850 Professional IC

AnCat – MCS – 2.850.3030

Manual
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# Table of contents

1 Introduction  
   1.1 Instrument description .......................................................... 1 
   1.2 Intended use .......................................................................... 5 
   1.3 About the documentation ...................................................... 5 
      1.3.1 Symbols and conventions .................................................. 5 
   1.4 Safety instructions ................................................................. 6 
      1.4.1 General notes on safety .................................................... 6 
      1.4.2 Electrical safety .............................................................. 6 
      1.4.3 Tubing and capillary connections ..................................... 7 
      1.4.4 Flammable solvents and chemicals ................................... 8 
      1.4.5 Recycling and disposal .................................................... 8 

2 Installation  
   2.1 About this chapter .................................................................. 9 
   2.2 Initial installation .................................................................... 9 
   2.3 Flow diagram .......................................................................... 11 
   2.4 Setting up the instrument .......................................................... 14 
      2.4.1 Packaging ........................................................................ 14 
      2.4.2 Checks ............................................................................ 14 
      2.4.3 Location .......................................................................... 14 
   2.5 Capillary connections in the IC system ...................................... 14 
   2.6 Rear of the instrument ............................................................... 16 
      2.6.1 Rollers and handle ............................................................ 16 
      2.6.2 Positioning and connecting the detector ............................ 19 
      2.6.3 Transport locking screws ................................................ 21 
      2.6.4 Leak sensor ..................................................................... 21 
      2.6.5 Drainage tubing ............................................................... 22 
   2.7 Capillary and cable feed-throughs ............................................. 24 
   2.8 Eluent ...................................................................................... 27 
      2.8.1 Connecting eluent bottle ................................................... 27 
   2.9 Eluent degasser ......................................................................... 31 
   2.10 High pressure pump ............................................................... 32 
      2.10.1 Capillary connections high pressure pump/purge valve ..... 32 
      2.10.2 Deaerating the high pressure pump ................................. 35 
   2.11 Inline filter ............................................................................ 37 
   2.12 Pulsation damper ................................................................... 38 
   2.13 Sample degasser ..................................................................... 40
# Table of contents

2.14 **Injection valve** ................................................................. 41  
2.14.1 Connecting the injection valve .................................................. 41  
2.14.2 Mode of operation of the injection valve .......................... 42  
2.14.3 Selecting the sample loop .................................................. 43  

2.15 **Column thermostat** .................................................. 44  

2.16 **Metrohm Suppressor Module (MSM)** ......................... 47  
2.16.1 General information on the MSM ................. 47  
2.16.2 Connecting the MSM .................................................. 47  

2.17 **Peristaltic pump** .......................................................... 50  
2.17.1 Principle of the peristaltic pump ......................................... 50  
2.17.2 Installing the peristaltic pump ........................................ 51  

2.18 **Metrohm CO₂ suppressor (MCS)** ................................ 55  
2.18.1 General information on the MCS ........................................... 55  
2.18.2 Connecting MCS .................................................. 55  
2.18.3 Installing the adsorption cartridges .................................... 56  

2.19 **Conductivity detector** .................................................. 58  

2.20 **Connecting the instrument** ........................................... 61  
2.20.1 Connecting the instrument to the PC ....................... 61  
2.20.2 Connecting the instrument to mains supply ............ 61  

2.21 **Guard column** .......................................................... 62  

2.22 **Separation column** .................................................. 64  

3 **Start-up** ........................................................................ 66  
3.1 Initial start-up .................................................................. 66  
3.2 Conditioning ..................................................................... 67  

4 **Operation and maintenance** ..................................... 69  
4.1 **General information** .................................................. 69  
4.1.1 Care ........................................................................... 69  
4.1.2 Maintenance by Metrohm Service ......................... 69  
4.1.3 Operation .......................................................... 70  
4.1.4 Shutting down .................................................. 70  

4.2 **Capillary connections** .................................................. 70  
4.2.1 Operation .......................................................... 70  

4.3 **Door** ........................................................................... 71  

4.4 **Eluent** ........................................................................... 71  
4.4.1 Production .................................................................. 71  
4.4.2 Operation .................................................................. 72  

4.5 **High pressure pump** .................................................. 72  
4.5.1 Protection .................................................................. 72  
4.5.2 Maintenance .......................................................... 73
4.6 Inline filter ................................................................. 83
4.6.1 Maintenance .............................................................. 83
4.7 Inline sample preparation ............................................... 85
4.8 Rinsing the sample path ................................................. 85
4.9 Sample degasser ........................................................... 87
4.9.1 Operation ................................................................. 87
4.10 Injection valve ............................................................. 87
4.10.1 Protection ................................................................. 87
4.11 Metrohm Suppressor Module (MSM) ......................... 87
4.11.1 Protection ................................................................. 87
4.11.2 Operation ................................................................. 87
4.11.3 Maintenance .............................................................. 88
4.12 Peristaltic pump ........................................................... 93
4.12.1 Operation ................................................................. 93
4.12.2 Maintenance .............................................................. 94
4.13 Metrohm CO\textsubscript{2} suppressor (MCS) ................... 96
4.13.1 Replacing the CO\textsubscript{2} adsorption cartridge .......... 96
4.13.2 Regenerating the H\textsubscript{2}O adsorption cartridge .... 96
4.14 Conductivity detector .................................................... 97
4.14.1 Maintenance .............................................................. 97
4.15 Separation column ....................................................... 97
4.15.1 Separating efficiency .................................................. 97
4.15.2 Protection ................................................................. 98
4.15.3 Storage ................................................................. 98
4.15.4 Regeneration .............................................................. 98
4.16 Quality Management and validation with Metrohm ...... 99

5 Troubleshooting ............................................................. 100
5.1 Problems and their solutions .......................................... 100

6 Technical specifications .................................................. 105
6.1 Reference conditions .................................................... 105
6.2 Instrument ................................................................. 105
6.3 Leak sensor ................................................................. 105
6.4 Ambient conditions ...................................................... 105
6.5 Housing ................................................................. 106
6.6 Eluent degasser ............................................................ 106
6.7 High pressure pump ...................................................... 106
6.8 Sample degasser .......................................................... 107
6.9 Injection valve .............................................................. 107
Table of contents

6.10 Column thermostat .................................................. 108
6.11 Metrohm Suppressor Module (MSM) ....................... 108
6.12 Peristaltic pump ....................................................... 108
6.13 Metrohm CO₂ suppressor (MCS) .............................. 109
6.14 Conductivity measuring system ............................... 109
6.15 Mains connection .................................................... 110
6.16 Interfaces ............................................................... 110
6.17 Safety specification .................................................. 111
6.18 Electromagnetic compatibility (EMC) ....................... 111
6.19 Weight ................................................................. 111

7 Conformity and warranty ............................................ 112
  7.1 Declaration of Conformity .......................................... 112
  7.2 Quality Management Principles ............................... 113
  7.3 Warranty (guarantee) ............................................... 114

8 Accessories ............................................................... 116
  8.1 Scope of delivery .................................................... 116
  8.2 Optional accessories .............................................. 127

Index ................................................................. 131
# Table of figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Front view of the instrument</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Flow diagram for a 2-channel system</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>Connection of capillaries with pressure screws</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Rollers and handle</td>
<td>17</td>
</tr>
<tr>
<td>5</td>
<td>Handle as MPak holder</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>Removable rear panel</td>
<td>19</td>
</tr>
<tr>
<td>7</td>
<td>Connection for the leak sensor on the rear of the instrument</td>
<td>22</td>
</tr>
<tr>
<td>8</td>
<td>Drainage tubing</td>
<td>23</td>
</tr>
<tr>
<td>9</td>
<td>Capillary feed-throughs on the doors</td>
<td>25</td>
</tr>
<tr>
<td>10</td>
<td>Capillary feed-throughs base tray/covering plate</td>
<td>26</td>
</tr>
<tr>
<td>11</td>
<td>Installing eluent bottle attachment</td>
<td>28</td>
</tr>
<tr>
<td>12</td>
<td>Mounting aspiration filter</td>
<td>28</td>
</tr>
<tr>
<td>13</td>
<td>Installing tubing weighting and aspiration filter</td>
<td>29</td>
</tr>
<tr>
<td>14</td>
<td>Eluent aspiration tubing fully equipped</td>
<td>29</td>
</tr>
<tr>
<td>15</td>
<td>Eluent bottle – connected</td>
<td>30</td>
</tr>
<tr>
<td>16</td>
<td>Eluent degasser</td>
<td>31</td>
</tr>
<tr>
<td>17</td>
<td>Capillary connections high pressure pump/purge valve</td>
<td>33</td>
</tr>
<tr>
<td>18</td>
<td>High pressure pump – Connect inlet</td>
<td>34</td>
</tr>
<tr>
<td>19</td>
<td>Deaerating the high pressure pump</td>
<td>36</td>
</tr>
<tr>
<td>20</td>
<td>Connecting inline filter</td>
<td>38</td>
</tr>
<tr>
<td>21</td>
<td>Pulsation damper – Connection</td>
<td>39</td>
</tr>
<tr>
<td>22</td>
<td>Sample degasser</td>
<td>40</td>
</tr>
<tr>
<td>23</td>
<td>Injection valve – connected</td>
<td>41</td>
</tr>
<tr>
<td>24</td>
<td>Injection valve – Positions</td>
<td>43</td>
</tr>
<tr>
<td>25</td>
<td>Column thermostat</td>
<td>45</td>
</tr>
<tr>
<td>26</td>
<td>MSM – connections</td>
<td>48</td>
</tr>
<tr>
<td>27</td>
<td>Peristaltic pump</td>
<td>50</td>
</tr>
<tr>
<td>28</td>
<td>Installing the pump tubing</td>
<td>51</td>
</tr>
<tr>
<td>29</td>
<td>Install pump tubing connection with filter</td>
<td>52</td>
</tr>
<tr>
<td>30</td>
<td>Install pump tubing connection without filter</td>
<td>53</td>
</tr>
<tr>
<td>31</td>
<td>MCS – connection</td>
<td>55</td>
</tr>
<tr>
<td>32</td>
<td>Adsorption cartridge holder</td>
<td>57</td>
</tr>
<tr>
<td>33</td>
<td>Conductivity detector front</td>
<td>59</td>
</tr>
<tr>
<td>34</td>
<td>Conductivity detector rear</td>
<td>60</td>
</tr>
<tr>
<td>35</td>
<td>Connection detector – MCS</td>
<td>61</td>
</tr>
<tr>
<td>36</td>
<td>Removing piston</td>
<td>74</td>
</tr>
<tr>
<td>37</td>
<td>Components of the piston cartridge</td>
<td>75</td>
</tr>
<tr>
<td>38</td>
<td>Tool for piston seal 6.2617.010</td>
<td>76</td>
</tr>
<tr>
<td>39</td>
<td>Removing the piston seal</td>
<td>77</td>
</tr>
<tr>
<td>40</td>
<td>Insert the piston seal into the tool</td>
<td>77</td>
</tr>
<tr>
<td>41</td>
<td>Inserting the piston seal into the pump head</td>
<td>78</td>
</tr>
<tr>
<td>42</td>
<td>Removing valves</td>
<td>79</td>
</tr>
<tr>
<td>43</td>
<td>Dismantling valve</td>
<td>80</td>
</tr>
<tr>
<td>44</td>
<td>Components of the inlet valve and outlet valve</td>
<td>81</td>
</tr>
<tr>
<td>45</td>
<td>Changing the filter</td>
<td>83</td>
</tr>
<tr>
<td>Figure 46</td>
<td>MSM – Components ........................................................................................................ 90</td>
<td></td>
</tr>
<tr>
<td>Figure 47</td>
<td>Pump tubing connection – Changing the filter ......................................................... 95</td>
<td></td>
</tr>
</tbody>
</table>
1 Introduction

1.1 Instrument description

The instrument **850 Professional IC – AnCat – MCS (2.850.3030)** 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.
1.1 Instrument description

Figure 1  Front view of the instrument

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 1 | Eluent bottle  
   See Chapter 2.8.1. |
| 2 | Conductivity detectors  
   See Chapter 2.19. |
| 3 | MCS  
   See Chapter 2.18. |
| 4 | Peristaltic pump  
   See Chapter 2.17. |
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.

**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.
1.1 Instrument description

**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.

**Metrohm Suppressor Module (MSM)**
The MSM is used for chemical suppression 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\(_2\) suppressor (MCS)**
The MCS removes the CO\(_2\) 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 – AnCat – MCS is used for the ion chromatographic determination of cations and anions. The two channels can be operated in parallel or completely independently of one another. Sequential suppression can be used in the anion channel:

- Chemical suppression with the Metrohm Suppressor Module (MSM) (see Chapter 2.16, page 47) and subsequent
- CO₂ suppression with the Metrohm CO₂ Suppressor (MCS) (see Chapter 2.18, page 55).

The use of sequential suppression reduces background conductivity to a minimum.

If required, the instrument can also be used for the determination of cations or anions without suppression.

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:

- **Cross-reference to figure legend**
  
  The first number refers to the figure number, the second to the instrument part in the figure.

- **Instruction step**
  
  Carry out these steps in the sequence shown.

- **Warning**
  
  This symbol draws attention to a possible life hazard or risk of injury.

- **Warning**
  
  This symbol draws attention to a possible hazard due to electrical current.
### 1.4 Safety instructions

#### 1.4.1 General notes on safety

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="warning.png" alt="Warning" /></td>
<td>This symbol draws attention to a possible hazard due to heat or hot instrument parts.</td>
</tr>
<tr>
<td><img src="warning.png" alt="Warning" /></td>
<td>This symbol draws attention to a possible biological hazard.</td>
</tr>
<tr>
<td><img src="caution.png" alt="Caution" /></td>
<td>This symbol draws attention to a possible damage of instruments or instrument parts.</td>
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<tr>
<td><img src="note.png" alt="Note" /></td>
<td>This symbol marks additional information and tips.</td>
</tr>
</tbody>
</table>

**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 Installation

2.1 About this chapter

The Installation chapter contains

- a list of all the steps to be carried out during the initial installation (see Chapter 2.2, page 9).
- a schematic overview of the flow paths (see Chapter 2.3, page 11).
- a description of the construction, connections and functionality of the instrument.
- step-by-step installation instructions. A part of these installation tasks has already been carried out before delivery. They are nevertheless described here in case they need to be carried out once again some time in the future (e.g. after maintenance of the high pressure pump).

2.2 Initial installation

Note

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

The following steps still have to be carried out after delivery:

Note

Each of the steps numbered 3, 7, 8, 11, 15 and 16 are to be performed for the anion and cation channels, respectively.

1 Setting up the instrument (see Chapter 2.4, page 14).

2 Remove handle and rollers (see Chapter 2.6.1, page 16).

3 Place the detector in the instrument and connect it (see Chapter 2.6.2, page 19).

4 Remove transport locking screws (see Chapter 2.6.3, page 21).
5 Connect the leak sensor (see Chapter 2.6.4, page 21).

6 Connect drainage tubings (see Chapter 2.6.5, page 22).

7 Connect the eluent bottle (see Chapter 2.8.1, page 27).

8 Install sample path connections.
   - Connect the sample degasser (if required) (see Chapter 2.13, page 40).
   - Connect sample path connections to the injection valve (see Chapter 2.14.2, page 42).

9 Installing the MSM (see Chapter 2.16, page 47) – with associated peristaltic pump (see Chapter 2.17, page 50).

10 Connect the MCS (see Chapter 2.18.2, page 55).

11 Connect detector capillaries (see Chapter 2.19, page 58).

12 Mains connection (see Chapter 2.20, page 61).

13 Connect the instrument to the PC (see Chapter 2.20.1, page 61).

14 Initial start-up (see Chapter 3.1, page 66).

15 Install the guard column (if used) (see Chapter 2.21, page 62).

16 Install the separation column (see Chapter 2.22, page 64).
2.3 Flow diagram

Figure 2 Flow diagram for a 2-channel system shows the flow paths for a system with one cation channel and one anion channel with application of sequential suppression (MSM (2.9) and MCS (2.10)):

**Anion channel**

With the upper high pressure pump (2.3), the MSM (2.9) and the left-hand conductivity detector (2.11).

**Cation channel**

With the lower high pressure pump (2.18) and the right-hand conductivity detector (2.24).

The two channels can be operated in parallel or completely independently of one another.

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 2.21, page 62) are not shown in the diagram. Which pressure screws, connections and couplings are used, is described in the installation chapters of the individual modules.
Figure 2  Flow diagram for a 2-channel system

1  Eluent input
   Connection to the eluent bottle (see Chapter 2.8.1, page 27).

2  Eluent degasser
   See Chapter 2.9.
<table>
<thead>
<tr>
<th></th>
<th>Equipment</th>
<th>Chapter/Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>High pressure pump</td>
<td>2.10</td>
</tr>
<tr>
<td>5</td>
<td>Inline filter</td>
<td>2.11</td>
</tr>
<tr>
<td>7</td>
<td>Injection valve</td>
<td>2.14</td>
</tr>
<tr>
<td>9</td>
<td>MSM</td>
<td>2.16</td>
</tr>
<tr>
<td>11</td>
<td>Detector</td>
<td>2.19</td>
</tr>
<tr>
<td>13</td>
<td>Sample input</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Sample output</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Eluent degasser</td>
<td>2.9</td>
</tr>
<tr>
<td>19</td>
<td>Purge valve</td>
<td>2.10.1</td>
</tr>
<tr>
<td>21</td>
<td>Pulsation damper</td>
<td>2.12</td>
</tr>
<tr>
<td>23</td>
<td>Separation column</td>
<td>2.22</td>
</tr>
<tr>
<td>25</td>
<td>Eluent output</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Sample degasser</td>
<td>2.13. Use optional</td>
</tr>
<tr>
<td>29</td>
<td>Peristaltic pump</td>
<td>2.17</td>
</tr>
<tr>
<td>4</td>
<td>Purge valve</td>
<td>2.10.1</td>
</tr>
<tr>
<td>6</td>
<td>Pulsation damper</td>
<td>2.12</td>
</tr>
<tr>
<td>8</td>
<td>Separation column</td>
<td>2.22</td>
</tr>
<tr>
<td>10</td>
<td>MCS</td>
<td>2.18</td>
</tr>
<tr>
<td>12</td>
<td>Eluent output</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Sample degasser</td>
<td>2.13</td>
</tr>
<tr>
<td>16</td>
<td>Eluent input</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>High pressure pump</td>
<td>2.10</td>
</tr>
<tr>
<td>20</td>
<td>Inline filter</td>
<td>2.11</td>
</tr>
<tr>
<td>22</td>
<td>Injection valve</td>
<td>2.14</td>
</tr>
<tr>
<td>24</td>
<td>Detector</td>
<td>2.19</td>
</tr>
<tr>
<td>26</td>
<td>Sample input</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Sample output</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Regeneration solution</td>
<td></td>
</tr>
</tbody>
</table>

When a guard column (see Chapter 2.21, page 62) is used, it is installed between injection valve and separation column.
2.4 Setting up the instrument

2.4.1 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.

2.4.2 Checks

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

2.4.3 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.

2.5 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 3  Connection of capillaries with pressure screws

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| **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**

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.
2.6 Rear of the instrument

2.6.1 Rollers and handle

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

---

**Caution**

For the capillary connections between the injection valve (see Chapter 2.14, page 41) and detector (see Chapter 2.19, page 58), PEEK capillaries with an internal diameter of 0.25 mm must be used. These are already connected to a newly delivered instrument.

*PTFE capillaries (poly-tetrafluoroethylene)*

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 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.
Figure 4  Rollers and handle

1  Knurled screws
   For fastening the handle (4-2) and the rear panel of the detector chamber.

2  Handle

3  Knurled screws
   For fastening the roller holder (4-5).

4  Rollers

5  Roller holder

Removing handle

1  Loosen knurled screws (4-1) and remove handle (4-2).

Removing rollers

Proceed as follows to remove the rollers:

1  Remove knurled screws (4-3).

2  Remove roller holder (4-5).
Mounting handle as MPak holder

Note

When extended, the handle (5-2) can also be used for hanging up MPaks (eluent bags).

1 Move handle (5-2) upwards and screw in the knurled screws (5-1) again.

Figure 5  Handle as MPak holder

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

2 Handle
   Extended. As holder for MPaks (eluent bag).
2.6.2 Positioning and connecting the detector

Figure 6 Removable rear panel

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

2 **Rear panel**  
Removable

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

4 **Capillary feed-throughs**

5 **Detector connection sockets**  
Labeled with Detector 1 and Detector 2 for connecting Metrohm detectors.
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 (6-1) on the rear panel.
   - Remove handle if still fastened to the instrument.
   - Remove rear panel (6-2).

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 (6-3) on the rear panel (6-2).
   - Place the detector output capillary in a suitable capillary feed-through.
   - Replace (6-2) rear panel.
     (Optionally, the handle can be remounted higher up and used as a holder for MPaks.)
   - Tighten (6-1) knurled screws.

4 Connecting the detector

Note

The instrument has two detector connection sockets (6-5), 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 (6·5)*.

### 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.

#### 2.6.3 Transport locking screws

To avoid damage to the high pressure pump and vacuum pump during transport, the pumps are secured with transport locking screws.

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.

#### 2.6.4 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 (7·2) 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 (7·2) into the leak sensor connector socket (7·1) on the rear of the instrument *(see Figure 7, page 22)*.
2.6 Rear of the instrument

Figure 7  Connection for the leak sensor on the rear of the instrument

1  Leak sensor connector socket
   Is labeled with “Leak Sensor”.

2  Leak sensor connector plug

3  Leak sensor connection cable
   Is firmly mounted on the rear of the instrument.

2.6.5 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 8  Drainage tubing

1  Drainage tubing connection
For draining escaped fluid from the covering plate.

3  Drainage tubing connection
For draining escaped fluid from the detector chamber.

5  Y connector 6.1807.010
For connecting the two drainage tubings (8-2) and (8-4).

2  Drainage tubing
Section of the 6.1816.020 silicon tubing. For draining escaped fluid from the covering plate.

4  Drainage tubing
Section of the 6.1816.020 silicon tubing. For draining escaped fluid from the detector chamber.

6  Drainage tubing
Section of the 6.1816.020 silicon tubing. Guides escaped fluid to the leak sensor.
2.7 Capillary and cable feed-throughs

### 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 connected drainage tubing to the leak sensor.

Proceed as follows to install the drainage tubing:

**Installing drainage tubing**

1. Plug drainage tubing (8·2) into the drainage tubing connection (8·1) of the covering plate and shorten to required length.

2. Plug drainage tubing (8·4) into the drainage tubing connection (8·3) of the detector chamber and shorten to required length.

3. Connect drainage tubing (8·2) from the covering plate and drainage tubing (8·4) from the detector chamber to the Y connector (8·5).

4. Connect drainage tubing (8·6) to the Y connector (8·5), shorten to required length and plug the other end of the drainage tubing into the drainage tubing connection (8·9).

5. Plug drainage tubing (8·7) into the drainage tubing connection (8·8) of the base tray and guide the other end into a waste container.

### 2.7 Capillary and cable feed-throughs

Several openings have been integrated for feeding through capillaries and cables. They are located on the doors (see Figure 9, page 25), on the rear panel (see Figure 6, Page 19) or below the covering plate or above the base tray (see Figure 10, Page 26).
Figure 9  Capillary feed-throughs on the doors

1  Luer connectors
   For connecting a 6.2816.020 syringe. For manual sample feeding.

2  Capillary feed-through

3  PEEK pressure screws, short
   6.2744.070

4  Door

Do not feed capillaries through the Luer connectors (9-1). The capillaries are fastened with PEEK pressure screws (9-3) from inside to the Luer connector. From outside, liquid can be aspirated or injected with a syringe.
2.7 Capillary and cable feed-throughs

Figure 10  Capillary feed-throughs base tray/covering plate

<table>
<thead>
<tr>
<th></th>
<th>Side panel (right)</th>
<th>Rear of the instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Right panel.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Side panel (left)</td>
<td>Front of the instrument</td>
</tr>
<tr>
<td>5</td>
<td>Capillary feed-through</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Upper. From front to right.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Capillary feed-through</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Upper. From front to back.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Lower. From front to right.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Capillary feed-through</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Upper. From front to back.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Capillary feed-through</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Lower. From front to left.</td>
<td></td>
</tr>
</tbody>
</table>
2.8 Eluent

2.8.1 Connecting eluent bottle

The eluent is aspirated out of the eluent bottle via the eluent aspiration tubing (11-1).

The eluent aspiration tubing is connected to the eluent degasser (see Chapter 2.9, page 31). The tubing must be threaded through a suitable capillary feed-through (see Chapter 2.7, page 24) 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:

<table>
<thead>
<tr>
<th>Assembling eluent aspiration tubing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Guide the free end of the eluent aspiration tubing (11-1) out of the instrument through a suitable capillary feed-through.</td>
</tr>
<tr>
<td>2 Installing the 6.1602.160 eluent bottle attachment</td>
</tr>
<tr>
<td>- Slide tubing nipple (11-2) and O-ring (11-3) onto the eluent aspiration tubing (11-1).</td>
</tr>
<tr>
<td>- Push eluent aspiration tubing (11-1) through the bottle attachment (11-4) and screw tight.</td>
</tr>
</tbody>
</table>
2.8 Eluent

![Diagram of eluent bottle attachment]

**Figure 11  Installing eluent bottle attachment**

| 1  | Eluent aspiration tubing 6.1834.080 |

3 Mounting aspiration filter

- Insert filter holder (12-1) into the aspiration filter (12-2) and screw tight.

![Diagram of mounting aspiration filter]

**Figure 12  Mounting aspiration filter**

| 2  | Aspiration filter 6.2821.090 |

---

850 Professional IC – AnCat – MCS
4 Installing tubing weighting and aspiration filter

- Slide the tubing weighting (13-3) onto the eluent aspiration tubing (13-1).
- Slide the clamping screw (13-4) onto the eluent aspiration tubing (13-1).
- Insert eluent aspiration tubing (13-1) into the aspiration filter (13-5). The end of the tubing must touch the base of the filter.
- Screw together clamping screw (13-4) and filter holder (12-1). The end of the tubing must still touch the base of the filter.

5 Mounting eluent aspiration tubing to the eluent bottle

- Insert the eluent aspiration tubing into the eluent bottle (15-10).
- Fasten the bottle attachment (13-2) on the eluent bottle (15-10). The aspiration filter (15-6) 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$_2$ adsorber (15-4).

- First, place a piece of wadding (15-3); then the CO$_2$ adsorber (15-4) in the large opening of the adsorber tube (15-2) and close with the plastic cover.
- Fasten the adsorber tube (15-2) using the SGJ clip (15-12) onto the bottle attachment (15-11).

**Figure 15 Eluent bottle – connected**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Eluent aspiration tubing 6.1834.080 For aspirating the eluent. Pre-installed.</td>
</tr>
<tr>
<td>2</td>
<td>Adsorber tube 6.1609.000</td>
</tr>
<tr>
<td>3</td>
<td>Wadding</td>
</tr>
<tr>
<td>4</td>
<td>CO$_2$ adsorber Adsorbs CO$_2$ from the air (e.g. Merck soda lime with indicator, no. 6839.10).</td>
</tr>
</tbody>
</table>
2.9 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**

![Diagram of eluent degasser connection](image)

**Figure 16** Eluent degasser

1 Eluent degasser input

2 Eluent degasser output
### 2.10 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 2.10.2, page 35) the high pressure pump.

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

All of the capillary connections of the high pressure pump and the purge valve are already installed in the newly delivered instrument.
Figure 17  Capillary connections high pressure pump/purge valve

1  Connection capillary
   PEEK capillary, connects main piston and auxiliary piston.

3  Outlet valve holder

5  Fastening screws
   For fastening the pump head.

7  Pump head input capillary
   PEEK capillary at the input of the pump head.

9  Coupling
   For the connection of the eluent path at the input of the high pressure pump. Can be ordered together with the pressure screw (17-8) under the number 6.2744.230.

11 Purge valve
   For deaerating the high pressure pump. With rotary knob in the center and pressure sensor.

13 Connection capillary
   Connects the output of the pump head with the purge valve.

2  PEEK pressure screw, short 6.2744.070

4  Pump head 6.2824.110

6  Inlet valve holder

8  Pressure screw
   For connecting a PEEK capillary to the coupling (17-9).

10 Deaerating capillary
   For aspirating the eluent when deaerating the high pressure pump (see Chapter 2.10.2, page 35).

12 Connection capillary
   For connecting the inline filter (see Chapter 2.11, page 37)
Note

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

Connecting inlet to the high pressure pump

1. **Pressure screw**
   For connecting the coupling (18-2) to the pump head input capillary (17-7).
   Can be ordered together with the coupling under the number 6.2744.230.

2. **Coupling 6.2744.230**
   For connecting the eluent aspiration tubing (18-4) to the input of the high pressure pump.

3. **Clamping screw**

4. **Eluent aspiration tubing**
   Eluent aspiration tubing 6.1834.080 or 6.1834.090.

5. **Backup ring**

1. **Connecting coupling**
   Fasten the coupling (18-2) with a pressure screw (18-1) on the pump head input capillary (17-7).

2. **Connecting eluent aspiration tubing**

   **Caution**

   The clamping screws must be tightened carefully. To tighten, grip the coupling (18-2) with the 6.2739.000 key and grip the clamping screw (18-3) with the 6.2621.050 wrench.

   - Plug the eluent aspiration tubing (18-4) into the coupling (18-2).
   - Tighten clamping screw (18-3).
2.10.2 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 3.1, page 66).

Deaerate the high pressure pump as follows (see Figure 19, page 36):
### Deaerating the high pressure pump

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

![Figure 19 Deaerating the high pressure pump](image)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Syringe 10 mL 6.2816.020</td>
</tr>
<tr>
<td></td>
<td>For aspirating the eluent.</td>
</tr>
<tr>
<td>2</td>
<td>Luer connector</td>
</tr>
<tr>
<td></td>
<td>On purging needle.</td>
</tr>
<tr>
<td>3</td>
<td>Purging needle 6.2816.040</td>
</tr>
<tr>
<td>4</td>
<td>Deaerating capillary</td>
</tr>
<tr>
<td>5</td>
<td>PEEK pressure screws, short 6.2744.070</td>
</tr>
<tr>
<td>6</td>
<td>Purge valve</td>
</tr>
<tr>
<td>7</td>
<td>Purge valve rotary knob</td>
</tr>
</tbody>
</table>

### Connecting the purging needle

- Push the end of the purging needle (19-3) over the end of the deaerating capillary (19-4) on the purge valve.

### Connecting the syringe

- Insert syringe (19-1) in the Luer connector (19-2) of the purging needle (see Figure 19, page 36).

### Opening purge valve

- Open the rotary knob (19-7) 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 (19-1) until bubble-free eluent flows into the syringe.

6 Completing deaerating
- Turn off high pressure pump.
- Close rotary knob (19-7).
- Remove syringe (19-1) from the Luer connector (19-2).
- Pull the purging needle (19-3) out of the deaerating capillary (19-4).

2.11 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.
2.12 Pulsation damper

Installing the inline filter

**Caution**

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

![Connecting inline filter](image)

**Figure 20  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.

2.12 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 2.10, page 32) and injection valve (see Chapter 2.14, page 41).

The pulsation damper can be operated in both directions.

Figure 21  Pulsation damper – Connection

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 1 | Connection capillary  
   Connection to the inline filter. |
| 2 | Fastening screws |
| 3 | PEEK pressure screws, short 6.2744.070 |
| 4 | Holder for pulsation damper |
| 5 | Pulsation damper 6.2620.150 |
| 6 | Connection capillary  
   Connection to the injection valve. |
2.13 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 22  Sample degasser**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sample degasser input</td>
</tr>
<tr>
<td>2</td>
<td>Sample degasser output</td>
</tr>
<tr>
<td>3</td>
<td>PEEK pressure screw, long 6.2744.090</td>
</tr>
<tr>
<td>4</td>
<td>Connection capillaries 6.1803.040</td>
</tr>
</tbody>
</table>

**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 (22-3) to the output of the sample degasser (22-2).

3. Connect 6.1803.040 connection capillary with a long PEEK pressure screw (22-3) to the input of the sample degasser (22-1).
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.

### 2.14 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.

#### 2.14.1 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 23  Injection valve – connected**

<table>
<thead>
<tr>
<th></th>
<th>Injection valve</th>
<th>Sample loop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Sample loop</td>
<td>Connected to connectors 3 and 6.</td>
</tr>
</tbody>
</table>
2.14 Injection valve

| 3 | Connection capillary | Connected to connector 4. Carries eluent to the injection valve. |
| 4 | Connection capillary (column inlet capillary) | Connected to connector 5. Carries eluent to the separation column. |
| 5 | Connection capillary | Connected to connector 1. Carries sample to the injection valve. |
| 6 | Connection capillary | Connected to connector 2. Carries sample to the waste container. |
| 7 | PEEK pressure screw 6.2744.010 |

---

Re 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 2.14.3, page 43.

**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 (23-2) with a 6.2744.010 PEEK pressure screw (23-7) to connector 3.
   - Fasten the other end of the sample loop (23-2) with a second 6.2744.010 PEEK pressure screw (23-7) to connector 6.

---

2.14.2 Mode of operation of the injection valve

The injection valve (see Figure 24, page 43) 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 24 Injection valve – Positions

<table>
<thead>
<tr>
<th></th>
<th>Position FILL</th>
<th>Position INJECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1 Eluent input</td>
<td>2 Eluent output</td>
</tr>
<tr>
<td></td>
<td>Capillary coming from the high pressure pump.</td>
<td>Capillary to the column.</td>
</tr>
<tr>
<td>B</td>
<td>3 Sample input</td>
<td>4 Sample output</td>
</tr>
<tr>
<td></td>
<td>Sample aspirating capillary.</td>
<td>Capillary to waste container.</td>
</tr>
<tr>
<td></td>
<td>5 Sample loop</td>
<td></td>
</tr>
</tbody>
</table>

**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.

### 2.14.3 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
2.15 **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.
The column thermostat contains two column holders (25-3) equipped with chip recognition. The separation columns can be clicked into the column holder with the chip.
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 (25-1).
2. Slide the column input capillary from below into the outer of the two capillary recesses (25-2). 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 above to below through the inner capillary recess until it emerges at the lower edge of the holder plate.

**Note**

The columns (guard column and separation column) may only be installed after the initial start-up (see Chapter 3.1, page 66).

- **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.
2.16 MetrohmSuppressorModule(MSM)

2.16.1 General information on the MSM

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

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

\[
R\text{-SO}_3^- + NaHCO_3/Na_2CO_3 \rightarrow R\text{-SO}_3^-Na^+ + H_2O + CO_2
\]

2.16.2 Connecting the MSM

To protect the MSM against foreign particles or bacterial growth, a 6.2744.180 pump tubing connection with filter (29-3) must be mounted between the peristaltic pump and the input capillaries of the MSM.

The three inputs and outputs of the suppressor units numbered 1..3 on the MSM each have 2 fixed mounted PTFE capillaries (see Figure 26, page 48).
The PTFE capillaries firmly mounted on the MSM are connected to the other components of the IC system as follows:

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Union nut</td>
</tr>
<tr>
<td>3</td>
<td>Eluent input capillary</td>
</tr>
<tr>
<td></td>
<td>Labeled with <em>Eluent.</em></td>
</tr>
<tr>
<td>5</td>
<td>Rinsing solution input capillary</td>
</tr>
<tr>
<td></td>
<td>Labeled with <em>H2O.</em></td>
</tr>
<tr>
<td>7</td>
<td>Regeneration solution output capillary</td>
</tr>
<tr>
<td></td>
<td>Labeled with <em>Waste.</em></td>
</tr>
<tr>
<td>8</td>
<td>Regeneration solution input capillary</td>
</tr>
<tr>
<td></td>
<td>Labeled with <em>H2SO4.</em></td>
</tr>
<tr>
<td>2</td>
<td>MSM connecting piece 6.2832.010</td>
</tr>
<tr>
<td>4</td>
<td>Eluent output capillary</td>
</tr>
<tr>
<td></td>
<td>Labeled with <em>Detector.</em></td>
</tr>
<tr>
<td>6</td>
<td>Rinsing solution output capillary</td>
</tr>
<tr>
<td></td>
<td>Labeled with <em>Waste.</em></td>
</tr>
</tbody>
</table>

**Caution**

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

Flattened capillaries must be shortened with the help of a 6.2621.080 capillary cutter.
Connecting the capillaries of the MSM

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

2 Connecting the eluent output capillary
   - Fasten the end of the output capillary labeled with *Detector* with a 6.2744.090 long PEEK pressure screw to the input of the MCS (insofar as an MCS is being used).
   OR
   Connect the end of the output capillary labeled with *Detector* and the detector input capillary with a 6.2744.040 coupling and two 6.2744.070 short pressure screws.

3 Connecting the rinsing solution input capillary
   - Fasten the end of the input 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 solution output capillary
   - Guide the end of the output capillary labeled with *Waste* into a sufficiently large waste container and fasten it there.

5 Connecting the regeneration solution input capillary
   - Fasten the end of the input 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 output capillary
   - Guide the end of the output 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 2.17, page 50)*.
2.17 Peristaltic pump

2.17.1 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 (27-3) and the tubing cartridge (27-5). During operation, the peristaltic pump drive rotates the roller hub (27-2), so that the rollers (27-3) push the liquid forward in the pump tubing.

Figure 27 Peristaltic pump

<table>
<thead>
<tr>
<th>1</th>
<th>Knurled screw in the mounting pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Roller hub</td>
</tr>
<tr>
<td>3</td>
<td>Rollers</td>
</tr>
<tr>
<td>4</td>
<td>Cartridge holder</td>
</tr>
<tr>
<td>5</td>
<td>Tubing cartridges 6.2755.000</td>
</tr>
<tr>
<td>6</td>
<td>Contact pressure lever</td>
</tr>
<tr>
<td>7</td>
<td>Snap-action lever</td>
</tr>
</tbody>
</table>
## 2.17.2 Installing the peristaltic pump

![Diagram of the peristaltic pump installation](image)

**Figure 28 Installing the pump tubing**

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

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 (27-1).

2. **Connecting the aspiration side**
   Place a 6.2744.034 tubing olive (28-2) 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 29, page 52) or
- **Case B**: a 6.2744.160 pump tubing connection without filter (see Figure 30, page 53).

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:

1. Slide union nut (29-1) onto the pump tubing.
2. Select a suitable adapter (29-2) and slide it onto the pump tubing. The type of adapter depends on the pump tubing (see Table 1, page 53).
3. Place the tubing olive with filter holder (29-3) onto the pump tubing.
4. Screw the union nut (29-1) onto the tubing olive (29-3).

or

**Case B**: 6.2744.160 pump tubing connection without filter:
Figure 30  Install pump tubing connection without filter

1 Union nut
2 Adapter
3 Tubing olive

- Slide union nut (30-1) onto the pump tubing.
- Select a suitable adapter (30-2) and slide it onto the pump tubing. The type of adapter depends on the pump tubing (see Table 1, page 53).
- Place the tubing olive (30-3) onto the pump tubing.
- Screw the union nut (30-1) onto the tubing olive (30-3).

4 Inserting the pump tubing
- Press the contact pressure lever all the way down.
- Place the pump tubing in the tubing cartridge. The stoppers (28-3) 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 (28-1).

<table>
<thead>
<tr>
<th>Pump tubing</th>
<th>Adapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1826.020 (blue/blue)</td>
<td>![Image]</td>
</tr>
<tr>
<td>6.1826.310 (orange/green)</td>
<td>![Image]</td>
</tr>
<tr>
<td>6.1826.320 (orange/yellow)</td>
<td>![Image]</td>
</tr>
<tr>
<td>6.1826.330 (orange/white)</td>
<td>![Image]</td>
</tr>
</tbody>
</table>
2.17 Peristaltic pump

---

### 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 (28-5), i.e. press it all the way down.
2. Switch on the peristaltic pump.
3. Raise the contact pressure lever one step at a time until liquid flows.
4. 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.
2.18  Metrohm CO\textsubscript{2} suppressor (MCS)

2.18.1  General information on the MCS

The MCS removes the CO\textsubscript{2} 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\textsubscript{2} from the eluent flow before detection. CO\textsubscript{2} can reach the eluent flow through the sample itself or arise through the suppression reaction in the MSM.

The CO\textsubscript{2} 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\textsubscript{2}-free air (CO\textsubscript{2} is removed by a CO\textsubscript{2} adsorption cartridge (32-4)) 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\textsubscript{2} to diffuse out of the eluent flow.

2.18.2  Connecting MCS

The MCS is connected between the MSM (see Chapter 2.16, page 47) and detector.

![MCS connection diagram](image)

*Figure 31  MCS – connection*

1  MCS input  
Connection to the MSM.

2  MCS output  
Connection to the detector.
2.18 Metrohm CO₂ suppressor (MCS)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 3 | Aspirating capillary  
For aspirating air low in CO₂ (as a result of CO₂ adsorption cartridge (32-4)). |
| 4 | PEEK pressure screw, long 6.2744.090 |
| 5 | Capillary connection |
| 6 | Pressure screw, short 6.2744.070  
Mounted on the air aspirating capillary. |
| 7 | Luer coupling 6.2744.120  
Mounted on the air aspirating capillary with pressure screw 6.2744.070. |

**Connecting the MCS**

1 **Connecting the MSM**
   Connect the eluent output capillary (labeled with Detector) using a 6.2744.090 long PEEK pressure screw (31-4) to the MCS inlet (31-1).

2 **Connecting the detector**
   Connect the detector input capillary (33-3) using a long PEEK pressure screw 6.2744.090 (31-4) to the MCS output (31-2).

**Caution**

If the MCS is not used, the input and output should be sealed with 6.2744.220 stoppers.

### 2.18.3 Installing the adsorption cartridges

For effective CO₂ removal, the air sucked through the degassing cell should be as low in CO₂ as possible. To achieve this, the air is aspirated through a 6.2837.000 CO₂ adsorption cartridge (32-4).

Moisture can block the CO₂ adsorption cartridge. In order to prevent this, a 6.2837.010 H₂O adsorption cartridge (32-7) is connected upstream.
### 2 Installation

#### 850 Professional IC – AnCat – MCS

---

![Figure 32 Adsorption cartridge holder](image)

**Figure 32 Adsorption cartridge holder**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PEEK pressure screw, short 6.2744.070</td>
</tr>
<tr>
<td>2</td>
<td>Luer coupling 6.2744.120</td>
</tr>
<tr>
<td>3</td>
<td>Clips For fastening the adsorption cartridges.</td>
</tr>
<tr>
<td>4</td>
<td>CO₂ adsorption cartridge 6.2837.000 For removing the CO₂ from the aspirated air. 3-layer filled, blue-brown-gray.</td>
</tr>
<tr>
<td>5</td>
<td>Adapter 6.1808.190 For connecting the H₂O adsorption cartridge and CO₂ adsorption cartridge.</td>
</tr>
<tr>
<td>6</td>
<td>PVC tubing For connecting the H₂O adsorption cartridge and CO₂ adsorption cartridge.</td>
</tr>
<tr>
<td>7</td>
<td>H₂O adsorption cartridge 6.2837.010 For removing the H₂O from the aspirated air. Filled with bead desiccant.</td>
</tr>
<tr>
<td>8</td>
<td>Adsorption cartridge holder 6.2057.080</td>
</tr>
<tr>
<td>9</td>
<td>MCS aspirating capillary Connection to the MCS. Corresponds to (31-3).</td>
</tr>
</tbody>
</table>

### Installing the adsorption cartridges

**1 Preparing the adsorption cartridge holder**

Push the 4 clips (32-3) into the slot of the adsorption cartridge holder (32-8).
2.19 Removing the caps
- Remove the two locking caps at the tip of the two cartridges.
- In the case of the H₂O adsorption cartridge, replace the round sealing cap on the larger end with the star-shaped sealing cap.

3 Connecting the CO₂ adsorption cartridge
- Insert the CO₂ adsorption cartridge into the coupling (32-2) on the end of the MCS aspirating capillary.
- Click the CO₂ adsorption cartridge into the two lower clips (32-3) of the adsorption cartridge holder (32-8).

4 Connecting the PVC tubing
- Insert the adapter (32-5) into the CO₂ adsorption cartridge.
- Fasten the PVC tubing (32-6) on the adapter (32-5).

5 Connecting the H₂O adsorption cartridge
- Place the H₂O adsorption cartridge into the PVC tubing (32-6).
- Click the H₂O adsorption cartridge into the two upper clips (32-3) of the adsorption cartridge holder (32-8).

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

2.19 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 33  Conductivity detector front

1  IC detector 1.850.9010
2  Opening for temperature sensor
3  Detector input capillary
   Permanently installed.
2.19 Conductivity detector

Figure 34  Conductivity detector rear

<table>
<thead>
<tr>
<th></th>
<th>Detector cable</th>
<th>Detector output capillary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>With mounted plug.</td>
<td>Permanently installed.</td>
</tr>
<tr>
<td>3</td>
<td>Type plate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With serial number.</td>
<td></td>
</tr>
</tbody>
</table>

**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 (35-1) using a 2.2744.090 long PEEK pressure screw (35-2) on the output of the MCS (35-3).
2 Installation

3.20 Connecting the instrument

3.20.1 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 of the instrument to a USB connector of the computer via the 6.2151.020 USB cable.

3.20.2 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, …)
2.21 Guard column

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.
   - 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.

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.

2.21 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 3.1, page 66) 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.
2.22 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](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](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](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 3.1, page 66) 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.
3 Start-up

The chapter Start-up is divided into 2 sections:

- **Initial start-up**: The initial start-up is carried out during the initial installation.
- **Conditioning**: Conditioning is carried out as a final installation step and each time after the system is started.

### 3.1 Initial start-up

The initial start-up is carried out during the initial installation. The entire system is flushed before guard column and separation column are installed.

#### Caution

The separation column and guard column may not be installed for the initial start-up.

Make sure that the 6.2744.040 coupling is being used instead of the columns.

Perform the following steps during the initial start-up:

1. **Preparing the software**
   - 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 eluent aspiration tubing is immersed in the eluent and that there is enough eluent in the eluent bottle.
   - Switch on the instrument.

3. **Deaerating the high pressure pump**
   - Deaerate the high pressure pump(s) via the purge valve (see Chapter 2.10.2, page 35).
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 54).

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 2.21, page 62).

3.2 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 4.4.2.3, page 72), 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.
3.2 Conditioning

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.
4 Operation and maintenance

4.1 General information

4.1.1 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.

4.1.2 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.
4.2 Capillary connections

4.1.3 Operation

Caution

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

4.1.4 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 µS/cm.

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

4.2 Capillary connections

4.2.1 Operation

All connections between injection valve (see Chapter 2.14, page 41), separation column (see Chapter 2.22, page 64) and detector (see Chapter 2.19, page 58) 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 2.10, page 32) and the detector.
4.3 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.

4.4 Eluent

4.4.1 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:

**Concentration**

An increase in the concentration generally leads to shorter retention times and faster separation, but also to higher background conductivity.

**pH**

pH changes result in shifts in the dissociation equilibria and hence changes in the retention times.

**Organic solvents**

The addition of an organic solvent (e.g. methanol, acetone, acetonitrile) to aqueous eluents generally accelerates lipophilic ions.
4.4.2 Operation

4.4.2.1 Supply bottle

The supply bottle with the eluent must be connected as indicated in Chapter 2.8.1, Page 27. 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.

4.4.2.2 Aspiration filter

To protect the IC system against foreign particles, we recommend aspirating the eluents via a 6.2821.090 aspiration filter (122). 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.

4.4.2.3 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.

4.5 High pressure pump

4.5.1 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 27).

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 4.4.2.3, page 72).
4 Operation and maintenance

4.5.2 Maintenance

**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.

**Pump head maintenance**

An unstable baseline (pulsation, flow fluctuations) is in many cases the result of contaminated valves (42-2), (42-3) 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 (17-2) and unscrew the coupling (17-9), the pump head input capillary (17-7) and the eluent aspiration tubing from the pump head.

3. Unscrew the pump head output capillary (17-13) from the pump head.

4. Remove pump head from the pump housing by loosening the 4 fastening screws (17-5) 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.
4.5 High pressure pump

**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 36 Removing piston](image)

   **1** Pump head  
   **2** Piston

2. **Dismantle 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 loosing 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.
4 Operation and maintenance

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

![Figure 37 Components of the piston cartridge](image)

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

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 38, page 76) 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.

![Diagram of tools](image)

**Figure 38  Tool for piston seal 6.2617.010**

<table>
<thead>
<tr>
<th>1</th>
<th>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pin for removing the old piston seal.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>Sleeve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sleeve for inserting the new piston seal.</td>
</tr>
</tbody>
</table>

**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 (17-4) with the tool.

Screw the special tool for the piston seal (38-1) with the narrow side just as far into the piston seal as the same can be removed.
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 (38-2). The sealing springs must be visible from the outside.

3 Inserting the new piston seal into the pump head

Guide the sleeve of the tool for the piston seal (38-2) with inserted piston seal into the pump head and press the seal with the wide end of the tool for the piston seal (38-1) into the pump head recess.
4.5 High pressure pump

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 (17-1) from the outlet valve holder.
   - Unscrew the holders for the inlet and outlet valves and remove valves.
### 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.

![Dismantling valve figure]

**Figure 43** Dismantling valve

<p>| | |</p>
<table>
<thead>
<tr>
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</tr>
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<tbody>
<tr>
<td>1</td>
<td>Needle</td>
</tr>
<tr>
<td></td>
<td>For pushing the valve components out of the valve housing.</td>
</tr>
<tr>
<td>2</td>
<td>Valve</td>
</tr>
<tr>
<td>3</td>
<td>Holder</td>
</tr>
<tr>
<td>4</td>
<td>Recess</td>
</tr>
<tr>
<td></td>
<td>For collecting the valve components.</td>
</tr>
</tbody>
</table>

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 44, page 81).*
4 Clean the components of the valve

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

5 Reassemble the valve

Reassemble valve components according to figure 44, page 81.

- 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 44, page 81).
- Place the valve housing over the stacked components 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 assembled correctly *(see Figure 44, page 81)*.

**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 *(42-4)*.
- 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 *(42-1)*.
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 (17-5). Firmly tighten the screws with the 6.2621.030 hexagon key.

2. Screw connection capillaries (17-1), (17-7) and (17-13) onto the pump head again.

### 4.6 Inline filter

#### 4.6.1 Maintenance

The 6.2821.120 inline filters comprise the filter housing (45-2), the filter screw (45-4) and the filter (45-3). New filters (45-3) are available under the order number 6.2821.130 (10 items).

The 6.2821.130 filters (20-3) should be changed every 3 months (more frequently at higher backpressure).

![Figure 45 Changing the filter](image)

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>PEEK pressure screws, short 6.2744.070</td>
</tr>
<tr>
<td>2</td>
<td>Filter housing Housing of the inline filter. Part of the 6.2821.120 accessories.</td>
</tr>
<tr>
<td>3</td>
<td>6.2821.130 filter Packaging contains 10 items.</td>
</tr>
<tr>
<td>4</td>
<td>Filter screw Screw of the inline filter. Part of the 6.2821.120 accessories.</td>
</tr>
<tr>
<td>5</td>
<td>Connection capillaries</td>
</tr>
</tbody>
</table>
## Changing the filter

The flow must be stopped before changing the filter.

### 1 Removing the inline filter
- Unscrew the pressure screws (45-1) from the inline filter.

### 2 Unscrewing the filter screw
- Screw the filter screw (45-4) out of the filter housing (45-2) with the aid of two 6.2621.000 adjustable wrenches.

### 3 Inserting the filter
- Remove the old filter (45-3) with tweezers.
- Place the new filter (45-3) flat in the filter housing with tweezers (45-2).

### 4 Mounting filter screw
- Screw the filter screw (45-4) back into the filter housing (45-2) and tighten by hand. Then additionally tighten slightly with two 6.2621.000 adjustable wrenches.

### 5 Remounting the inline filter
- Screw the pressure screws (45-1) 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.
4.7 Inline sample preparation

To protect the separation column (see Chapter 2.22, Page 64) 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 2.13, Page 40) (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⁺ with H⁺) and cation exchange (replacement of e.g. heavy metals with H⁺), a sample preparation module (SPM) is used.

4.8 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.
4.8 Rinsing the sample path

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.
4.9 Sample degasser

4.9.1 Operation

If you are working with sample degassing, the longer "transfer time" (see Ascertaining the transfer time, page 85) 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.

4.10 Injection valve

4.10.1 Protection

To prevent contamination of the injection valve, a 6.2821.120 inline filter (see Chapter 2.11, page 37) should be mounted between the high pressure pump and the pulsation damper.

4.11 Metrohm Suppressor Module (MSM)

4.11.1 Protection

To protect the MSM against foreign particles or bacterial growth, a pump tubing connection with filter must be mounted between the peristaltic pump (see Chapter 2.17, page 50) and the input capillaries of the MSM (see Figure 29, page 52).

4.11.2 Operation

Note

The suppressor units must never be regenerated in the same flow direction in which the eluent is pumped. Therefore always mount the input and output capillaries according to diagram outlined in Figure 26, Page 48.

The MSM consists of 3 suppressor units, which are used for suppression, regenerated with sulfuric acid or rinsed with ultra pure water in rotation.
In order to record every new chromatogram under comparable conditions, you should normally work with a freshly regenerated suppressor.

Caution

The MSM must never be switched over in a dry state, as there is a risk of jamming. If the MSM is in a dry state, the MSM must be rinsed for at least 5 minutes before it may be switched over.

Caution

In the case of reduced capacity or high backpressure, the MSM must be regenerated (see Chapter 4.11.3.1, page 88), cleaned (see Chapter 4.11.3.2, page 89) or replaced (see Chapter 4.11.3.3, page 92).

4.11.3 Maintenance

4.11.3.1 Regenerating the MSM

If the suppressor units are loaded for a longer period with certain heavy metals (e.g. iron) or organic impurities, these can no longer be completely removed with the regeneration solution (50 mmol/L H₂SO₄) normally used. The capacity of the suppressor units is consequently affected, which can result in reduced phosphate sensitivity in less serious cases and a significant rise in the baseline in more serious cases. If such capacity problems occur at one or more positions, the suppressor units must be regenerated:

Regenerating the MSM

Regenerate the MSM as follows:

1 Disconnecting the MSM from the IC system
   - Disconnect the MSM from the separation column and detector.

2 Regenerating the MSM

Caution

The pump tubing made of PVC must not be used for rinsing with solutions containing organic solvents. In this case, other pump tubing 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 (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$_2$SO$_4$ + 0.1 mol/L oxalic acid
  - Contamination with organic cationic complexing agents:
    0.1 mol/L H$_2$SO$_4$ / 0.1 mol/L oxalic acid / acetone 5%
  - Severe contamination with organic substances:
    0.2 mol/L H$_2$SO$_4$ / acetone$\geq$ 20%

3 Connecting the MSM to the IC system

- Reconnect the MSM to the IC system. If the capacity problems remain, MSM rotor A must be replaced (see Chapter 4.11.3.3, page 92).

4.11.3.2 Cleaning the MSM

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

- Increased backpressure onto the output capillaries of the MSM.
- Blockage of the MSM which cannot be eliminated (solutions can no longer be pumped through the MSM).
- Jamming of the MSM which cannot be eliminated (MSM can no longer be switched over).
4.11 Metrohm Suppressor Module (MSM)

Figure 46  MSM – Components

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Union nut</td>
</tr>
<tr>
<td>2</td>
<td>MSM connecting piece 6.2832.010</td>
</tr>
<tr>
<td>3</td>
<td>MSM rotor A 6.2832.000</td>
</tr>
<tr>
<td>4</td>
<td>MSM housing</td>
</tr>
<tr>
<td>5</td>
<td>Slot in the MSM housing</td>
</tr>
</tbody>
</table>

Cleaning the MSM

Clean the MSM as follows:

1  Disconnecting the MSM from the IC system
   - Switch off the instrument.
   - Disconnect the MSM from the separation column, peristaltic pump and detector.

2  Dismantling the MSM
   - Unscrew union nut (46-1) from the MSM housing (46-4).
   - Pull MSM connecting piece (46-2) and MSM rotor A (46-3) out of the MSM housing (46-4). The MSM connecting piece and MSM rotor A normally stick to one another - if this is not the case: Take a sharp object, insert into the slot (46-5) in the MSM housing, and pull out MSM rotor A (46-3) in this way.
   - Detach the MSM connecting piece (46-2) from MSM rotor A (46-3).

3  Cleaning the supply and discharge lines
   - Connect in turn each of the 6 capillary tubings fastened on the MSM connecting piece (46-2) on the high pressure pump (see Chapter 2.10, page 32) and pump through ultra pure water.
Check whether solution emerges at the MSM connecting piece (46.2). If one of the supply or discharge lines remained blocked, the SPM connecting piece (46.2) must be replaced (order number 6.2832.010).

4 Cleaning the MSM rotor A

- Clean sealing surface of the MSM rotor A (46.3) with ethanol using a lint-free cloth.

5 Inserting the MSM rotor A

**Caution**

An incorrectly inserted MSM rotor A (46.3) can be destroyed during start-up.

- Insert the MSM rotor A (46.3) into the MSM housing (46.4) in such a way that the tubing connections on the rear of MSM rotor A fit into the corresponding recesses inside the MSM housing and one of the three holes of the MSM rotor A is visible from below in the slot of the MSM housing (46.5).
- If the MSM rotor A (46.3) is correctly inserted, its sealing area will be approx. 4 mm within the MSM housing (46.4). If this is not the case, MSM rotor A must be moved into the right position from below using a sharp object (e.g. screwdriver).

6 Cleaning the MSM connecting piece

- Clean sealing surface of the MSM connecting piece (46.2) with ethanol using a lint-free cloth.

7 Inserting the MSM connecting piece

- Insert the MSM connecting piece (46.2) into the MSM housing (46.4) in such a way that the connector 1 is on top and the three pins of the MSM connecting piece fit into the corresponding recesses on the MSM housing (46.4).

8 Connecting and conditioning the MSM

- Reconnect the MSM to the IC system.
- Before switching the MSM over for the first time, rinse the three suppressor units with solution for 5 minutes.
4.11 Metrohm Suppressor Module (MSM)

4.11.3 Replace parts of the MSM

It may be necessary to replace parts of the MSM 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 which cannot be eliminated (solutions cannot no longer be pumped through the suppressor).

Both the MSM rotor A (46·3) and the MSM connecting piece (46·2) with its supply and discharge lines can be replaced.

**Replacing parts of the MSM**

Replace parts of the MSM as follows *(see Figure 46, page 90)*:

1. **Disconnecting the MSM from the IC system**
   - Switch off the instrument.
   - Disconnect the MSM from the separation column, peristaltic pump and detector.

2. **Dismantling the MSM**
   - Unscrew union nut (46·1) from the MSM housing (46·4).
   - Pull MSM connecting piece (46·2) and MSM rotor A (46·3) out of the MSM housing (46·4). The MSM connecting piece and MSM rotor A normally stick to one another - if this is not the case: Take a sharp object, insert into the slot (46·5) in the MSM housing, and pull out MSM rotor A (46·3) in this way.
   - Detach the MSM connecting piece (46·2) from MSM rotor A (46·3).

3. **Cleaning the new MSM rotor A**
   - Clean the sealing surface of the new MSM rotor A (46·3) with ethanol using a lint-free cloth.

4. **Inserting the new MSM rotor A**

   **Caution**

   An incorrectly inserted MSM rotor A (46·3) can be destroyed during start-up.
4 Operation and maintenance

- Insert the new MSM rotor A (46-3) in the MSM housing (46-4) in such a way that the tubing connections on the rear of MSM rotor A fit into the corresponding recesses inside the MSM housing and one of the three holes of MSM rotor A is visible from below in the slot (46-5) of the MSM housing.
- If the MSM rotor A (46-3) is correctly inserted, its sealing area will be approx. 4 mm within the MSM housing (46-4). If this is not the case, MSM rotor A must be moved into the right position from below using a sharp object (e.g. screwdriver).

5 Cleaning the MSM connecting piece
- Clean the sealing surface of the MSM connecting piece (46-2) with ethanol using a lint-free cloth.

6 Inserting the new MSM connecting piece
- Insert the MSM connecting piece (46-2) into the MSM housing (46-4) in such a way that the connector 1 is on top and the three pins of the MSM connecting piece fit into the corresponding recesses on the MSM connecting piece (46-4).

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

4.12 Peristaltic pump

4.12.1 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 (28-10) 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.
4.12 Peristaltic pump

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.

4.12.2 Maintenance

4.12.2.1 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 2 Pump tubing

<table>
<thead>
<tr>
<th>Order number</th>
<th>Name</th>
<th>Material</th>
<th>Inner diameter</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1826.020</td>
<td>Pump tubing (blue/blue), 2-stopper</td>
<td>PVC (Tygon ST)</td>
<td>1.65 mm</td>
<td>Pump tubing for online IC instruments and automation in voltammetry</td>
</tr>
<tr>
<td>6.1826.310</td>
<td>Pump tubing LFL (orange/green), 3-stopper</td>
<td>PVC (Tygon)</td>
<td>0.38 mm</td>
<td>Pump tubing for bromate determination using the triiodide method.</td>
</tr>
<tr>
<td>6.1826.320</td>
<td>Pump tubing LFL (orange/yellow), 3-stopper</td>
<td>PVC (Tygon)</td>
<td>0.48 mm</td>
<td>For suppressor solutions, acceptor solutions for inline dialysis and for inline ultrafiltration.</td>
</tr>
<tr>
<td>Order number</td>
<td>Name</td>
<td>Material</td>
<td>Inner diameter</td>
<td>Use</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------------------------------------</td>
<td>------------------</td>
<td>----------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>6.1826.330</td>
<td>Pump tubing LFL (orange/white), 3-stopper</td>
<td>PVC (Tygon)</td>
<td>0.64 mm</td>
<td>No special applications.</td>
</tr>
<tr>
<td>6.1826.340</td>
<td>Pump tubing LFL (black/black), 3-stopper</td>
<td>PVC (Tygon)</td>
<td>0.76 mm</td>
<td>For the sample solution in inline dialysis.</td>
</tr>
<tr>
<td>6.1826.360</td>
<td>Pump tubing LFL (white/white), 3-stopper</td>
<td>PVC (Tygon)</td>
<td>1.02 mm</td>
<td>For sample transfer.</td>
</tr>
<tr>
<td>6.1826.380</td>
<td>Pump tubing LFL (gray/gray), 3-stopper</td>
<td>PVC (Tygon)</td>
<td>1.25 mm</td>
<td>For inline sample dilution.</td>
</tr>
<tr>
<td>6.1826.390</td>
<td>Pump tubing LFL (yellow/yellow), 3-stopper</td>
<td>PVC (Tygon)</td>
<td>1.37 mm</td>
<td>For the sample solution in inline ultrafiltration.</td>
</tr>
</tbody>
</table>

### 4.12.2.2 Pump tubing connection with filter

The 6.2821.130 filters (47-2) should be changed every 3 months, more frequently at higher backpressure.

![Figure 47](image_url)

**Figure 47  Pump tubing connection – Changing the filter**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tubing olive</td>
</tr>
<tr>
<td>2</td>
<td>Filter 6.2821.130 Packaging contains 10 items.</td>
</tr>
<tr>
<td>3</td>
<td>Filter housing</td>
</tr>
</tbody>
</table>

**Replacing the filter**

**1 Unscrewing filter screw**

- Screw the filter screw (47-3) out of the tubing olive (47-1) with the aid of two 6.2621.000 adjustable wrenches.

**2 Replacing the filter**

- Remove the old filter (47-2) with tweezers.
- Place the new filter (47-2) flat in the tubing olive (47-1) with tweezers.
4.13 Metrohm CO₂ suppressor (MCS)

4.13.1 Replacing the CO₂ adsorption cartridge

The CO₂ adsorption cartridge 6.2837.000 (32-4) must be replaced regularly. This is because of blockages and losses in capacity.

Blockage

Moisture can block the CO₂ 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 CO₂ adsorption cartridge, an H₂O adsorption cartridge (32-7) is installed upstream. Regular regeneration (see Chapter 4.13.2, page 96) of the H₂O adsorption cartridge extends the service life of the CO₂ adsorption cartridge.

Capacity loss

The adsorption capacity of the CO₂ 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 CO₂ reaches the detector).

4.13.2 Regenerating the H₂O adsorption cartridge

The function of the H₂O adsorption cartridge is to protect the CO₂ adsorption cartridge against moisture. The service life of the H₂O adsorption cartridge depends on the moisture content of the ambient air. Moisture reduces the capacity of the H₂O 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 H₂O 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.

Mounting filter screw

- Screw the filter screw (47-3) back into the tubing olive (47-1) and tighten by hand. Then additionally tighten with two 6.2621.000 adjustable wrenches.
4.14 Conductivity detector

4.14.1 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 (33-3) or the detector output capillary (34-2) 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 (34-2) and rinse - the pressure may not exceed 5 MPa.

4.15 Separation column

4.15.1 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](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](http://www.metrohm.com) in the Applications area or via the Metrohm agent responsible.
4.15.2 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 2.21, page 62) 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 2.12, page 38) must be installed in order to protect the column material from pressure concussion caused by injection.

4.15.3 Storage

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

4.15.4 Regeneration

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
</table>

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.
4.16 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/ under Support.
## 5 Troubleshooting

### 5.1 Problems and their solutions

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marked drop in pressure</td>
<td>Leak in the system.</td>
<td>Check and seal connections (see Chapter 2.5, page 14).</td>
</tr>
<tr>
<td>Marked rise in pressure</td>
<td>6.2821.120 inline filter blocked.</td>
<td>Replace 6.2821.130 filter (see Chapter 4.6, page 83).</td>
</tr>
<tr>
<td></td>
<td>MSM – blocked.</td>
<td>Regenerate the MSM (see Chapter 4.11.3.1, page 88).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: 6.2821.180 pump tubing connection with filter must be used (29-3).</td>
</tr>
<tr>
<td>Conductivity detector</td>
<td>Conductivity detector blocked.</td>
<td>Shorten capillary ends by several mm (see Chapter 4.14.1, Page 97).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rinse detector against the normal flow direction (see Chapter 4.14.1, Page 97).</td>
</tr>
<tr>
<td>Guard column – blocked.</td>
<td>Replace guard column (see Chapter 2.21, page 62).</td>
<td></td>
</tr>
<tr>
<td>Separation column –</td>
<td>Regenerate separation column (see Chapter 4.15.4, page 98).</td>
<td></td>
</tr>
<tr>
<td>blocked.</td>
<td>Replace separation column (see “Connecting and rinsing the separation column”, page 65).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note: Samples should always be microfiltered (see Chapter 4.7, page 85).</td>
<td></td>
</tr>
<tr>
<td>Injection valve – valve</td>
<td>Have the valve cleaned (by Metrohm service technicians).</td>
<td></td>
</tr>
<tr>
<td>blocked.</td>
<td>Drift of the baseline</td>
<td>Thermal equilibrium not yet attained.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Condition (see Chapter 2.15, page 44) instrument with the column thermostat switched on.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Leak in the system.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check and seal connections (see Chapter 2.5, page 14).</td>
</tr>
<tr>
<td>Problem</td>
<td>Cause</td>
<td>Remedy</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>--------</td>
</tr>
<tr>
<td>Troubleshooting</td>
<td><strong>Eluent – Evaporation of the organic solvent in the eluent.</strong></td>
<td>Check the eluent bottle attachment (see Figure 13, page 29).</td>
</tr>
<tr>
<td>Peak areas lower than expected</td>
<td><strong>Sample – Leak in the sample path.</strong></td>
<td>Check the sample path.</td>
</tr>
<tr>
<td></td>
<td><strong>Sample – Blockage in the sample path.</strong></td>
<td>Check the sample path.</td>
</tr>
<tr>
<td></td>
<td><strong>Sample – Sample loop not (completely) filled.</strong></td>
<td>Prolong the sample transfer time.</td>
</tr>
<tr>
<td></td>
<td><strong>Sample – Gas bubbles in the sample.</strong></td>
<td>Use the sample degasser (see Chapter 2.13, page 40) (if available).</td>
</tr>
<tr>
<td></td>
<td><strong>MCS – not connected.</strong></td>
<td>Connect the MCS.</td>
</tr>
<tr>
<td>Peristaltic pump – insufficient or no delivery rate</td>
<td><strong>Peristaltic pump – contact pressure too weak.</strong></td>
<td>Correctly set contact pressure (see “Set flow rate”, page 54).</td>
</tr>
<tr>
<td></td>
<td><strong>Peristaltic pump – filter blocked.</strong></td>
<td>Replace the filter (see Chapter 4.12.2.2, page 95).</td>
</tr>
<tr>
<td></td>
<td><strong>Peristaltic pump – pump tubing defective.</strong></td>
<td>Replace pump tubing (see Chapter 4.12.2.1, page 94).</td>
</tr>
<tr>
<td>Very noisy baseline</td>
<td><strong>High pressure pump – contaminated pump valves.</strong></td>
<td>Clean pump valves (see Chapter 4.5.2, page 73).</td>
</tr>
<tr>
<td></td>
<td><strong>Eluent – Leak in the eluent path.</strong></td>
<td>Check the eluent path.</td>
</tr>
<tr>
<td></td>
<td><strong>Eluent – Blockage in the eluent path.</strong></td>
<td>Check the eluent path.</td>
</tr>
<tr>
<td></td>
<td><strong>High pressure pump – defective piston seals.</strong></td>
<td>Replace piston seals (see Chapter 4.5.2, page 73).</td>
</tr>
<tr>
<td></td>
<td><strong>MCS – CO₂ adsorption cartridge exhausted.</strong></td>
<td>Replace CO₂ adsorption cartridge (see Chapter 4.13.1, page 96).</td>
</tr>
<tr>
<td></td>
<td><strong>Pulsation damper not connected.</strong></td>
<td>Connect the pulsation damper (see Chapter 2.12, page 38).</td>
</tr>
<tr>
<td></td>
<td><strong>Pulsation damper not connected.</strong></td>
<td>Connect pulsation damper (see Chapter 2.12, page 38).</td>
</tr>
</tbody>
</table>
### 5.1 Problems and their solutions

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MCS – vacuum pump defective.</strong></td>
<td><strong>MCS – vacuum pump defective.</strong></td>
<td><strong>Contact the Metrohm Service.</strong></td>
</tr>
<tr>
<td><strong>Background conductivity too high</strong></td>
<td><strong>MSM – not connected.</strong></td>
<td><strong>Connect the MSM (see Chapter 2.16, page 47).</strong></td>
</tr>
<tr>
<td></td>
<td><strong>MCS – not connected.</strong></td>
<td><strong>Connect the MCS.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Incorrect eluent.</strong></td>
<td><strong>Change eluent (see Chapter 4.4.2.3, page 72).</strong></td>
</tr>
<tr>
<td></td>
<td><strong>MSM – regeneration or rinsing solution flow problems.</strong></td>
<td><strong>Check the flow of the regeneration and rinsing solution (see Chapter 2.16.2, page 47).</strong></td>
</tr>
<tr>
<td><strong>Data of the separation column cannot be read.</strong></td>
<td><strong>Column chip contaminated.</strong></td>
<td><strong>Clean contact surfaces of the column chip (with alcohol).</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Column chip defective.</strong></td>
<td><strong>1. Save column configuration in MagIC Net. 2. Notify Metrohm Service.</strong></td>
</tr>
<tr>
<td><strong>Individual peaks greater than expected</strong></td>
<td><strong>Sample – Carry-over of the samples from previous measurement.</strong></td>
<td><strong>Rinse system longer between two samples.</strong></td>
</tr>
<tr>
<td><strong>MSM – No (or insufficient) pumping of regeneration or rinsing solution</strong></td>
<td><strong>Leak in the system.</strong></td>
<td><strong>Check connections.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Peristaltic pump – contact pressure too weak.</strong></td>
<td><strong>Correctly set contact pressure (see &quot;Set flow rate&quot;, page 54).</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Peristaltic pump – filter blocked (see Figure 29, page 52).</strong></td>
<td><strong>Replace the filter (see &quot;Replacing the filter&quot;, page 95).</strong></td>
</tr>
<tr>
<td></td>
<td><strong>MSM – backpressure too high.</strong></td>
<td><strong>Clean the MSM (see Chapter 4.11.3.2, page 89) or replace parts (see Chapter 4.11.3.3, page 92).</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Peristaltic pump – pump tubing defective.</strong></td>
<td><strong>Replace pump tubing (see Figure 28, page 51).</strong></td>
</tr>
<tr>
<td><strong>Poor reproducibility of the retention times</strong></td>
<td><strong>Eluent – Leak in the eluent path.</strong></td>
<td><strong>Check the eluent path.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Eluent – Blockage in the eluent path.</strong></td>
<td><strong>Check the eluent path.</strong></td>
</tr>
<tr>
<td><strong>Chromatograms have poor resolution</strong></td>
<td><strong>Separation column – diminished separating efficiency.</strong></td>
<td><strong>Regenerate separation column (see Chapter 4.15.4, page 98).</strong></td>
</tr>
<tr>
<td>Problem</td>
<td>Cause</td>
<td>Remedy</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>--------</td>
</tr>
</tbody>
</table>
| **Conductivity detector is not recognized in the software** | No connection. | ■ Check the cable connection (34-1).  
■ Turn the instrument off and on again (after 15 seconds). |
| **Extreme spread of the peaks in the chromatogram. Splitting (dual peaks)** | Connections – dead volume in the system. | Check the connections (see Chapter 2.5, page 14) (use PEEK capillaries with an internal diameter of 0.25 mm between the injection valve and detector).  
Guard column – diminished performance. | ■ Replace guard column (see Chapter 2.21, page 62). |
| | Separation column – dead volume at column head. | ■ Install separation column in reverse flow direction (if permitted by the information sheet).  
■ Replace separation column (see “Connecting and rinsing the separation column”, page 65). |
| **Greater rise in the baseline** | MSM – reduced capacity. | Regenerate the MSM (see Chapter 4.11.3.1, page 88). |
| **Precision problems - significant scattering of the measured values** | Sample – Gas bubbles in the sample. | Use sample degasser (see Chapter 2.13, page 40).  
Sample – Rinsing volume too low. | Prolong the rinsing time (see Chapter 4.8, page 85).  
MCS – vacuum too low. | ■ Check connectors. If they are ok:  
■ Contact the Metrohm Service. |
| **Unexpected change to the retention times in the chromatograms** | Separation column – diminished separating efficiency. | ■ Regenerate separation column (see Chapter 4.15.4, page 98).  
■ Replace separation column (see “Connecting and rinsing the separation column”, page 65). |
### 5.1 Problems and their solutions

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eluent – Gas bubbles in the eluent.</strong></td>
<td></td>
<td>Check connections of the eluent degasser <em>(see Chapter 2.9, page 31).</em></td>
</tr>
<tr>
<td><strong>High pressure pump – defective.</strong></td>
<td></td>
<td>Request Metrohm Service.</td>
</tr>
</tbody>
</table>
| **Vacuum is not being built**       | Eluent Degasser – Connector **Vacuum** on the rear of the instrument not (tightly) sealed. | - Seal the connector **Vacuum** tightly with a 6.144.6040 threaded stopper.  
   or when using an 872 Extension Module:  
   - Connect an FEP tubing between the IC instrument and the Extension Module and tighten both clamping screws until they seal. |
6 Technical specifications

6.1 Reference conditions

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

- Ambient temperature: +25 °C (± 3 °C)
- Instrument status: > 40 minutes in operation (equilibrated)

6.2 Instrument

- IC system:
  - Metal-free IC system
  - Compact system with modular design
  - Up to two complete chromatographic systems in one housing

- Material: Painted polyurethane hard foam without CFCs, fire class V0

- Operating pressure range:
  - 0…50 MPa (500 bar) high pressure pump
  - 0…35 MPa (350 bar) standard-PEEK system

- Intelligent components: iPump, iDetector, iColumn, MagIC Net

6.3 Leak sensor

- Type: Electronic, no calibration necessary

6.4 Ambient conditions

- Operation:
  - Ambient temperature: +5…+45 °C
  - Humidity: 20…80 % relative humidity

- Storage:
  - Ambient temperature: −20…+70 °C

- Transport:
  - Ambient temperature: −40…+70 °C
6.5 Housing

Dimensions
- **Width**: 365 mm
- **Height**: 642 mm
- **Depth**: 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**
- **Indicators**: LED for power display
- **On/Off switch**: On the rear panel of the instrument

6.6 Eluent degasser

**Material**: fluoropolymer

**Resistance to solvents**: No restriction (apart from PFC)

**Build-up time for the vacuum**: < 60 s

6.7 High pressure pump

**Type**
- Serial dual-piston pump
- Intelligent pump head recognition
- Chemically inert
- Metal-free pump heads
- Materials in contact with eluent: PEEK, ZrO₂, PTFE/PE
- Self-optimizing flow and pressure

**Flow rate**
- **Adjustable flow range**: 0.001…20.0 mL/min
- **Flow increment**: 1 µL/min
- **Reproducibility of the eluent flow**: < 0.1 % deviation
Pressure range

- **Pump** 0...50.0 MPa (0...500 bar)
- **Pump head** 0...35.0 MPa (0...350 bar) (applies for the standard PEEK pump head)
- **Residual pulsation** < 1 %

Safety shutdown

- **Function** Automatic shutdown upon reaching the pressure limit values
- **Maximum pressure limit**
  - Adjustable from 0.1...50 MPa (1...500 bar)
  - The pump is automatically shut down at the first piston stroke above the maximum limit value
- **Minimum pressure limit**
  - Adjustable from 0...49 MPa (0...490 bar)
  - The shutdown mechanism is inactive at 0 MPa
  - The shutdown mechanism only becomes active 2 minutes after system start
  - The pump is automatically shut down after 3 piston strokes below the minimum pressure limit

Gradient capacity

- **Profile** Isocratic or gradient (extendable to quaternary)
- **Resolution** Step, linear, convex and concave
- **Resolution** < 1 nL/min flow increments

6.8 Sample degasser

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

6.9 Injection valve

- **Actuator time** typ.100 ms
- **Max. operating pressure** 35 MPa (350 bar)
- **Material** PEEK
### 6.10 Column thermostat

**Type**

Peltier technique thermostat for two intelligent separation columns

<table>
<thead>
<tr>
<th>Adjustable temperature range</th>
<th>Heating</th>
<th>Ambient temperature +50 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling</td>
<td>Ambient temperature –20 °C</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature reproducibility</th>
<th>± 0.2 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability</td>
<td>&lt; 0.05 °C</td>
</tr>
<tr>
<td>Heating up time</td>
<td>&lt; 30 minutes from 20 to 50 °C</td>
</tr>
<tr>
<td>Cooling time</td>
<td>&lt; 40 minutes from 50 to 20 °C</td>
</tr>
</tbody>
</table>

### 6.11 Metrohm Suppressor Module (MSM)

<table>
<thead>
<tr>
<th>Resistance to solvents</th>
<th>No restriction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching duration</td>
<td>typ. 100 ms</td>
</tr>
</tbody>
</table>

| Operating pressure           | 2.5 MPa (25 bar), valve function prevents damage at overpressure |

### 6.12 Peristaltic pump

<table>
<thead>
<tr>
<th>Type</th>
<th>2-channel peristaltic pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotating direction</td>
<td>Counterclockwise/Clockwise rotation</td>
</tr>
<tr>
<td>Rotational speed</td>
<td>0…42 rpm in 7 stages at 6 rpm.</td>
</tr>
</tbody>
</table>

| Pumping properties            | 0.3 mL/min at 18 rpm; with 6.1826.320 standard pump tubing. |
| Material of pump tubings      | recommended: Tygon Long Flex Life |
6.13 Metrohm CO₂ suppressor (MCS)

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

6.14 Conductivity measuring system

Type
  ▪ Microprocessor-controlled Digital Signal Processing (DSP technology)
  ▪ Intelligent detector with 6 reference chromatograms
Measuring range    0…15000 µS/cm single range
Noise    < 0.1 nS at 1 µS/cm
Deviations from the linearity    < 1 % for conductivity values greater than 1…16 µS/cm (typical for analyses with sequential suppression)
Drift    < 0.2 nS/cm per hour
Measuring rate    10 measurements per second for optimum results without filtering
Resolution    0.0047 nS/cm
Baseline    Noise < 0.2 nS/cm typical for sequential suppression
Conductivity detector
  Cell volume    0.8 µL
  Cell constant
    ▪ Individual calibration data saved in the detector
    ▪ adjustable range: 13.0…21.0 /cm
Electrodes    Ring-shaped electrodes made from stainless steel
Materials in contact with eluent    Chemically inert PCTFE
Maximum operating pressure    5.0 MPa (50 bar)
6.15 Mains connection

- **Cell temperature**: 20…50 °C in increments of 5 °C
- **Temperature stability**: < 0.001 °C
- **Temperature compensation**: 0…5 %/K adjustable, default 2.3 %/K
- **Heating up time**: < 30 minutes (40 °C)

### Required voltage
100…240 V ± 10 % (auto-sensing)

### Required frequency
50…60 Hz ± 3 (auto-sensing)

### Power consumption
- 65 W for typical analysis application
- 25 W standby (detector to 40 °C)

### Power supply unit
- Up to 300 W maximum, electronically monitored
- Internal fuse 3.15 A

6.16 Interfaces

**USB**
- **Input**: 1 USB upstream, type B (for connection to the PC)
- **Output**: 2 USB downstream, type A

**MSB**
- 2 MSB Mini Din 8-pin (female) (for Dosino, stirrer, remote lines, ...)

---

**Caution**

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

- **Detector**: 2 DSUB-15-pin high density (female)
- **Column recognition**: 3 (including 2 in the column thermostat *(see Chapter 2.15, page 44)*)
- **Leak sensor**: 1 jack plug
- **Further connections**: 1 DSUB 15-pin (female)
6.17 Safety specification

Design / Test
- EN/IEC/UL 61010-1
- CSA-C22.2 No. 61010-1
- Degree of protection IP20
- Protection class I

6.18 Electromagnetic compatibility (EMC)

Emission
- EN/IEC 61326-1
- EEN 55022 / CISPR 22
- EN/IEC 61000-6-3
- EN/IEC 61000-3-2
- EN/IEC 61000-3-3

Immunity
- EN/IEC 61326-1
- EN/IEC 61000-4-2
- EN/IEC 61000-4-3
- EN/IEC 61000-4-4
- EN/IEC 61000-4-5
- EN/IEC 61000-4-6
- EN/IEC 61000-4-8
- EN/IEC 61000-4-11
- EN/IEC 61000-4-14
- NAMUR: 2006

6.19 Weight

1.850.3030  33.6 kg (without accessories)
1.850.9010 (conductivity detector)  2.3 kg (with accessories)
Transport carriage (rollers and handle)  1.8 kg
7 Conformity and warranty

7.1 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

850 Professional IC

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

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

Electromagnetic compatibility


Safety specifications


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
7 Conformity and warranty

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

7.2 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.

7.3 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.
8 Accessories

Caution

Subject to change without notice!

8.1 Scope of delivery

2.850.3030  850 Professional IC – AnCat – MCS

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Order no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.850.3030</td>
<td>850 Professional IC – AnCat – MCS Professional IC 850 AnCat – MCS</td>
</tr>
<tr>
<td>1</td>
<td>6.2122.0x0</td>
<td>Mains cable with C13 line socket IEC-60320-C13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cable plug according to customer requirements.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switzerland: Type SEV 12 6.2122.020</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Germany, …: Type CEE(7), VII 6.2122.040</td>
</tr>
<tr>
<td></td>
<td></td>
<td>USA, …: Type NEMA/ASA 6.2122.070</td>
</tr>
<tr>
<td>2</td>
<td>1.850.9010</td>
<td>IC Detector MF</td>
</tr>
<tr>
<td>2</td>
<td>6.1602.150</td>
<td>Bottle attachment / GL 45 - 3 x UNF 10/32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For connecting capillary tubing 1/16 in. Used with MSM auxiliary solutions and in inline dialysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material: Plastic</td>
</tr>
<tr>
<td>2</td>
<td>6.1602.160</td>
<td>Eluent bottle attachment GL 45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For eluent bottles; with connections for adsorber tube and aspiration tubing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Opening ground joint: A-14/15</td>
</tr>
<tr>
<td>Qty.</td>
<td>Order no.</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>6.1608.020</td>
<td>Glass bottle / 1000 mL / GL 45</td>
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<tr>
<td></td>
<td></td>
<td>Bottle for auxiliary solutions</td>
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<td></td>
<td></td>
<td>Width (mm):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Height (mm):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Volume (mL):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eluent bottle and waste bottle for dialysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material:</td>
</tr>
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<td></td>
<td></td>
<td>Height (mm):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Volume (mL):</td>
</tr>
<tr>
<td>2</td>
<td>6.1609.000</td>
<td>Adsorber tube / large and bent</td>
</tr>
<tr>
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<td></td>
<td>For filling with adsorber material.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Height (mm):</td>
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<tr>
<td></td>
<td></td>
<td>Inner diameter (mm):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SGJ size:</td>
</tr>
<tr>
<td>1</td>
<td>6.1803.020</td>
<td>PTFE capillary 0.97 mm i.d. / 5 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For all IC instruments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outer diameter (mm):</td>
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<tr>
<td></td>
<td></td>
<td>Inner diameter (mm):</td>
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<tr>
<td></td>
<td></td>
<td>Length (m):</td>
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</tbody>
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### 8.1 Scope of delivery

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<tr>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.1803.040</td>
<td>PTFE capillary 0.5 mm i.d. / 1 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capillary for sample handling in IC.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PTFE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outer diameter (inches): 1/16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inner diameter (mm): 0.5</td>
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<tr>
<td></td>
<td></td>
<td>Length (m):</td>
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<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>6.1807.010</td>
<td>Y Connector for Tubing i.d. 6-9 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Connector for waste tubings</td>
</tr>
<tr>
<td>1</td>
<td>6.1815.010</td>
<td>Spiral band / 0.5 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For holding together different cables or tubing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length (m):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Qty.</td>
<td>Order no.</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>6.1816.020</td>
<td>Silicone tubing 6 mm i.d. / 1 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For drainage tubing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material: Silicone rubber</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outer diameter (mm): 9</td>
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<tr>
<td></td>
<td></td>
<td>Inner diameter (mm): 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length (m): 1</td>
</tr>
<tr>
<td>2</td>
<td>6.1826.320</td>
<td>Pump tubing LFL (orange/yellow), 3 Stopper</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For suppressor solutions, acceptor solutions for inline dialysis and for inline ultrafiltration</td>
</tr>
<tr>
<td>2</td>
<td>6.2023.020</td>
<td>Clip for SGJ 14/15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clip for SGJ 14/15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material: POM</td>
</tr>
<tr>
<td>1</td>
<td>6.2057.080</td>
<td>Adsorption cartridge holder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Holder to install adsorption cartridges in Professional IC Instruments</td>
</tr>
</tbody>
</table>
### 8.1 Scope of delivery

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Order no.</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.2151.020</td>
<td>Cable USB A - USB B / 1.8 m</td>
<td>USB connecting cable&lt;br&gt;Length (m): 1.8</td>
</tr>
<tr>
<td>1</td>
<td>6.2251.000</td>
<td>Colored sleeves for PEEK capillaries</td>
<td>Colored pieces of heat shrink tubing for capillary coding. Three pieces each of five different colors.</td>
</tr>
<tr>
<td>1</td>
<td>6.2322.010</td>
<td>PRIMUS multi anion standard solution: Promo</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6.2322.020</td>
<td>PRIMUS multi cation standard solution: Promo</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6.2617.010</td>
<td>Tool for piston seal</td>
<td>For removing and assembling the piston seal for all IC pumps</td>
</tr>
<tr>
<td>2</td>
<td>6.2621.000</td>
<td>Adjustable wrench</td>
<td>Maximum opening: 20 mm. For IC instruments&lt;br&gt;Length (mm): 150</td>
</tr>
<tr>
<td>Qty.</td>
<td>Order no.</td>
<td>Description</td>
<td>Length (mm):</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>--------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>1</td>
<td>6.2621.030</td>
<td>Hexagon key 4 mm</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 mm. For IC Sample Processors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.2621.050</td>
<td>1/4 in. wrench</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For 1/4 in. screws. For IC instruments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.2621.080</td>
<td>Capillary cutter</td>
<td>118</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For plastic capillaries. For IC instruments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.2621.100</td>
<td>Hexagon key 3 mm</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hexagon key 3 mm. For IC Sample Processors</td>
<td></td>
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</tbody>
</table>
### 8.1 Scope of delivery

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Order no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.2626.000</td>
<td><strong>Front Drain Nozzle</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drain Nozzle to Professional IC instruments to be mounted in the front</td>
</tr>
<tr>
<td>2</td>
<td>6.2739.000</td>
<td><strong>Wrench</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>For tightening connectors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length (mm): 68</td>
</tr>
<tr>
<td>1</td>
<td>6.2743.080</td>
<td><strong>Stopper for Overflow, 5 pieces</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>For Professional IC instruments</td>
</tr>
<tr>
<td>1</td>
<td>6.2744.014</td>
<td><strong>Pressure screw 2x</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>With UNF 10/32 connection. For the connection of PEEK capillaries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material: PEEK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length (mm): 26</td>
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<tr>
<td>Qty.</td>
<td>Order no.</td>
<td>Description</td>
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<tr>
<td>------</td>
<td>------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>6.2744.020</td>
<td>Luer/UNF coupling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For IC instruments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material: PEEK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length (mm): 19</td>
</tr>
<tr>
<td>1</td>
<td>6.2744.034</td>
<td>Coupling olive/UNF 10/32 2x</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Connection of pressure screw and pump tubing. 2 pieces. For IC instruments with peristaltic pumps</td>
</tr>
<tr>
<td>3</td>
<td>6.2744.040</td>
<td>2 x UNF 10/32 coupling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For connecting 1/16 in. capillaries. For IC instruments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material: PEEK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length (mm): 24</td>
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</table>
### 8.1 Scope of delivery

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Order no.</th>
<th>Description</th>
<th>Description</th>
</tr>
</thead>
</table>
| 3    | 6.2744.070| Pressure screw short                             | Short version. With UNF 10/32 connection. 5 pieces. For the connection of PEEK capillaries.  
Material: PEEK  
Length (mm): 21 |
| 3    | 6.2744.090| Pressure screw long                              | 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| Pump tubing connection with safety device and filter | For the connection of a pump tubing and a capillary with built-in filter.  
Material: PEEK |
<p>| 2    | 6.2744.210| Tubing adaptor for aspiration filter             | For Professional IC instruments |</p>
<table>
<thead>
<tr>
<th>Qty.</th>
<th>Order no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6.2816.020</td>
<td>Syringe 10 mL with Luer connection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For different usage in IC and VA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material: PP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length (mm): 102</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Volume (mL): 10</td>
</tr>
<tr>
<td>1</td>
<td>6.2816.040</td>
<td>Purging needle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With PTFE tubing and Luer connection. For syringes. For</td>
</tr>
<tr>
<td></td>
<td></td>
<td>aspirating eluents.</td>
</tr>
<tr>
<td>2</td>
<td>6.2821.090</td>
<td>Aspiration filter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pore size 20 µm. Set of 5 items. For 6.1834.000 aspiration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tubing and 6.1821.040 and 6.1821.050 inlet tubes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material: PE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outer diameter (mm): 9.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length (mm): 35.5</td>
</tr>
<tr>
<td>2</td>
<td>6.2821.130</td>
<td>Spare filter for inline filter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spare filter plates for inline filter.</td>
</tr>
</tbody>
</table>
### 8.1 Scope of delivery

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Order no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.2837.000</td>
<td>CO₂ adsorber cartridge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adsorber cartridge for purifying the air.</td>
</tr>
<tr>
<td>2</td>
<td>6.2837.010</td>
<td>H₂O adsorption cartridge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To CO₂ Suppressor. Water adsorption cartridge for the aspirated air.</td>
</tr>
<tr>
<td>1</td>
<td>8.850.8052EN</td>
<td>Manual 850 Professional IC, 2.850.3030 - AnCat MCS, English</td>
</tr>
</tbody>
</table>
### 8.2 Optional accessories

#### 2.850.3030 850 Professional IC – AnCat – MCS

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1826.310</td>
<td>Pump tubing LFL (orange/green) 3-stopper</td>
</tr>
<tr>
<td></td>
<td>Pump tubing for bromate determination using the triiodide method.</td>
</tr>
<tr>
<td>6.1826.330</td>
<td>Pump tubing LFL (orange/white), 3-stopper</td>
</tr>
<tr>
<td></td>
<td>For all IC instruments with peristaltic pumps.</td>
</tr>
<tr>
<td>6.1826.340</td>
<td>Pump tubing LFL (black/black), 3-stopper</td>
</tr>
<tr>
<td></td>
<td>For the sample solution in inline dialysis</td>
</tr>
<tr>
<td>Order no.</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>6.1826.360</td>
<td>Pump tubing LFL (white/white), 3-stopper</td>
</tr>
<tr>
<td>6.1826.380</td>
<td>Pump tubing LFL (gray/gray), 3-stopper</td>
</tr>
<tr>
<td>6.1826.390</td>
<td>Pump tubing LFL (yellow/yellow), 3-stopper</td>
</tr>
<tr>
<td>6.2057.090</td>
<td>Column holder</td>
</tr>
<tr>
<td>Order no.</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6.2148.010</td>
<td>Remote box MSB</td>
</tr>
<tr>
<td></td>
<td>An additional remote interface for the connection of devices that are controlled via remote lines. With permanently attached cable.</td>
</tr>
<tr>
<td>6.2617.040</td>
<td>Tool for piston seal Macro</td>
</tr>
<tr>
<td></td>
<td>For removing and assembling the piston seal for Macro pump heads</td>
</tr>
<tr>
<td>6.2741.040</td>
<td>PE/PTFE piston seal Macro</td>
</tr>
<tr>
<td></td>
<td>For all Macro pump heads</td>
</tr>
<tr>
<td>6.2824.130</td>
<td>Macro pump head PEEK</td>
</tr>
<tr>
<td></td>
<td>Macro pump head for intelligent IC instruments, flow range 0.1...20 mL/min, maximum pressure 12.5 MPa.</td>
</tr>
<tr>
<td>6.6059.001</td>
<td>MagIC Net™ Multi – 1 additional license</td>
</tr>
<tr>
<td></td>
<td>1 additional license</td>
</tr>
<tr>
<td>6.6059.002</td>
<td>MagIC Net™ Multi – 5 additional licenses</td>
</tr>
<tr>
<td></td>
<td>5 additional licenses</td>
</tr>
<tr>
<td>6.6059.003</td>
<td>MagIC Net™ Multi – 10 additional licenses</td>
</tr>
<tr>
<td></td>
<td>10 additional licenses</td>
</tr>
<tr>
<td>6.6059.112</td>
<td>MagIC Net™ 1.1 Professional CD : 1 license</td>
</tr>
<tr>
<td></td>
<td>Professional PC program for controlling intelligent Professional IC systems, Compact IC systems and their peripherals such as Professional Sample Processor, 800 Dosino, 771 Compact Interface, etc. The software permits control, data acquisition, evaluation and monitoring as well as report generation of ion chromatographic analyses. Graphics user interface for routine operations, extensive database programs, method development, configuration and manual system con-</td>
</tr>
</tbody>
</table>
### 8.2 Optional accessories

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Description</th>
</tr>
</thead>
</table>
| 6.6059.113 | **MagIC Net™ 1.1 Multi CD: 3 licenses**  
Professional PC program for controlling intelligent Professional IC systems, Compact IC systems and their peripherals such as Professional Sample Processor, 800 Dosino, 771 Compact Interface, etc. The software permits control, data acquisition, evaluation and monitoring as well as report generation of ion chromatographic analyses. Graphics user interface for routine operations, extensive database programs, method development, configuration and manual system control; very flexible user administration, efficient database operations, extensive data export functions, individually configurable report generator, control and monitoring of all system components and the chromatography results. MagIC Net™ complies fully with FDA Regulation 21 CFR Part 11 as well as GLP. Dialog languages: German, English, French, Chinese, Korean, Japanese, et. al. 1 license |
| 6.9988.503 | **Validation Documentation for 850 (English - German)** – CD |

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**Table:**

- **Order no.**
- **Description**

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**Notes:**

- MagIC Net™ complies fully with FDA Regulation 21 CFR Part 11 as well as GLP.
- Dialog languages: German, English, French, Chinese, Korean, Japanese, et. al.

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**Client Server version with 3 licenses**

**Validation Documentation for 850 (English - German)** – CD
Index

Numbers/Symbols
6.2821.090 aspiration filter .......... 72
6.2821.130 filter ..................... 83

A
Accessories
Optional ................................ 127
Adsorption cartridges
Connection ............................ 56
Ambient conditions .................. 105
Anion channel ........................ 11
Aspiration filter 6.2821.090 ....... 72
Aspiration tubing for eluent .......... 27

B
Baseline
Conditioning .......................... 68
Unstable ................................ 73
Blockage
Conductivity detector ................. 97
Blood .................................... 85

C
Cable feed-throughs .................... 24
Capillaries
Installation .......................... 14
Capillary feed-throughs ............. 24
Carry-over ........................... 85
Cartridges
Connection ........................... 56
Cation channel ........................ 11
Changing
Eluent ................................. 72
Cleaning
MSM ..................................... 90
Valves of the high pressure pump ........ 78
CO₂ adsorption cartridge .......... 57
Replacement .......................... 96
Column
see also "Separation column" .......... 64
Column recognition .................... 110
Column thermostat
Column thermostat ..................... 108
Installation ............................ 44
Conditioning .......................... 68
Conductivity detector
Cable connector ....................... 19
Capillary connector ................... 58

Cell constant .......................... 109
Cell volume ............................ 109
Maintenance ........................... 97
Positioning ............................ 19
Conductivity measuring system
Technical data ........................ 109
Connections
Installation ............................ 14
Connector
Mains .................................... 110
Contamination
High pressure pump .................. 72
Valves in the high pressure pump ......... 73
Contamination MSM
Heavy metals .......................... 88
Crystallization
High pressure pump ................... 72

D
Deaerating
High pressure pump .................. 35
Purge valve ............................. 32
Degasser
Eluent degasser ........................ 31
Sample degasser ...................... 40
Degassing
Eluent .................................... 31
Degree of protection ..................... 111
Design
Safety specification ..................... 111
Detector
Cable connector ........................ 19
Conductivity detector ................. 58
Interface ............................... 110
Positioning ............................. 19
Diagram ................................. 11
Dilution ................................. 85
Dimensions ............................. 106
Door ....................................... 71
Drainage tubing
Installation ............................. 22

E
Electromagnetic compatibility ........ 111
Electrostatic charge ..................... 7
Eluent
Aspiration ............................. 27
Production ............................. 71

Eluent bottle
Figure ................................. 30
Installation ............................. 27
Operation .............................. 72
Eluent degasser
Installation ............................. 31
Technical specifications .............. 106
EMC ........................................ 111
Emission ............................... 111
Equilibration .......................... 68

F
Feed-throughs
Capillaries ............................. 24
Fill
Injection valve ........................ 43
Filter
see also "inline filter" ................. 37
Filter 6.2821.090
Aspiration filter ....................... 72
Flow diagram ........................... 11
Flow fluctuations ...................... 73
Flow increment ........................ 106
Flow range ............................. 106
Flow rate ............................... 106
Frequency ............................. 110

G
Gas ...................................... 31, 40
GLP ........................................ 99
Guarantee ............................... 114
Guard column
Installation ............................. 62
Rinsing ................................. 63

H
H₂O adsorption cartridge .............. 57
Regeneration ............................ 96
Handle ................................... 16
Heating
see also "Column thermostat" ............. 44
Heavy metals
Contamination of the MSM .......... 88
High pressure pump
Installation ............................. 32
Maintenance ............................ 72
Protection .............................. 21, 72
Technical specifications .............. 106
Tubing connection ..................... 32
Safety specification ................. 111
Sample
  Carry-over .......................... 85
  Sample loop .......................... 43
  Transfer time .......................... 85
Sample degasser
  Installation .......................... 40
  Operation .......................... 87
  Technical data .......................... 107
Sample loop ............................. 43
Sample path
  Rinsing .......................... 85
Sample preparation ...................... 85
Scope of delivery .......................... 116
Screws
  Connection .......................... 15
Separation column
  Installation .......................... 64
  Protection .......................... 3, 39, 98
  Regeneration .......................... 98
  Rinsing .......................... 65
  Separating efficiency .......................... 97
  Storage .......................... 98
Service ................................. 6, 69
Service Agreement ...................... 99
Shutting down ......................... 70
Standards ............................. 111
Start-up ................................. 66
Storage ................................. 105
Suppressor
  Maintenance .......................... 87
  Operation .......................... 87
  see also “MSM” ...................... 47
Switching on ............................. 62

T

Technical data
  Column thermostat .................. 108
  Conductivity measuring system .......................... 109
  Detector .......................... 110
  Interfaces .......................... 110
  Leak sensor .......................... 105
  MCS ................................. 109
  MSM ................................. 108
  Reference conditions ........ 105
  Sample degasser ............... 107
Technical specifications
  Eluent degasser .................. 106
  High pressure pump .............. 106
  Peristaltic pump .................. 108
  Temperature .......................... 105
Test
  Safety specification .............. 111
Thermostat
  see also “Column thermostat” .......................... 44
Transfer time ............................. 44
Transport ................................. 85
  Rollers .......................... 21
  Transport locking screws ........ 21
  Tubing ................................. 11
  Tubing pump
    See also “Peristaltic pump” .. 50
Tubings
  Installation ......................... 14

U

USB ................................. 110

V

Vacuum pump
  Protection .......................... 21
Validation .............................. 99
Valve
  see also “Injection valve” .... 41
Valves of the high pressure pump
  .......................................... 81
Voltage ................................. 110

W

Warranty .............................. 114