Metrohm IC Driver 2.0 for Empower™ Instructions for Use

Manual

8.102.8069EN / 2015-10-13

Metrohm

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Although all the information given in this documentation has been checked with great care, errors cannot be entirely excluded. Should you notice any mistakes please send us your comments using the address given above.

Change Control

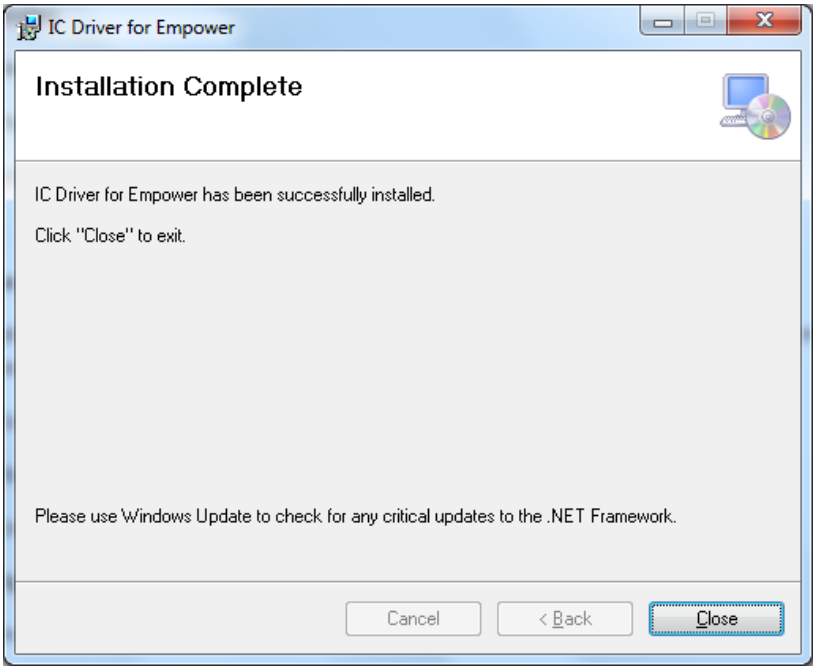
Version	Date	Summary of Changes
1.0	October 2015	First Edition

Contents

1 Preconditions

The following preconditions must be met to ensure proper functioning:

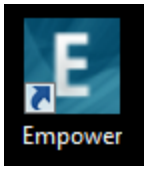
- Empower™ is installed according to the Waters instructions. Refer to the Waters instructions for information concerning the minimum system requirements.
- The Metrohm driver is installed according to the instructions (8.102.8068 "Metrohm IC Driver for Empower™ installation").



2 Starting Empower™ and creating a node

2.1 Starting Empower™

1. Connect the Metrohm instruments to the PC (via USB) and the power supply.
2. Switch the PC on.
3. Switch the Metrohm instruments on.
4. Start Empower™ by clicking on the corresponding icon on the desktop.
   Note: Ensure that all Metrohm instruments are switched on before starting Empower™. In case of issues while starting Empower™, see *chapter 12.1 on page 78*.



5. Enter your Empower™ user name and password and click on **OK**.

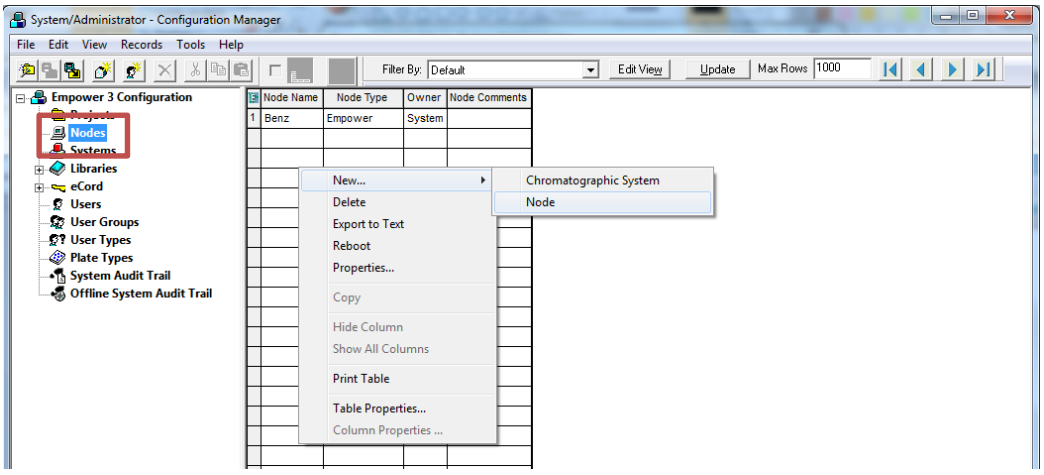
2.2 Configuring the system

1. Click on **Configure the System**.

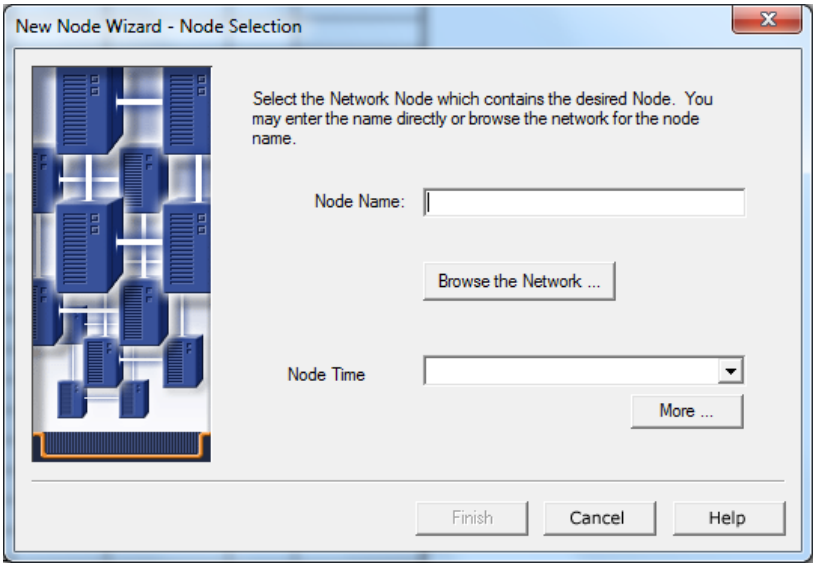
The Configuration Manager opens. Its icon will appear and blink in the lower task bar of your screen.

2. Go to **Nodes**.

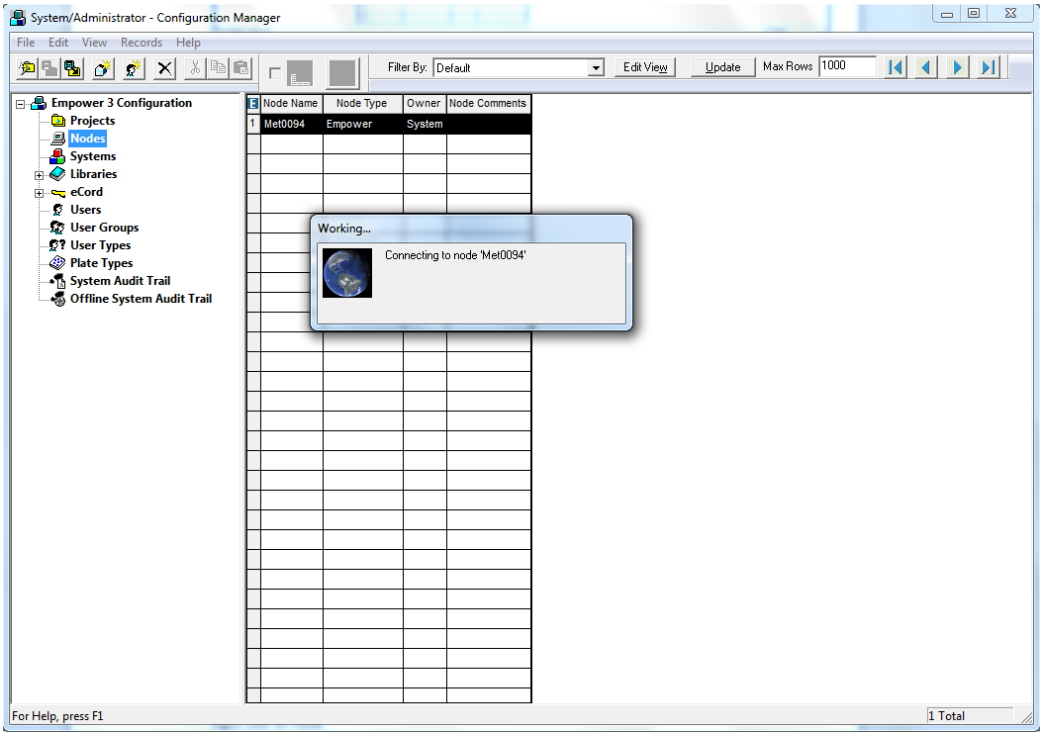
3. Create a new node (i.e. where your instruments are connected to the PC). For this purpose, right-click on the table and click on **New…** > **Node**.



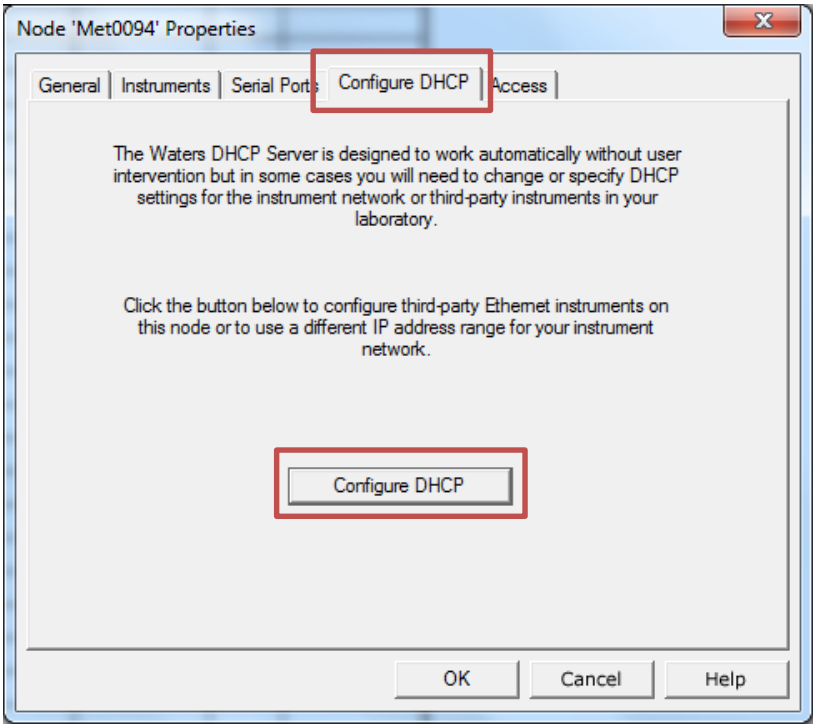
4. Follow the instructions of the wizard.



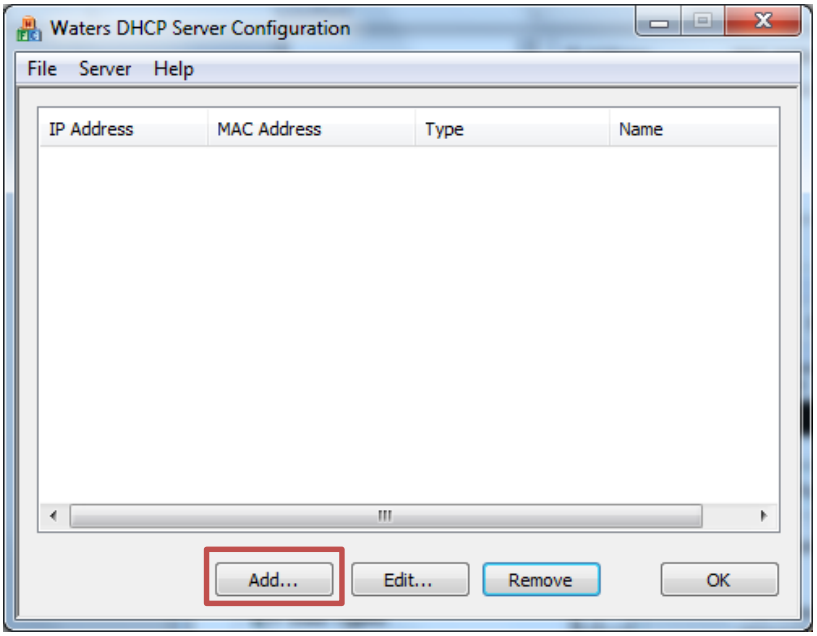
5. Right-click on the new node and open the **Properties** menu item. The connection to the **node** will be established.



6. Click on **Configure DHCP** on the **Configure DHCP** tab.



7. Click on **Add…**.



8. Enter the following parameters:
   Note: If several systems are added, both the **IP address** and the **MAC address** have to differ.

   Note: All systems that are configured on the DHCP Server must be powered on.

Parameter	Value
IP Address	000.000.000.xxx, (where xxx = 001-255) e.g. start with 000.000.000.001
MAC Address	00-00-00-00-00-xx, (where xx = 00-99) e.g. start with 00-00-00-00-00-01
Instrument Type	Select **Metrohm IC**. This includes all implemented Metrohm instruments, also Sample Processors and Dosinos.
Serial Number / Unique Name	These are the actual settings used to detect the instrument on the USB bus. They must meet the requirements below.

   Requirements for the **Serial Number / Unique Name**:

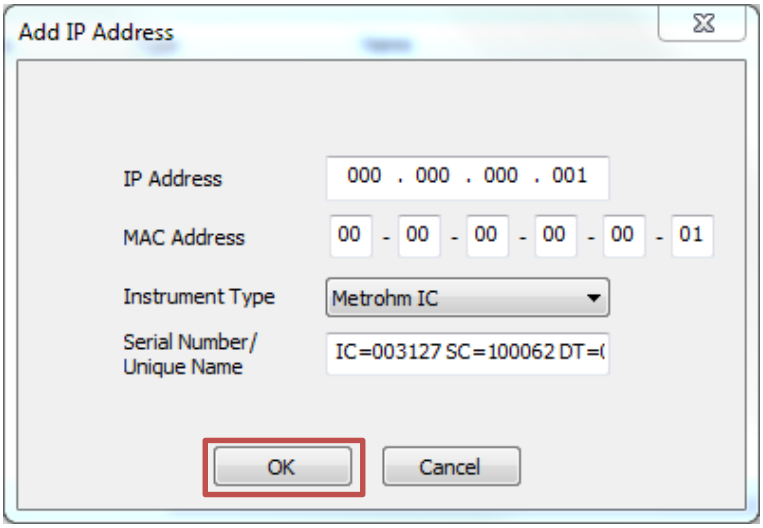
   - The serial number must be the last six characters (including leading 0s) printed on the serial number sticker found on the back of the instrument.
   - The serial numbers must be prefixed with the following abbreviations (excluding double quotes):
   - IC-instrument: "IC="
   - Sample Processor: "SP="
   - Sample Center: "SC="
   - Detector (Stand Alone): "DT="
   - If you are using multiple instruments, you can combine them. Any combinations are possible. In this case, the serial numbers must be separated by a space. The order of the different modules is freely selectable.

   Examples (excluding double quotes):

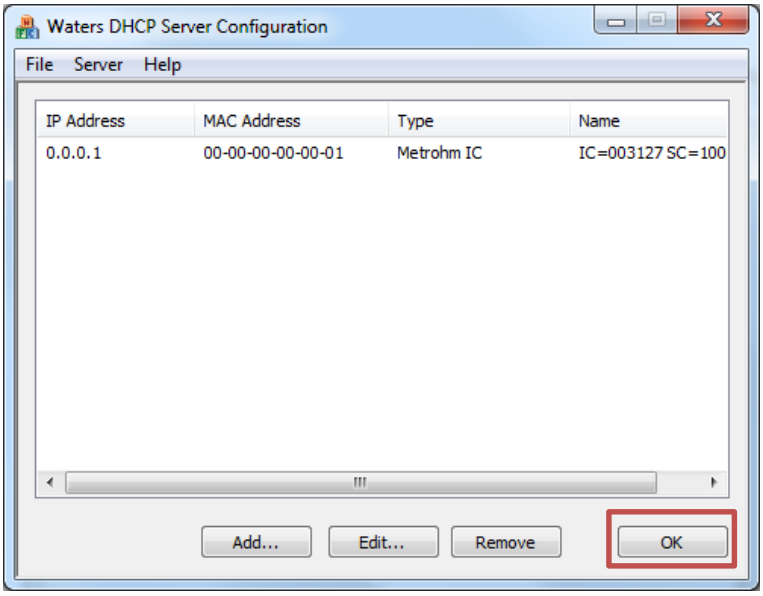
   - IC only: "IC=003127"
   - SP only: "SP=003534"
   - SC only: "SC=100062"
   - DT only: "DT=004101"
   - Combination: "IC=003127 SC=100062 DT=004101"

9. When entered the values, click on **OK**.

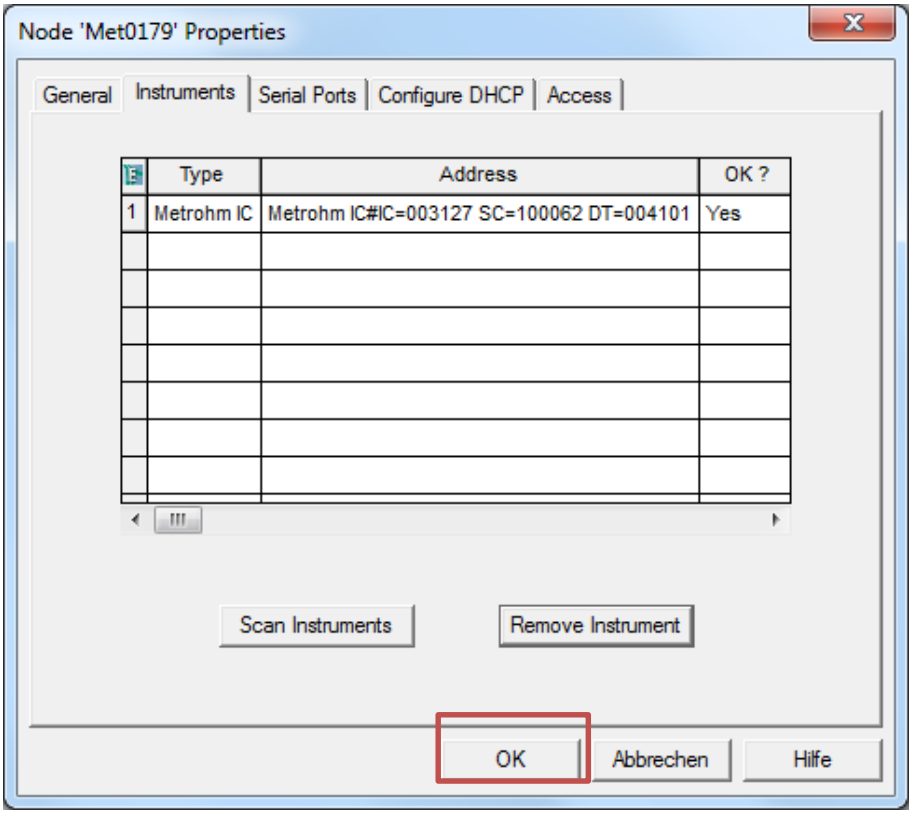
   Example:



10. Click on **OK**.

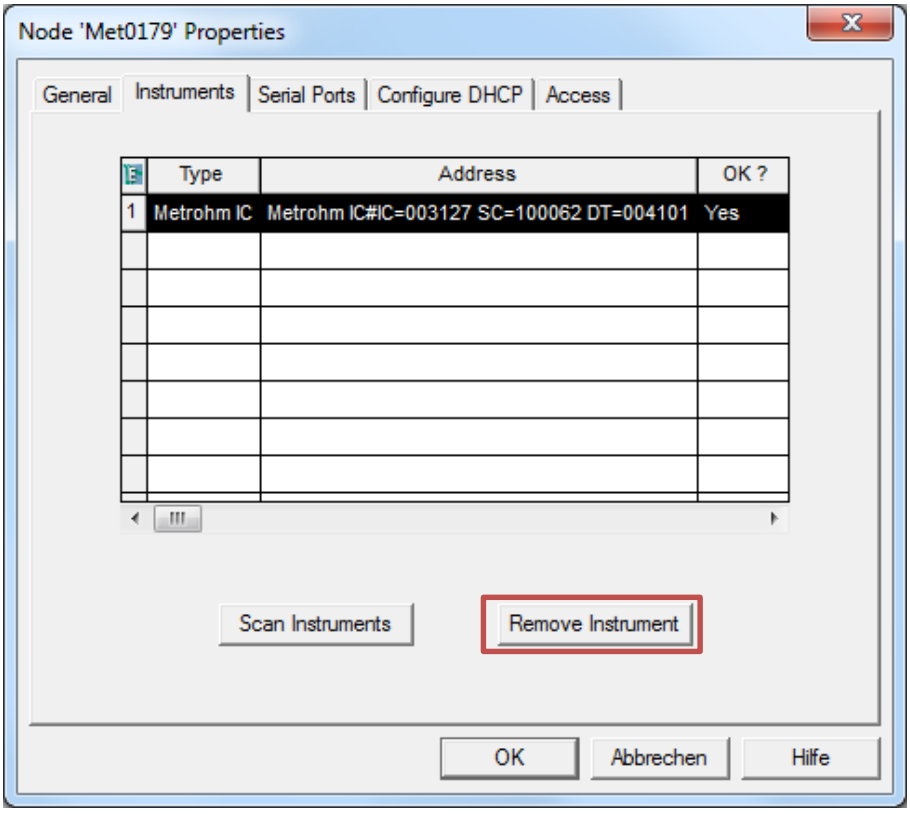


11. Click on **OK**.

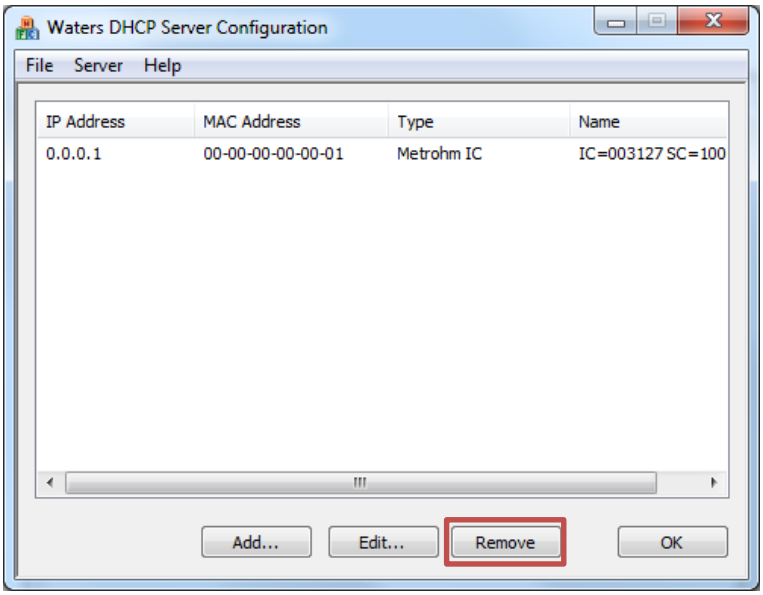


Removing an instrument

1. To remove a not used instrument, select the instrument by clicking on the number of the corresponding row and click on **Remove Instrument**.



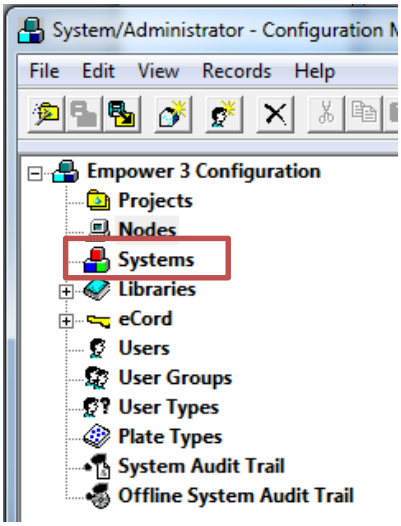
2. Click on **Configure DHCP** on the **Configure DHCP** tab.
3. Select the instrument you want to remove and click **Remove**.



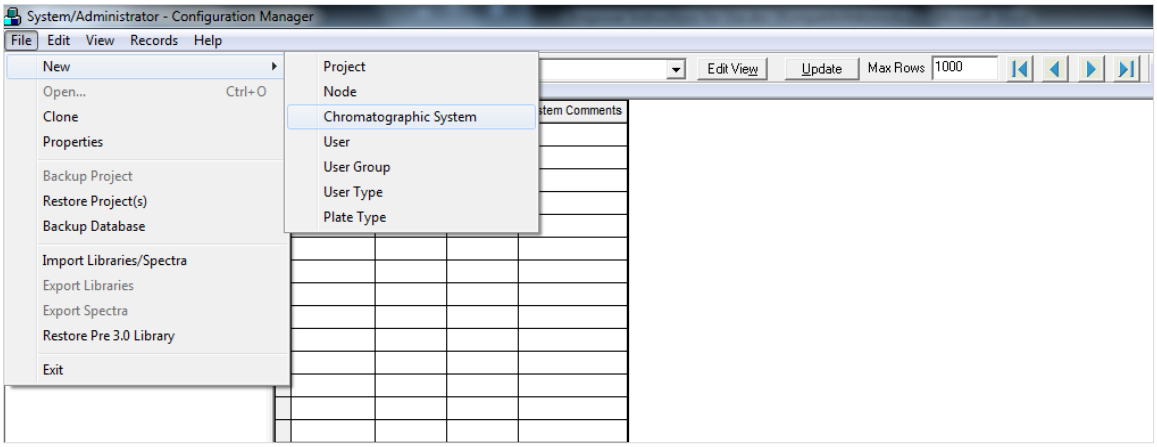
3 Setting up a chromatographic system

3.1 Generating a system

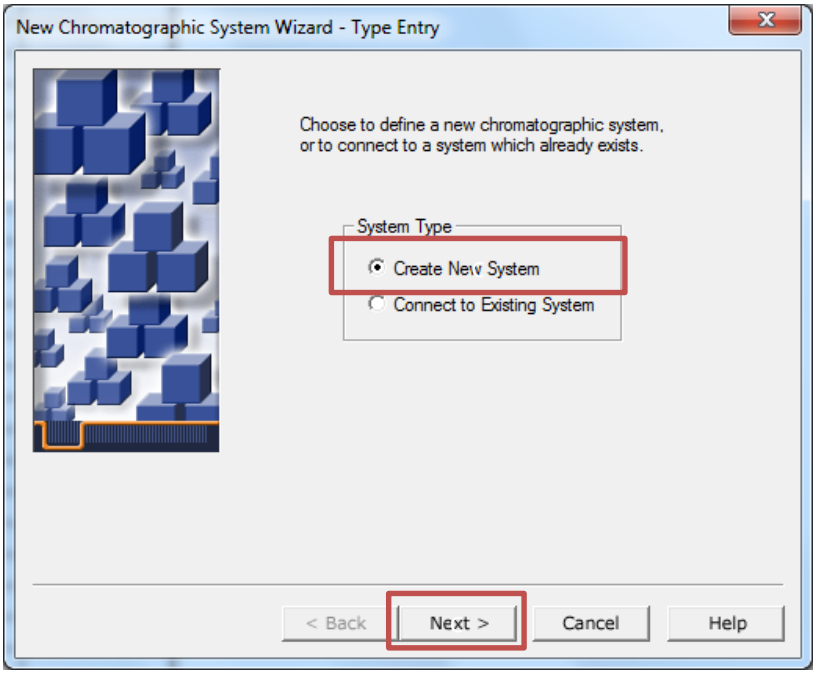
1. Go to **Systems**.



2. Create a new system by selecting the **New > Chromatographic System** menu item.



3. Select **Create New System** and click on **Next**.

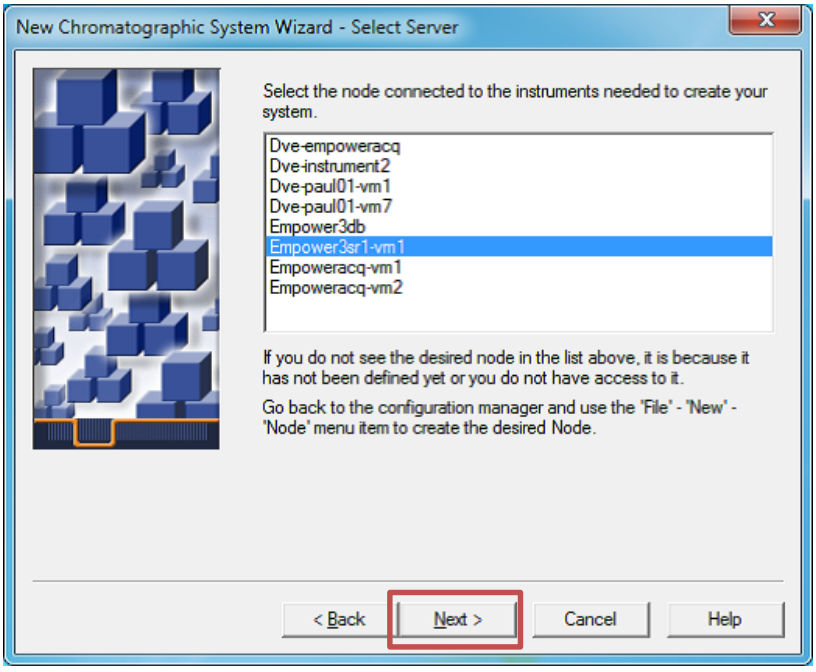


Detailed explanations

Field	Explanation
Create New System	Specifies that you create a new chromatographic system using available instruments connected to an **acquisition server**. It is not necessary that the system is directly connected to your Empower™ workstation.
Connect to Existing System	Specifies that the current user can access the selected chromatographic system. If the system is password-protected, you need the password to access the system. Then you can use the chromatographic system to acquire and process data and to generate reports.

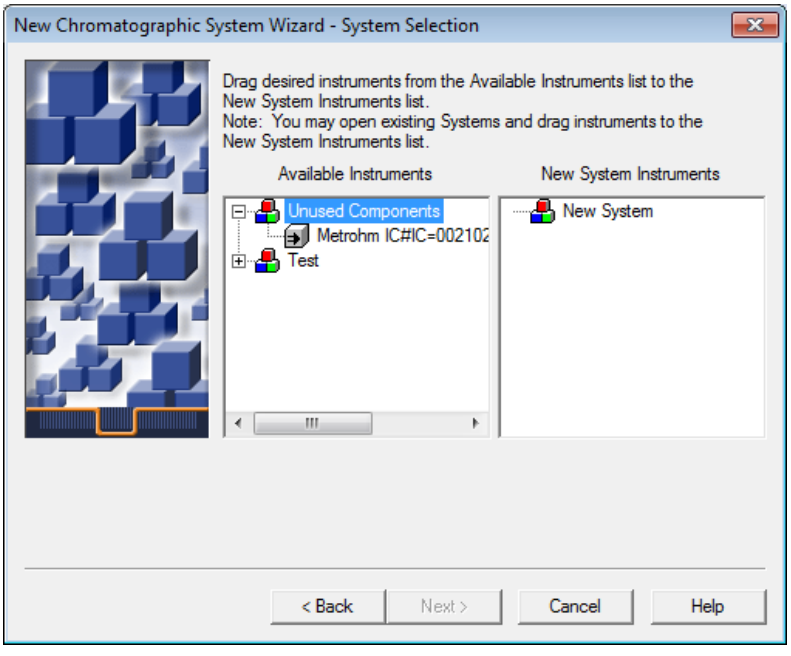
4. Click on **Next**.
5. Choose (client/server) acquisition server.
6. In case of a client/server installation, the **node** must be selected on which the **Metrohm IC Driver for Empower™** was installed.

7. Click on **Next**.



3.2 System selection

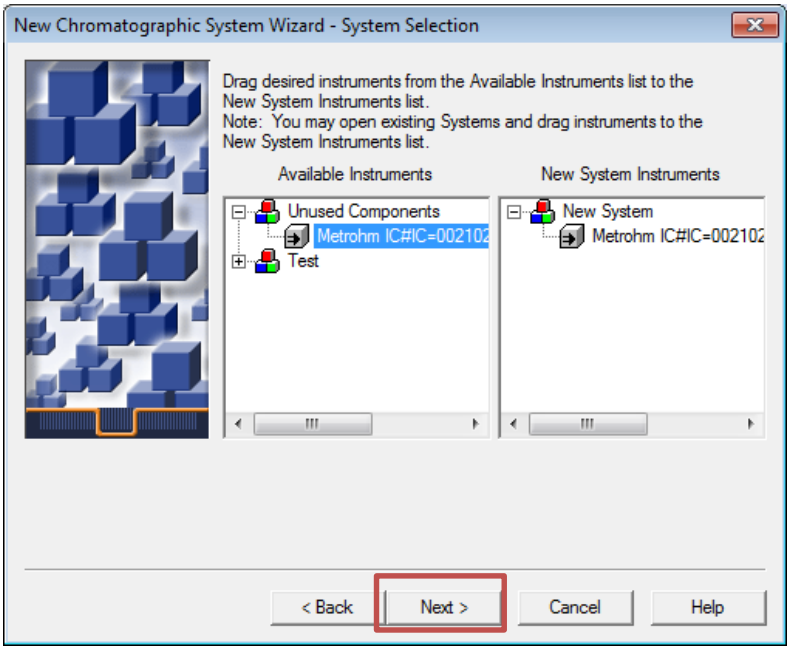
1. Select an instrument from the **Available Instruments** list and drag it to the list beneath **New System Instruments**. You can use instruments from the **Unused Components** and an existing system. If the instrument is not in the **Available Instruments** list, click on **Cancel** and check the properties of the **acquisition server**.



Note: With one chromatographic system only one IC instrument can be controlled. It is not possible to control multiple IC instruments with one chromatographic system. For this purpose, two different chromatographic systems are required (see *chapter "Restrictions" on page 80*).

2. Click on **Next**.

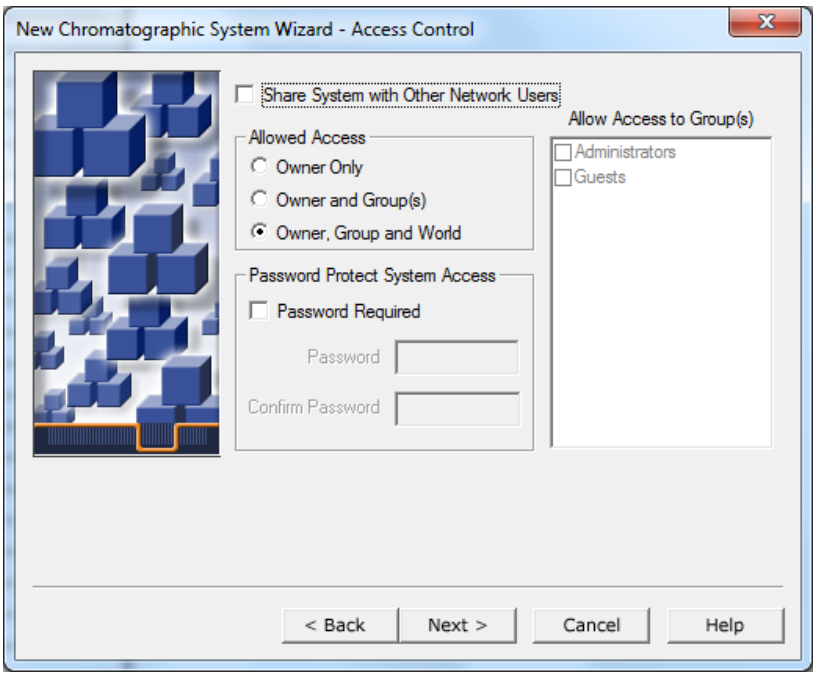
   Note: You cannot drag the last instrument from an existing system. To free up the last instrument, delete the system.



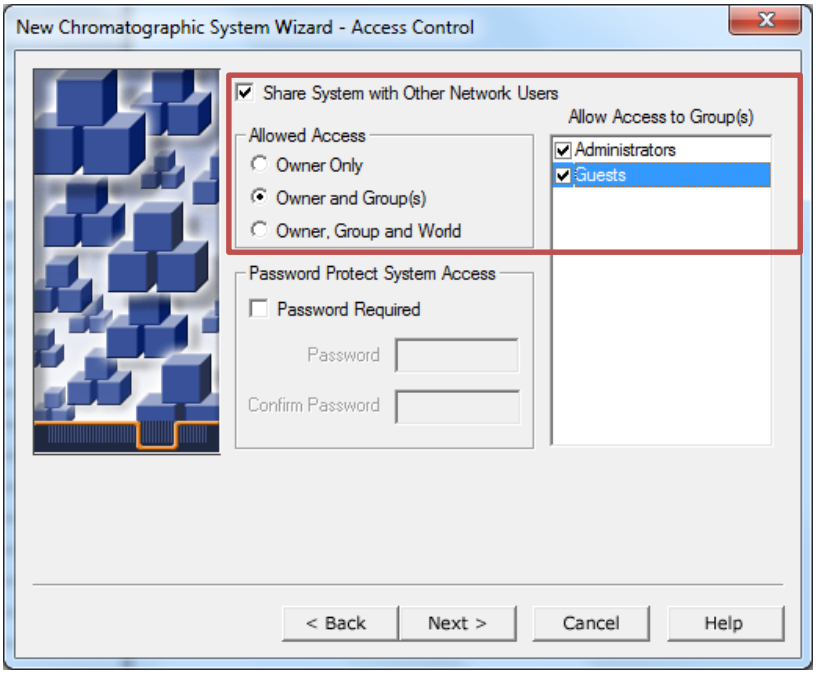
3.3 Access Control

Use this window to control how other users access the new system you are creating. You can share the system with other network users and password-protect it.

Note: If you have access to a chromatographic system, you do not need to enter the password unless you are crossing databases.



1. If required, enable the fields under **Allow Access to Group(s)**.

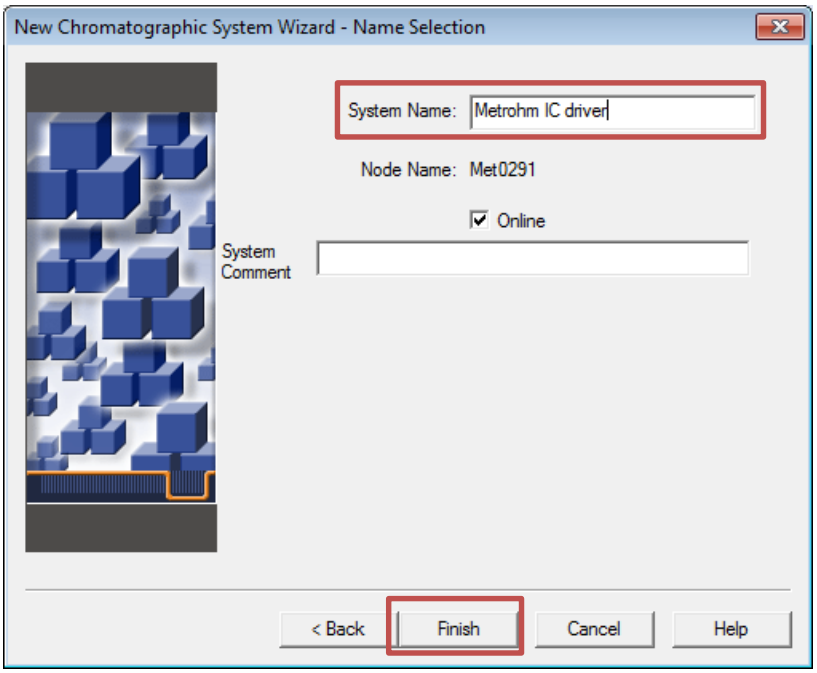


Detailed explanations

Field	Explanation
Share System with Other Network Users	Specifies that other network users (determined by the access option you select; see below) can use the system. If you select this option, consider password-protecting the system to limit its use to authorized users.
Allowed Access	
Owner Only	Specifies that the owner of the chromatographic system and users with administrator rights can access the selected chromatographic system.
Owner and Group(s)	Specifies that the owner of the chromatographic system, group members as specified in the **Allow Access to Group(s)** list and administrators can access the selected system. Group access only allows a user to operate a chromatographic system. Note: To modify a chromatographic system, you need access to the chromatographic system and its **acquisition server**.
Owner, Group and World	Specifies that all users in the database can operate the selected chromatographic system.

Password Protect System Access	
Password Required	Specifies that users enter a password before they can access the selected chromatographic system across databases.
Password	Specifies that a password (up to 30 alphanumeric characters) is needed to access the selected chromatographic system across databases.
Confirm Password	Requires reentry of the password to confirm that it was spelled correctly.
Allow Access to Group(s)	
	Select the user group(s) that you want to give access to the selected chromatographic system. Access rights of these user groups override access rights of the selected World user type. If you select **Owner, Group and World**, groups that were not selected in the **Allow Access to Group(s)** list are assigned the **World** user type access.

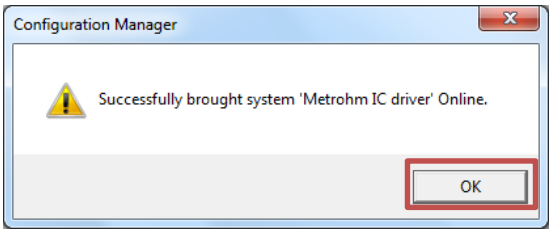
2. Click on **Next**.
3. Enter a system name and click on **Finish** to complete the setup of the new chromatographic system and to close the wizard.



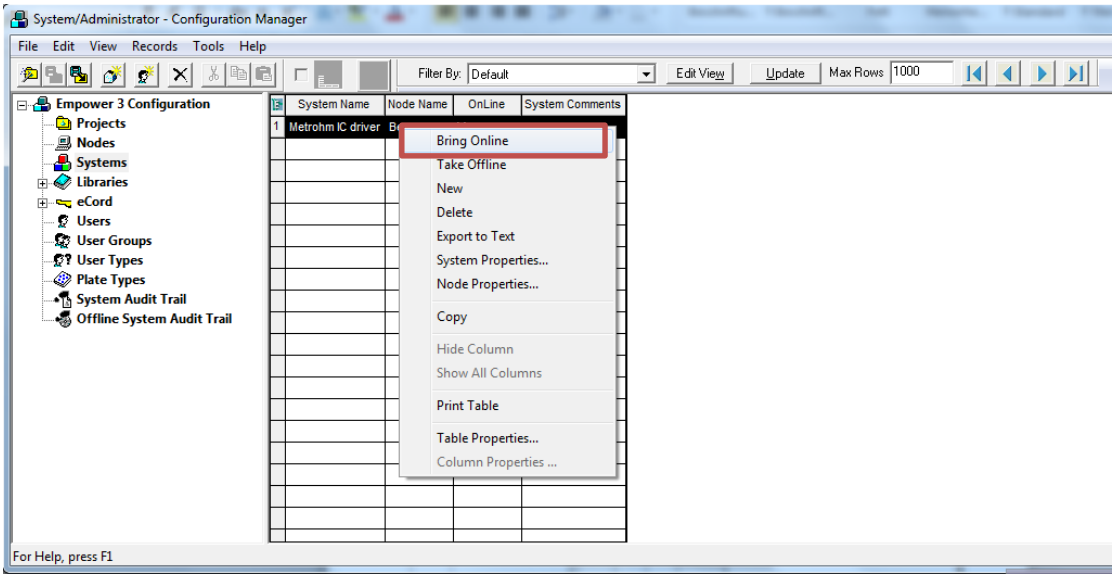
Detailed explanations

Field	Explanation
System Name	Identifies the chromatographic system in the Empower™ database and in the **Configuration Manager**. Up to 30 alphanumeric characters are allowed for the system name. Use a meaningful system name in case other users have access to the system.
Acquisition Server Name	Name of the acquisition server to which the selected system is connected. This field is not editable.
Online	If all configured system instruments are available (not configured in another online system), this brings the new system online. Default: selected.
System Comment	Displays optional remarks (up to 250 characters). Comments that describe the chromatographic system, its components and its intended use can help others if they have access to the system.

4. The following Message appears.
5. Click on **OK**.

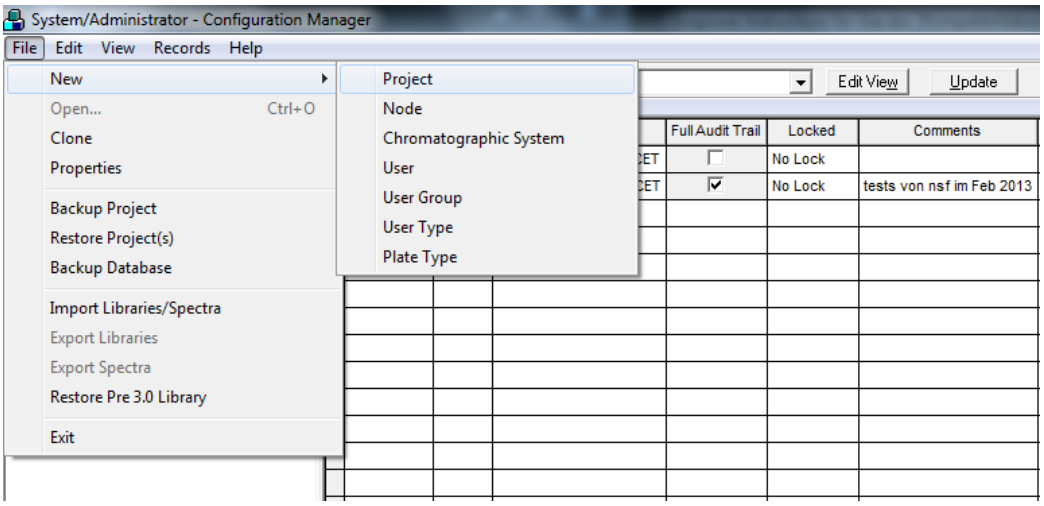


6. Check if the system is online. If not, bring it online by right-clicking on the system and clicking on **Bring Online**.



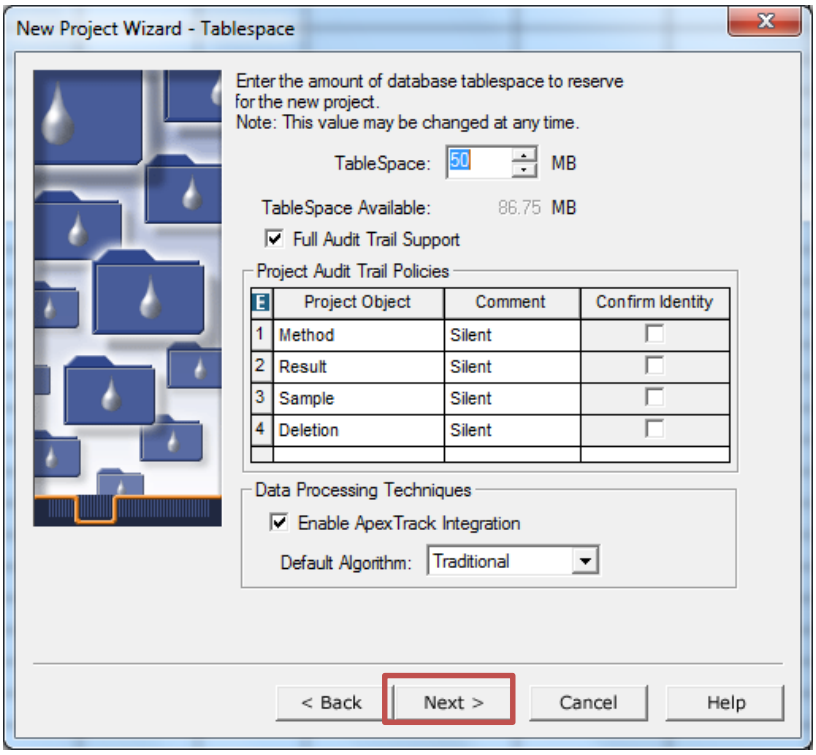
4 Creating a project

1. Create a new project by selecting the **New > Project** menu item.

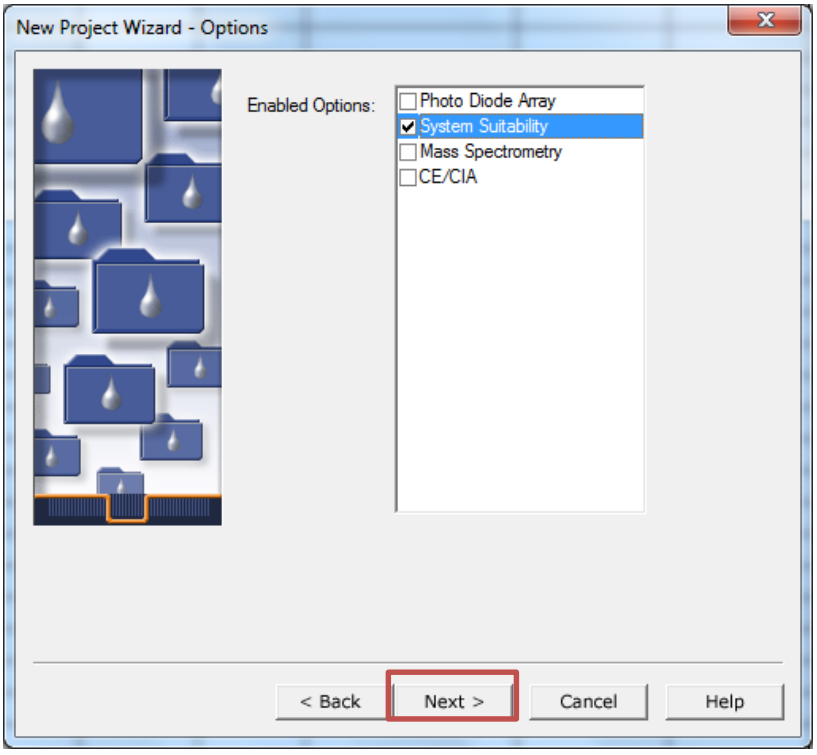


2. The **Tablespace** form appears.

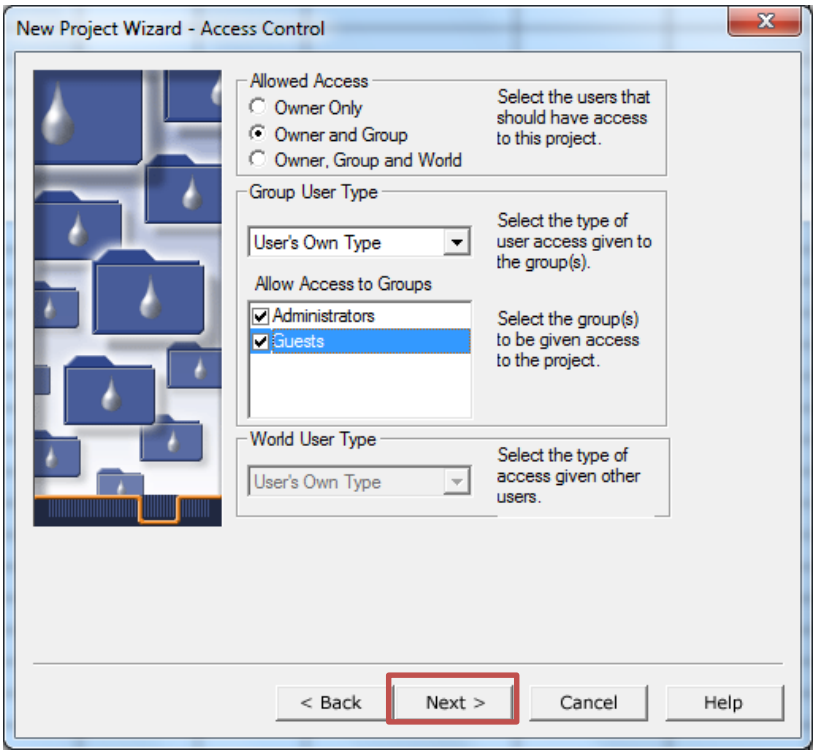
3. Click on **Next**.



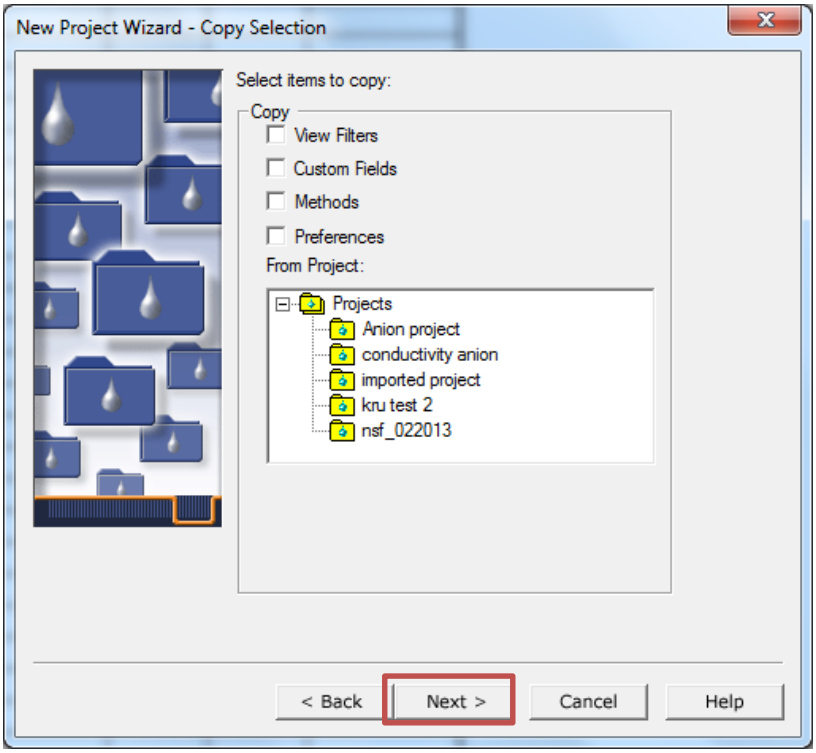
4. Click on **Next**.



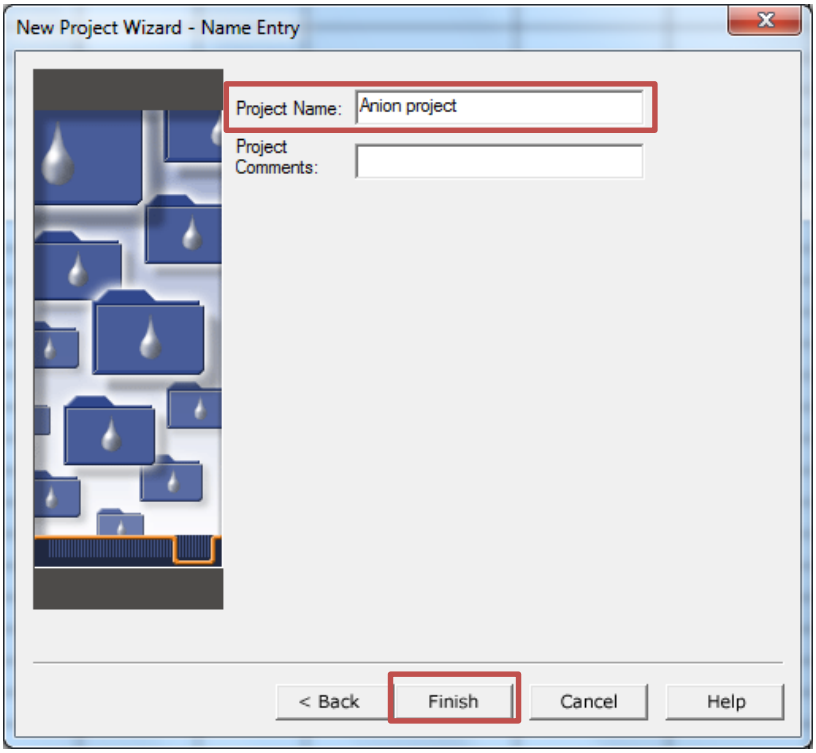
5. Click on **Next**.



6. In the **Projects** tree view, select an appropriate project for already existing settings.
7. Click on **Next**.



8. Enter a **Project Name**.
9. Click on **Finish**.



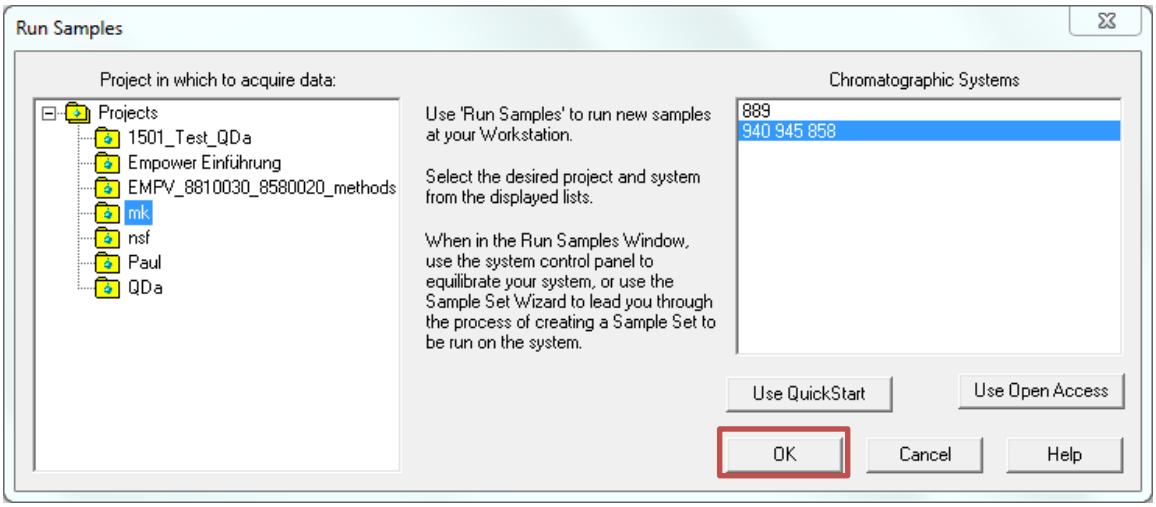
5 Creating an instrument method

Note: An already existing instrument method can only be used with the same system configuration the instrument method has been created with.

5.1 Opening the Run Samples interface

1. In the Empower™ start window, go to **Run Samples**.

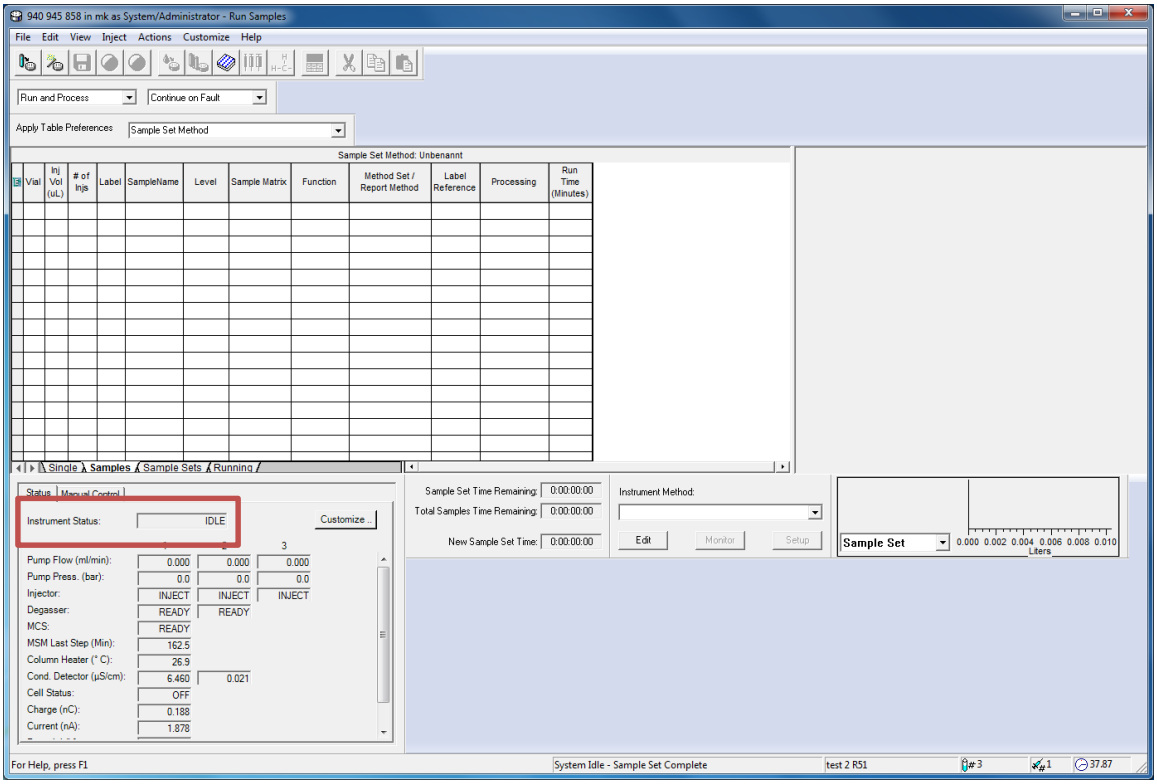
2. Choose your chromatographic system and click on **OK**.
   Note: In this manual, we will show you how to create an instrument method using the Pro interface. For a quick set up of an instrument method, click on **Use QuickStart**. The basic principle for the QuickStart is the same as described in this procedure.

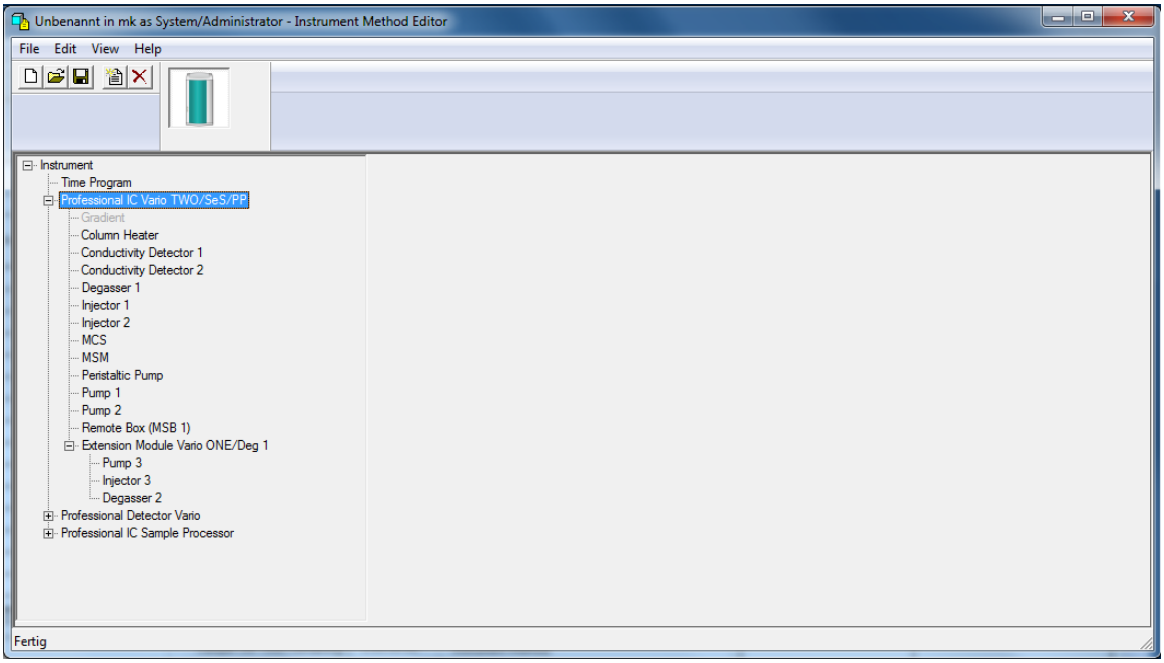


A **Run Samples** session is initiated. The corresponding icon in the task bar appears.

3. Wait until the instrument status changes from **INITIALIZING** to **IDLE**. This may take several minutes.

4. As soon as the instrument status has changed to **IDLE**, select **Edit > Instrument Method**.





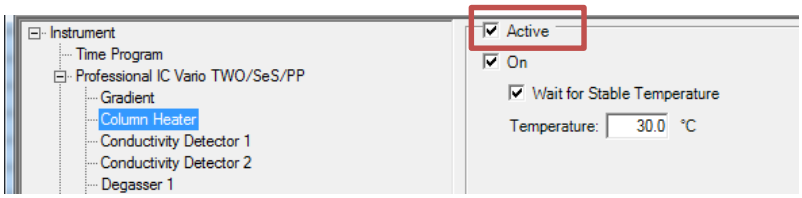
5. The window shows all modules of your setup in a tree structure. Select a module and enter the desired start parameters.

5.2 Setting the start parameters

Note: The selection option with the tabs depends on the instrument types.

Note: To set the parameters for a device, you first have to activate the device by checking the checkbox **Active**.

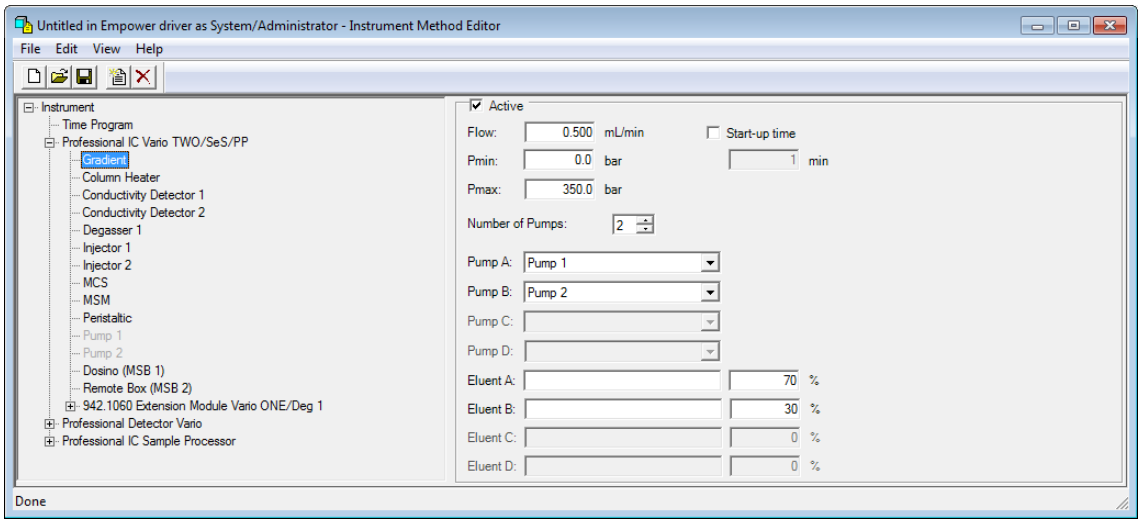
Example:



5.2.1 Setting the parameters for the different possible modules of an ion chromatograph

The following screenshots show start parameters for a typical anion setup.

IC – Gradient

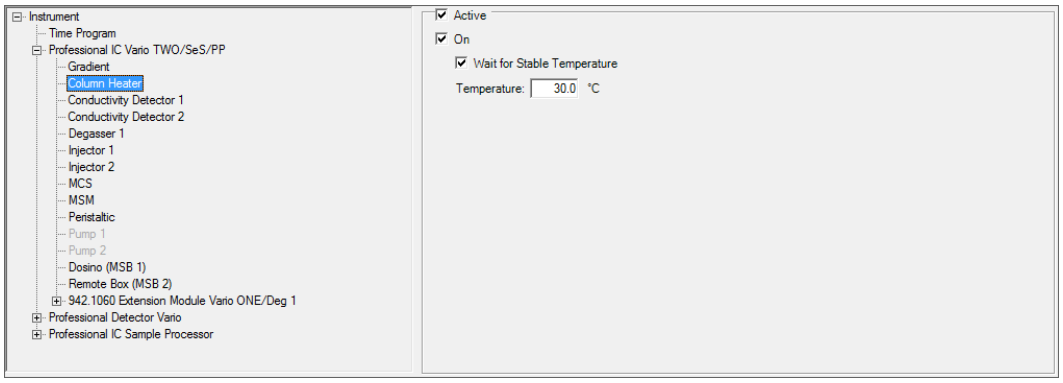


Detailed explanations

Parameter	Explanation
Flow	Flow of the high-pressure pump when starting the method.
Pmin	Minimum pressure when starting the method. If the pressure is below the entered minimum pressure, the high-pressure pump switches off automatically.
Pmax	Maximum pressure when starting the method. If the pressure is above the entered maximum pressure, the high-pressure pump switches off automatically.
Start-up time	When activated, a start-up time for reaching the defined flowrate can be defined.

Number of pumps	Determines the amount of connected high-pressure pumps
Pump A-D	To assign the pumps to pumps A-D.
Eluent A-D	Determines the mixing ratio of the eluents when starting the method. The total in percent has always to be 100.

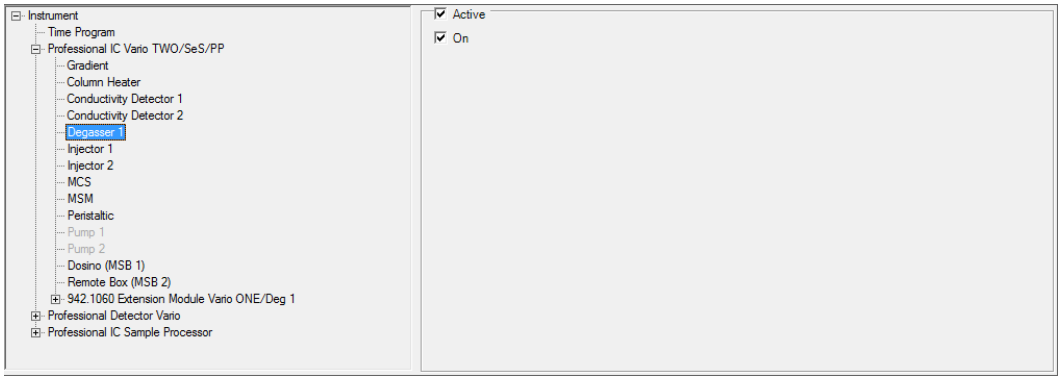
IC – Column Heater



Detailed explanations

Parameter	Explanation
Wait for Stable Temperature	If this option is switched on, then a determination will not start until the set temperature has been reached and is stable.
Temperature	Temperature that is set for the column heater when the hardware is started.

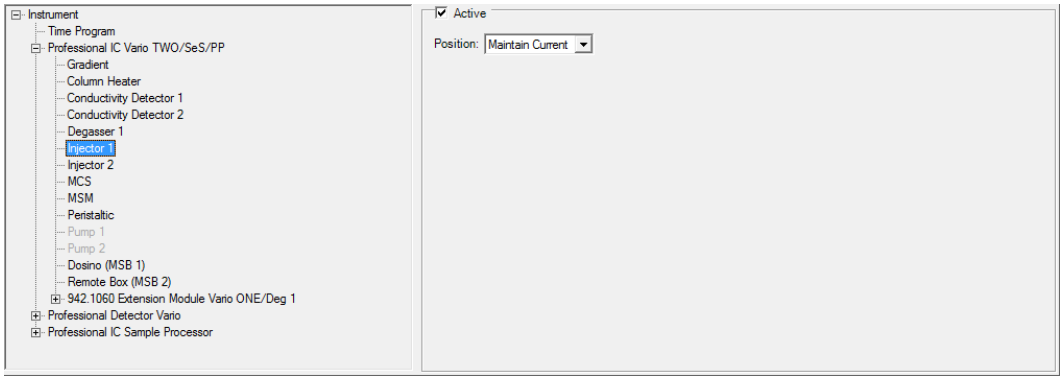
IC – Degasser



Detailed explanations

Parameter	Explanation
On	Determines whether the device is switched on when the hardware is started or not.

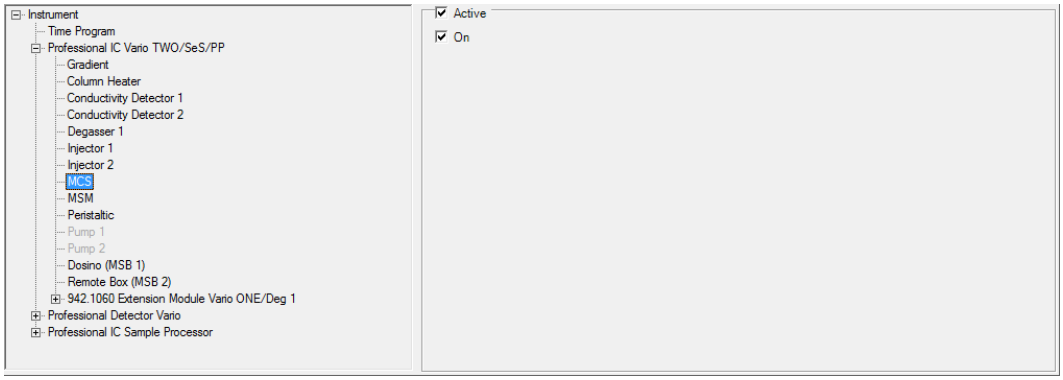
IC – Injector



Detailed explanations

Parameter	Explanation
Position	Position of the injection valve when the hardware is started.

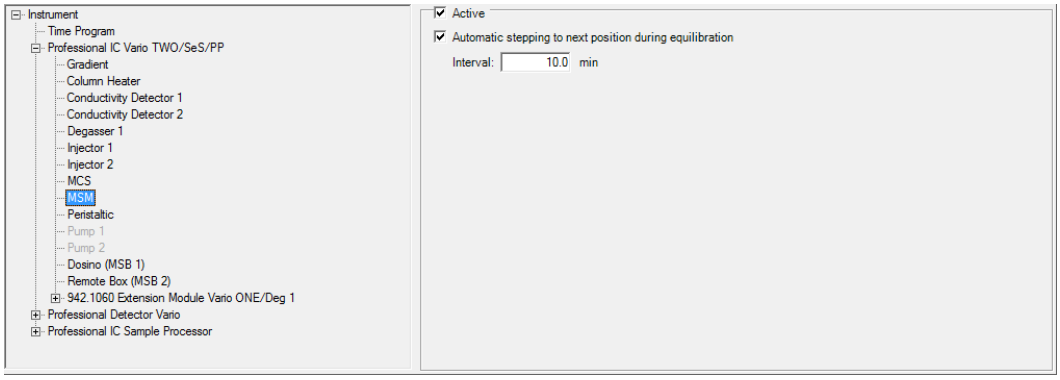
IC – MCS



Detailed explanations

Parameter	Explanation
On	Determines whether the device is switched on when the hardware is started or not.

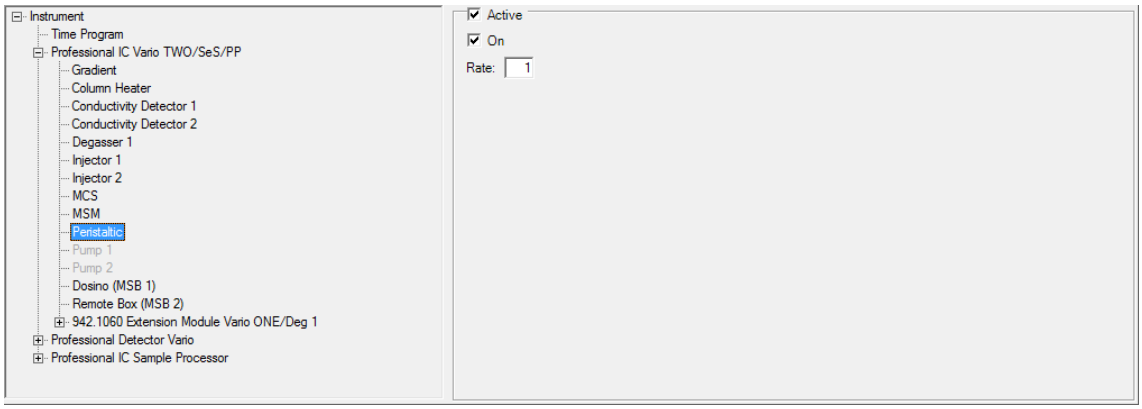
IC – MSM



Detailed explanations

Parameter	Explanation
Automatic stepping to next position during equilibration	If this option is enabled, then – after the method is loaded – automatic stepping of the rotor to the next position is initiated within the equilibrate mode. The time interval defined in the parameter Interval is used.
Interval	Time interval between 2 sequential automatic rotor stepping operations.

IC – Peristaltic



Detailed explanations

Parameter	Explanation
Rate	Rate of the peristaltic pump when the hardware is started
On	Determines whether the device is switched on when the hardware is started or not.

IC – Dosino

Note: The dosing devices (Dosinos) have to be connected to the instrument before the system is set up, because they are not plug-and-play devices.

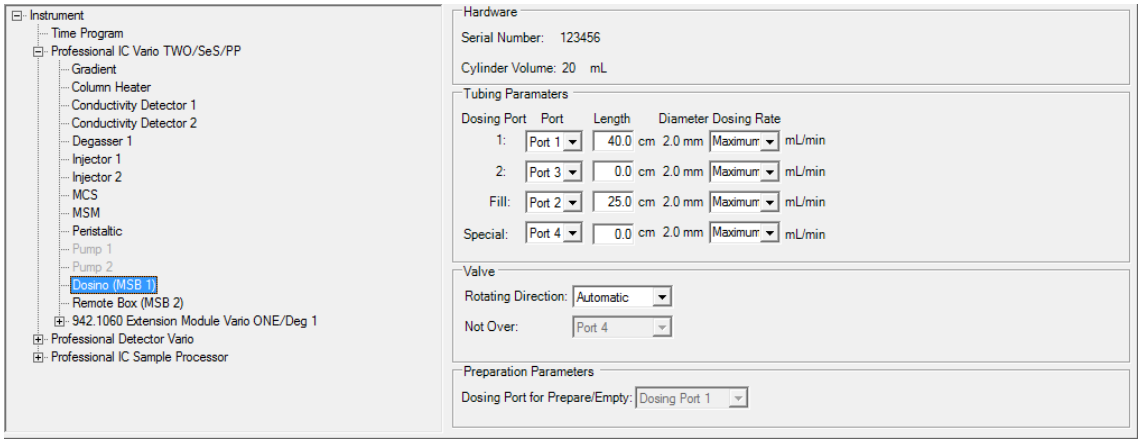
The Dosinos can be connected to the following devices:

- IC devices
- Stand-alone detectors
- IC sample processors

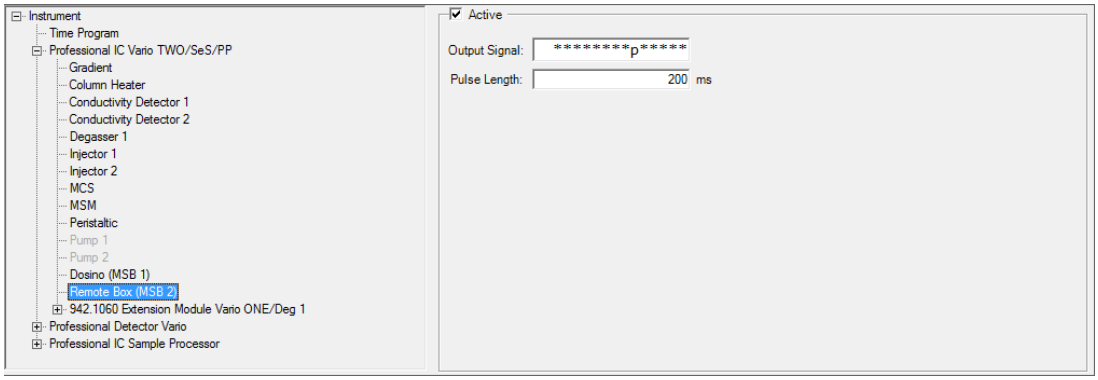
Connecting dosinos to the sample center is not possible.

Note: Dosino default settings normally do not require any modification.

Note: If a Prep or Empty command is performed with the Dosino, then the "Dosing Port 1" will always be used as the port for ejecting the solution (Port for Prep/Empty).



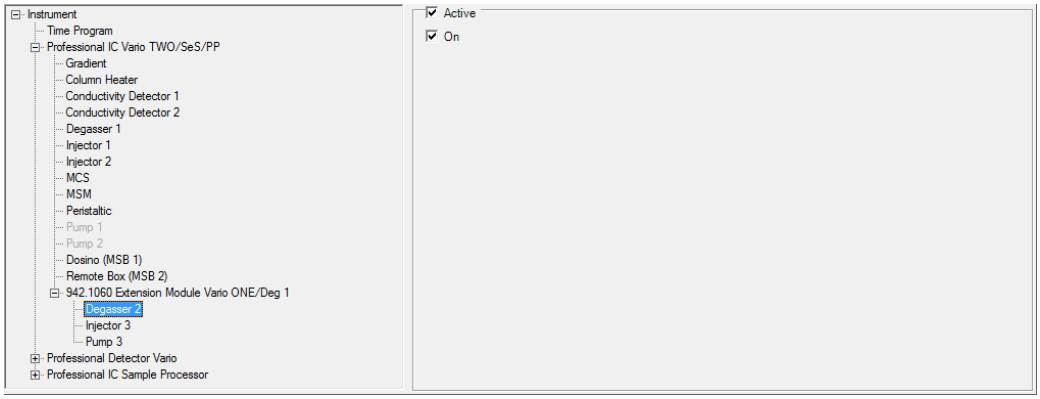
IC – Remote Box



Detailed explanations

Parameter	Explanation
Output signal	Input of the binary pattern for the output signal of exactly 14 characters. 0 = Output line deactivated 1 = Output line activated * = Retain the status of the output line p = set pulse (pulse length = 200 ms). If an impulse with a different length is to be emitted, you can enter the desired value in the field **Pulse Length**. The output lines are numbered from right to left: 13-12-11-10-9-8-7-6-5-4-3-2-1-0 **Examples:** ********1***** : Sets the status of output line 9 on active. ****0********* : Sets the status of output line 5 on deactive.

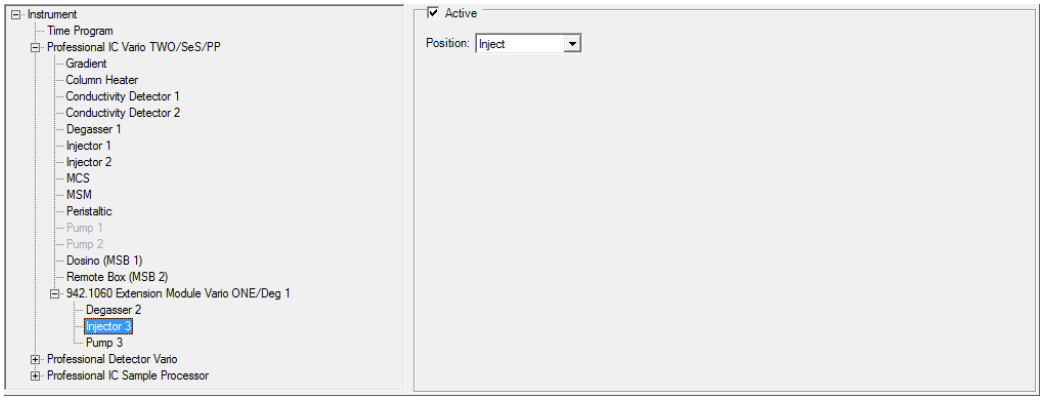
IC – Extension Module – Degasser



Detailed explanations

Parameter	Explanation
On	Determines whether the device is switched on when the hardware is started or not.

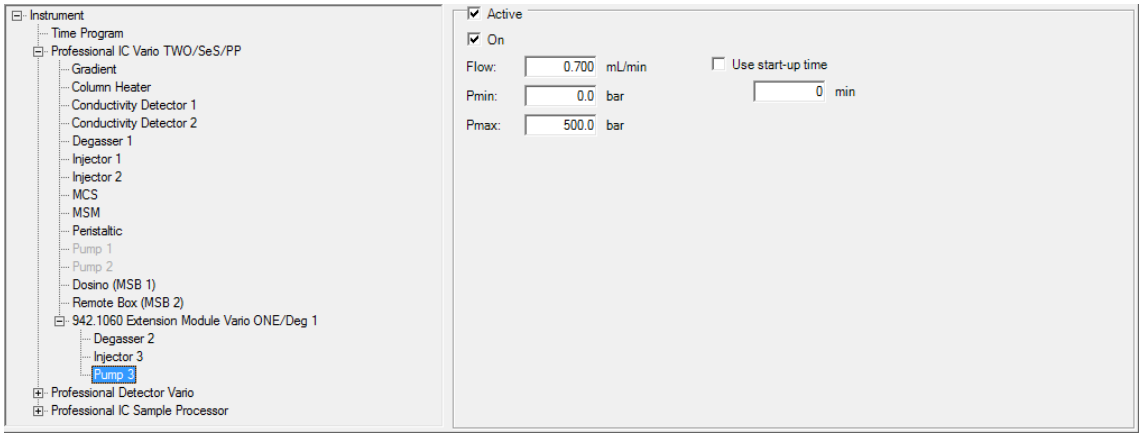
IC – Extension Module – Injector



Detailed explanations

Parameter	Explanation
Position	Position of the injection valve when the hardware is started.

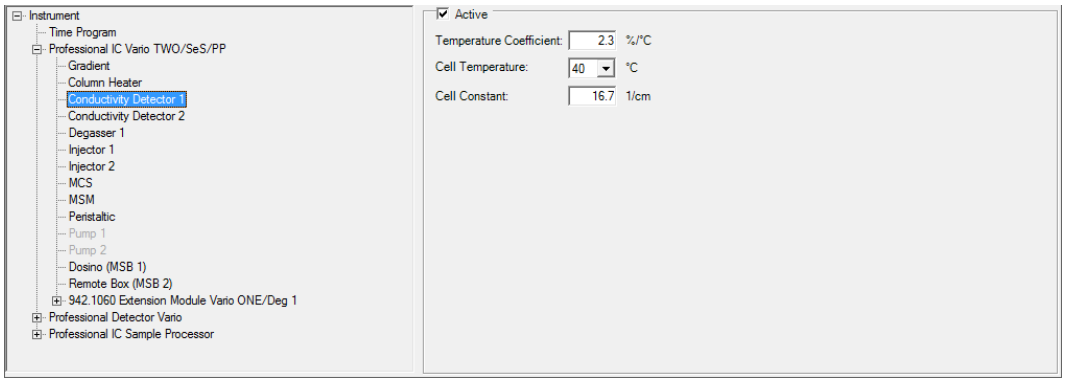
IC – Extension Module – Pump



Detailed explanations

Parameter	Explanation
On	Determines whether the device is switched on when the hardware is started or not.
Flow	Flow of the high pressure pump when the hardware is started.
Pmin	Minimum permitted pressure in the system when the hardware is started. The high pressure pump automatically switches off if this pressure level is not reached.
Pmax	Maximum permitted pressure in the system when the hardware is started. The high pressure pump automatically switches off if this pressure is exceeded.
Use start-up time	When activated, a start-up time for reaching the defined flowrate can be defined.

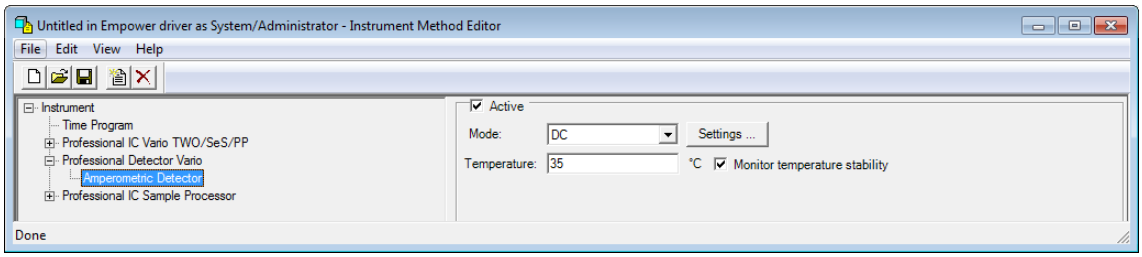
5.2.2 Setting the parameters for the Conductivity Detector



Detailed explanations

Parameter	Explanation
Temperature Coefficient	Temperature coefficient that is set when the hardware is started. The temperature coefficient corrects the measured conductivity of the detector at the operating temperature to the conductivity at the reference temperature 20 °C.
Cell Temperature	Selecting thermostat temperature of the detector block.
Cell Constant	Cell constant of the measuring cell.

5.2.3 Setting the parameters for the Amperometric Detector

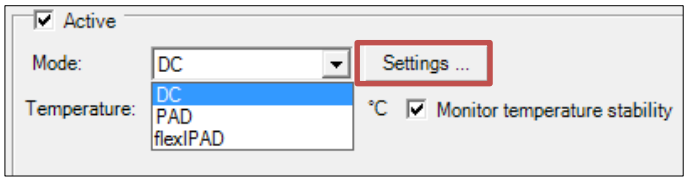


Detailed explanations

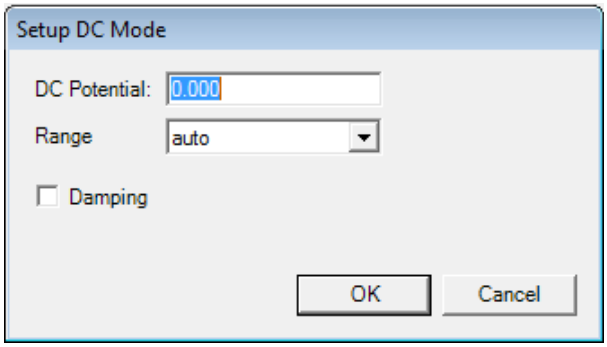
Parameter	Explanation
Mode	Selection of the measuring mode of the amperometric detector. Following measuring modes are available: • DC: Measurement with constant potential. • PAD: Measurement with several potential steps. • flexIPAD: Measurement with flexible potential steps (levels, ramps) and integration.
Temperature	Temperature that is set in the detector when the hardware is started.
Monitor temperature stability	If this option is switched on, then a determination will not start until the set temperature has been reached and is stable. If this option is switched off, then the sequence of a determination will not be influenced by the temperature. An attempt will indeed be made to achieve the temperature and to maintain it, but the determination will begin in any case.
Settings	Opens the dialog for setting the parameters of the selected measuring mode of the amperometric detector. For further information concerning the settings for the different modes, see below.

Settings for the different measuring modes

The following measuring modes are available. Select the desired mode and click **Settings** to change the parameters.



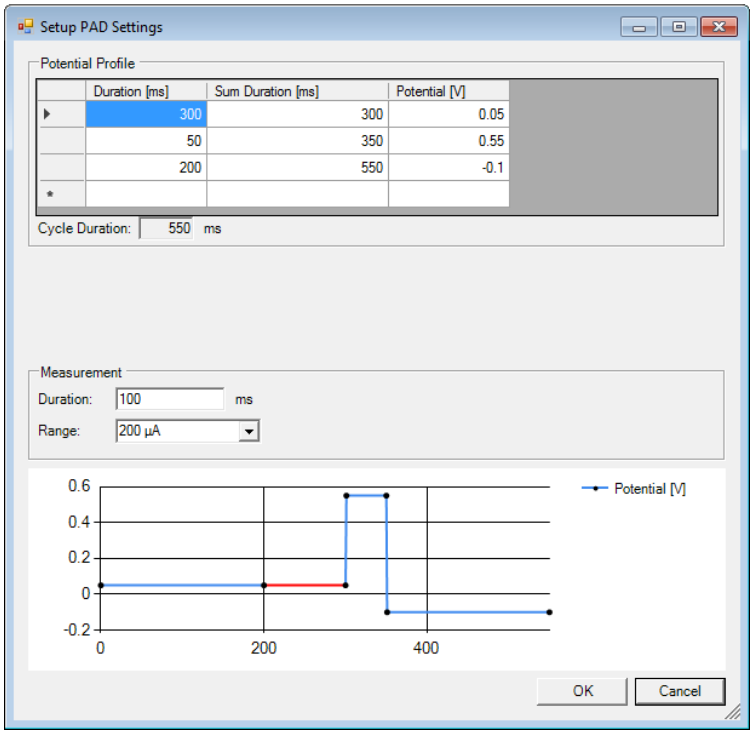
DC



Detailed explanations

Parameter	Explanation
DC potential	Potential of the working electrode in comparison to the reference electrode.
Range	Selection of the measuring range. **auto**: Automatic setting of the measuring range. This selection is not allowed with damping activated.
Damping	Switching the auxiliary damping on or off.

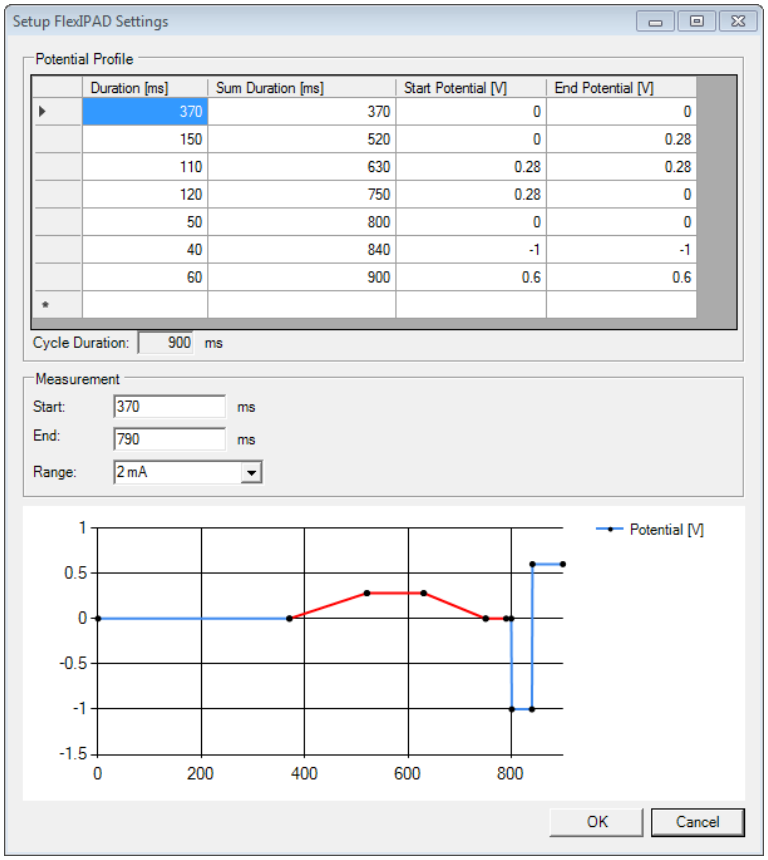
PAD



Detailed explanations

Parameter	Explanation
Duration [ms]	Duration of the potential step in milliseconds.
Sum Duration [ms]	Cumulative duration of potential steps 1 - n in milliseconds (n = number of the observed potential step).
Potential [V]	Potential of the step in volts.
Cycle duration	Display of the total duration of the potential profile in milliseconds (sum of the durations of the individual steps).
Duration	Duration of the measurement.
Range	Selection of the measuring range.

flexIPAD



Detailed explanations

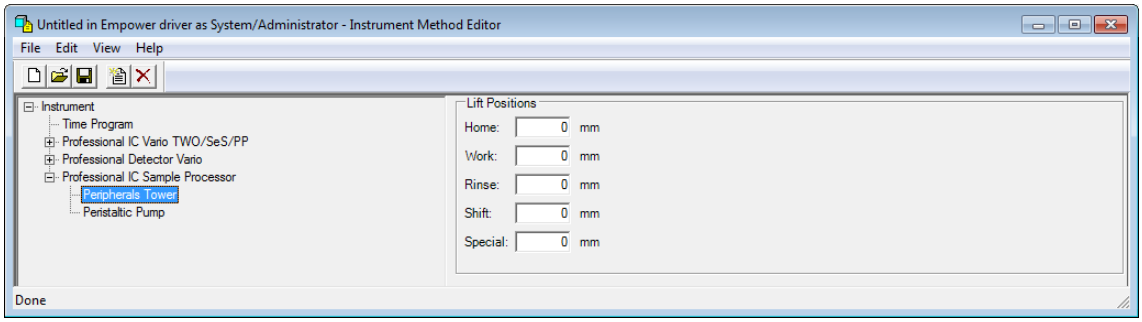
Parameter	Explanation
Duration [ms]	Duration of the potential step in milliseconds.
Sum Duration [ms]	Cumulative duration of potential steps 1 - n in milliseconds (n = number of the observed potential step).
Start potential [V]	Start potential of the step in volts.
End potential [V]	Terminal potential of the step in volts.
Cycle duration	Display of the total duration of the potential profile in milliseconds (sum of the durations of the individual steps).
Start	Start time of the measurement.
End	Ending time point of the measurement.
Range	Selection of the measuring range.

5.2.4 Setting the parameters for the IC Sample Processor

Sample Processor – Peripherals Tower

Note: These values are dependent on the racks and sample vessels used.

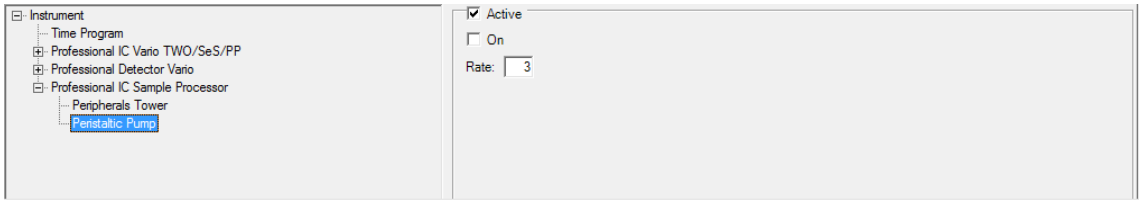
Note: The needle of the Sample Processor can only move to positions on the rack used (no external positions such as the rinsing station).



Detailed explanations

Parameter	Explanation
Home	The home position is usually the uppermost stop of the lift.
Work	Usually at this lift position the sample is taken.
Rinse	This lift position is used for rinsing.
Shift	Each time that the rack shifts, the lift will move to this position if it is located at a lower lift position. If the lift is located at a higher lift position than that defined here, then the shifting will take place at the current lift position. This means that the shift position must be selected so that a safe movement across the entire rack is possible at any time.
Special	This additional definable position can be used e.g. during pipetting so that the tip is just immersed in the sample solution.

Sample Processor – Peristaltic Pump



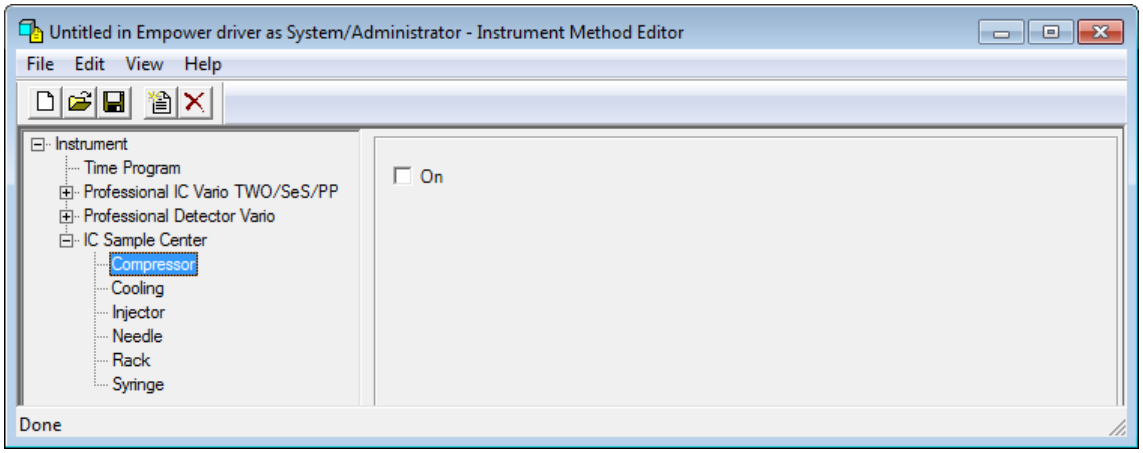
Detailed explanations

Parameter	Explanation
Rate	Rate of the peristaltic pump when the hardware is started.
On	Determines whether the devide is switched on when the hardware is started or not.

5.2.5 Setting the parameters for the Sample Center

Note: Needle or rack commands can only be processed if the door of the 889 sample center is closed. If the door is open, the state of the module changes to "Error" (indicated by the red LED on the 889 and a corresponding message in the Empower™ message center). In this case, go to **Manual Control** and select the command **Reset Device** in the folder **General**. If the command **Reset Device** does not work, reset the system according to chapter 12.1 on page 78.

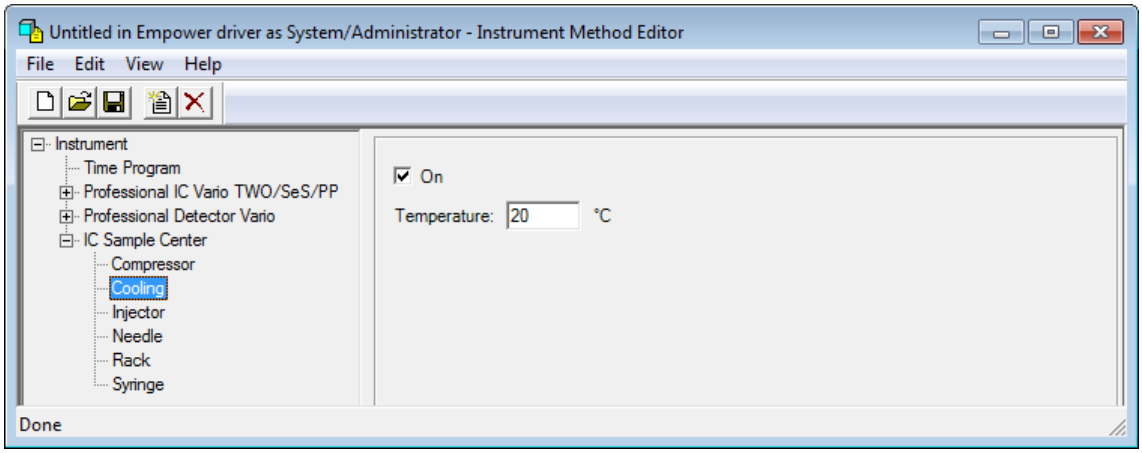
Compressor



Detailed explanations

Parameter	Explanation
On	The compressor is switched on when the hardware is started.

Cooling



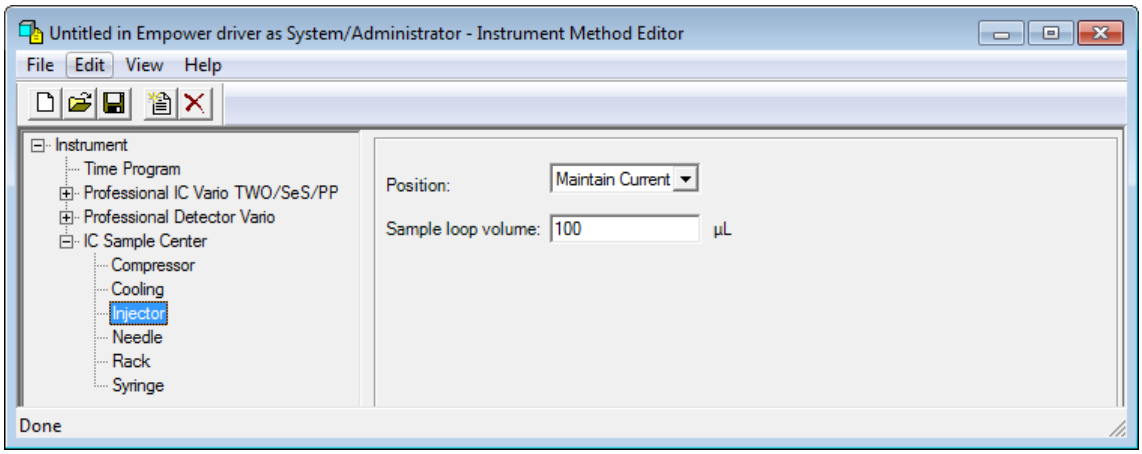
Detailed explanations

Parameter	Explanation
On	The cooling is switched on when the hardware is started.
Temperature	Temperature that is set for the cooling when the hardware is started.

Injector

Note: The range of the injection volume is depending on the injection mode. If the volume is outside the respective range, the instrument will switch to failure. The maximum injection volume is calculated in accordance with the following formulas:

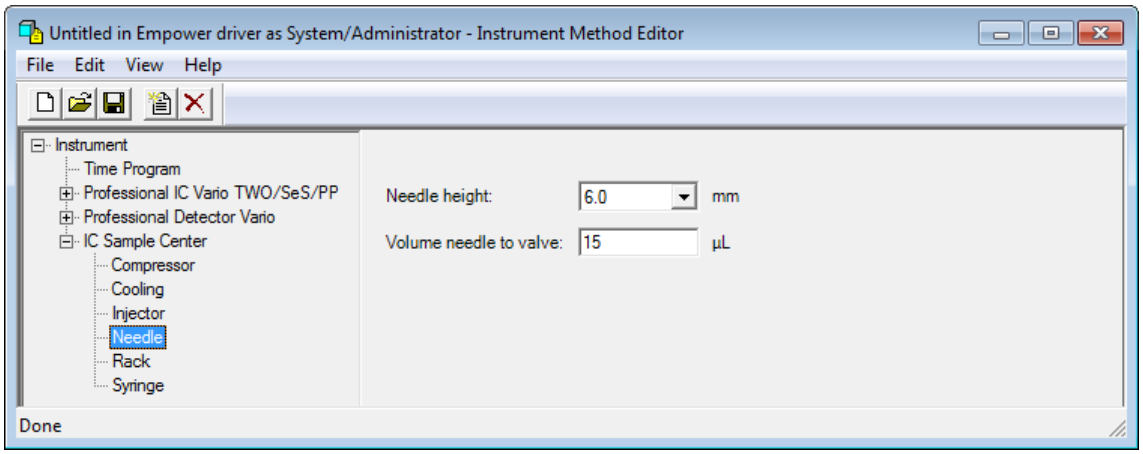
- Full loop: injection volume = sample loop volume
- Partial loopfill: max. injection volume = 0.5 × sample loop volume
- Pickup: max. injection volume = (sample loop volume − 3 × needle volume) / 2



Detailed explanations

Parameter	Explanation
Position	Position of the injection valve when the hardware is started.
Sample loop volume	Volume of the sample loop of the injection valve, in µL. **Note**: The injection volume in the sample table has to fit to the entered value in the field **Sample loop volume**. For further information refer to the 889 Sample Center user manual.

Needle

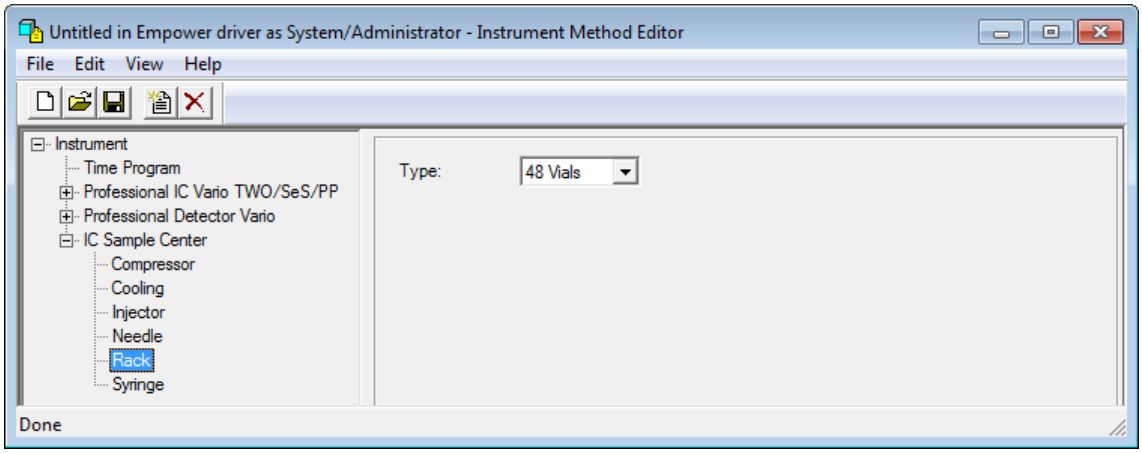


Detailed explanations

Parameter	Explanation
Needle height	Vertical distance of the needle tip from the bottom of the vial or the cavity of the micro titer plate.
Volume needle to valve	Whole volume, from the needle tip to the injection valve, in µL.

Note: For information how to exchange the needle, refer to the IC sample center manual (8.889.8001EN).

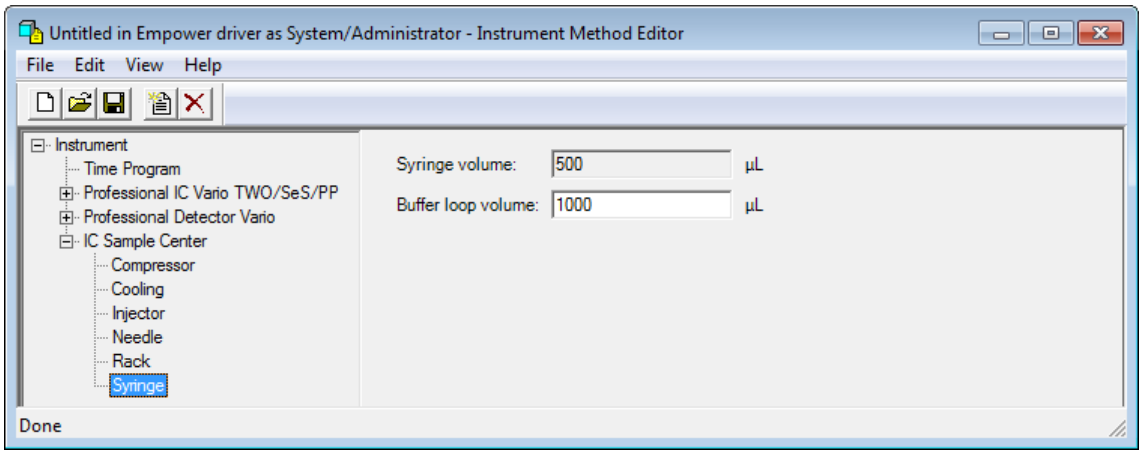
Rack



Detailed explanations

Parameter	Explanation
Type	Selection of the rack type.

Syringe



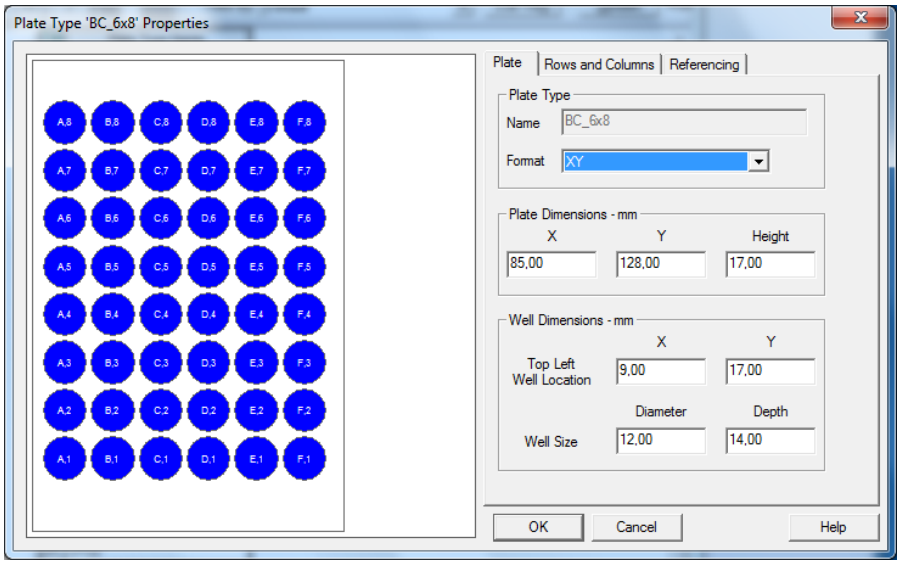
Detailed explanations

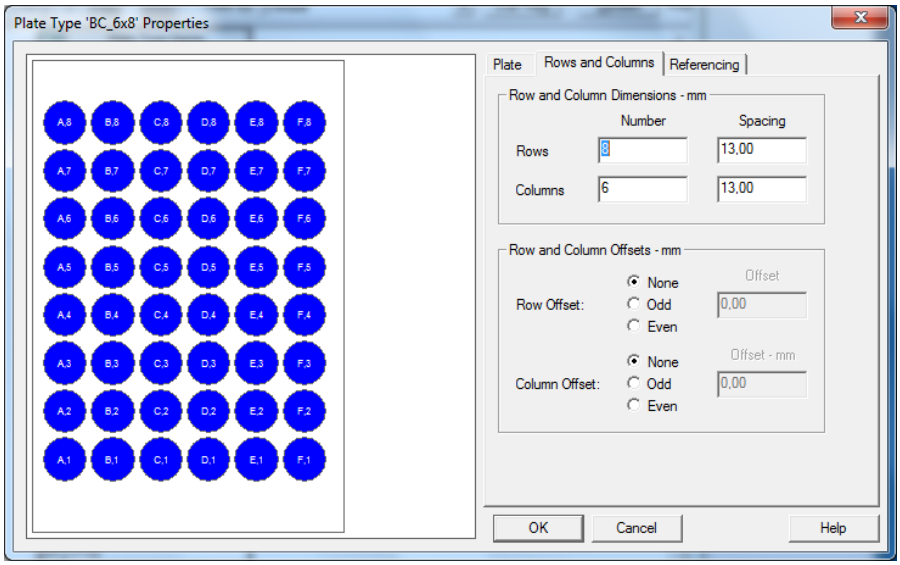
Parameter	Explanation
Syringe volume	Display of the volume of the syringe in µL.
Buffer loop volume	Volume of the buffer loop in µL.

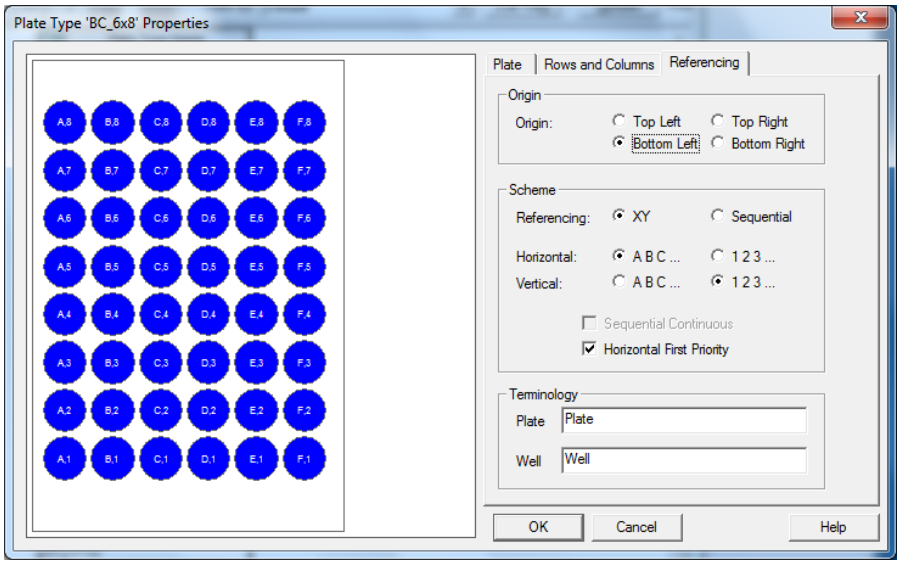
Define plates for sample set method

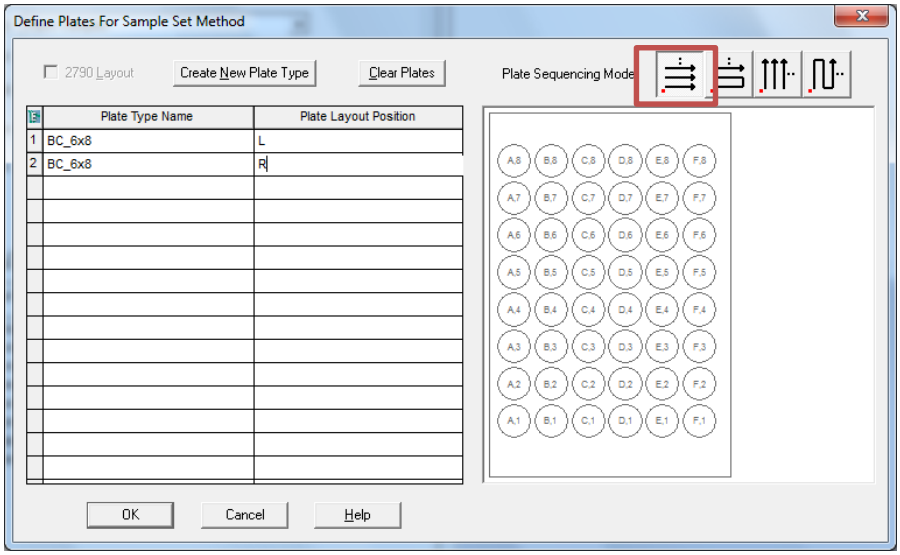
The following screenshots show the correct configuration of the 889 sample center.

1. To enter the configuration, click on the **Plates** symbol in the Run Samples section and click on **Create New Plate Type.**









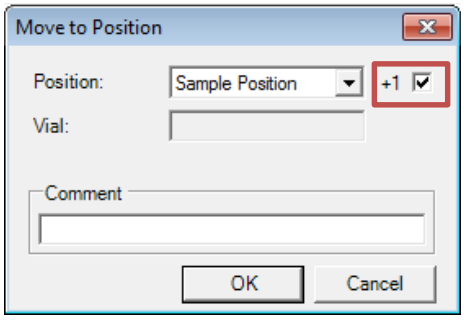
Note: Pay attention to select the correct **Plate Sequencing Mode**.

Defining the sample positions when measuring two channels

When measuring two channels (with two different solutions, e.g. anions/cations) with one time program, you have to define the sample positions in the time program.

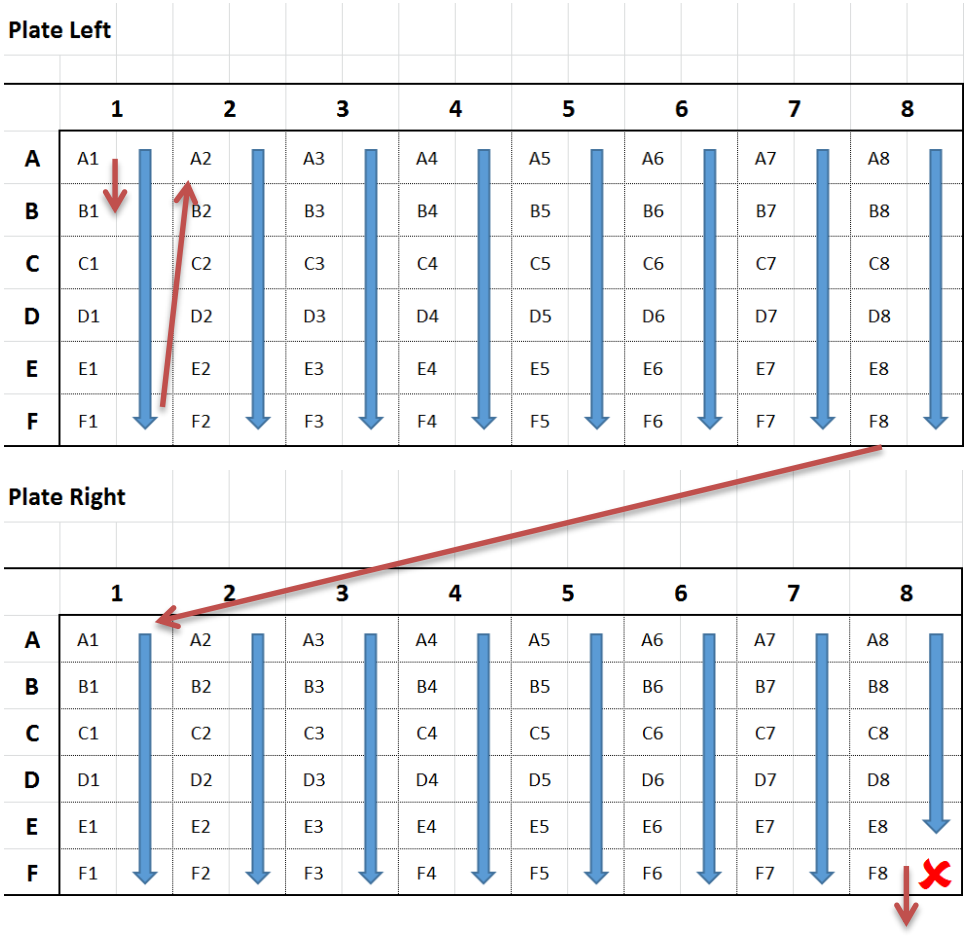
Note: If you are using the **+1** command as described below, you cannot use a predefined injection mode (e.g. Full Loop Injection). In this case you have to write the sequence for the injection manually.

When adding a **Move to Position** command, check the checkbox **+1**.



Checking the checkbox **+1** has the following meanings:

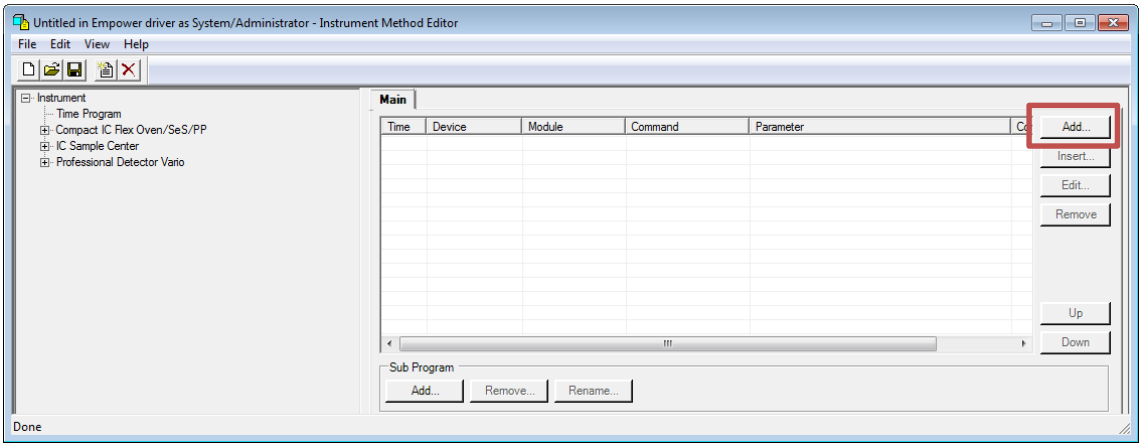
- LA1 + 1 = LB1
- LF1 + 1 = LA2
- LF8 + 1 = RA1
- RF8 + 1 = RA9 (is invalid)



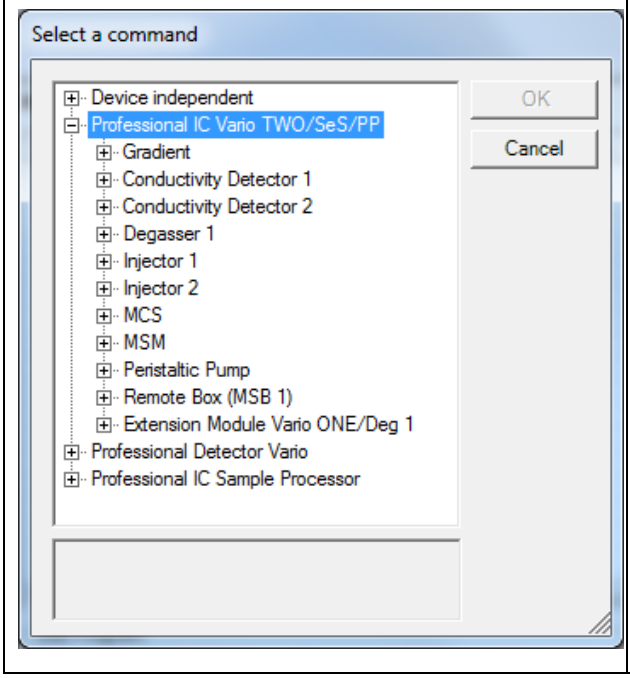
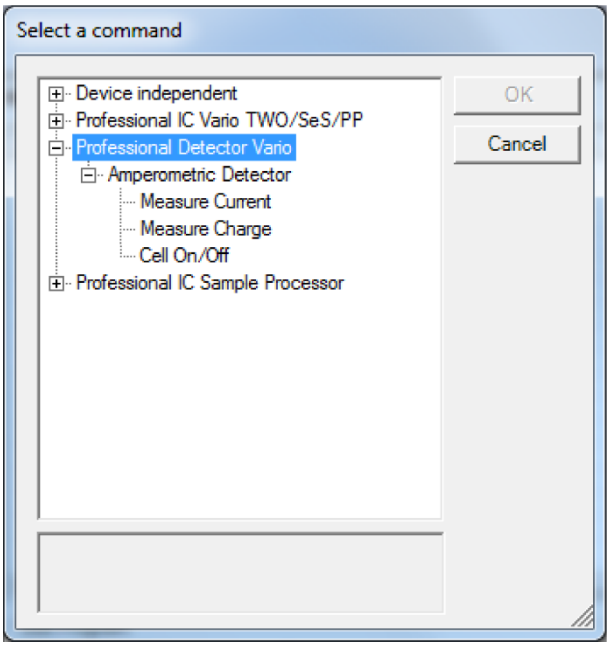
5.3 Creating the time program of the method

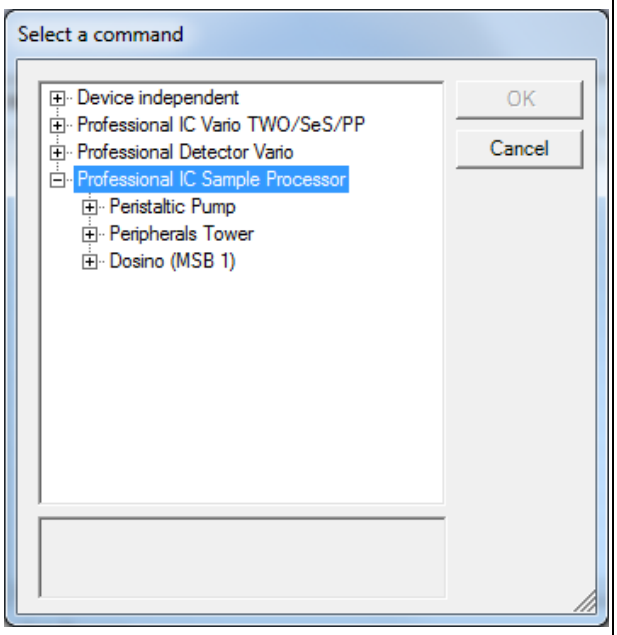
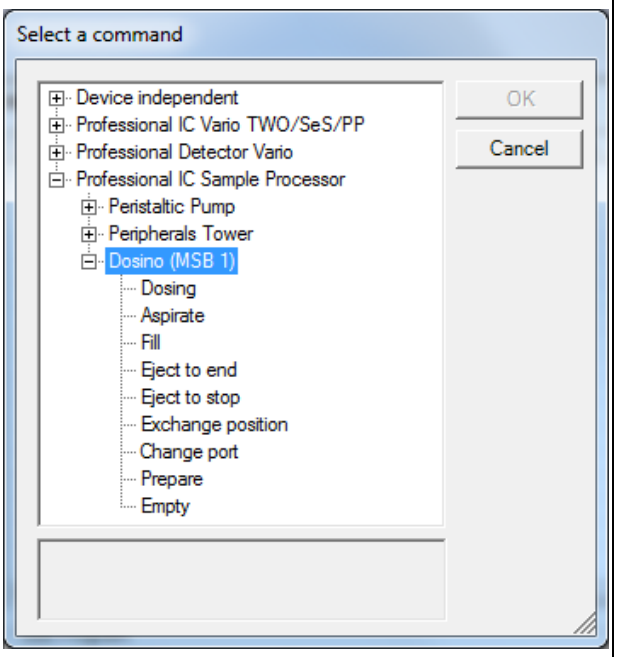
Write a time program to set the chronological order of the action of your measurement.

Commands can be selected with **Add…**.

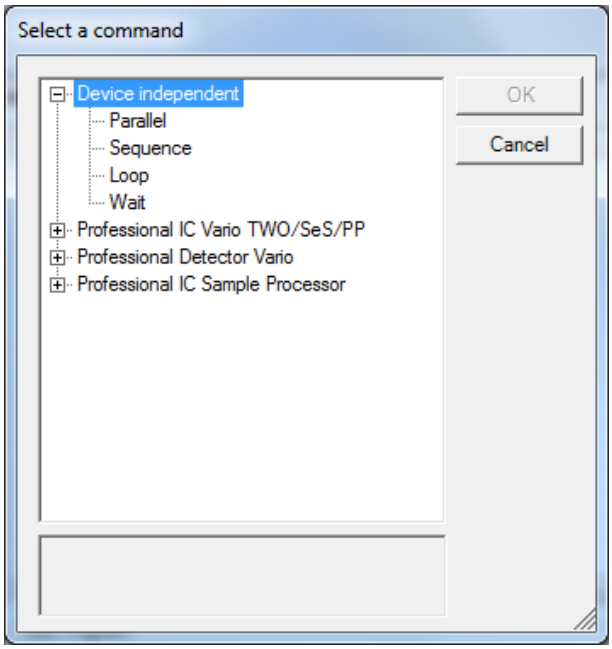


Depending on the instrument type, an IC instrument can perform the following actions:

Commands **IC instrument** (depending on the instrument type)	Commands **Amperometric Detector**
	

Commands **Sample Processor**	Commands **Dosino**
	

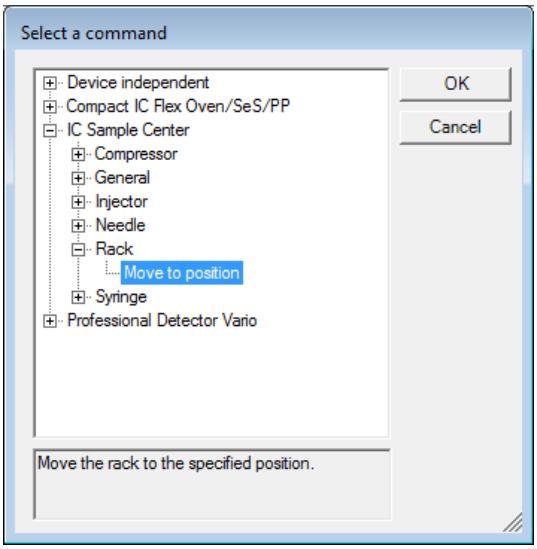
Device-independent commands are commonly used for the execution of subprograms. Subprograms can be used to create more complex time programs.



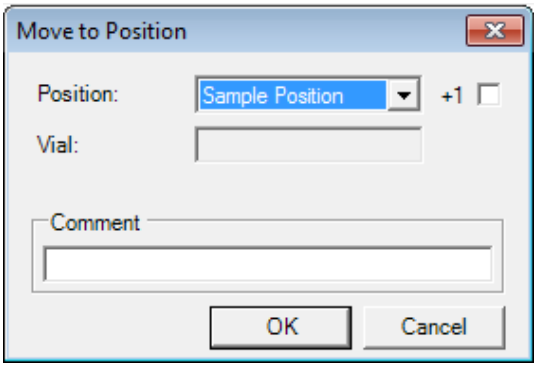
5.3.1 Time program – Example

To start a simple time program, you can proceed as follows:

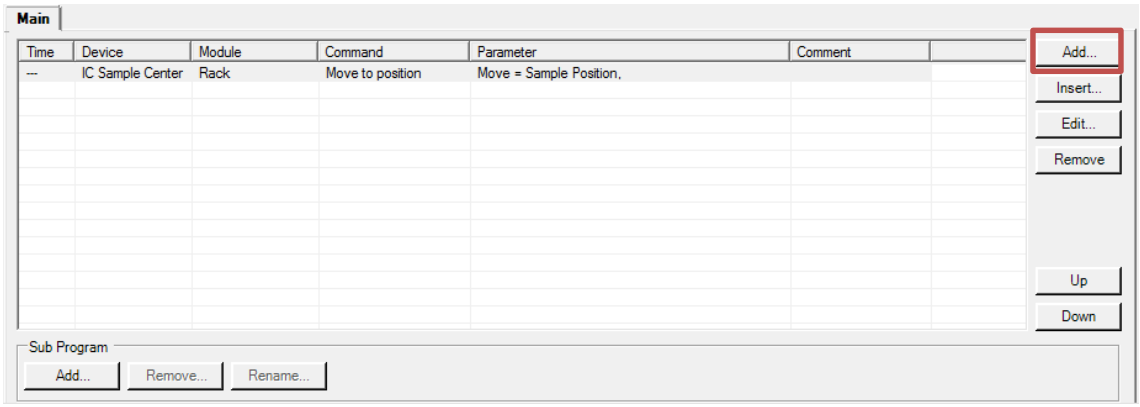
1. Double-click on **Move to position**.



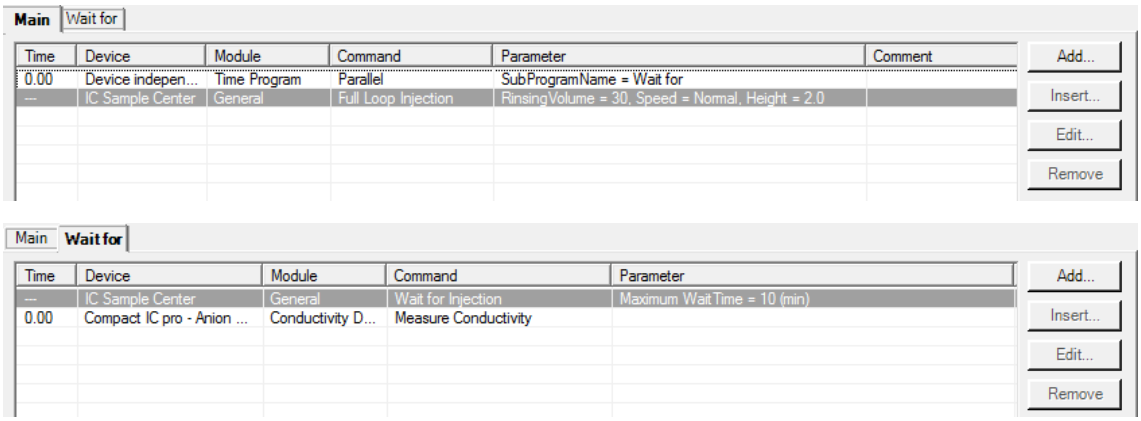
2. Select **Sample Position.**



The first line in the time program looks as follows:



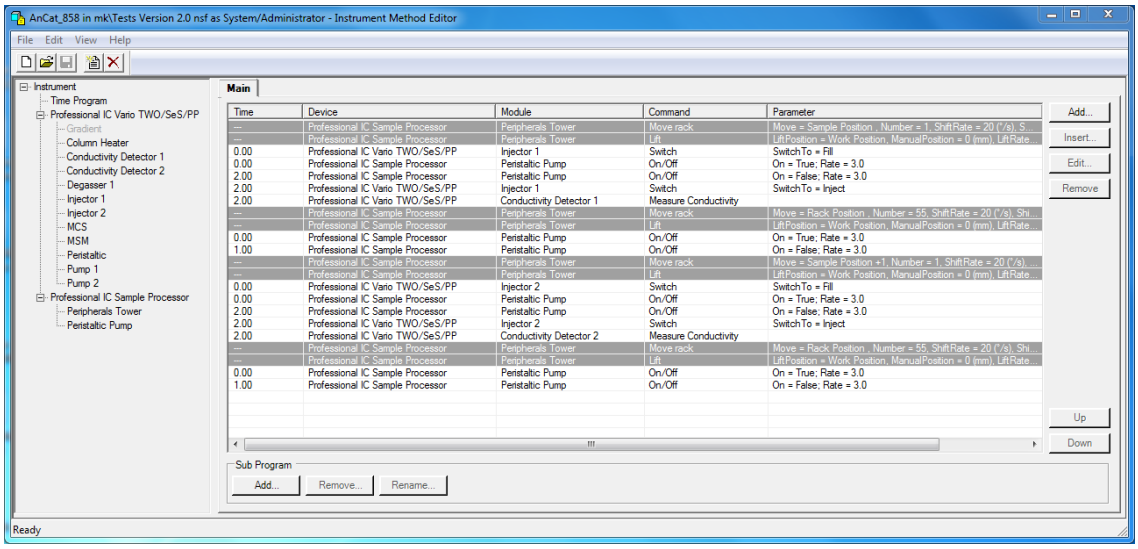
3. With **Add…** more lines can be added, e.g.:



Actions of indefinite time are highlighted in **gray** in the time program. The time counter restarts at zero after such a command.

4. Save your instrument method (e.g. as "**AnionInstrument**" to make clear that this is an instrument method).

Example for an An/Cat method:



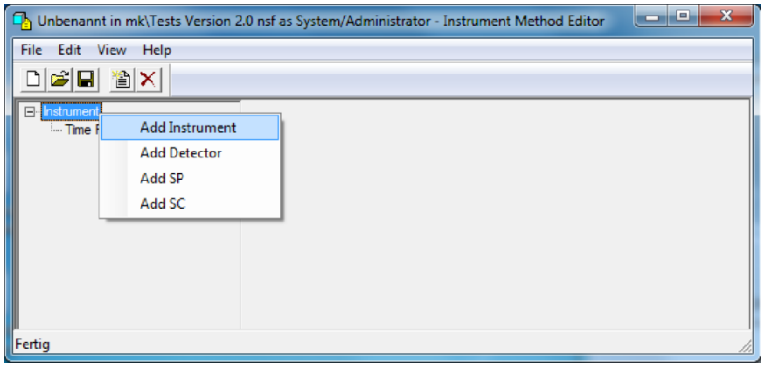
5.4 Creating an offline method

The offline method allows you to create a method without any devices connected to your PC. The following prerequisites have to be fulfilled that you can create an offline method and afterwards use it for your analysis:

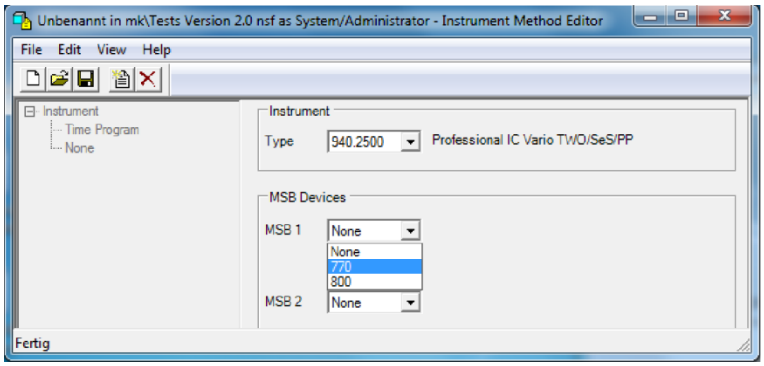
- When creating an offline method no device has to be connected to the PC. If however there is a device connected to the PC, setting up an offline method is not possible.
- Ensure that the configuration of the node and the system correspond with the real system you you will connect to the PC afterwards. Otherwise there will be an error message when you try to use the method for your analysis.

To create an offline method proceed as follows:

1. If not yet done, disconnect all Metrohm devices connected to the PC.
2. Create a new node as described in *chapter 0 on page 7.*
3. Insert the parameters for the DHCP. In case you want to use the method for your analysis afterwards, ensure that the values correspond with the real system values.
4. Right-click on **Instrument** and click **Add Instrument**.



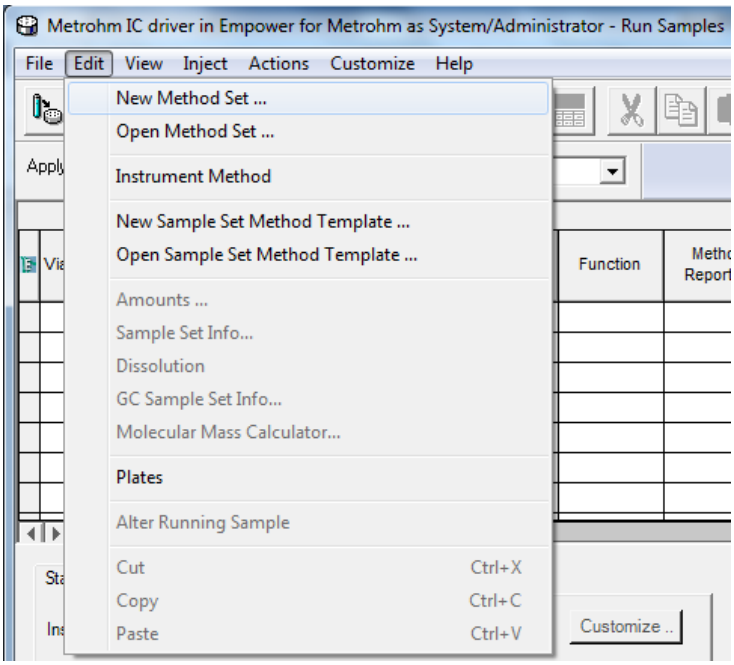
5. Select the desired instrument in the drop-dow list **Type**. If you want to connect any MSB devices, select them in the drop-down lists below. The numbers belong to the following devices: **770** Remote Box, **800** Dosino.



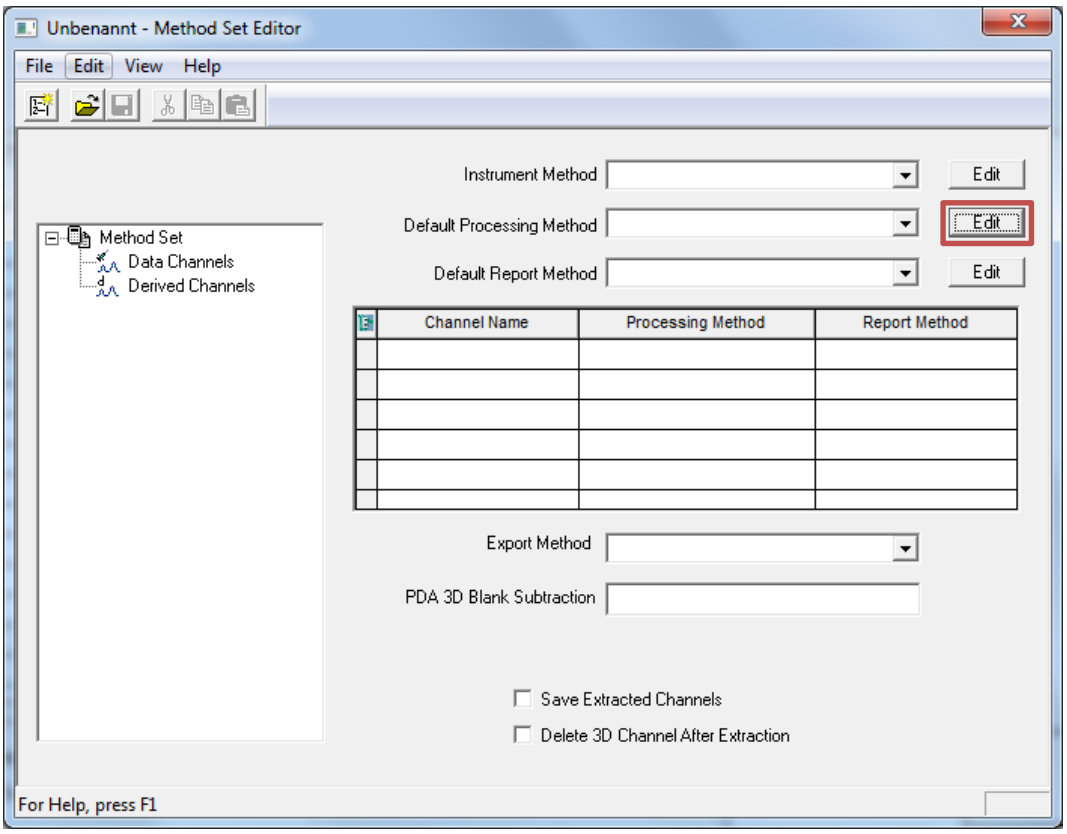
6. Click on **Apply** in the lower right corner. If the button is not visible, maximize the window.
7. If desired add more devices by right-clicking on **Instrument**. For detailed information refer to *chapter 0 on page 7.*

6 Creating a processing method

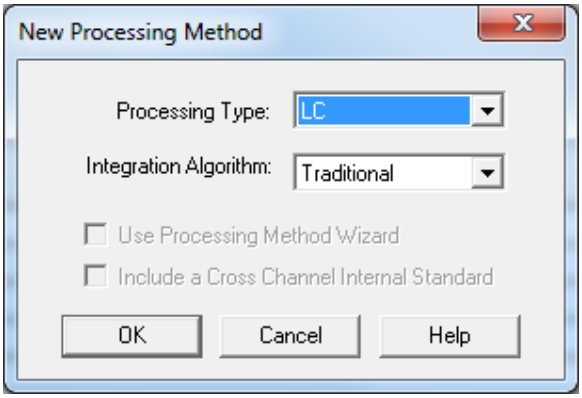
1. Click on **Edit > New Method Set...**



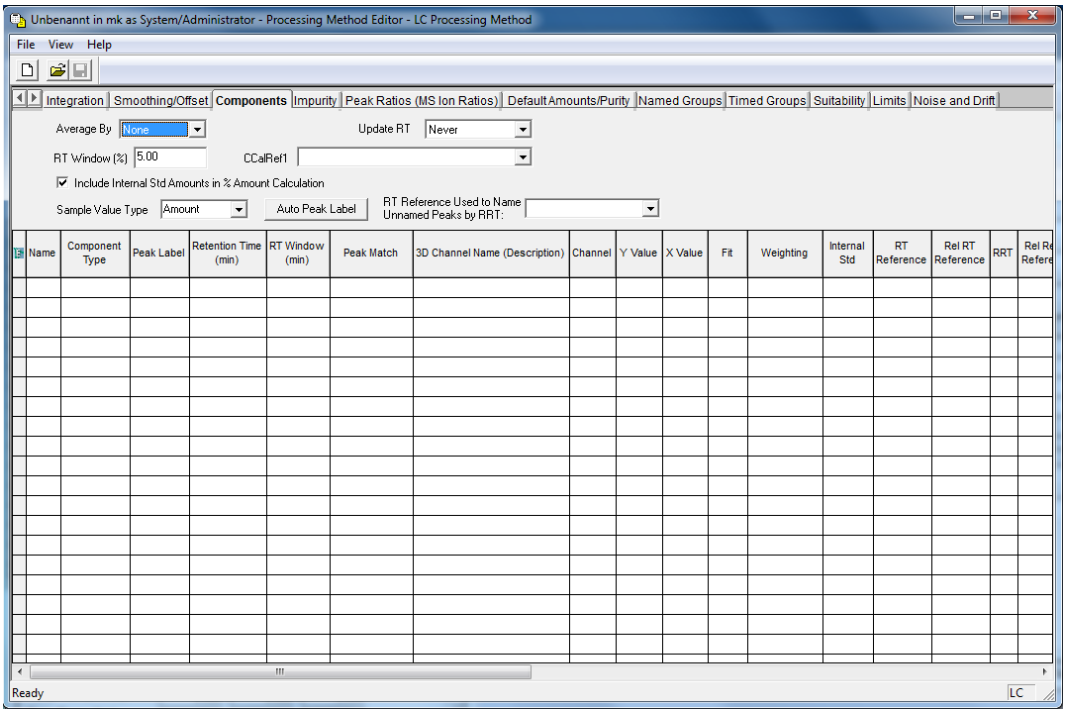
2. Click on **Edit** in the line **Default Processing Method**.



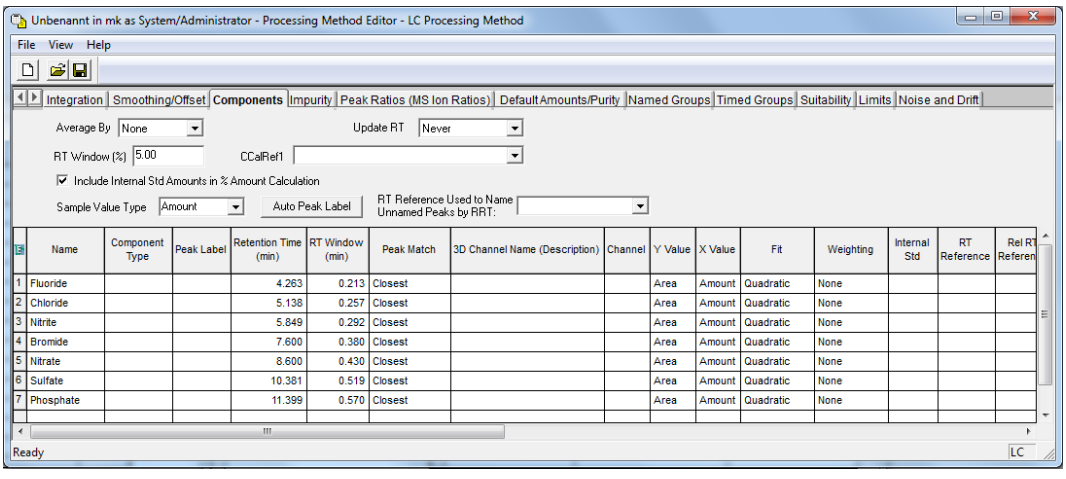
The following window appears:



3. Select the processing type and the integration algorithm, and then click on **OK**.
4. Make a list of the analytes and their retention time under **Components**.

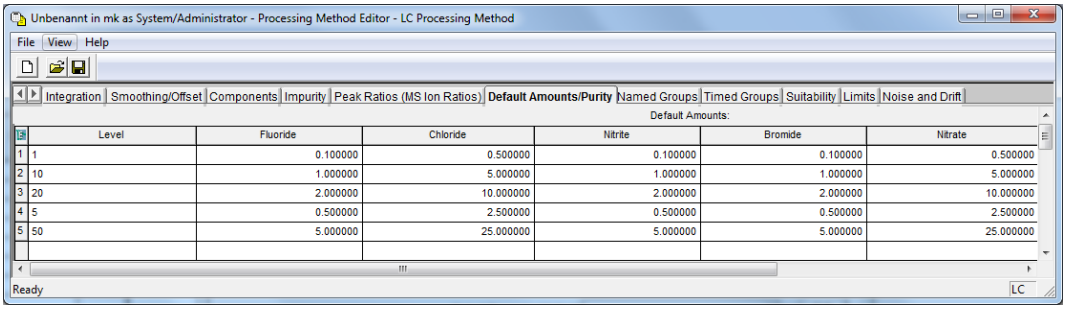


5. Open the tab **Components** to define the retention times of the analytes and the desired calibration parameters.

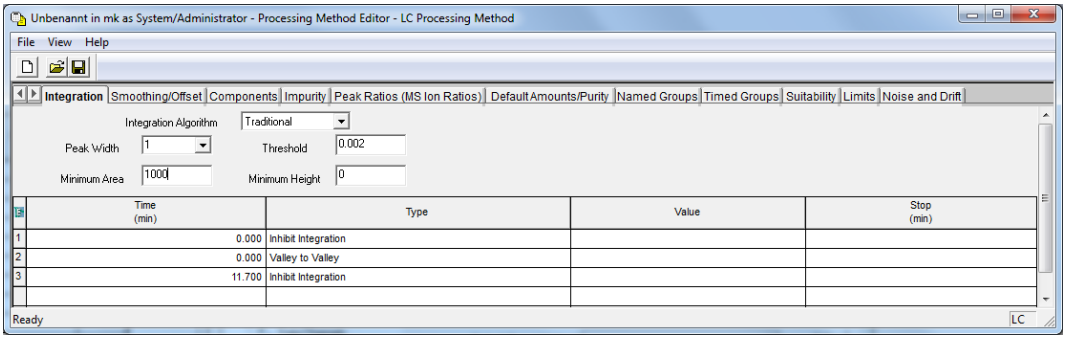


The processing method can be adjusted later. It is not necessary to fill in all parameters. It is possible to start with the default settings.

6. Enter the levels of your standard solutions on the tab **Default Amounts**.

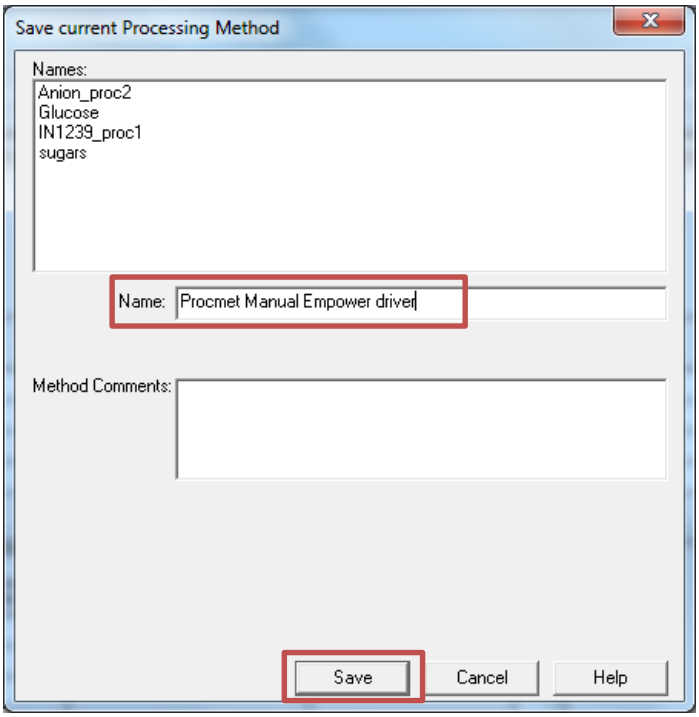


7. The integration parameters can be set on the tab **Integration**.



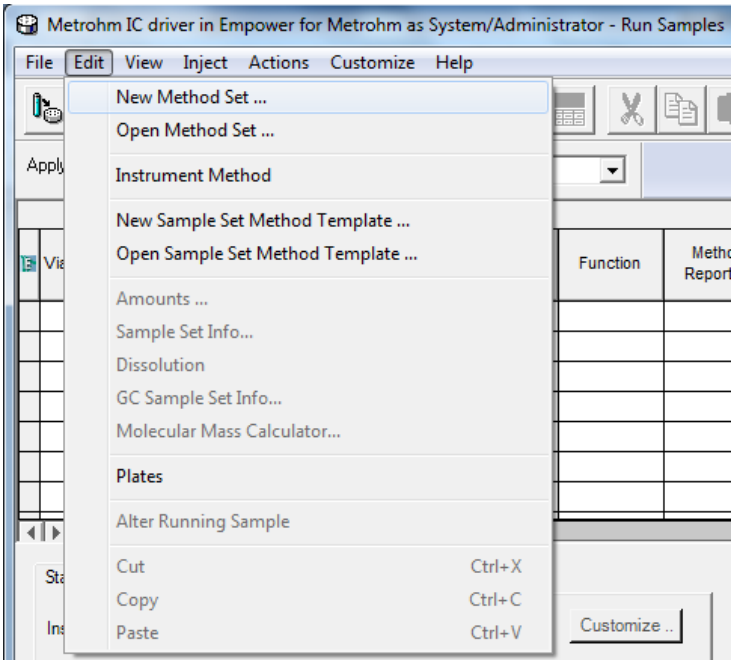
8. Save the processing method by clicking on the save button  .

9. Enter a name for the processing method and click on Save.



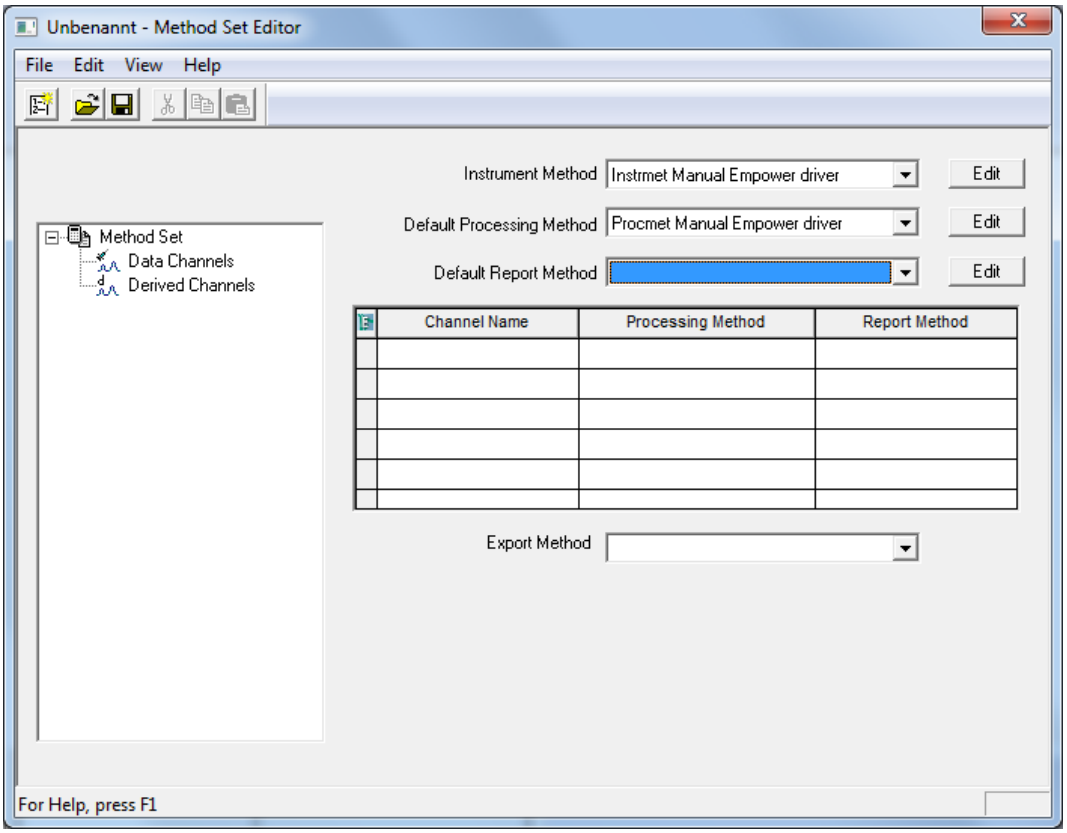
7 Forming a method set

1. Click on **Edit > New Method Set…**

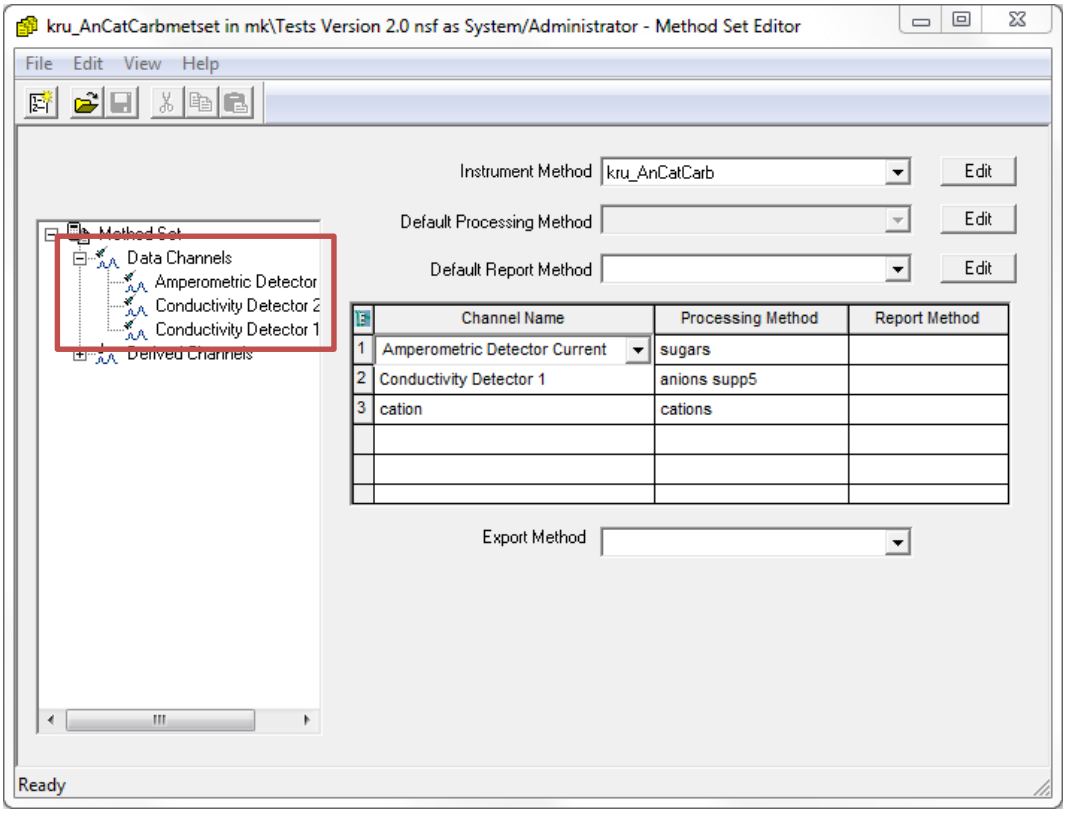


2. Group your **Instrument Method** and your **Default Processing Method** to a **Method Set**.

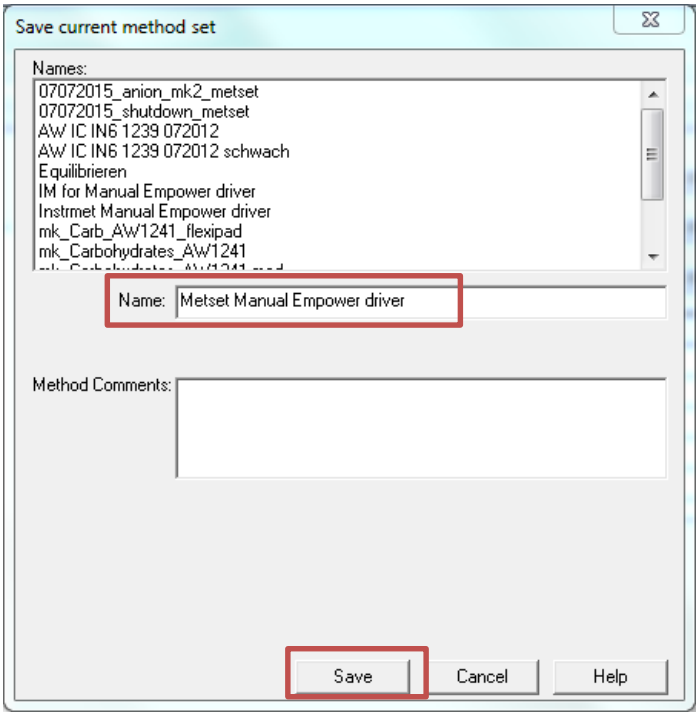
   Default Report Method and **Export Method** are optional.



Note: If you measure two different channels simultaneously, select them in the tree view **Data Channels** and drag them to the table beneath. You can assign to each channel a Processing Method.



3. Save your method Set by clicking on the **Save** button  .
4. Enter a name for the method set and click on **Save**.

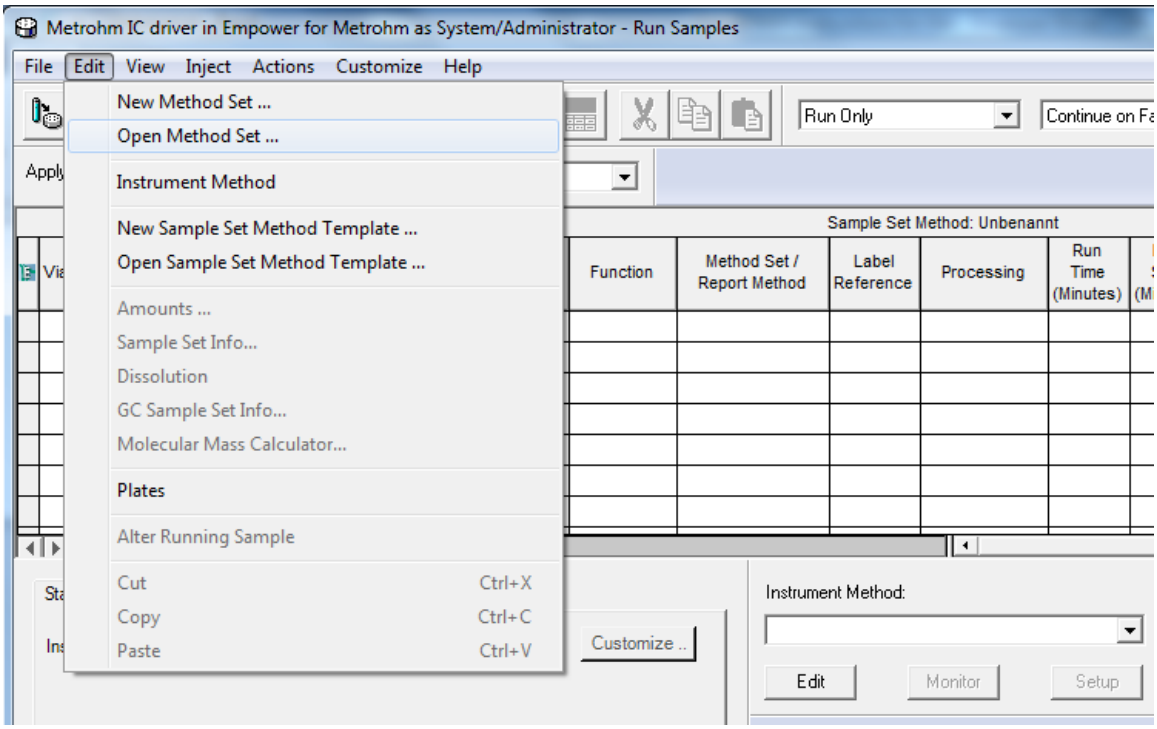


8 Measuring cations

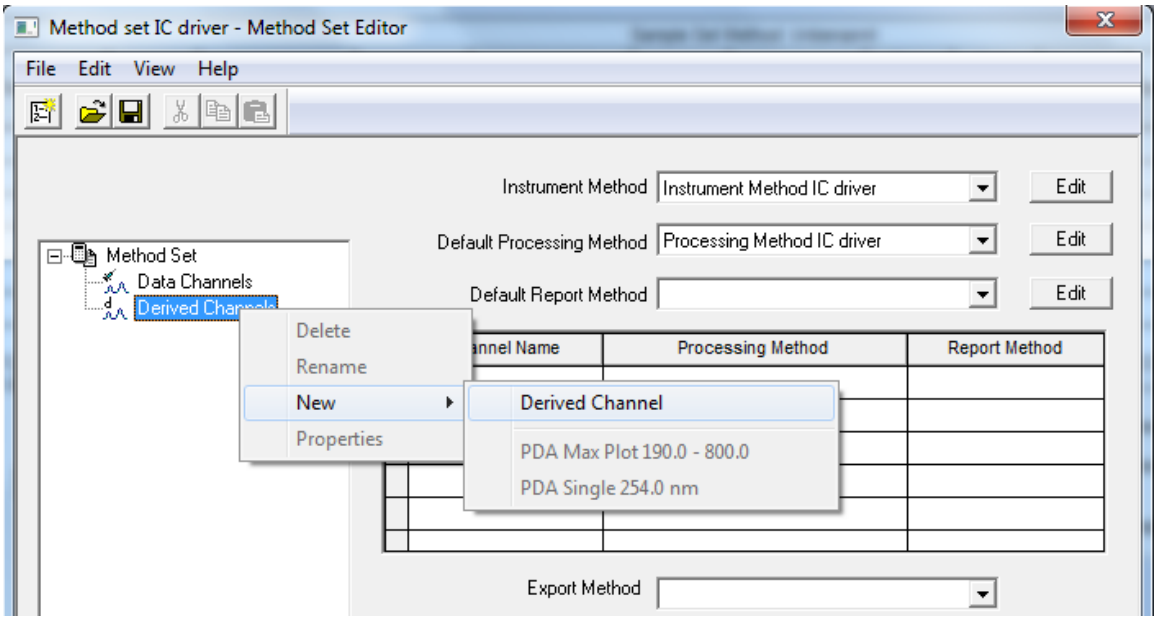
For non-suppressed cation determination, the peaks in the live display are negative. In the analysis results, the chromatograms are displayed correctly (with positive peaks). For anion determination, the peaks are always positive.

If the analytes are measured as negative peaks, the chromatogram has to be inverted by means of a **derived channel**. This means that the conductance measured is multiplied by "**-1**". In order to swap the chromatogram, modifie the method set as follows:

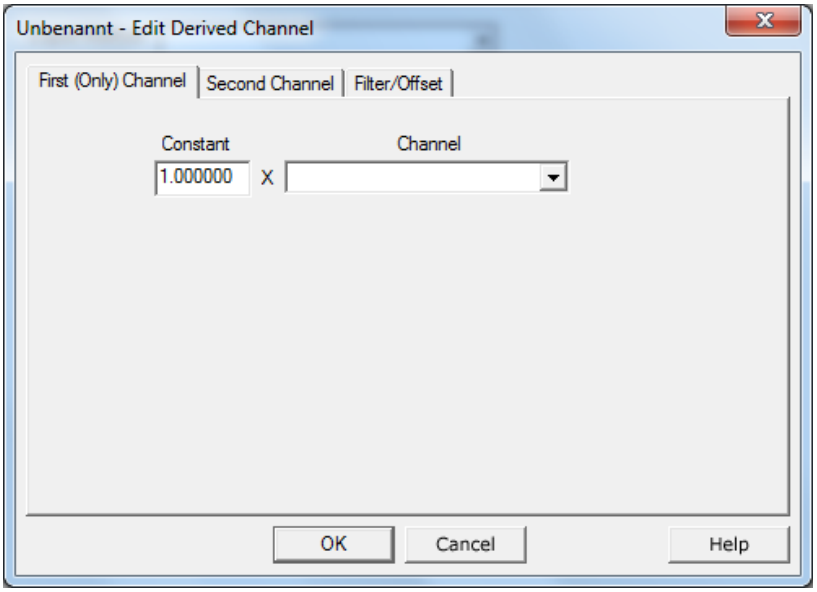
1. Open the desired method set by chlicking on **Edit > Open Method Set…**

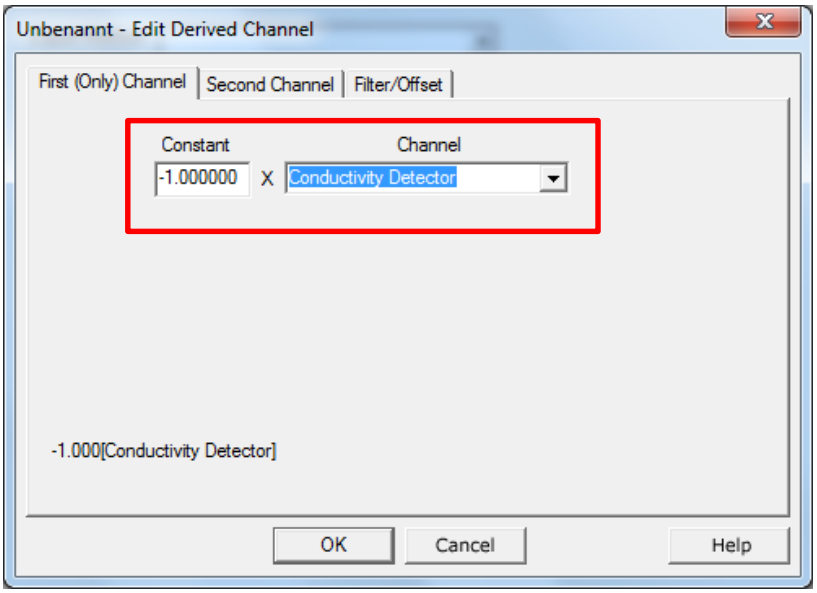


2. Create a derived channel by right-clicking on **Derived Channels > New > Derived Channel**.



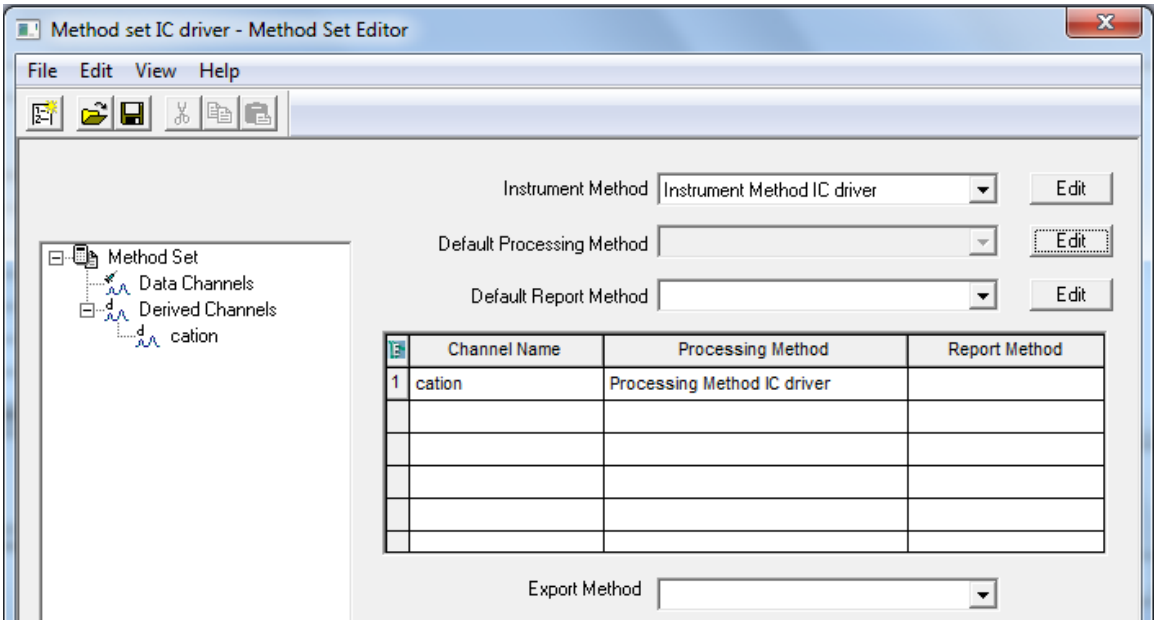
3. For the derived channel, the conductivity needs to be multiplied by "**-1**" to obtain the inverse:





4. Give the derived channel a name.

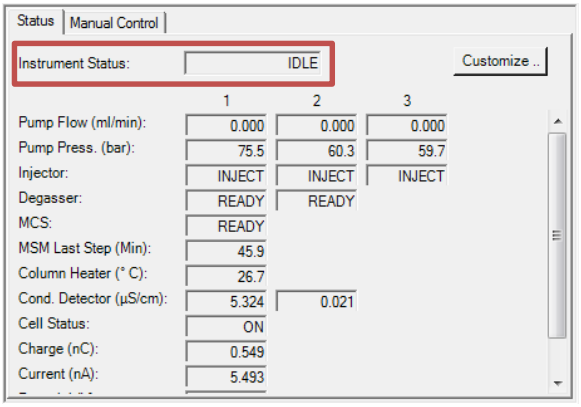
5. Choose a processing method for the cation channel.



9 Running samples

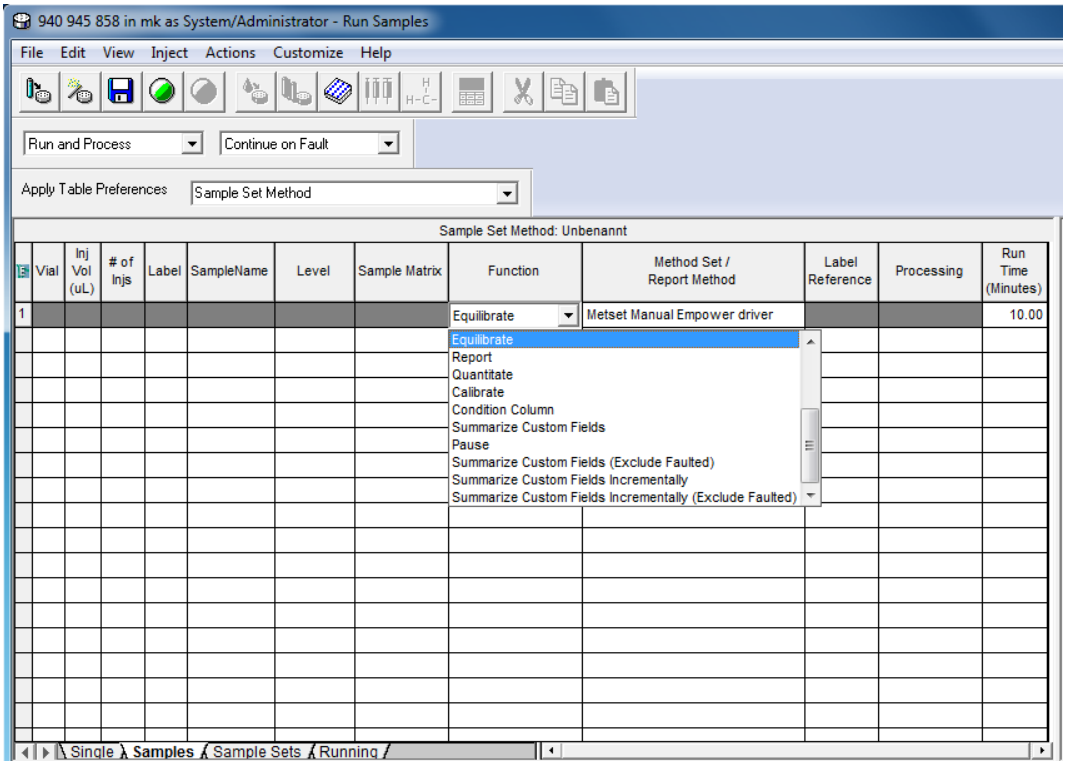
9.1 Creating a sample table and starting the analysis

Note: The instrument status must be **IDLE** before starting a measuring series.



1. Start filling in the sample table.

   - Start with a line for equilibration of the system.
     Use the **Equilibrate** function for this.
   - Enter a long run time (e.g. 30 min).
     This makes sure that the system has a stable baseline before moving on to the next line.



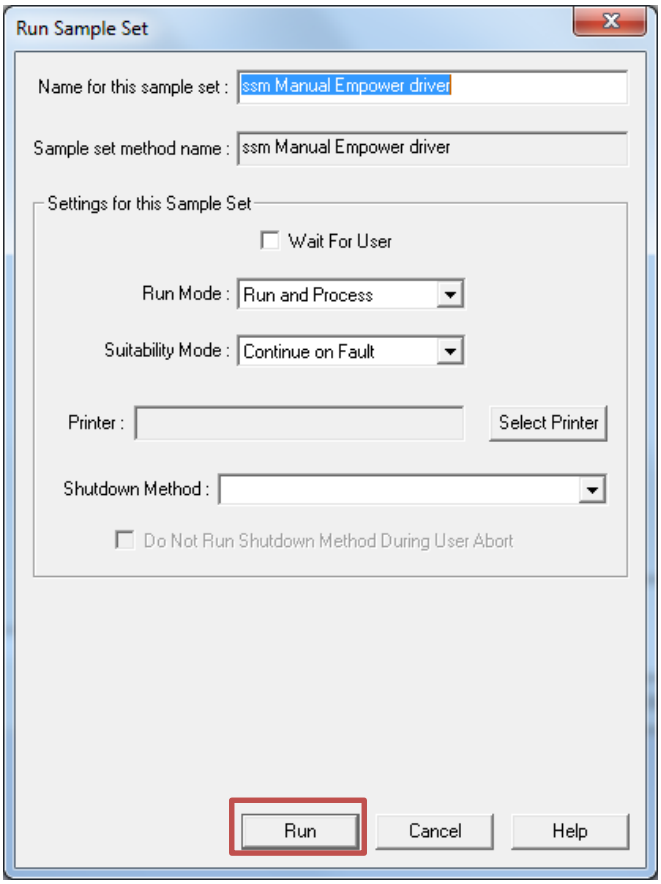
2. Create a sample table according to your needs.

Sample Set Method: Unbenannt

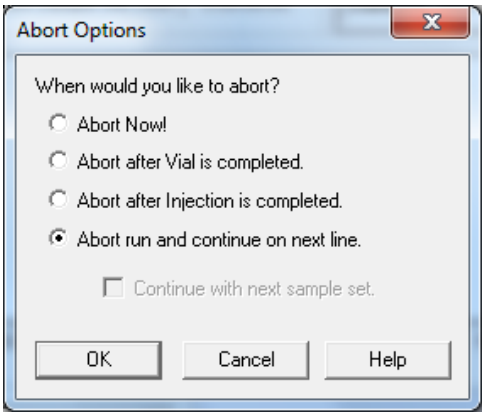
	Vial	Inj Vol (uL)	# of Injs	Label	SampleName	Level	Sample Matrix	Function	Method Set / Report Method	Label Reference	Processing	Run Time (Minutes)
1								Equilibrate	Metset Manual Empower driver			10.00
2	1	20.0	1		Standard 1	Level 1		Inject Standards	Metset Manual Empower driver		Normal	10.00
3	2	20.0	1		Standard 2	Level 2		Inject Standards	Metset Manual Empower driver		Normal	10.00
4	3	20.0	1		Standard 3	Level 3		Inject Standards	Metset Manual Empower driver		Normal	10.00
5	4	20.0	1		tab			Inject Samples	Metset Manual Empower driver		Normal	10.00

3. To start the series, click on the **Run** button (only if the instrument status is **IDLE**).

4. Enter a name for the sample set and click on **Run**.
Note: For information regarding the shutdown method, refer to *chapter "9.2* Using a Shutdown Method*" on page 64*.



5. When your baseline is stable, you can click on **Abort** and select the **Abort run and continue on next line** option. This will result in a short stop of all modules.



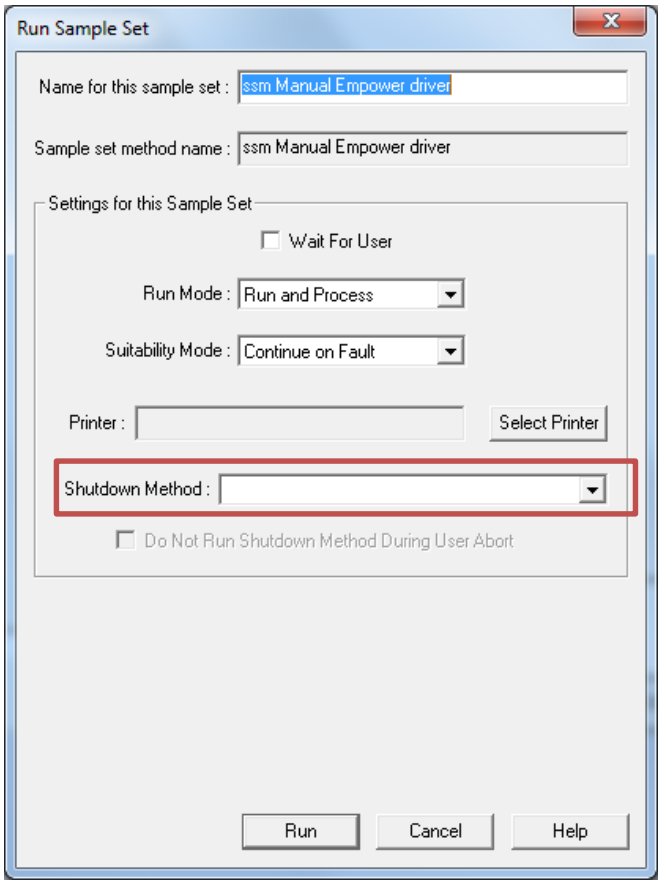
The **Abort Run** command has the following results:

- **Abort Now**: The current run including all modules stops immediately. Some values in the status window are freezed.
- **Abort after Vial is completed**: The run stops after completing all injections from the current vial, on the current row in the Samples table. The modules do not stop.
- **Abort after Injection is completed**: The run stops after completing the current injection. The modules do not stop.
- **Abort current run and continue on next line**: The run including all modules stop on the current row. Then, continues acquisition with the next row in the sample set method.

Note: If a shutdown method is selected (see chapter 9.2 Using a Shutdown Method) and the option "Do not Run Shutdown Method During User Abort" is not activated, the shutdown method will be executed subsequently.

9.2 Using a Shutdown Method

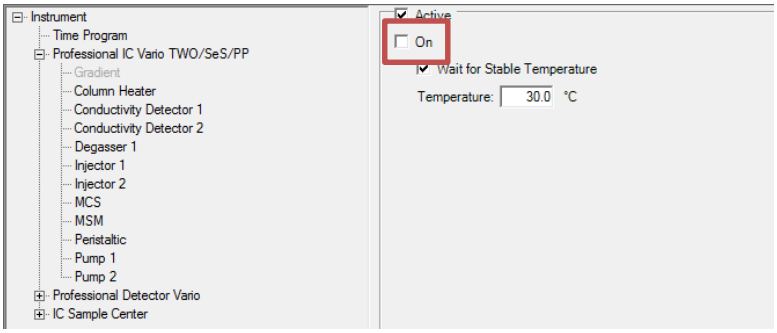
A shutdown method is downloaded to the instrument at the end of the sample set. This allows the user to deactivate not used devices.



9.2.1 Creating a Shutdown Method

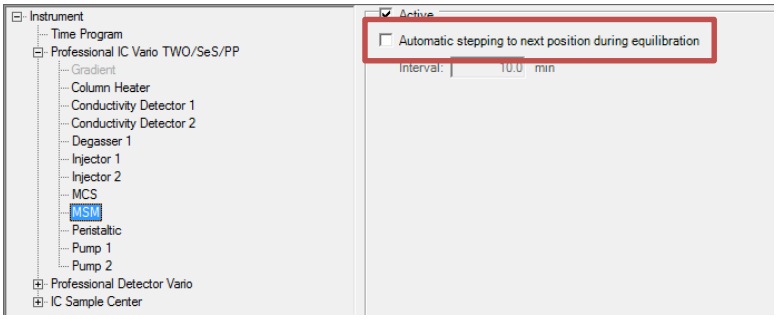
To create a shutdown method, proceed as follows (example):

1. Create a new instrument method (see chapter *"Creating an instrument method" on page 25*).
2. Switch off the following devices by unchecking the checkbox **On**:

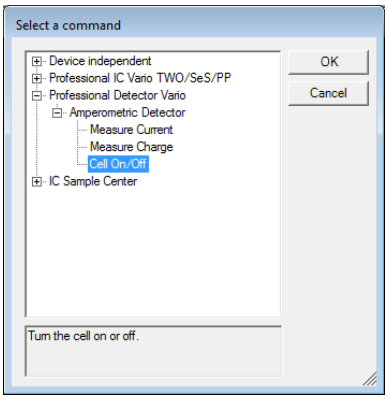


- Column Heater
- Degasser
- MCS
- Peristaltic
- Pump 1+2

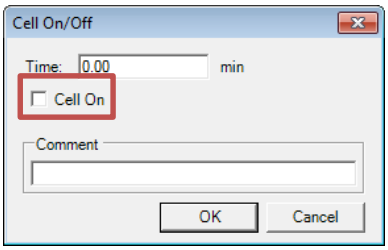
3. Open **MSM** and uncheck **Automatic stepping** to next position during equilibration.



4. If you are using the amperometric detector: Open the **Time Programm**.
5. Click **Add**.
6. Go to **Professional Detector Vario > Amperometric Detector > Cell On/Off**.



7. Uncheck **Cell On** and click **OK**.

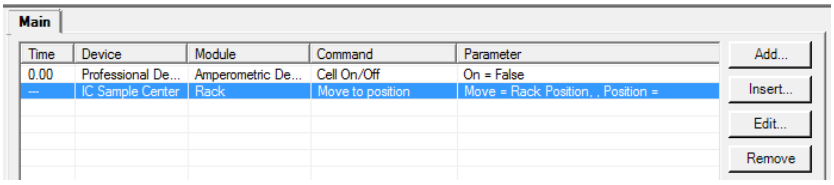


8. Save the instrument method.

9.2.2 Restrictions

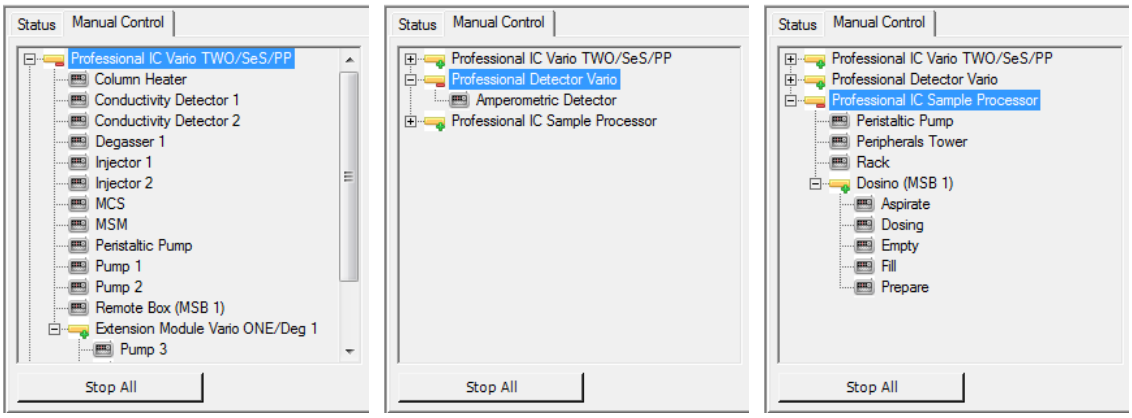
When using a shutdown method, take into consideration the following restrictions:

- Empower™ will show status IDLE and accept user input while the time program might still be running. Before starting a new sample set, ensure that the shutdown method is finished.
- In case of a shutdown method, Empower™ does not pass sample location information. So any time program entry that tries to use this information will fail.
  Example: The command „Move to position" in the time programm below will not be executed and the time program fails.

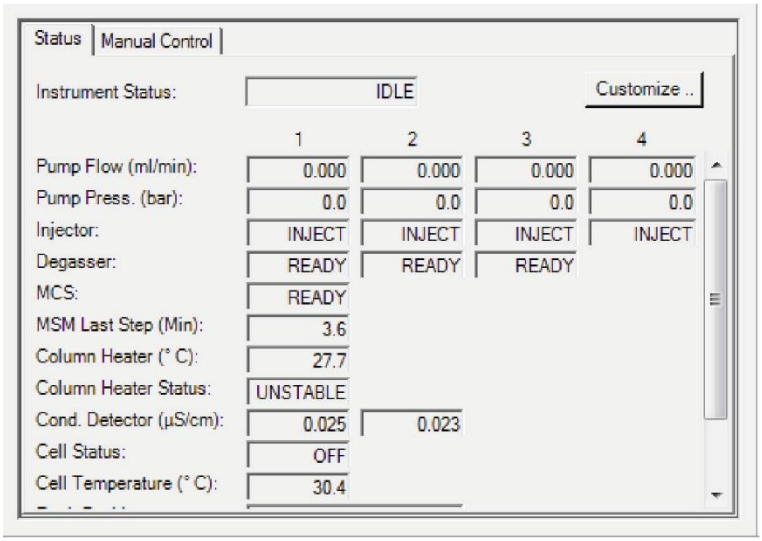


9.3 Manual control

Under **Manual Control**, all hardware components can be operated individually (only when no measurement is running). The manual control is located next to the status parameters.



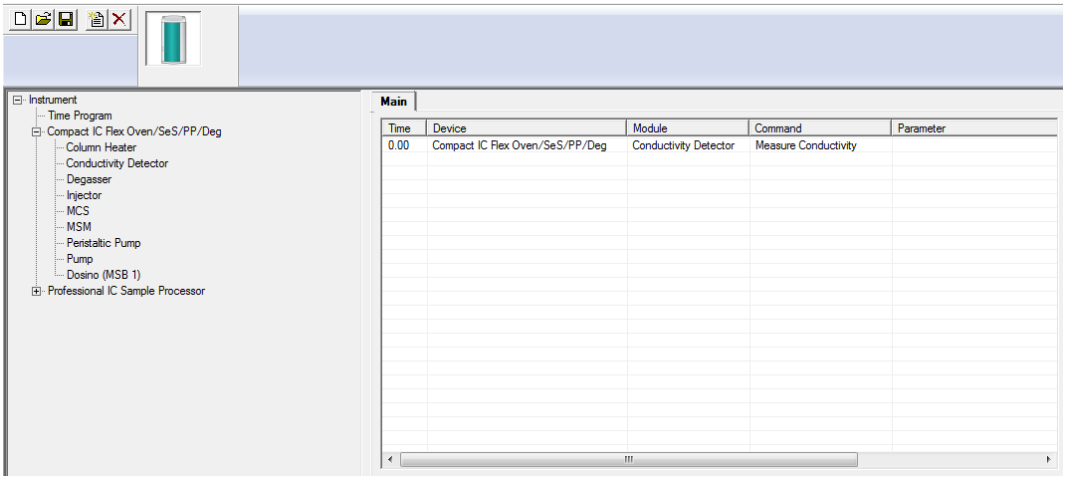
The **Status** tab displays the current state of the instrument and its modules. For further information concerning the numbering of the modules refer to *chapter 11 on page 75*.



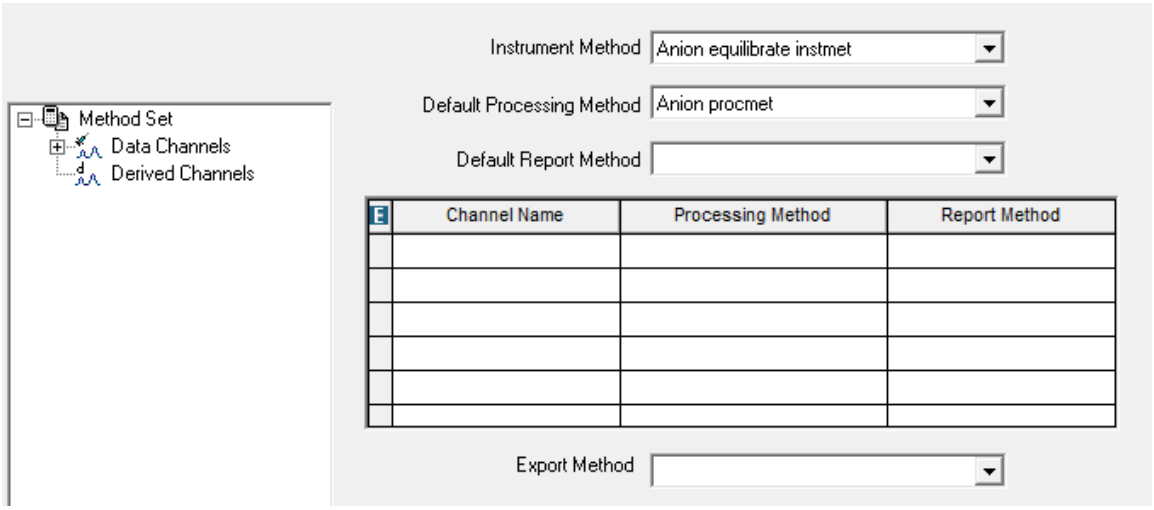
9.4 Equilibrating the system

You can use the method which you use afterwards for the analysis to equilibrate the system. For this purpose add the function „Equilibrate“ to the sample table. In this case, only the command "Measure Cond./Measure Current" of the time program will be executed. The other commands of the time program will not be executed.

Additionally it might be useful to create an “Equilibration” method. For this purpose create an instrument method named "Equilibration" (all parameters as desired, e.g. pump flow 0.7 mL/min, MSM autostep all 10 min, etc.). In the time program enter just one line to start data acquisition to be able to monitor the baseline during equilibration.



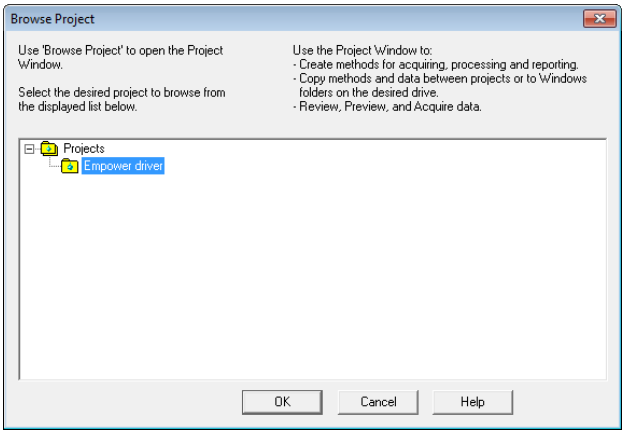
Create also a method set “Equilibration”. This method set can be run in the first line of each sample table.



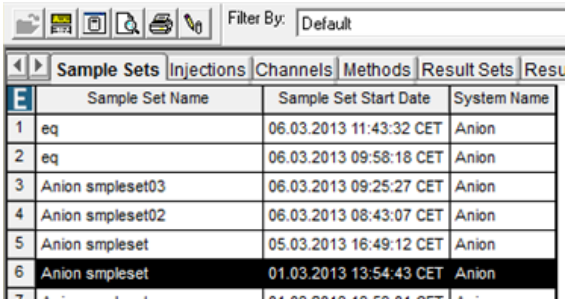
10 Evaluating recorded data

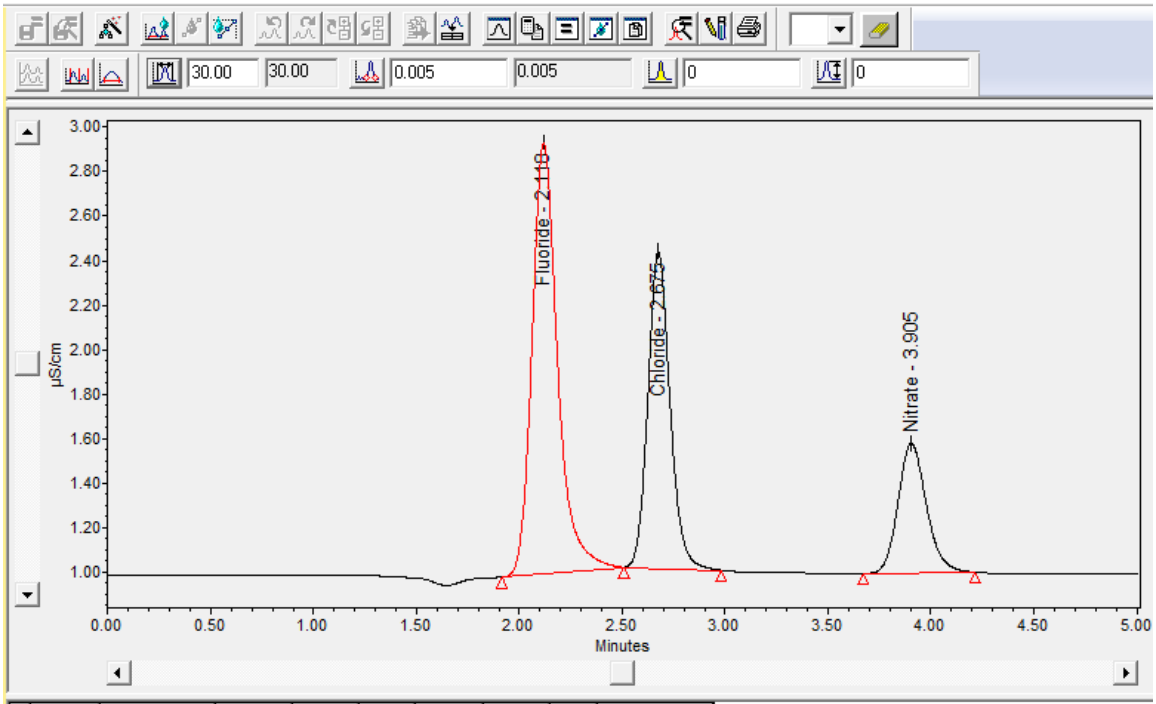
1. To review recorded data, go to **Browse Project** in the Empower™ start window.

2. Select the desired projet in the project tree and click on **OK**.



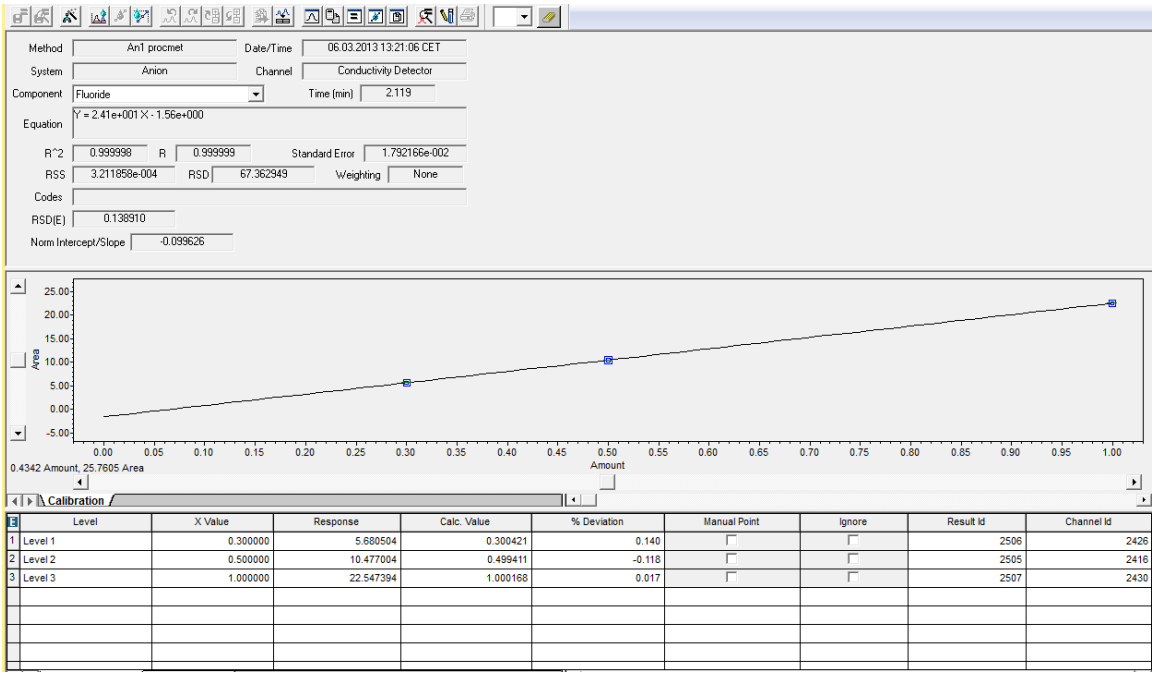
3. Right-click on the name of the **sample set** and choose **review**.





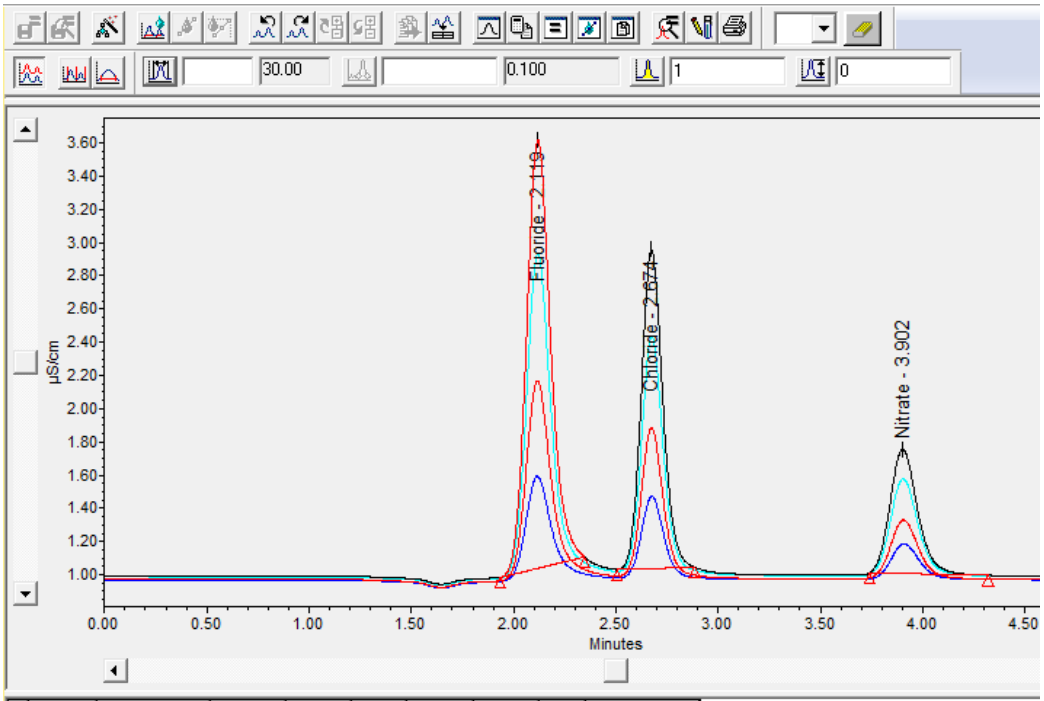
	Name	Retention Time (min)	Area (µV*sec)	% Area	Height (µV)	Int Type	Amount	Units	Peak Type
1	Fluoride	2.118	17	50.85	2	BB	0.759	mg/L	Found
2	Chloride	2.675	11	32.27	1	BB	0.755	mg/L	Found
3	Nitrate	3.905	6	16.88	1	BB	0.785	mg/L	Found

4. The  icon shows the calibration.



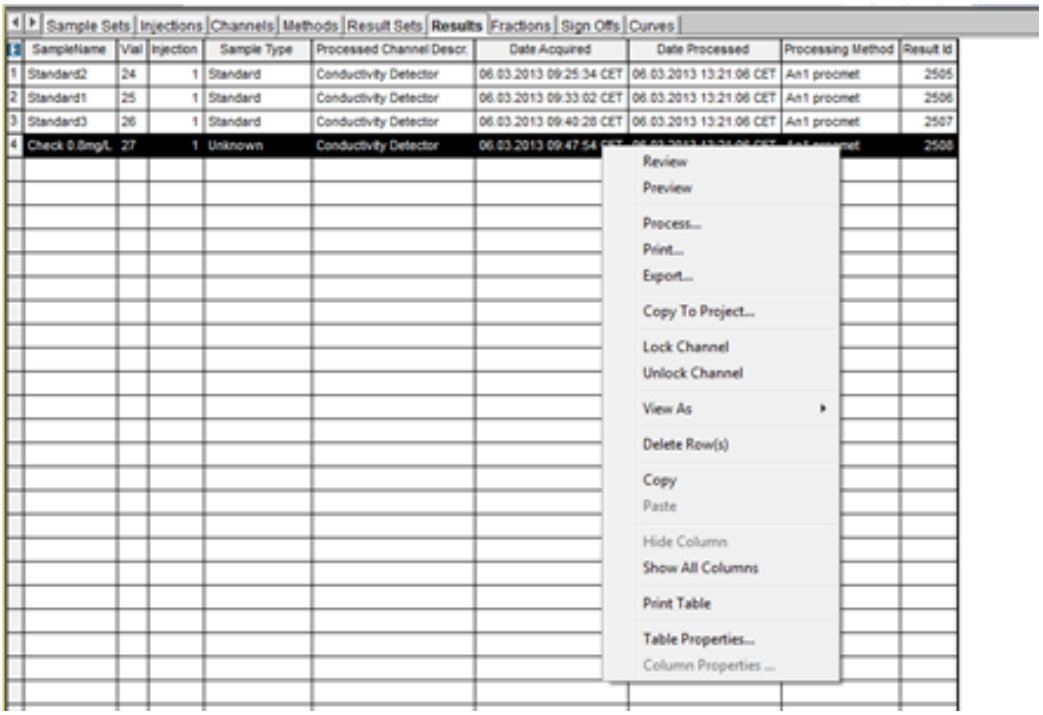
	Level	X Value	Response	Calc. Value	% Deviation	Manual Point	Ignore	Result Id	Channel Id
1	Level 1	0.300000	5.680504	0.300421	0.140			2506	2426
2	Level 2	0.500000	10.477004	0.499411	-0.118			2505	2416
3	Level 3	1.000000	22.547394	1.000168	0.017			2507	2430

5. Several results can be loaded into the review by highlighting them and then opening the review window. Use the icon  to overlay curves.

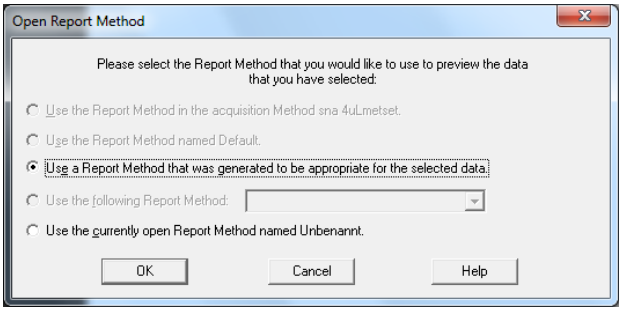


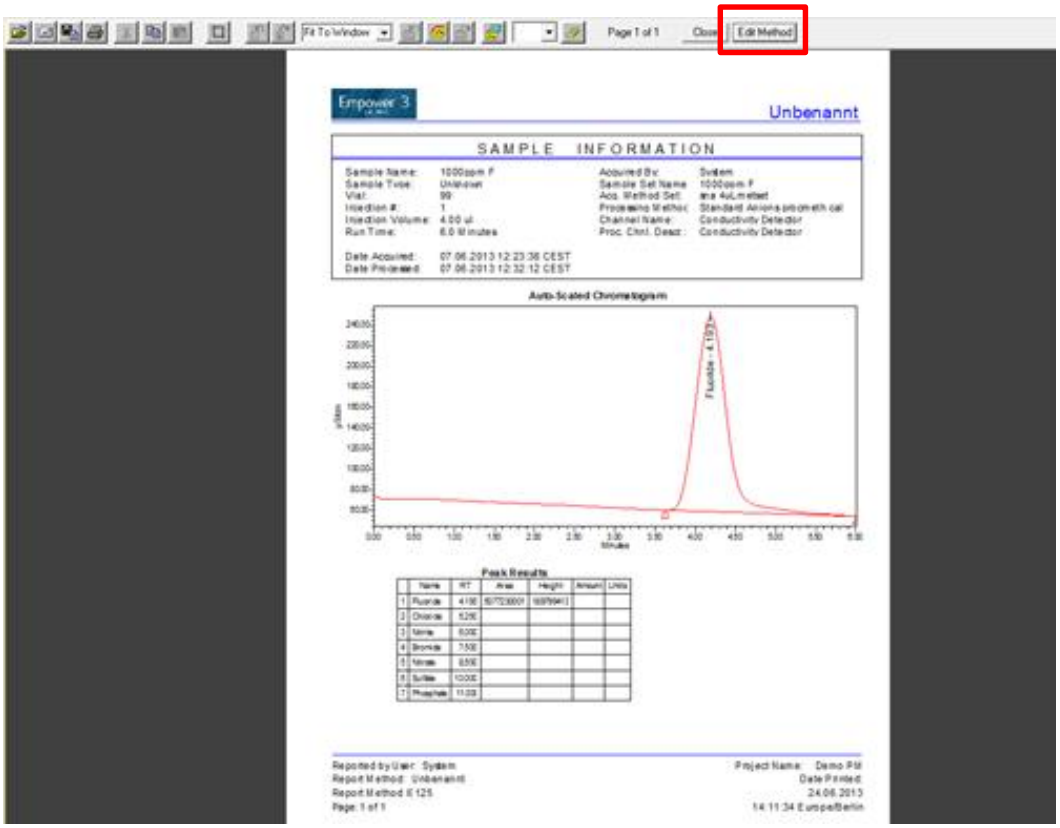
	Name	Retention Time (min)	Area (µV*sec)	% Area	Height (µV)	Int Type	Amount	Units	Peak Type
1	Fluoride	2.119	21	50.15	3	BB	1.000	mg/L	Found
2	Chloride	2.674	14	33.20	2	BB	1.000	mg/L	Found
3	Nitrate	3.902	7	16.65	1	BB	1.000	mg/L	Found

6. For a report, right-click on the desired **sample** and select **Preview**.

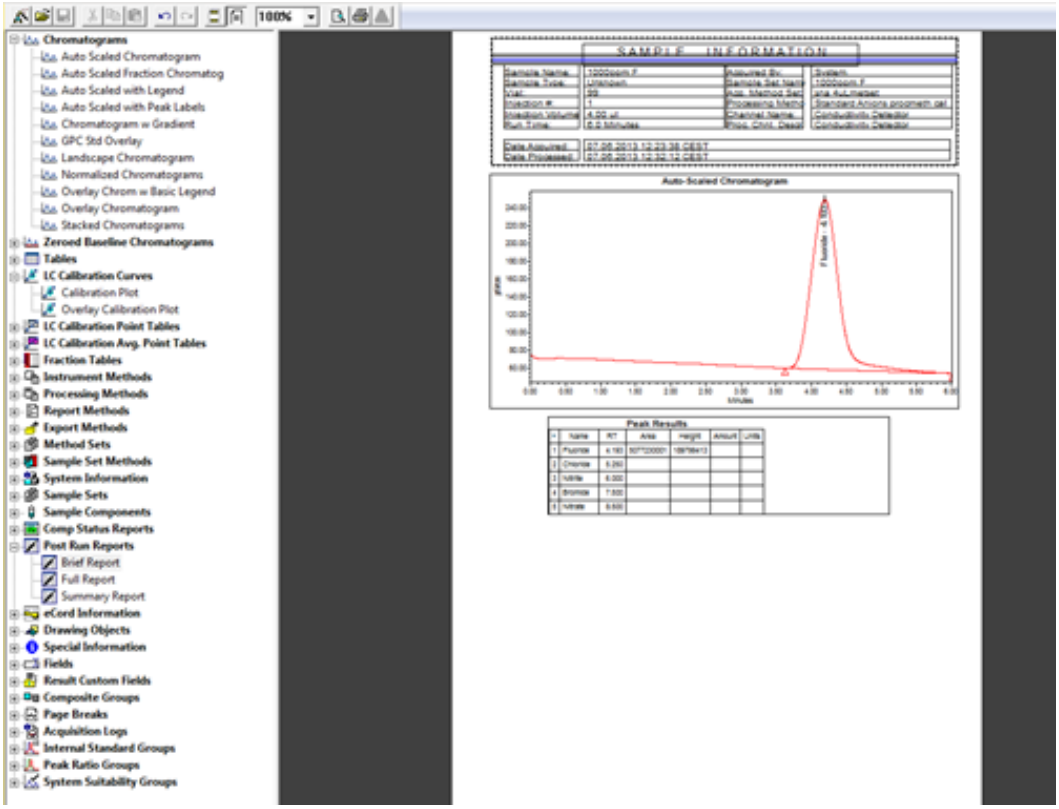


7. A selection window appears in which you can select an appropriate **Report Method**:





8. The report can be modified as required using the **Edit Method** button.



9. The information can be applied directly to the report by double-clicking on the corresponding fields.

10.1 Example

Among many other things, the report can contain the chromatogram, the calibration curve, instrument parameters (e.g. information on the column and the cell used) as well as the time program. A rudimentary example is shown below:

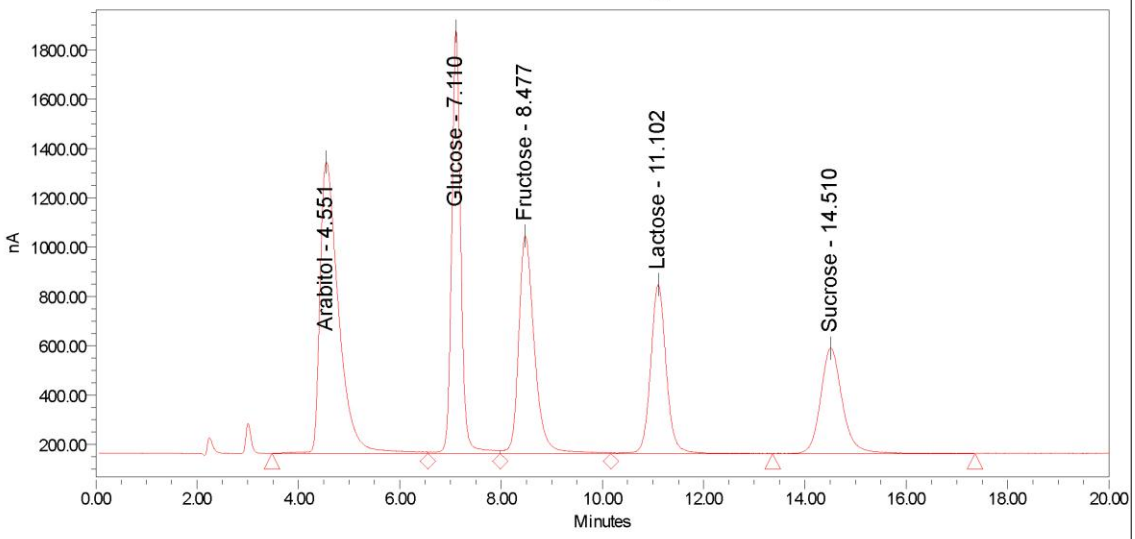
Empower 3 SOFTWARE

test post run

SAMPLE INFORMATION

Sample Name:		Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	20150910R55_3channel_Dosino
Vial:	5	Acq. Method Set:	sugar_anion_cation_Dosino
Injection #:	1	Processing Method:	sugars
Injection Volume:	10.00 ul	Channel Name:	Amperometric Detector Current
Run Time:	20.0 Minutes	Proc. Chnl. Descr.:	Amperometric Detector Current
Date Acquired:	10.09.2015 20:33:27 CEST		
Date Processed:	10.09.2015 21:01:57 CEST		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	Arabitol	4.551	30449798800	1181569303		
2	Glucose	7.110	21338658969	1714166068		
3	Fructose	8.477	19057920018	881502361		
4	Lactose	11.102	14693041605	685646072		
5	Sucrose	14.510	12826958095	428109807		

Metrohm IC Post Run Report

Sample: Vial: 5 Inj: 1

IC Properties

IC Device Type	0940.2500
IC Program Version	5.940.0100
IC Serial Number	3127
Detector Device Type	0945.0020
Detector Program Version	5.940.0100
Detector Serial Number	4101

Column Properties

Column 1 Type	Metrosep C 4 - 150/4.0
Column 1 Serial Number	0037.2546
Column 1 Order Number	6.1050.420
Column 1 Particle Size	5(µm)
Column 1 Length	150(mm)
Column 1 Inner Diameter	4(mm)
Column 2 Type	Metrosep A Supp 5 - 150/4.0
Column 2 Serial Number	7111642
Column 2 Order Number	6.1006.520
Column 2 Particle Size	5(µm)
Column 2 Length	150(mm)
Column 2 Inner Diameter	4(mm)
Column 3 Type	Metrosep Carb 2 - 150/4.0
Column 3 Serial Number	0086.2041
Column 3 Order Number	6.1090.420
Column 3 Particle Size	5(µm)
Column 3 Length	150(mm)
Column 3 Inner Diameter	4(mm)

Pump Properties

Pump 1 Type	Standard	Pump 2 Pressure Max	150(bar)
Pump 1 Serial Number	26778	Pump 2 Correction Factor	1
Pump 1 Flow Range Min	0.01(mL/min)	Pump 3 Type	Standard
Pump 1 Flow Range Max	5.00(mL/min)	Pump 3 Serial Number	26798
Pump 1 Pressure Max	250(bar)	Pump 3 Flow Range Min	0.01(mL/min)
Pump 1 Correction Factor	1	Pump 3 Flow Range Max	5.00(mL/min)
Pump 2 Type	Standard	Pump 3 Pressure Max	200(bar)
Pump 2 Serial Number	26849	Pump 3 Correction Factor	1
Pump 2 Flow Range Min	0.01(mL/min)		
Pump 2 Flow Range Max	5.00(mL/min)		

Conductivity Detector Properties

Conductivity Detector 1 Serial Number	4288
Conductivity Detector 1 Cell Constant	16.7(1/cm)
Conductivity Detector 1 Thermostat	40(°C)
Conductivity Detector 2 Serial Number	37270
Conductivity Detector 2 Cell Constant	16.7(1/cm)

11 Numbering of the modules

The numbering of each module is depending on its position in the daisy chain. The daisy chain defines how multiple modules are wired together in sequence.

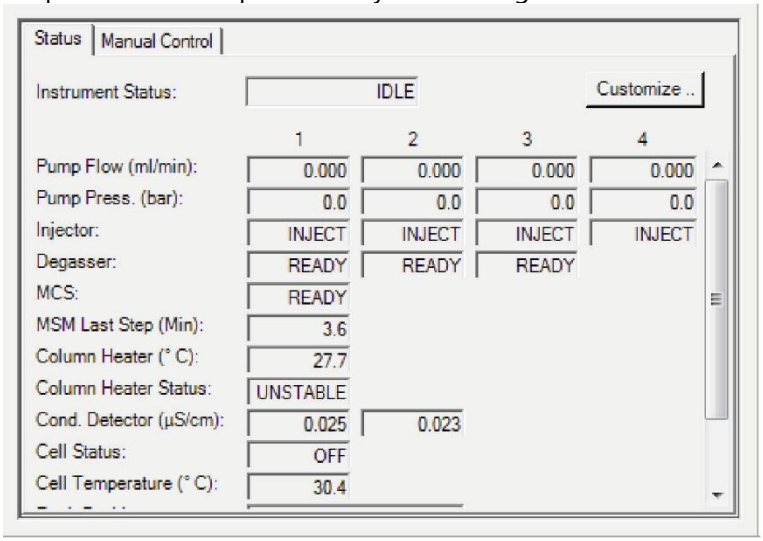
- For the **IC instrument** this means: The upper module always gets the number 1, the lower module number 2 (for pumps and injectors, see image below).
- For the **extension modules** this means: Only one extension module can be connected directly to the IC instrument. The second extension module has to be connected to the first and the third to the second. The numbering of the modules begins with the IC instrument and continues with the extension modules according to their position in the daisy chain.

Note: The numbering is fix and cannot be changed manually.

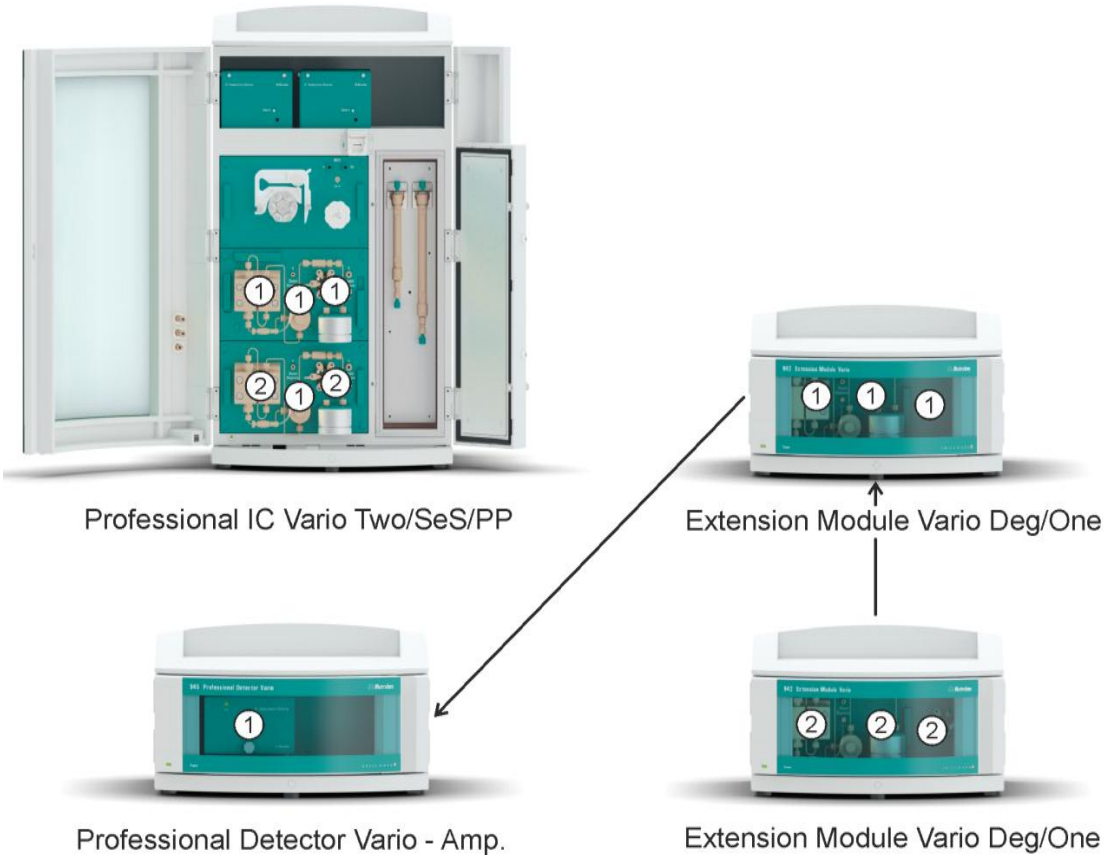
The following illustrations show the numbering of the modules for different system configurations.

Extension modules are connected to the IC instrument.

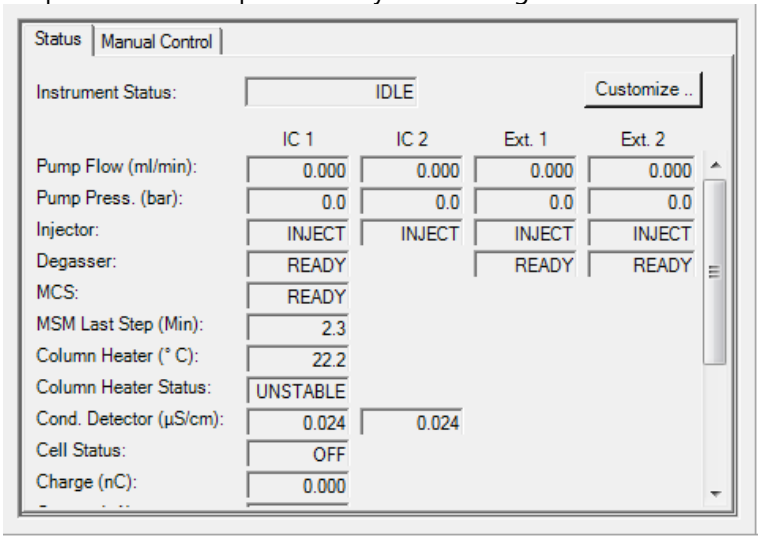
In the Empower™ status panel the system configuration above looks like this:



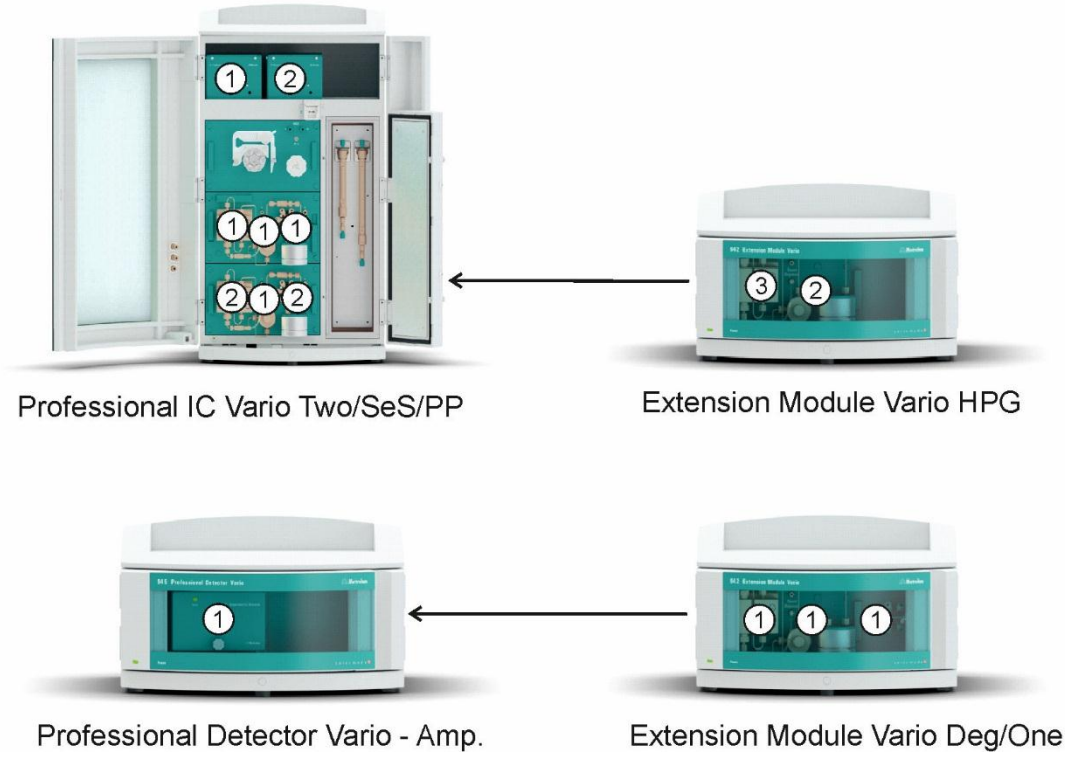
Extension Modules are connected to the detector.



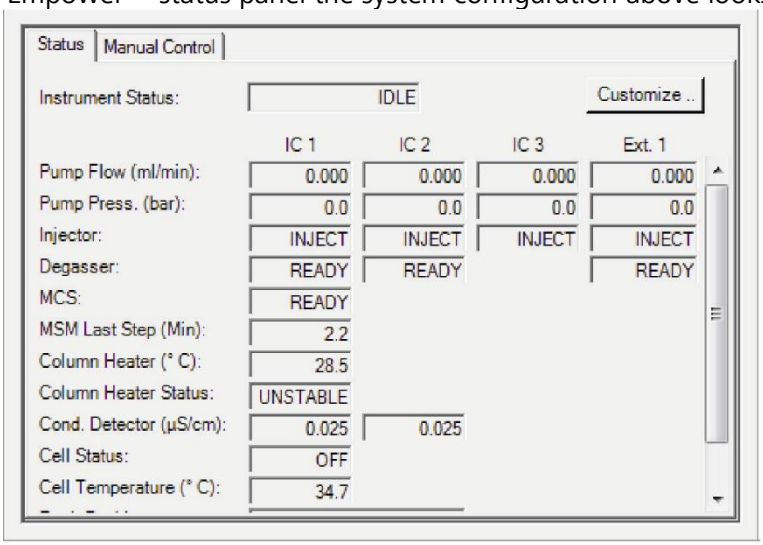
In the Empower™ status panel the system configuration above looks like this:



1 extension module is connected to the IC instrument and 1 extension module is connected to the detector.



In the Empower™ status panel the system configuration above looks like this:

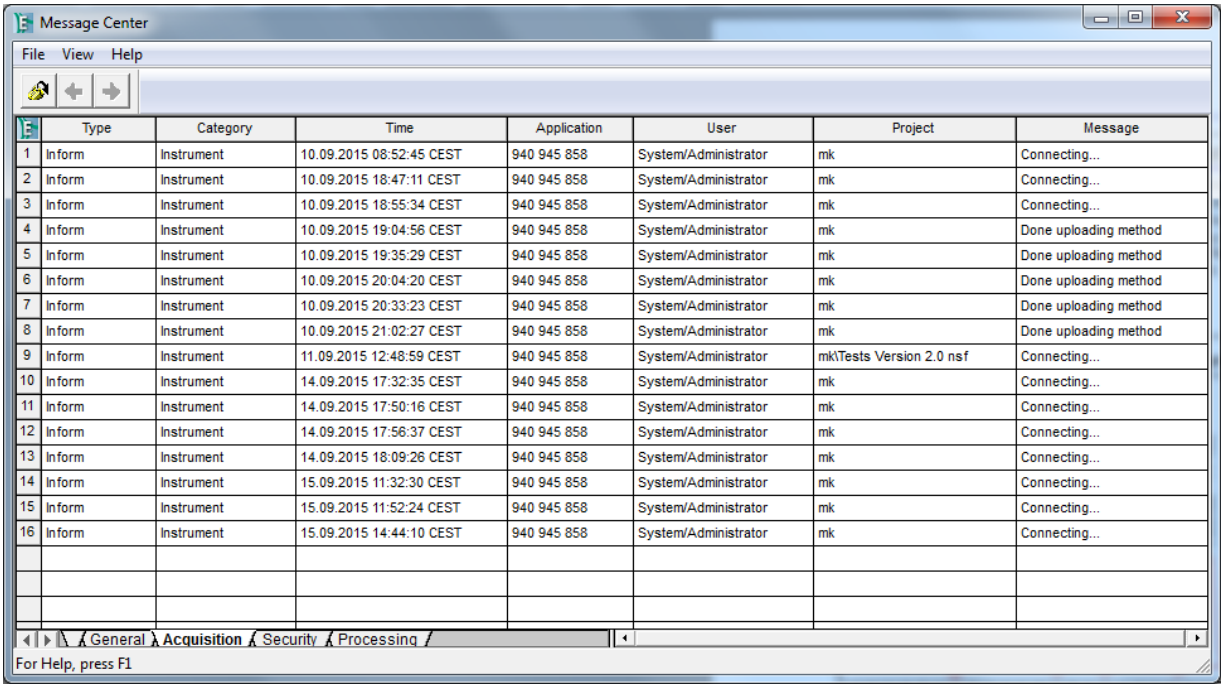


12 Troubleshooting

12.1 Message Center

1. Double-clicking on the "**E**" in the task bar opens the Message Center, in which error messages are documented.

2. A list of all current messages appears (example list).

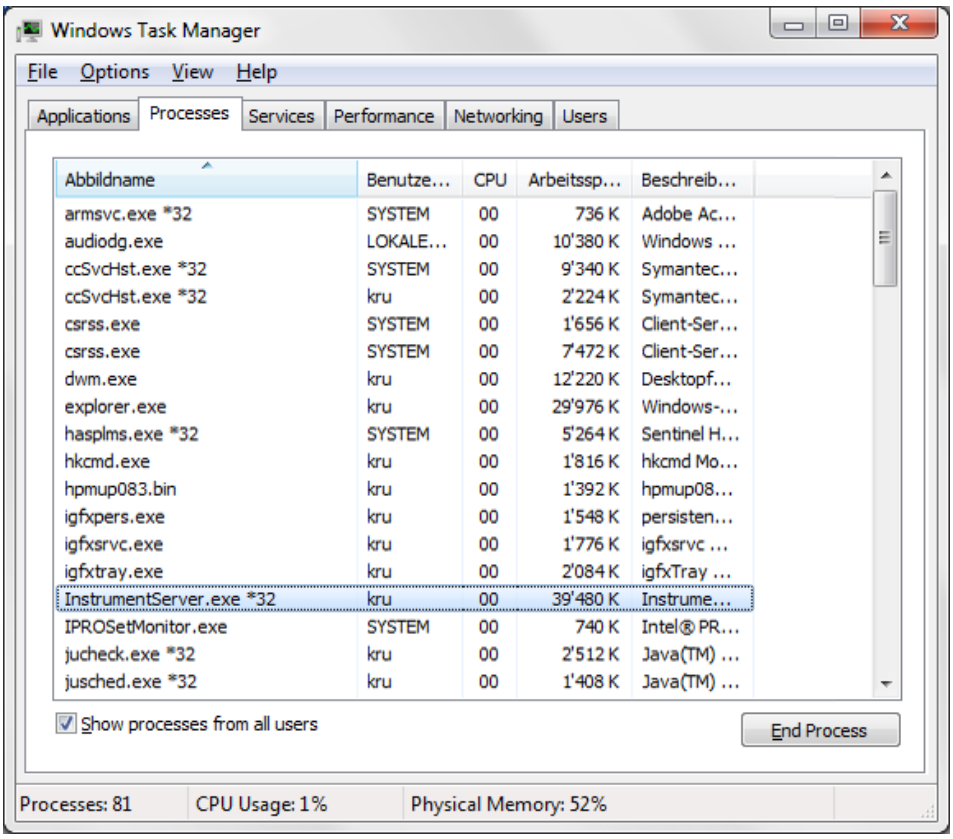


	Type	Category	Time	Application	User	Project	Message
1	Inform	Instrument	10.09.2015 08:52:45 CEST	940 945 858	System/Administrator	mk	Connecting...
2	Inform	Instrument	10.09.2015 18:47:11 CEST	940 945 858	System/Administrator	mk	Connecting...
3	Inform	Instrument	10.09.2015 18:55:34 CEST	940 945 858	System/Administrator	mk	Connecting...
4	Inform	Instrument	10.09.2015 19:04:56 CEST	940 945 858	System/Administrator	mk	Done uploading method
5	Inform	Instrument	10.09.2015 19:35:29 CEST	940 945 858	System/Administrator	mk	Done uploading method
6	Inform	Instrument	10.09.2015 20:04:20 CEST	940 945 858	System/Administrator	mk	Done uploading method
7	Inform	Instrument	10.09.2015 20:33:23 CEST	940 945 858	System/Administrator	mk	Done uploading method
8	Inform	Instrument	10.09.2015 21:02:27 CEST	940 945 858	System/Administrator	mk	Done uploading method
9	Inform	Instrument	11.09.2015 12:48:59 CEST	940 945 858	System/Administrator	mk\Tests Version 2.0 nsf	Connecting...
10	Inform	Instrument	14.09.2015 17:32:35 CEST	940 945 858	System/Administrator	mk	Connecting...
11	Inform	Instrument	14.09.2015 17:50:16 CEST	940 945 858	System/Administrator	mk	Connecting...
12	Inform	Instrument	14.09.2015 17:56:37 CEST	940 945 858	System/Administrator	mk	Connecting...
13	Inform	Instrument	14.09.2015 18:09:26 CEST	940 945 858	System/Administrator	mk	Connecting...
14	Inform	Instrument	15.09.2015 11:32:30 CEST	940 945 858	System/Administrator	mk	Connecting...
15	Inform	Instrument	15.09.2015 11:52:24 CEST	940 945 858	System/Administrator	mk	Connecting...
16	Inform	Instrument	15.09.2015 14:44:10 CEST	940 945 858	System/Administrator	mk	Connecting...

12.2 Stopping the process

If there is a system failure or if the connection is lost, proceed as follows to restart Empower™ :

1. Close Empower™ .
2. Stop **InstrumentServer.exe** (with Task Manager/Processes).



3. Power down all Metrohm instruments.
4. Power down and restart the PC.
5. Power up all Metrohm instruments.
6. Restart Empower™ by clicking on the corresponding icon on the desktop.
7. Open **Run Samples**.

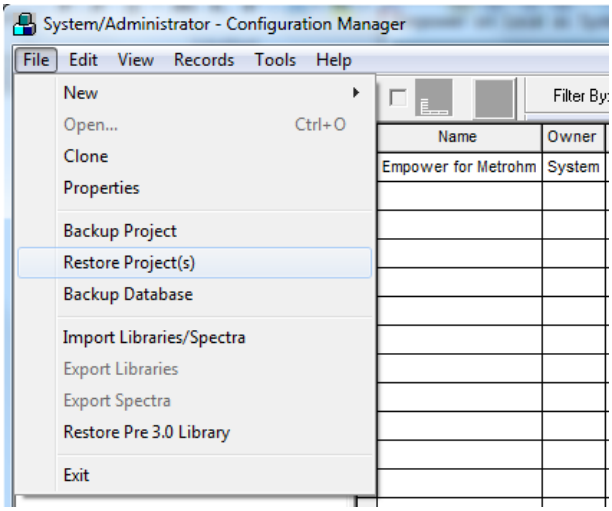
13 Restrictions

- This device driver allows you to operate one or several IC systems from one PC. One IC system may maximally include the following modules:
- One Sample Changer (889 Sample Center or 858 Professional Sample Processor)
- One Professional Detector Vario – Amperometry (2.945.0020)
- Two IC conductivity detectors (2.850.9010)
- The number of MSB devices (e.g. Dosinos) depends on the number of available ports (according to the system configuration).
- Two Metrohm IC instruments can be operated in parallel in two different systems.
- Two 858 Professional Sample Processors cannot be operated with one PC.
- The remote box does not work with the 858 sample processor. If you use a remote box, plug it in the IC instrument or the detector.
- The last data acquisition (using measure current or measure conductivity in the time program) has to start within 10 minutes from t = 0. Otherwise the whole run will abort.

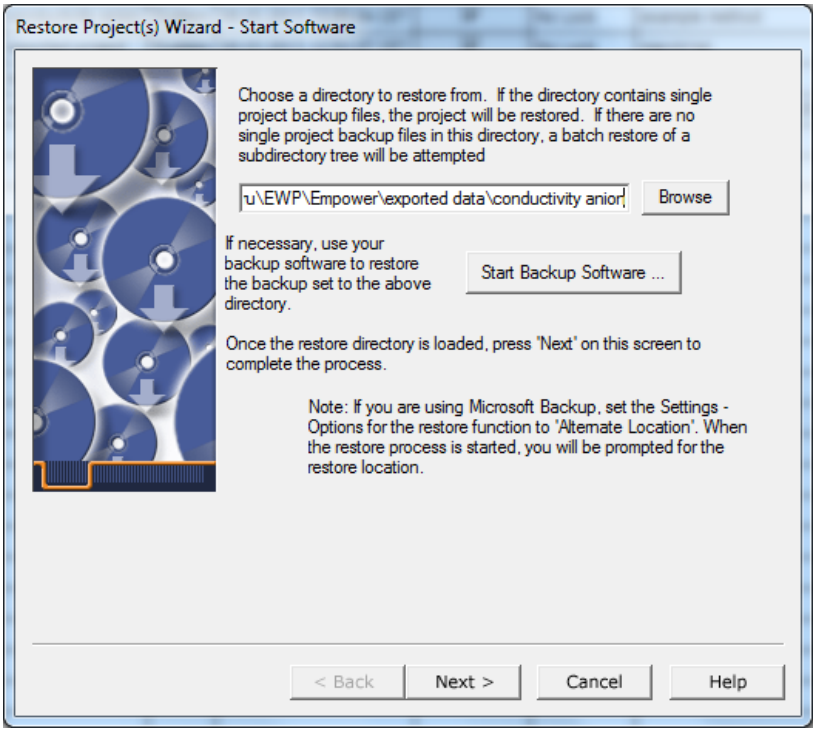
14 Importing example methods

1. Go to **Configure the System** in the Empower™ start window.

2. Go to **File > Restore Project(s)** or click on the **Restore Project(s)** button  .



3. **Browse** to find the desired project.



4. Click **Next** until finished.

   The imported project will not only contain exemplary chromatograms, but also all instrument methods and processing methods that were used to record them.