

# 850 Professional IC



Anion – MSM-HC – MCS – LP Gradient – 2.850.2230

Manual  
8.850.8026EN





Metrohm AG  
CH-9101 Herisau  
Switzerland  
Phone +41 71 353 85 85  
Fax +41 71 353 89 01  
info@metrohm.com  
www.metrohm.com

# **850 Professional IC**

## **Anion – MSM-HC – MCS – LP Gradient – 2.850.2230**

### **Manual**

Teachware  
Metrohm AG  
CH-9101 Herisau  
teachware@metrohm.com

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# Table of contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Instrument description .....	1
1.2	Intended use .....	3
1.3	About the documentation .....	4
1.3.1	Symbols and conventions .....	4
1.4	Safety instructions .....	5
1.4.1	General notes on safety .....	5
1.4.2	Electrical safety .....	5
1.4.3	Tubing and capillary connections .....	6
1.4.4	Flammable solvents and chemicals .....	6
1.4.5	Recycling and disposal .....	6
<b>2</b>	<b>Overview of the instrument</b>	<b>8</b>
2.1	Front .....	8
2.2	Rear .....	10
<b>3</b>	<b>Installation</b>	<b>13</b>
3.1	About this chapter .....	13
3.2	Initial installation .....	13
3.3	Installation of the low pressure gradient .....	16
3.4	Installation diagram .....	17
3.5	Setting up the instrument .....	20
3.5.1	Packaging .....	20
3.5.2	Checks .....	20
3.5.3	Location .....	20
3.6	Capillary connections in the IC system .....	20
3.7	Rear of the instrument .....	22
3.7.1	Rollers and handle .....	22
3.7.2	Positioning and connecting the detector .....	25
3.7.3	Transport locking screws .....	27
3.7.4	Leak sensor .....	27
3.7.5	Drainage tubing .....	28
3.8	Capillary and cable feed-throughs .....	30
3.9	Eluent .....	33
3.9.1	Connecting eluent bottle .....	33
3.10	Eluent degasser .....	37
3.11	Low pressure gradient .....	38



<b>3.12</b>	<b>High pressure pump</b> .....	<b>42</b>
3.12.1	Capillary connections high pressure pump/purge valve .....	42
3.12.2	Connecting low pressure gradient .....	43
3.12.3	Deaerating the high pressure pump .....	44
<b>3.13</b>	<b>Inline filter</b> .....	<b>46</b>
<b>3.14</b>	<b>Pulsation damper</b> .....	<b>47</b>
<b>3.15</b>	<b>Sample degasser</b> .....	<b>48</b>
<b>3.16</b>	<b>Injection valve</b> .....	<b>50</b>
3.16.1	Connecting the injection valve .....	50
3.16.2	Mode of operation of the injection valve .....	51
3.16.3	Selecting the sample loop .....	52
<b>3.17</b>	<b>Column thermostat</b> .....	<b>52</b>
<b>3.18</b>	<b>High Capacity Metrohm Suppressor Module (MSM-HC)</b> .....	<b>55</b>
3.18.1	General information on the MSM-HC .....	55
3.18.2	Connecting the MSM-HC .....	55
<b>3.19</b>	<b>Peristaltic pump</b> .....	<b>58</b>
3.19.1	Principle of the peristaltic pump .....	58
3.19.2	Installing the peristaltic pump .....	59
<b>3.20</b>	<b>Metrohm CO<sub>2</sub> suppressor (MCS)</b> .....	<b>63</b>
3.20.1	General information on the MCS .....	63
3.20.2	Connecting MCS .....	63
3.20.3	Installing the adsorption cartridges .....	64
<b>3.21</b>	<b>Conductivity detector</b> .....	<b>66</b>
<b>3.22</b>	<b>Connecting the instrument</b> .....	<b>69</b>
3.22.1	Connecting the instrument to the PC .....	69
3.22.2	Connecting the instrument to mains supply .....	69
<b>3.23</b>	<b>Guard column</b> .....	<b>70</b>
<b>3.24</b>	<b>Separation column</b> .....	<b>72</b>
<b>4</b>	<b>Start-up</b> .....	<b>74</b>
4.1	Initial start-up .....	74
4.2	Conditioning .....	75
<b>5</b>	<b>Operation and maintenance</b> .....	<b>77</b>
<b>5.1</b>	<b>General information</b> .....	<b>77</b>
5.1.1	Care .....	77
5.1.2	Maintenance by Metrohm Service .....	77
5.1.3	Operation .....	78
5.1.4	Shutting down .....	78
<b>5.2</b>	<b>Capillary connections</b> .....	<b>78</b>
5.2.1	Operation .....	78

<b>5.3</b>	<b>Door</b> .....	<b>79</b>
<b>5.4</b>	<b>Eluent</b> .....	<b>79</b>
5.4.1	Production .....	79
5.4.2	Operation .....	80
<b>5.5</b>	<b>High pressure pump</b> .....	<b>80</b>
5.5.1	Protection .....	80
5.5.2	Maintenance .....	81
<b>5.6</b>	<b>Inline filter</b> .....	<b>91</b>
5.6.1	Maintenance .....	91
<b>5.7</b>	<b>Inline sample preparation</b> .....	<b>93</b>
<b>5.8</b>	<b>Rinsing the sample path</b> .....	<b>93</b>
<b>5.9</b>	<b>Sample degasser</b> .....	<b>95</b>
5.9.1	Operation .....	95
<b>5.10</b>	<b>Injection valve</b> .....	<b>95</b>
5.10.1	Protection .....	95
<b>5.11</b>	<b>High Capacity Metrohm Suppressor Module (MSM-HC)</b> .....	<b>95</b>
5.11.1	Protection .....	95
5.11.2	Operation .....	95
5.11.3	Maintenance .....	96
<b>5.12</b>	<b>Peristaltic pump</b> .....	<b>101</b>
5.12.1	Operation .....	101
5.12.2	Maintenance .....	102
<b>5.13</b>	<b>Metrohm CO<sub>2</sub> suppressor (MCS)</b> .....	<b>104</b>
5.13.1	Replacing the CO <sub>2</sub> adsorption cartridge .....	104
5.13.2	Regenerating the H <sub>2</sub> O adsorption cartridge .....	104
<b>5.14</b>	<b>Conductivity detector</b> .....	<b>105</b>
5.14.1	Maintenance .....	105
<b>5.15</b>	<b>Separation column</b> .....	<b>105</b>
5.15.1	Separating efficiency .....	105
5.15.2	Protection .....	106
5.15.3	Storage .....	106
5.15.4	Regeneration .....	106
<b>5.16</b>	<b>Quality Management and validation with Metrohm</b> ....	<b>107</b>
<b>6</b>	<b>Troubleshooting</b> .....	<b>108</b>
6.1	Problems and their solutions .....	108
<b>7</b>	<b>Technical specifications</b> .....	<b>113</b>
7.1	Reference conditions .....	113
7.2	Instrument .....	113
7.3	Leak sensor .....	113



7.4	Ambient conditions .....	113
7.5	Housing .....	114
7.6	Eluent degasser .....	114
7.7	Low pressure gradient .....	114
7.8	High pressure pump .....	115
7.9	Sample degasser .....	116
7.10	Injection valve .....	116
7.11	Column thermostat .....	116
7.12	High Capacity Metrohm Suppressor Module (MSM-HC) .....	117
7.13	Peristaltic pump .....	117
7.14	Metrohm CO <sub>2</sub> suppressor (MCS) .....	117
7.15	Conductivity measuring system .....	118
7.16	Mains connection .....	119
7.17	Interfaces .....	119
7.18	Safety specification .....	120
7.19	Electromagnetic compatibility (EMC) .....	120
7.20	Weight .....	120
<b>8</b>	<b>Conformity and warranty</b> .....	<b>121</b>
8.1	Declaration of Conformity .....	121
8.2	Quality Management Principles .....	122
8.3	Warranty (guarantee) .....	123
<b>9</b>	<b>Accessories</b> .....	<b>125</b>
9.1	Scope of delivery .....	125
9.2	Optional accessories .....	136
	<b>Index</b> .....	<b>138</b>

## Table of figures

Figure 1	Front 850 Professional IC – Anion – MSM-HC – MCS – LP Gradient .....	8
Figure 2	Rear 850 Professional IC Anion – MSM-HC – MCS – LP Gradient .....	10
Figure 3	Installation diagram .....	18
Figure 4	Connection of capillaries with pressure screws .....	21
Figure 5	Rollers and handle .....	23
Figure 6	Handle as MPak holder .....	24
Figure 7	Removable rear panel .....	25
Figure 8	Connection for the leak sensor on the rear of the instrument .....	28
Figure 9	Drainage tubing .....	29
Figure 10	Capillary feed-throughs on the doors .....	31
Figure 11	Capillary feed-throughs base tray/covering plate .....	32
Figure 12	Installing eluent bottle attachment .....	34
Figure 13	Mounting aspiration filter .....	34
Figure 14	Installing tubing weighting and aspiration filter .....	35
Figure 15	Eluent aspiration tubing fully equipped. ....	35
Figure 16	Eluent bottle – connected .....	36
Figure 17	Eluent degasser .....	37
Figure 18	Low pressure gradient .....	39
Figure 19	Connecting mixing coil for low pressure gradients .....	40
Figure 20	Connecting eluent connection tubings .....	41
Figure 21	Capillary connections high pressure pump/purge valve .....	42
Figure 22	Mixing coil for low pressure gradients connection .....	44
Figure 23	Deaerating the high pressure pump .....	45
Figure 24	Connecting inline filter .....	47
Figure 25	Pulsation damper – Connection .....	48
Figure 26	Sample degasser .....	49
Figure 27	Injection valve – connected .....	50
Figure 28	Injection valve – Positions .....	51
Figure 29	Column thermostat .....	53
Figure 30	MSM-HC – Connectors .....	56
Figure 31	Peristaltic pump .....	58
Figure 32	Installing the pump tubing .....	59
Figure 33	Install pump tubing connection with filter .....	60
Figure 34	Install pump tubing connection without filter .....	61
Figure 35	MCS – connection .....	63
Figure 36	Adsorption cartridge holder .....	65
Figure 37	Conductivity detector front .....	67
Figure 38	Conductivity detector rear .....	68
Figure 39	Connection detector – MCS .....	69
Figure 40	Removing piston .....	82
Figure 41	Components of the piston cartridge .....	83
Figure 42	Tool for piston seal 6.2617.010 .....	84
Figure 43	Removing the piston seal .....	85
Figure 44	Inserting the piston seal into the tool .....	85



Figure 45	Inserting the piston seal into the pump head .....	86
Figure 46	Removing valves .....	87
Figure 47	Dismantling valve .....	88
Figure 48	Components of the inlet valve and outlet valve .....	89
Figure 49	Changing the filter .....	91
Figure 50	MSM-HC – Components .....	98
Figure 51	Pump tubing connection – Changing the filter .....	103

# 1 Introduction

## 1.1 Instrument description

The instrument **850 Professional IC – Anion – MSM-HC – MCS – LP Gradient** (2.850.2230) is one of the model versions of the Professional IC line of instruments manufactured by the Metrohm Company. The Professional IC line of instruments is distinguished by:

- the **intelligence** of its components, which are able to monitor and optimize all functions and to provide documentation according to FDA requirements.
- its **compactness**.
- its **flexibility**. A suitable model version exists for every application. Individual instruments can be converted, expanded or modified to create a different instrument as needed.
- its **transparency**. All components are easily accessible and arranged in a clear manner.
- its **safety**. Chemicals and electronics are separated and a leak sensor is integrated in the wet end.
- its **environmental compatibility**.
- **low noise emission**.

The instrument is operated with **MagIC Net** software. It is connected via a USB connection to a PC on which MagIC Net is installed. The software automatically recognizes the instrument and checks its functional readiness. MagIC Net controls and monitors the instrument, evaluates the measured data and administers it in a database. The operation of MagIC Net is described in the online help or in the tutorial for MagIC Net.

The low pressure mixing valve and two additional eluent degassers in the lower area of the instrument are used for the controlled mixing of up to 3 eluents.

The instrument contains the following components:

### **Eluent degasser**

The eluent degasser removes gas bubbles and dissolved gases from the eluent. For degassing, the eluent flows into a vacuum chamber through a special fluoropolymer capillary.

### **Low pressure gradient**

Up to three different eluents can be mixed with the low pressure gradient. The mixing takes place in the low pressure zone, i.e. before the eluent is conveyed to the high pressure pump.



### **High pressure pump**

The intelligent and low pulsation high pressure pump pumps the eluent through the system. It is equipped with a chip on which its technical specifications and "life history" (operating hours, service data, ... ) are saved.

### **Inline filter**

Inline filters protect the separation column securely against possible contamination from the eluent. Inline filters can however also just as well be used for the purpose of protecting other sensitive components against contaminations in the solutions used. The fine 2 µm material of the readily and easily replaceable filter platelets removes particles such as bacteria and algae from the solutions.

### **Pulsation damper**

The pulsation damper protects the separation column from damage caused by pressure fluctuations when switching the injection valve, and reduces interfering pulsations during highly sensitive measurements.

### **Sample degasser**

The sample degasser removes gas bubbles and dissolved gases from the sample. For degassing, the sample flows into a vacuum chamber through a special fluoropolymer capillary.

### **Injection valve**

The injection valve connects the eluent and sample path through rapid and precise valve switchover. A precisely measured amount of sample solution is injected and rinsed with eluent onto the separation column.

### **Column thermostat**

The column thermostat controls the temperature of the column and eluent channel and thus ensures stable measuring conditions. It provides space for 2 separation columns.

### **High Capacity Metrohm Suppressor Module (MSM-HC)**

The MSM-HC is used for chemical suppression with high capacity during anion analysis. It is pressure-stable, robust and resistant to solvents.

### **Peristaltic pump**

The Peristaltic pump is used for pumping sample and auxiliary solutions. It can rotate in both directions.

### **Metrohm CO<sub>2</sub> suppressor (MCS)**

The MCS removes the CO<sub>2</sub> from the eluent flow. This reduces the background conductivity, improves the detection sensitivity and minimizes the injection and carbonate peaks.

### Conductivity detector

The conductivity detector continuously measures the conductivity of the liquid passing through and indicates these signals in digital form (DSP – Digital Signal Processing). The conductivity detector exhibits outstanding thermal stability and thus guarantees reproducible measuring conditions.

### Separation column

The intelligent separation column is the heart of the ion chromatographic analysis. It separates the different components corresponding to their interactions with the column. The Metrohm analytical columns are equipped with a chip on which their technical specifications and their history (first use / setting up, operating hours, injections, ... ) are saved.

## 1.2 Intended use

The **850 Professional IC – Anion – MSM-HC – MCS – LP Gradient** can be used for the ion chromatographic determination of anions with **sequential suppression** in cases where the complexity of the separation problem requires the use of gradients.

Sequential suppression consists of:

- Chemical suppression by the Metrohm Suppressor Module (MSM) and subsequent
- CO<sub>2</sub> suppression by the Metrohm CO<sub>2</sub> Suppressor (MCS) (*see Chapter 3.20, page 63*).

The use of this technology reduces background conductivity to an absolute minimum.

If required, the instrument can also be used as a normal isocratic anion system with sequential suppression or for the determination of cations and anions without suppression.

The present instrument is suitable for processing chemicals and flammable samples. The usage of the 850 Professional IC – Anion – MSM-HC – MCS – LP Gradient therefore requires that the user has basic knowledge and experience in the handling of toxic and caustic substances. Knowledge with respect to the application of the fire prevention measures prescribed for laboratories is also mandatory.



## 1.3 About the documentation



### CAUTION

Please read through this documentation carefully before putting the instrument into operation. The documentation contains information and warnings which have to be followed by the user in order to ensure safe operation of the instrument.

### 1.3.1 Symbols and conventions

The following symbols and styles are used in this documentation:

(5-12)	<p><b>Cross-reference to figure legend</b></p> <p>The first number refers to the figure number, the second to the instrument part in the figure.</p>
1	<p><b>Instruction step</b></p> <p>Carry out these steps in the sequence shown.</p>
	<p><b>Warning</b></p> <p>This symbol draws attention to a possible life hazard or risk of injury.</p>
	<p><b>Warning</b></p> <p>This symbol draws attention to a possible hazard due to electrical current.</p>
	<p><b>Warning</b></p> <p>This symbol draws attention to a possible hazard due to heat or hot instrument parts.</p>
	<p><b>Warning</b></p> <p>This symbol draws attention to a possible biological hazard.</p>
	<p><b>Caution</b></p> <p>This symbol draws attention to a possible damage of instruments or instrument parts.</p>
	<p><b>Note</b></p> <p>This symbol marks additional information and tips.</p>

## 1.4 Safety instructions

### 1.4.1 General notes on safety



#### WARNING

This instrument may only be operated in accordance with the specifications in this documentation.

This instrument has left the factory in a flawless state in terms of technical safety. To maintain this state and ensure non-hazardous operation of the instrument, the following instructions must be observed carefully.

### 1.4.2 Electrical safety

The electrical safety when working with the instrument is ensured as part of the international standard IEC 61010.



#### WARNING

Only personnel qualified by Metrohm are authorized to carry out service work on electronic components.



#### WARNING

Never open the housing of the instrument. The instrument could be damaged by this. There is also a risk of serious injury if live components are touched.

There are no parts inside the housing which can be serviced or replaced by the user.

#### Mains voltage



#### WARNING

An incorrect mains voltage can damage the instrument.

Only operate this instrument with a mains voltage specified for it (see rear panel of the instrument).



### Protection against electrostatic charges



#### WARNING

Electronic components are sensitive to electrostatic charges and can be destroyed by discharges.

Always pull the mains cable out of the mains connection socket before connecting or disconnecting electrical appliances on the rear panel of the instrument.

### 1.4.3 Tubing and capillary connections



#### CAUTION

Leaks in tubing and capillary connections are a safety risk. Tighten all connections well by hand. Avoid applying excessive force to tubing connections. Damaged tubing ends lead to leakage. Appropriate tools can be used to loosen connections.

Check the connections regularly for leakage. If the instrument is used mainly in unattended operation, then weekly inspections are mandatory.

### 1.4.4 Flammable solvents and chemicals

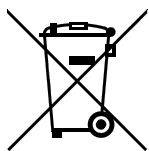


#### WARNING

All relevant safety measures are to be observed when working with flammable solvents and chemicals.

- Set up the instrument in a well-ventilated location (e.g. laboratory flue).
- Keep all sources of flame far from the workplace.
- Clean up spilled fluids and solids immediately.
- Follow the safety instructions of the chemical manufacturer.

### 1.4.5 Recycling and disposal



This product is covered by European Directive 2002/96/EC, WEEE – Waste from Electrical and Electronic Equipment.

The correct disposal of your old equipment will help to prevent negative effects on the environment and public health.



More details about the disposal of your old equipment can be obtained from your local authorities, from waste disposal companies or from your local dealer.



## 2 Overview of the instrument

### 2.1 Front

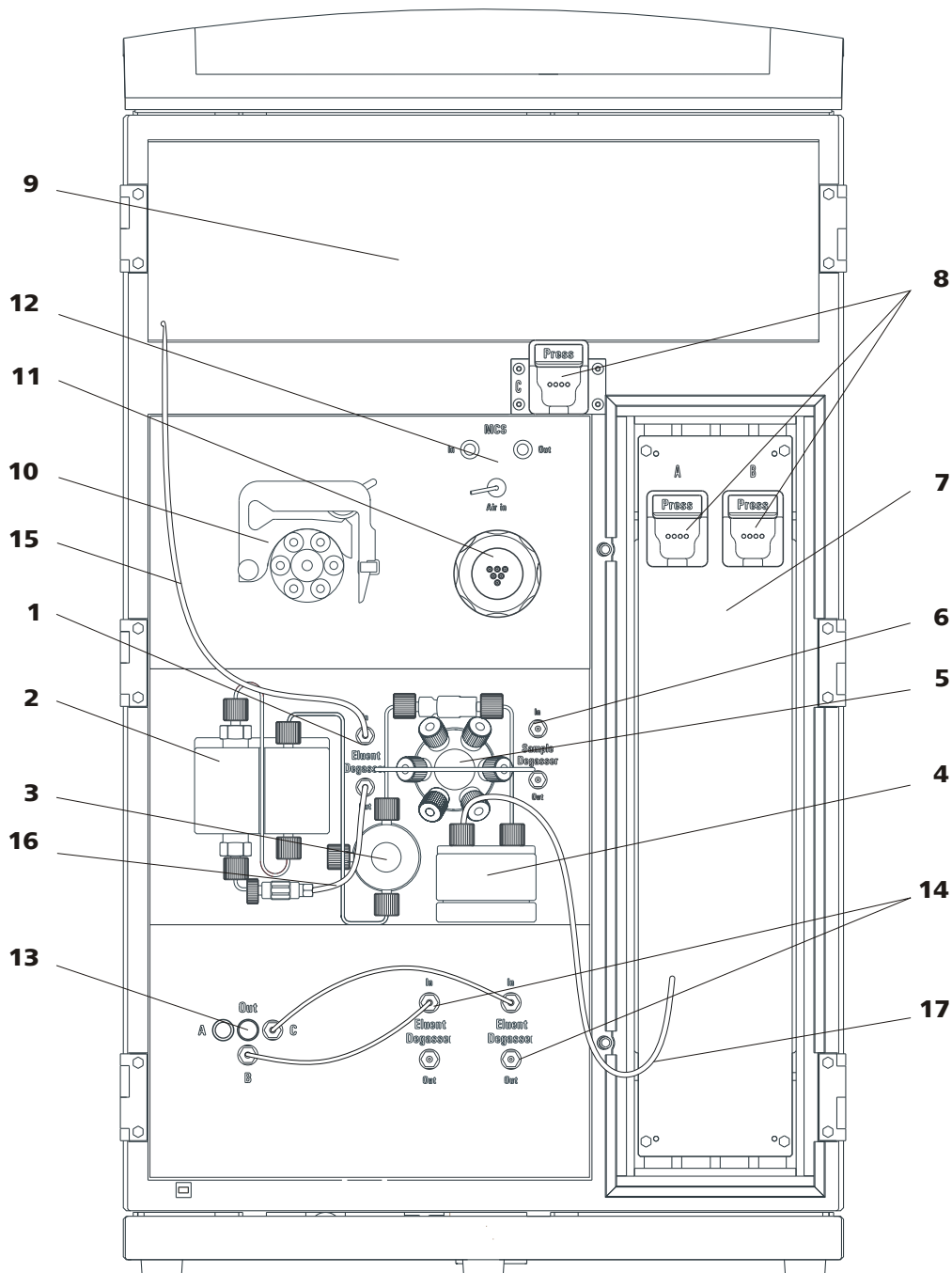


Figure 1 Front 850 Professional IC – Anion – MSM-HC – MCS – LP Gradient

**1 Eluent degasser**  
See Chapter 3.10, Page 37.

**2 High pressure pump**  
See Chapter 3.12, Page 42.

<b>3 Purge valve</b> For deaerating the high pressure pump <i>See Chapter 3.12.3, Page 44.</i>	<b>4 Pulsation damper</b> <i>See Chapter 3.14, Page 47.</i>
<b>5 Injection valve</b> <i>See Chapter 3.16, Page 50.</i>	<b>6 Sample degasser</b> <i>See Chapter 3.15, Page 48. Use optional.</i>
<b>7 Column thermostat</b> <i>See Chapter 3.17, Page 52.</i>	<b>8 Column holder</b> For two separation columns ( <i>see Chapter 3.24, page 72</i> ) in the column thermostat and one outside the column thermostat.
<b>9 Detector chamber</b> Space for the conductivity detector <i>See Chapter 3.21, Page 66.</i>	<b>10 Peristaltic pump</b> <i>See Chapter 3.19, Page 58</i>
<b>11 MSM-HC</b> <i>See Chapter 3.18, Page 55</i>	<b>12 MCS</b> <i>See Chapter 3.20, Page 63</i>
<b>13 Mixing valve</b> <i>See Chapter 3.11, Page 38</i>	<b>14 Eluent degasser</b> For two additional eluents. ( <i>see Chapter 3.10, page 37</i> )
<b>15 Eluent aspiration tubing 6.1834.080</b>	<b>16 Connection tubing eluent degasser – high pressure pump 6.1834.090</b>
<b>17 Column inlet capillary 6.1831.150</b>	



## 2.2 Rear

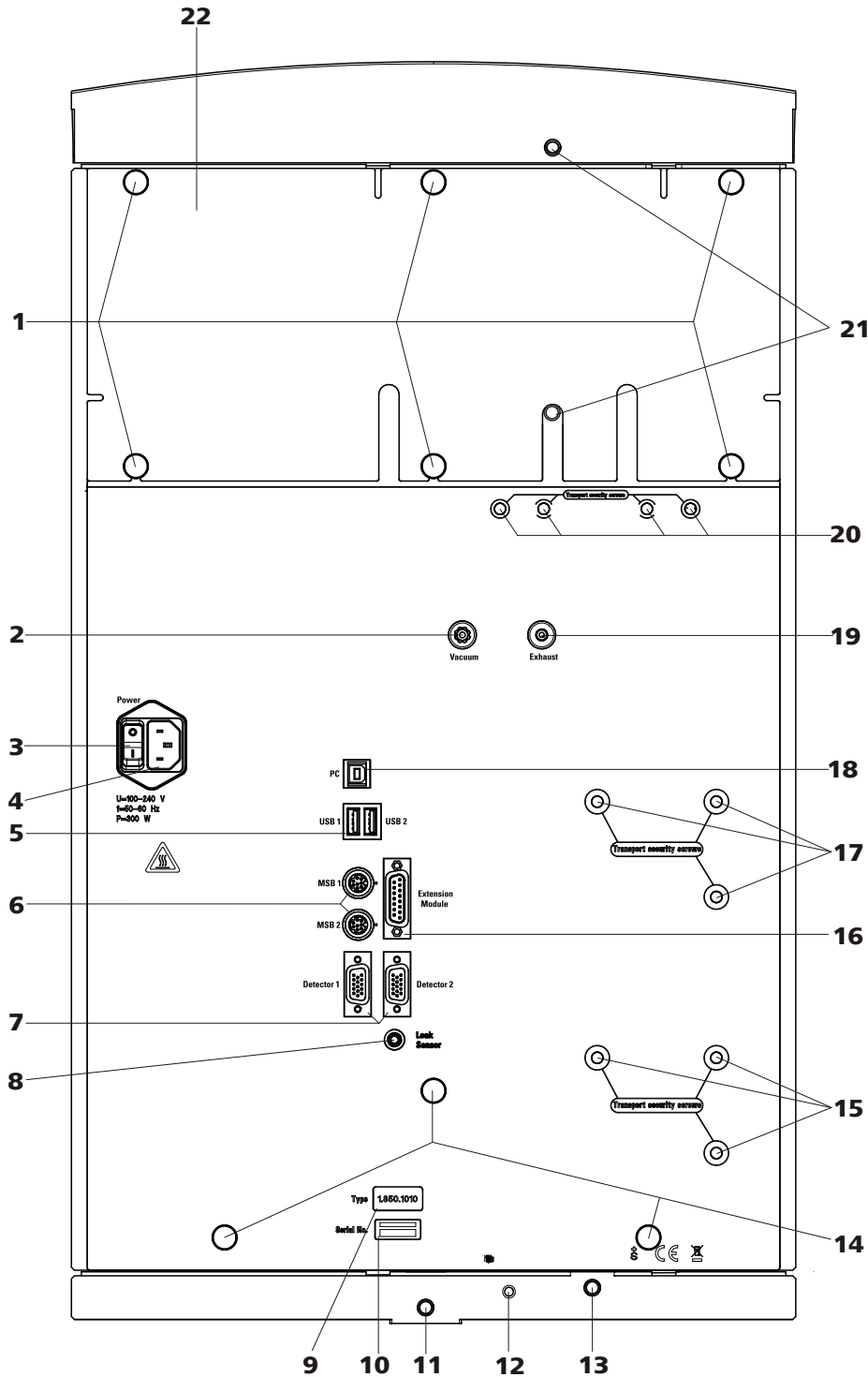


Figure 2 Rear 850 Professional IC-Anion – MSM-HC – MCS – LP Gradient

**1 Knurled screws**

For fastening the rear panel (2-22) and handle (5-2).

**2 Vacuum connection**

For connecting further degassing chambers in extension modules.  
Labeled with *Vacuum*.

<b>3 Mains switch</b> For switching the instrument on and off. 1 = ON 0 = OFF	<b>4 Mains connection socket</b> For connecting the mains cable.
<b>5 USB connectors</b> 2 USB connectors (labeled with <i>USB 1</i> and <i>USB 2</i> ).	<b>6 MSB connectors</b> 2 MSB connectors (labeled with <i>MSB 1</i> and <i>MSB 2</i> ) for connecting MSB devices <b>Caution:</b> The 850 <b>must</b> be switched off when connecting a device. MSB = Metrohm Serial Bus.
<b>7 Detector connectors</b> 2 detector connectors (labeled with <i>Detector 1</i> and <i>Detector 2</i> for connecting Metrohm detectors.	<b>8 Leak sensor connection socket</b> For connecting the leak sensor connector plug (8-2).
<b>9 Instrument type</b>	<b>10 Serial number</b>
<b>11 Drainage tubing connection</b> For connecting a drainage tubing 6.1816.020 (9-8).	<b>12 Leak sensor connection cable</b> For connecting the leak sensor.
<b>13 Drainage tubing connection</b> For connecting a drainage tubing 6.1816.020 (9-9).	<b>14 Knurled screws</b> For fastening the rollers.
<b>15 Transport locking screws</b> For securing the lower high pressure pump when transporting the instrument (only necessary for instruments with two high pressure pumps).	<b>16 Extension module connection</b> For connecting an extension module (labeled with <i>Extension Module</i> ).
<b>17 Transport locking screws</b> For securing the high pressure pump when transporting the instrument.	<b>18 PC connection socket</b> For connecting the instrument to the computer with the USB cable 6.2151.020.
<b>19 Waste air opening</b> For extracting the air from the vacuum chamber. Labeled with <i>Exhaust</i> .	<b>20 Transport locking screws</b> For securing the vacuum pump when transporting the instrument.
<b>21 Drainage tubing connection</b> For connecting a drainage tubing 6.1816.020 (9-1).	<b>22 Rear panel</b> Removable. Access to the detector chamber.



**CAUTION**

---

When connecting an instrument to the MSB connector (2-**6**) you **must** switch off the 850 Professional IC.

## 3 Installation

### 3.1 About this chapter

The *Installation* chapter contains

- this overview
- a brief set of instructions for the initial installation of the 850 Professional IC – Anion – MSM-HC – MCS – LP Gradient (*see Chapter 3.2, page 13*) as an isocratic system. At each step you will find cross-references to more detailed installation instructions for individual components, should you require such aids.
- a brief set of instructions for the initial installation of the low pressure gradient (*see Chapter 3.3, page 16*). At each step you will find cross-references to more detailed installation instructions for individual components, should you require such aids.
- an installation diagram (*see Figure 3, page 18*), showing a completely installed instrument.
- several chapters with detailed installation instructions for all components, including those that are already installed at the time the instrument is delivered.

### 3.2 Initial installation



#### NOTE

A large number of the capillary connections are already connected at the time the instrument is delivered.

The 850 Professional IC – Anion – MSM-HC – MCS – LP Gradient is supplied the same way as an isocratic instrument, i.e. it can be put into operation with minimum effort for usage with only one eluent. Carry out the following steps:

#### Installing 850 Professional IC – Anion – MSM-HC – MCS – LP Gradient

##### 1 Setting up the instrument

*See Chapter 3.5, Page 20.*



## 2 Installations on the rear of the instrument

- Remove handle and rollers (see Chapter 3.7.1, page 22).
- Place the detector in the instrument and connect it (see Chapter 3.7.2, page 25).
- Remove transport locking screws (see "Removing transport locking screws", page 27).
- Connect the leak sensor (see "Connecting the leak sensor", page 27).
- Connect drainage tubings (see "Installing drainage tubing", page 30).

## 3 Installing the eluent path

- Equip the eluent aspiration tubing and connect with the eluent bottle (see Chapter 3.9.1, page 33).
- Instead of the column, connect the 6.2744.040 coupling with a 6.2744.010 pressure screw at the end of the pre-installed column inlet capillary.
- Use a 6.2744.014 pressure screw to connect the capillary of the MSM-HC labeled with *Eluent* to the other end of the 6.2744.040 coupling.
- Use a 6.2744.090 long pressure screw to connect the capillary of the MSM-HC labeled with *Detector* to the input of the MCS (see Chapter 3.20.2, page 63).
- Connect the detector inlet capillary with a 6.2744.090 long pressure screw to the output of the MCS (see Chapter 3.20.2, page 63).

## 4 Installing the sample path



### NOTE

The sample degasser does not have to be connected. We recommend the usage of the sample degasser only if the sample matrix requires it.

- Connect the 6.1803.040 sample aspirating capillary (**3-8**) connected at the sample input of the injection valve to the output of the sample degasser with the aid of a 6.2744.090 long pressure screw (see Chapter 3.15, page 48).
- Connect a part of the 6.1803.040 sample aspirating capillary with a 6.2744.090 long pressure screw to the input of the sample degasser. Guide the other end out of the instrument through a capillary feed-through.

## 5 Installing the peristaltic pump

See Chapter 3.19.2, Page 59

- Install pump tubings.
- Connect aspirating capillaries for the regeneration solution and the rinsing solution.

## 6 Installing the MSM-HC

- Connect the MSM-HC capillary labeled with *H2SO4* to the outlet of the pump tubing for the regeneration solution.
- Connect the MSM-HC capillary labeled with *H2O* to the outlet of the pump tubing for the rinsing solution.
- Guide the two MSM-HC capillaries labeled with *Waste* through an instrument's capillary feed-through to the waste container and fix them there.

## 7 Connecting the instrument

- Connect the instrument to the PC (see Chapter 3.22.1, page 69).
- Connect instrument to mains supply (see Chapter 3.22.2, page 69).

## 8 Initial start-up

See Chapter 4.1, Page 74

- Switch on the PC and start MagIC Net.
- Switch on and prepare the instrument.
- Deaerating the high pressure pump.
- Rinse the instrument without column(s).

## 9 Connecting the columns

- Remove the 6.2744.040 coupling between the column inlet capillary and the MSM-HC capillary labeled with *Eluent*.
- Install the guard column (if used) (see "Connecting and rinsing the guard column", page 71).
- Install the separation column (see "Connecting and rinsing the separation column", page 73).

## 10 Conditioning the instrument

See Chapter 4.1, Page 74

The instrument is now ready for measuring samples.



## 3.3 Installation of the low pressure gradient

The installation of the 850 Professional IC – Anion – MSM-HC – MCS – LP Gradient must be adjusted slightly in order to be operated as a low pressure gradient system. The following installation instructions list the necessary work steps in brief. At each step you will find cross-references to more detailed installation instructions for individual components, should you require such aids.

### Installing the low pressure gradient

#### 1 Expanding the instrument to low pressure gradient

*See Chapter 3.11, Page 38*

- Loosen the 6.1834.090 connection tubing from the output of the eluent degasser.
- Dismount the coupling (21-9) and pump head inlet capillary (21-7) of the high pressure pump.
- Use the short pressure screw to tightly screw the 6.2758.020 mixing coil for low pressure gradients directly onto the input of the high pressure pump, (*see Chapter 3.12.2, page 43*) and the longer pressure screw to screw it tightly to the output of the mixing valve (*see "Connecting mixing coil for low pressure gradients", page 40*).
- Screw on the 6.1834.120 connection tubing to the output of the eluent degasser (*see "Connecting the eluent degasser", page 37*) and connect with input A of the mixing valve (*see "Connecting connection tubings", page 41*).
- Equip two 6.1834.080 eluent aspiration tubings (*see "Assembling eluent aspiration tubing", page 33*) and screw tightly to the eluent degasser inputs in the low pressure gradient (*see "Connecting the eluent degasser", page 37*).

## 3.4 Installation diagram

*Figure 3 Installation diagram* shows the capillary connections with the application of a low pressure gradient with three solutions.

The arrangement of the modules in the diagram corresponds to the front view of the instrument. Liquid containers (eluent bottle, sample vessel, waste container, auxiliary solutions container) and guard column (*see Chapter 3.23, Page 70*) are not shown in the diagram.

Most of the capillaries are already pre-installed at the time the instrument is delivered. Capillaries on which nothing needs to be done at the time of initial installation are not numbered in the diagram.

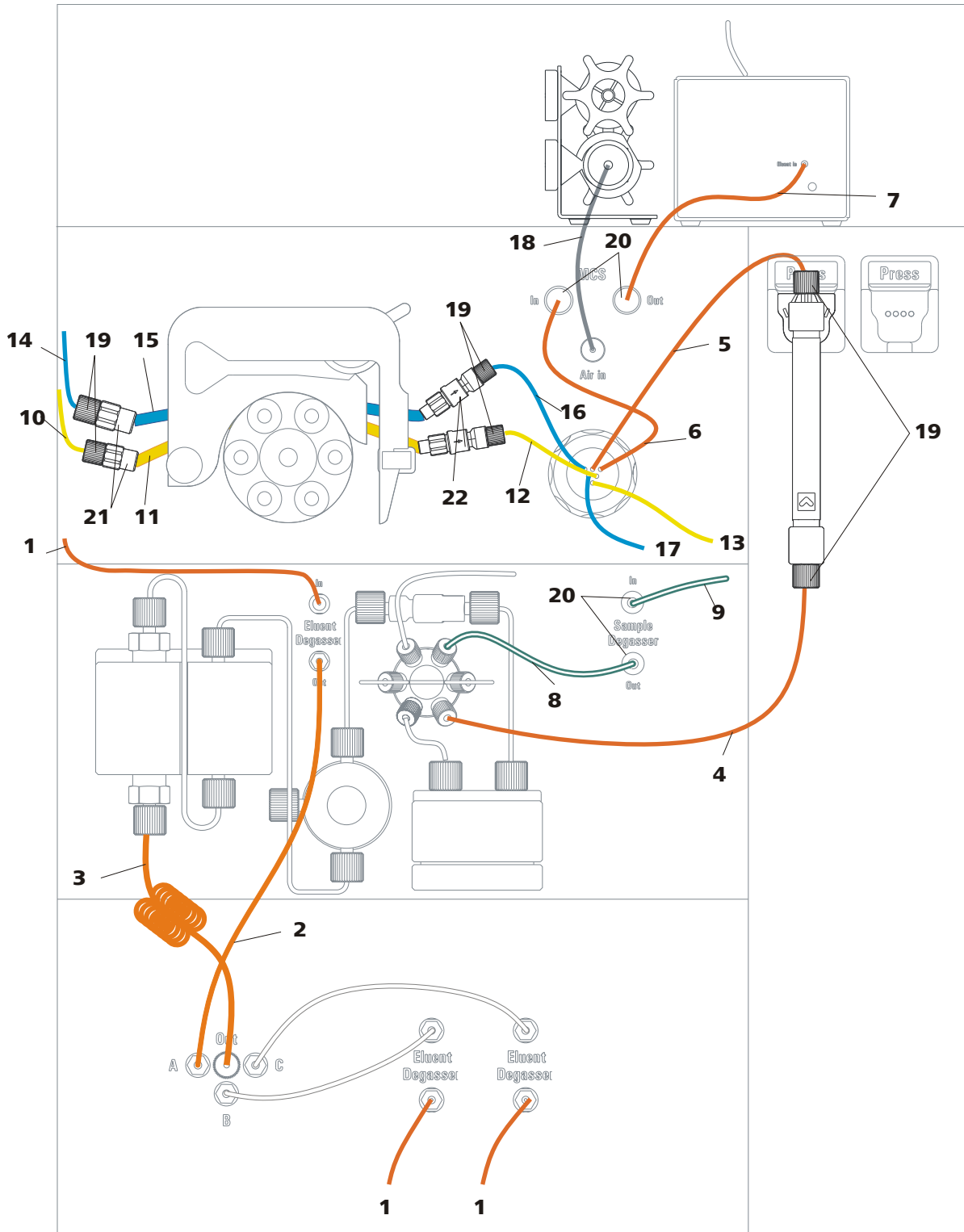


Figure 3 Installation diagram

**1 Eluent aspiration tubing 6.1834.080**  
 Three aspiration tubings for three different eluents (see Chapter 3.9.1, page 33).

**2 Tubing connection 6.1834.120**  
 Connection Eluent degasser – Mixing valve input A

<b>3</b>	<b>Mixing coil for low pressure gradients 6.2758.020</b>	<b>4</b>	<b>Column inlet capillary</b> Connected to the injection valve and threaded into the capillary recesses of the column thermostat.
<b>5</b>	<b>Connection capillary</b> Capillary of the MSM-HC labeled with <i>Eluent</i> .	<b>6</b>	<b>Connection capillary</b> Capillary of the MSM-HC labeled with <i>Detector</i> .
<b>7</b>	<b>Detector inlet capillary</b>	<b>8</b>	<b>Sample aspirating capillary 6.1803.040</b> Connected to the injection valve. The other end can be connected either to the sample degasser or guided directly out of the instrument.
<b>9</b>	<b>PTFE connection capillary</b> Section of the 6.1803.040 PTFE capillary. Connects sample degasser with sample processor (required only if the sample degasser is to be used).	<b>10</b>	<b>Regeneration solution aspirating capillary 6.1803.020</b> Connection to the regeneration solution bottle.
<b>11</b>	<b>Pump tubing 6.1826.320</b> Pump tubing with yellow-orange stoppers for conveying the regeneration solution.	<b>12</b>	<b>Connection capillary for the regeneration solution</b> Capillary of the MSM-HC labeled with <i>H2SO4</i> .
<b>13</b>	<b>Regeneration solution outlet capillary</b> Capillary of the MSM-HC labeled with <i>Waste</i> .	<b>14</b>	<b>Rinsing solution aspirating capillary 6.1803.020</b> Connection to the bottle with rinsing solution.
<b>15</b>	<b>Pump tubing 6.1826.320</b> Pump tubing with yellow-orange stoppers for conveying the rinsing solution.	<b>16</b>	<b>Connection capillary for the rinsing solution</b> Capillary of the MSM-HC labeled with <i>H2O</i> .
<b>17</b>	<b>Rinsing solution outlet capillary</b> Capillary of the MSM-HC labeled with <i>Waste</i> .	<b>18</b>	<b>Air aspirating capillary</b> For aspirating CO <sub>2</sub> -low air from the cartridges of the MCS.
<b>19</b>	<b>PEEK pressure screws, short 6.2744.070</b>	<b>20</b>	<b>PEEK pressure screws, long 6.2744.090</b>
<b>21</b>	<b>Tubing olive 6.2744.030</b>	<b>22</b>	<b>Pump tubing connection with safety device 6.2744.180</b>

You will find detailed descriptions of the individual installation steps in the following chapters.



## **3.5 Setting up the instrument**

### **3.5.1 Packaging**

The instrument is supplied in highly protective special packaging together with the separately packed accessories. Keep this packaging, as only this ensures safe transportation of the instrument.

### **3.5.2 Checks**

Immediately after receipt, check whether the shipment has arrived complete and without damage by comparing it with the delivery note.

### **3.5.3 Location**

The instrument has been developed for operation indoors and may not be used in explosive environments.

Place the instrument in a location of the laboratory which is suitable for operation, free of vibrations, protected from corrosive atmosphere, and contamination by chemicals.

The instrument should be protected against excessive temperature fluctuations and direct sunlight.

## **3.6 Capillary connections in the IC system**

This chapter contains general information concerning the capillary connections in the IC instruments.

Generally speaking, capillary connections between two components of an IC instrument are made up of one connection capillary and two pressure screws with which the capillary is connected to the respective components.

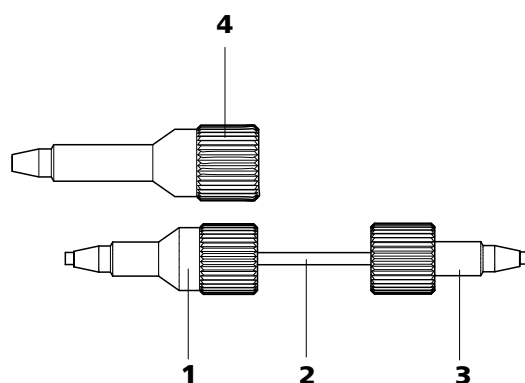


Figure 4 Connection of capillaries with pressure screws

**1 PEEK pressure screw 6.2744.014**

Use on the injection valve.

**2 Connection capillary**

**3 PEEK pressure screw, short 6.2744.070**

For use on the high pressure pump, the purge valve, the inline filter, the pulsation damper, the guard column and the separation column.

**4 PEEK pressure screw, long 6.2744.090**

Usage on other components. Is not used on all instruments.



**NOTE**

In order to keep the dead volume as low as possible, capillary connections should generally be as short as possible.



**NOTE**

For an improved overview, capillary and tubing connections can be bundled with the 6.1815.010 spiral band.

**Connection capillary**

PEEK capillaries and PTFE capillaries are used in the IC system.

*PEEK capillaries (polyetheretherketone)*

PEEK capillaries are temperature-resistant up to 100°C, stable under pressure up to 400 bar, flexible, chemically inert and exhibit an extremely smooth surface. They can be readily cut down to the desired length with the capillary cutter.

Usage:

- 6.1831.010 PEEK capillary (internal diameter of 0.25 mm) for the entire high pressure range.
- 6.1831.030 PEEK capillary (internal diameter of 0.75 mm) for sample handling in the ultra trace range.

**CAUTION**

For the capillary connections between the injection valve (*see Chapter 3.16, page 50*) and detector (*see Chapter 3.21, page 66*), PEEK capillaries with an internal diameter of 0.25 mm must be used. These are already connected to a newly delivered instrument.

*PTFE capillaries (polytetrafluoroethylene)*

PTFE capillaries are transparent and enable visual tracing of the liquids to be pumped. They are chemically inert, flexible and temperature-resistant up to 80°C.

Usage:

PTFE capillaries (6.1803.0x0) are used for the low pressure range.

- PTFE capillaries with internal diameter of 0.5 mm for sample handling.
- PTFE capillaries with internal diameter of 0.97 mm for the sample handling as for rinsing and regeneration solutions (they do not have to be in the scope of delivery of the instrument).

**NOTE**

Capillaries must have a flawless level cut edge. For cutting PEEK capillaries only use the 6.2621.080 capillary cutter.

## 3.7 Rear of the instrument

### 3.7.1 Rollers and handle

In order to make transport easier, the instrument is equipped with rollers and a handle.

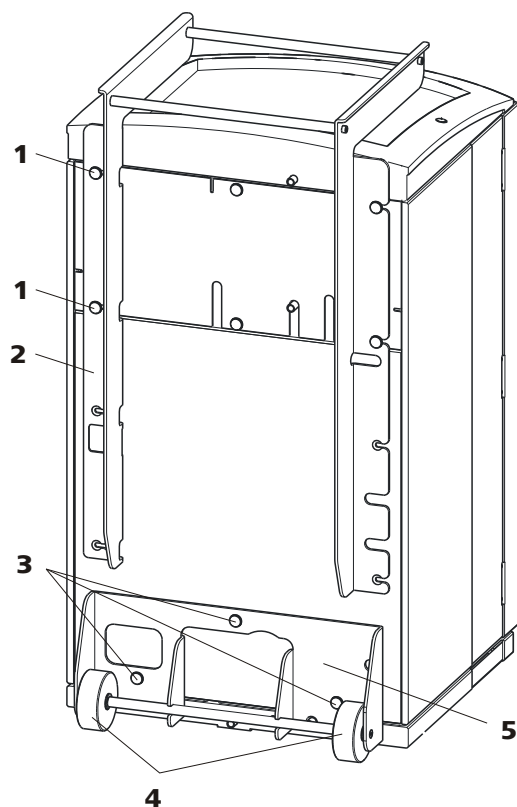


Figure 5 Rollers and handle

**1 Knurled screws**

For fastening the handle (5-2) and the rear panel of the detector chamber.

**2 Handle**

**3 Knurled screws**

For fastening the roller holder (5-5).

**4 Rollers**

**5 Roller holder**

### Removing handle

- 1 Loosen knurled screws (5-1) and remove handle (5-2).

### Removing rollers

Proceed as follows to remove the rollers:

- 1 Remove knurled screws (5-3).
- 2 Remove roller holder (5-5).



### Mounting handle as MPak holder



#### NOTE

When extended, the handle (6-2) can also be used for hanging up MPaks (eluent bags).

- 1 Move handle (6-2) upwards and screw in the knurled screws (6-1) again.

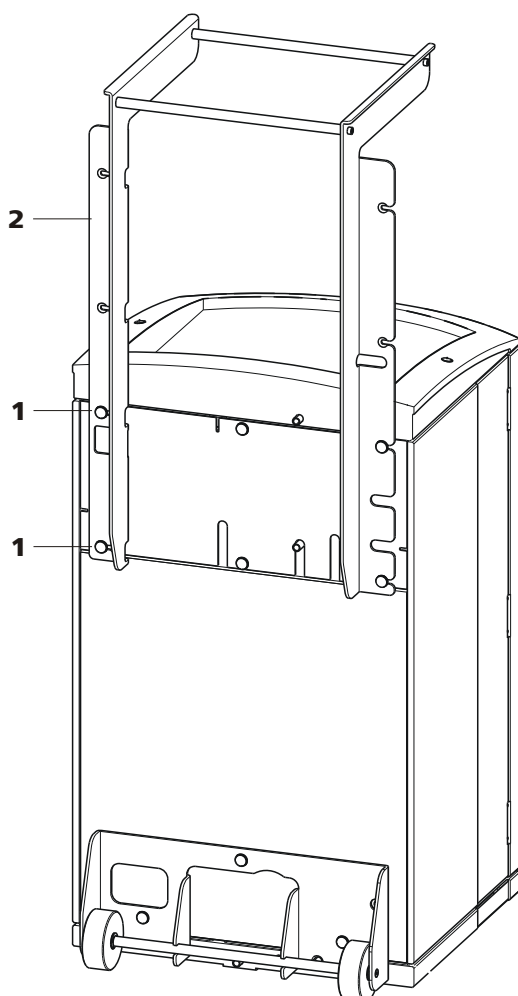


Figure 6 Handle as MPak holder

#### 1 Knurled screws

For fastening the handle (6-2) and the rear panel of the detector chamber.

#### 2 Handle

Extended. As holder for MPaks (eluent bag).

### 3.7.2 Positioning and connecting the detector

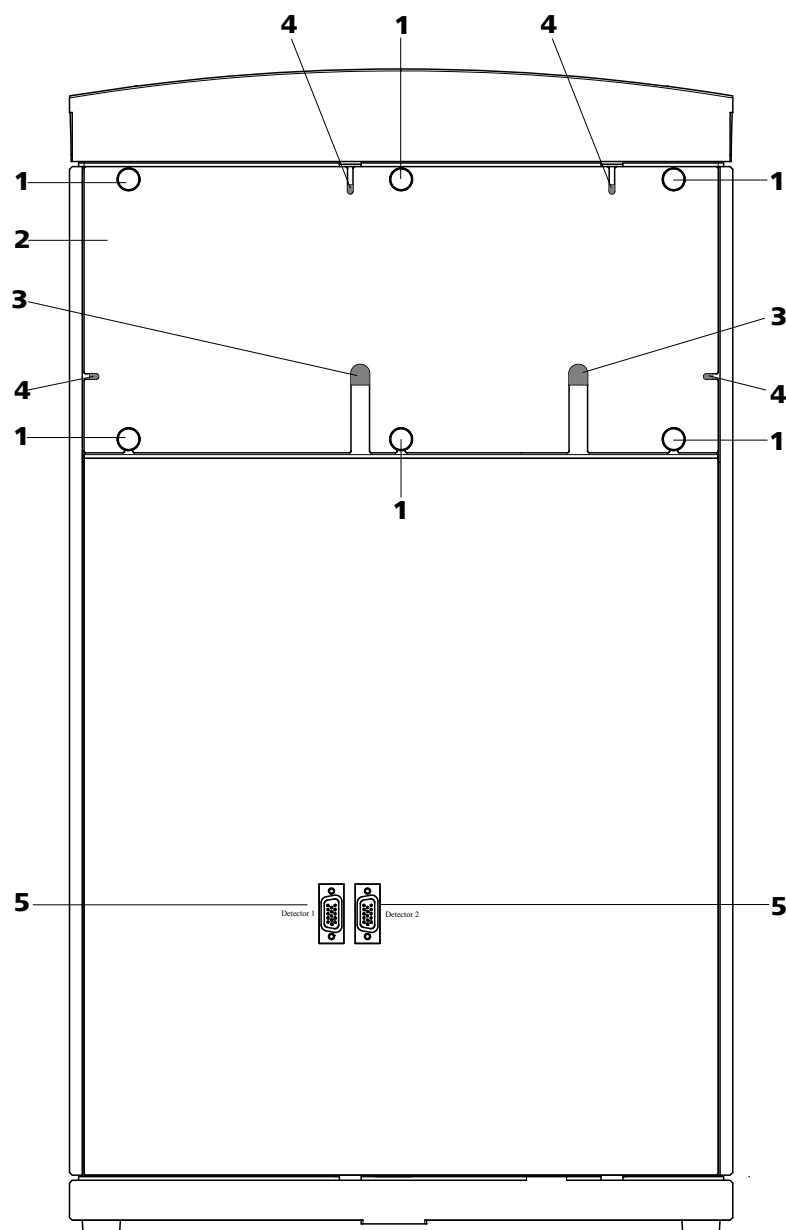


Figure 7 Removable rear panel

**1 Knurled screws**  
For fastening the removable rear panel.

**3 Cable feed-throughs**  
For feeding through detector cables.

**5 Detector connection sockets**  
Labeled with *Detector 1* and *Detector 2* for connecting Metrohm detectors.

**2 Rear panel**  
Removable

**4 Capillary feed-throughs**

**NOTE**

Up to two detectors can be positioned and connected.

**CAUTION**

The instrument **must** be turned off when connecting a detector.

**1 Removing rear panel**

- Unscrew knurled screws (7-1) on the rear panel.
- Remove handle if still fastened to the instrument.
- Remove rear panel (7-2).

**2 Positioning the detector**

- Put the detector through this opening and position it on the support surface intended for this purpose. Slide it right up to the front.

**3 Replacing rear panel**

- Insert the detector cable in a cable feed-through (7-3) on the rear panel (7-2).
- Place the detector output capillary in a suitable capillary feed-through.
- Replace (7-2) rear panel.  
(Optionally, the handle can be remounted higher up and used as a holder for MPaks.)
- Tighten (7-1) knurled screws.

**4 Connecting the detector****NOTE**

The instrument has two detector connection sockets (7-5), *Detector 1* and *Detector 2*. You must ensure that the selected connector corresponds to the connector entered in the MagIC Net method.

**Recommendation:** Use *Detector 1* as standard. In the AnCat system with 2 detectors: *Detector 1* for anions, *Detector 2* for cations.

- Connect the detector cable to the detector connection socket *Detector 1 (7-5)*.

## 5 Connecting detector output



### NOTE

The detector output capillary must be free of blockages (the measuring cell is tested to 5 MPa = 50 bar backpressure).

Guide the detector output capillary into a sufficiently large waste container and fasten it there.

### 3.7.3 Transport locking screws

To avoid damage to the high pressure pump and vacuum pump during transport, the pumps are secured with transport locking screws (2-17) (2-15)(2-20).

Remove these transport locking screws before the initial start-up.

#### Removing transport locking screws

- 1 Remove and keep transport locking screws.



### WARNING

In order to avoid damage to the pumps, the transport locking screws must be remounted each time the instrument undergoes major transport.

### 3.7.4 Leak sensor

The leak sensor detects escaping liquid which collects in the base tray of the instrument.

To activate the leak sensor, the leak sensor connector plug (8-2) must be connected, the instrument switched on and the leak sensor switched to **active** in the software.

#### Connecting the leak sensor

- 1 Plug the leak sensor connector plug (8-2) into the leak sensor connector socket (8-1) on the rear of the instrument (see Figure 8, page 28).

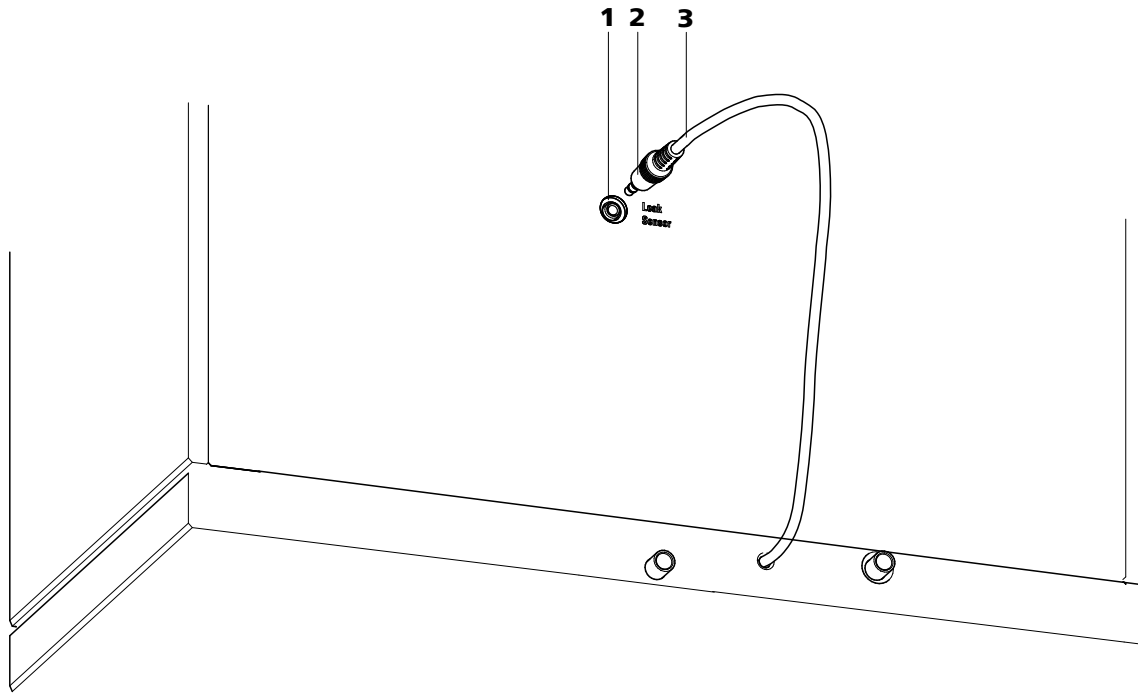


Figure 8 Connection for the leak sensor on the rear of the instrument

- |   |  |
|---|--|
| <p><b>1 Leak sensor connector socket</b><br/>Is labeled with "Leak Sensor".</p>                   | <p><b>2 Leak sensor connector plug</b></p> |
| <p><b>3 Leak sensor connection cable</b><br/>Is firmly mounted on the rear of the instrument.</p> |  |

### 3.7.5 Drainage tubing

Fluid that escapes in the covering plate or in the detector chamber flows through the drainage tubing into the base tray and past the leak sensor into the waste container. This ensures that any leaks in the system will be detected by the leak sensor.

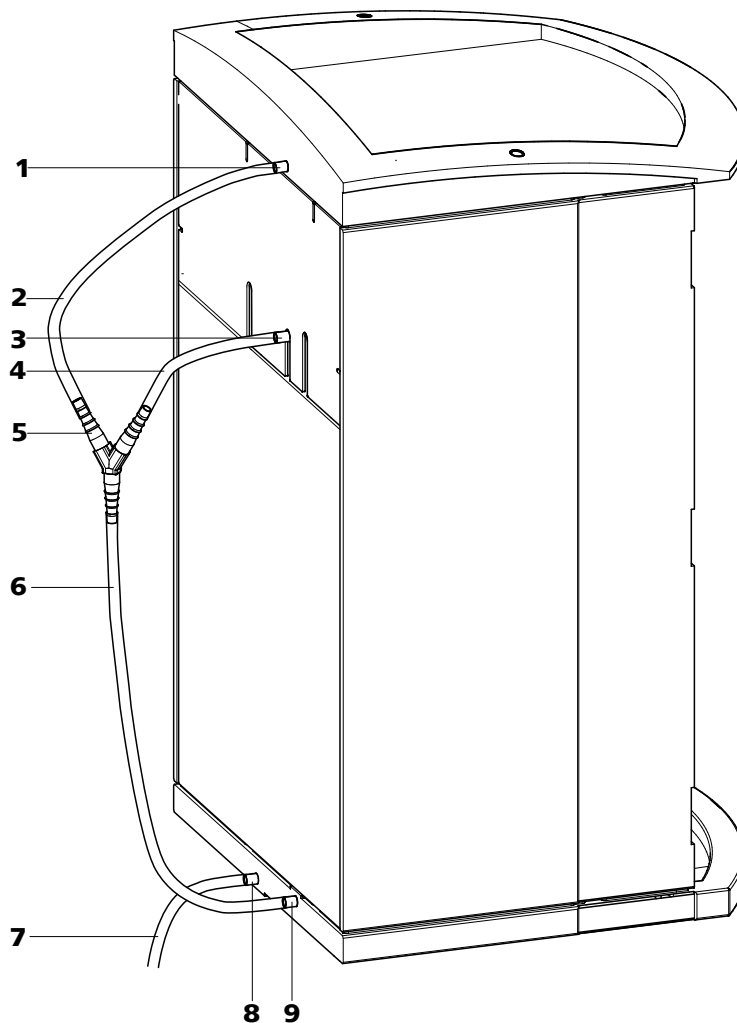


Figure 9 Drainage tubing

<p><b>1 Drainage tubing connection</b> For draining escaped fluid from the covering plate.</p>	<p><b>2 Drainage tubing</b> Section of the 6.1816.020 silicon tubing. For draining escaped fluid from the covering plate.</p>
<p><b>3 Drainage tubing connection</b> For draining escaped fluid from the detector chamber.</p>	<p><b>4 Drainage tubing</b> Section of the 6.1816.020 silicon tubing. For draining escaped fluid from the detector chamber.</p>
<p><b>5 Y connector 6.1807.010</b> For connecting the two drainage tubings (9-2) and (9-4).</p>	<p><b>6 Drainage tubing</b> Section of the 6.1816.020 silicon tubing. Guides escaped fluid to the leak sensor.</p>

**7 Drainage tubing**

Section of the 6.1816.020 silicon tubing.  
Guides escaped fluid into a waste container.

**8 Drainage tubing connection**

For draining escaped fluid from the base tray  
through the connected drainage tubing.

**9 Drainage tubing connection**

For supplying escaped fluid through the con-  
nected drainage tubing to the leak sensor.

Proceed as follows to install the drainage tubing:

### Installing drainage tubing

- 1** Plug drainage tubing (9-2) into the drainage tubing connection (9-1) of the covering plate and shorten to required length.
- 2** Plug drainage tubing (9-4) into the drainage tubing connection (9-3) of the detector chamber and shorten to required length.
- 3** Connect drainage tubing (9-2) from the covering plate and drainage tubing (9-4) from the detector chamber to the Y connector (9-5).
- 4** Connect drainage tubing (9-6) to the Y connector (9-5), shorten to required length and plug the other end of the drainage tubing into the drainage tubing connection (9-9).
- 5** Plug drainage tubing (9-7) into the drainage tubing connection (9-8) of the base tray and guide the other end into a waste container.

## 3.8 Capillary and cable feed-throughs

Several openings have been integrated for feeding through capillaries and cables. They are located on the doors (see Figure 10, page 31), on the rear panel (see Figure 7, Page 25) or below the covering plate or above the base tray (see Figure 11, Page 32).

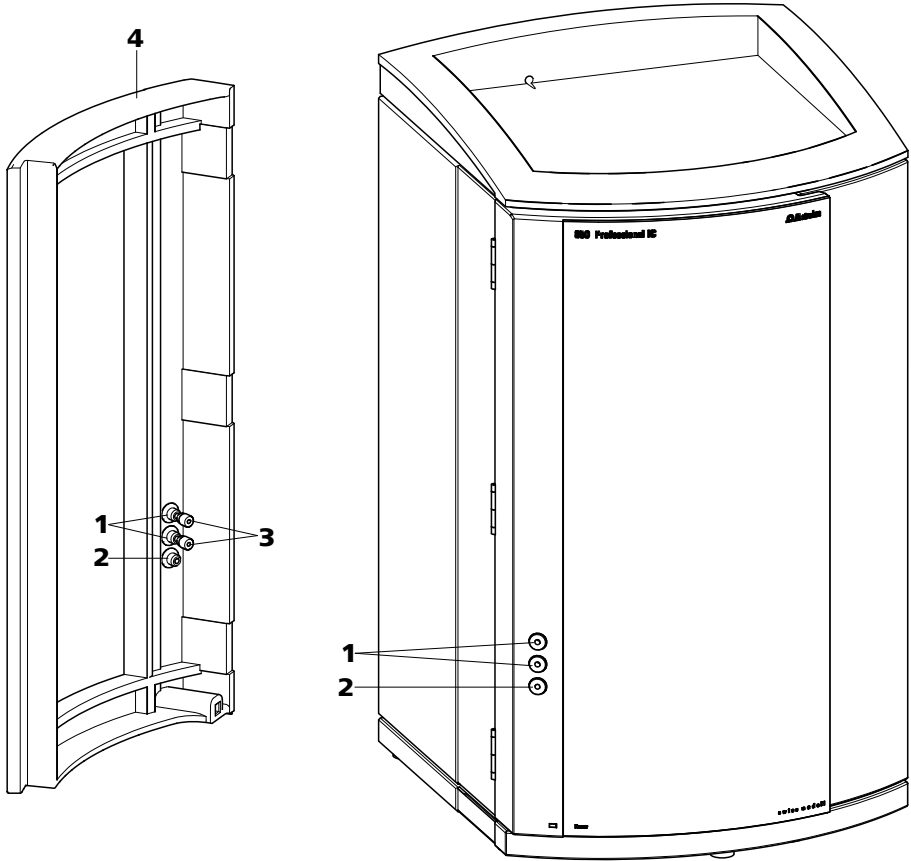


Figure 10 Capillary feed-throughs on the doors

- |   |                                 |
|---|---------------------------------|
| <b>1 Luer connectors</b><br>For connecting a 6.2816.020 syringe. For manual sample feeding. | <b>2 Capillary feed-through</b> |
| <b>3 PEEK pressure screws, short 6.2744.070</b>   | <b>4 Door</b>                   |

Do not feed capillaries through the Luer connectors (10-1). The capillaries are fastened with PEEK pressure screws (10-3) from inside to the Luer connector. From outside, liquid can be aspirated or injected with a syringe.

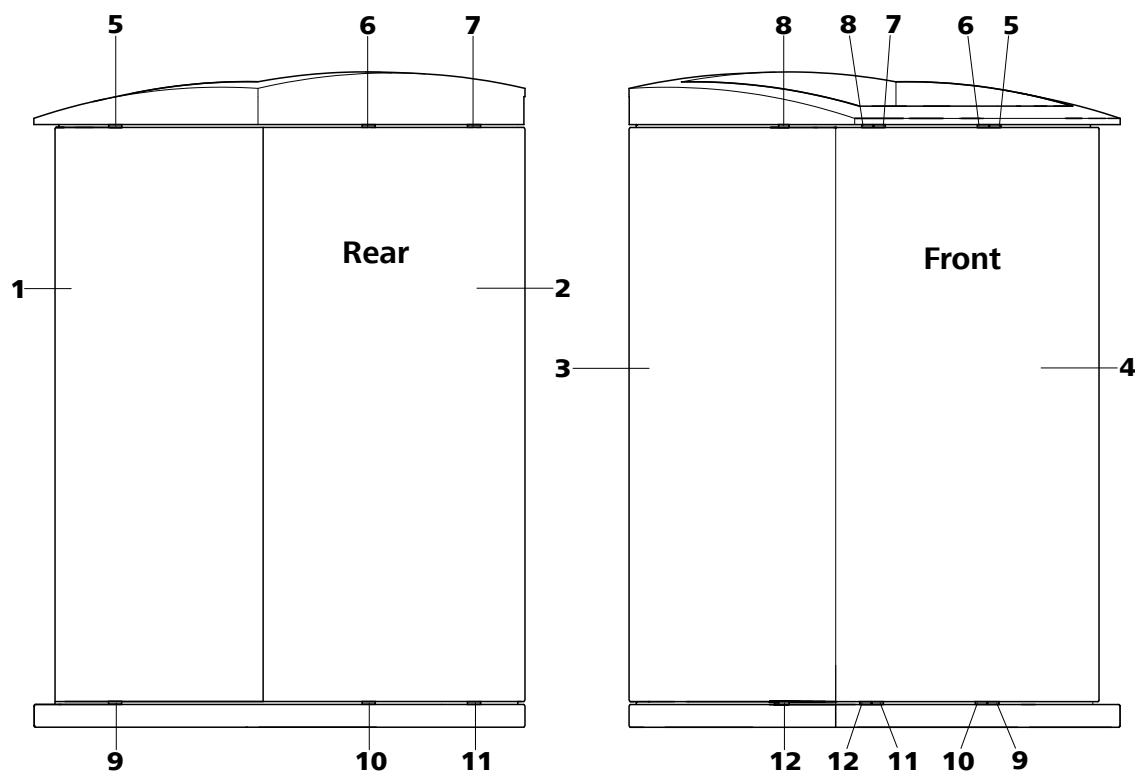


Figure 11 Capillary feed-throughs base tray/covering plate

<b>1</b> Side panel (right) Right panel.	<b>2</b> Rear of the instrument
<b>3</b> Side panel (left) Left panel.	<b>4</b> Front of the instrument
<b>5</b> Capillary feed-through Upper. From front to right.	<b>6</b> Capillary feed-through Upper. From front to back.
<b>7</b> Capillary feed-through Upper. From front to back.	<b>8</b> Capillary feed-through Upper. From front to left.
<b>9</b> Capillary feed-through Lower. From front to right.	<b>10</b> Capillary feed-through Lower. From front to back.
<b>11</b> Capillary feed-through Lower. From front to back.	<b>12</b> Capillary feed-through Lower. From front to left.

## 3.9 Eluent

### 3.9.1 Connecting eluent bottle

The eluent is aspirated out of the eluent bottle via the eluent aspiration tubing (12-1).

The eluent aspiration tubing is connected to the eluent degasser (see Chapter 3.10, page 37). The tubing must be threaded through a suitable capillary feed-through (see Chapter 3.8, page 30) of the instrument before the other end can be equipped.

You will require the parts from the following accessories for equipping the eluent aspiration tubing:

- 6.1602.160 eluent bottle attachment GL 45
- 6.2744.210 tubing adapter for aspiration filter
- 6.2821.090 aspiration filter

To equip the eluent aspiration tubing proceed as follows:

#### Assembling eluent aspiration tubing

- 1 Guide the free end of the eluent aspiration tubing (12-1) out of the instrument through a suitable capillary feed-through.
- 2 **Installing the 6.1602.160 eluent bottle attachment**
  - Slide tubing nipple (12-2) and O-ring (12-3) onto the eluent aspiration tubing (12-1).
  - Push eluent aspiration tubing (12-1) through the bottle attachment (12-4) and screw tight.

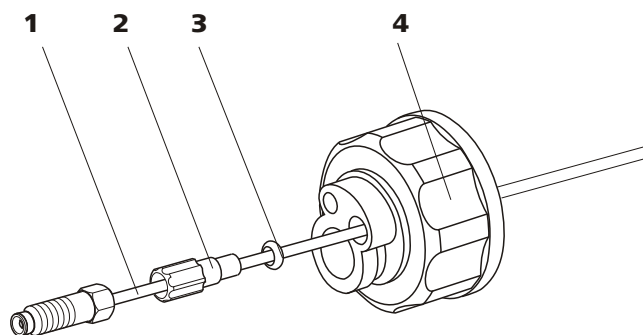


Figure 12 Installing eluent bottle attachment

**1 Eluent aspiration tubing 6.1834.080**

**2 Tubing nipple**

From accessory set 6.1602.160.

**3 O-ring**

From accessory set 6.1602.160.

**4 Bottle attachment**

From accessory set 6.1602.160.

### 3 Mounting aspiration filter

- Insert filter holder (13-1) into the aspiration filter (13-2) and screw tight.

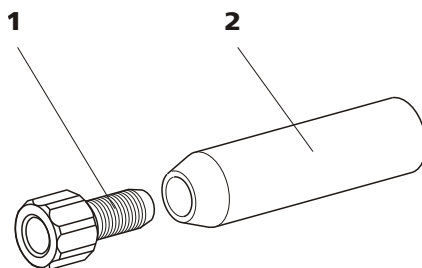


Figure 13 Mounting aspiration filter

**1 Filter holder**

From accessory set 6.2744.210.

**2 Aspiration filter 6.2821.090**

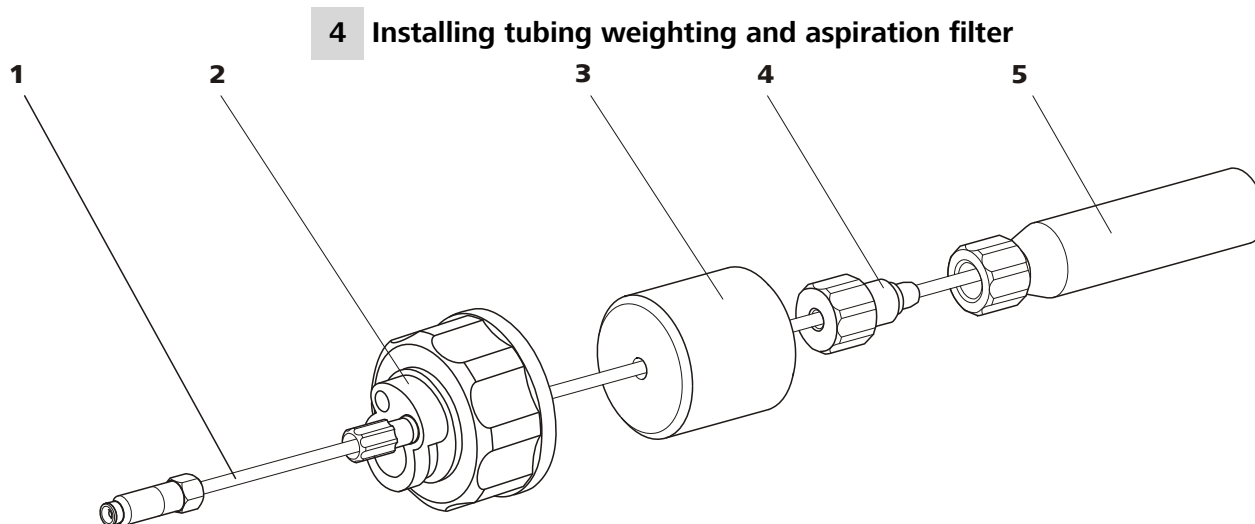


Figure 14 Installing tubing weighting and aspiration filter

**1 Eluent aspiration tubing 6.1834.080**

**2 Eluent bottle attachment 6.1602.160**

**3 Tubing weighting**  
From accessory set 6.2744.210.

**4 Clamping screw**  
From accessory set 6.2744.210.

**5 Aspiration filter 6.2821.090**  
With filter holder from accessory set 6.2744.210.

- Slide the tubing weighting (14-3) onto the eluent aspiration tubing (14-1).
- Slide the clamping screw (14-4) onto the eluent aspiration tubing (14-1).
- Insert eluent aspiration tubing (14-1) into the aspiration filter (14-5). The end of the tubing must touch the base of the filter.
- Screw together clamping screw (14-4) and filter holder (13-1). The end of the tubing must still touch the base of the filter.

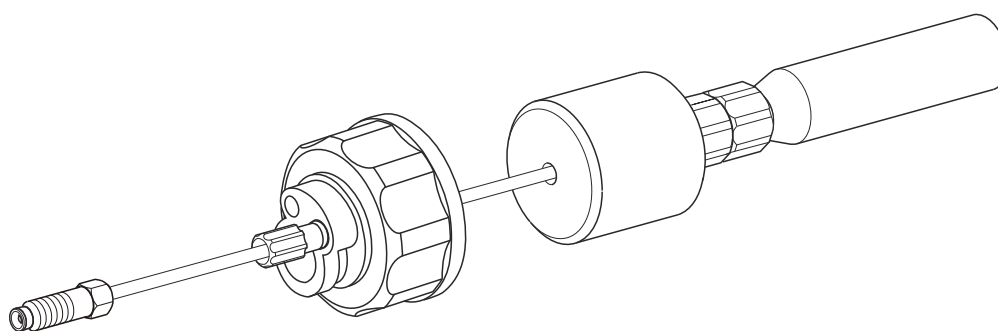


Figure 15 Eluent aspiration tubing fully equipped.

#### 5 Mounting eluent aspiration tubing to the eluent bottle

- Insert the eluent aspiration tubing into the eluent bottle (16-10).



- Fasten the bottle attachment (14-2) on the eluent bottle (16-10). The aspiration filter (16-6) must rest on the base of the eluent bottle.

## 6 Mounting the adsorber tube



### NOTE

In the case of alkaline eluents and eluents with lower buffer capacity, the eluent bottle must be equipped with a CO<sub>2</sub> adsorber (16-4).

- First, place a piece of wadding (16-3), then the CO<sub>2</sub> adsorber (16-4) in the large opening of the adsorber tube (16-2) and close with the plastic cover.
- Fasten the adsorber tube (16-2) using the SGJ clip (16-12) onto the bottle attachment (16-11).

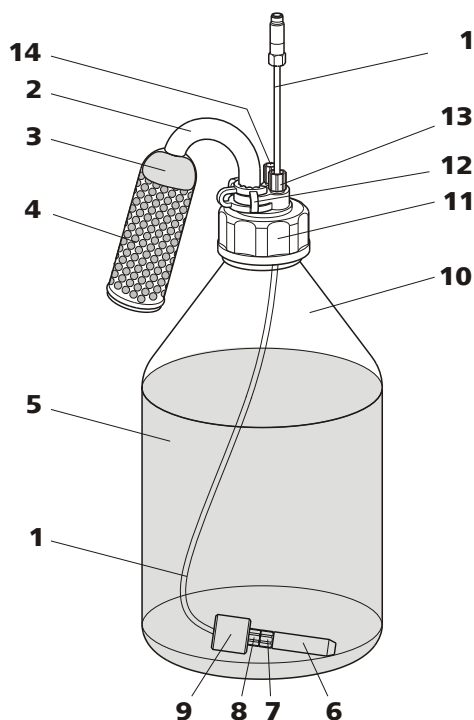


Figure 16 Eluent bottle – connected

**1 Eluent aspiration tubing 6.1834.080**  
For aspirating the eluent. Pre-installed.

**3 Wadding**

**2 Adsorber tube 6.1609.000**

**4 CO<sub>2</sub> adsorber**

Adsorbs CO<sub>2</sub> from the air (e.g. Merck soda lime with indicator, no. 6839.10).

<b>5</b>	<b>Eluent</b>	<b>6</b>	<b>Aspiration filter 6.2821.090</b>
<b>7</b>	<b>Filter holder</b> From accessory set 6.2744.210.	<b>8</b>	<b>Clamping screw</b> From accessory set 6.2744.210.
<b>9</b>	<b>Tubing weighting</b> From accessory set 6.2744.210.	<b>10</b>	<b>Eluent bottle 6.1608.070</b>
<b>11</b>	<b>Bottle attachment 6.1602.160</b>	<b>12</b>	<b>SGJ clip 6.2023.020</b>
<b>13</b>	<b>Tubing nipple</b>	<b>14</b>	<b>Thread stopper</b>

### 3.10 Eluent degasser

Gas bubbles in the eluent lead to an unstable baseline, as high pressure pumps can transport liquids, but not gases. The eluent therefore has to be degassed, before it reaches the high pressure pump.

The eluent degasser removes gas bubbles and dissolved gases from the eluent. For degassing, the eluent flows into a vacuum chamber through a special fluoropolymer capillary.



#### NOTE

The eluent degasser is already installed in the newly delivered instrument. The following installation instructions need **not** be carried out at the time of initial installation.

#### Connecting the eluent degasser

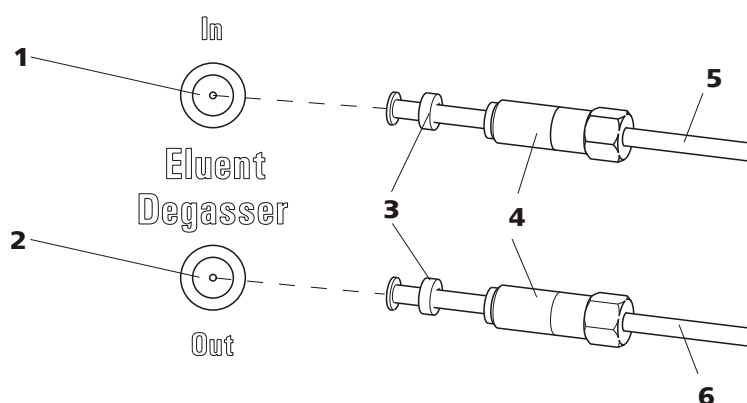


Figure 17 Eluent degasser

**1** Eluent degasser input

**2** Eluent degasser output

**3 Tubing flare**

With tubing nipple.

**4 Clamping screw****5 Eluent aspiration tubing 6.1834.080**

For aspirating the eluent. The clamping screw (17-4) is firmly mounted.

**6 Connection capillary 6.1834.090**

Connection from the eluent degasser to the high pressure pump (see Chapter 3.12, page 42). The clamping screw (17-4) is firmly mounted.

**1****CAUTION**

The clamping screws (17-4) must be tightened carefully. Use the 6.2621.050 wrench for this.

- Insert the eluent aspiration tubing (17-5) in the eluent degasser input (17-1).
- Carefully tighten clamping screw (17-4).

**2**

- Insert connection capillary (17-6) (the end with the longer clamping screw (17-4)) into the eluent degasser output (17-2).
- Carefully tighten clamping screw (17-4).
- Connect the other end of the connection capillary (17-6) (with the shorter clamping screw) to the high pressure pump.

## 3.11 Low pressure gradient

Up to three different eluents can be mixed with the low pressure gradient. The three "normally closed" valves are usually closed. With each pumping cycle, the valves are kept open until the desired percentage of eluent has flowed, after which they are closed again. This results in a situation where the valves also open and close audibly when 100% of a solution is conveyed.

The eluent gradient generated in the mixing valve is aspirated by the high pressure pump and conveyed into the IC system. Because of the physical restrictions of the mixing valve, the flow must not exceed 3 mL/min. when using a low-pressure gradient.

In general, the use of the low pressure gradient is recommended for eluent percentages ranging from 10...90%. However, depending on the installed pump head and the set flow, the smallest possible eluent percentage can vary (see Table 1, page 39).

Table 1 Smallest possible eluent percentage depending on installed pump head and set flow

Flow	Standard pump head	Macro pump head
1 mL/min	10 %	2.5 %
2 mL/min	20 %	5 %
3 mL/min	not recommended	7.5 %

Depending on the application, an optimal assignment of each eluent to a valve is documented in the Application Notes. To obtain a reproducible gradient profile, this eluent-valve assignment must remain unchanged.

Each eluent is degassed by means of its own eluent degasser (see Chapter 3.10, page 37).

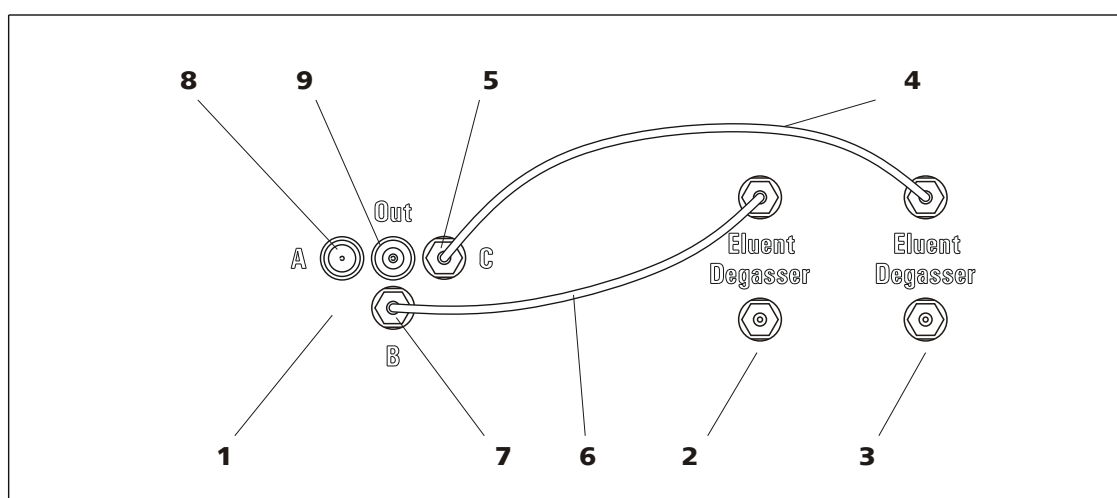


Figure 18 Low pressure gradient

<b>1</b>	<b>Mixing valve</b>	<b>2</b>	<b>Eluent degasser</b> for Eluent B
<b>3</b>	<b>Eluent degasser</b> for Eluent C	<b>4</b>	<b>Connection tubing 6.1834.100</b> Connects eluent degasser (18-3) and mixing valve C. Pre-installed.
<b>5</b>	<b>Eluent inlet C</b>	<b>6</b>	<b>Connection tubing 6.1834.100</b> Connects the eluent degasser (18-2) and the mixing valve input B. Pre-installed.
<b>7</b>	<b>Eluent inlet B</b>	<b>8</b>	<b>Eluent inlet A</b>
<b>9</b>	<b>Eluent outlet</b>		



### Connecting mixing coil for low pressure gradients

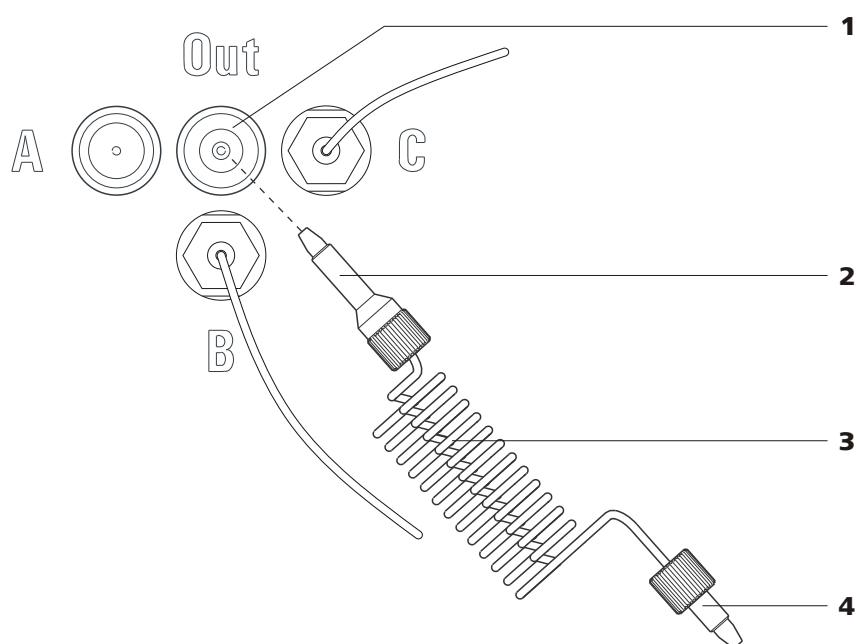


Figure 19 Connecting mixing coil for low pressure gradients

**1 Eluent outlet**

**2 Pressure screw long**  
for the connector on the mixing valve.

**3 Mixing coil for low pressure gradients**  
**6.2758.020**

**4 Pressure screw short**  
for the connection on the high pressure pump.

- 1** Screw on the 6.2758.020 mixing coil for low pressure gradients (19-3) with the 6.2744.090 long PEEK pressure screw (19-2) to the eluent outlet (19-1).
- 2** Fasten the other end of the mixing coil for low pressure gradients (19-3) with the 6.2744.070 short PEEK pressure screw (19-4) directly to the inlet valve holder of the high pressure pump (see Chapter 3.12.2, page 43).

### Connecting connection tubings



#### NOTE

The connection tubings to the inputs B and C are already installed at the time the instrument is delivered. Only connector A still needs to be connected.

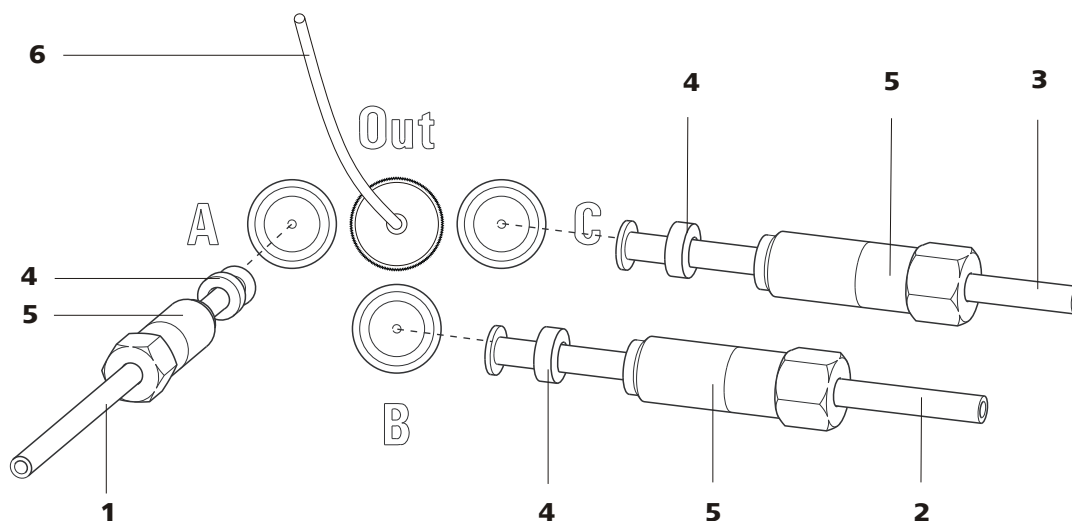


Figure 20 Connecting eluent connection tubings

**1** Connection tubing eluent degasser – mixing valve (6.1834.120)

**2** Connection tubing eluent degasser – mixing valve (6.1834.100)  
Pre-installed.

**3** Connection tubing eluent degasser – mixing valve (6.1834.110)  
Pre-installed.

**4** Backup ring

**5** Clamping screw

**6** Mixing coil for low pressure gradients  
6.2758.020

- 1**
  - Plug the connection tubing (20-1) into eluent inlet A and fix in place with the backup ring (20-4).
  - Carefully tighten the clamping screw (20-5) with 6.2621.050 wrench.
- 2** Repeat Step 1 with the other two eluent connection tubings (20-2) and (20-3).



### 3.12 High pressure pump

The intelligent and low pulsation high pressure pump pumps the eluent through the system. It is equipped with a chip on which its technical specifications and "life history" (operating hours, service data, ... ) are saved.

The purge valve is used for deaerating (see Chapter 3.12.3, page 44) the high pressure pump.

#### 3.12.1 Capillary connections high pressure pump/purge valve



**NOTE**

All of the capillary connections of the high pressure pump and the purge valve are already installed in the newly delivered instrument.

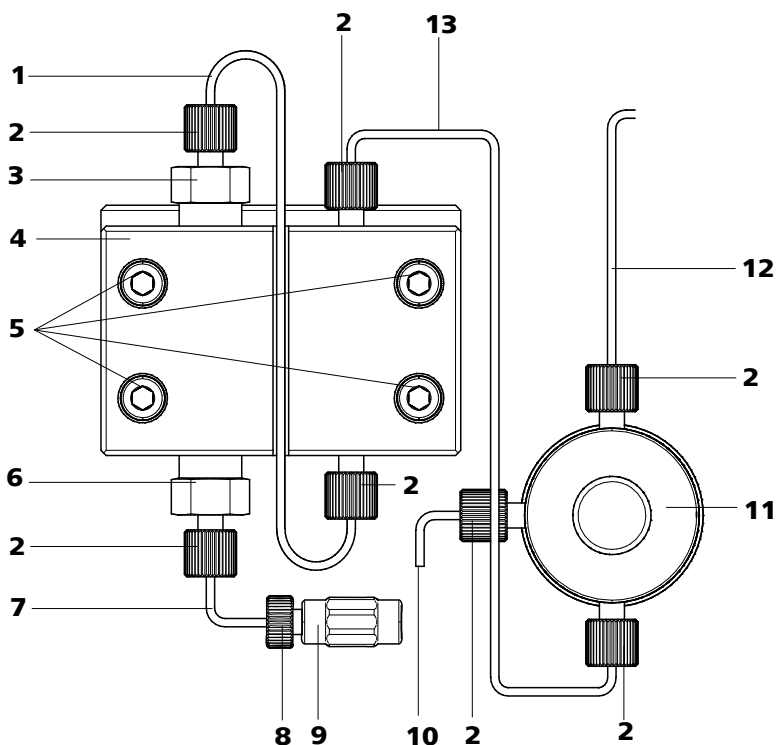


Figure 21 Capillary connections high pressure pump/purge valve

<b>1 Connection capillary</b> PEEK capillary connects main piston and auxiliary piston.	<b>2 PEEK pressure screw, short 6.2744.070</b>
<b>3 Outlet valve holder</b>	<b>4 Pump head 6.2824.110</b>

<p><b>5 Fastening screws</b> For fastening the pump head.</p>	<p><b>6 Inlet valve holder</b></p>
<p><b>7 Pump head input capillary</b> PEEK capillary at the input of the pump head.</p>	<p><b>8 Pressure screw</b> For connecting a PEEK capillary to the coupling (21-9).</p>
<p><b>9 Coupling</b> For the connection of the eluent path at the input of the high pressure pump. Can be ordered together with the pressure screw (21-8) under the number 6.2744.230.</p>	<p><b>10 Deaerating capillary</b> For aspirating the eluent when deaerating the high pressure pump (see Chapter 3.12.3, page 44).</p>
<p><b>11 Purge valve</b> For deaerating the high pressure pump. With rotary knob in the center and pressure sensor.</p>	<p><b>12 Connection capillary</b> For connecting the inline filter (see Chapter 3.13, page 46).</p>
<p><b>13 Connection capillary</b> Connects the output of the pump head with the purge valve.</p>	

### 3.12.2 Connecting low pressure gradient



#### NOTE

The eluent aspirating capillary is already installed on the high pressure pump in the newly delivered instrument. The connector must be modified in order to use the instrument as a low pressure gradient.

#### Connecting low pressure gradient

##### 1 Removing the connection tubing eluent degasser – high pressure pump

- Loosen the clamping screw at the output of the eluent degasser and remove the connection tubing.
- Loosen the pressure screw on the inlet valve holder (21-2) and remove the connection tubing together with the coupling (21-9) and the pump head input capillary (21-7).

##### 2 Connecting mixing coil for low pressure gradients

- Screw the end of the mixing coil for low pressure gradients (22-3) with the shorter pressure screw (22-2) to the inlet valve holder (22-1).

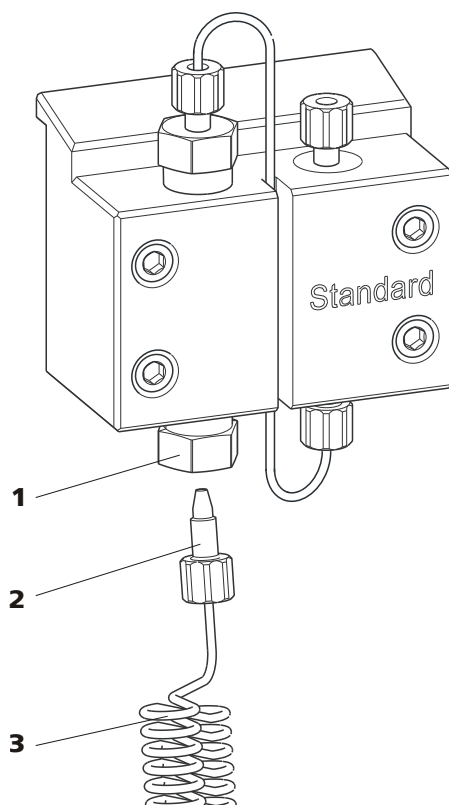


Figure 22 Mixing coil for low pressure gradients connection

**1** Inlet valve holder

**2** PEEK pressure screw, short 6.2744.070

**3** Mixing coil for low pressure gradients  
6.2758.020

### 3.12.3 Deaerating the high pressure pump

The high pressure pump will only operate perfectly if the pump head contains no more air bubbles. Therefore it must be deaerated during initial start-up and after every change of eluent.



#### CAUTION

The high pressure pump must **not** be deaerated before the initial start-up (see Chapter 4.1, page 74).

Deaerate the high pressure pump as follows (see Figure 23, page 45):

#### Deaerating the high pressure pump

The instrument must be connected to the PC and switched on to deaerate the high pressure pump.

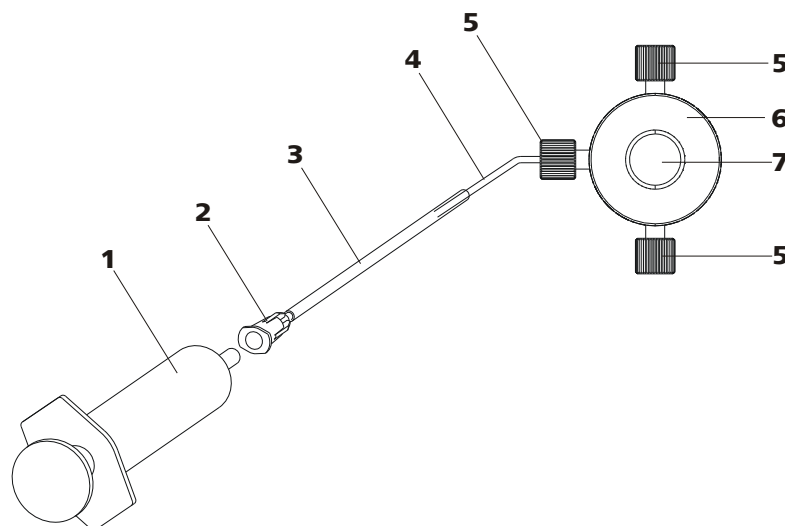


Figure 23 Deaerating the high pressure pump

**1 Syringe 10 mL 6.2816.020**

For aspirating the eluent.

**3 Purging needle 6.2816.040**

**5 PEEK pressure screws, short  
6.2744.070**

**7 Purge valve rotary knob**

**2 Luer connector**

On purging needle.

**4 Deaerating capillary**

**6 Purge valve**

**1 Connecting the purging needle**

- Push the end of the purging needle (23-3) over the end of the deaerating capillary (23-4) on the purge valve.

**2 Connecting the syringe**

- Insert syringe (23-1) in the Luer connector (23-2) of the purging needle (see Figure 23, page 45).

**3 Opening purge valve**

- Open the rotary knob (23-7) by approx. ½ rotation counterclockwise.

**4 Setting the flow rate**

- Start MagIC Net (if not yet started).
- Ensure that the eluent aspiration tubing is immersed sufficiently in the eluent.
- Let the high pressure pump run.



### 5 Aspirating eluent

- Aspirate with the syringe (23-1) until bubble-free eluent flows into the syringe.

### 6 Completing deaerating

- Turn off high pressure pump.
- Close rotary knob (23-7).
- Remove syringe (23-1) from the Luer connector (23-2).
- Pull the purging needle (23-3) out of the deaerating capillary (23-4).

## 3.13 Inline filter

Between the purge valve and the pulsation damper the 6.2821.120 inline filter is installed as protection against particles.

Inline filters protect the separation column securely against possible contamination from the eluent. Inline filters can however also just as well be used for the purpose of protecting the suppressor against contaminations in the regeneration or rinsing solutions. The fine 2 µm material of the readily and easily replaceable filter platelets removes particles such as bacteria and algae from the solutions.



#### NOTE

The inline filter is already installed in the newly delivered instrument. The following installation instructions need **not** be carried out at the time of initial installation.

#### Installing the inline filter



#### CAUTION

Observe the flow direction marked on the filter housing for the connection of the inline filter.

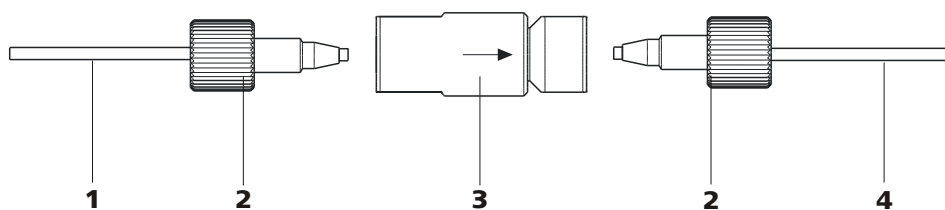


Figure 24 Connecting inline filter

**1 Connection capillary**

Connects the purge valve with the inline filter.

**2 PEEK pressure screws, short  
6.2744.070**

**3 Inline filter 6.2821.120**

Protects against particles.

**4 Connection capillary**

Connects the inline filter with the pulsation damper.

- 1** Screw on the connection capillary running from the purge valve with a 6.2744.070 pressure screw to the input side of the inline filters.
- 2** Screw on the connection capillary running to the pulsation damper with a 6.2744.070 pressure screw to the output side of the inline filter.

### 3.14 Pulsation damper



**NOTE**

The pulsation damper is already installed in the newly delivered instrument.



**CAUTION**

The pulsation damper is maintenance-free and may not be opened.

The pulsation damper protects the separation column from damage caused by pressure fluctuations when switching the injection valve, and reduces interfering pulsations during highly sensitive measurements. In order to ensure these functionalities, it must be connected between the high pressure pump (see Chapter 3.12, page 42) and injection valve (see Chapter 3.16, page 50).

The pulsation damper can be operated in both directions.

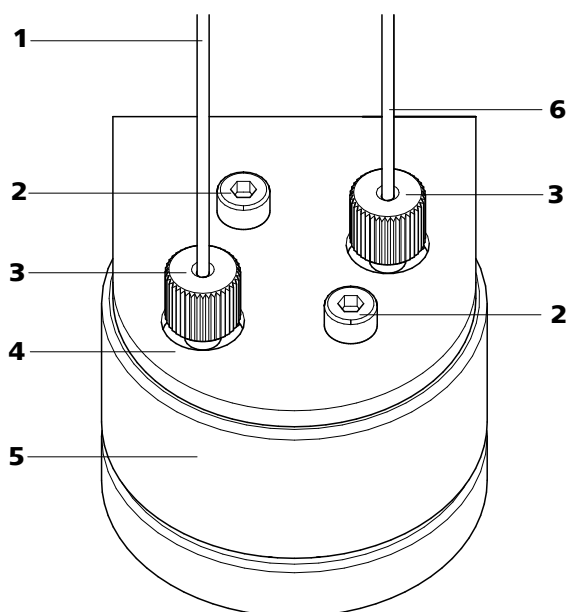


Figure 25 Pulsation damper – Connection

<b>1 Connection capillary</b> Connection to the inline filter.	<b>2 Fastening screws</b>
<b>3 PEEK pressure screws, short</b> <b>6.2744.070</b>	<b>4 Holder for pulsation damper</b>
<b>5 Pulsation damper 6.2620.150</b>	<b>6 Connection capillary</b> Connection to the injection valve.

### 3.15 Sample degasser

The sample degasser removes gas bubbles and dissolved gases from the sample. For degassing, the sample flows into a vacuum chamber through a special fluoropolymer capillary.

Gas bubbles in the sample lead to poor reproducibility, as the quantity of sample in the sample loop would not always be the same. Samples (containing gas) should therefore be degassed before injection. For this the sample is sucked through a degasser chamber before injection, whereby any gas bubbles are automatically removed.



#### NOTE

When using the sample degasser, the rinsing time extends by at least 2 minutes.

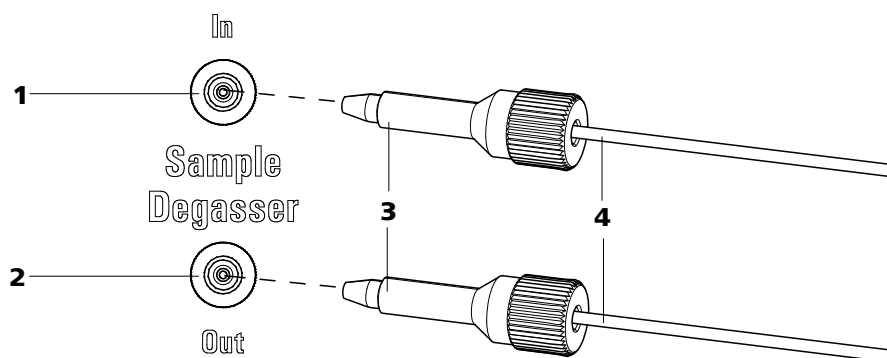


Figure 26 Sample degasser

<b>1</b>	<b>Sample degasser input</b>	<b>2</b>	<b>Sample degasser output</b>
<b>3</b>	<b>PEEK pressure screw, long 6.2744.090</b>	<b>4</b>	<b>Connection capillaries 6.1803.040</b>

### Connecting the sample degasser

- 1** Remove and keep 6.2744.220 thread stoppers from the input and output of the sample degasser.
- 2** Connect the end of the 6.1803.040 sample aspirating capillary connected to the injection valve with a long PEEK pressure screw (26-**3**) to the output of the sample degasser (26-**2**).
- 3** Connect 6.1803.040 connection capillary with a long PEEK pressure screw (26-**3**) to the input of the sample degasser (26-**1**).
- 4** Guide the other end of the connection capillary out of the instrument through a capillary feed-through.



#### CAUTION

If the sample degasser is not used, the input and output **must** be sealed with the 6.2744.220 thread stoppers.



## 3.16 Injection valve

The injection valve connects the eluent and sample path. Through rapid and precise valve switchover a precise amount of sample solution defined by the size of the sample loop is injected and rinsed with eluent onto the separation column.

### 3.16.1 Connecting the injection valve

The injection valve has six connectors: two for the sample path (connectors 1 and 2), two for the eluent path (connectors 4 and 5) and two for the sample loop (connectors 3 and 6).



#### NOTE

The capillaries of the eluent path and the sample path and the sample loop are already installed in the newly delivered instrument.

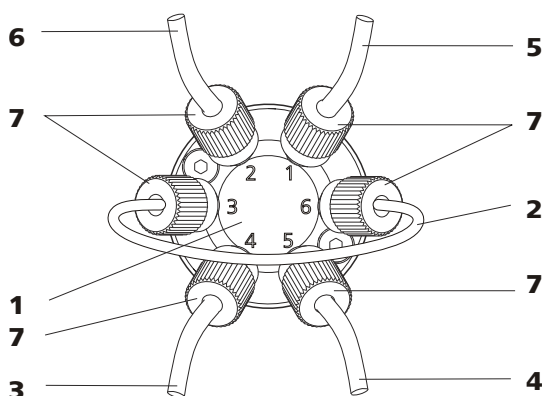


Figure 27 Injection valve – connected

#### 1 Injection valve

#### 3 Connection capillary

Connected to connector 4. Carries eluent to the injection valve.

#### 5 Connection capillary

Connected to connector 1. Carries sample to the injection valve.

#### 7 PEEK pressure screw 6.2744.010

#### 2 Sample loop

Connected to connectors 3 and 6.

#### 4 Connection capillary (column inlet capillary)

Connected to connector 5. Carries eluent to the separation column.

#### 6 Connection capillary

Connected to connector 2. Carries sample to the waste container.

### Replacing the sample loop

The sample loop can be replaced, depending on requirements. For additional information concerning selection of the appropriate sample loop, see Chapter 3.16.3, page 52.



#### NOTE

Use only 6.2744.010 PEEK pressure screws for connecting capillaries and sample loop to the injection valve.

#### 1 Removing existing sample loop

- Loosen 6.2744.010 pressure screws at connector 3 and connector 6.
- Remove sample loop.

#### 2 Mounting new sample loop

- Fasten one end of the sample loop (27-2) with a 6.2744.010 PEEK pressure screw (27-7) to connector 3.
- Fasten the other end of the sample loop (27-2) with a second 6.2744.010 PEEK pressure screw (27-7) to connector 6.

### 3.16.2 Mode of operation of the injection valve

The injection valve (see Figure 28, page 51) can adopt two valve positions - **FILL** and **INJECT**. Switching back and forth between the two valve positions determines whether the sample path or the eluent path is guided through the sample loop. The following figure provides a schematic display of the flow paths of the two valve positions.

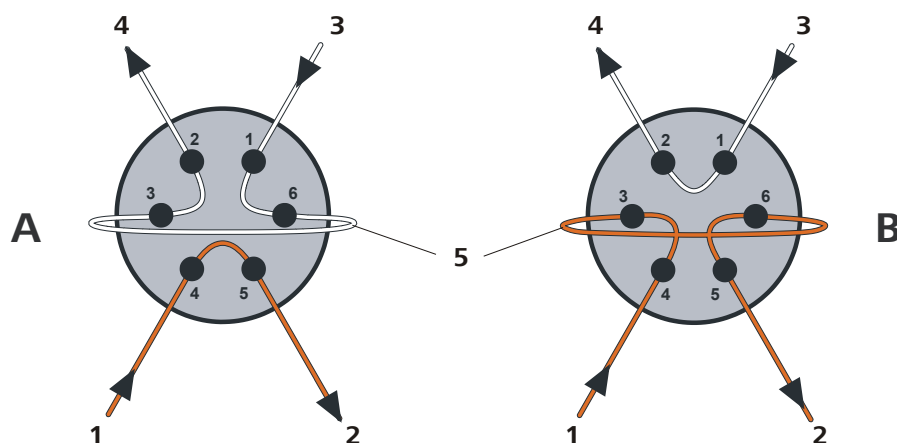


Figure 28 Injection valve – Positions

**A** Position FILL

**B** Position INJECT



<b>1 Eluent input</b> Capillary coming from the high pressure pump.	<b>2 Eluent output</b> Capillary to the column.
<b>3 Sample input</b> Sample aspirating capillary.	<b>4 Sample output</b> Capillary to waste container.
<b>5 Sample loop</b>	

**Position A**

In the position **FILL**, the sample solution flows through the sample loop to the waste container. The eluent flows directly to the separation column at the same time.

**Position B**

In the position **INJECT**, the eluent flows through the sample loop to the separation column. If sample solution is to be found in the sample loop at the time of the valve switchover, then this will be conveyed along with the eluent, thus making its way to the separation column. The flow in the sample path is either stopped or the sample flows directly to the waste container.

**3.16.3 Selecting the sample loop**

The amount of sample solution injected depends on the volume of the sample loop. The choice is made on the basis of the application. The following sample loops are normally used:

Cation determination	10 µL
Anion determination with suppression	20 µL
Anion determination without suppression	100 µL

**3.17 Column thermostat**

The column thermostat controls the temperature of the column and eluent channel and thus ensures stable measuring conditions. It provides space for 2 separation columns.

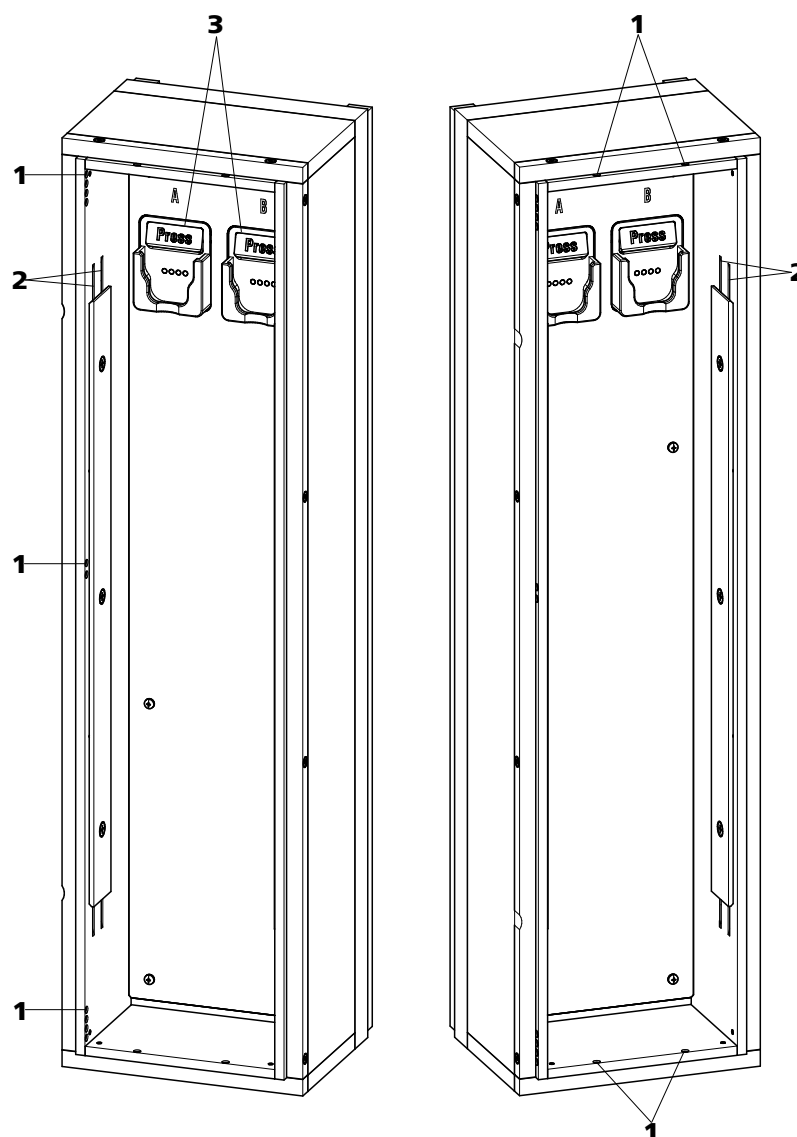


Figure 29 Column thermostat

**1 Capillary feed-throughs**

For guiding the capillaries in and out.

**2 Capillary recesses**

For controlling the temperature of the eluent.

Preheating capillary already pre-installed.

**3 Column holder**

For fastening the columns.

With column recognition.

The column thermostat contains two column holders (29-3) equipped with chip recognition. The separation columns can be clicked into the column holder with the chip.

**NOTE**

The column input capillary is already threaded into the capillary recesses of the column thermostat at the time the instrument is first delivered. The following installation instructions need **not** be carried out at the time of initial installation.

**Threading capillaries**

- 1** Introduce column input capillary into the column thermostat via a suitable capillary feed-through (29-1).
- 2** Slide the column input capillary from below into the outer of the two capillary recesses (29-2). Slide it through under the holder plate until it emerges again at the top.
- 3** Carefully bend the column input capillary downward and slide from from above to below through the inner capillary recess until it emerges at the lower edge of the holder plate.

**4****NOTE**

The columns (guard column and separation column) may only be installed after the initial start-up (see Chapter 4.1, page 74).

- **Before initial start-up:**  
Fasten the 6.2744.040 coupling with a 6.2744.010 pressure screw to the end of the column input capillary.
- **After initial start-up:**  
Fasten the guard column (if used) or the separation column with a 6.2744.010 pressure screw to the end of the column input capillary.

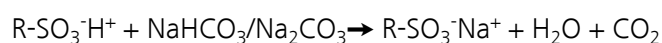
## 3.18 High Capacity Metrohm Suppressor Module (MSM-HC)

### 3.18.1 General information on the MSM-HC

The MSM-HC is used for chemical suppression during anion analysis if eluents with a high ionic concentration are used or if the concentration is being significantly increased in the course of a gradient application. It consists of 3 suppressor units in total, which are used for suppression, regenerated with sulfuric acid or rinsed with ultra pure water in rotation.

#### Suppression reaction in the MSM-HC

When using a carbonate eluent, the following reaction (amongst others) occurs in the MSM-HC:



### 3.18.2 Connecting the MSM-HC



#### CAUTION

To protect the MSM-HC against foreign particles or bacterial growth, a 6.2744.180 pump tubing connection with filter must be mounted between the peristaltic pump and the inlet capillaries of the MSM-HC.

The three inputs and outputs of the suppressor units numbered with 1, 2 and 3 on the MSM-HC each have 2 fixed mounted PTFE capillaries (see *Figure 30, page 56*).

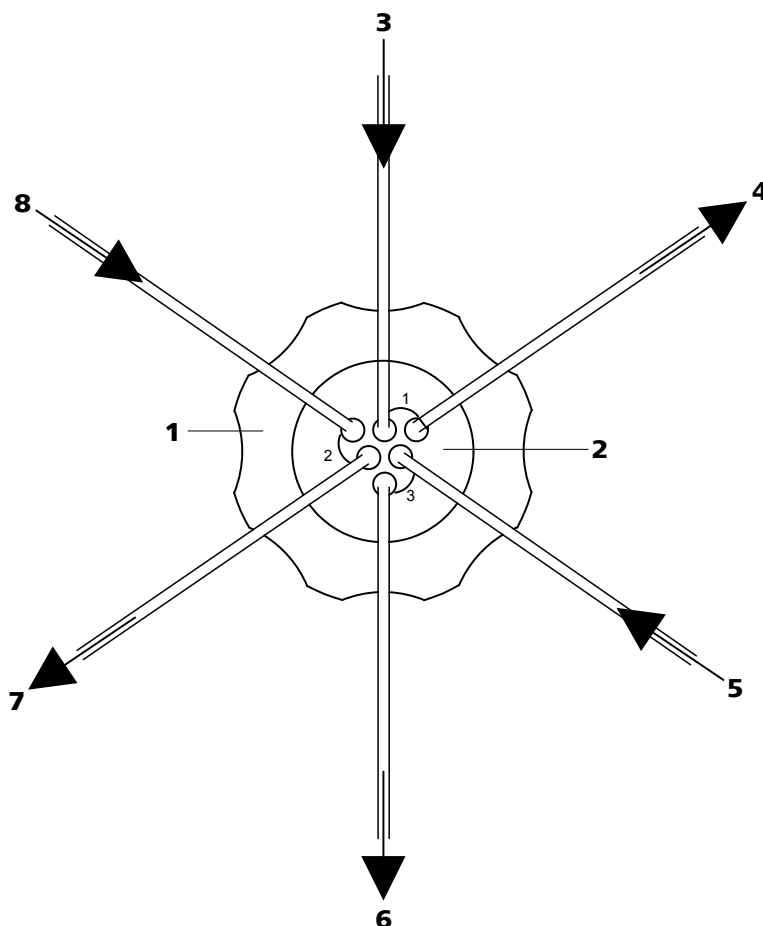


Figure 30 MSM-HC – Connectors

<b>1</b> Union nut	<b>2</b> MSM-HC connecting piece 6.2835.010
<b>3</b> Eluent inlet capillary Labeled with <i>Eluent</i> .	<b>4</b> Eluent outlet capillary Labeled with <i>Detector</i> .
<b>5</b> Rinsing solution inlet capillary Labeled with <i>H2O</i> .	<b>6</b> Rinsing solution outlet capillary Labeled with <i>Waste</i> .
<b>7</b> Regeneration solution outlet capillary Labeled with <i>Waste</i> .	<b>8</b> Regeneration solution inlet capillary Labeled with <i>H2SO4</i> .

The PTFE capillaries firmly mounted on the MSM-HC are connected to the other components of the IC system as follows:



**CAUTION**

As the PTFE capillaries are very soft, the pressure screws should not be overtightened.

Flattened capillaries can be shortened with the help of a capillary cutter.

## Connecting the capillaries of the MSM-HC

### 1 Connecting the eluent inlet capillary

- Fasten the end of the inlet capillary labeled with *Eluent* with a 6.2744.070 short PEEK pressure screw to the output of the column.

### 2 Connecting the eluent outlet capillary

- Fasten the end of the outlet capillary labeled with *Detector* with a long PEEK pressure screw (6.2744.090) to the input of the MCS.  
OR  
Connect the end of the outlet capillary labeled with *Detector* and the detector inlet capillary with a 6.2744.040 coupling and two 6.2744.070 short pressure screws.

### 3 Connecting the rinsing solution inlet capillary

- Fasten the end of the inlet capillary labeled with *H2O* with a 6.2744.070 short PEEK pressure screw to the pump tubing connection of the pump tubing which carries the rinsing solution.

### 4 Connecting the rinsing the solution outlet capillary

- Guide the other end of the outlet capillary labeled with *Waste* into a sufficiently large waste container and fasten it there.

### 5 Connecting the regeneration solution inlet capillary

- Fasten the end of the inlet capillary labeled with *H2SO4* with a 6.2744.070 short PEEK pressure screw to the pump tubing connection of the pump tubing which carries the regeneration solution.

### 6 Connecting the regeneration solution outlet capillary

- Guide the other end of the outlet capillary labeled with *Waste* into a sufficiently large waste container and fasten it there.

The rinsing and regeneration solutions are pumped with a peristaltic pump (see Chapter 3.19, page 58).



## 3.19 Peristaltic pump

### 3.19.1 Principle of the peristaltic pump

The Peristaltic pump is used for pumping sample and auxiliary solutions. It can rotate in both directions.

The peristaltic pump pumps liquids according to the principle of displacement. The pump tubing is clamped between the rollers (31-3) and the tubing cartridge (31-5). During operation, the peristaltic pump drive rotates the roller hub (31-2), so that the rollers (31-3) push the liquid forward in the pump tubing.

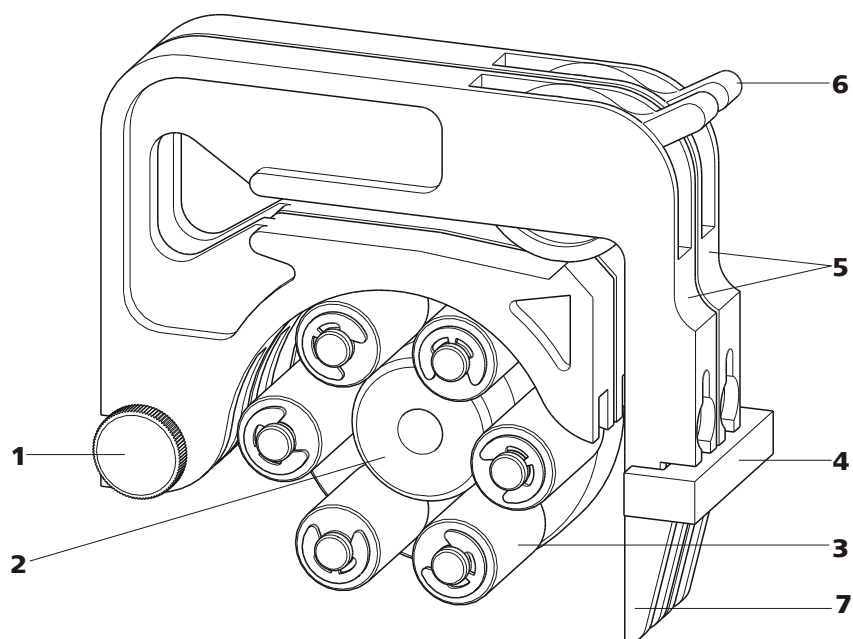


Figure 31 Peristaltic pump

<b>1</b>	<b>Knurled screw in the mounting pin</b>	<b>2</b>	<b>Roller hub</b>
<b>3</b>	<b>Rollers</b>	<b>4</b>	<b>Cartridge holder</b>
<b>5</b>	<b>Tubing cartridges 6.2755.000</b>	<b>6</b>	<b>Contact pressure lever</b>
<b>7</b>	<b>Snap-action lever</b>		

### 3.19.2 Installing the peristaltic pump

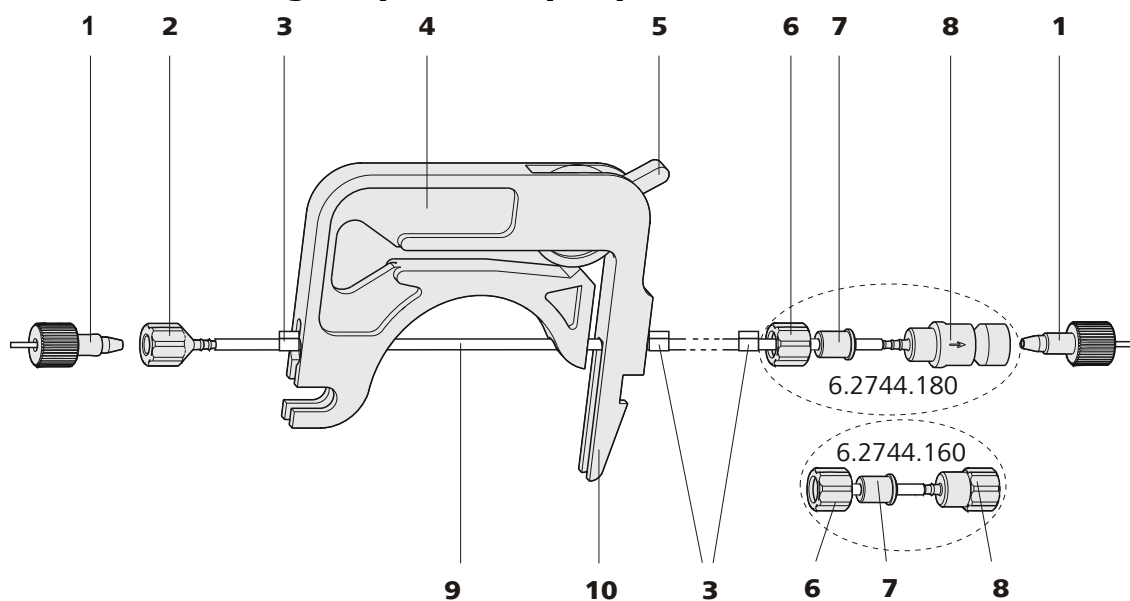


Figure 32 Installing the pump tubing

<b>1</b>	<b>PEEK pressure screws, short (6.2744.070)</b>	<b>2</b>	<b>Tubing olive (6.2744.034)</b>
<b>3</b>	<b>Stopper</b> The colors of the stopper indicate the inner diameter of the pump tubing.	<b>4</b>	<b>Tubing cartridge (6.2755.000)</b>
<b>5</b>	<b>Contact pressure lever</b>	<b>6</b>	<b>Union nut</b>
<b>7</b>	<b>Adapter</b>	<b>8</b>	<b>Tubing olive</b> Either with filter holder (6.2744.180) or without filter holder (6.2744.160).
<b>9</b>	<b>Pump tubing (6.1826.xx0)</b>	<b>10</b>	<b>Snap-action lever</b>

Mount the pump tubing as follows:

#### 1 Removing the tubing cartridge

Release the tubing cartridge from the cartridge holder by pressing the snap-action lever and unhooking from the mounting pins (31-1).

#### 2 Connecting the aspiration side

Place a 6.2744.034 tubing olive (32-2) on the aspiration side of the pump tubing.



### 3 Connecting the pressure side



#### NOTE

Depending on the use of the peristaltic pump, on the pressure side you can either connect:

- **Case A:** a 6.2744.180 pump tubing connection **with filter** (see Figure 33, page 60) or
- **Case B:** a 6.2744.160 pump tubing connection **without filter** (see Figure 34, page 61).

For pumping the auxiliary solutions to the MSM or to the SPM, a 6.2744.180 pump tubing connection **with filter must** be used.

**Case A:** 6.2744.180 pump tubing connection with filter:

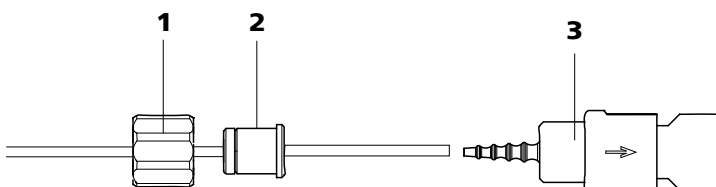


Figure 33 Install pump tubing connection with filter

**1 Union nut**

**2 Adapter**

**3 Tubing olive with filter holder**

- Slide union nut (33-**1**) onto the pump tubing.
- Select a suitable adapter (33-**2**) and slide it onto the pump tubing. The type of adapter depends on the pump tubing (see Table 2, page 61).
- Place the tubing olive with filter holder (33-**3**) onto the pump tubing.
- Screw the union nut (33-**1**) onto the tubing olive (33-**3**).

or

**Case B:** 6.2744.160 pump tubing connection without filter:

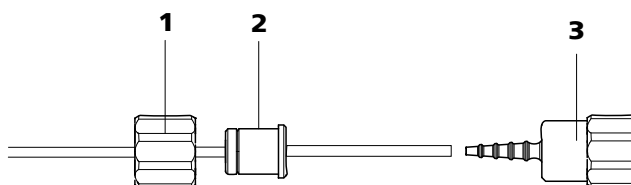


Figure 34 Install pump tubing connection without filter

**1 Union nut**

**2 Adapter**

**3 Tubing olive**

- Slide union nut (34-1) onto the pump tubing.
- Select a suitable adapter (34-2) and slide it onto the pump tubing. The type of adapter depends on the pump tubing (see Table 2, page 61).
- Place the tubing olive (34-3) onto the pump tubing.
- Screw the union nut (34-1) onto the tubing olive (34-3).

#### 4 Inserting the pump tubing

- Press the contact pressure lever all the way down.
- Place the pump tubing in the tubing cartridge. The stoppers (32-3) must snap into the corresponding holders of the tubing cartridge.





#### 5 Inserting the tubing cartridge

- Hang the tubing cartridge in the mounting pin and press in the cartridge holder until the snap-action lever snaps in.





#### 6 Connecting the capillaries

- Screw the respective capillaries tightly to the two tubing olives with PEEK pressure screws (32-1).

Table 2 Pump tubings and suitable adapters

Pump tubing	Adapter
6.1826.020 (blue/blue)	
6.1826.310 (orange/green)	
6.1826.320 (orange/yellow)	
6.1826.330 (orange/white)	



Pump tubing	Adapter
6.1826.340 (black/black)	
6.1826.360 (white/white)	
6.1826.380 (gray/gray)	
6.1826.390 (yellow/yellow)	

### Set flow rate

The contact pressure of the tubing cartridge must be adjusted in order to regulate the flow rate. Proceed as follows:

#### Set the contact pressure

- 1
  - Fully loosen the contact pressure lever (32-5), i.e. press it all the way down.
  - Switch on the peristaltic pump.
  - Raise the contact pressure lever one step at a time until liquid flows.
  - When liquid starts flowing, raise the contact pressure lever by an additional 2 ratchet increments.

The contact pressure is now set optimally.

The delivery rate depends not only on the correct contact pressure but also on the interior diameter of the pump tubing and the rotational speed of the drive.



#### NOTE

Pump tubings are consumable material. The service life of the pump tubings depends on the contact pressure amongst other factors.

## 3.20 Metrohm CO<sub>2</sub> suppressor (MCS)

### 3.20.1 General information on the MCS

The MCS removes the CO<sub>2</sub> from the eluent flow. This reduces the background conductivity, improves the detection sensitivity and minimizes the injection and carbonate peaks.

The MCS is used for removing CO<sub>2</sub> from the eluent flow before detection. CO<sub>2</sub> can reach the eluent flow through the sample itself or arise through the suppression reaction in the MSM.

The CO<sub>2</sub> peak is effectively minimized through connection of the MCS between the MSM and detector. The principle is based on the gas permeability of the fluoropolymer membrane inside the degassing cell of the MCS. The eluent is guided through a capillary with a fluoropolymer membrane inside the degassing cell. A vacuum is generated in the degassing cell via a pump. At the same time, the pump sucks CO<sub>2</sub>-free air (CO<sub>2</sub> is removed by a CO<sub>2</sub> adsorption cartridge (36-4)) through the degassing cell. The pressure and concentration difference in the degassing cell in comparison to the inside of the capillary now causes the CO<sub>2</sub> to diffuse out of the eluent flow.

### 3.20.2 Connecting MCS

The MCS is connected between the MSM (see Chapter 3.18, page 55) and detector.

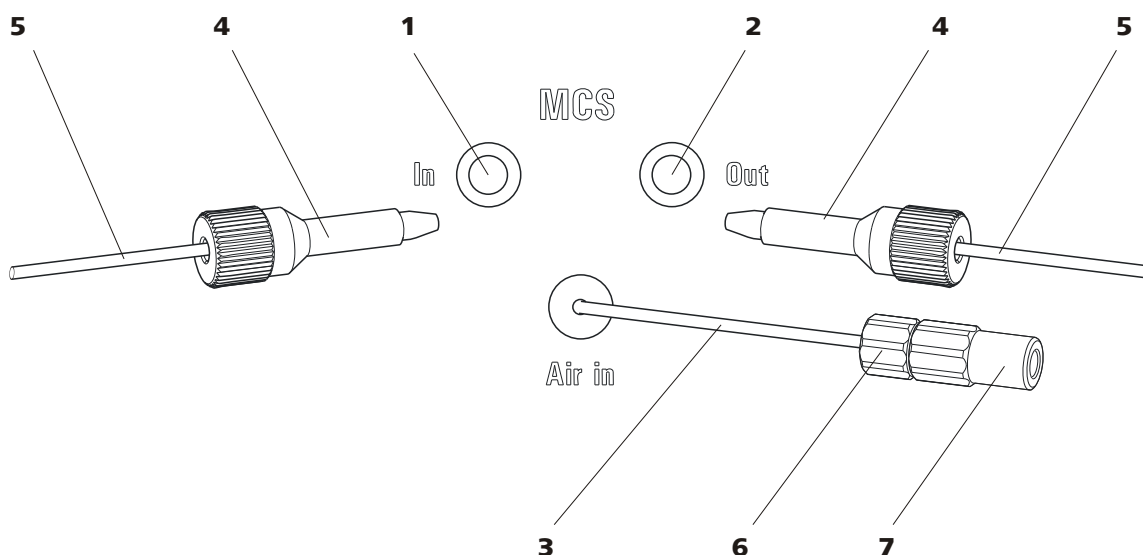


Figure 35 MCS – connection

**1 MCS input**  
Connection to the MSM.

**2 MCS output**  
Connection to the detector.



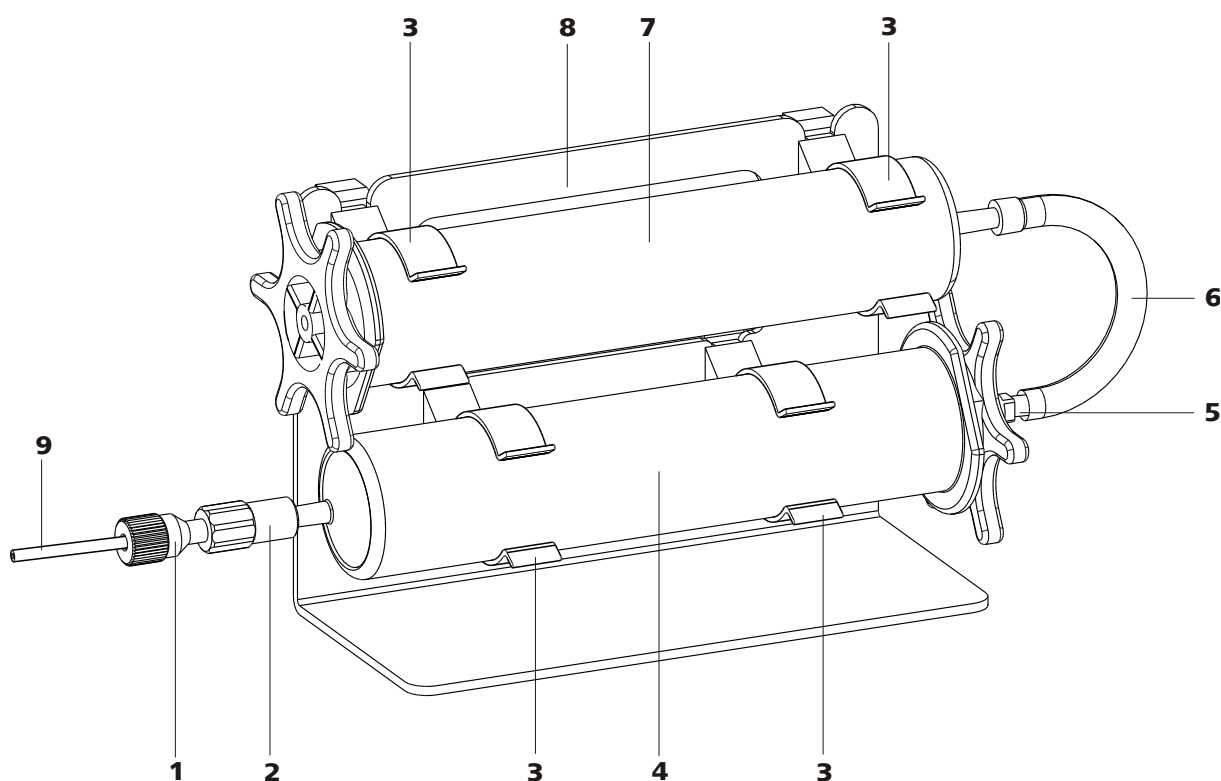


Figure 36 Adsorption cartridge holder

<b>1</b>	<b>PEEK pressure screw, short 6.2744.070</b>	<b>2</b>	<b>Luer coupling 6.2744.120</b>
<b>3</b>	<b>Clips</b> For fastening the adsorption cartridges.	<b>4</b>	<b>CO<sub>2</sub> adsorption cartridge 6.2837.000</b> For removing the CO <sub>2</sub> from the aspirated air. 3-layer filled, blue-brown-gray.
<b>5</b>	<b>Adapter 6.1808.190</b> For connecting the H <sub>2</sub> O adsorption cartridge and CO <sub>2</sub> adsorption cartridge.	<b>6</b>	<b>PVC tubing</b> For connecting the H <sub>2</sub> O adsorption cartridge and CO <sub>2</sub> adsorption cartridge.
<b>7</b>	<b>H<sub>2</sub>O adsorption cartridge 6.2837.010</b> For removing the H <sub>2</sub> O from the aspirated air. Filled with bead desiccant.	<b>8</b>	<b>Adsorption cartridge holder 6.2057.080</b>
<b>9</b>	<b>MCS aspirating capillary</b> Connection to the MCS. Corresponds to (35-3).		

### Installing the adsorption cartridges

#### 1 Preparing the adsorption cartridge holder

Push the 4 clips (36-3) into the slot of the adsorption cartridge holder (36-8).

**2 Removing the caps**

- Remove the two locking caps at the tip of the two cartridges.
- In the case of the H<sub>2</sub>O adsorption cartridge, replace the round sealing cap on the larger end with the star-shaped sealing cap.

**3 Connecting the CO<sub>2</sub> adsorption cartridge**

- Insert the CO<sub>2</sub> adsorption cartridge into the coupling (36-2) on the end of the MCS aspirating capillary .
- Click the CO<sub>2</sub> adsorption cartridge into the two lower clips (36-3) of the adsorption cartridge holder (36-8).

**4 Connecting the PVC tubing**

- Insert the adapter (36-5) into the CO<sub>2</sub> adsorption cartridge.
- Fasten the PVC tubing (36-6) on the adapter (36-5).

**5 Connecting the H<sub>2</sub>O adsorption cartridge**

- Place the H<sub>2</sub>O adsorption cartridge into the PVC tubing (36-6).
- Click the H<sub>2</sub>O adsorption cartridge into the two upper clips (36-3) of the adsorption cartridge holder (36-8).

**6 Placing the adsorption cartridge holder in the instrument**

- Place the adsorption cartridge holder with cartridges into the detector chamber of the instrument.

## 3.21 Conductivity detector

The conductivity detector continuously measures the conductivity of the liquid passing through and indicates these signals in digital form (DSP – Digital Signal Processing). The conductivity detector exhibits outstanding thermal stability and thus guarantees reproducible measuring conditions.



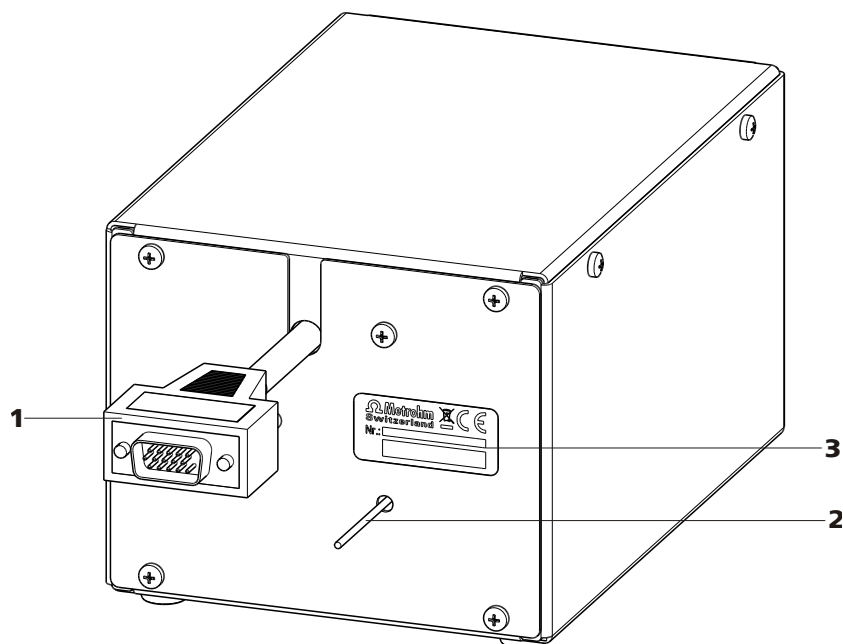


Figure 38 Conductivity detector rear

**1 Detector cable**

With mounted plug.

**2 Detector output capillary**

Permanently installed.

**3 Type plate**

With serial number.



**NOTE**

In order to prevent unnecessary peak widening after separation, the connection between the outlet of the separation column and the inlet in the detector should be kept as short as possible.

**Connecting the detector input capillary to the MCS**

- 1 ■ Fasten the detector input capillary (39-1) using a 2.2744.090 long PEEK pressure screw (39-2) on the output of the MCS (39-3).

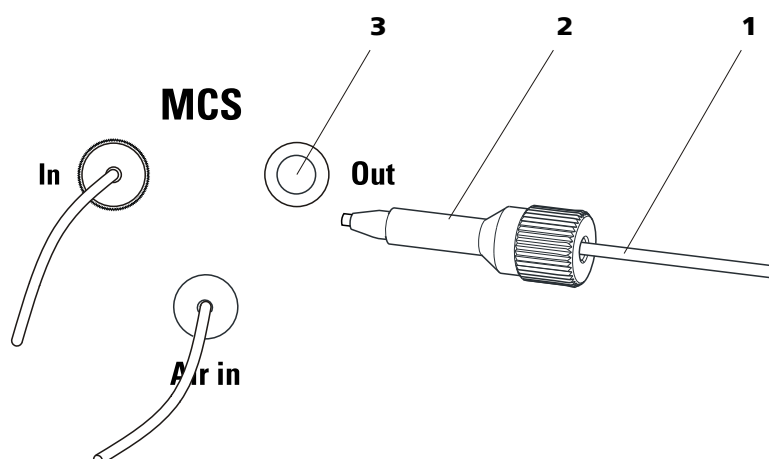


Figure 39 Connection detector – MCS

1 Detector input capillary

2 Pressure screw, long 6.2744.090

3 MCS output

## 3.22 Connecting the instrument

### 3.22.1 Connecting the instrument to the PC



#### NOTE

The instrument must be turned off when connecting the PC.

#### 1 Connecting the USB cable

Connect the PC connection socket (2-**18**) of the instrument to a USB connector of the computer via the 6.2151.020 USB cable.

### 3.22.2 Connecting the instrument to mains supply



#### WARNING

The power supply unit must not get wet. Protect it against the direct effect of liquids.

#### Mains cable

Which mains cable is supplied depends on the location:

- 6.2122.020 with plug SEV 12 (Switzerland, ...)
- 6.2122.040 with plug CEE(7), VII (Germany, ...)
- 6.2122.070 with plug NEMA 5-15 (USA, ...)



The mains cable is three-core and provided with a plug with grounding. If another plug has to be mounted, the yellow/green conductor (IEC standard) must be connected to the protective ground (protection class I).

### 1 Connecting the mains cable

- Plug the mains cable into the mains connection socket (2-4).
- Connect the mains cable to the mains supply.

### 2 Switching the instrument on and off

Switch the instrument on and off with the mains switch (2-3).

After switching on, the LED on the front of the instrument flashes while a system test is carried out and the connection to the software is established. Once the system test is complete and the connection to the software has been established, the LED lights up continuously.

## 3.23 Guard column

The use of guard columns serves for protecting the separation column and increasing their service life considerably. The guard columns available from Metrohm represent either actual guard columns or are so-called guard column cartridges which are used together with a cartridge holder. The installation of a guard column cartridge in the associated holder is described in the information sheet of the guard columns.



#### NOTE

Information regarding which guard column is suitable for your separation column can be found in the **Metrohm IC Column Program** (which is available from your Metrohm agent), the information sheet provided along with your separation column, the product information on the separation column at <http://www.metrohm.com> (product area Ion Chromatography), or obtained directly from your agent.



#### CAUTION

New guard columns are filled with solution and are sealed on both sides with stoppers or caps, respectively. Before using the guard column, you need to ensure that this solution is miscible with the eluents used (observe manufacturer's data).

**NOTE**

The guard column may only be installed after the **initial start-up** (see *Chapter 4.1, page 74*) of the instrument. Until then, use the 6.2744.040 coupling instead of the guard and separation column.

**Connecting and rinsing the guard column****1 Connecting the guard column****CAUTION**

When inserting the guard column, always ensure that it is inserted correctly corresponding to the flow direction (if indicated).

- Remove locking caps and/or stoppers from the guard column.
  - Fasten the lower end of the guard column with a 6.2744.070 short PEEK pressure screw to the column input capillary .
  - Fasten the connection capillary (3.4224.240) enclosed with the guard column to the upper end of the guard column with a 6.2744.070 short PEEK pressure screw.
- Guard columns are also available which can be screwed with the upper end directly onto the separation column.

**2 Rinsing the guard column**

- Place beaker under the outlet capillary of the guard column.
- Start the high pressure pump and rinse the guard column approx. 5 minutes with eluent. Set the flow according to the corresponding column information sheet.
- Switch off the high pressure pump again.



## 3.24 Separation column

The intelligent separation column (iColumn) is the heart of the ion chromatographic analysis. It separates the different components corresponding to their interactions with the column. Metrohm analytical columns are equipped with a chip on which their technical specifications and their history (first use / setting up, operating hours, injections, ... ) are saved.



### NOTE

Information regarding which separation column is suitable for your application can be found in the **Metrohm IC Column Program**, the product information for your separation column at <http://www.metrohm.com> in the product area ion chromatography, or obtained directly from your agent.



### CAUTION

New separation columns are filled with solution and are sealed on both sides with stoppers. Before using the column, you need to ensure that this solution is miscible with the eluents used (observe manufacturer's data).

You can find the separation columns and guard columns currently available from Metrohm in the Metrohm IC Column Program, or in the Internet at <http://www.metrohm.com> in the product area Ion Chromatography. A test chromatogram and an information sheet are provided along with each column. You can request detailed information on special IC applications in the corresponding "**Application Bulletins**" or "**Application Notes**", available in the Internet at <http://www.metrohm.com> in the Applications area or via the Metrohm agent responsible free of charge.



### NOTE

The separation column may only be installed after the **initial start-up** (see Chapter 4.1, page 74) of the instrument. Until then, use the 6.2744.040 coupling instead of the guard and separation column.

## Connecting and rinsing the separation column

### 1 Connecting the separation column



#### CAUTION

When using the columns, always ensure that these are correctly inserted corresponding to the flow direction indicated.

- Remove stoppers from the separation column.
- Connect the lower end of the separation column with a 6.2744.070 short PEEK pressure screw to the outlet capillary of the guard column (if used), or to the column input capillary .

### 2 Rinsing the separation column

- Place beaker under the outlet end of the separation column.
- Set the flow rate of the high pressure pump to the value suitable for the separation column selected.
- Start the high pressure pump and rinse the separation column approx. 10 minutes with eluent.
- Switch off the high pressure pump again.

### 3 Mounting the separation column

- Hang separation column with chip into the column holder.



#### NOTE

The iColumns are equipped with a chip on which their operating data is saved. The chip has to be hooked into the chip holder provided for this so that the column recognition can function.



#### 4 Setting the contact pressure of the peristaltic pump



##### NOTE

This work step needs to be performed only if a peristaltic pump is being used.

- If peristaltic pumps are used, set the contact pressure (see "Set flow rate", page 62).

#### 5 Rinsing the instrument without columns

- Rinse the instrument (without columns) with eluent for 5 minutes.

The instrument is now prepared for the installation of the columns (see Chapter 3.23, page 70).

## 4.2 Conditioning

After the installation and after switching on the instrument, the system must be conditioned with eluent until a stable baseline is reached.



##### NOTE

After a change of eluent (see Chapter 5.4.2.3, page 80), the conditioning time can lengthen considerably.

### Conditioning the system

#### 1 Preparing the software



##### CAUTION

Ensure that the flow set is not higher than the flow permissible for the corresponding column (see column information sheet and chip data set).

- Start the PC program **MagIC Net**.
- Open the **Equilibration** tab in **MagIC Net**.
- Select (or create) a suitable method.



## 2 Preparing the instrument

- Ensure that the column is correctly mounted in accordance with the flow direction indicated on the label (arrow must point in the direction of flow).
- Ensure that the eluent aspiration tubing is immersed in the eluent and that there is enough eluent in the eluent bottle.

## 3 Checking leak-tightness

- In **MagIC Net**, start the equilibration.
- Check all capillaries and their connections from the high pressure pump to the detector block for signs of liquid escaping. If eluent escapes anywhere, tighten the corresponding pressure screw or loosen the connection, check the end of the capillary, shorten it with a capillary cutter if necessary, and restore the connection.

## 4 Conditioning the system

Rinse the system with eluent until the required stability of the baseline is attained (normally 30 minutes).

The instrument is now ready for measuring samples.

## 5 Operation and maintenance

### 5.1 General information

#### 5.1.1 Care



#### WARNING

The instrument housing must not be opened by untrained personnel.

The instrument requires appropriate care. Excess contamination of the instrument may result in functional disruptions and a reduction in the service life of the sturdy mechanics and electronics.



#### CAUTION

Although this is extensively prevented by design measures, the mains plug should be unplugged immediately if aggressive media has penetrated the inside of the instrument, so as to avoid serious damage to the instrument electronics. In such cases, the Metrohm Service must be informed.

On the rear of the instrument, the drainage tubings must be mounted and the leak sensor must be plugged in and activated as protection against escaping liquids.

Spillages of chemicals and solvents should be cleaned up immediately. In particular, the plug connections on the rear panel of the instrument (especially the mains plug) should be protected from contamination.

#### 5.1.2 Maintenance by Metrohm Service

Maintenance of the instrument is best carried out as part of an annual service, which is performed by specialist personnel of the Metrohm company. If working frequently with caustic and corrosive chemicals, a shorter maintenance interval is recommended. The Metrohm service department offers every form of technical advice for maintenance and service of all Metrohm instruments.



### 5.1.3 Operation



#### CAUTION

In order to avoid disturbing temperature influences, the entire system including the eluent bottle must be protected against direct sunlight.

### 5.1.4 Shutting down

If the instrument is shut down for a longer period, the entire IC system (without separation column) must be rinsed salt-free with methanol/ultra pure water (1:4), in order to prevent eluent salts from forming crystals which may cause subsequent damage.

Guard column and separation column are excluded from the eluent path for rinsing. The connection capillaries are directly connected to one another with a 6.2744.040 coupling. Rinsing is carried out with methanol/ultra pure water (1:4) until the conductivity drops below 10  $\mu\text{S}/\text{cm}$ .

Rinse with eluent for at least 15 minutes at starting up again and before connecting the guard column and separation column.

## 5.2 Capillary connections

### 5.2.1 Operation

All connections between injection valve (*see Chapter 3.16, page 50*), separation column (*see Chapter 3.24, page 72*) and detector (*see Chapter 3.21, page 66*) must be as short as possible, have a low dead volume and be completely leak-tight. The PEEK capillary after the detector must be free of blockages (the measuring cell is tested to 5 MPa = 50 bar back-pressure). Only use PEEK capillaries with an internal diameter of 0.25 mm in the high pressure range between the high pressure pump (*see Chapter 3.12, page 42*) and the detector.

## 5.3 Door



### CAUTION

The door is made of PMMA (polymethylmetacrylate). It must never be cleaned with abrasive media or solvents.



### CAUTION

Never use the door as a handle.

## 5.4 Eluent

### 5.4.1 Production

The chemicals used for the production of eluents should have a degree of purity of at least "p.a.". Only ultra pure water (resistance > 18.2 MΩ\*cm) may be used for dilution (this generally applies for reagents which are used in ion chromatography).

Newly produced eluents should always be microfiltered (filter 0.45 µm).



### CAUTION

Only microfiltered (filter 0.45 µm) eluents may be used.

The composition of the eluent has a crucial effect on the chromatographic analysis:

<b>Concentration</b>	An increase in the concentration generally leads to shorter retention times and faster separation, but also to higher background conductivity.
<b>pH</b>	pH changes result in shifts in the dissociation equilibria and hence changes in the retention times.
<b>Organic solvents</b>	The addition of an organic solvent (e.g. methanol, acetone, acetonitrile) to aqueous eluents generally accelerates lipophilic ions.



## 5.4.2 Operation

### 5.4.2.1 Supply bottle

The supply bottle with the eluent must be connected as indicated in *Chapter 3.9.1, Page 33*. This is above all important for eluents with volatile solvents (e.g. acetone).

Moreover, condensation must also be prevented in the eluent bottle. Drop formation can change the concentration ratio in the eluent.

### 5.4.2.2 Aspiration filter

To protect the IC system against foreign particles, we recommend aspirating the eluents via a 6.2821.090 aspiration filter (**13-2**). This aspiration filter must be replaced should it show signs of yellow discoloration (but no later than every 3 months).

In the case of very sensitive measurements, the eluent should be stirred constantly with a magnetic stirrer.

### 5.4.2.3 Changing the eluent

When changing the eluent, it must be ensured that no precipitates can occur. Solutions following one another in direct succession must therefore be miscible. If the system has to be rinsed organically, several solvents with rising or falling lipophilia must be used.

## 5.5 High pressure pump

### 5.5.1 Protection



#### CAUTION

The pump head is filled ex works with methanol/ultra pure water. It must be ensured that the eluent used is freely miscible with the solvent remaining in the pump head.

To protect the high pressure pump against **foreign particles**, we recommend that the eluent undergoes a **microfiltration** (filter 0.45 µm) before being aspirated via a 6.2821.090 aspiration filter (*see "Assembling eluent aspiration tubing", page 33*).

**Salt crystals** between the piston and seal cause abrasion particles which can find their way into the eluent. These lead to contaminated valves, a rise in pressure and in extreme cases scratched pistons. It is therefore essential to ensure that **no precipitates** can occur (*see Chapter 5.4.2.3, page 80*).

**CAUTION**

In order to spare the pump seals, the pump should not be operated dry. Therefore ensure that the eluent supply is correctly connected and that there is enough eluent in the eluent bottle each time before turning on the pump.

**5.5.2 Maintenance****CAUTION**

Maintenance work on the high pressure pump may not be carried out unless the **instrument is switched off**.

**Pump head maintenance**

An unstable baseline (pulsation, flow fluctuations) is in many cases the result of contaminated valves (46-2), (46-3) or defective, leaking piston seals on the high pressure pump. Proceed as follows for cleaning contaminated valves and/or replacing worn parts such as pistons, piston seal and valves:

This maintenance work should be carried out at least once a year.

**Removing the pump head**

- 1 Turn off high pressure pump and wait until pressure is released.
- 2 Loosen the pressure screw on the inlet valve holder (21-2) and unscrew the connection tubing together with the coupling (21-9) pump head input capillary (21-7) and eluent aspiration tubing from the pump head.
- 3 Unscrew the pump head output capillary (21-13) from the pump head.
- 4 Remove pump head from the pump housing by loosening the 4 fastening screws (21-5) using the 6.2621.030 hexagon key. The main piston is on the left (viewed from the front), and the auxiliary piston is on the right.



## Cleaning/replacing the zirconium oxide piston

Clean one piston after the other as follows:

### 1 Removing the piston cartridge from the pump head

Loosen the piston cartridge with a wrench and unscrew from the pump head by hand.

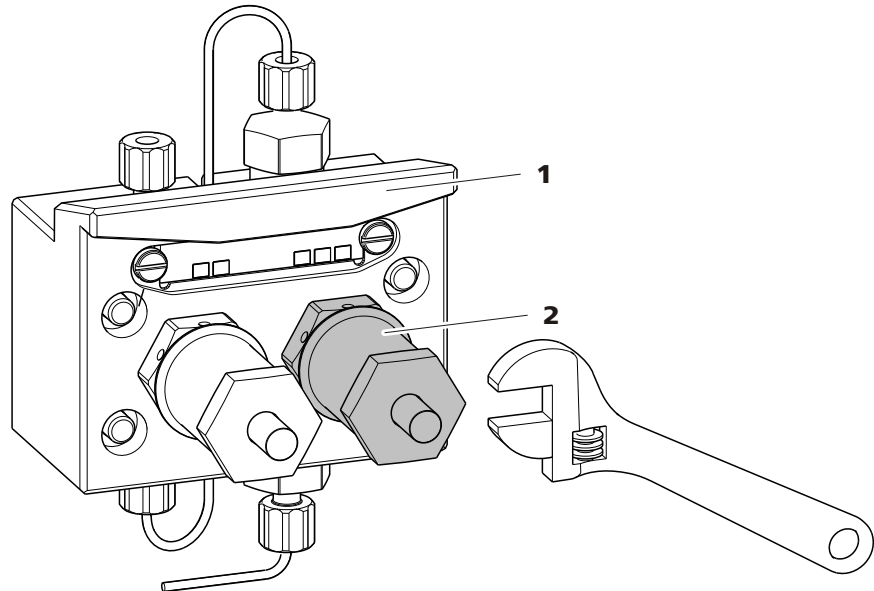


Figure 40 Removing piston

1 Pump head

2 Piston

### 2 Dismantling the piston



#### CAUTION

On the inside of the piston cartridge there is a taut spring than can jump out of the piston cartridge if suddenly losing tension.

When opening the piston cartridge, hold pressure towards the spring and unscrew carefully.

- Loosen the screw of the piston cartridge with a wrench and unscrew carefully by hand and by holding pressure towards the taut spring.
- Remove the zirconium oxide piston and lay on a tissue.
- Remove the spring retainer, spring and the inner plastic sleeve from the piston cartridge and lay by.

- Remove the backup ring from the pump head and lay to the other parts.

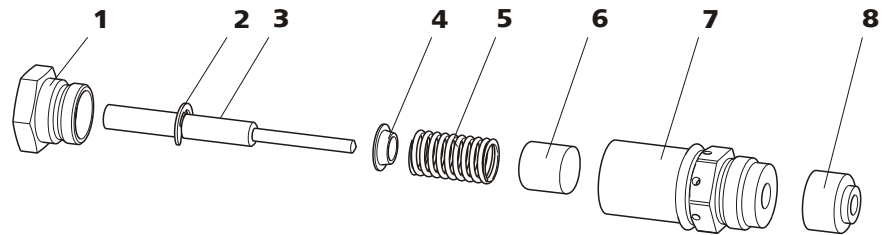


Figure 41 Components of the piston cartridge

<b>1</b>	<b>Piston cartridge screw</b>	<b>2</b>	<b>Retaining washer</b>
<b>3</b>	<b>Zirconium oxide piston with piston shaft</b> Order number: 6.2824.070.	<b>4</b>	<b>Spring retainer</b>
<b>5</b>	<b>Spring</b> Order number: 6.2824.060.	<b>6</b>	<b>Inner plastic sleeve</b> Protects from metallic abrasion.
<b>7</b>	<b>Piston cartridge</b>	<b>8</b>	<b>Backup ring</b>

### 3 Cleaning the components of the piston

- Clean zirconium oxide pistons contaminated by abrasion or deposits with pure abrasive cleaning powder, rinse particle free with ultra pure water and dry.  
Replace highly contaminated or scratched zirconium oxide pistons (spare part: 6.2824.070 zirconium oxide piston).
- Rinse the other parts of the piston and dry with a lint-free cloth.

### 4 Assembling the piston

- Insert the inner plastic sleeve, spring and spring retainer into the piston cartridge.
- Slide the zirconium oxide piston carefully into the piston cartridge until its tip emerges from the small opening of the piston cartridge.
- Attach screw and tighten by hand.

### Replacing the piston seal

The 6.2617.010 special tool (see Figure 42, page 84) is necessary in order to remove the piston seal from the pump head. It consists of two



parts: a tip for removing the old piston seal and a sleeve for inserting the new piston seal.

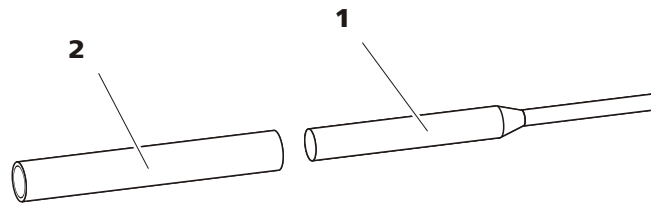


Figure 42 Tool for piston seal 6.2617.010

**1 Pin**  
Pin for removing the old piston seal.

**2 Sleeve**  
Sleeve for inserting the new piston seal.



### CAUTION

Screwing the 6.2617.010 special tool for the piston seal into the piston seal destroys this completely!

### 1 Removing the piston seal



### CAUTION

Avoid touching the sealing surface in the pump head (21-4) with the tool.

Screw the special tool for the piston seal (42-1) with the narrow side just as far into the piston seal as the same can be removed.

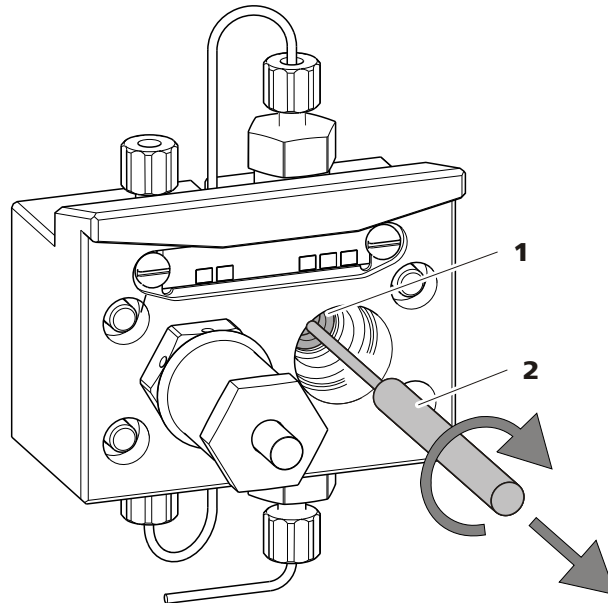


Figure 43 Removing the piston seal

**1** Piston seal

**2** Tool for piston seal  
Pin of the tool.

### 2 Inserting the new piston seal into the tool

Insert the new piston seal tightly by hand into the recess of the sleeve of the tool for the piston seal (42-2). The sealing springs must be visible from the outside.

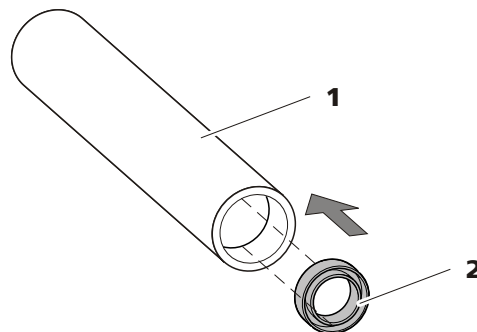


Figure 44 Inserting the piston seal into the tool

**1** Tool for piston seal 6.2617.010  
Sleeve for inserting the new piston seal.

**2** Piston seal  
Order number: 6.2741.020

### 3 Inserting the new piston seal into the pump head

Guide the sleeve of the tool for the piston seal (42-2) with inserted piston seal into the pump head and press the seal with the wide end of the tool for the piston seal (42-1) into the pump head recess.

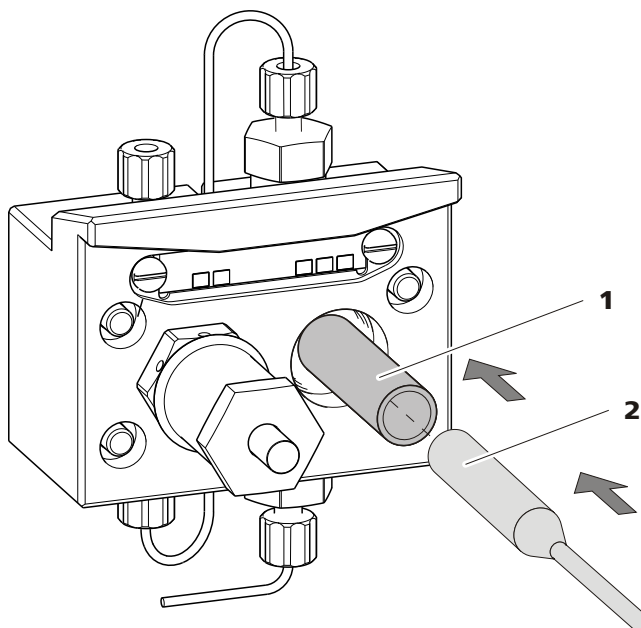


Figure 45 Inserting the piston seal into the pump head

#### 4 Replacing the piston cartridge

Screw the assembled piston cartridge back into the pump head and tighten, first by hand, then additionally by approx. 15° with a wrench.

### Cleaning the inlet valve and outlet valve

#### 1 Removing valves

- Unscrew the connection capillary for the auxiliary piston (21-1) from the outlet valve holder.
- Unscrew the holders for the inlet and outlet valves and remove valves.

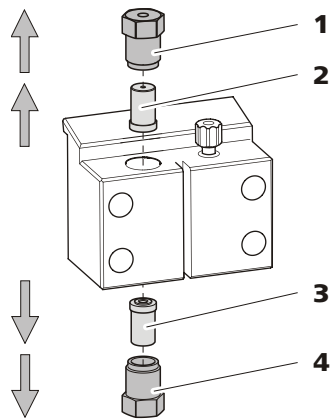


Figure 46 Removing valves

**1 Outlet valve holder****2 Outlet valve**

Order number: 6.2824.160

**3 Inlet valve**

Order number: 6.2824.170

**4 Inlet valve holder****2 Cleaning undissected valve**

Clean contaminated or blocked valves initially **without** dismantling them completely.

- Rinse the valve in eluent flow and counterflow direction using a spray bottle filled with ultra pure water, RBS solution or acetone.
- The rinsing effect is further increased through a short treatment (lasting for a maximum of 20 s) in an ultrasonic bath.

**NOTE**

Longer lasting ultrasonic baths can damage the ruby ball of the valve.

Only if this cleaning is useless, dismantle the valves separately and clean the components.

**3 Dismantling valve**

Dismantle every valve separately.

**NOTE**

For dismantling the valve the 6.2617.020 tool for valve cartridges is required.



- Place the valve with the seal faced downwards above the recess in the holder.
- Push the valve components out of the valve housing using the needle of the tool.

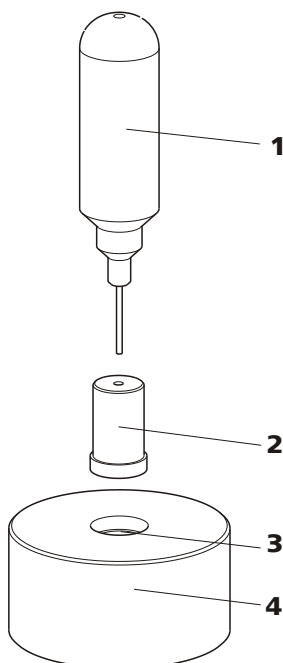


Figure 47 Dismantling valve

**1 Needle**

For pushing the valve components out of the valve housing.

**2 Valve**

**3 Holder**

**4 Recess**

For collecting the valve components.

The components of the valve are collected in the recess of the holder.



**NOTE**

The components of the valve are very small. In order not to lose them, put the components into a dish.

- The inlet valve and the outlet valve consist of the same, just differently arranged components (see Figure 48, page 89).

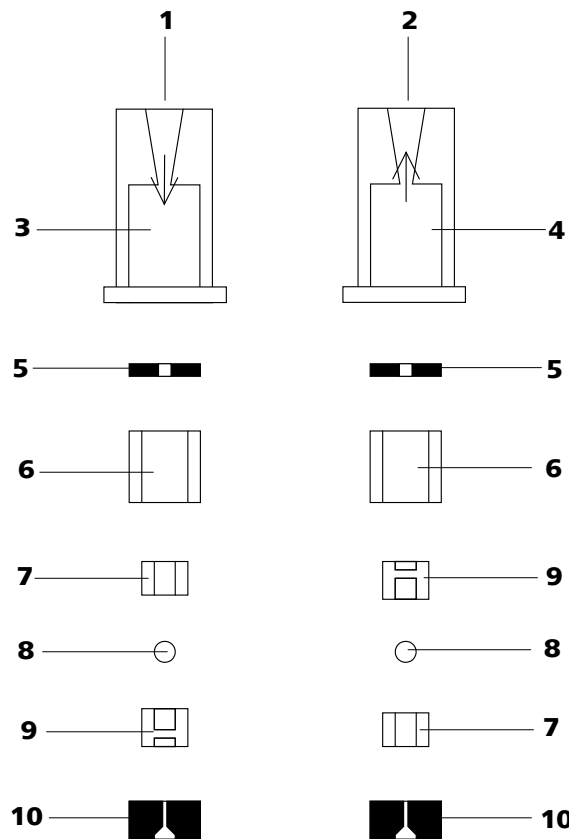


Figure 48 Components of the inlet valve and outlet valve

<b>1</b>	<b>Inlet valve 6.2824.170</b>	<b>2</b>	<b>Outlet valve 6.2824.160</b>
<b>3</b>	<b>Inlet valve housing</b>	<b>4</b>	<b>Outlet valve housing</b>
<b>5</b>	<b>Sealing ring (black)</b>	<b>6</b>	<b>Sleeve</b>
<b>7</b>	<b>Sapphire sleeve</b> The shiny side must point to ruby ball.	<b>8</b>	<b>Ruby ball</b>
<b>9</b>	<b>Ceramic holder for ruby ball</b>	<b>10</b>	<b>Seal</b> The larger opening must point outwards.

#### 4 Cleaning the components of the valve

Rinse the valve components with ultra pure water and/or acetone and dry with a lint-free cloth.

#### 5 Reassembling the valve

Reassemble valve components *according to figure 48, page 89*.

- Insert the seal with the larger opening faced downwards into the recess of the tool.
- Lay the other valve components above another in the correct sequence (*see Figure 48, page 89*).



- Place over the valve housing and hold it tightly.
- By tilting the tool, the valve components slide into the valve housing.
- Press the seal by hand well on the valve housing.

## 6 Checking the flow direction

Rinse the valve in the direction of the arrow on the valve housing and check whether liquid is escaping on the other end.

If this is not the case, the valve has to be dismantled again and be reassembled correctly (see *Figure 48, page 89*).

## 7 Inserting the valves back into the pump head



### CAUTION

If by mistake, the inlet valve is mounted instead of the outlet valve, an extreme pressure builds up within the working cylinder, which can destroy the piston seal!

When inserting the valves, please take into account that the liquid is being pumped through the pump head from bottom to top.

- Insert the inlet valve into the inlet valve holder the way the seal is visible.
- Screw the inlet valve holder into the bottom of the pump head and tighten with a wrench (46-4).
- Insert the outlet valve into the outlet valve holder the way the seal is visible.
- Screw the outlet valve holder into the top of the pump head and tighten with a wrench (46-1).

## Mounting the pump head



### NOTE

To prevent the pump head from being positioned the wrong way, it is provided with different bore hole depths for the fastening bolts, i. e. a fastening bolt is longer than all others. The bore hole with the greatest depth must therefore be assigned to the longest bolt. If this is not the case, the pump will not function perfectly.

- 1** Mount the pump head on the pump again using the four fastening screws (21-5). Firmly tighten the screws with the 6.2621.030 hexagon key.
- 2** Screw connection capillaries (21-1), (21-7) and (21-13) onto the pump head again.

## 5.6 Inline filter

### 5.6.1 Maintenance

The 6.2821.120 inline filters comprise the filter housing (49-2), the filter screw (49-4) and the filter (49-3). New filters (49-3) are available under the order number 6.2821.130 (10 items).

The 6.2821.130 filters (24-3) should be changed every 3 months (more frequently at higher backpressure).

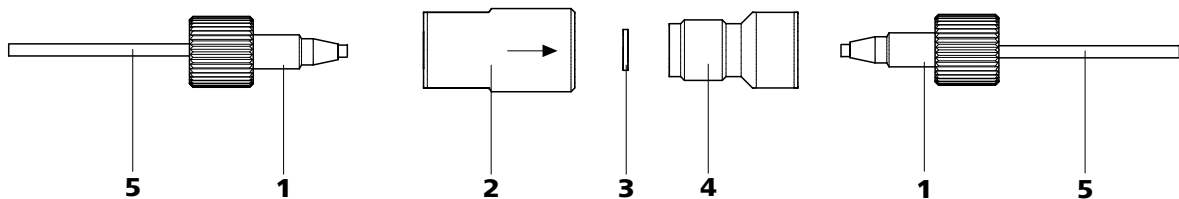


Figure 49 Changing the filter

**1 PEEK pressure screws, short**  
6.2744.070

**3 6.2821.130 filter**  
Packaging contains 10 items.

**5 Connection capillaries**

**2 Filter housing**  
Housing of the inline filter. Part of the 6.2821.120 accessories.

**4 Filter screw**  
Screw of the inline filter. Part of the 6.2821.120 accessories.



## Changing the filter

The flow must be stopped before changing the filter.

### 1 Removing the inline filter

- Unscrew the pressure screws (49-1) from the inline filter.

### 2 Unscrewing the filter screw

- Screw the filter screw (49-4) out of the filter housing (49-2) with the aid of two 6.2621.000 adjustable wrenches.

### 3 Inserting the filter

- Remove the old filter (49-3) with tweezers.
- Place the new filter (49-3) flat in the filter housing with tweezers (49-2).

### 4 Mounting filter screw

- Screw the filter screw (49-4) back into the filter housing (49-2) and tighten by hand. Then additionally tighten slightly with two 6.2621.000 adjustable wrenches.

### 5 Remounting the inline filter

- Screw the pressure screws (49-1) back onto the inline filter.

### 6 Rinsing the inline filter

- Dismantle the guard column (if present) and the separation column and replace with a 6.2744.040 coupling.
- Rinse the instrument with eluent.

## 5.7 Inline sample preparation

To protect the separation column (see *Chapter 3.24, Page 72*) against foreign particles which can affect the separating efficiency, we recommend that all samples undergo a microfiltration (filter 0.45 µm). The ultrafiltration cell can be used for **filtration** (see documentation on the *IC Equipment for Ultrafiltration*).

Samples containing significant amounts of **gas** should be degassed. The sample degasser (see *Chapter 3.15, Page 48*) (if available) is used for degassing.

**Matrix-loaded** samples (e.g. blood, oil) should be prepared for the measurement by means of dialysis (see documentation on the *IC Equipment for Dialysis*).

If the concentration of the sample is too high, it should be **diluted** before feeding (see documentation on the *IC Equipment for Sample Dilution*).

For the sample preparation methods **Neutralization** (replacement of e.g. Na<sup>+</sup> with H<sup>+</sup>) and **cation exchange** (replacement of e.g. heavy metals with H<sup>+</sup>), a sample preparation module (SPM) is used.

## 5.8 Rinsing the sample path

Before a new sample can be measured, the sample path must be rinsed with it so that the measuring result is not falsified by the previous sample (**Sample carry-over**).

In the case of automated sample feeding, the rinsing time should be at least 3 times the **transfer time**. The transfer time is the time required by the sample to flow from the sample vessel to the end of the sample loop.

### Ascertaining the transfer time

The transfer time depends on the pump capacity of the peristaltic pump, the total capillary volume and the volume of the gas removed by the sample degasser (if used) - in other words the amount of gas in the sample.

#### 1 Emptying the sample path

Pump air through the sample path (pump tubing, tubing connections, capillary in the degasser, sample loop) for several minutes until all liquid is displaced by the air.



## 2 Aspirating the sample and measuring time

Aspirate a sample typical for the later application and use a stop watch to measure the time required by the sample to travel from the sample vessel to the end of the sample loop.

The time measured corresponds to the "transfer time". The rinsing time should be at least 3 times the transfer time.

## Checking the rinsing time

It is possible to determine whether the rinsing time is adequate via a direct measurement of the sample carry-over. Proceed as follows:

### 1 Preparing two samples

- **Sample A:** A typical sample for the application.
- **Sample B:** Ultra pure water.

### 2 Determining "Sample A"

Let "Sample A" pass through the sample path for the duration of the rinsing time, then inject and measure.

### 3 Determining "Sample B"

Let "Sample B" pass through the sample path for the duration of the rinsing time, then inject and measure.

### 4 Calculating sample carry-over

The degree of the sample carry-over corresponds to the ratio of the peak areas of the measurement for sample B to the measurement for sample A. The lower the ratio, the lower the sample carry-over. This ratio can be altered by varying the rinsing time – thus allowing the rinsing time required for the application to be ascertained.

## 5.9 Sample degasser

### 5.9.1 Operation

If you are working with sample degassing, the longer "transfer time" (*see Ascertaining the transfer time, page 93*) means that it is also necessary to rinse for longer (with the subsequent sample). The rinsing time should be at least 3 times the "transfer time" so as to minimize the carry-over effects. The "transfer time" itself depends on the pump capacity, total capillary volume and volume of gas removed (i.e. the amount of gas in the sample).



#### NOTE

When using the sample degasser, the rinsing time extends by at least 2 minutes.

## 5.10 Injection valve

### 5.10.1 Protection

To prevent contamination of the injection valve, a 6.2821.120 inline filter (*see Chapter 3.13, page 46*) should be mounted between the high pressure pump and the pulsation damper.

## 5.11 High Capacity Metrohm Suppressor Module (MSM-HC)

### 5.11.1 Protection

To protect the MSM-HC against foreign particles or bacterial growth, a 6.2744.180 pump tubing connection with filter (*see Figure 33, page 60*) must be mounted between the peristaltic pump and the inlet capillaries of the MSM-HC.

### 5.11.2 Operation



#### NOTE

The suppressor units must never be regenerated in the same flow direction in which the eluent is pumped. Therefore always mount the inlet and outlet capillaries according to diagram outlined in *figure 30*.



## 2 Regenerating the MSM-HC



### CAUTION

The pump tubings made of PVC must not be used for rinsing with solutions containing organic solvents. In this case, other pump tubings must be used for rinsing.



### NOTE

The high pressure pump can be used for regeneration. For this, remove the guard column and separation column and connect the capillary directly to the MSM-HC (regenerate in opposite direction).

- Rinse the 3 suppressor units with the following solutions for about 15 minutes each:
  - **Contamination with heavy metals:**  
1 mol/L H<sub>2</sub>SO<sub>4</sub> + 0.1 mol/L oxalic acid
  - **Contamination with organic cationic complexing agents:**  
0.1 mol/L H<sub>2</sub>SO<sub>4</sub> / 0.1 mol/L oxalic acid / acetone 5%
  - **Severe contamination with organic substances:**  
0.2 mol/L H<sub>2</sub>SO<sub>4</sub> / acetone ≥ 20%

## 3 Connecting the MSM-HC to the IC system

- Reconnect the MSM-HC to the IC system. If the capacity problems remain, the MSM-HC rotor A must be replaced (*see Chapter 5.11.3.3, page 100*).

### 5.11.3.2 Cleaning the MSM-HC

It may be necessary to clean the MSM-HC in the following cases:

- Increased backpressure onto the connection tubings of the MSM-HC.
- Blockage of the MSM-HC which cannot be eliminated (solutions can no longer be pumped through the MSM-HC).
- Jamming of the MSM-HC which cannot be eliminated (MSM-HC can no longer be switched over).

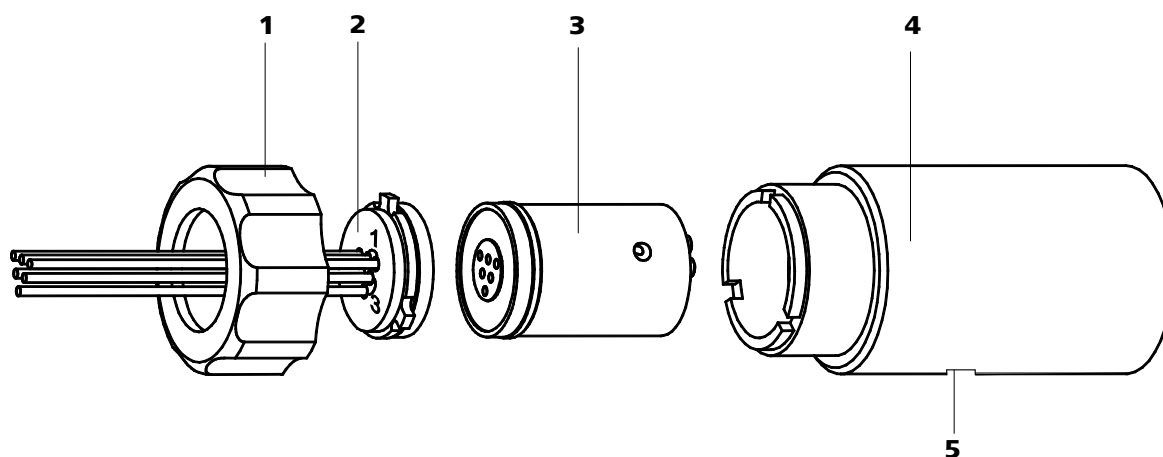


Figure 50 MSM-HC – Components

<b>1</b>	<b>Union nut</b>	<b>2</b>	<b>MSM-HC connecting piece 6.2835.010</b>
<b>3</b>	<b>MSM-HC rotor A 6.2842.000</b>	<b>4</b>	<b>MSM-HC housing</b>
<b>5</b>	<b>Slot in the MSM-HC housing</b>		

### Cleaning the MSM-HC

Clean the MSM-HC as follows:

#### 1 Disconnecting the MSM-HC from the IC system

- Switch off the instrument.
- Disconnect the MSM-HC from the separation column, peristaltic pump and detector.

#### 2 Dismantling the MSM-HC

- Unscrew union nut (50-1) from the MSM-HC housing (50-4).
- Pull the MSM-HC connecting piece (50-2) and the MSM-HC rotor A (50-3) out of the MSM-HC housing (50-4). The connecting piece and the MSM-HC rotor A normally stick to one another – if this is not the case: Take a sharp object, insert into the slot (50-5) in the MSM-HC housing, and pull out the MSM-HC rotor A (50-3) in this way.
- Detach the MSM-HC connecting piece (50-2) from MSM-HC rotor A (50-3).

#### 3 Cleaning the supply and discharge lines

- Connect in turn each of the 6 capillary tubings fastened on the MSM-HC connecting piece (50-2) on the high pressure pump and pump through ultra pure water.

- Check whether solution emerges at the MSM-HC connecting piece (50-2). If one of the supply or discharge lines remained blocked, the MSM-HC connecting piece (50-2) must be replaced (order number 6.2835.010).

#### 4 Cleaning the MSM-HC rotor A

- Clean the sealing surface of the MSM-HC rotor A (50-3) with ethanol using a lint-free cloth.

#### 5 Inserting the MSM-HC rotor A



#### CAUTION

An incorrectly inserted MSM rotor A (50-3) can be **destroyed** during start-up.

- Insert the MSM-HC rotor A (50-3) into the MSM-HC housing (50-4) in such a way that the tubing connections on the rear of MSM-HC rotor A fit into the corresponding recesses inside the MSM-HC housing and one of the three holes of the MSM-HC rotor A is visible from below in the slot (50-5) of the MSM-HC housing.
- If the MSM-HC rotor A (50-3) is correctly inserted, its sealing surface will be approx. 4 mm within the MSM-HC housing (50-4). If this is not the case, the MSM-HC rotor A must be moved into the right position from below using a sharp object (e.g. screwdriver).

#### 6 Cleaning the MSM-HC connecting piece

- Clean the sealing surface of the MSM-HC connecting piece (50-2) with ethanol using a lint-free cloth.

#### 7 Inserting the MSM-HC connecting piece

- Insert the MSM-HC connecting piece (50-2) into the MSM-HC housing (50-4) in such a way that the connector 1 is on top and the three pins of the connecting piece fit into the corresponding recesses on the MSM-HC housing (50-4).
- Reattach the union nut (50-1) onto the coupling and tighten.

#### 8 Connecting and conditioning the MSM-HC

- Reconnect the MSM-HC to the IC system.
- Before switching the MSM-HC over for the first time, rinse the three suppressor units with solution for 5 minutes.



### 5.11.3.3 Replacing parts of the MSM-HC

It may be necessary to replace parts of the MSM-HC in the following cases:

- Loss of suppression capacity which cannot be eliminated (reduced phosphate sensitivity and/or significant rise in the baseline).
- Blockage of the MSM-HC which cannot be eliminated (solutions can no longer be pumped through the suppressor).

Both the MSM-HC rotor A (50-3) and the MSM-HC connecting piece (50-2) with its supply and discharge lines can be replaced.

#### Replacing parts of the MSM-HC

Replace parts of the MSM-HC as follows (see Figure 50, page 98):

##### 1 Disconnecting the MSM-HC from the IC system

- Switch off the instrument.
- Disconnect the MSM-HC from the separation column, peristaltic pump and detector.

##### 2 Dismantling the MSM-HC

- Unscrew union nut (50-1) from the MSM-HC housing (50-4).
- Pull the MSM-HC connecting piece (50-2) and the MSM-HC rotor A (50-3) out of the MSM-HC housing (50-4). The connecting piece and the MSM-HC rotor A normally stick to one another – if this is not the case: Take a sharp object, insert into the slot (50-5) in the MSM-HC housing, and pull out the MSM-HC rotor A (50-3) in this way.
- Detach the MSM-HC connecting piece (50-2) from MSM-HC rotor A (50-3).

##### 3 Cleaning the new MSM-HC rotor A

- Clean the sealing surface of the new MSM-rotor A (50-3) with ethanol using a lint-free cloth.

##### 4 Inserting the new MSM-HC rotor A



#### CAUTION

An incorrectly inserted MSM rotor A (50-3) can be **destroyed** during start-up.

- Insert the new MSM-HC rotor A (50-3) in the MSM-HC housing (50-4) in such a way that the tubing connections on the rear of MSM-HC rotor A fit into the corresponding recesses inside the MSM-HC housing and one of the three holes of MSM-HC rotor A is visible from below in the slot (50-5) of the MSM-HC housing.
- If the MSM-HC rotor A (50-3) is correctly inserted, its sealing surface will be approx. 4 mm within the MSM-HC housing (50-4). If this is not the case, the MSM-HC rotor A must be moved into the right position from below using a sharp object (e.g. screwdriver).

#### 5 Cleaning the MSM-HC connecting piece

- Clean the sealing surface of the MSM-HC connecting piece (50-2) with ethanol using a lint-free cloth.

#### 6 Inserting the new MSM-HC connecting piece

- Insert the MSM-HC connecting piece (50-2) into the MSM-HC housing (50-4) in such a way that the connector 1 is on top and the three pins of the connecting piece fit into the corresponding recesses on the MSM-HC housing (50-4).
- Reattach the union nut (50-1) onto the coupling and tighten.

#### 7 Connecting and conditioning the MSM-HC

- Reconnect the MSM-HC to the IC system.
- Before switching the MSM-HC over for the first time, rinse the three suppressor units with solution for 5 minutes.

## 5.12 Peristaltic pump

### 5.12.1 Operation

The pumping capacity of the peristaltic pump depends on the drive speed (set via software), the contact pressure and, above all, the internal diameter of the pump tubing. Depending on the application, different pump tubings are used.



#### CAUTION

The service life of the pump tubings also depends on the contact pressure. Therefore fully lift the tubing cartridges by loosening the snap-action lever (32-10) on the right-hand side if the peristaltic pump is to be turned off for a longer period. Once set, the contact pressure remains unaffected.

**CAUTION**

The 6.1826.xxx pump tubings consist of PVC or PP and therefore must not be used for rinsing with solutions containing acetone. In this case, use other pump tubings or use another pump for rinsing.

**5.12.2 Maintenance****5.12.2.1 Pump tubing**

The pump tubing used in the peristaltic pump is a consumable whose service life is restricted.

The LFL pump tubing with 3 stoppers is stretched in the tubing cartridge in such a way that it comes to rest between two stoppers. This results in two possible positions for the tubing cartridge. If the pump tubing should exhibit clear signs of wear, then this can be stretched a second time, in the respective alternate position.

Therefore replace the pump tubing periodically, or when used permanently approx. every 4 weeks.

**Selecting the pump tubing**

The pump tubing differs in material, diameter and hence also pumping capacity. Depending on the application, different pump tubings are used.

The following table provides information on the properties and use of the pump tubing:

Table 3 Pump tubing

Order number	Name	Material	Inner diameter	Use
6.1826.020	Pump tubing (blue/blue), 2-stopper	PVC (Tygon ST)	1.65 mm	Pump tubing for online IC instruments and automation in voltammetry
6.1826.310	Pump tubing LFL (orange/green), 3-stopper	PVC (Tygon)	0.38 mm	Pump tubing for bromate determination using the triiodide method.
6.1826.320	Pump tubing LFL (orange/yellow), 3-stopper	PVC (Tygon)	0.48 mm	For suppressor solutions, acceptor solutions for inline dialysis and for inline ultrafiltration.

Order number	Name	Material	Inner diameter	Use
6.1826.330	Pump tubing LFL (orange/white), 3-stopper	PVC (Tygon)	0.64 mm	No special applications.
6.1826.340	Pump tubing LFL (black/black), 3-stopper	PVC (Tygon)	0.76 mm	For the sample solution in inline dialysis.
6.1826.360	Pump tubing LFL (white/white), 3-stopper	PVC (Tygon)	1.02 mm	For sample transfer.
6.1826.380	Pump tubing LFL (gray/gray), 3-stopper	PVC (Tygon)	1.25 mm	For inline sample dilution.
6.1826.390	Pump tubing LFL (yellow/yellow), 3-stopper	PVC (Tygon)	1.37 mm	For the sample solution in inline ultrafiltration.

### 5.12.2.2 Pump tubing connection with filter

The 6.2821.130 filters (51-2) should be changed every 3 months, more frequently at higher backpressure.

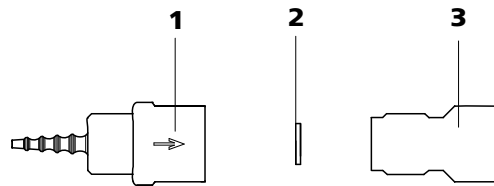


Figure 51 Pump tubing connection – Changing the filter

**1 Tubing olive**

**2 Filter 6.2821.130**  
Packaging contains 10 items.

**3 Filter housing**

### Replacing the filter

#### 1 Unscrewing filter screw

- Screw the filter screw (51-3) out of the tubing olive (51-1) with the aid of two 6.2621.000 adjustable wrenches.

#### 2 Replacing the filter

- Remove the old filter (51-2) with tweezers.
- Place the new filter (51-2) flat in the tubing olive (51-1) with tweezers.



### 3 Mounting filter screw

- Screw the filter screw (51-3) back into the tubing olive (51-1) and tighten by hand. Then additionally tighten with two 6.2621.000 adjustable wrenches.

## 5.13 Metrohm CO<sub>2</sub> suppressor (MCS)

### 5.13.1 Replacing the CO<sub>2</sub> adsorption cartridge

The CO<sub>2</sub> adsorption cartridge 6.2837.000 (36-4) must be replaced regularly. This is because of blockages and losses in capacity.

#### Blockage

Moisture can block the CO<sub>2</sub> adsorption cartridge. This is revealed by a change in color of the cartridge material (the orange part becomes colorless). As the air flow is reduced, the vacuum becomes lower. To protect the CO<sub>2</sub> adsorption cartridge, an H<sub>2</sub>O adsorption cartridge (36-7) is installed upstream. Regular regeneration (see Chapter 5.13.2, page 104) of the H<sub>2</sub>O adsorption cartridge extends the service life of the CO<sub>2</sub> adsorption cartridge.

#### Capacity loss

The adsorption capacity of the CO<sub>2</sub> adsorption cartridge is limited. Depending on the period of operation and laboratory environment, the adsorption capacity will diminish over time. This is manifested in a rising baseline (as more CO<sub>2</sub> reaches the detector).

### 5.13.2 Regenerating the H<sub>2</sub>O adsorption cartridge

The function of the H<sub>2</sub>O adsorption cartridge is to protect the CO<sub>2</sub> adsorption cartridge against moisture. The service life of the H<sub>2</sub>O adsorption cartridge depends on the moisture content of the ambient air. Moisture reduces the capacity of the H<sub>2</sub>O adsorption cartridge (which can be observed by a change in color). Before the color changes in the entire filling material (from orange to colorless, with Fluka Order No. 94098), the H<sub>2</sub>O adsorption cartridge should be regenerated (see information sheet). The filling material is replaced during regeneration:

- 1 Allow material to dry loose (not in cartridge) at 140 °C overnight and refill. Or dispose of the old material, and fill with new material.
- 2 Cover the packed material with wadding.

## 5.14 Conductivity detector

### 5.14.1 Maintenance



#### CAUTION

The conductivity detector must not be opened!



#### WARNING

When rinsing the detector, the pressure must not exceed **5 MPa**. In order to ensure this, the maximum pressure of the high pressure pump must be set to **5 MPa** in MagIC Net.

If the conductivity detector is blocked, you should first of all check whether the blockage results from the capillary ends being pressed together too firmly. In this case, shorten the detector input capillary (37-3) or the detector output capillary (38-2) by several millimeters.

If this does not help, the conductivity detector can be rinsed against the normal flow direction. For this, connect the high pressure pump to the detector output capillary (38-2) and rinse - **the pressure may not exceed 5 MPa**.

## 5.15 Separation column

### 5.15.1 Separating efficiency

Which analysis quality can be attained, depends to a great extent on the separating efficiency of the separation column used. The separating efficiency of the selected separation column must be sufficient for the analysis problems present. If difficulties occur, you should always first check the quality of the separation column by recording a standard chromatogram.

You can find detailed information on the separation columns available from Metrohm in the information sheet provided along with your separation column, in the **Metrohm IC-Column Program** (available via your Metrohm agent) or in the Internet at <http://www.metrohm.com> in the product area Ion chromatography. You can request free information on special IC applications in the corresponding "**Application Bulletins**" or "**Application Notes**", which are available in the Internet at <http://www.metrohm.com> in the Applications area or via the Metrohm agent responsible.



### 5.15.2 Protection

To protect the separation column against foreign particles, which can affect the separating efficiency, we recommend that both the eluent and the samples undergo a microfiltration (filter 0.45 µm) before being aspirated via the 6.2821.090 aspiration filter.

The use of guard columns (*see Chapter 3.23, page 70*) serves for protecting the actual separation columns and increases their service life considerably. Information regarding which guard column is suitable for your separation column can be seen in the **Metrohm IC Column Program** (which is available from your Metrohm agent), the information sheet provided along with your separation column, the product information on the separation column at <http://www.metrohm.com> (product area Ion Chromatography) or can be obtained directly from your agent.

The pulsation damper (*see Chapter 3.14, page 47*) must be installed in order to protect the column material from pressure concussion caused by injection.

### 5.15.3 Storage

Always store the separation columns sealed and filled according to the data of the column manufacturer when not using them.

### 5.15.4 Regeneration



#### NOTE

The regeneration is considered as the last measure, and not to be carried out regularly.

If the separating properties of the column have deteriorated, the column can be regenerated according to the specifications of the column manufacturer. In the case of separation columns available from Metrohm, the specification for regeneration can be found on the information sheet provided along with each column.

## 5.16 Quality Management and validation with Metrohm

### Quality Management

Metrohm offers you comprehensive support in implementing quality management measures for instruments and software. Further information on this can be found in the brochure «**Quality Management with Metrohm**» available from your local Metrohm agent.

### Validation

Please contact your local Metrohm agent for support in validating instruments and software. Here you can also obtain validation documentation to provide help for carrying out the **Installation Qualification** (IQ) and the **Operational Qualification** (OQ). IQ and OQ are also offered as a service by the Metrohm agents. In addition, various application bulletins are also available on the subject, which also contain **Standard Operating Procedures** (SOP) for testing analytical measuring instruments for reproducibility and correctness.

### Maintenance

Electronic and mechanical functional groups in Metrohm instruments can and should be checked as part of regular maintenance by specialist personnel from Metrohm. Please ask your local Metrohm agent regarding the precise terms and conditions involved in concluding a corresponding maintenance agreement.



#### NOTE

You can find information on the subjects of quality management, validation and maintenance as well as an overview of the documents currently available at [www.metrohm.com/com/](http://www.metrohm.com/com/) under **Support**.



## 6 Troubleshooting

### 6.1 Problems and their solutions

Problem	Cause	Remedy
<b>Marked drop in pressure</b>	<i>Leak in the system.</i>	Check and seal connections ( <i>see Chapter 3.6, page 20</i> ).
<b>Marked rise in pressure</b>	<i>6.2821.120 inline filter blocked.</i>	Replace 6.2821.130 filter ( <i>see Chapter 5.6, page 91</i> ).
	<i>MSM-HC – blocked.</i>	<ul style="list-style-type: none"> <li>Regenerate the MSM-HC (<i>see Chapter 5.11.3.1, page 96</i>).</li> </ul> <p>Note: 6.2821.180 pump tubing connection with filter must be used .</p>
	<i>Conductivity detector blocked.</i>	<ul style="list-style-type: none"> <li>Shorten capillary ends by several mm (<i>see Chapter 5.14.1, Page 105</i>).</li> <li>Rinse detector against the normal flow direction (<i>see Chapter 5.14.1, Page 105</i>).</li> </ul>
	<i>Guard column – blocked.</i>	Replace guard column ( <i>see Chapter 3.23, page 70</i> ).
	<i>Separation column – blocked.</i>	<ul style="list-style-type: none"> <li>Regenerate separation column (<i>see Chapter 5.15.4, page 106</i>).</li> <li>Replace separation column (<i>see "Connecting and rinsing the separation column", page 73</i>).</li> </ul> <p>Note: Samples should always be microfiltered (<i>see Chapter 5.7, page 93</i>).</p>
	<i>Injection valve – valve blocked.</i>	Have the valve cleaned (by Metrohm service technicians).
<b>Drift of the baseline</b>	<i>Thermal equilibrium not yet attained.</i>	Condition ( <i>see Chapter 3.17, page 52</i> ) instrument with the column thermostat switched on .
	<i>Leak in the system.</i>	Check and seal connections ( <i>see Chapter 3.6, page 20</i> ).

<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
	<i>Eluent – Evaporation of the organic solvent in the eluent.</i>	Check the eluent bottle attachment (see Figure 14, page 35).
<b>Peak areas lower than expected</b>	<i>Sample – Leak in the sample path.</i>	Check the sample path.
	<i>Sample – Blockage in the sample path.</i>	Check the sample path.
	<i>Sample – Sample loop not (completely) filled.</i>	Prolong the sample transfer time.
	<i>Sample – Gas bubbles in the sample.</i>	Use the sample degasser (see Chapter 3.15, page 48) (if available).
	<i>MCS – not connected.</i>	Connect the MCS.
<b>Peristaltic pump – insufficient or no delivery rate</b>	<i>Peristaltic pump – contact pressure too weak.</i>	Correctly set contact pressure (see "Set flow rate", page 62).
	<i>Peristaltic pump – filter blocked.</i>	Replace the filter (see Chapter 5.12.2.2, page 103).
	<i>Peristaltic pump – pump tubing defective.</i>	Replace pump tubing (see Chapter 5.12.2.1, page 102).
<b>Very noisy baseline</b>	<i>High pressure pump – contaminated pump valves.</i>	Clean pump valves (see "Cleaning the inlet valve and outlet valve", page 86).
	<i>Eluent – Leak in the eluent path.</i>	Check the eluent path.
	<i>Eluent – Blockage in the eluent path.</i>	Check the eluent path.
	<i>High pressure pump – defective piston seals.</i>	Replace piston seals (see "Replacing the piston seal", page 83).
	<i>MCS – CO<sub>2</sub> adsorption cartridge exhausted.</i>	Replace CO <sub>2</sub> adsorption cartridge (see Chapter 5.13.1, page 104).
	<i>Pulsation damper not connected.</i>	Connect the pulsation damper (see Chapter 3.14, page 47).
	<i>Pulsation damper not connected.</i>	Connect pulsation damper (see Chapter 3.14, page 47).



<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
	<i>MCS – vacuum pump defective.</i>	Contact the Metrohm Service.
<b>Background conductivity too high</b>	<i>MSM-HC – not connected.</i>	Connecting the MSM-HC ( <i>see Chapter 3.18, page 55</i> ).
	<i>MCS – not connected.</i>	Connect the MCS.
	<i>Incorrect eluent.</i>	Change eluent ( <i>see Chapter 5.4.2.3, page 80</i> ).
	<i>MSM-HC – regeneration or rinsing solution flow problems.</i>	Check the flow of the regeneration and rinsing solution ( <i>see Chapter 3.18.2, page 55</i> ).
<b>Data of the separation column cannot be read.</b>	<i>Column chip contaminated.</i>	Clean contact surfaces of the column chip (with alcohol).
	<i>Column chip defective.</i>	<ol style="list-style-type: none"> <li>1. Save column configuration in MagIC Net.</li> <li>2. Notify Metrohm Service.</li> </ol>
<b>Individual peaks greater than expected</b>	<i>Sample – Carry-over of the samples from previous measurement.</i>	Rinse system longer between two samples.
<b>MSM-HC – No (or insufficient) pumping of regeneration or rinsing solution</b>	<i>Leak in the system.</i>	Check connections.
	<i>Peristaltic pump – contact pressure too weak.</i>	Correctly set contact pressure .
	<i>Peristaltic pump – filter blocked .</i>	Replace the filter .
	<i>MSM-HC – backpressure too high.</i>	Clean the MSM-HC ( <i>see Chapter 5.11.3.2, page 97</i> ) or replace parts ( <i>see Chapter 5.11.3.3, page 100</i> ).
	<i>Peristaltic pump – pump tubing defective.</i>	Replace pump tubing .
<b>Poor reproducibility of the retention times</b>	<i>Eluent – Leak in the eluent path.</i>	Check the eluent path.
	<i>Eluent – Blockage in the eluent path.</i>	Check the eluent path.
<b>Chromatograms have poor resolution</b>	<i>Separation column – diminished separating efficiency.</i>	<ul style="list-style-type: none"> <li>▪ Regenerate separation column (<i>see Chapter 5.15.4, page 106</i>).</li> </ul>

<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
		<ul style="list-style-type: none"> <li>Replace separation column (see "Connecting and rinsing the separation column", page 73).</li> </ul>
<b>Conductivity detector is not recognized in the software</b>	<i>No connection.</i>	<ul style="list-style-type: none"> <li>Check the cable connection (38-1).</li> <li>Turn the instrument off and on again (after 15 seconds).</li> </ul>
<b>Extreme spread of the peaks in the chromatogram. Splitting (dual peaks)</b>	<i>Connections – dead volume in the system.</i>	Check the connections (see Chapter 3.6, page 20) (use PEEK capillaries with an internal diameter of 0.25 mm between the injection valve and detector).
	<i>Guard column – diminished performance.</i>	<ul style="list-style-type: none"> <li>Replace guard column (see Chapter 3.23, page 70).</li> </ul>
	<i>Separation column – dead volume at column head.</i>	<ul style="list-style-type: none"> <li>Install separation column in reverse flow direction (if permitted by the information sheet).</li> <li>Replace separation column (see "Connecting and rinsing the separation column", page 73).</li> </ul>
<b>Greater rise in the baseline</b>	<i>MSM-HC – reduced capacity.</i>	Regenerate the MSM-HC (see Chapter 5.11.3.1, page 96).
<b>Precision problems - significant scattering of the measured values</b>	<i>Sample – Gas bubbles in the sample.</i>	Use sample degasser (see Chapter 3.15, page 48).
	<i>Injection valve – sample loop.</i>	Check installation of the sample loop (see Chapter 3.16.1, page 50).
	<i>Sample – Rinsing volume too low.</i>	Prolong the rinsing time (see Chapter 5.8, page 93).
	<i>Injection valve – defective.</i>	Request Metrohm Service.
	<i>MCS – vacuum too low.</i>	<ul style="list-style-type: none"> <li>Check connectors. If they are ok:</li> <li>Contact the Metrohm Service.</li> </ul>
<b>Unexpected change to the retention times in the chromatograms</b>	<i>Separation column – diminished separating efficiency.</i>	<ul style="list-style-type: none"> <li>Regenerate separation column (see Chapter 5.15.4, page 106).</li> <li>Replace separation column (see "Connecting and rinsing the separation column", page 73).</li> </ul>



<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
	<i>Eluent – Gas bubbles in the eluent.</i>	Check connections of the eluent degasser (see Chapter 3.10, page 37).
	<i>High pressure pump – defective.</i>	Request Metrohm Service.
<b>Vacuum is not being built</b>	<i>Eluent Degasser – Connector <b>Vacuum</b> on the rear of the instrument not (tightly) sealed.</i>	<ul style="list-style-type: none"> <li>▪ Seal the connector <b>Vacuum</b> tightly with a 6.144.6040 threaded stopper.</li> <li>or when using an 872 Extension Module:</li> <li>▪ Connect an FEP tubing between the IC instrument and the Extension Module and tighten both clamping screws until they seal.</li> </ul>

## 7 Technical specifications

### 7.1 Reference conditions

The technical data listed in this Chapter refers to the following reference conditions:

<i>Ambient temperature</i>	+25 °C (± 3 °C)
<i>Instrument status</i>	> 40 minutes in operation (equilibrated)

### 7.2 Instrument

<i>IC system</i>	<ul style="list-style-type: none"> <li>▪ Metal-free IC system</li> <li>▪ Compact system with modular design</li> <li>▪ Up to two complete chromatographic systems in one housing</li> </ul>
<i>Material</i>	Painted polyurethane hard foam without CFCs, fire class V0
<i>Operating pressure range</i>	<ul style="list-style-type: none"> <li>▪ 0...50 MPa (500 bar) high pressure pump</li> <li>▪ 0...35 MPa (350 bar) standard-PEEK system</li> </ul>
<i>Intelligent components</i>	iPump, iDetector, iColumn, MagIC Net

### 7.3 Leak sensor

<i>Type</i>	Electronic, no calibration necessary
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### 7.4 Ambient conditions

<i>Operation</i>	
<i>Ambient temperature</i>	+5...+45 °C
<i>Humidity</i>	20...80 % relative humidity
<i>Storage</i>	
<i>Ambient temperature</i>	-20...+70 °C
<i>Transport</i>	
<i>Ambient temperature</i>	-40...+70 °C



## 7.5 Housing

### Dimensions

<i>Width</i>	365 mm
<i>Height</i>	642 mm
<i>Depth</i>	380 mm

*Material of base tray, housing and bottle holder* Polyurethane hard foam (PUR) with flame retardation for fire class V0, CFC-free, painted

### Operating elements

<i>Indicators</i>	LED for power display
<i>On/Off switch</i>	On the rear panel of the instrument

## 7.6 Eluent degasser

<i>Material</i>	fluoropolymer
<i>Resistance to solvents</i>	No restriction (apart from PFC)
<i>Build-up time for the vacuum</i>	< 60 s

## 7.7 Low pressure gradient

<i>Profile</i>	Step, linear, convex and concave
<i>Valve type</i>	Normally-closed
<i>Degasser</i>	One eluent degasser each for each of the three eluents.

## 7.8 High pressure pump

<i>Type</i>	<ul style="list-style-type: none"> <li>▪ Serial dual-piston pump</li> <li>▪ Intelligent pump head recognition</li> <li>▪ Chemically inert</li> <li>▪ Metal-free pump heads</li> <li>▪ Materials in contact with eluent: PEEK, ZrO<sub>2</sub>, PTFE/PE</li> <li>▪ Self-optimizing flow and pressure</li> </ul>
<i>Flow rate</i>	
<i>Adjustable flow range</i>	0.001...20.0 mL/min
<i>Flow increment</i>	1 µL/min with standard pump head
<i>Reproducibility of the eluent flow</i>	< 0.1 % deviation
<i>Pressure range</i>	
<i>Pump</i>	0...50.0 MPa (0...500 bar)
<i>Pump head</i>	0...35.0 MPa (0...350 bar) (applies for the standard PEEK pump head)
<i>Residual pulsation</i>	< 1 %
<i>Safety shutdown</i>	
<i>Function</i>	Automatic shutdown upon reaching the pressure limit values
<i>Maximum pressure limit</i>	<ul style="list-style-type: none"> <li>▪ Adjustable from 0.1...50 MPa (1...500 bar)</li> <li>▪ The pump is automatically shut down at the first piston stroke above the maximum limit value</li> </ul>
<i>Minimum pressure limit</i>	<ul style="list-style-type: none"> <li>▪ Adjustable from 0...49 MPa (0...490 bar)</li> <li>▪ The shutdown mechanism is inactive at 0 MPa</li> <li>▪ The shutdown mechanism only becomes active 2 minutes after system start</li> <li>▪ The pump is automatically shut down after 3 piston strokes below the minimum pressure limit</li> </ul>



## 7.9 Sample degasser

<i>Material</i>	fluoropolymer
<i>Resistance to solvents</i>	No restriction (apart from PFC)
<i>Build-up time for the vacuum</i>	< 60 s

## 7.10 Injection valve

<i>Actuator time</i>	typ. 100 ms
<i>Max. operating pressure</i>	35 MPa (350 bar)
<i>Material</i>	PEEK

## 7.11 Column thermostat

<i>Type</i>	Peltier technique thermostat for two intelligent separation columns
<i>Adjustable temperature range</i>	0...+ 80 °C, in increments of 0.1 °C
<i>Heating</i>	Ambient temperature +50 °C
<i>Cooling</i>	Ambient temperature –20 °C
<i>Temperature reproducibility</i>	± 0.2 °C
<i>Stability</i>	< 0.05 °C
<i>Heating up time</i>	< 30 minutes from 20 to 50 °C
<i>Cooling time</i>	< 40 minutes from 50 to 20 °C

## 7.12 High Capacity Metrohm Suppressor Module (MSM-HC)

<i>Resistance to solvents</i>	No restriction
<i>Switching duration</i>	typ.100 ms
<i>Operating pressure</i>	2.5 MPa (25 bar), valve function prevents damage at overpressure

## 7.13 Peristaltic pump

<i>Type</i>	2-channel peristaltic pump
<i>Rotating direction</i>	Counterclockwise/Clockwise rotation
<i>Rotational speed</i>	0...42 rpm in 7 stages at 6 rpm.
<i>Pumping properties</i>	0.3 mL/min at 18 rpm; with 6.1826.320 standard pump tubing.
<i>Material of pump tubings</i>	recommended: Tygon Long Flex Life

## 7.14 Metrohm CO<sub>2</sub> suppressor (MCS)

<i>Material</i>	fluoropolymer
<i>Resistance to solvents</i>	No restriction (apart from PFC)
<i>Vacuum</i>	
<i>Working range</i>	Microprocessor-controlled / stabilized
<i>Build-up time after start</i>	< 30 s
<i>Capillary volume</i>	400 µL
<i>Recommended flow range</i>	0.1...1.0 mL



## 7.15 Conductivity measuring system

<i>Type</i>	<ul style="list-style-type: none"> <li>▪ Microprocessor-controlled Digital Signal Processing (DSP technology)</li> <li>▪ Intelligent detector with 6 reference chromatograms</li> </ul>
<i>Measuring range</i>	0...15000 $\mu\text{S}/\text{cm}$ single range
<i>Noise</i>	< 0.1 nS at 1 $\mu\text{S}/\text{cm}$
<i>Deviations from the linearity</i>	< 1 % for conductivity values greater than 1...16 $\mu\text{S}/\text{cm}$ (typical for analyses with sequential suppression)
<i>Drift</i>	< 0.2 nS/cm per hour
<i>Measuring rate</i>	10 measurements per second for optimum results without filtering
<i>Resolution</i>	0.0047 nS/cm
<i>Baseline</i>	Noise < 0.2 nS/cm typical for sequential suppression
<i>Conductivity detector</i>	
<i>Cell volume</i>	0.8 $\mu\text{L}$
<i>Cell constant</i>	<ul style="list-style-type: none"> <li>▪ Individual calibration data saved in the detector</li> <li>▪ adjustable range: 13.0...21.0 /cm</li> </ul>
<i>Electrodes</i>	Ring-shaped electrodes made from stainless steel
<i>Materials in contact with eluent</i>	Chemically inert PCTFE
<i>Maximum operating pressure</i>	5.0 MPa (50 bar)
<i>Cell temperature</i>	20...50 °C in increments of 5 °C
<i>Temperature stability</i>	< 0.001 °C
<i>Temperature compensation</i>	0...5 %/K adjustable, default 2.3 %/K
<i>Heating up time</i>	< 30 minutes (40 °C)

## 7.16 Mains connection

<i>Required voltage</i>	100...240 V $\pm$ 10 % (auto-sensing)
<i>Required frequency</i>	50...60 Hz $\pm$ 3 (auto-sensing)
<i>Power consumption</i>	<ul style="list-style-type: none"> <li>▪ 65 W for typical analysis application</li> <li>▪ 25 W standby (detector to 40 °C)</li> </ul>
<i>Power supply unit</i>	<ul style="list-style-type: none"> <li>▪ Up to 300 W maximum, electronically monitored</li> <li>▪ internal fuse 3.15 A</li> </ul>

## 7.17 Interfaces

### USB

<i>Input</i>	1 USB upstream, type B (for connection to the PC)
<i>Output</i>	2 USB downstream, type A

<i>MSB</i>	2 MSB Mini Din 8-pin (female) (for Dosino, stirrer, remote lines, ...)
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### CAUTION

When connecting an instrument to the MSB connector you **must** switch off the 850 Professional IC.

<i>Detector</i>	2 DSUB-15-pin high density (female)
<i>Column recognition</i>	3 (including 2 in the column thermostat ( <i>see Chapter 3.17, page 52</i> ))
<i>Leak sensor</i>	1 jack plug
<i>Further connections</i>	<ul style="list-style-type: none"> <li>▪ 1 DSUB 15-pin (female)</li> </ul>



## 7.18 Safety specification

<i>Design / Test</i>	<ul style="list-style-type: none"> <li>▪ EN/IEC/UL 61010-1</li> <li>▪ CSA-C22.2 No. 61010-1</li> <li>▪ Degree of protection IP20</li> <li>▪ Protection class I</li> </ul>
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## 7.19 Electromagnetic compatibility (EMC)

<i>Emission</i>	<ul style="list-style-type: none"> <li>▪ EN/IEC 61326-1</li> <li>▪ EEN 55022 / CISPR 22</li> <li>▪ EN/IEC 61000-6-3</li> <li>▪ EN/IEC 61000-3-2</li> <li>▪ EN/IEC 61000-3-3</li> </ul>
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<i>Immunity</i>	<ul style="list-style-type: none"> <li>▪ EN/IEC 61326-1</li> <li>▪ EN/IEC 61000-4-2</li> <li>▪ EN/IEC 61000-4-3</li> <li>▪ EN/IEC 61000-4-4</li> <li>▪ EN/IEC 61000-4-5</li> <li>▪ EN/IEC 61000-4-6</li> <li>▪ EN/IEC 61000-4-8</li> <li>▪ EN/IEC 61000-4-11</li> <li>▪ EN/IEC 61000-4-14</li> <li>▪ NAMUR: 2006</li> </ul>
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## 7.20 Weight

<i>1.850.2210</i>	29.4 kg (without accessories)
<i>1.850.9010 (conductivity detector)</i>	2.3 kg (with accessories)
<i>Transport carriage (rollers and handle)</i>	1.8 kg

## 8 Conformity and warranty

### 8.1 Declaration of Conformity

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

*Name of commodity*

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#### **850 Professional IC**

The 850 Professional IC is an intelligent instrument for ion chromatography analysis.

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This instrument has been built and has undergone final type testing according to the standards:

*Electromagnetic compatibility*

Emission:	EN/IEC 61326-1: 2006, EN 55011 / CISPR 11: 2003, EN/IEC 61000-6-3: 2006, EN/IEC 61000-3-2: 2006, EN/IEC 61000-3-3: 2005
Immunity:	EN/IEC 61326-1: 2006, EN/IEC 61000-6-1: 2007, EN/IEC 61000-4-2: 2001, EN/IEC 61000-4-3: 2006, EN/IEC 61000-4-4: 2004, EN/IEC 61000-4-5: 2001, EN/IEC 61000-4-6: 2001, EN/IEC 61000-4-8: 2001, EN/IEC 61000-4-11: 2004, EN/IEC 61000-4-14: 2004, NAMUR: 2004

*Safety specifications*

EN/IEC 61010-1: 2001, UL 61010-1: 2004,  
CSA-C22.2 No. 61010-1: 2004, protection class I

It has also been certified by ElectroSuisse, a member of the International Certification Body (CB/IEC).



This instrument meets the requirements of the CE mark as contained in the EU directives 2006/95/EC (LVD), 2004/108/EC (EMC). It fulfils the following specifications:

EN 61326-1	Electrical equipment for measurement, control and laboratory use – EMC requirements
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EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use



This instrument meets the requirements of the ETL Listed Mark for the North American market. It conforms to the electrical safety standards UL 61010-1 and CSA-C22.2 No. 61010-1. This product is listed in Intertek's Directory of Listed Products.

*Manufacturer*

Metrohm Ltd., CH-9101 Herisau/Switzerland

Metrohm Ltd. is holder of the SQS-certificate ISO 9001:2000 Quality management system for development, production and sales of instruments and accessories for ion analysis.

Herisau, 27 October, 2008

D. Strohm

Vice President, Head of R&D

Ch. Buchmann

Vice President, Head of Production

Responsible for Quality Assurance

## 8.2 Quality Management Principles

Metrohm Ltd. holds the ISO 9001:2000 Certificate, registration number 10872-02, issued by SQS (Swiss Association for Quality and Management Systems). Internal and external audits are carried out periodically to assure that the standards defined by Metrohm's QM Manual are maintained.

The steps involved in the design, manufacture and servicing of instruments are fully documented and the resulting reports are archived for ten years. The development of software for PCs and instruments is also duly documented and the documents and source codes are archived. Both remain the possession of Metrohm. A non-disclosure agreement may be asked to be provided by those requiring access to them.

The implementation of the ISO 9001:2000 quality management system is described in Metrohm's QM Manual, which comprises detailed instructions on the following fields of activity:

### **Instrument development**

The organization of the instrument design, its planning and the intermediate controls are fully documented and traceable. Laboratory testing accompanies all phases of instrument development.

### **Software development**

Software development occurs in terms of the software life cycle. Tests are performed to detect programming errors and to assess the program's functionality in a laboratory environment.

### **Components**

All components used in the Metrohm instruments have to satisfy the quality standards that are defined and implemented for our products. Suppliers of components are audited by Metrohm as the need arises.

### **Manufacture**

The measures put into practice in the production of our instruments guarantee a constant quality standard. Production planning and manufacturing procedures, maintenance of production means and testing of components, intermediate and finished products are prescribed.

### **Customer support and service**

Customer support involves all phases of instrument acquisition and use by the customer, i.e. consulting to define the adequate equipment for the analytical problem at hand, delivery of the equipment, user manuals, training, after-sales service and processing of customer complaints. The Metrohm service organization is equipped to support customers in implementing standards such as GLP, GMP, ISO 900X, in performing Operational Qualification and Performance Verification of the system components or in carrying out the System Validation for the quantitative determination of a substance in a given matrix.

## **8.3 Warranty (guarantee)**

Metrohm guarantees that the deliveries and services it provides are free from material, design or manufacturing errors. The warranty period is 36 months from the day of delivery; for day and night operation it is 18 months. The warranty remains valid on condition that the service is provided by an authorized Metrohm service organization.

Glass breakage is excluded from the warranty for electrodes and other glassware. The warranty for the accuracy corresponds to the technical specifications given in this manual. For components from third parties that make up a considerable part of our instrument, the manufacturer's warranty provisions apply. Warranty claims cannot be pursued if the Customer has not complied with the obligations to make payment on time.

During the warranty period Metrohm undertakes, at its own choice, to either repair at its own premises, free of charge, any instruments that can be shown to be faulty or to replace them. Transport costs are to the Customer's account.



Faults arising from circumstances that are not the responsibility of Metrohm, such as improper storage or improper use, etc. are expressly excluded from the warranty.

## 9 Accessories









### CAUTION




Subject to change without notice.

### 9.1 Scope of delivery





#### 2.850.2230 850 Professional IC – Anion – MSM-HC – MCS – LP Gradient


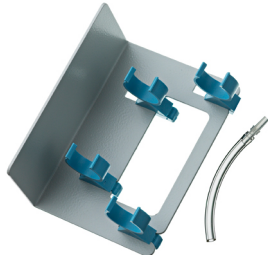


Qty.	Order no.	Description	
1	1.850.2230	850 Professional IC Anion – MSM-HC – MCS – LP Gradient	
1	6.2122.0x0	<b>Mains cable with C13 line socket IEC-60320-C13</b>  Cable plug according to customer requirements. Switzerland: Type SEV 12 6.2122.020 Germany, ...: Type CEE(7), VII 6.2122.040 USA, ...: Type NEMA/ASA 6.2122.070	
1	1.850.9010	<b>IC Detector MF</b>	
2	6.1602.150	<b>Bottle neck attachment / GL 45 - 3 x UNF 10/32</b>  For connecting capillary tubing 1/16 in. (=1.6 mm). Used for MSM auxiliary solutions and in inline dialysis. Material: Plastic	
3	6.1602.160	<b>Eluent bottle attachment GL 45</b>  For eluent bottles; with connections for drying tube and aspiration tubing. Opening ground joint: A-14/15	

Qty.	Order no.	Description	
2	6.1608.020	<b>Glass bottle / 1000 mL / GL 45</b> Bottle for auxiliary solutions Width (mm): 96 Height (mm): 223 Volume (mL): 1000	
3	6.1608.070	<b>Eluent bottle / 2 L / GL 45</b> Material: Clear glass Height (mm): 262 Volume (mL): 2000	
3	6.1609.000	<b>Adsorbing tube, large and bent</b> For filling with adsorber material. Material: Glass Height (mm): 129 Inner diameter (mm): 32 SGJ size: B-14/15	
1	6.1803.020	<b>PTFE capillary 0.97 mm i.d. / 5 m</b> For all IC instruments Material: PTFE Outer diameter (mm): 1.57 Inner diameter (mm): 0.97 Length (m): 5	

Qty.	Order no.	Description	
1	6.1803.040	<b>PTFE capillary 0.5 mm i.d. / 1 m</b> Capillary for sample handling in IC. Material: PTFE Outer diameter (inches): 1/16 Inner diameter (mm): 0.5 Length (m): 1	
1	6.1807.010	<b>Y-connector for tubing 6-9 mm i.d.</b> Connector for waste tubing	
1	6.1815.010	<b>Spiral band 0.5 m</b> For holding together different cables or tubing. Length (m): 0.5	



Qty.	Order no.	Description
2	6.1816.020	<b>Silicone tubing 6 mm i.d., 1 m</b> For waste tubing. Material: Silicone rubber Outer diameter (mm): 9 Inner diameter (mm): 6 Length (m): 1
		
2	6.1826.320	<b>Pump tubing LFL (orange/yellow), 3 stoppers</b> For suppressor solutions, acceptor solution in Inline Dialysis and for Inline Ultrafiltration
		
2	6.1834.080	<b>Aspiration tubing, 2 m</b> Aspiration tubing for Professional IC instruments Material: PTFE Outer diameter (mm): 2.5 Inner diameter (mm): 1.5 Length (m): 2
		
1	6.1834.120	<b>Tubing connection Degasser - mixing valve, 215 mm</b> Connection between the Eluent Degasser and the low pressure mixing valve. Length (mm): 215
		

Qty.	Order no.	Description	
3	6.2023.020	<b>Clip for SGJ 14/15</b> Clip for SGJ 14/16 Material: POM	
1	6.2057.080	<b>Adsorption cartridge holder (ProfIC)</b> Holder to install adsorption cartridges in Professional IC Instruments	
1	6.2151.020	<b>Cable USB A - USB B 1.8 m</b> USB connecting cable Length (m): 1.8	
1	6.2322.010	<b>PRIMUS multi anion standard solution: Promo</b>	
1	6.2617.010	<b>Tool for piston seal</b> For removing and assembling the piston seal for all standard pump heads	



Qty.	Order no.	Description
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2	6.2621.000	<b>Adjustable wrench</b>
		Max. opening: 20 mm. For IC instruments
		Length (mm): 150



1	6.2621.030	<b>Hexagon key 4 mm</b>
		Length (mm): 73







1	6.2621.050	<b>1/4 in. wrench</b>
		For 1/4 in. screws. For IC instruments
		Length (mm): 73







Qty.	Order no.	Description
1	6.2621.080	<b>Capillary cutter</b> For plastic capillaries. Used with IC instruments Length (mm): 118
		
1	6.2621.100	<b>Hexagon key 3 mm</b> Hexagon key 3 mm for IC Sample Processors Length (mm): 73
		
1	6.2626.000	<b>Drain nozzle (ProfIC)</b> Drain nozzle for Professional IC instruments, for mounting on front panel
		
2	6.2739.000	<b>Wrench</b> For tightening connectors Length (mm): 68
		


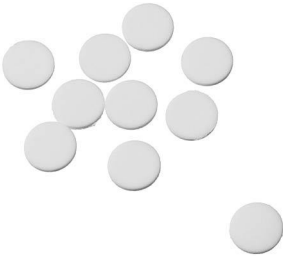




Qty.	Order no.	Description	
1	6.2743.080	<b>Stopper for overflow (ProfIC), 5 pieces</b> For Professional IC instruments	
1	6.2744.014	<b>Pressure screw 2x</b> With UNF 10/32 connection. For the connection of PEEK capillaries Material: PEEK Length (mm): 26	
1	6.2744.020	<b>Luer/UNF coupling</b> For IC instruments Material: PEEK Length (mm): 19	
1	6.2744.034	<b>Coupling nozzle - UNF 10/32, 2 pieces</b> Connection pressure screw and pump tubing. 2 pieces. For IC instruments with peristaltic pumps	


Qty.	Order no.	Description	
2	6.2744.040	<b>2 x UNF 10/32 coupling</b>	
		For connecting 1/16 in. capillaries. For IC instruments Material: PEEK Length (mm): 24	
2	6.2744.070	<b>Pressure screw short</b>	
		Short version. With UNF 10/32 connection. 5 pieces. For the connection of PEEK capillaries Material: PEEK Length (mm): 21	
2	6.2744.090	<b>Pressure screw long</b>	
		Long version. With UNF 10/32 connection. 2 pieces. For the connection of PEEK capillaries (MCS and Sample degasser) Material: PEEK	
2	6.2744.180	<b>Pump tubing connector with security lock and filter</b>	
		For the connection of a pump tubing and a capillary with built-in filter Material: PEEK	



Qty.	Order no.	Description	
3	6.2744.210	<b>Tubing adaptor for aspiration filter (ProfIC)</b> For Professional IC instruments	
1	6.2758.020	<b>Mixing coil for low pressure gradients</b>	
1	6.2816.020	<b>Syringe 10 mL with Luer connection</b> For various applications in IC and VA Material: PP Length (mm): 102 Volume (mL): 10	
1	6.2816.040	<b>Purging needle</b> With PTFE tubing and Luer connection. For syringes. For aspirating eluents.	

Qty.	Order no.	Description	
3	6.2821.090	<b>Aspiration filter</b> Pore size 20 µm, set of 5 pieces. For 6.1834.000 Aspiration tubing and 6.1821.040 and 6.1821.050 Filter tubes. Material: PE Outer diameter (mm): 9.5 Length (mm): 35.5	
1	6.2821.130	<b>Spare filter for inline filter</b> Spare filters for inline filter.	
1	6.2837.000	<b>CO<sub>2</sub> adsorber cartridge</b> Adsorber cartridge for purifying the air.	
2	6.2837.010	<b>H<sub>2</sub>O adsorption cartridge</b> To CO <sub>2</sub> Suppressor. Water adsorption cartridge for the aspirated air.	

Qty.	Order no.	Description
1	8.850.8026EN	Manual for 850 Professional IC, 2.850.2230 – Anion – MSM-HC – MCS – LP Gradient, English



## 9.2 Optional accessories

### 2.850.2230 850 Professional IC – Anion – MSM-HC – MCS – LP Gradient

Order no.	Description
6.2617.040	<b>Tool for piston seal, macro</b> For removing and assembling the piston seal for all macro pump heads
6.2741.040	<b>PE/PTFE piston seal, macro</b> For all macro pump heads
6.2824.130	<b>Macro pump head PEEK</b> Macro pump head for intelligent IC instruments, flow range 0.1...20 mL/min, maximum pressure 12.5 MPa. Material: PEEK (metal-free)



### 6.6059.112 MagIC Net™ 1.1 Professional CD: 1 license

Professional PC program for controlling intelligent Professional IC systems, Compact IC instruments and their peripherals such as Professional Sample Processors, 800 Dosino, 771 Compact Interface, etc. The software permits control, data acquisition, evaluation and monitoring as well as report generation for ion chromatographic analyses. MagIC Net™ comprises the following features: graphic user interface for routine operations, extensive database programs, method development, configuration and manual system control, highly flexible user administration, efficient database operations, extensive data export functions, individually configurable report generator, control and monitoring of all system components and the chromatographic results. MagIC Net™ complies with FDA



Order no.	Description
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regulation 21 CFR part 11 as well as GLP. Dialog languages: German, English, French, Chinese, Korean, Japanese and more. 1 license.

<b>6.6059.113</b>	<b>MagIC Net™ 1.1 Multi CD: 3 licenses</b>
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Professional PC program for controlling intelligent Professional IC systems, Compact IC instruments and their peripherals such as Professional Sample Processors, 800 Dosino, 771 Compact Interface, etc. The software permits control, data acquisition, evaluation and monitoring as well as report generation for ion chromatographic analyses. MagIC Net™ comprises the following features: graphic user interface for routine operations, extensive database programs, method development, configuration and manual system control; highly flexible user administration, efficient database operations, extensive data export functions, individually configurable report generator, control and monitoring of all system components and the chromatographic results. MagIC Net™ complies with FDA regulation 21 CFR part 11 as well as GLP. Dialog languages: German, English, French, Chinese, Korean, Japanese and more. Client-Server version with 3 licenses.



<b>6.9988.503</b>	<b>Validation Documentation for 850 (English / German) – CD</b>
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Quality Management with Metrohm





# Index

## Numbers/Symbols

6.2821.090 aspiration filter ..... 80  
6.2821.130 filter ..... 91

## A

Accessories ..... 125  
  Optional ..... 136  
  Scope of delivery ..... 125  
Adsorption cartridges  
  Connection ..... 64  
Ambient conditions ..... 113  
Aspiration filter 6.2821.090 ..... 80  
Aspiration tubing for eluent ..... 33

## B

Baseline  
  Conditioning ..... 76  
  Unstable ..... 81  
Blockage  
  Conductivity detector ..... 105  
Blood ..... 93

## C

Cable feed-throughs ..... 30  
Capillaries  
  Installation ..... 20  
Capillary feed-throughs ..... 30  
Carry-over ..... 93  
Cartridges  
  Connection ..... 64  
Changing  
  Eluent ..... 80  
Cleaning  
  MSM-HC ..... 98  
  Valves of the high pressure  
  pump ..... 86  
CO<sub>2</sub> adsorption cartridge ..... 65  
  Replacement ..... 104  
Column  
  see also "Separation column"  
  ..... 72  
Column recognition ..... 119  
Column thermostat  
  Column thermostat ..... 116  
  Installation ..... 52  
Conditioning ..... 76  
Conductivity detector  
  Cable connector ..... 25  
  Capillary connector ..... 66  
  Cell constant ..... 118

  Cell volume ..... 118  
  Maintenance ..... 105  
  Positioning ..... 25  
Conductivity measuring system  
  Technical data ..... 118  
Connections  
  Installation ..... 20  
Connector  
  Mains ..... 119  
Contamination  
  High pressure pump ..... 80  
  Valves in the high pressure  
  pump ..... 81  
Contamination MSM-HC  
  Heavy metals ..... 96  
Crystallization  
  High pressure pump ..... 80

## D

Deaerating  
  High pressure pump ..... 44  
  Purge valve ..... 42  
Degasser  
  Eluent degasser ..... 37  
  Sample degasser ..... 48  
Degassing  
  Eluent ..... 37  
Degree of protection ..... 120  
Design  
  Safety specification ..... 120  
Detector  
  Cable connector ..... 25  
  Conductivity detector ..... 66  
  Interface ..... 119  
  Positioning ..... 25  
Diagram ..... 17  
Dilution ..... 93  
Dimensions ..... 114  
Door ..... 79  
Drainage tubing  
  Installation ..... 28

## E

Electromagnetic compatibility ..... 120  
Electrostatic charge ..... 6  
Eluent  
  Aspiration ..... 33  
  Production ..... 79

Eluent bottle  
  Figure ..... 36  
  Installation ..... 33  
  Operation ..... 80  
Eluent degasser  
  Installation ..... 37  
  Technical specifications ..... 114  
EMC ..... 120  
Emission ..... 120  
Equilibration ..... 76

## F

Feed-throughs  
  Capillaries ..... 30  
Fill  
  Injection valve ..... 52  
Filter  
  see also "inline filter" ..... 46  
Filter 6.2821.090  
  Aspiration filter ..... 80  
Flow fluctuations ..... 81  
Flow increment ..... 115  
Flow range ..... 115  
Flow rate ..... 115  
Frequency ..... 119

## G

Gas ..... 37, 48  
GLP ..... 107  
Guarantee ..... 123  
Guard column  
  Installation ..... 70  
  Rinsing ..... 71

## H

H<sub>2</sub>O adsorption cartridge ..... 65  
  Regeneration ..... 104  
Handle ..... 22  
Heating  
  see also "Column thermostat"  
  ..... 52  
Heavy metals  
  Contamination of the MSM-HC  
  ..... 96  
High Capacity Metrohm Suppressor  
Module  
  see also "MSM-HC" ..... 55  
High pressure pump  
  Installation ..... 42  
  Maintenance ..... 80

- Protection ..... 27, 80  
 Technical specifications ..... 115  
 Tubing connection ..... 42  
 Valves ..... 89  
 Housing ..... 114  
 Humidity ..... 113
- I**
- IC column  
 see also "Separation column"  
 ..... 72  
 Immunity ..... 120  
 Impurity MSM-HC  
 Organic ..... 96  
 Initial installation ..... 13  
 Inject  
 Injection valve ..... 52  
 Injection valve ..... 2  
 Fill ..... 52  
 Inject ..... 52  
 Installation ..... 50, 116  
 Maintenance ..... 95  
 Protection ..... 95  
 Inline filter ..... 46  
 Inline sample preparation ..... 93  
 Installation ..... 17  
 Column thermostat ..... 52  
 Conductivity detector ..... 66  
 Drainage tubing ..... 28  
 Eluent bottle ..... 33  
 Eluent degasser ..... 37  
 Guard column ..... 70  
 High pressure pump ..... 42  
 Initial installation ..... 13  
 Injection valve ..... 50, 116  
 Leak sensor ..... 27  
 Low pressure gradient ..... 16  
 MCS ..... 63  
 MSM-HC ..... 55  
 Peristaltic pump ..... 59  
 Pulsation damper ..... 47  
 Pump tubings ..... 59  
 Sample degasser ..... 48  
 Separation column ..... 72  
 Verbindungen ..... 20  
 Instrument  
 Connecting ..... 69  
 Interface  
 MSB ..... 119  
 USB ..... 119  
 Interfaces ..... 119  
 Further connections ..... 119  
 Leak sensor ..... 119
- L**
- Leak ..... 81  
 Leak sensor  
 Connection socket ..... 11  
 Installation ..... 27  
 Interface ..... 119  
 Technical data ..... 113  
 Leak-tightness ..... 75, 76  
 Leaking piston seals ..... 81  
 Loop  
 see also "Sample loop" ..... 52  
 Low pressure gradient  
 Installation ..... 16
- M**
- Mains cable ..... 69  
 Mains connection ..... 69, 70, 119  
 Mains connection socket ..... 11  
 Mains voltage ..... 5  
 Maintenance  
 Conductivity detector ..... 105  
 High pressure pump ..... 80  
 Injection valve ..... 95  
 MSM-HC ..... 95  
 Peristaltic pump ..... 101  
 Pump head ..... 81  
 Material ..... 114  
 MCS  
 Capillary connector ..... 63  
 Connecting the cartridges ... 64  
 Installation ..... 63  
 Technical data ..... 117  
 Use ..... 63  
 Measuring range ..... 118  
 MPak  
 Holder ..... 24  
 MSB ..... 119  
 Connectors ..... 11  
 MSM-HC  
 Cleaning ..... 98  
 Installation ..... 55  
 Maintenance ..... 95  
 Operation ..... 95  
 Protection ..... 95  
 Regeneration ..... 96  
 Replacing parts ..... 100  
 Switching ..... 96  
 Technical specifications ..... 117
- N**
- Noise ..... 118
- O**
- Oil ..... 93
- Operation  
 MSM-HC ..... 95  
 Peristaltic pump ..... 101  
 Sample degasser ..... 95  
 Optional accessories ..... 136  
 Organic impurities  
 MSM-HC ..... 96  
 Overview of the instrument ..... 8  
 Rear ..... 10
- P**
- PC connector ..... 69  
 Peristaltic pump  
 Installation ..... 59  
 Maintenance ..... 101  
 Operation ..... 101  
 Principle ..... 58  
 Technical specifications ..... 117  
 Piston seal ..... 81  
 Pistons of the high pressure pump  
 ..... 81  
 Power consumption ..... 119  
 Power supply unit ..... 119  
 Precipitates ..... 80  
 Pressure limit ..... 115  
 Pressure range ..... 115  
 Pressure screws  
 Connection ..... 21  
 Protection  
 Injection valve ..... 95  
 Inline filter ..... 46  
 Protection  
 MSM-HC ..... 95  
 Protection class ..... 120  
 Pulsation ..... 81  
 Pulsation damper  
 Installation ..... 47  
 Pump head  
 Maintenance ..... 81  
 Pump tubing  
 Overview ..... 102  
 Pump tubings  
 Installing ..... 59  
 Service life ..... 101  
 Purge valve ..... 42
- Q**
- Quality Management ..... 107
- R**
- Reference conditions ..... 113  
 Regeneration ..... 77  
 MSM-HC ..... 96  
 Rinsing  
 Conductivity detector ..... 105

## Index

Guard column ..... 71  
Pump tubings ..... 102  
Sample path ..... 93  
Separation column ..... 73  
Rinsing time ..... 94  
Rise in pressure ..... 80  
Rollers ..... 22

## S

Safety instructions ..... 5  
Safety shutdown ..... 115  
Safety specification ..... 120  
Sample  
    Carry-over ..... 93  
    Sample loop ..... 52  
    Transfer time ..... 93  
Sample degasser  
    Installation ..... 48  
    Operation ..... 95  
    Technical data ..... 116  
Sample loop ..... 52  
Sample path  
    Rinsing ..... 93  
Sample preparation ..... 93  
Scope of delivery ..... 125  
Screws  
    Connection ..... 21  
Separation column  
    Installation ..... 72  
    Protection ..... 2, 47, 106  
    Regeneration ..... 106  
    Rinsing ..... 73

Separating efficiency ..... 105  
Storage ..... 106  
Service ..... 5, 77  
Service Agreement ..... 107  
Shutting down ..... 78  
Standards ..... 120  
Start-up ..... 74  
Storage ..... 113  
Suppressor  
    Maintenance ..... 95  
    Operation ..... 95  
Switching on ..... 70

## T

Technical data  
    Column thermostat ..... 116  
    Conductivity measuring system  
        ..... 118  
    Detector ..... 119  
    Interfaces ..... 119  
    Leak sensor ..... 113  
    MCS ..... 117  
    Reference conditions ..... 113  
    Sample degasser ..... 116  
Technical specifications  
    Eluent degasser ..... 114  
    High pressure pump ..... 115  
    Peristaltic pump ..... 117  
Technical Specifications  
    MSM-HC ..... 117  
Temperature ..... 113

Test  
    Safety specification ..... 120  
Thermostat  
    see also "Column thermostat"  
        ..... 52  
Transfer time ..... 93  
Transport ..... 113  
    Rollers ..... 22  
Transport locking screws ..... 27  
Tubing ..... 17  
Tubing pump  
    See also "Peristaltic pump" . 58  
Tubings  
    Installation ..... 20

## U

USB ..... 119  
    Connectors ..... 11

## V

Vacuum pump  
    Protection ..... 27  
Validation ..... 107  
Valve  
    see also "Injection valve" .... 50  
Valves of the high pressure pump  
    ..... 89  
Voltage ..... 119

## W

Warranty ..... 123