range* is selected, the signal can be shifted by ±0.5 V via the *Analog % Offset* function.

Analog Range
Defines the voltage range that will be set on the analog output on the back of the **ESA Coulochem III** detector. Possible values are *-1.0 V*, *-0.1 V*, *0.1 V* and *1.0 V*.

Thermal Organizer
Sets the Thermal Organizer Module power on or off, if it is installed. Furthermore, allows to set the temperature that should be maintained in the organizer.

Perform Autozero Before Run
When checked, performs the autozero operation on the beginning of the analysis run.

Note: Autozero operation takes a lot of time to perform - around half a minute or
               so. It is not advisable to use the *Perform Autozero Before Run* checkbox in
               shorter analyses, and the integration interval should be adjusted
               accordingly.
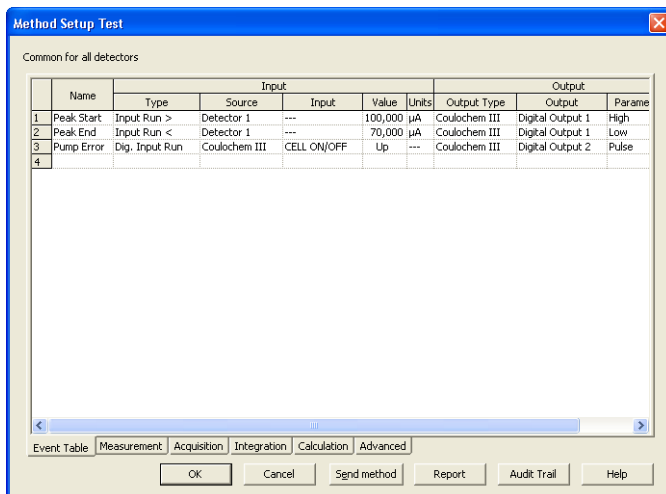
4.2 Method Setup - Event Table

Fig 8: Method Setup - Event Table

Both the inputs and outputs of the **ESA Coulochem III** detector can be used in the **Event Table**, either as the input conditions or for the output reaction.
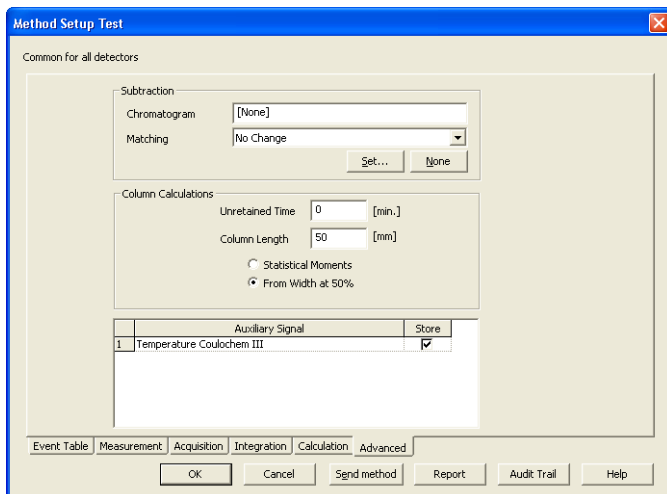
4.3 Method Setup - Advanced

Fig 9: Method Setup - Advanced

When the Organizer Heater compartment of the **ESA Coulochem III** detector is installed, it is possible to use the *Temperature* auxiliary signal. The signal can be stored into the measured chromatograms using the checkbox on the Method Setup - Advanced tab.

4.4 Device Monitor

The window with the detector status can be invoked by the *Monitor - Device Monitor* command from the Instrument window or using the ⊘*LC Monitor* icon. It displays the actual signal belonging to all signals configured on the Instrument, as well as other information such as the detector temperatures. Each detector has its own section in the Device Monitor window.

Fig 10: Device Monitor

The detector can be partially controlled from the Device Monitor window. Available control commands and fields are:

Zero Detector
This button performs the autozero operation - the output signal of the detector is set to zero. If the detector provides more than one signal, all of them will be zeroed. The button is not available during the analysis run.

Set Cells Off/On
Invoking this button shuts the detection cells off or on. The button name changes according to the actual state of the detector cells. It is only possible to turn the cells off during the analysis run, then the button gets disabled until the analysis is finished. If the detector provides more than one signal, all of them will be turned off/on.

- -
Note: It is not possible to start the analysis when the detection cells are off, unless the start is triggered by external signal.

Thermal Organizer
Shows the status of the Thermal Organizer, e.g. if it is installed, powered on or off and what is the temperature in it.

Det Status
Using the button opens the Hardware Configuration dialog for **ESA Coulochem III** detector more closely described the chapter **"Method Setup - Acquisition"** on pg **7**.

Digital inputs and Digital Outputs section

This section allows monitoring the state of the **ESA Coulochem III** detector inputs and monitoring and control of the **ESA Coulochem III** detector digital outputs.
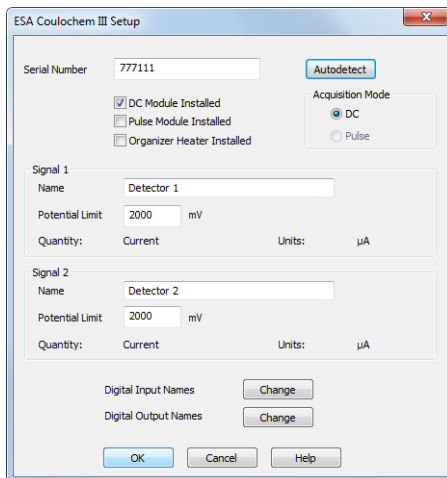
4.5 ESA Coulochem III Setup

Fig 11: ESA Coulochem III Setup

Serial Number
Shows the autodetected serial number of the **ESA Coulochem III** detector. In case more than one detector is connected to the same computer, the field allows to select which one will be used in configuration.

Autodetect
This button is used to test the connection to the **ESA Coulochem III** detector. When the detector is connected, the *Serial Number* field is filled with the autodetected serial number of the detector.

DC Module Installed
Enables the use of the installed DC card. When this card is present, the *DC Acquisition Mode* can be selected.

Pulse Module Installed
Enables the use of the installed Pulse Mode card. When this card is present, the *Pulse Acquisition Mode* can be selected.

Organizer Heater Installed
Enables the use of the organizer heater. Checking the option adds a temperature auxiliary signal into the Method Setup - Advanced tab and activates the *Thermal Organizer* section on the Method Setup - Acquisition tab for the **ESA Coulochem III** detector.

Acquisition Mode

Allows to select the operation mode in case both the *DC Module* and *Pulse Module* are installed.

DC

Standard type of operation for the *DC Module* - detector gives two signals of actual Current measured in µA.

Pulse

Standard type of operation for the *Pulse Module* - detector gives only one signal of the Charge measured in µC.

Note: When both communication cards are present in the **ESA Coulochem III** detector and the *Pulse* mode is selected, it is not possible to read the method from the detector without sending it to the detector first after the start of the detector.

Signal 1 (2)

Fields belonging to particular detectors enable to set the relevant detector names and potential limit for each signal. In case the *Pulse* option is selected in the *Acquisition Mode* section, only the Signal 1 is available.

Each signal also has the *Quantity* and *Units* values, which are not modifiable. These show the quantity measured by the detector and units in which the signal is gained.

Name

Allows to change the name for the particular signal. The name is then displayed in the System Configuration dialog and in the *Select Detector* section of the Method Setup - Acquisition dialog.

Potential Limit

Sets the potential limit for the particular signal. When changing the potential used later in the Method Setup - Acquisition dialog, the user is limited by the ± *Potential Limit* value. Possible values for the *Potential Limit* range between *0* and *2000* mV.

Digital Input Names

Using the *Change* button displays the Digital Input Names dialog which allows to set the names for events mapped on the physical inputs of the detector. The meaning of the inputs, however, cannot be changed.
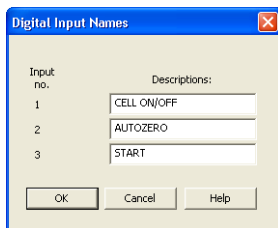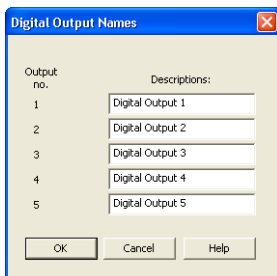

Fig 12: Digital Input Names

Digital Output Names

Using the *Change* button displays the Digital Output Names dialog which allows to set the names for events mapped on the physical outputs of the detector.

Fig 13: Digital Output Names

4.6 Digital Outputs Control

The **ESA Coulochem III** detector contains five digital TTL outputs which are also designed as relay contacts.
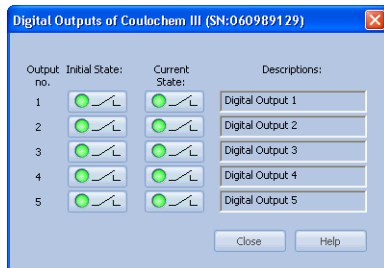

Fig 14: Digital Output Control

This dialog allows to change the *Initial* and *Actual* state of the digital outputs of the **ESA Coulochem III** detector. The digital outputs may be also controlled from the Method Setup - Event Table tab.

5 Report Setup

All of the detector settings accessible on the Method Setup - Acquisition tab for the given signal are reported. To do so, the *Instrument Control* parameter on the Method tab of the Report Setup dialog must be checked.
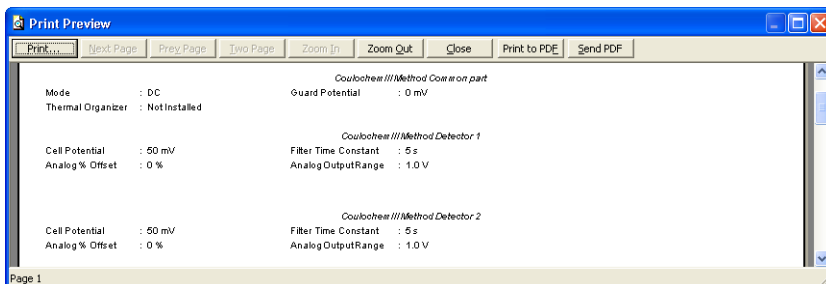

Fig 15: Report Setup

6 Troubleshooting

▌**Clarity method cannot be sent to the ESA Coulochem III detector, the analysis cannot be run after opening the Clarity Instrument.**

Description: The detector equilibrates itself after the start, most probably. The equilibration takes approximately three minutes and during that time the method cannot be sent to the detector nor the acquisition cannot be started from **Clarity**.

Solution: Wait until the countdown on the detector display reaches 0 before opening **Clarity**.

▌**The signal in the Data Acquisition window cannot be seen at the beginning of the analysis, analysis time is not running.**

Description: Most probably, the *Perform Autozero Before Run* function was used. The use of the function stops receiving data for approximately 30s.

Solution: If the data from the start of the chromatogram are needed, switch the autozero function off. As a workaround, you can create an autozero method that will only perform autozero in the dummy run, preceding the real one.