# Metrohm IC Driver, ICP-MS MassHunter

Driver version 1.0, 6.6090.100

Tutorial

8.0102.8020EN / v1 / 2024-08-01

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Technical Communication
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This documentation is an original document.

This documentation has been prepared with great care. However, errors can never be entirely ruled out. Please send comments regarding possible errors to the address above.

**Disclaimer**

Deficiencies arising from circumstances that are not the responsibility of Metrohm, such as improper storage or improper use, etc., are expressly excluded from the warranty. Unauthorized modifications to the product (e.g., conversions or attachments) exclude any liability on the part of the manufacturer for resulting damage and its consequences. Instructions and notes in the Metrohm product documentation must be strictly followed. Otherwise, Metrohm's liability is excluded.

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# 1 Overview

Metrohm IC Driver 1.0, ICP-MS MassHunter is a software driver for integrating Metrohm IC instruments in Agilent's ICP-MS MassHunter Software 5.3 or higher.

Press **[F1]** anywhere in the driver to open the online help.

## 1.1 About the documentation

**NOTE**

Read through this documentation carefully before putting the product into operation.

The documentation contains important information and warnings which you must follow in order to ensure safe operation of the product. For information on safety instructions of the Metrohm IC instrument, refer to the corresponding manual.

This tutorial describes the Metrohm IC Driver, ICP-MS MassHunter. For information on MassHunter or the Agilent ICP-MS, refer to the **MassHunter Workstation User Guide** or the **ICP-MS MassHunter Help**.

### Symbols and conventions

The following icons and formatting may appear in this documentation:

| | |
|---|---|
| *(5-**12**)* | **Cross-reference to figure legend**<br>The first number refers to the figure number, the second to the product part in the figure. |
| **1** | **Instruction step**<br>Carry out these steps in the sequence shown. |
| **Method** | Designations for names of parameters, menu items, tabs and dialog windows in the software. |
| **File ► New** | Menu or menu item |
| **Work area / Properties** | Menu paths in order to arrive at a particular position in the software. |
| **[Next]** | **Button** or **key**. |

# 2 Comprehensive information

## 2.1 Preconditions

The following preconditions must be fulfilled to ensure proper mode of operation:

- MassHunter is installed according to the Agilent instructions. Refer to the Agilent instructions for information concerning the minimum system requirements.
- The Metrohm IC Driver 1.0, ICP-MS MassHunter is installed according to the installation instructions (8.0102.8021EN Installation instructions for Metrohm IC Driver 1.0, ICP-MS MassHunter).

**NOTE**

Refer to the MassHunter Help for further information on preconditions: **Learning ► User Manuals ► Software ► MassHunter 5.x Installation Guide**.

## 2.2 Terminology

For the understanding of this tutorial, it is important to define the terms **unit**, **module** and **instrument**.

*Unit* A unit is a functional part of a module. Units are for example high-pressure pumps, injectors or degassers.

*Module* A module is an instrument with its own housing. A module consists of several units. Modules are for example 930/940 ICs, 858 Professional Sample Processors or 942 Extension Modules.

*Instrument* An instrument consists of several modules. An instrument contains all modules that are required for the analysis. An instrument is for example the combination of a 930 Compact IC Flex and an 858 Professional Sample Processor.

# 3 Instrument configuration

In the configuration, all comprehensive instrument settings (e.g., device name, serial number) are defined.

An instrument may maximally include the following modules:

- 1 IC instrument (930 Compact IC Flex or 940 Professional IC Vario)
- 1 autosampler (889 IC Sample Center or 858 Professional Sample Processor or 919 IC Autosampler plus)
- 1 Remote Box MSB: The Remote Box is mandatory in instruments with an Agilent ICP-MS. Together with the IC equipment, connection Agilent ICP-MS, the Remote Box enables remote control between the IC instrument and the Agilent ICP-MS. The Remote Box must be connected to MSB 1 of the IC instrument.
- 1 800 Dosino per IC instrument, 3 800 Dosinos per 858 Professional Sample Processor or 919 IC Autosampler plus
- 3 942 Extension Modules Vario per 940 Professional IC Vario

Additionally, the IC equipment, connection Agilent ICP-MS (6.05330.400) is mandatory in instruments with an Agilent ICP-MS. Together with the Remote Box MSB, the IC equipment, connection Agilent ICP-MS enables remote control between the IC instrument and the Agilent ICP-MS.

**NOTE**

Only the Dosino that is connected to the IC can be used for Dosino regeneration or a Dose-in gradient. Dosinos that are connected to the 858 Professional Sample Processor or 919 IC Autosampler plus can be used for liquid handling.

Always connect the Remote Box to MSB 1.

## Configuration

1. Ensure that there is no leak in the Metrohm instruments.

   Switch on the Metrohm instruments.

2. Open the application **Instrument Configuration** (**Windows start menu ► Metrohm ► Instrument Configuration**).

3. Click on **[Select Instruments...]**.

   The **Instrument Selection** dialog opens.

4 In the **Instrument Selection** dialog, click on **[Scan]** to confirm that the driver should discover Metrohm instruments.

All connected modules are recognized automatically.

5 To select the discovered modules, click on **[Select All]**.

Confirm your selection with **[OK]**.

The **Metrohm IC Configuration** dialog shows the configured modules.

6 Double-click on a module to set the configuration parameters *(see "Configuration parameters", page 4)*.

7 Click on **[Save]** in the **Metrohm IC Configuration** dialog.

8 After saving the configuration, you can create a configuration report.

Therefore, click on the Print icon  . Select a location to store the configuration report as PDF file *(see chapter 14.1, page 80)*.

**NOTE**

The stirrer of the 858 Professional Sample Processor is deactivated by default. If you want to use the stirrer, then activate the stirrer in manual configuration of the 858 Professional Sample Processor *(see chapter 7.3.1, page 43)*.

### Configuration parameters

- *930 Compact IC Flex / 940 Professional IC Vario / 942 Extension Module Vario*
- *858 Professional Sample Processor*
- *889 IC Sample Center*
- *919 IC Autosampler plus*
- *Dosing device*

# 4 Physical connection between IC and Agilent ICP-MS

## 4.1 Remote connection IC instrument – Agilent ICP-MS

**NOTE**

For further information on remote signal settings, refer to the **MassHunter Workstation User Guide** or the **ICP-MS MassHunter Help**. To open the help, press **[F1]** in the window you want to learn more about.

Signals between the IC instrument and the Agilent ICP-MS are transferred via remote signals. Therefore, the Remote Box and the IC equipment, connection Agilent ICP-MS are required.

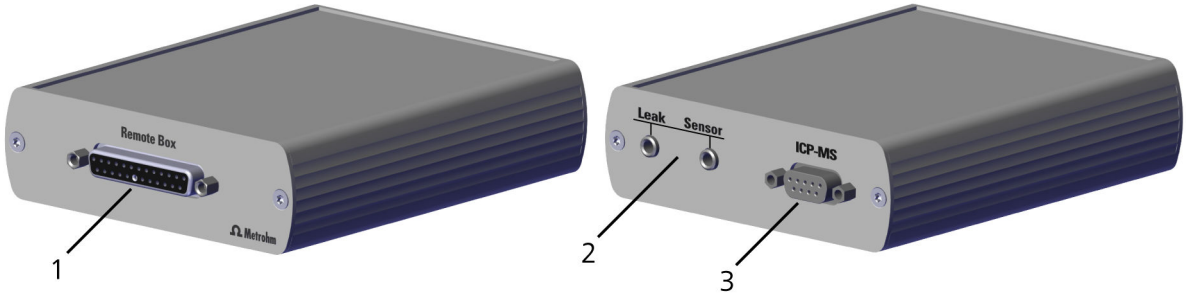



*Figure 1 Connection Box, remote control ICP-MS*

| | |
|---|---|
| **1 Connector Remote Box** | **2 Connector Leak Sensor** |
| **3 Connector ICP-MS** | |

**Install the Remote Box MSB and the IC equipment, connection Agilent ICP-MS**

**WARNING**

**Electric shock caused by live parts**

Never open the housing of the Connection Box, remote control ICP-MS.

**WARNING**

**Damage due to unauthorized cables**

To prevent damage on the Connection Box, remote control ICP-MS, the Metrohm IC instrument or Agilent ICP-MS, only the following cables may be used:

- Remote cable, IC - Agilent ICP-MS (6.2141.410)
- Connection cable, Remote Box MSB (6.2141.420)
- Connection cable, leak sensor (6.2141.430)

**WARNING**

**Damage due to relocation**

To prevent damage on the Connection Box, remote control ICP-MS, the Metrohm IC instrument or Agilent ICP-MS, all cables must be unplugged before relocating any of the connected devices.

**Accessories:**

- Remote Box MSB (6.2148.010)
- IC equipment, connection Agilent ICP-MS (6.05330.400)
  - Connection Box, remote control ICP-MS (6.2149.310)
  - Remote cable, IC - Agilent ICP-MS (6.2141.410)
  - Connection cable, Remote Box MSB (6.2141.420)
  - Connection cable, leak sensor (6.2141.430)

  Alternatively to ordering the IC equipment, the required parts can be ordered individually.

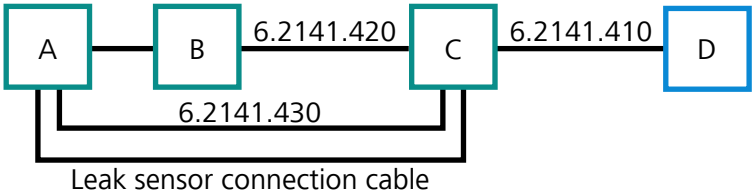



*Figure 2 Remote connection*

| | |
|---|---|
| **A** **IC instrument** | **B** **Remote Box MSB** |
| **C** **Connection Box, remote control ICP-MS** | **D** **Agilent ICP-MS** |

**1 Remote Box MSB**

Connect the Remote Box MSB to the connector **MSB 1** of the IC instrument.

**2 Connection cable, Remote Box MSB (6.2141.420)**

Connect the Remote Box MSB and the connector **Remote Box** of the connection box.

**3 Leak sensor connection cable**

On the backside of the IC instrument, disconnect the leak sensor connection cable from the connector **Leak Sensor**.

Connect the leak sensor connection cable to the connector **Leak Sensor** of the connection box.

**4 Connection cable, leak sensor (6.2141.430)**

Connect the connector **Leak Sensor** of the connection box and the connector **Leak Sensor** of the IC instrument.

**5 Remote cable, IC - Agilent ICP-MS (6.2141.410)**

Connect the connector **ICP-MS** of the connection box and the remote connector of the Agilent ICP-MS.

With the described installation, the Remote Interface is connected to the leak sensor of the IC instrument. If the plasma is switched off, the leak sensor receives a signal to stop the IC instrument. If a message appears stating that a leak was detected, either a leak occurred on the IC instrument or the leak sensor received a stop signal from the Agilent ICP-MS. The message is logged in the **Diagnostics** file *(see "Log files", page 84)*.

## 4.2 Spray chamber connections

### Spray chamber inlet

For the ignition sequence and the tuning, connect the spray chamber inlet to the tuning solution.

For data acquisition, connect the spray chamber inlet to the eluent outlet of the IC instrument.

### Spray chamber outlet

Metrohm recommends to transfer the waste from the spray chamber outlet with the peristaltic pump of the IC instrument. The peristaltic pump of the IC instrument must always be running while running the Agilent ICP-MS. You can use the waste from the spray chamber as regeneration solution for the MSM (STREAM).

In case of a software crash, the Agilent ICP-MS and the IC instrument do not stop. If the Agilent ICP-MS runs out of gas, it stops. Because the software is no longer running, the IC instrument does not receive a stop signal

from the Agilent ICP-MS and continues to run. As consequence, the eluent accumulates in the spray chamber if you transfer the waste from the spray chamber outlet with the peristaltic pump of the Agilent ICP-MS. The disposal of the waste is not guaranteed. This risk only occurs if the software or the computer crashed. Else, if one of the instruments stops during a running batch, the other instrument stops as well.

# 5 ICP-MS Instrument Control – First start-up

In the program part **ICP-MS Instrument Control**, the user can create and manage batches and all components belonging to a batch (e.g., instrument method, acquisition parameters, sample list).

## Set-up Metrohm modules

ICP-MS Instrument Control is opened for the first time after installing the Metrohm IC Driver 1.0, ICP-MS MassHunter.

**1** Start ICP-MS Instrument Control.

The dialog **Application Key** opens.

**2** Enter the following details:

- Application Key: MetrohmIC
- Application Label: MetrohmIC
- Device Type: Other

Click on **[Register]** to open ICP-MS Instrument Control.

The **ICP-MS MassHunter Workstation** dialog opens.

**NOTE**

If any other **Device Type** than **Other** is selected, ICP-MS Instrument Control cannot function properly. The ICP-MS Instrument Control needs to be reset:

1. Close ICP-MS Instrument Control.
2. Open the folder:
   **C:\Program Files\Agilent\Spectroscopy\PluginFramework**
3. Delete the file **MetrohmIC.xml**
4. Start ICP-MS Instrument Control and enter the correct details.

**3** Select the program part **Instrument Control**.

**ICP-MS Instrument Control** opens *(see chapter 5, page 9)*. The **Dashboard** is shown.

**4** On the dashboard, right-click on **Mainframe** and select **External Device**.

The **External Device Connection** dialog appears.

5 On the tab **MetrohmIC** enable the check box **Connect**.

Confirm with **[OK]**.

6 Right-click on **Sample Introduction** and select **Settings...**.

The **Settings** dialog appears.

7 In the **Sample Introduction** selection list, select **Other**.

Close the dialog with **[Close]**.

The Metrohm modules are shown on the **Dashboard**.

The **Instrument method** opens. In the **Instrument method** window, you can create a method with the configured Metrohm modules *(see chapter 6, page 12)*.

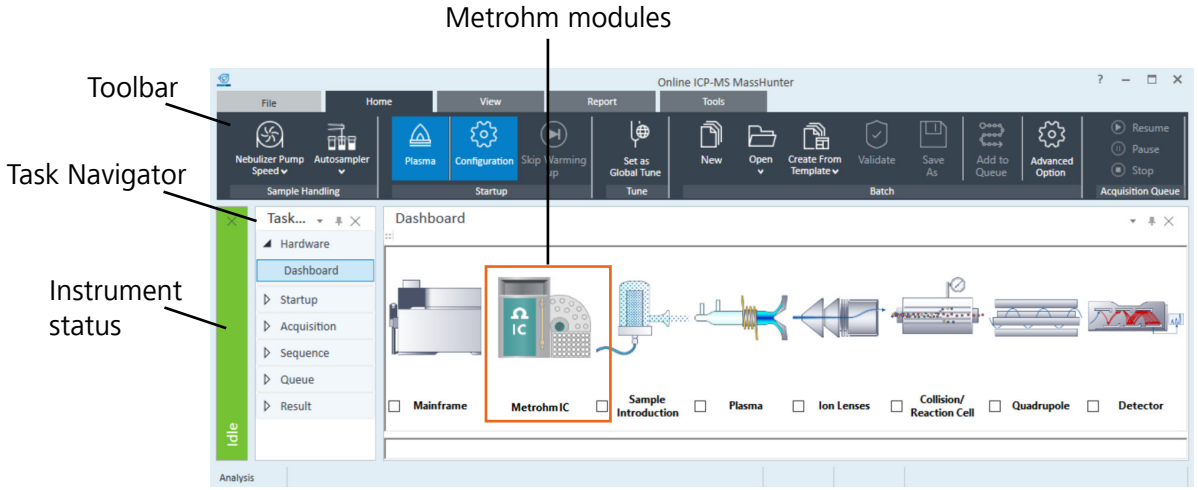



*Figure 3 ICP-MS Instrument Control – Dashboard overview*

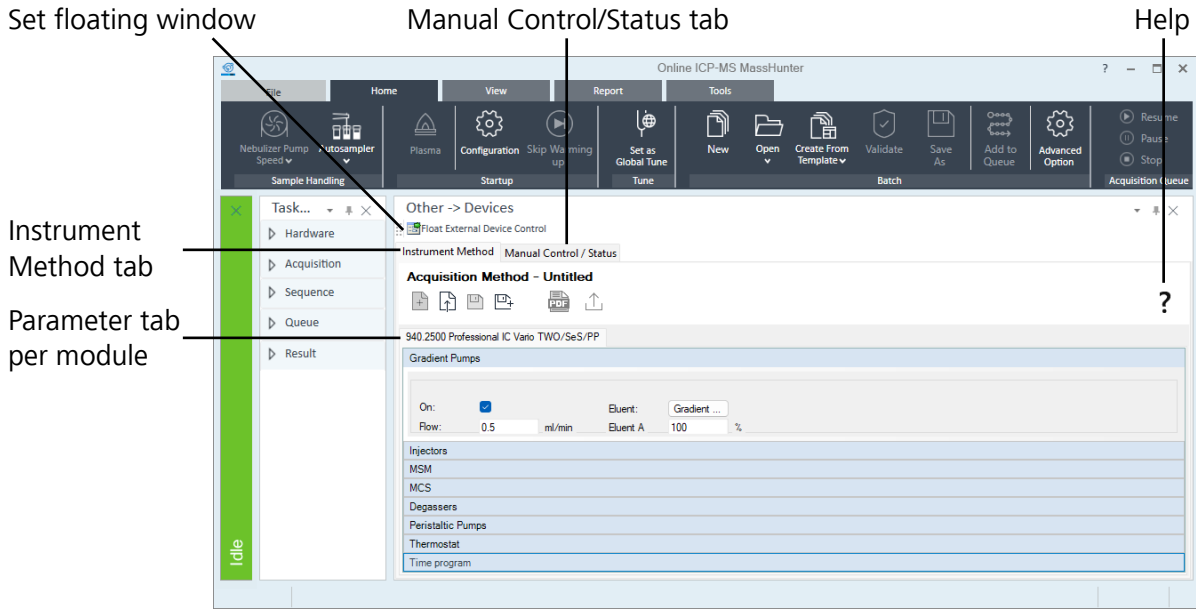



*Figure 4 Metrohm IC Driver, ICP-MS MassHunter – Overview*

# 6 Method

A method is an instruction for processing a sample. A method consists of start parameters *(see chapter 7.1.1, page 16)* and time programs *(see chapter 7.1.2, page 17)*.

## 6.1 Instrument method

**ICP-MS Instrument Control ▶ Hardware ▶ Dashboard ▶ Instrument Method**

### Create an instrument method

**1** Navigate to **Task Navigator ▶ Hardware ▶ Dashboard**. Right-click on **MetrohmIC** and select **Properties...**. Confirm the appearing dialog with **[OK]**.

A new method is opened. The status of the method is **New Method**.

Alternatively, create a method with the **New Method** icon .

The start parameters and time program of each Metrohm module are visible in individual tabs.

The start parameters are set to the default values.

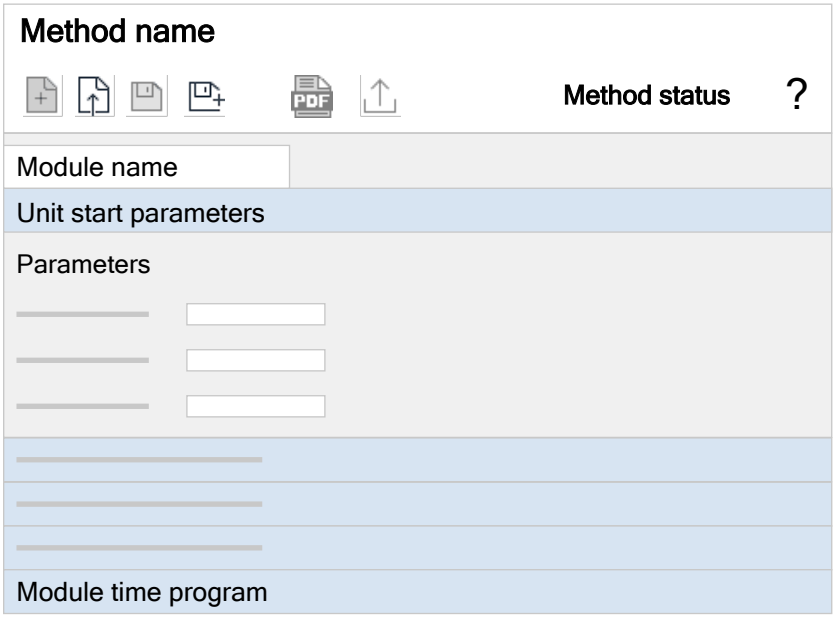



*Figure 5 ICP-MS Instrument Control – Method*

2 If necessary, adapt the start parameters *(see chapter 7.1.1, page 16)*.

Write the time program for each module *(see chapter 7.1.2, page 17)*.

3 Save the method with the **Save** icon. Select a location to store the method in the file format *.xml.

After saving the method, the status of the method is changed to **Opened Method**.

You can create a method report. Therefore, click on the **Print** icon. Select a location to store the method report in the file format *.pdf *(see chapter 14.2, page 80)*.

4 Click on **Float External Device Control** to open the method in a separate floating window. Otherwise, the method is no longer visible under **Dashboard ► Instrument control** once you sent the method to the instrument.

**NOTE**

If you open the method in a floating window, windows that open afterwards are positioned behind the floating window. This can result in a deadlock, in which a window requests an action. All other windows are inactive until this action has been performed. However, the window that requires an action is inaccessible because it is located behind the floating window. All windows automatically open in the middle of the primary screen. To avoid the described problem, Metrohm recommends to open the floating window on a second screen or in the right quarter of the primary screen *(see chapter 7.1, page 15)*.

To operate the IC instrument with specific instrument parameters after the last sample, create a specific end method. Therefore, create an instrument method with the desired start parameters. Run the method as sample in the last line of the sample list *(see chapter 11, page 74)*.

## 6.2 Method resolve

If you load a method, then the Metrohm IC Driver, ICP-MS MassHunter checks whether the configured hardware corresponds to the instrument the method was written with.

It is possible to load a method that was written on an instrument with a different configuration. In this case, the Metrohm IC Driver, ICP-MS MassHunter resolves the differences between the instruments in the following way:

- If the configured instrument contains **different modules** than the instrument from the loaded method, all modules and time program commands are removed from the method.
- If the configured instrument contains **fewer modules** than the instrument from the loaded method, all modules and time program commands are removed from the method.
- If the configured instrument contains **more modules** than the instrument from the loaded method, then the additional modules are added to the method. The start parameters are set to their default values. Adapt the start parameters if necessary. The time program of the additional modules is empty.
- If the configured instrument contains **fewer units** than the instrument from the loaded method, then the start parameters of the missing units are removed. A warning occurs in the time program if a time program command uses a non existing unit. The user has to resolve this difference manually by deleting or adapting the affected time program command.
- If the configured instrument contains **more units** than the instrument from the loaded method, then the default start parameters of the additional units are added. Adapt the start parameters if necessary.

If a method resolve is necessary, a message appears. If you open a method that has been resolved previously, the method resolve message appears again because the original configuration is still stored in the background. Despite the message, another method resolve is not necessary.

# 7 Instrument parameters

**NOTE**

In this tutorial, instrument parameters for all modules and units are described. It depends on your instrument configuration which parameters you can set. In the Metrohm IC Driver, ICP-MS MassHunter only the parameters available for your instrument are visible.

## 7.1 General description

**NOTE**

If you open the method in a floating window, windows that open afterwards are positioned behind the floating window. This can result in a deadlock, in which a window requests an action. All other windows are inactive until this action has been performed. However, the window that requires an action is inaccessible because it is located behind the floating window. All windows automatically open in the middle of the primary screen. To avoid the described problem, Metrohm recommends to open the floating window on a second screen or in the right quarter of the primary screen.

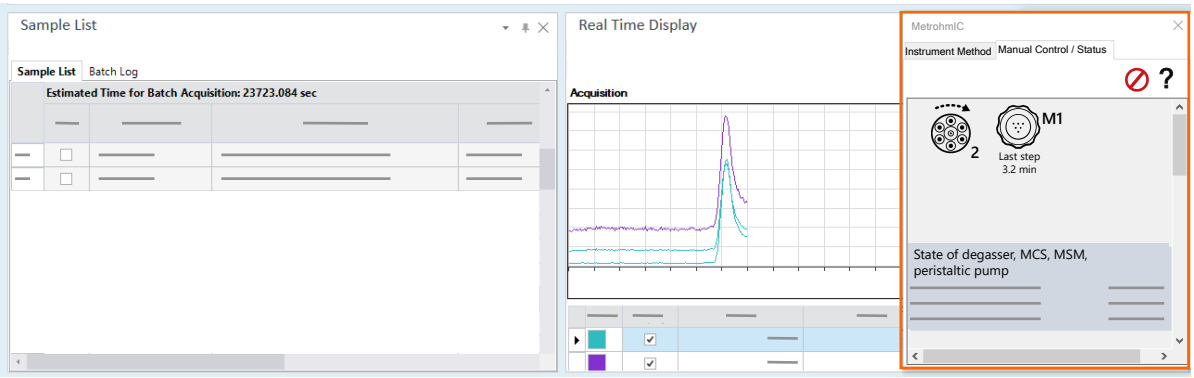



*Figure 6 Floating window right quarter*

### 7.1.1 Start parameters

**ICP-MS Instrument Control ▶ Hardware ▶ Dashboard ▶ Instrument Method**

Start parameters are sent to the units when you start the method.

To open the method section, right-click on **MetrohmIC** and select **Properties...**. Open the **Instrument Method** tab.

Click on a unit to set its start parameters. If the instrument contains 2 units of the same type (e.g., 2 high-pressure pumps), then the same menu appears for both units *(see chapter 7.1.4, page 21)*. The start parameters of both units can be set independently.

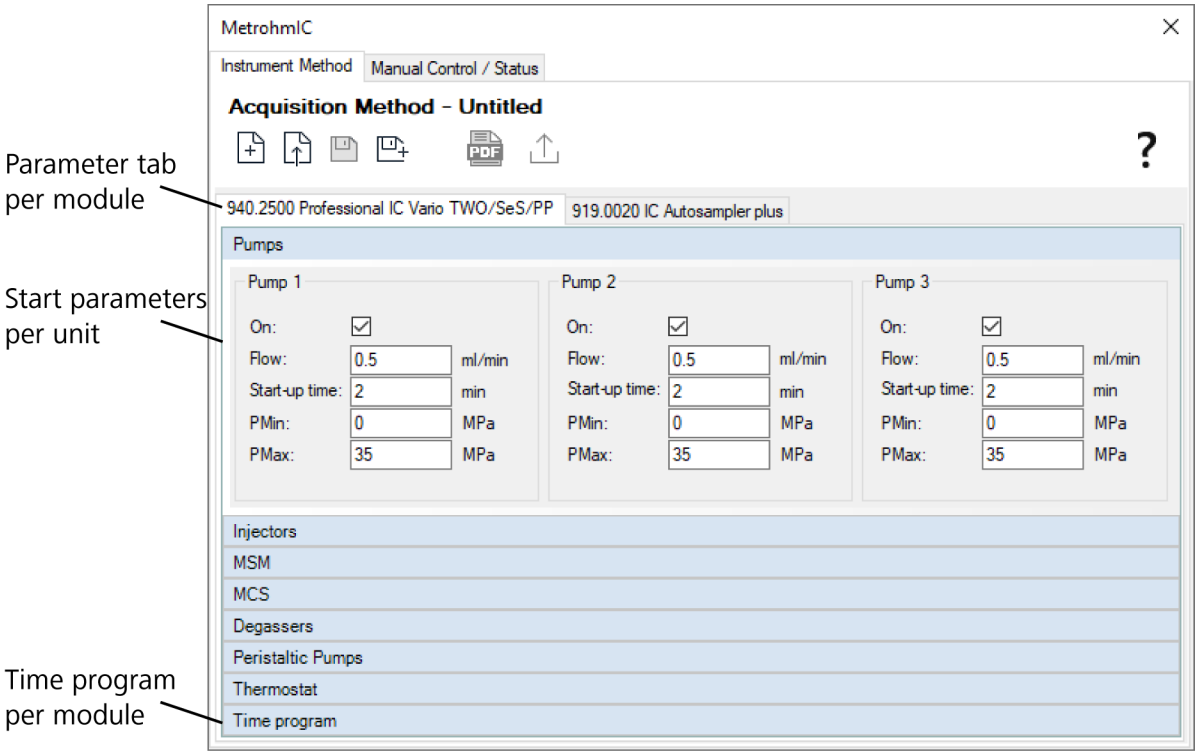



*Figure 7 Instrument method tab*

**Parameters**

- *930 Compact IC Flex / 940 Professional IC Vario / 942 Extension Module Vario*
- *858 Professional Sample Processor*
- *889 IC Sample Center*
- *919 IC Autosampler plus*

## 7.1.2 Time program

**ICP-MS Instrument Control ▶ Hardware ▶ Dashboard ▶ Instrument Method**

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

To write a time program, right-click on **MetrohmIC** and select **Properties...**. Open the **Instrument Method** tab. The last line of a modules method editor contains the time program.

If several modules are configured (e.g., 940 Professional IC and 858 Professional Sample Processor), then each module has its own time program. Several modules can be synchronized with events *(see chapter 7.1.2.1, page 17)*.

To write a time program command, click on **[Add]**. Select a command in the drop-down list and define the command in the appearing dialog.

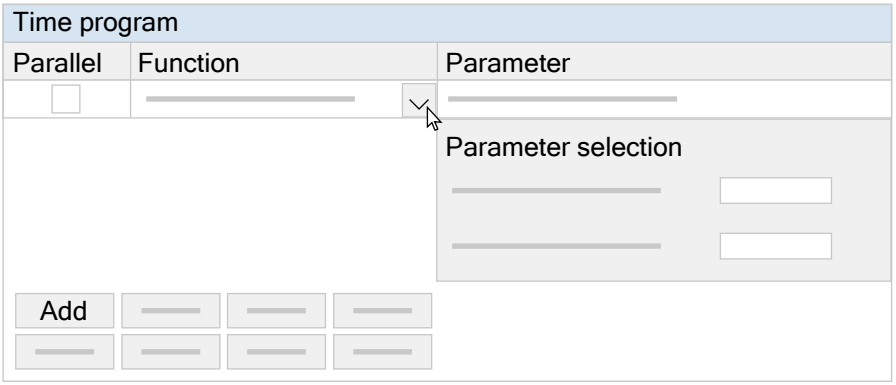



*Figure 8 Adding time program commands*

### Parameters

- *930 Compact IC Flex / 940 Professional IC Vario / 942 Extension Module Vario*
- *858 Professional Sample Processor*
- *889 IC Sample Center*
- *919 IC Autosampler plus*
- *Dosing device*

### 7.1.2.1 Device-independent commands

**ICP-MS Instrument Control ▶ Hardware ▶ Dashboard ▶ Instrument Method**

| | |
|---|---|
| **Device-independent commands** | |
| **Parallel** | To save time, run 2 commands in parallel. Check the checkbox **Parallel**. While a command is being executed, the time program already continues with the next line. This option is possible for all time program commands of the dosing device and for the time program command **Move**. |

| | |
|---|---|
| **Wait** | Holds the program schedule. |
| **Events ►** | Each module has its own time program. These time programs run in parallel but independently of each other. Synchronize time programs with the time program commands **Event Set**, **Event Wait** and **Event Reset**. |
| **Event Set** | An **Event Set** triggers actions in other time program commands. An **Event Set** indicates the moment when another time program has to execute its commands.<br>As soon as the time program reaches the line with the **Event Set**, other time programs can see the **Event Set**. |
| **Event Wait** | An **Event Wait** is always looking for **Event Sets** with the same name. If the **Event Wait** of a time program detects a corresponding **Event Sets**, then the time program executes the commands that follow after the **Event Wait**. |
| **Event Reset** | An **Event Reset** removes the corresponding **Event Set**. If you set an **Event Reset**, then the **Event Wait** keeps on looking for the corresponding **Event Set** and does not execute subsequent time program commands. |

### Example of a time program with device-independent commands and events

This example describes the synchronization of 2 time programs with events.

Both time programs start in parallel.

First, the sample processor transports the sample to the injector. Then the IC injects, while the sample processor rinses the needle. Therefore, the time program of the IC must wait until the sample processor has transported the sample to the injector.

#### Time program – 930 Compact IC Flex

*Table 1 Time program – 930 Compact IC Flex*

| | Function | Parameter |
|---|---|---|
| 1 | Event Wait | Event Wait: Name = Loop Filled |
| 2 | Switch injector | Injector: 1, Position = Inject |

**1 Event Wait: Name=Loop Filled**

The time program of the IC is looking for an event set called **Loop Filled**.

When the event set **Loop Filled** is executed in the time program of the sample processor, the IC starts executing the command in line 2.

**2 Switch injector**

The IC switches the injector to the position **Inject**.

## Time program – 858 Professional Sample Processor

*Table 2 Time program – 858 Professional Sample Processor*

| | Function | Parameter |
|---|---|---|
| 1 | Move | Move: Position type = VialFromSequence, Lift Position = Work |
| 2 | Set peristaltic | Pump: Rate = 3, On |
| 3 | Wait | Wait: Wait time = 3 min |
| 4 | Set peristaltic | Pump: Rate = 1, Off |
| 5 | Event Set | Event Set: Name = Loop Filled |
| 6 | Move | Move: Position type = ExternalPosition, External Position = Rinse |
| 7 | Set peristaltic | Pump: Rate = 3, On |
| 8 | Wait | Wait: Wait time = 3 min |
| 9 | Set peristaltic | Pump: Rate = 1, Off |

**1 Move**

The sample processor moves to a position on the rack to take a sample.

**2 Set peristaltic**

The peristaltic pump of the sample processor starts on rate 3.

**3 Wait**

The time program of the sample processor waits for 3 minutes before it continues with the next line. During the waiting time, the peristaltic pump transports the sample to the injector.

**4 Set peristaltic**

The peristaltic pump of the sample processor stops.

**5 Event Set: Name=Loop Filled**

This event set matches the event wait of the IC because both events have the same name.

As soon as the time program of the IC reaches the line with the event wait command, the time program of the IC starts looking for the corresponding event set.

Now, as the time program of the sample processor reached the event set, the IC starts executing the commands that follow the event wait command.

**6 Move**

The sample processor moves to a position on the Liquid Handling Station.

**7 Set peristaltic**

The peristaltic pump of the sample processor starts on rate 3.

**8 Wait**

The time program of the sample processor waits for 3 minutes before it continues with the next line. During the waiting time, the needle is rinsed in the Liquid Handling Station.

**9 Set peristaltic**

The peristaltic pump of the sample processor stops.

### 7.1.3 Manual control/Status

**ICP-MS Instrument Control ► Hardware ► Dashboard ► Manual Control/Status**

The units of a module are shown in different status panels.

To access the status panels, right-click on **MetrohmIC** and select **Properties...**. Open the **Manual Control/Status** tab.

The status panels display the live parameters of the configured units and enable the user to operate the individual units manually.

**NOTE**

To receive detailed information about a unit, hover the cursor over the corresponding unit (e.g. **Column**).

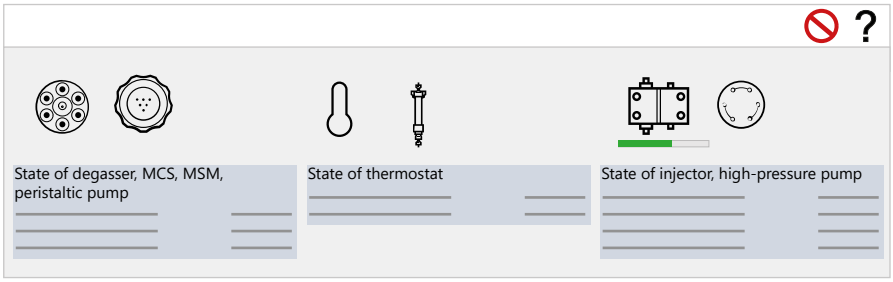



*Figure 9 Manual Control / Status tab*

Open the manual control of a unit by right-clicking on the respective icon in the status panel.

To confirm changes in manual control and leave the dialog, click on **[OK]**. To confirm changes and keep the dialog open, click on **[Apply]**. To close the dialog, click on the close button **[X]**. If you didn't apply the changes before closing the dialog, the changes are discarded.

**NOTE**

If the instrument goes offline, the status panels do not show the actual instrument status anymore. The status panels display the instrument status at the time the instrument was last online. The hardware does not switch off automatically if the instrument goes offline. To ensure that the hardware is off, switch off the hardware with the power-off button.

With the stop button you can stop the IC instrument immediately. If you press the stop button during a determination, the determination is aborted immediately.

**Parameters**

- *930 Compact IC Flex / 940 Professional IC Vario / 942 Extension Module Vario*
- *858 Professional Sample Processor*
- *889 IC Sample Center*
- *919 IC Autosampler plus*
- *Dosing device*

### 7.1.4 Numbering of the units

If you set start parameters and time program commands, you have to select the index of the respective unit.

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

- For 930/940 ICs this means: The upper unit always gets the number 1, the lower unit number 2 (e.g., for pumps and injectors).
- For 942 Extension Modules this means: Only 1 extension module can be connected directly to the IC instrument. The second extension module has to be connected to the first extension module. The third extension module has to be connected to the second extension module. The numbering of the units begins with the IC instrument and continues with the extension modules according to their position in the daisy chain.

**NOTE**

The numbering is fixed and cannot be changed manually.

In the status panels, the numbers of the units are not shown. Distinguish identical units by their position in the status panel.

*Table 3 Numbering of the units in the status panel*

| | |
|---|---|
| 1 | 3 |
| 2 | 4 |

**Example dosing devices:**

Numbering of the dosing devices in the status panel. The instrument contains 3 dosing devices.

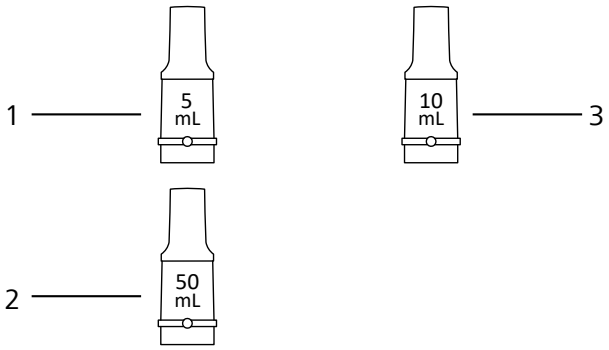



*Figure 10 Numbering of the dosing devices*

## 7.2 930 Compact IC Flex / 940 Professional IC Vario / 942 Extension Module Vario

The 930 Compact IC Flex and 940 Professional IC Vario are ion chromatographs. The 930 Compact IC Flex and 940 Professional IC Vario are available in various product versions with different units.

The 942 Extension Modules Vario are used to expand 940 Professional ICs Vario with additional functions. The Metrohm IC Driver, ICP-MS MassHunter supports 3 product versions of the 942 Extension Module Vario:

- 942 Extension Module Vario HPG: Expands your instrument to a gradient instrument.
- 942 Extension Module Vario ONE/Deg: Expands your instrument with an additional channel.
- 942 Extension Module Vario SeS/PP: Expands your instrument with sequential suppression.

### 7.2.1 Configuration

| | |
|---|---|
| **930 IC/940 IC/942 Extension Module** | |
| **Communication** | The following parameters are entered automatically:<br>▪ Device name<br>▪ Type ID<br>▪ Serial number |
| **Options ►** | |
| **MSB** | The connected MSB devices are recognized automatically. The following MSB devices are available:<br>▪ 800 Dosino<br>Always connect the Dosino to MSB 2.<br>▪ Remote Box<br>The Remote Box is mandatory in instruments with an Agilent ICP-MS!<br>The Remote Box coordinates control signals between the IC and the Agilent ICP-MS. The IC and the Agilent ICP-MS are able to send and receive signals via remote lines.<br>Always connect the Remote Box to MSB 1.<br>Configure the Remote Box for the 930/940 IC. Do not select the Remote Box as MSB device for the 858 Professional Sample Processor or 919 IC Autosampler plus.<br>Click on **[Configure]** to set further parameters *(see chapter 7.6.1, page 63)*. |
| **Extension module** | Extension modules are only available for 940 ICs. Extension modules are detected automatically. |

| | |
|---|---|
| **Gradient Pumps** | Gradient pumps are only available for 940 ICs.<br><br>A high-pressure gradient can only be configured for **940 Professional ICs Vario** and for **942 Extensions Modules Vario** that are connected to a 940 Professional IC Vario. At least 2 high-pressure pumps are necessary to configure a high-pressure gradient.<br><br>Define the following parameters:<br><br>▪ Number of Pumps<br>Define how many pumps the high-pressure gradient pump consists of.<br>▪ Pump A–D<br>Assign the high-pressure pumps to the gradient pump.<br>A high-pressure pump can be used either for a high-pressure gradient or for a Dose-in gradient or as a normal high-pressure pump. A high-pressure pump cannot be configured for several functions. |
| **Dose-in gradient** | For ICs with a high-pressure pump and a Dosino, it is possible to configure a gradient pump for a Dose-in gradient.<br><br>Define the following parameters:<br><br>▪ Pumps<br>Select a high-pressure pump that you want to use for the Dose-in gradient pump.<br>A high-pressure pump can be used either for a high-pressure gradient or for a Dose-in gradient or as a normal high-pressure pump. A high-pressure pump cannot be configured for several functions.<br>▪ Dosino<br>Assign a Dosino to the selected high-pressure pump. |
| **Regeneration** | For ICs with an MSM and a Dosino, it is possible to configure Dosino regeneration for the MSM. The regeneration solution for the MSM regeneration is transported and dosed by a dosing device.<br><br>Define the following parameters:<br><br>▪ MSM<br>Select an MSM to be regenerated with Dosino regeneration.<br>▪ Dosino<br>Assign a Dosino to the selected MSM. |

**NOTE**

A Dosino can be used either for a Dose-in gradient or for Dosino regeneration or as a normal Dosino. A Dosino cannot be configured for several functions.

You can use only 1 Dosino with the IC instrument. Connect the Dosino to MSB 2 of the IC. Connect the Remote Box to MSB 1 of the IC. You cannot connect the Dosino to the MSB socket of the Remote Box. Otherwise, the Remote Box is not recognized anymore.

If you want to use a Dosino for Dosino regeneration or a Dose-in gradient, then configure it for a 930/940 IC. It is not possible to use Dosinos at the 858 Professional Sample Processor for Dosino regeneration or Dose-in gradients.

**NOTE**

A high-pressure pump can be used either for a high-pressure gradient or for a Dose-in gradient or as a normal high-pressure pump. A high-pressure pump cannot be configured for several functions.

## 7.2.2 Start parameters

### 7.2.2.1 High-pressure pump

| | |
|---|---|
| **Pump 1** | |
| **On** | The high-pressure pump is switched on when you start the method. |
| **Flow** | Flow of the high-pressure pump when you start the method.<br>The maximum permitted flow depends on the spray chamber. Refer to Agilent instructions for your instrument. |
| **Start-up time** | Define a start-up time for reaching the defined flow rate. |
| **PMin** | Minimum permitted pressure in the instrument when you start the method. |
| **PMax** | Maximum permitted pressure in the instrument when you start the method.<br>If the IC contains a column, the maximum pressure of the column is used as default value for PMax. |

**NOTE**

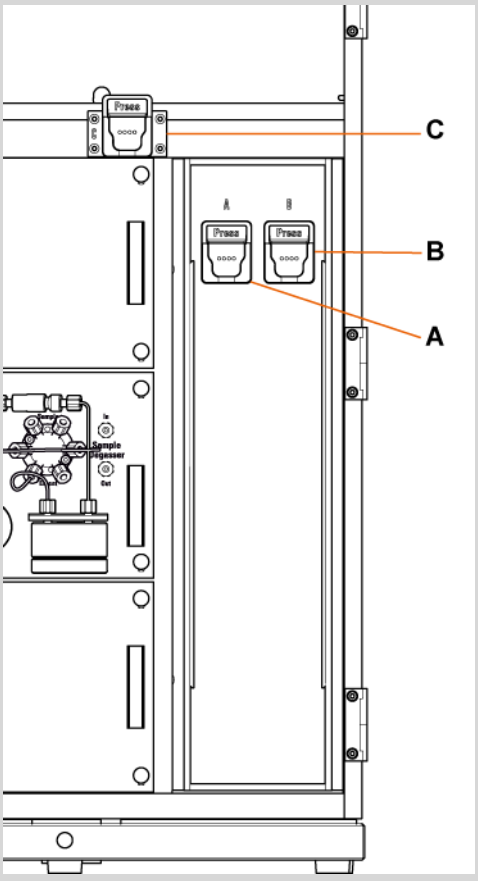
If the pressure is below PMin or above PMax, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)*. The instrument is switched off.

**NOTE**

Besides the PMax that is defined in the start parameters, there is a PMax written on the column chip. If these values differ, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)* as soon as the **lower** of both values is exceeded.

Each column holder is assigned to a high-pressure pump.

- Pump 1 – Column holder A
- Pump 2 – Column holder B
- Pump 3 – Column holder C



### 7.2.2.2 Injector

| | |
|---|---|
| **Injector 1** | |
| **Position** | Position of the injector when the run starts.<br>▪ Inject<br>Switches the valve to **Inject**.<br>▪ Fill<br>Switches the valve to **Fill**.<br>▪ Maintain Current<br>The valve maintains its current position. |

### 7.2.2.3 MSM

| | |
|---|---|
| **MSM 1** | |
| **Automatic stepping to next position during equilibration** | If you enable this option, then automatic stepping of the rotor to the next position is initiated within the equilibrate mode and between injections. The time interval defined in the parameter interval is used. |
| **Interval** | Time interval between 2 sequential automatic rotor stepping operations. |
| **Dosino regeneration ►** | If Dosino regeneration is configured, then it takes place automatically after each step of the rotor.<br>This parameter is only shown if Dosino regeneration is configured. |
| **Dosing device** | The dosing device is defined in the configuration of the Dosino regeneration *(see chapter 7.2.1, page 23)*. |
| **Solution ►** | These parameters are only shown if Dosino regeneration is configured. |
| **Dosing Port** | Port for dosing the regeneration solution. |
| **Volume** | Volume of the regeneration solution. |
| **Time** | Duration of the regeneration.<br>The Dosino regeneration time must not be longer than the acquisition time. |
| **Dosing rate** | Dosing rate at which the MSM is regenerated. The dosing rate is automatically calculated from the **Volume** and **Time**.<br>This dosing rate is only applied to sequences and single sample analysis. If you send the current method to the instrument to equilibrate the instrument, then the default dosing rate of 1.0 mL/min is applied for the first MSM step. For all following MSM steps, the dosing rate from the method is applied. |
| **Fill Port** | Port for filling the regeneration solution. |

### 7.2.2.4 MCS

| | |
|---|---|
| **MCS 1** | |
| **On** | The MCS is switched on when you start the method. |

### 7.2.2.5 Degasser

| | |
|---|---|
| **Degasser 1** | |
| **On** | The degasser is switched on when you start the method. |

### 7.2.2.6 Peristaltic pump

| | |
|---|---|
| **Peristaltic pump 1** | |
| **On** | The peristaltic pump is switched on when you start the method. |
| **Rate** | Rate of the peristaltic pump when you start the method. |

### 7.2.2.7 Thermostat

| | |
|---|---|
| **Thermostat** | |
| **On** | The thermostat is switched on when you start the method. |
| **Temperature** | Temperature that is set for the thermostat when you start the method. |
| **Wait for Stable Temperature** | A run does not start before the set temperature has been reached and is stable. |

### 7.2.2.8 High-pressure gradient

| | |
|---|---|
| **Gradient Pumps** | |
| **On** | The high-pressure gradient pump is switched on when you start the method. |
| **Flow** | Flow of the high-pressure gradient pump when you start the method.<br>The maximum permitted flow depends on the spray chamber. Refer to Agilent instructions for your instrument. |
| **Start-up time** | Define a start-up time for reaching the defined flow rate. |
| **PMin** | Minimum permitted pressure in the instrument when you start the method.<br>The high-pressure gradient pump consists of several individual high-pressure pumps. If the pressure of 1 individual high-pressure pump falls below PMin, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)*. |

| | |
|---|---|
| **PMax** | Maximum permitted pressure in the instrument when you start the method.<br>The high-pressure gradient pump consists of several individual high-pressure pumps. If the pressure of 1 individual high-pressure pump exceeds PMax, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)*. |
| **Eluent A–D** | Define the proportion in the mixing ratio for each eluent. Ensure that the total of all eluent proportions is 100%. |
| **Gradient…** | Click on **[Gradient…]** to define the gradient profile. Execute the gradient profile with the time program command **Start Gradient**. For each step in the gradient profile, define the following parameters:<br>▪ Time<br>Moment when the gradient command is executed.<br>▪ Eluent A - D<br>Define the proportion in the mixing ratio for each eluent. Ensure that the total of all eluent proportions is 100%.<br>▪ Curve<br>Selection of the curve form with which the previous entry in the gradient table moves to the current entry.<br>– Linear<br>If the flow is not modified, then the proportion of eluent changes in a linear fashion.<br>If the flow and the proportion of the eluents is modified, then the proportion of the eluents and the flow change in a linear fashion. The mixing ratio changes in a nonlinear fashion.<br>– Step<br>If the flow is not modified, then the proportion of the eluent remains at its current value up to the point in time of the next command line. Then the proportion changes to the value of the next command line at once.<br>If the flow and the proportion of the eluents is modified, then the proportion of the eluents and the flow of the pump remain at their current value up to the point in time of the next command line. Then they change to the value of the next command line at once. The mixing ratio changes in the same way.<br>– Convex 1 - 4 / Concave 1 - 4<br>If the flow is not modified, then the proportion of the eluent changes along the selected curve.<br>If the flow and the proportion of the eluents is modified, then the flow changes along the selected curve. The proportion of eluents changes along the selected curve. The mixing ratio changes in a nonlinear fashion.<br>▪ Flow<br>Flow rate at which the gradient step is executed.<br>The maximum permitted flow depends on the spray chamber. Refer to Agilent instructions for your instrument. |

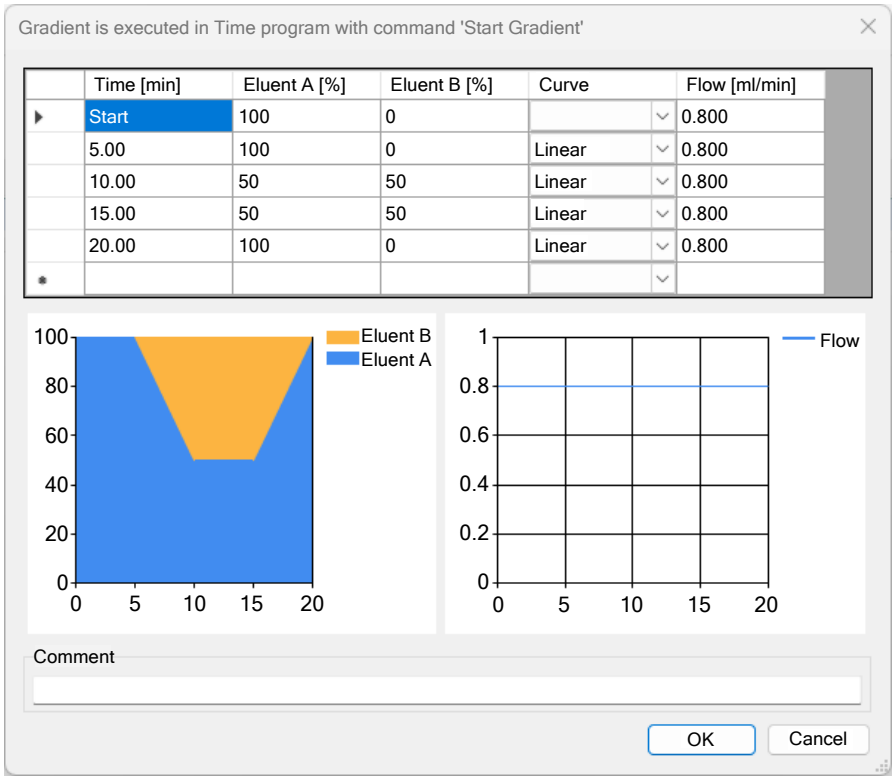



*Figure 11 High-pressure gradient – Start parameters*

**NOTE**

If the pressure is below PMin or above PMax, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)*. The instrument is switched off.

**NOTE**

Besides the PMax that is defined in the start parameters, there is a PMax written on the column chip. If these values differ, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)* as soon as the **lower** of both values is exceeded.

Each column holder is assigned to a high-pressure pump.

- Pump 1 – Column holder A
- Pump 2 – Column holder B
- Pump 3 – Column holder C

See *chapter 7.2.2.1, page 25* for an illustration of the column holders.

### 7.2.2.9 Dose-in gradient

| | |
|---|---|
| **Pumps** | |
| **On** | The high-pressure pump is switched on when you start the method. |
| **Flow** | Flow of the high-pressure pump when you start the method.<br>The maximum permitted flow depends on the spray chamber. Refer to Agilent instructions for your instrument. |
| **Start-up time** | Define a start-up time for reaching the defined flow rate. |
| **PMin** | Minimum permitted pressure in the instrument when you start the method. |
| **PMax** | Maximum permitted pressure in the instrument when you start the method. |
| **Gradient…** | Click on **[Gradient…]** to define the gradient profile. Execute the gradient profile with the time program command **Dose-in Gradient**. For each step in the gradient profile, define the following parameters:<br>▪ Time<br>Moment when the gradient command is executed.<br>▪ Ratio<br>Proportion in the mixing ratio from the dosing device to the flow of the high-pressure pump.<br>▪ Curve<br>Selection of the curve form with which the previous entry in the gradient table moves to the current entry.<br>– Linear<br>The proportion of the eluent from the dosing device changes in a linear fashion.<br>– Step<br>The proportion of the eluent from the dosing device remains at its current value up to the point in time of the next command line. Then the proportion changes to the value of the next command line at once.<br>▪ Flow<br>Flow rate at which the gradient is executed.<br>The maximum permitted flow depends on the spray chamber. Refer to Agilent instructions for your instrument. |


*Figure 12 Dose-in gradient – Start parameters*

**NOTE**

If the pressure is below PMin or above PMax, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)*. The instrument is switched off.

**NOTE**

Besides the PMax that is defined in the start parameters, there is a PMax written on the column chip. If these values differ, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)* as soon as the **lower** of both values is exceeded.

Each column holder is assigned to a high-pressure pump.

- Pump 1 – Column holder A
- Pump 2 – Column holder B
- Pump 3 – Column holder C

See *chapter 7.2.2.1, page 25* for an illustration of the column holders.

## 7.2.3 Time program

### 7.2.3.1 Injector

| | |
|---|---|
| **Switch injector** | |
| **Injector** | Number of the injector. |
| **Position** | Position of the injector.<br>▪ Inject<br>Switches the valve to **Inject**.<br>▪ Fill<br>Switches the valve to **Fill**. |

### 7.2.3.2 MSM

| | |
|---|---|
| **MSM Step** | |
| **Execution condition** | The command is only run if the minimum regeneration time has been reached or exceeded. |
| **MSM** | Number of the MSM. |
| **Minimal regeneration time** | Time that must have elapsed since the last stepping. |

### 7.2.3.3 Peristaltic pump

| | |
|---|---|
| **Set peristaltic** | |
| **Pump on** | Switches on the peristaltic pump and sets the value for the pump rate. |
| **Pump** | Number of the peristaltic pump. |

| | |
|---|---|
| **Rate** | Rate of the peristaltic pump. |

### 7.2.3.4 High-pressure pump

| | |
|---|---|
| **Measure Pressure** | |
| **Pump** | Number of the pump. |

### 7.2.3.5 Remote Box

| | |
|---|---|
| **Set Lines** | |
| | With this time program command, the IC instrument sends a signal to the Agilent ICP-MS to start data acquisition. |
| **MSB port** | The Remote Box is always connected to MSB port 1 of the IC instrument. |
| **Output signal** | Input of the binary pattern for the output signal of exactly 14 bits.<br>The output lines are numbered from right to left:<br>13-12-11-10-9-8-7-6-5-4-3-2-1-0<br>Use the following output lines:<br>▪ Shutdown signal: Output line 8 (*****p********)<br>▪ Start signal: Output line 10 (***p**********)<br>0 = Output line deactivated<br>1 = Output line activated<br>* = Retain the status of the output line<br>p = set pulse (pulse length = 200 ms).<br>If you add a time program command to activate the output line (*****1********), always add the corresponding command to deactivate the output line again (*****0********).<br>**Example:**<br>*****p********: Output line 8 of the IC instrument sends a shutdown signal of the defined pulse length to the Agilent ICP-MS. |

**NOTE**

If you shut down the plasma with the command **Set Lines** or by disabling the button **[Plasma]** in MassHunter, the IC continues to run.

| | |
|---|---|
| **Scan Lines** | |
| | The IC instrument receives signals from the Agilent ICP-MS via remote settings. The command **Scan Lines** is not necessary. |
| **MSB port** | The Remote Box is always connected to MSB port 1 of the IC instrument. |
| **Input signal** | Input of the binary pattern for the output signal of exactly 8 bits.<br>The input lines are numbered from right to left: 7-6-5-4-3-2-1-0 |
| **Timeout** | If **Timeout** is activated, then the time program is continued as soon as either the requested input signal has been received or the waiting time has expired. If the waiting time expires, the run is aborted.<br>If **Timeout** is not activated, then the time program waits indefinitely for an input signal. |

### 7.2.3.6 High-pressure gradient

| | |
|---|---|
| **Start Gradient** | |
| **Start Gradient** | Executes the gradient profile that was defined in the start parameters under **Settings** *(see chapter 7.2.2.8, page 28)*. |

**NOTE**

Ensure that the gradient is executed immediately after the injection. Therefore, the time program entry for **Start Gradient** must be placed immediately after the entry for **Switch injector** to **Inject** position.

### 7.2.3.7 Dose-in gradient

| | |
|---|---|
| **Dose-in Gradient** | |
| | Executes the gradient profile that was defined in the start parameters. |
| **MSB** | The Dosino for the Dose-in gradient is always connected to MSB port 2 of the IC instrument. |

**NOTE**

Ensure that the gradient is executed immediately after the injection. Therefore, the time program entry for **Dose-in gradient** must be placed immediately after the entry for **Switch injector** to **Inject** position.

## 7.2.4 Manual control

### 7.2.4.1 High-pressure pump

| | |
|---|---|
| **High-pressure pump**  | |
| **Pump set flow ▶** | |
| **Flow** | Flow of the high-pressure pump.<br>The maximum permitted flow depends on the spray chamber. Refer to Agilent instructions for your instrument. |
| **PMin** | Minimum permitted pressure in the instrument. |
| **PMax** | Maximum permitted pressure in the instrument. |
| **Pump off** | Switches off the high-pressure pump. |

**NOTE**

Besides the PMax that is defined in the manual control, there is a PMax written on the column chip. If these values differ, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)* as soon as the **lower** of these values is exceeded.

Each column holder is assigned to a high-pressure pump.

- Pump 1 – Column holder A
- Pump 2 – Column holder B
- Pump 3 – Column holder C

See *chapter 7.2.2.1, page 25* for an illustration of the column holders.

**NOTE**

If the high-pressure pump is used for a Dose-in gradient, this is indicated with **D1** in the icon.

### 7.2.4.2 Injector


| | |
|---|---|
| **Injector Inject** | Switches the valve to **Inject**. |
| **Injector Fill** | Switches the valve to **Fill**. |

### 7.2.4.3 MSM


| | |
|---|---|
| **MSM Step** | The MSM steps. The time since the last step is reset.<br>With Dosino regeneration, the default dosing rate of 1.0 mL/min is applied. It is not possible to change the dosing rate in manual control. If you want to use a different dosing rate, edit the dosing rate in the MSM start parameters *(see chapter 7.2.2.3, page 27)* and send the method to the instrument. |
| **MSM AutoStep ▶** | Automatic stepping of the rotor to the next position starts. |
| **Interval** | Time interval between 2 sequential automatic rotor stepping operations.<br>With Dosino regeneration, the default dosing rate of 1.0 mL/min is applied. It is not possible to change the dosing rate in manual control. If you want to use a different dosing rate, edit the dosing rate in the MSM start parameters *(see chapter 7.2.2.3, page 27)* and send the method to the instrument. |
| **MSM AutoStep off** | Automatic stepping of the rotor to the next position stops. |

**NOTE**

If the MSM is regenerated with Dosino regeneration, this is indicated with **M1** in the icon.

### 7.2.4.4 MCS

| | |
|---|---|
| **MCS** | |
| **MCS On** | Switches on the MCS. |
| **MCS Off** | Switches off the MCS. |

### 7.2.4.5 Degasser

| | |
|---|---|
| **Degasser** | |
| **Degasser On** | Switches on the degasser. |
| **Degasser Off** | Switches off the degasser. |

### 7.2.4.6 Peristaltic pump

| | |
|---|---|
| **Peristaltic pump**  | |
| **Peristaltic pump set rate** | Rate of the peristaltic pump when you start the hardware. |
| **Peristaltic pump off** | Switches off the peristaltic pump. |

### 7.2.4.7 Thermostat

| | |
|---|---|
| **Thermostat**  30°C | |
| **Thermostat set temperature ►** | |
| **Temperature** | Temperature of the thermostat.<br>The red icon indicates that the thermostat is still warming up.<br>As soon as the defined temperature has been reached, the icon turns black. |
| **Thermostat off** | Switches off the thermostat. |

### 7.2.4.8 Remote Box

**Remote Box**

**MSB port**

The Remote Box is always connected to MSB port 1 of the IC instrument.

**Output signal**

The output signal is read-only.

Input of the binary pattern for the output signal of exactly 14 bits.

The output lines are numbered from right to left:
13-12-11-10-9-8-7-6-5-4-3-2-1-0

Use the following output line:

- Shutdown signal: Output line 8 (*****p********)

0 = Output line deactivated

1 = Output line activated

* = Retain the status of the output line

p = set pulse (pulse length = 200 ms).

If you add a time program command to activate the output line (*****1********), always add the corresponding command to deactivate the output line again (*****0********).

**Example:**

*****p********: Output line 8 of the IC instrument sends a shutdown signal of the defined pulse length to the Agilent ICP-MS.

**NOTE**

If you shut down the plasma with the command **Set Lines** or by disabling the button **[Plasma]** in MassHunter, the IC continues to run.

### 7.2.4.9 High-pressure gradient

**High-pressure gradient pump**


**Pump set flow ►**

**Flow**

Flow of the gradient pump.

The maximum permitted flow depends on the spray chamber. Refer to Agilent instructions for your instrument.

**PMin**

Minimum permitted pressure in the instrument.

| | |
|---|---|
| | The high-pressure gradient pump consists of several individual high-pressure pumps. If the pressure of 1 individual high-pressure pump falls below PMin, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)*. |
| **PMax** | Maximum permitted pressure in the instrument.<br>The high-pressure gradient pump consists of several individual high-pressure pumps. If the pressure of 1 individual high-pressure pump exceeds PMax, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)*. |
| **Pump off** | Switches off the gradient pump. |

The extended status panel displays the **Pump gradient flow**. The pump gradient flow is the sum of the flows of all pumps that are part of the high-pressure gradient. If the instrument also contains a Dose-in gradient, then the flow of the respective pump is shown below the pump icon and in the extended table as **Pump x flow**. The flow of the Dose-in gradient pump is not part of the pump gradient flow.

**NOTE**

Besides the PMax that is defined in the manual control, there is a PMax written on the column chip. If these values differ, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)* as soon as the **lower** of these values is exceeded.

Each column holder is assigned to a high-pressure pump.

- Pump 1 – Column holder A
- Pump 2 – Column holder B
- Pump 3 – Column holder C

See *chapter 7.2.2.1, page 25* for an illustration of the column holders.

### 7.2.4.10 Dose-in gradient

#### 7.2.4.10.1 High-pressure pump

| | |
|---|---|
| **High-pressure pump**  | |
| **Pump set flow ►** | |
| **Flow** | Flow of the high-pressure pump.<br>The maximum permitted flow depends on the spray chamber. Refer to Agilent instructions for your instrument. |

| | |
|---|---|
| **PMin** | Minimum permitted pressure in the instrument. |
| **PMax** | Maximum permitted pressure in the instrument. |
| **Pump off** | Switches off the high-pressure pump. |

**NOTE**

Besides the PMax that is defined in the manual control, there is a PMax written on the column chip. If these values differ, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)* as soon as the **lower** of these values is exceeded.

Each column holder is assigned to a high-pressure pump.

- Pump 1 – Column holder A
- Pump 2 – Column holder B
- Pump 3 – Column holder C

See *chapter 7.2.2.1, page 25* for an illustration of the column holders.

**NOTE**

If the high-pressure pump is used for a Dose-in gradient, this is indicated with **D1** in the icon.


### 7.2.4.10.2 Dosing device


**Dosing device**

| | |
|---|---|
| **Aspirate ▶** | Aspirates the specified volume via the defined port. There is **no** automatic filling beforehand or afterwards. |
| **Port** | Port for aspirating the sample. |
| **Rate** | Rate for aspirating the sample. |
| **Volume** | Volume to aspirate. |
| **Dosing ▶** | Doses the specified volume via the defined port. There is automatic filling beforehand or afterwards via the configured port *(see chapter 7.6.1, page 63)*. |

| | |
|---|---|
| **Port** | Port for dosing the sample. |
| **Rate** | Rate for dosing the sample. |
| **Filling Rate** | Rate for filling the cylinder after dosing the sample. |
| **Volume** | Volume to dose and fill in the cylinder. |
| **Empty** | Empties the cylinder and all tubings of the dosing unit.<br>The parameters for emptying the dosing unit are defined in the configuration *(see chapter 7.6.1, page 63)*. |
| **Fill ►** | Fills the cylinder via the specified port. |
| **Port** | Port for filling the cylinder. |
| **Rate** | Rate for filling the cylinder. |
| **Move to exchange position ►** | Fills the cylinder via the specified port first. Then rotates the valve disk to Port 2. The Dosino can be removed from the dosing unit. |
| **Port** | Port for filling the cylinder. |
| **Rate** | Rate for filling the cylinder. |
| **Prepare** | Rinses the cylinder and all tubings of the dosing unit with the solution that is connected to the fill port.<br>The parameters for preparing the dosing unit are defined in the configuration *(see chapter 7.6.1, page 63)*. |
| **Stop Dosino** | Stops the dosing device. |

**NOTE**

If the dosing device is used for Dosino regeneration, this is indicated with **M1** in the icon.


If the dosing device is used for a Dose-in gradient, this is indicated with **D1** in the icon.

# 7.3 858 Professional Sample Processor

The 858 Professional Sample Processor is conceived for preparing samples for ion chromatography.

The equipment with a Swing Head with a robotic arm makes it possible to approach any given point on a sample rack. As a result, the number and sequencing of the samples on the sample rack is almost unlimited.

Optionally, you can combine the 858 Professional Sample Processor with a Liquid Handling Station to rinse the needle and dilute samples.

## 7.3.1 Configuration

| | |
|---|---|
| **858 Professional Sample Processor** | |
| **Communication** | The following parameters are entered automatically:<br>▪ Device name<br>▪ Type ID<br>▪ Serial number |
| **Options ►** | |
| **MSB** | The 800 Dosino can be selected as an MSB device. Up to 3 Dosinos can be connected to the 858 Professional Sample Processor.<br>Click on **[Configure]** to set further parameters *(see chapter 7.6.1, page 63)*. |
| **Misc** | The rack is detected automatically.<br>The stirrer is deactivated by default. If you want to use the stirrer, then activate the stirrer. |

## 7.3.2 Configuration of the lift positions

Configure the work position of the 858 Professional Sample Processor.

If you use a Liquid Handling Station, configure the external positions of the 858 Professional Sample Processor.

Therefore, right-click on **MetrohmIC** and select **Settings**. The **Settings** dialog opens.

The external positions on the Liquid Handling Station depend on the exact position of the Liquid Handling Station. Therefore, these lift positions have to be configured individually for each instrument.

The following lift positions can be defined:

- Work position
  Position for locations on the rack. You can adjust the immersion depth.

- Positions on the Liquid Handling Station. You can adjust the immersion depth and the angle.
  - Rinsing unit – Rinse
  - Rinsing unit – Disposal
  - Dilution unit – Special
  - Dilution unit – Standard

  Dilution unit – Special and Dilution unit – Standard have the same angle setting. The difference between them lies in their immersion depths.

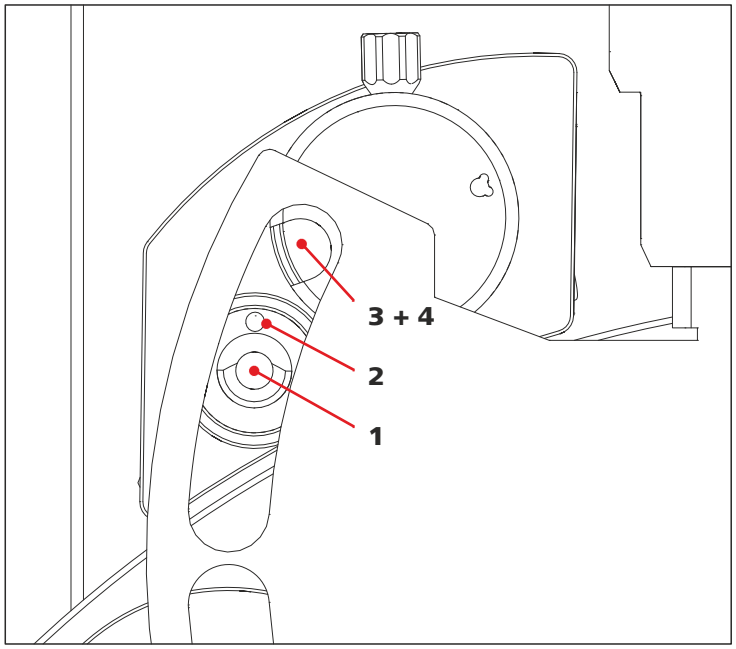



*Figure 13 Positions on the Liquid Handling Station*

| | | | |
|---|---|---|---|
| **1** | **Rinsing unit – Rinse** | **2** | **Rinsing unit – Disposal** |
| **3** | **Dilution unit – Special** | **4** | **Dilution unit – Standard** |

**NOTE**

Before moving the arm, the needle is lifted to an immersion depth of 0 mm automatically. This prevents the needle from colliding with the Liquid Handling Station or with a vial.

*Table 4 Lift positions – Input values*

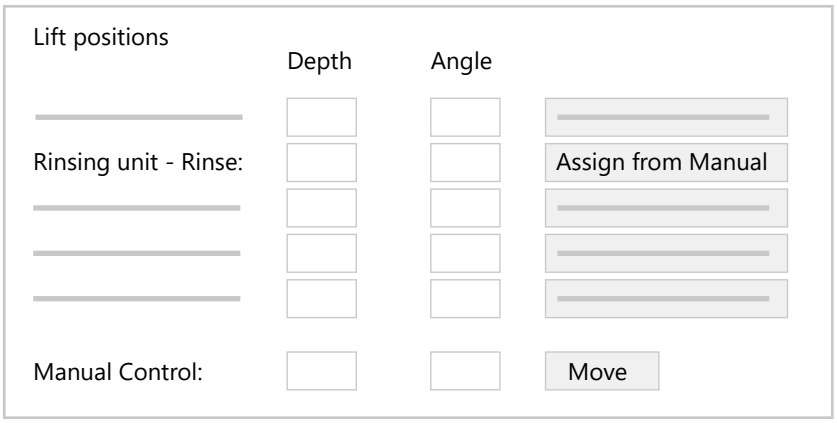
| Lift position | Depth | Angle |
|---|---|---|
| Work position | Range: 0–125 mm<br>Default: 125 mm | - |

| Lift position | Depth | Angle |
|---|---|---|
| Rinsing unit – Rinse | Range: 0–125 mm<br>Default: 125 mm | Range: 8.5–117.0°<br>Default: 108.5° |
| Rinsing unit – Disposal | Range: 0–50 mm<br>Default: 50 mm | Range: 8.5–117.0°<br>Default: 109.5° |
| Dilution unit – Special | Range: 0–25 mm<br>Default: 25 mm | Range: 8.5–117.0°<br>Default: 116.6° |
| Dilution unit – Standard | Range: 0–50 mm<br>Default: 50 mm | Range: 8.5–117.0°<br>Default: 116.6° |

**Example: Configure the lift position Rinsing unit – Rinse**

**1** Enter the estimated angle value for the lift position **Rinsing unit – Rinse** in **Manual Control**.

Click on **[Move]**.




The needle is lifted to 0 mm. Then, the arm of the 858 Professional Sample Processor moves to the position that you entered in **Manual Control**.

**2** Check whether the needle is centered over the position **Rinsing unit – Rinse**.

**3** If you are not sure whether the angle is set correctly, lower the needle a bit (approximately 10 mm). Set the depth to 10 mm in **Manual Control**.

Click on **[Move]**.

4 Repeat steps 1–3 until you find the correct position.

5 Enter the desired depth for the lift position **Rinsing unit – Rinse** in **Manual Control**.

6 Click on **[Assign from Manual]** next to **Rinsing unit – Rinse position** to transfer the values from **Manual Control** to **Rinsing unit - Rinse**.

7 Repeat this procedure for all positions on the Liquid Handling Station.

## 7.3.3 Start parameters

### 7.3.3.1 Stirrer

| | |
|---|---|
| **Stirrer** | |
| **On** | The stirrer is switched on when you start the method. |
| **Rate** | Rate of the stirrer. |

### 7.3.3.2 Peristaltic pump

| | |
|---|---|
| **Peristaltic pump 1** | |
| **On** | The peristaltic pump is switched on when you start the method. |
| **Rate** | Rate of the peristaltic pump when you start the method. |

## 7.3.4 Time program

### 7.3.4.1 858 Robotic arm and sample rack

| | |
|---|---|
| **Move** | |
| **Position type** | Type of target position.<br>▪ Vial from Sequence<br>▪ Vial from Method<br>▪ External Position<br>▪ (Vial from Sequence +1)<br>This position type has no use. |
| **External Position** | Number of the external position.<br>Configure the external positions in the **Settings** *(see chapter 7.3.2, page 43)*. |
| **Vial** | Number of the vial on the rack. |

| | |
|---|---|
| **Lift position** | ▪ Home<br>Home position is always 0.<br>▪ Work<br>Configure the work position in the **Settings** *(see chapter 7.3.2, page 43)*.<br>The sample is aspirated at this lift position.<br>▪ User Defined<br>The user can define an additional position. |
| **Depth** | Immersion depth of the needle.<br>This input field is only active if the lift position **User Defined** is selected. |

### 7.3.4.2 Stirrer

| | |
|---|---|
| **Set stirrer** | |
| **Stirrer on** | |
| **Rate** | Rate of the stirrer. |

**NOTE**

If you run a method with stirrer commands on an instrument without stirrer, then the time program of the 858 Professional Sample Processor is deleted completely. To adjust a method with stirrer commands to run it on an instrument without stirrer, proceed as follows:

Activate the stirrer in the configuration of the 858 Professional Sample Processor. Open the method. Remove the stirrer commands. Save the method. Now you can run the adapted method on an instrument without stirrer.

### 7.3.4.3 Peristaltic pump

| | |
|---|---|
| **Set peristaltic** | |
| **Pump on** | Switches on the peristaltic pump and sets the value for the pump rate. |
| **Pump** | Number of the peristaltic pump. |
| **Rate** | Rate of the peristaltic pump. |

## 7.3.5 Manual control

### 7.3.5.1 858 Robotic arm and sample rack

| | |
|---|---|
| **Robotic arm and sample rack** | |
| **Move ►** | |
| **Position type** | Type of target position.<br>▪ Rack<br>▪ External Position<br>Configure the external positions in the **Settings** *(see chapter 7.3.2, page 43)*. |
| **External position** | Number of the external position.<br>This input field is only active if the position type **External position** is selected. |
| **Vial** | Number of the vial on the rack.<br>This input field is only active if the position type **Rack** is selected. |
| **Lift position** | ▪ Home<br>Home position is always 0.<br>▪ Work<br>The sample is aspirated at this lift position.<br>Configure the work position in the **Settings** *(see chapter 7.3.2, page 43)*.<br>▪ User Defined<br>The user can define an additional position. |
| **Depth** | Immersion depth of the needle.<br>This input field is only active if the lift position **User defined** is selected. |
| **Initialize Rack** | Initializes the rack. |

### 7.3.5.2 Stirrer

| | |
|---|---|
|  **Stirrer** | |
| **Stirrer set rate ►** | |
| **Rate** | Rate of the stirrer when you start the hardware. |
| **Stirrer off** | Switches off the stirrer. |

### 7.3.5.3 Peristaltic pump

**Peristaltic pump**

**Peristaltic pump set rate**

Rate of the peristaltic pump when you start the hardware.

**Peristaltic pump off**

Switches off the peristaltic pump.

## 7.4 889 IC Sample Center

The 889 IC Sample Center is a robust autosampler for high sample throughput and small sample volumes. The 889 IC Sample Center works according to the x-y-z principle and with high-resolution injection control for precise sample delivery.

The optional cooling function cools thermosensitive samples.

**NOTE**

The 889 IC Sample Center is available in 4 versions which differ in the combination of integrated modules. In this help, all parameters and commands are described. However, depending on your product version, you may not be able to see all commands and parameters.

### 7.4.1 Configuration

**889 IC Sample Center**

**Communication**

The following parameters are entered automatically:

- Device name
- Type ID
- Serial number
  You cannot find the serial number of the 889 IC Sample Center on the module. Contact a Metrohm service engineer, if you need to know the serial number of your 889 IC Sample Center.

**Options ▶**

**Misc**

Syringe and Injector are only available for 2.889.0010 and 2.889.0020.

Enter the following parameters:

- Syringe volume
  Volume of the syringe.

| | |
|---|---|
| | ▪ Buffer loop<br>Volume of the buffer loop.<br>▪ Sample loop<br>Volume of the sample loop of the injection valve.<br>▪ Needle to valve<br>Whole volume, from the needle tip to the injection valve.<br>The needle is supplied together with the necessary capillary. The capillary is labeled with the volume in µL. Put this value in here.<br><br>The syringe volume and the buffer loop volume have to match. Ensure that the volumes correspond to one of the following combinations:<br><br>▪ Syringe volume = 250 µL<br>Buffer loop volume = 500 µL<br>▪ Syringe volume = 500 µL<br>Buffer loop volume = 1'000 µL<br>▪ Syringe volume = 1'000 µL<br>Buffer loop volume = 2'000 µL<br><br>Refer to the manual *8.889.8001 IC Sample Center* for further information. |
| **Racks** | ▪ Left rack<br>Select a rack type.<br>▪ Right rack<br>Select a rack type.<br><br>Select the same rack type for both rack holders or a combination with **None** and any rack type.<br><br>The racks can also be changed in manual control *(see chapter 7.4.4.3, page 56)*. |

## 7.4.2 Start parameters

### 7.4.2.1 Cooling

| | |
|---|---|
| **Cooling** | |
| **On** | The cooling is switched on when you start the method. |
| **Temperature** | Temperature that is set for the cooling when you start the method. |
| **Wait for Stable Temperature** | A run does not start before the set temperature has been reached and is stable. |

### 7.4.2.2 Injector

| | |
|---|---|
| **Injector** | |
| **Position** | Position of the injector when the run starts.<br><br>▪ Inject<br>Switches the valve to **Inject**. |

| | |
|---|---|
| | ▪ Fill<br>Switches the valve to **Fill**.<br>▪ Maintain Current<br>The valve maintains its current position. |

#### 7.4.2.3 Compressor

| | |
|---|---|
| **Compressor** | |
| **On** | The compressor is switched on when you start the method. |

### 7.4.3 Time program

#### 7.4.3.1 889 Sample rack and needle

| | |
|---|---|
| **Move** | |
| **Position type** | Type of target position.<br>▪ Wash<br>▪ Rack<br>▪ Waste<br>▪ Vial from Sequence<br>▪ (Vial from Sequence +1)<br>This position type has no use. |
| **Rack** | ▪ Left<br>▪ Right<br>This input field is only active if the position type **Rack** is selected. |
| **Row** | This input field is only active if the position type **Rack** is selected. |
| **Column** | This input field is only active if the position type **Rack** is selected. |
| **Needle position** | ▪ Home<br>Home position is always 0.<br>▪ Work<br>This input field is only active if the position type **Rack** is selected. |
| **Depth** | Immersion depth of the needle.<br>This input field is only active if the position type **Rack** and the needle position **Work** is selected. |

### 7.4.3.2 Injector

| | |
|---|---|
| **Switch injector** | |
| **Position** | Position of the injector.<br>▪ Inject<br>Switches the valve to **Inject**.<br>▪ Fill<br>Switches the valve to **Fill**. |

### 7.4.3.3 889 IC Sample Center

| | |
|---|---|
| **Full loop injection** | |
| **Rinsing volume** | Volume for rinsing. |
| **Needle height** | Distance of the needle tip from the bottom of the vial. |
| **Syringe Speed** | Speed at which the syringe plunger is moved.<br>▪ Slow<br>▪ Normal<br>▪ Fast |
| **Air segment** | If selected, then an air segment separates the sample from the content of the wash bottle (usually UPW). |
| **Headspace pressure** | If selected, then overpressure is channeled in through the air needle. This ensures that no air or steam bubbles form while aspirating the sample. Only select this option if you use vials with septa. |
| **Wash after injection** | If selected, then the washing procedure is carried out after the injection. |

| | |
|---|---|
| **Partial loop injection** | |
| **Injection volume Input** | ▪ From method<br>▪ From sample data<br>▪ Injection volume<br>The default setting for this input field is **From method**.<br>Metrohm recommends to change the setting to **From sample data**. |
| **Injection volume** | Define the injection volume manually.<br>Maximum injection volume = 0.5 x sample loop volume<br>The sample loop volume is defined in the configuration of the 889 IC Sample Center *(see chapter 7.4.1, page 49)*.<br>Refer to the manual *8.889.8001 IC Sample Center* for further information regarding the injection volume. |

| | |
|---|---|
| | If the Injection volume Input **From method** is selected, the injection volume has to be > 0 µL. |
| **Rinsing volume** | Volume for rinsing. |
| **Needle height** | Distance of the needle tip from the bottom of the vial. |
| **Syringe Speed** | Speed at which the syringe plunger is moved.<br>▪ Slow<br>▪ Normal<br>▪ Fast |
| **Air segment** | If selected, then an air segment separates the sample from the content of the wash bottle (usually UPW). |
| **Headspace pressure** | If selected, then overpressure is channeled in through the air needle. This ensures that no air or steam bubbles form while aspirating the sample. Only select this option if you use vials with septa. |
| **Wash after injection** | If selected, then the washing procedure is carried out after the injection. |

| | |
|---|---|
| **Pickup injection** | |
| **Injection volume Input** | ▪ From sample data<br>▪ Injection volume |
| **Injection volume** | Define the injection volume manually.<br>Maximum injection volume = (sample loop volume - 3 x needle volume) / 2<br>The sample loop volume and needle volume are defined in the configuration of the 889 IC Sample Center *(see chapter 7.4.1, page 49)*.<br>Refer to the manual *8.889.8001 IC Sample Center* for further information regarding the injection volume.<br>This input field is only active if the injection volume input **Injection volume** is selected. |
| **Transport volume** | Volume of transport solution. |
| **Needle height** | Distance of the needle tip from the bottom of the vial. |
| **Syringe Speed** | Speed at which the syringe plunger is moved.<br>▪ Slow<br>▪ Normal<br>▪ Fast |
| **Air segment** | If selected, then an air segment separates the sample from the content of the wash bottle (usually UPW). |

| | |
|---|---|
| **Headspace pressure** | If selected, then overpressure is channeled in through the air needle. This ensures that no air or steam bubbles form while aspirating the sample. Only select this option if you use vials with septa. |
| **Wash after injection** | If selected, then the washing procedure is carried out after the injection. |

**NOTE**

After injecting the sample, the 889 IC Sample Center automatically sets an event called **Injection Performed**. The event wait does not need to be entered manually. The corresponding event wait in the time program of the 930/940 IC must be set manually. In the time program of the 930/940 IC, enter a command to start measuring after the event wait.

| | |
|---|---|
| **Wash** | Performs the washing procedure. |

### 7.4.3.4 Syringe

| | |
|---|---|
| **Syringe change port** | |
| **Position** | The syringe valve port rotates to the selected position.<br>▪ Needle<br>▪ Wash<br>▪ Waste |

| | |
|---|---|
| **Fill** | |
| **Syringe Port** | Port for filling the syringe.<br>▪ Needle<br>▪ Wash<br>▪ Waste |
| **Syringe Speed** | Speed at which the syringe plunger is moved.<br>▪ Slow<br>▪ Normal<br>▪ Fast |

| | |
|---|---|
| **Eject** | |
| **Syringe Port** | Port for ejecting the content of the syringe.<br>▪ Needle<br>▪ Wash |

| | |
|---|---|
| | ▪ Waste |
| **Syringe Speed** | Speed at which the syringe plunger is moved.<br>▪ Slow<br>▪ Normal<br>▪ Fast |

| | |
|---|---|
| **Aspirate** | |
| **Volume** | Volume to aspirate. The entered volume must not exceed the actual volume of the installed syringe. The maximum volume that can be aspirated depends on the current position of the syringe plunger. |
| **Syringe Port** | Port for aspirating the sample.<br>▪ Needle<br>▪ Wash<br>▪ Waste |
| **Syringe Speed** | Port for aspirating the sample.<br>▪ Slow<br>▪ Normal<br>▪ Fast |

| | |
|---|---|
| **Dispense** | |
| **Volume** | Volume to dispense. The entered volume must not exceed the actual volume of the installed syringe. The maximum volume that can be dispensed depends on the current position of the syringe plunger. |
| **Syringe Port** | Port for dispensing the sample.<br>▪ Needle<br>▪ Wash<br>▪ Waste |
| **Syringe Speed** | Speed at which the syringe plunger is moved.<br>▪ Slow<br>▪ Normal<br>▪ Fast |

## 7.4.4 Manual control

### 7.4.4.1 Injector


| | |
|---|---|
| **Injector Inject** | Switches the valve to **Inject**. |
| **Injector Fill** | Switches the valve to **Fill**. |

### 7.4.4.2 Cooling


| | |
|---|---|
| **Cooling set temperature ►** | |
| **Temperature** | Temperature of the thermostat.<br>The blue icon indicates that the cooling is still cooling down.<br>As soon as the defined temperature has been reached, the icon turns black. |
| **Cooling off** | Switches off the thermostat. |

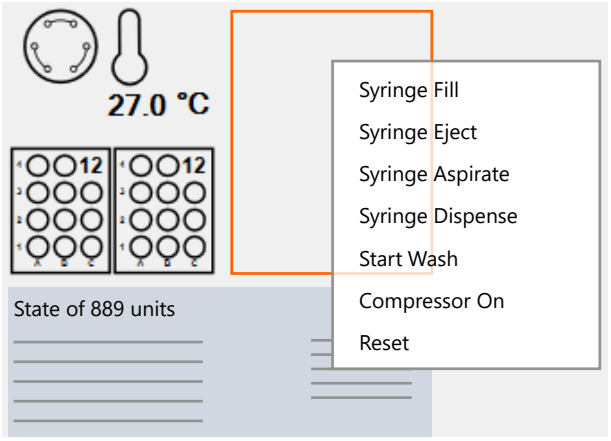
### 7.4.4.3 889 Sample rack and needle


| | |
|---|---|
| **Move ►** | |
| **Position type** | Type of target position.<br>▪ Rack<br>The vial number has the following format:<br>LA1 = Left rack, Row A, Column 1<br>RB2 = Right rack, Row B, Column 2<br>▪ Wash Position<br>▪ Waste Position |
| **Rack** | ▪ Left<br>▪ Right<br>This input field is only active if the position type **Rack** is selected. |

| | |
|---|---|
| **Row** | This input field is only active if the position type **Rack** is selected. |
| **Column** | This input field is only active if the position type **Rack** is selected. |
| **Needle** | ▪ Home<br>The uppermost stop of the lift.<br>▪ Work<br>The sample is aspirated at this lift position.<br>If the position type **Wash Position** or **Waste Position** is selected, then the needle is always in **Work** position. |
| **Depth** | Immersion depth of the needle.<br>This input field is only active if the position type **Rack** and the needle position **Work** are selected. |
| **Home** | The needle goes into **Home** position |
| **Assign Racks ►** | Select the same rack type for both rack holders or a combination with **None** and any rack type. |
| **Left rack** | Select a rack type for the left rack. |
| **Right rack** | Select a rack type for the right rack. |
| **Exchange Rack** | Moves the rack to exchange position in order to exchange the racks. |
| **Exchange Needle** | Moves the needle to exchange position in order to exchange the needle. For more information on exchanging the needle, refer to *8.889.8001 Manual 889 IC Sample Center* or *8.889.8004 Manual 889 IC Sample Center Basic*.<br>Remove both racks before moving the needle to exchange position. |

### 7.4.4.4 889 Syringe, Compressor, Washing procedure

| | |
|---|---|
| **Syringe, Compressor, Washing procedure** | To access these commands, right-click in the background area **beside** the 889 icons (orange frame in the image below). |




**Syringe Fill ▶**

Fills the syringe completely via the specified port.

**Port**

Port for filling the syringe.

- Needle
- Wash
- Waste

**Speed**

Speed at which the syringe plunger is moved.

- Fast
- Normal
- Slow

This input field is only active if the port **Needle** is selected.

**Syringe Eject ▶**

Ejects the content of the syringe via the specified port.

**Port**

Port for ejecting the content of the syringe.

- Needle
- Wash
- Waste

**Speed**

Speed at which the syringe plunger is moved.

- Fast
- Normal
- Slow

This input field is only active if the port **Needle** is selected.

**Syringe Aspirate ▶**

Aspirates the specified volume via the defined port.

**Volume**

Volume to aspirate. The maximum volume that can be aspirated depends on the current position of the syringe plunger.

**Port**

Port for aspirating the sample.

| | |
|---|---|
| | ▪ Needle<br>▪ Wash<br>▪ Waste |
| **Speed** | Speed at which the syringe plunger is moved.<br>▪ Fast<br>▪ Normal<br>▪ Slow<br>This input field is only active if the port **Needle** is selected. |
| **Syringe Dispense ►** | Dispenses the specified volume via the defined port. |
| **Volume** | Volume to dispense. The maximum volume that can be dispensed depends on the current position of the syringe plunger. |
| **Port** | Port for dispensing the sample.<br>▪ Needle<br>▪ Wash<br>▪ Waste |
| **Speed** | Speed at which the syringe plunger is moved.<br>▪ Fast<br>▪ Normal<br>▪ Slow<br>This input field is only active if the port **Needle** is selected. |
| **Compressor On** | Switches on the compressor. |
| **Compressor Off** | Switches off the compressor. |
| **Start Wash** | Starts the washing procedure. |
| **Stop Wash** | Stops the washing procedure. |
| **Reset** | Resets the module. |

# 7.5 919 IC Autosampler plus

The 919 IC Autosampler plus fulfills the requirements of laboratories with medium sample numbers. The 919 IC Autosampler plus contains the following rack for 56 samples with a vessel volume of up to 11 mL: Sample rack, 56 x 11 mL and 1 x 250 mL (PVC) (6.2041.510). The rack can be removed.

## 7.5.1 Configuration

| | |
|---|---|
| **Communication** | The following parameters are entered automatically:<br>▪ Device name<br>▪ Type ID<br>▪ Serial number<br>When you launch the instrument, Metrohm IC Driver, ICP-MS MassHunter checks the type ID and serial number. It is not possible to launch the instrument if the actual type ID or serial number do not match the configured type ID or serial number. |
| **Options ►** | |
| **MSB** | The 800 Dosino can be selected as an MSB device. Up to 3 Dosinos can be connected to the 919 IC Autosampler plus.<br>Click on **[Configure]** to set further parameters *(see chapter 7.6.1, page 63)*. |
| **Misc** | The rack is detected automatically. |

## 7.5.2 Configuration of the lift positions

Configure the work position of the 919 IC Autosampler plus.

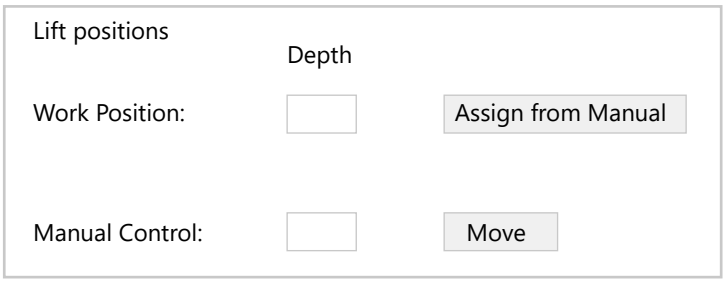
The **Work Position** is the position for locations on the rack. You can adjust the immersion depth.

Therefore, right-click on **MetrohmIC** and select **Settings**. The **Settings** dialog appears.

**Configure the Work Position**

1 Enter the desired depth for the **Work Position** in **Manual Control** (range: 0–125 mm, default value: 125 mm).

Click on **[Move]**.




The needle of the 919 IC Autosampler plus is lowered to the depth that you entered in **Manual Control**.

2 Click on **[Assign from Manual]** next to **Work Position** to transfer the value from **Manual Control** to **Work Position**.

## 7.5.3 Start parameters

### 7.5.3.1 Peristaltic pump

| | |
|---|---|
| **Peristaltic pump 1** | |
| **On** | The peristaltic pump is switched on when you start the method. |
| **Rate** | Rate of the peristaltic pump when you start the method. |

## 7.5.4 Time program

### 7.5.4.1 Tower and sample rack

| | |
|---|---|
| **Move** | |
| **Position type** | Type of target position.<br>▪ Vial from Sequence<br>▪ Vial from Method<br>▪ (Vial from Sequence +1)<br>This position type has no use. |
| **Vial** | Number of the vial on the rack. |
| **Lift position** | ▪ Home<br>Home position is always 0.<br>▪ Work<br>The sample is aspirated at this lift position.<br>Configure the work position in the **Settings** *(see chapter 7.5.2, page 60)*.<br>▪ User Defined<br>The user can define an additional position. |
| **Depth** | Immersion depth of the needle. |

| | |
|---|---|
| | This input field is only active if the lift position **User Defined** is selected. |

### 7.5.4.2 Peristaltic pump

| | |
|---|---|
| **Set peristaltic** | |
| **Pump on** | Switches on the peristaltic pump and sets the value for the pump rate. |
| **Pump** | Number of the peristaltic pump. |
| **Rate** | Rate of the peristaltic pump. |

## 7.5.5 Manual control

### 7.5.5.1 Tower and sample rack

| | |
|---|---|
| **Tower and sample rack** | |
| **Move ►** | |
| **Vial** | Number of the vial on the rack. |
| **Lift position** | ▪ Home<br>Home position is always 0.<br>▪ Work<br>The sample is aspirated at this lift position.<br>Configure the work position in the **Settings** *(see chapter 7.5.2, page 60)*.<br>▪ User Defined<br>The user can define an additional position. |
| **Depth** | Immersion depth of the needle.<br>This input field is only active if the lift position **User defined** is selected. |
| **Initialize Rack** | Initializes the rack. |

### 7.5.5.2 Peristaltic pump

| | |
|---|---|
| **Peristaltic pump**  | |
| **Peristaltic pump set rate** | Rate of the peristaltic pump when you start the hardware. |
| **Peristaltic pump off** | Switches off the peristaltic pump. |

# 7.6 Dosing device

The dosing device consists of an 800 Dosino that serves as dosing drive and a dosing unit. The dosing unit is available with 4 cylinder sizes: 5 mL, 10 mL, 20 mL and 50 mL.

Use the dosing device for liquid handling tasks.

The 4 ports of the dosing unit are designed for flexible use.

## 7.6.1 Configuration

| | |
|---|---|
| **Dosing device** | |
| **Serial Number** | The serial number is entered automatically.<br>This field contains the serial number of the 800 Dosino, not the serial number of the dosing unit. |
| **Volume** | The volume of the cylinder is entered automatically. |
| **Tubing Parameters ►** | Parameters for the tubing that is connected to the dosing unit.<br>These parameters are important for the correct execution of the commands **Prepare** and **Empty** because they take the volumes of the tubing connections into account. |
| **Port** | Port to be used as dosing port. Assign a port 1 - 4 to each dosing port. |
| **Length (cm)** | Length of the tubing on the dosing port. |
| **Dosing Rate (mL/min)** | Diameter of the dosing rate.<br>The value depends on the volume of the dosing unit. When the function is carried out, the dosing rate is automatically decreased to the highest possible value. |
| **Preparation Parameters** | Configure the parameters for preparing and emptying the dosing unit *(see chapter 7.6.3, page 66)*, *(see chapter 7.6.2, page 64)*.<br>Dosing port through which the cylinder content is ejected during preparation and emptying.<br>Dosing port for the **Prepare** and **Empty** commands is always **Dosing Port 1**. |
| **Valve ►** | |
| **Rotation Direction** | Rotating direction of the valve disk.<br>▪ Ascending<br>The valve disk rotates in the direction of ascending port numbers.<br>▪ Descending<br>The valve disk rotates in the direction of descending port numbers. |

| | |
|---|---|
| | ▪ Automatic<br>The valve disk rotates in the direction with the shortest path.<br>▪ Not Over<br>The valve disk does not cross the specified port during rotation. |
| **Not Over** | This field gets activated if you select the rotation direction **Not Over**.<br>This port is not crossed during rotation. |

## 7.6.2 Time program

| | |
|---|---|
| **Aspirate** | |
| | Aspirates the specified volume via the defined port. There is no automatic filling beforehand or afterwards. |
| **MSB** | Number of the MSB port the Dosino is connected to. |
| **Port** | Port for aspirating the sample. |
| **Rate** | Rate for aspirating the sample. |
| **Volume mode** | Select a volume mode from the drop-down list.<br>▪ from method<br>▪ Injection volume<br>The injection volume is defined in the sequence. |
| **Volume** | This input field is only active if the volume mode **from method** is selected.<br>User defined volume to aspirate. |

| | |
|---|---|
| **Dose** | |
| | Doses the specified volume via the defined port. There is automatic filling beforehand or afterwards via the configured port *(see chapter 7.6.1, page 63)*. |
| **MSB** | Number of the MSB port the Dosino is connected to. |
| **Port** | Port for dosing the sample. |
| **Rate** | Rate for dosing the sample. |
| **Filling rate** | Rate for filling the cylinder after dosing the sample. |
| **Volume mode** | Select a volume mode from the drop-down list.<br>▪ from method<br>▪ Injection volume<br>The injection volume is defined in the sequence. |

| | |
|---|---|
| **Volume** | This input field is only active if the volume mode **from method** is selected.<br>User defined volume to dose. |
| **Eject to end volume** | |
| | Ejects the entire content of the cylinder via the specified port. |
| **MSB** | Number of the MSB port the Dosino is connected to. |
| **Port** | Port for ejecting the entire content of the cylinder. |
| **Rate** | Rate for ejecting the sample. |
| **Fill** | |
| | Fills the cylinder via the specified port. |
| **MSB** | Number of the MSB port the Dosino is connected to. |
| **Port** | Port for filling the cylinder. |
| **Rate** | Rate for filling the cylinder. |
| **Change port** | |
| | The valve rotates to the specified port. |
| **MSB** | Number of the MSB port the Dosino is connected to. |
| **Port** | The valve is switched to the defined port. |
| **Empty** | |
| | Empties the cylinder and all tubings of the dosing unit.<br>Define the parameters for emptying the dosing unit in the configuration *(see chapter 7.6.1, page 63)*. |
| **MSB** | Number of the MSB port the Dosino is connected to. |
| **Prepare** | |
| | Rinses the cylinder and all tubings of the dosing unit with the solution that is connected to the fill port.<br>Define the parameters for preparing the dosing unit in the configuration *(see chapter 7.6.1, page 63)*. |

| | |
|---|---|
| **MSB** | Number of the MSB port the Dosino is connected to. |

## 7.6.3 Manual control

| | |
|---|---|
|   **Dosing device** | |
| **Aspirate ►** | Aspirates the specified volume via the defined port. There is **no** automatic filling beforehand or afterwards. |
| **Port** | Port for aspirating the sample. |
| **Rate** | Rate for aspirating the sample. |
| **Volume** | Volume to aspirate. |
| **Dosing ►** | Doses the specified volume via the defined port. There is automatic filling beforehand or afterwards via the configured port *(see chapter 7.6.1, page 63)*. |
| **Port** | Port for dosing the sample. |
| **Rate** | Rate for dosing the sample. |
| **Filling Rate** | Rate for filling the cylinder after dosing the sample. |
| **Volume** | Volume to dose and fill in the cylinder. |
| **Empty** | Empties the cylinder and all tubings of the dosing unit.<br>The parameters for emptying the dosing unit are defined in the configuration *(see chapter 7.6.1, page 63)*. |
| **Fill ►** | Fills the cylinder via the specified port. |
| **Port** | Port for filling the cylinder. |
| **Rate** | Rate for filling the cylinder. |
| **Move to exchange position ►** | Fills the cylinder via the specified port first. Then rotates the valve disk to Port 2. The Dosino can be removed from the dosing unit. |
| **Port** | Port for filling the cylinder. |
| **Rate** | Rate for filling the cylinder. |
| **Prepare** | Rinses the cylinder and all tubings of the dosing unit with the solution that is connected to the fill port. |

| | |
|---|---|
| | The parameters for preparing the dosing unit are defined in the configuration *(see chapter 7.6.1, page 63)*. |
| **Stop Dosino** | Stops the dosing device. |

**NOTE**

If the dosing device is used for Dosino regeneration, this is indicated with **M1** in the icon.


If the dosing device is used for a Dose-in gradient, this is indicated with **D1** in the icon.

# 8 Batch

**ICP-MS Instrument Control ▶ Toolbar ▶ Home**

**NOTE**

For further information on batch creation, refer to the **MassHunter Workstation User Guide** or the **ICP-MS MassHunter Help**. To open the help, press **[F1]** in the window you want to learn more about.

A batch contains all data that is related to an analysis (e.g., instrument method, sample list).

Create a batch in order to define the acquisition parameters *(see chapter 10, page 72)* and create a sequence *(see chapter 11, page 74)*.

Metrohm recommends to create a batch from a batch template. There is a batch template for each type of Agilent ICP-MS stored in **C:\Agilent \ICPMH\1\DATA\BatchTemplate**.

## Create a batch

1. In the toolbar go to the **Home** tab. Click on **[Create From Template]**.

   The file explorer opens.

2. Select the batch template for your instrument. Click on **[Open]**.

   The **Save Batch As** dialog opens.

3. Enter a batch name. Click on **[Create]**.

   The new batch opens in the ICP-MS Instrument Control.

# 9 Equilibration

**ICP-MS Instrument Control ▶ Hardware ▶ Dashboard ▶ Instrument Method**

**NOTE**

For further information on starting and tuning the Agilent ICP-MS, refer to the **MassHunter Workstation User Guide** or the **ICP-MS MassHunter Help**. To open the help, press **[F1]** in the window you want to learn more about.

## Equilibrate the IC instrument

**NOTE**

Before starting the equilibration, make sure there are no leaks in the IC instrument. If a leak causes an error during equilibration, both the IC instrument an the Agilent ICP-MS turn off.

1 Navigate to **Task Navigator ▶ Hardware ▶ Dashboard**. Right-click on **Sample Introduction** and select **Settings...**.

The **Settings** dialog appears.

2 In the **Sample Introduction** selection list, select **Other**.

Close the dialog with **[Close]**.

3 To apply the start parameters defined in your method, click on the **Upload** icon .

**NOTE**

If you use the peristaltic pump of the IC instrument to transfer the waste from the spray chamber *(see "Spray chamber outlet", page 7)*, switch on the peristaltic pump in the start parameters. The peristaltic pump of the IC instrument must always be running while running the Agilent ICP-MS.

The instrument executes the start parameters. The instrument does not acquire data.

## Start the Agilent ICP-MS

- The peristaltic pump of the IC instrument is running, as it transfers the waste from the spray chamber.

**1** Navigate to **Task Navigator ► Hardware ► Dashboard**. Right-click on **Sample Introduction** and select **Settings...**.

The **Settings** dialog appears.

**2** In the **Sample Introduction** selection list, select **PeriPump**.

Close the dialog with **[Close]**.

With the sample introduction **PeriPump**, you have no access to the IC instrument. The IC instrument continues to run the start parameters.

**3** Connect the sample inlet of the spray chamber to the tuning solution.

**4** To start the plasma and run the ignition sequence, go to the toolbar. Click on **Plasma ► Execute Configured Ignition Sequence**.

The ignition sequence takes approximately 30 minutes. During the ignition sequence, the IC instrument continues to equilibrate.

After the ignition sequence, equilibrate the Agilent ICP-MS *(see "Equilibrate the Agilent ICP-MS", page 70)*.

## Equilibrate the Agilent ICP-MS

- The peristaltic pump of the IC instrument is running, as it transfers the waste from the spray chamber.
- The sample inlet of the spray chamber is connected to the tuning solution.
- The start-up of the plasma with the ignition sequence has been performed *(see "Start the Agilent ICP-MS", page 70)*.

**1** To set up the instrument for equilibration, navigate to **Task Navigator ► Hardware ► Dashboard**. Right-click on **Sample Introduction** and select **Settings...**.

The **Settings** dialog appears.

**2** In the **Sample Introduction** selection list, select **Other**.

Close the dialog with **[Close]**.

Samples will be introduced with the IC instrument.

3 To start the equilibration, navigate to **Task Navigator ► Startup ► User Tune Configuration**.

To use the tune for batches later on, click on **[Set as Global Tune]**.

In the tune selection list, select **AutoTune**. Start the tuning with **[Start AutoTune]**.

The Agilent ICP-MS performs the tuning.

4 In the **User Tune Configuration** area, click on **[Start Signal Monitor]** to monitor the baselines of the selected masses.

The equilibration is finished as soon as the baselines are stable.

5 Connect the sample inlet of the spray chamber to the eluent outlet of the IC instrument.

# 10 Acquisition parameters

**ICP-MS Instrument Control ► Acquisition**

**NOTE**

For further information on acquisition parameters, refer to the **MassHunter Workstation User Guide** or the **ICP-MS MassHunter Help**. To open the help, press **[F1]** in the window you want to learn more about.

Access the acquisition parameters via **Task Navigator ► Acquisition**.

To save time, you can set the acquisition parameters while the instrument is equilibrating.

Set the following acquisition parameters:

| | |
|---|---|
| **Acquisition** | |
| **Setup ►** | |
| **Acq Mode** | Select **TRA**.<br>In the batch templates *(see chapter 8, page 68)*, **TRA** is predefined.<br>With the acquisition mode TRA (time-resolved analysis), a measuring curve is acquired. |
| **Tune Modes** | Define the tune. To use the tune you performed during equilibration, select the name of the respective tune *(see chapter 9, page 69)*.<br>You can select only one tune mode for an IC-ICP/MS analysis. |
| **Element Selection ►** | |
| **Select Elements** | The **Select Elements on Periodic Table** dialog opens.<br>Select the desired elements. Confirm with **[OK]**. |
| **Sample Period [sec]** | The sampling period is calculated automatically from the integration time of the entered elements. |
| **Acq Time [sec]** | Enter the expected length of the chromatogram.<br>The acquisition time can be specified in the sample list as well, e.g. if a shorter acquisition time is sufficient for certain samples *(see chapter 11, page 74)*.<br>If you use Dosino regeneration, the acquisition time must be at least as long as the Dosino regeneration time. |

| | |
|---|---|
| **Integration Parameters ►** | |
| **Peak table** | The table contains the parameters for the integration of the measuring point list and determination of the peak data. If you already know which peaks to expect (e.g., in routine analysis), enter the peak data for the chosen elements. |
| **Calibration** | Set the calibration parameters and enter your calibration standards in the table. |

# 11 Sample list

**ICP-MS Instrument Control ► Sequence ► Sample List**

**NOTE**

For further information on the sample list, refer to the **MassHunter Workstation User Guide** or the **ICP-MS MassHunter Help**. To open the help, press **[F1]** in the window you want to learn more about.

Enter your samples in the table.

The fields **Sample Name**, **Vial#**, **Injection Volume (µL)**, **File Name** and **IC Method** are mandatory. These fields are only available if you created the batch from a batch template *(see chapter 8, page 68)*. To visualize these fields or other fields, the view can be adapted with **[Add/ Remove Columns]**.

In several fields, you can use the **Fill Down** function. Therefore, select the cell with the content to be transferred and the cells to be filled down. Open the context menu and select **Fill Down**.

You can use the list format or the block list format. Switch between the formats with the button **[Use Block List]**.

In the block list format, the option **[Whole List]** is available. Do not use the option **[Whole List]**. Otherwise, user-defined fields disappear from the sample table. If you activated the option **[Whole List]**, click on **[Whole List]** again to return to the block list format.

By default, the sample list contains the following columns:

| | |
|---|---|
| **Sample Type** | If you use the sample type **CalStd**, data from the calibration table (**Acquisition ► Calibration**) are applied *(see menu "Acquisition", page 72)*. |
| **Sample Name** | |
| **Level** | Enter the level for calibration standards.<br>Use the same level numbers, you entered in **Acquisition ► Calibration** *(see menu "Acquisition", page 72)*. |
| **Vial# ►** | |
| **858 Professional Sample Processor/919 IC Autosampler plus** | Enter the vial number. |

| | |
|---|---|
| **889 IC Sample Center** | The vial number has the following format:<br>LA1 = Left rack, Row A, Column 1<br>RB2 = Right rack, Row B, Column 2<br>Enter the vial number or select the vial in the vial selector.<br>The vial selector is a graphical representation of the racks. Open the vial selector with the arrow in the respective **Vial** cell.<br>Ensure that all vial positions entered in the sample table contain a vial. If a position contains no vial, the sequence is aborted. |
| **Injection Volume (µL)** | Enter the injection volume in µL. |
| **Total Dilution** | Enter the dilution factor.<br>To calculate the dilution factor, double-click on the cell. In the appearing window, enter the **Sample Weight or Volume** and the **Final Weight or Volume**. The dilution factor is calculated and entered automatically. |
| **File Name** | The determination is saved with this name in the database. Each sample requires a unique file name. If you don't specify a file name, an automatic file name is assigned. |
| **IC Method** | Enter the folder path, the method name and the file extension (e.g., **C:\Agilent\ICPMH\1\DATA\7850batch1\Method\Method1.xml**).<br>Copy the folder path from the file explorer. Add a backslash. Copy the method name including the file extension and add it to the path.<br>Do **not** use **Fill Down**. Otherwise, numbers in the path name are increased by 1 for each sample. |
| **Post-Run Report** | Define whether a Post-Run-Report should be generated at the end of the determination *(see chapter 14.3, page 81)*. By default, a Post-Run Report is generated.<br>If do not want a Post-Run Report to be generated, enter **No**.<br>If you enter **Yes**, **Y**, or **N**, a Post-Run Report is generated. A Post-Run Report is also generated if you leave the cell blank. |
| **Comment** | |

## Validate method

**1** Validate the method after creating the sample list.

In the toolbar, go to the **Home** tab. Click on **[Validate]**.

If necessary, correct the sample table.

2 Save the batch. In the toolbar, go to the **File** tab. Click on **[Save Batch]** or **[Save Batch as]**.

3 Click on **[Add to Queue]** to start data acquisition *(see chapter 12, page 77)*.

# 12 Data acquisition

**ICP-MS Instrument Control ▶ Sequence ▶ Sample List**

**ICP-MS Data Acquisition ▶ Queue ▶ Acquisition Queue**

**NOTE**

For further information on data acquisition, refer to the **MassHunter Workstation User Guide** or the **ICP-MS MassHunter Help**. To open the help, press **[F1]** in the window you want to learn more about.

**NOTE**

Metrohm recommends to monitor the IC instrument in a floating window. Before starting a determination, open a floating window with the tabs **Method** and **Manual Control/Status** on a second screen or in the right quarter of the primary screen *(see chapter 7.1, page 15)*.

## Start a determination

1 Navigate to your sample list (**Sequence ▶ Sample List**) *(see chapter 11, page 74)*.

2 Click on **[Add to Queue]**. If you have not saved the batch yet, you are asked to save it now.

The **Acquisition Queue** window appears. The acquisition will be started as soon as the previous acquisitions are finished.

At the start of the determination, the **ICP-MS Data Analysis** program part opens *(see chapter 13, page 79)*.

3 To shut down the IC instrument and the Agilent ICP-MS after the batch is finished, activate the option **[Plasma Off at End]** in the **Acquisition Queue** window *(see chapter 12, page 77)*.

If you do not shut down the Agilent ICP-MS with **[Plasma Off at End]** the IC instrument and the Agilent ICP-MS remain in their current state after the last determination. If the state should deviate from the current state, run an end method in the last line of the sample table.

If you change a method that is used in the running determination, the change is not applied to the running sample. The change is applied to subsequent samples.

**NOTE**

If you stop the acquisition queue with the **[Stop]** button in the toolbar, the instrument behaves in the following way:

The running sequence is stopped. The time program of the autosampler is aborted.

If a gradient is running, the gradient continues until the gradient profile is completed.

If you click on **[Requeue]** or **[Edit and requeue]**, the requeued sequence starts as soon as the gradient profile is complete.

Do not stop the acquisition queue during the first line of the sample list. Otherwise the sequence gets stuck.

**NOTE**

889 IC Sample Center - missing vial:

If a vial from the sample table is missing in the 889 IC Sample Center, data acquisition continues despite the missing vial. The 889 IC Sample Center is in error state. The baseline is monitored. After the acquisition time elapsed, the sequence continues with the next line in the sample list.

# 13 Data analysis

**NOTE**

For information on data analysis, refer to the **MassHunter Workstation User Guide** or the **ICP-MS MassHunter Help**. To open the help, press **[F1]** in the window you want to learn more about.

# 14 Reports

**NOTE**

For further information on reports, refer to the **MassHunter Workstation User Guide** or the **ICP-MS MassHunter Help**. To open the help, press **[F1]** in the window you want to learn more about.

## 14.1 Configuration report

After saving the configuration, you can create a configuration report.

Therefore, click on the Print icon in the **Metrohm IC Configuration** dialog.

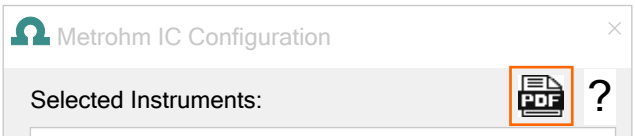



*Figure 14 Create configuration report*

Select a location to store the configuration report as PDF file.

Information on instrument configuration: *Instrument configuration*

A configuration report contains information on the instrument configuration (e.g., device name, type ID, serial number).

## 14.2 Method report

After saving the method, you can create a method report. Therefore, click on the Print icon on the **Instrument Method** tab.


*Figure 15 Create method report*

Select a location to store the method report as PDF file.

Information on method creation: *Instrument method*

A method report contains information on the following topics:

- Instrument (e.g., device name, type ID, serial number)
- Start parameters
- Time program commands

## 14.3 Post-Run Report

**ICP-MS Data Analysis ► Report**

You can create reports with report templates. For analysis with the acquisition mode **TRA** select the report template **Quantitation report** or **Chromatogram method report**.

Define in the sample list whether a Post-Run Report is generated at the end of a determination *(see chapter 11, page 74)*. If defined accordingly, a Post-Run Report is generated automatically at the end of a determination according to the chosen report template.

Post-Run Reports are stored in the batch folder (C:\Agilent\ICPMH\1\DATA \'Batch name').

The file name corresponds to the following scheme: 'Timestamp computer time'_ICpostrun.pdf (e.g., 20240130_135910_ICpostrun.pdf)

Regarding Metrohm modules, the Post-Run Report contains information on the following topics:

- Instrument (e.g., device name, type ID, serial number)
- Samples (e.g., sample name, volume, vial number)
- Instrument method (e.g., method name, date of last modification, modifier name)

# 15 Tips and tricks

### Configuration

- An instrument may maximally include the following modules:
  - 1 IC instrument (930 Compact IC Flex or 940 Professional IC Vario)
  - 1 autosampler (889 IC Sample Center or 858 Professional Sample Processor or 919 IC Autosampler plus)
  - 1 Remote Box MSB: The Remote Box is mandatory in instruments with an Agilent ICP-MS. Together with the IC equipment, connection Agilent ICP-MS, the Remote Box enables remote control between the IC instrument and the Agilent ICP-MS. The Remote Box must be connected to MSB 1 of the IC instrument.
  - 1 800 Dosino per IC instrument, 3 800 Dosinos per 858 Professional Sample Processor or 919 IC Autosampler plus
  - 3 942 Extension Modules Vario per 940 Professional IC Vario
- The IC equipment, connection Agilent ICP-MS (6.05330.400) is mandatory in instruments with an Agilent ICP-MS. Together with the Remote Box MSB, the IC equipment, connection Agilent ICP-MS enables remote control between the IC instrument and the Agilent ICP-MS.
- You can use only 1 Dosino with the IC instrument. Only the Dosino that is connected to the IC instrument can be used for Dosino regeneration or a Dose-in gradient.
- The stirrer is deactivated by default. If you want to use the stirrer, then activate the stirrer in manual configuration of the 858 Professional Sample Processor *(see chapter 7.3.1, page 43)*.
- Connect the Dosino to MSB 2 of the IC. Connect the Remote Box to MSB 1 of the IC.
  Do not select the Remote Box as MSB device for the 858 Professional Sample Processor or 919 IC Autosampler plus.
- A high-pressure pump can be used either for a high-pressure gradient or for a Dose-in gradient or as a normal high-pressure pump. A high-pressure pump cannot be configured for several functions.
- A high-pressure gradient can only be configured for 940 Professional ICs Vario and for 942 Extensions Modules Vario that are connected to a 940 Professional IC Vario. At least 2 high-pressure pumps are necessary to configure a high-pressure gradient.
- Besides the PMax that is defined in the manual control, there is a PMax written on the column chip. If these values differ, an error is generated and logged in the **Diagnostics** file *(see "Log files", page 84)* as soon as the lower of these values is exceeded.

### Connection IC – Agilent ICP-MS

- If you use the peristaltic pump of the IC instrument to transfer the waste from the spray chamber, the peristaltic pump of the IC instrument must always be switched on while running the Agilent ICP-MS.

### Method

- Ensure that gradients are executed immediately after the injection. Therefore, the time program entry for **Start Gradient** must be placed immediately after the entry for **Switch injector** to **Inject** position.
- To save time, run 2 commands in parallel. Check the checkbox **Parallel**. While a command is being executed, the time program already continues with the next line.
- Open a method in a separate window by clicking on **Float External Device Control**, before sending the method to the instrument. Otherwise, the method is no longer visible under **Dashboard ► Instrument control** once you sent the method to the instrument.
- If you open the method in a floating window, windows that open afterwards are positioned behind the floating window. This can result in a deadlock, in which a window requests an action. All other windows are inactive until this action has been performed. However, the window that requires an action is inaccessible because it is located behind the floating window. All windows automatically open in the middle of the primary screen. To avoid the described problem, Metrohm recommends to open the floating window on a second screen or in the right quarter of the primary screen.
- The hardware does not switch off automatically if an instrument goes offline. To ensure that the hardware is off, switch off the hardware with the power-off button.
- In the MSM start parameters, the dosing rate for Dosino regeneration is calculated from the parameters **Volume** and **Time**. If you send the current method to the instrument to equilibrate the instrument, then the default dosing rate of 1.0 mL/min is applied for the first MSM step. For all following MSM steps, the dosing rate from the method is applied.

### Driver error

- Some error messages in MassHunter contain the text **driver error**. These messages do not refer to the Metrohm IC Driver, ICP-MS MassHunter. These messages can result from an emergency stop due to a leak or a hardware problem, for example.

# 16 Troubleshooting

### Instrument errors

If an error occurs during equilibration or during data acquisition, send the method to the instrument again. If the error persists, search the diagnostics log (C:\Agilent\ICPMH\LOG\MetrohmIC). If necessary, send the log files to your regional Metrohm representative *(see "Log files", page 84)*.

### Log files

If a problem with your instrument occurs, then the diagnostics log, the log files for the Agilent ICP-MS or the Metrohm log contain further information on the problem.

The diagnostics log contains messages about errors and activities, for example executing parameters. The diagnostics log states whether the logged activities were executed successfully or not. In case of a failure or an error, the diagnostics log provides information on solving the problem or possible reasons for the failure or error.

#### Troubleshooting with log files

1. Open the diagnostics log.

   The diagnostics log is stored in the following folder:
   **C:\Agilent\ICPMH\LOG\MetrohmIC**

   The file name is **Diagnostics**.

2. Check if there is a message that provides more information on your problem.

3. If you are not able to solve the problem, e-mail the following log files to your regional Metrohm representative.

   - Diagnostics log: C:\Agilent\ICPMH\LOG\MetrohmIC
   - Log files for the Agilent ICP-MS: C:\Agilent\ICPMH\LOG

### Configuration

#### Reset configuration

If you change the physical instrument configuration, in some cases you cannot adapt the instrument configuration in Metrohm IC Driver, ICP-MS MassHunter accordingly. Therefore, reset the configuration.

Example: A 940 Professional IC Vario and a 942 Extension Module Vario are configured and physically connected. If you disconnect the 942 Extension Module Vario, it is still present in the configuration and cannot be removed.

1. Open the following folder:
   **C:\ProgramData\Metrohm\MassHunter**

2. Remove the file **AutoConfigSettingsList.xml**.

3. Open the application **Instrument Configuration** (**Windows start menu ► Metrohm ► Instrument Configuration**).

   The configuration is empty.

4. Configure the connected modules with **Select Instruments ► Scan** *(see chapter 3, page 3)*.

   The instrument connection in Metrohm IC Driver, ICP-MS MassHunter matches the physical configuration.

   A new file **AutoConfigSettingsList.xml** is created with the new configuration.

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