872 Extension Module

IC Module – 2.872.0030

Manual

8.872.8004EN

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Documentation in additional languages can be found on *http://products.metrohm.com* under **Literature/Technical documentation**.

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1 Introduction

1.1 Instrument description

Existing 850 Professional IC instruments can be expanded to include additional functions by means of 872 Extension Modules. Every 850 Professional IC instrument can be supplemented with up to 3 extension modules.

The **872 Extension Module IC Module** allows to extend an 850 Professional IC instrument by another IC Module complete with high pressure pump, purge valve, inline filter, pulsation damper and injection valve.

The **872 Extension Module IC Module** can be used wherever an additional IC Module is necessary.

With the 872 Extension Module IC Module, a one-channel low pressure gradient instrument can this way be extended to a two-channel AnCat instrument with low pressure gradient. All instruments with sample preparation can be extended to two-channel systems as well.

In a system with photometric detection with a 886 Professional Thermostat/Reactor as column holder and thermostat and an 887 Professional UV/VIS Detector, it is also possible to use the 872 Extension Module IC Module for conveying reagents.

The extension module is operated with **MagIC Net** software, just like the IC instrument. When it is connected to an 850 Professional IC instrument, **MagIC Net** recognizes the extension module automatically and checks its functional capability. It controls and monitors the unit IC instrument – extension module, evaluates the measured data and administers it in a database.

The **872 Extension Module – IC Module** comprises 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.

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.

1.2 Intended use

The present instrument is suitable for processing chemicals and flammable samples. The usage of the 872 Extension Module therefore requires that the user has basic knowledge and experience in the handling of toxic and caustic substances. Knowledge with respect to the application of the fire prevention measures prescribed for laboratories is also mandatory.

1.3 About the documentation

1.3.1 Content and scope

This document describes the **872 Extension Module – IC Module**, its assembly and connection to the IC instrument, as well as the installation, operation and maintenance of the individual components. Technical specifications, troubleshooting and information concerning scope of delivery and optional accessories makes up the rest of the manual.

This document does not on the other hand describe the functions of the IC instrument - IC extension module unit, nor does it describe the capillary connections that proceed from the extension module. For this purpose, please refer to the manual for the IC instrument and that for the sample processor.

Additional information concerning the configuration of MagIC Net can be found on the online help for MagIC Net.

1.3.2 Symbols and conventions

The following symbols and styles are used in this documentation:

*(5-**12**)*	**Cross-reference to figure legend** The first number refers to the figure number, the second to the instrument part in the figure.
1	**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.
	**Warning** This symbol draws attention to a possible hazard due to heat or hot instrument parts.
	**Warning** This symbol draws attention to a possible biological hazard.
	**Caution** This symbol draws attention to a possible damage of instruments or instrument parts.
	**Note** This symbol marks additional information and tips.

1.4 Safety instructions

1.4.1 General notes on safety

Warning

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

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

1.4.2 Electrical safety

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

Warning

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

Warning

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

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

Mains voltage

Warning

An incorrect mains voltage can damage the instrument.

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

Protection against electrostatic charges

Warning

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

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

1.4.3 Tubing and capillary connections

Caution

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

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

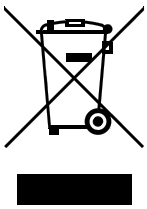
1.4.4 Flammable solvents and chemicals

Warning

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

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

1.4.5 Recycling and disposal



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

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

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

2 Overview of the instrument

2.1 Front

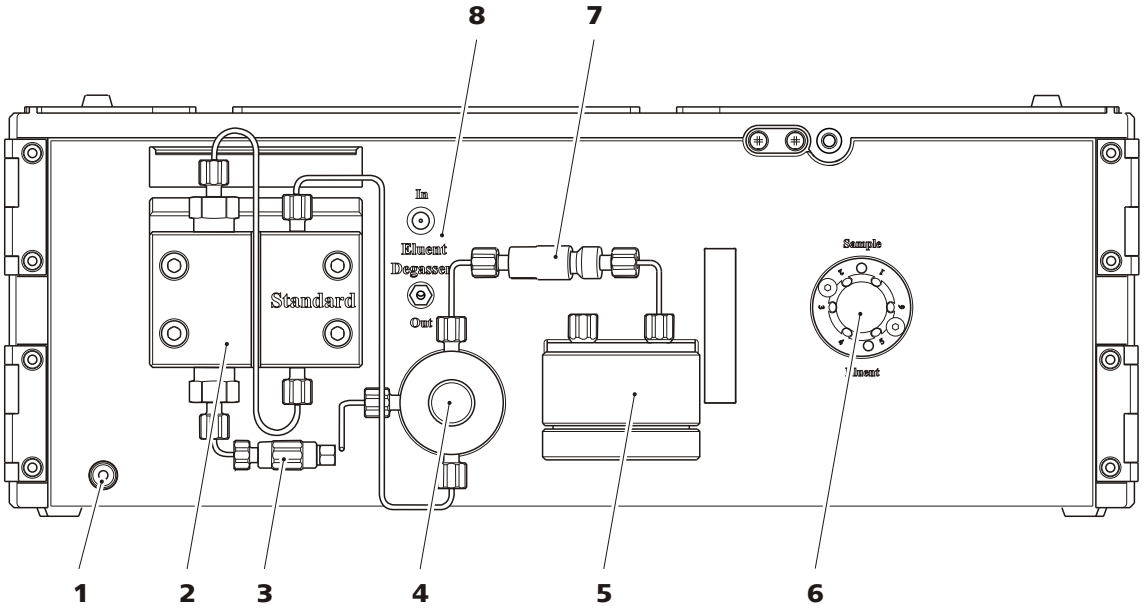


Figure 1 Front 872 Extension Module IC Module

1	**Standby indicator**	**2**	**High pressure pump** *See Chapter 4.6*
3	**Coupling 6.2744.230** For connecting the eluent aspiration tubing.	**4**	**Purge valve** *See Chapter 4.6*
5	**Pulsation damper** *See Chapter 4.8*	**6**	**Injection valve** *See Chapter 4.9*
7	**Inline filter** *See Chapter 4.7*	**8**	**Eluent degasser** *See Chapter 4.5*

2.2 Rear

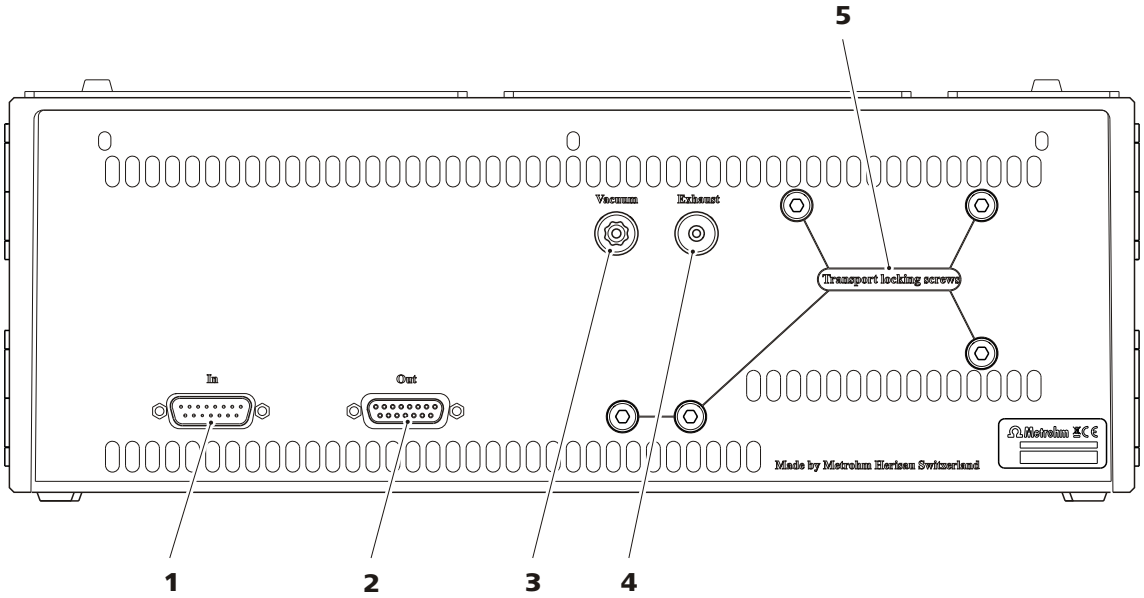


Figure 2 Rear 872 Extension Module IC Module

1 **Connector In** To connect the extension module to the IC instrument or to a previous extension module.	**2** **Connector Out** To connect an additional extension module.
3 **Connector Vacuum** For connecting further degassing chambers in extension modules (labeled with *Vacuum*).	**4** **Waste air opening** For extracting the air from the vacuum chamber (labeled with *Exhaust*).
5 **Transport locking screws** For securing the high pressure pump and the vacuum pump when transporting the instrument.	

3 Assembly

3.1 General

The extension modules are fitted directly to the 850 Professional IC instrument and connected with it via 6.2156.060 connection cable. Extension modules have no power supply of their own, but rather draw the electricity they require from the instrument with which they are connected.

Up to three extension modules can be connected to an 850 Professional IC instrument. The following restrictions are to be taken into account:

Restrictions

The 850 Professional IC instruments and their extension modules must not have more than 4 identical components in common, i.e.:

- a maximum of 4 high pressure pumps,
- a maximum of 4 peristaltic pumps,
- a maximum of 4 injection valves,
- a maximum of 4 suppressors (MSM, SPM incl.),
  BUT
- only a maximum of 3 degassers
- and a maximum of 3 CO_2 suppressors (MCS)

Note

If all 4 high pressure pumps are being used at once, then not all of them are permitted to run at maximum flow for longer periods of time.

Extension modules can be mounted in the following setup versions:

- above, between instrument and bottle holder *(3-**A**)*, or
- below, between instrument and base tray *(3-**B**)*, or
- next to the instrument *(3-**C**)* with a separate 6.2061.110 base tray and a 6.2061.100 bottle holder (to be ordered additionally). For this, the longer 6.2156.070 connection cable (to be ordered additionally), is necessary, too.

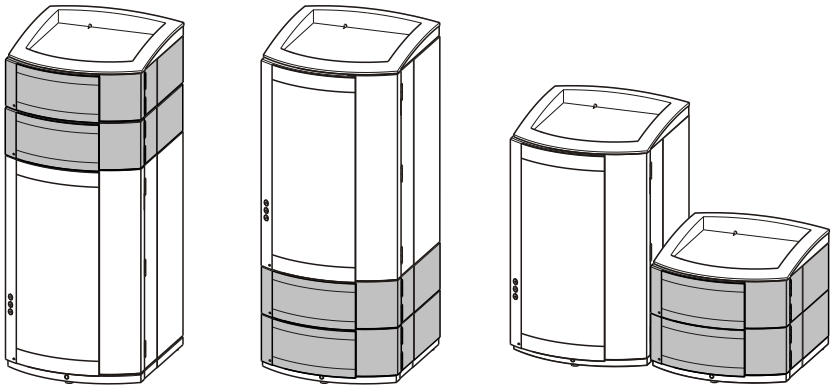


Figure 3 Setup versions

A **Extension module above the IC instrument**
Between the 850 Professional IC and the bottle holder.

B **Extension module on the below the IC instrument**
Between the base plate and the 850 Profession IC.

C **Extension module next to the IC instrument**
With its own base plate and its own bottle holder next to the 850 bottle holder.

Position the extension module in such a way that the capillary connections can be kept as short as possible. If several extension modules are used, then they should all be installed in the same location if possible – either above, below or next to the IC instrument. If this is not possible, then the extension modules that are located at greater distances from one another must be connected with one another by means of the longer 6.2156.070 connection cable (available as optional accessory).

3.2 Mounting the extension module onto the IC instrument

1 Switching off the IC instrument

Switch the IC instrument off and disconnect the mains cable.

2 Clearing the bottle holder

If there are bottles and other items on the bottle holder, remove them.

3 Removing drainage tubings

Loosen the drainage tubing from the drainage tubing connector on the bottle holder.

4 Dismounting the bottle holder

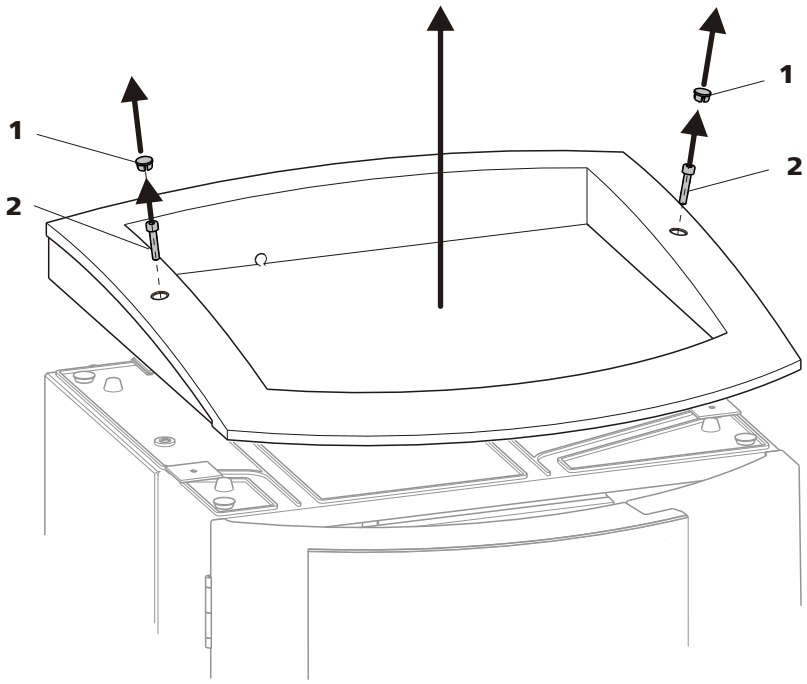


Figure 4 Dismounting the bottle holder

1	Cover stoppers	2	Cylinder screws

- Remove covering stoppers *(4-**1**)*.
- Loosen the cylinder screws with a 6.2621.100 3 mm hexagon key.
- Remove the bottle holder

5 Attaching the extension module(s)

Place the extension module(s) on the IC instrument.

6 Mounting the bottle holder

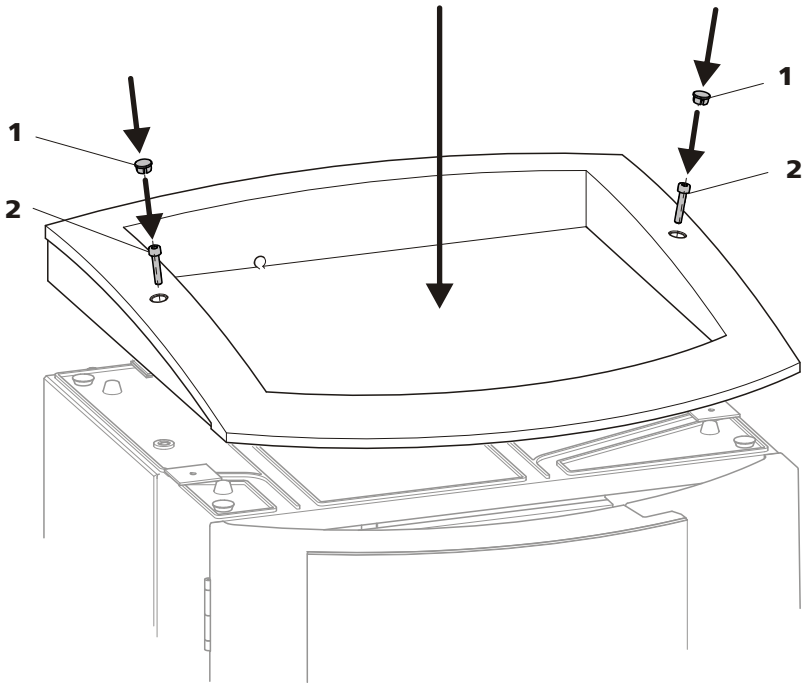


Figure 5 Mounting the bottle holder

1 Cover stoppers	**2 Cylinder screws**

- Attach the bottle holder on the extension module.
- Tighten the cylinder screws *(4-**2**)* with an 6.2621.100 3 mm hexagon key
- Insert covering stoppers *(4-**1**)*.

7 Connecting the extension module

- Plug a 6.2156.060 cable into the connector **In** of the extension module and screw it tight.
- Plug the other end of the cable into the **Extension module** connector of the IC instrument and screw it tight.

8 Optional: Connecting a further extension module

- Plug the cable 6.2156.060 or a longer 6.2156.070 cable (optional accessory) into the connector **In** of the second extension module and screw it tight.
- Plug the other end of the cable into the **Out** connector of the first extension module and screw it tight.

9 Mounting the drainage tubing

Reconnect the drainage tubing to the drainage tubing connector of the bottle holder.

Possibly, a longer section of silicone tubing 6.186.020 must be cut to fit and mounted *(see also the manual for the IC instrument)*.

3.3 Mounting the extension module below the IC instrument

1 Switching off the IC instrument

Switch the IC instrument off and disconnect the mains cable.

2 Clearing the bottle holder

If there are bottles and other things on the bottle holder, remove them.

3 Disconnecting all connections on the rear of the instrument

- Disconnect the mains cable,
- Disconnect the MSB cable,
- Disconnect the USB cable,
- Disconnect the leak sensor,
- Remove the drainage tubings.

4 Removing the detector(s)

Disconnect the detector cable(s) and remove the detector(s) from the IC instrument *(see manual for the IC instrument)*.

5 Removing the base tray

- Tilt the IC instrument sideways and lay it down flat.
- Loosen the cylinder screws with a 6.2621.100 3 mm hexagon key.
- Remove base tray.

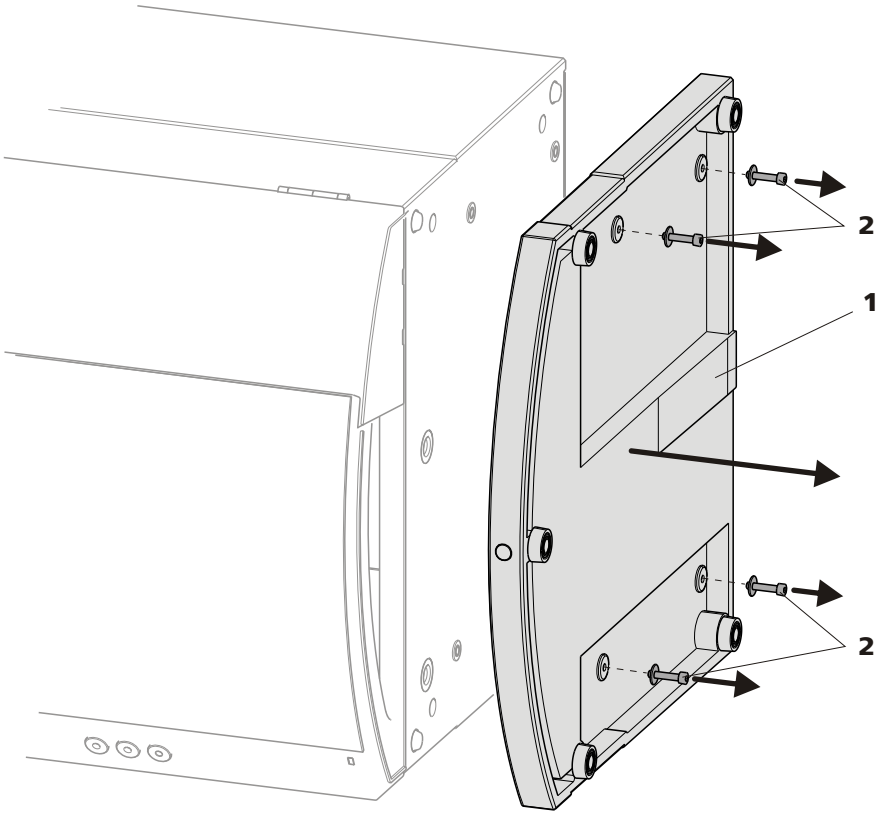


Figure 6 Removing the base tray

1 Base tray	**2 Cylinder screws** With washer.

6 Mounting the base tray

- Tilt the extension module sideways and lay it down flat.
- Attach base tray.
- Slide the washers onto the cylinder screws *(7-**2**)* and tighten these with a 3 mm hexagon key (6.2621.100).

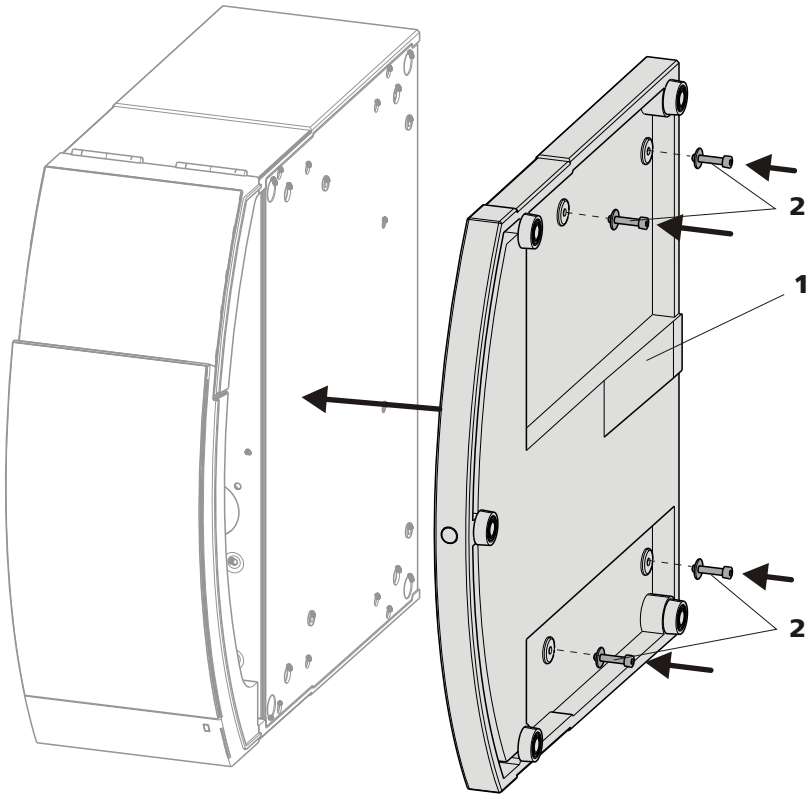


Figure 7 Mounting the base tray

1 Base tray	**2 Cylinder screws** With washer.

- Set up the extension module.
- Optional: Set up further extension modules.
- Set up the IC instrument.

7 Connecting the extension module

- Plug a 6.2156.060 cable into the connector **In** of the extension module and screw it tight.
- Plug the other end of the cable into the **Extension module** connector of the IC instrument and screw it tight.

8 Optional: Connecting a further extension module

- Plug the cable 6.2156.060 or a longer 6.2156.070 cable (optional accessory) into the connector **In** of the second extension module and screw it tight.
- Plug the other end of the cable into the **Out** connector of the first extension module and screw it tight.

9 Inserting the detector(s) again and connecting it (them)

See manual for the IC instrument.

10 Restoring the loosened connections

- Reconnect the drainage tubings,
  Possibly, a longer section of silicone tubing 6.186.020 must be cut to fit and mounted *(see also the manual for the IC instrument)*.
- Connect the leak sensor *(see manual for the IC instrument)*,
- Connect the USB cable,
- Connect the MSB cable,
- Plug in the mains cable.

3.4 Setting up the extension module next to the IC instrument

1 Switching off the IC instrument

Switch the IC instrument off and disconnect the mains cable.

2 Mounting the base tray

- Tilt the extension module sideways and lay it down flat.
- Attach base tray.
- Tighten the washers and the cylinder screws *(8-**2**)* with a 3 mm hexagon key (6.2621.100).

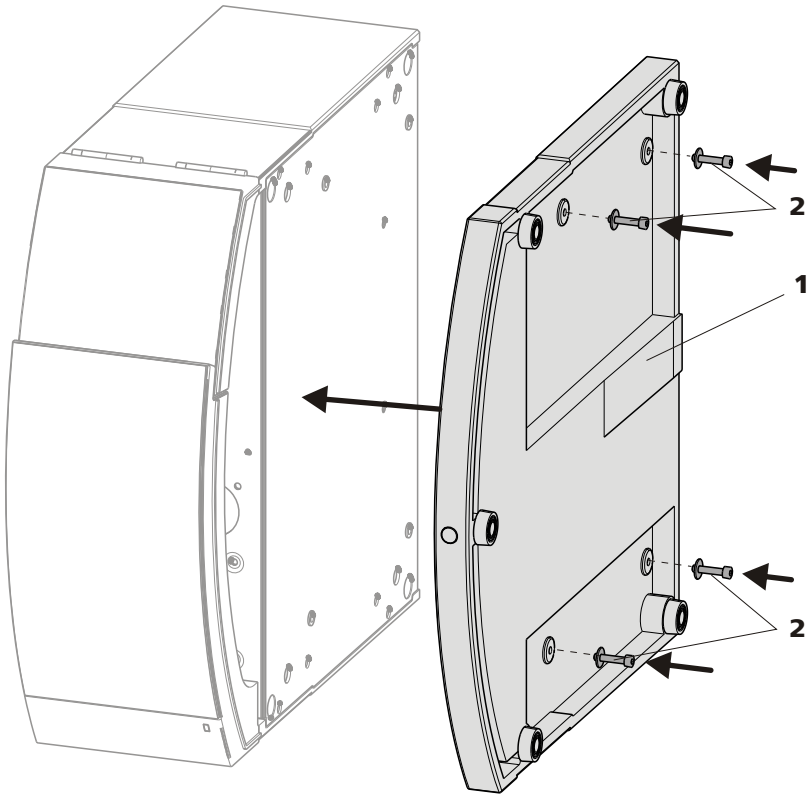


Figure 8 Mounting the base tray

1 Base tray	**2 Cylinder screws** With washer.

- Set up the extension module.
- Optional: Set up further extension modules.

3 Mounting the bottle holder

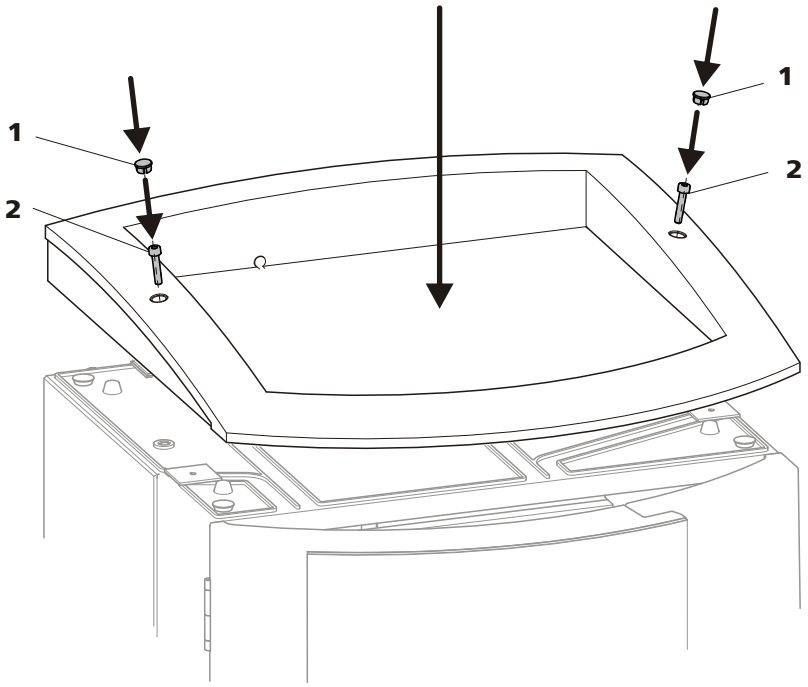


Figure 9 Mounting the bottle holder

1 Cover stoppers	**2 Cylinder screws**

- Place the bottle holder on the extension module.
- Tighten the cylinder screws *(9-**2**)* with an 6.2621.100 3 mm hexagon key.
- Insert covering stoppers *(9-**1**)*.

4 Connecting the extension module

- Plug a 6.2156.060 cable into the connector **In** of the extension module and screw it tight.
- Plug the other end of the cable into the **Extension module** connector of the IC instrument and screw it tight.

5 Optional: Connecting a further extension module

- Plug the cable 6.2156.060 or a longer 6.2156.070 cable (optional accessory) into the connector **In** of the second extension module and screw it tight.
- Plug the other end of the cable into the **Out** connector of the first extension module and screw it tight.

6 Connecting the leak sensor

- Plug the 6.2103.170 adapter into the leak sensor connector of the IC instrument.
- Connect the leak sensor cable of the IC instrument to the adapter.
- Connect the leak sensor cable of the extension module to the adapter.

7 Connecting the drainage tubings

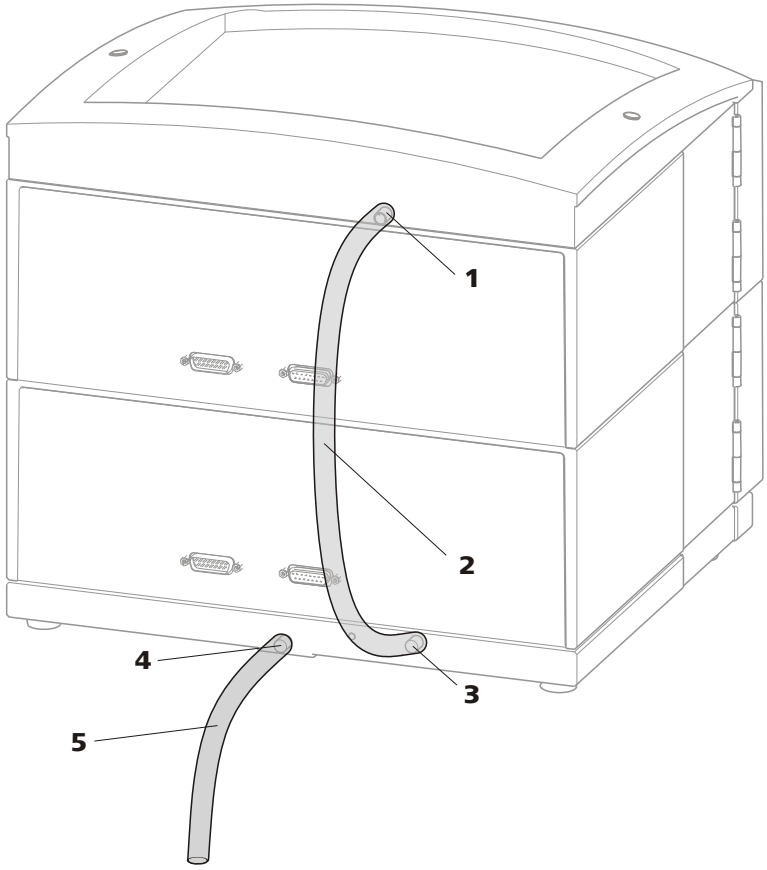


Figure 10 Connecting the drainage tubings

1 **Drainage tubing connector** For draining escaped liquid from the bottle holder.	**2** **Drainage tubing** Section of the 6.1816.020 silicon tubing. For draining escaped liquid from the bottle holder.

3	**Drainage tubing connection** For supplying escaped liquid through the connected drainage tubing to the leak sensor.
4	**Drainage tubing connector** For draining escaped liquid from the base tray through the connected drainage tubing.
5	**Drainage tubing** Section of the 6.1816.020 silicon tubing. Guides escaped liquid into a waste container.

- Plug the drainage tubing *(10-**2**)* onto the drainage tubing connector *(10-**1**)* of the bottle holder and shorten to required length.
- Plug the other end of the drainage tubing *(10-**2**)* onto the drainage tubing connector *(10-**3**)* of the base tray.
- Plug the drainage tubing *(10-**5**)* onto the drainage tubing connector *(10-**4**)* and guide the other end into a waste container.

3.5 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 all of the transport locking screws with the 6.2621.030 4 mm hexagon key and keep them in a safe place.

Warning

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

4 Installation

4.1 About this chapter

The *Installation* chapter contains

- this overview
- a brief set of instructions for the installation of the 872 Extension Module IC Module *(see Chapter 4.2, page 21)*. At each step you will find cross-references to more detailed installation instructions for individual components, should you require such aids.
- an installation diagram *(see Chapter 4.3, page 22)*, showing a completely installed instrument.
- several chapters with detailed installation instructions for all components, including those that are already installed at the time the instrument is delivered.

4.2 Installation overview

Note

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

The following work steps must still be carried out:

Installing 872 Extension Module IC Module

1 Installing the eluent path

- Tighten the clamping screw of the 6.1834.080 eluent aspiration tubing to the eluent degasser input.
  Equip the free end of the eluent aspiration tubing *(11-**1**)* and connect it to the eluent bottle *(see Chapter 4.4, page 23)*.
- Tighten one end of the 6.1831.010 PEEK capillary with a 6.2744.014 PEEK pressure screw to the connector 4 of the injection valve *(see Chapter 4.9.1, page 35)*.
  Shorten to required length with the capillary cutter and with the aid of a 6.2744.040 coupling and two 6.2744.010 pressure screws connect to the column outlet capillary in the IC instrument.

Note

The separation column must not be connected to the system before having it started up for the first time (see manual for the IC instrument).

2 Installing the sample path

- Connect one end of the 6.1803.040 PTFE capillary *(11-**3**)* with a 6.2744.014 PEEK pressure screw to connector 1 of the injection valve *(see Chapter 4.9.1, page 35)*.
  Guide the other end through a suitable capillary feed-through out of the extension module to the Sample Processor and connect it there (see Sample Processor manual).
- Connect one end of the second 6.1803.040 PTFE capillary *(11-**4**)* with a 6.2744.014 PEEK pressure screw to connector 2 of the injection valve.
  Guide the other end through a capillary feed-through out of the extension module to a waste container and fasten it there.

3 Putting the extension module into operation

See Chapter 5, Page 39

- Putting the extension module into operation together with the IC instrument (see chapter *Start-up* in the manual for the IC instrument).
- Deaerate the high pressure pump at the same time *(see Chapter 4.6.2, page 31)*.

4.3 Installation diagram

Figure 11 Installation diagram shows the capillary connections of the 872 Extension Module IC Module as an additional IC Module which can be integrated into any existing system.

The arrangement of the modules in the diagram corresponds to the front view of the extension module.

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

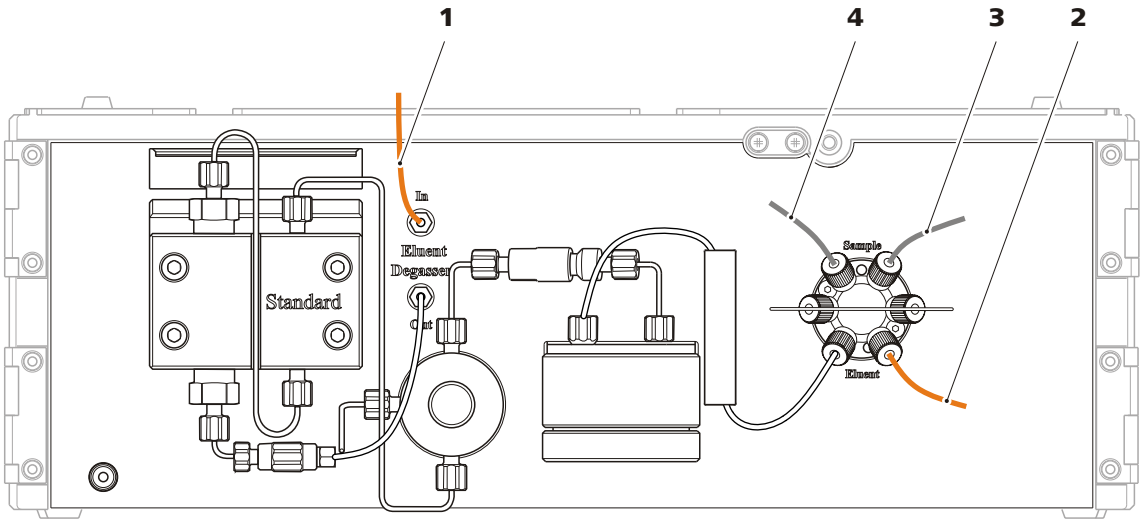


Figure 11 Installation diagram

1	**Eluent aspiration tubing 6.1834.080** Connected to the eluent degasser. Connect the other end to the eluent bottle.	**2**	**Eluent connection capillary 6.1831.010**
3	**Sample aspirating capillary 6.1803.040**	**4**	**Sample outlet capillary 6.1803.040**

The following chapters describe the individual installation steps in detail.

4.4 Eluent

4.4.1 Connecting eluent bottle

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

The eluent aspiration tubing is connected to the eluent degasser *(see Chapter 4.5, page 27)*. The tubing must be threaded through a suitable capillary feed-through of the instrument before the other end can be equipped.

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

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

To equip the eluent aspiration tubing proceed as follows:

Assembling eluent aspiration tubing

1. Guide the free end of the eluent aspiration tubing *(12-**1**)* out of the instrument through a suitable capillary feed-through.

2 Installing eluent bottle attachment 6.1602.160

- Slide tubing nipple *(12-**2**)* and O-ring *(12-**3**)* onto the eluent aspiration tubing *(12-**1**)*.
- Push eluent aspiration tubing *(12-**1**)* through the bottle attachment *(12-**4**)* and screw tight.

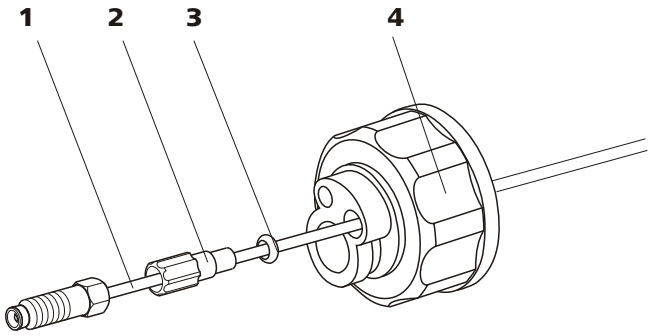


Figure 12 Installing eluent bottle attachment

1 Eluent aspiration tubing 6.1834.080	**2 Tubing nipple** From accessories set 6.1602.160.
3 O-ring From accessories set 6.1602.160.	**4 Bottle attachment** From accessories set 6.1602.160.

3 Mounting aspiration filter

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

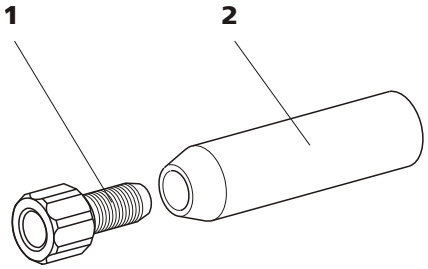


Figure 13 Mounting aspiration filter

1 Filter holder From accessories set 6.2744.210.	**2 Aspiration filter 6.2821.090**

4 Install tubing weighting and aspiration filter

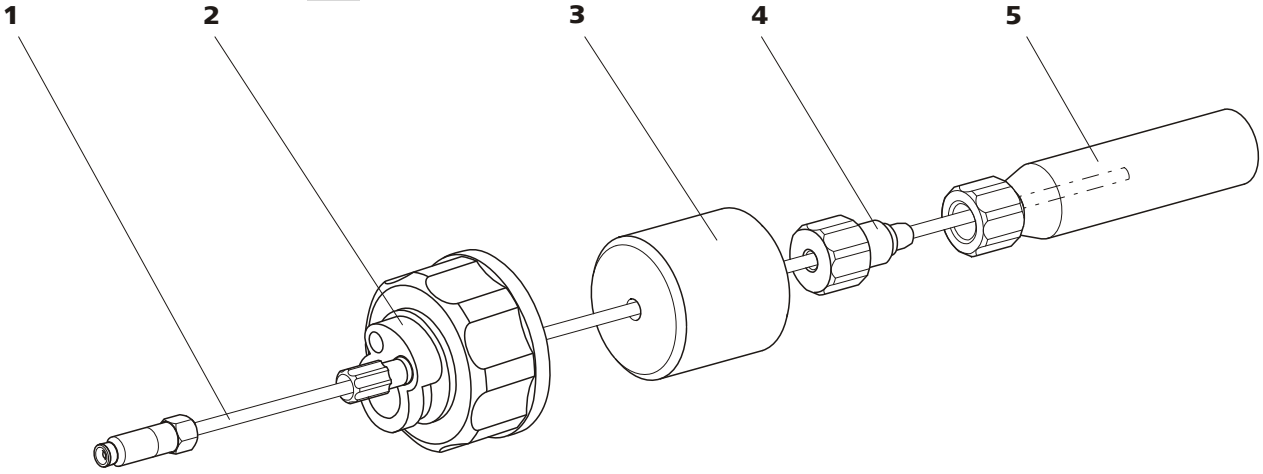


Figure 14 Install tubing weighting and aspiration filter

1 **Eluent aspiration tubing 6.1834.080**	**2** **Eluent bottle attachment 6.1602.160**
3 **Tubing weighting** From accessories set 6.2744.210.	**4** **Clamping screw** From accessories set 6.2744.210.
5 **Aspiration filter 6.2821.090** With filter holder from accessories set 6.2744.210.	

- Slide the tubing weighting *(14-**3**)* onto the eluent aspiration tubing *(14-**1**)*.
- Slide the clamping screw *(14-**4**)* onto the eluent aspiration tubing *(14-**1**)*.
- Insert the eluent aspiration tubing *(14-**1**)* into the aspiration filter *(14-**5**)*. The end of the tubing should approximately reach to the center of the aspiration filter.
- Screw together clamping screw *(14-**4**)* and filter holder *(13-**1**)*.

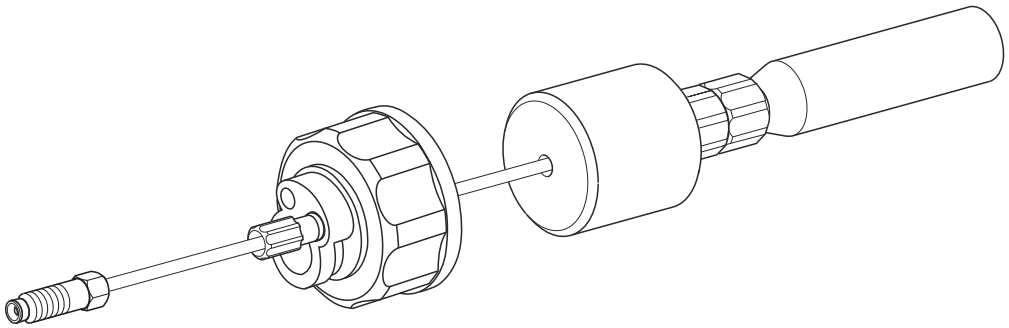


Figure 15 Eluent aspiration tubing fully equipped.

5 Mounting eluent aspiration tubing to the eluent bottle

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

- Fasten the completely equipped bottle attachment *(16-**10**)* on the eluent bottle. The aspiration filter *(16-**6**)* must rest on the base of the eluent bottle.
- Close the remaining small opening on the bottle attachment with a threaded stopper from the accessories set.

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 *(16-**4**)*.

- First, place a piece of cotton *(16-**3**)*, then the CO_2 adsorber *(16-**4**)* in the large opening of the adsorber tube *(16-**2**)* and close with the plastic cover.
- Fasten the adsorber tube *(16-**2**)* using the SGJ clip *(16-**12**)* onto the bottle attachment *(16-**11**)*.

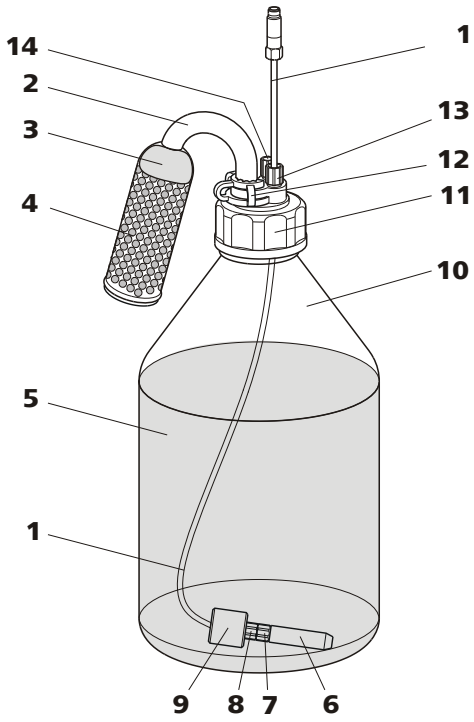


Figure 16 Eluent bottle – connected

1 Eluent aspiration tubing 6.1834.080 For aspirating the eluent. Pre-installed.	**2 Adsorber tube 6.1609.000**

3	**Wadding**	**4**	**CO_2 adsorber** Adsorbs CO_2 from the air (e.g. Merck soda lime with indicator, no. 6839.10).
5	**Eluent**	**6**	**Aspiration filter 6.2821.090**
7	**Filter holder** From accessories set 6.2744.210.	**8**	**Clamping screw** From accessories set 6.2744.210.
9	**Tubing weighting** From accessories set 6.2744.210.	**10**	**Eluent bottle 6.1608.070**
11	**Bottle attachment 6.1602.160**	**12**	**SGJ clip 6.2023.020**
13	**Tubing nipple**	**14**	**Threaded stopper**

4.5 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 must only be followed, if the connections to the degasser had to be disconnected for maintenance.

Connecting the eluent degasser

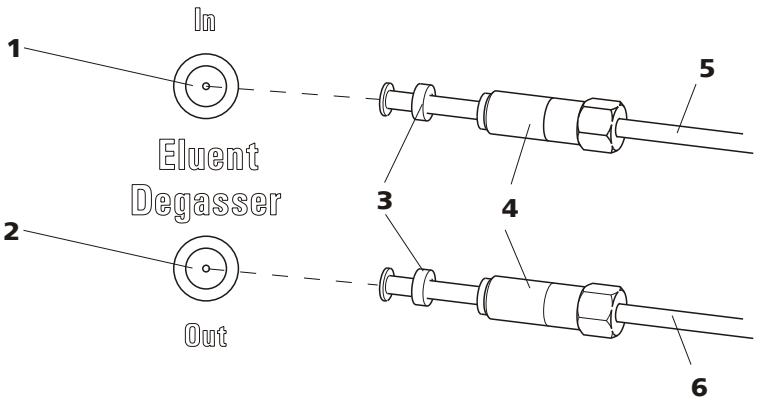


Figure 17 Eluent degasser

1	**Eluent degasser input**	**2**	**Eluent degasser output**
3	**Tubing flare** With tubing nipple.	**4**	**Clamping screw**
5	**Eluent aspiration tubing (6.1834.080)** For aspirating the eluent. The clamping screw *(17-**4**)* is firmly mounted.	**6**	**Connection tubing (6.1834.090)** Connection from the eluent degasser to the high pressure pump *(see Chapter 4.6, page 29)*. The clamping screw *(17-**4**)* is firmly mounted.

1

Caution

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

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

2

- Insert connection capillary *(17-**6**)* (the end with the longer clamping screw *(17-**4**)*) into the eluent degasser output *(17-**2**)*.
- Carefully tighten the clamping screw *(17-**4**)*.
- Connect the other end of the connection capillary *(17-**6**)* (with the shorter clamping screw) to the high pressure pump *(18-**9**) (see "Connecting inlet to the high pressure pump", page 30)*.

4.6 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 4.6.2, page 31)* the high pressure pump.

4.6.1 Capillary connections high pressure pump/purge valve

Note

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

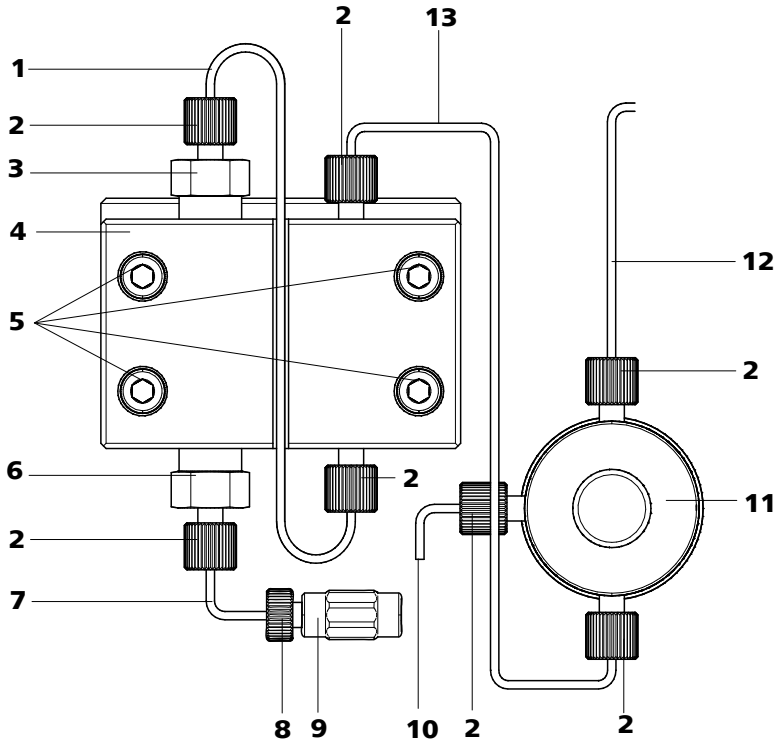


Figure 18 Capillary connections high pressure pump/purge valve

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

5 **Fastening screws**
For fastening the pump head.

6 **Inlet valve holder**

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

8 **Pressure screw**
For connecting a PEEK capillary to the coupling *(18-**9**)*.

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 *(18-**8**)* under the number 6.2744.230.

10 **Deaerating capillary**
For aspirating the eluent when deaerating the high pressure pump *(see Chapter 4.6.2, page 31)*.

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

12 **Connection capillary**
For connecting the inline filter *(see Chapter 4.7, page 33)*

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

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

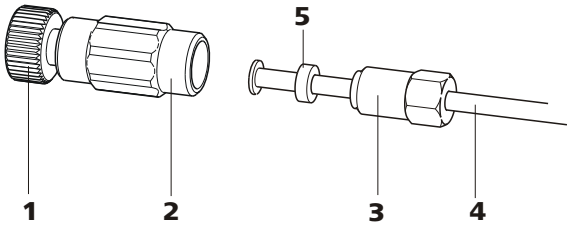


Figure 19 High pressure pump – Connect inlet

1 **Pressure screw**
For connecting the coupling *(19-**2**)* to the pump head input capillary *(18-**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 *(19-**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 *(19-**2**)* with a pressure screw *(19-**1**)* on the pump head input capillary *(18-**7**)*.

2 Connecting eluent aspiration tubing

Caution

The clamping screws must be tightened carefully. To tighten, grip the coupling *(19-**2**)* with the 6.2739.000 key and grip the clamping screw *(19-**3**)* with the 6.2621.050 wrench.

- Plug the eluent aspiration tubing *(19-**4**)* into the coupling *(19-**2**)*.
- Tighten clamping screw *(19-**3**)*.

4.6.2 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 .

Deaerate the high pressure pump as follows *(see Figure 20, page 32)*:

Deaerating the high pressure pump

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

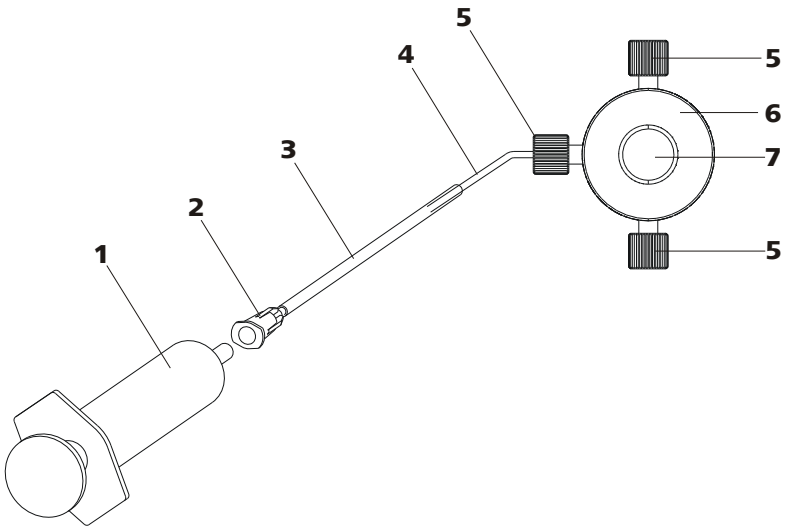


Figure 20 Deaerating the high pressure pump

1 Syringe 10 mL 6.2816.020 For aspirating the eluent.	**2 Luer connector** On purging needle.
3 Purging needle 6.2816.040	**4 Deaerating capillary**
5 PEEK pressure screws, short 6.2744.070	**6 Purge valve**
7 Purge valve rotary knob	

1 Connecting the purging needle

- Push the end of the purging needle *(20-**3**)* over the end of the deaerating capillary *(20-**4**)* on the purge valve.

2 Connecting the syringe

- Insert syringe *(20-**1**)* in the Luer connector *(20-**2**)* of the purging needle *(see Figure 20, page 32)*.

3 Opening purge valve

- Open the rotary knob *(20-**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 *(20-**1**)* until bubble-free eluent flows into the syringe.

6 Completing deaerating

- Turn off high pressure pump.
- Close rotary knob *(20-**7**)*.
- Remove syringe *(20-**1**)* from the Luer connector *(20-**2**)*.
- Pull the purging needle *(20-**3**)* out of the deaerating capillary *(20-**4**)*.

4.7 Inline filter

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

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

Note

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

Installing the inline filter

Caution

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

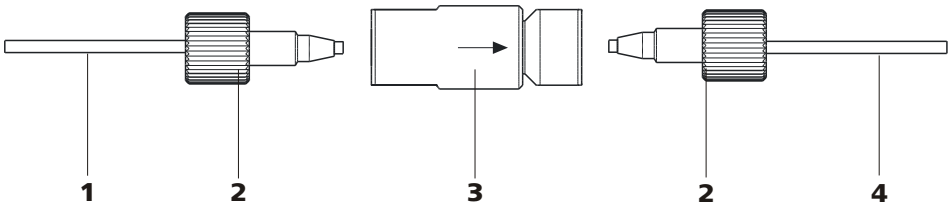


Figure 21 Connecting inline filter

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.

4.8 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 4.6, page 29)* and injection valve *(see Chapter 4.9, page 35)*.

The pulsation damper can be operated in both directions.

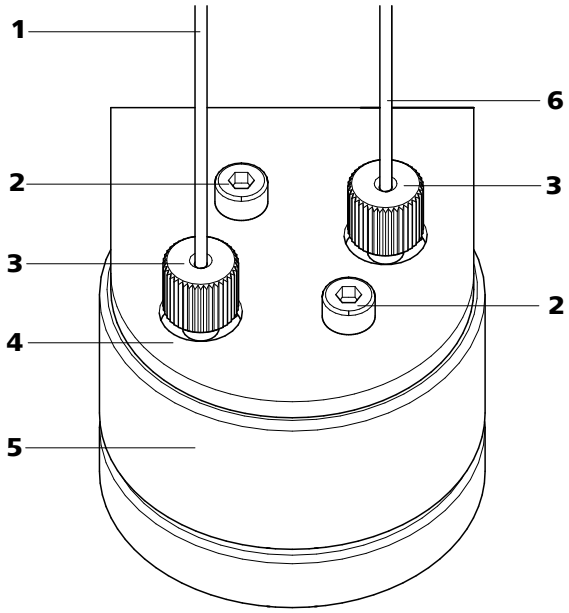


Figure 22 Pulsation damper – Connection

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.

4.9 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.

4.9.1 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.

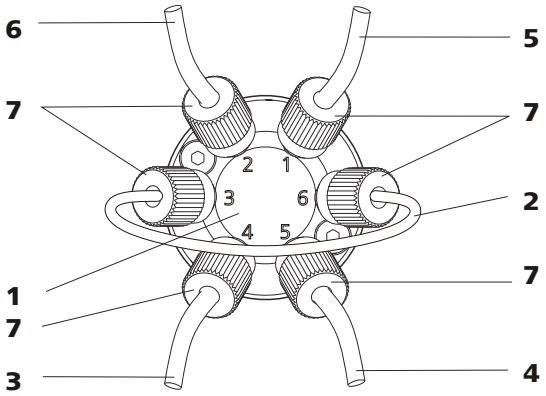


Figure 23 Injection valve – connected

1 **Injection valve**	**2** **Sample loop** Connected to connectors 3 and 6.
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**	

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 4.9.3, page 38*.

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.

4.9.2 Mode of operation of the injection valve

The injection valve *(see Figure 24, page 37)* 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.

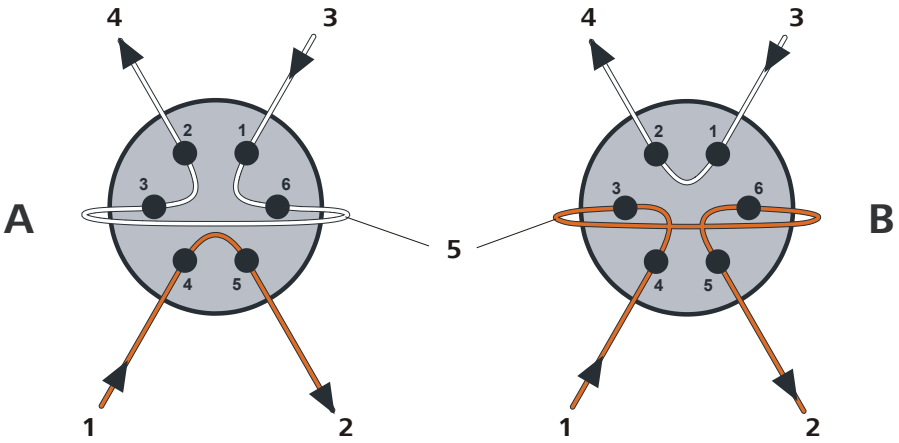


Figure 24 Injection valve – Positions

A	**Position FILL**	**B**	**Position INJECT**
1	**Eluent input** Capillary coming from the high pressure pump.	**2**	**Eluent output** Capillary to the column.
3	**Sample input** Sample aspirating capillary.	**4**	**Sample output** Capillary to waste container.
5	**Sample loop**		

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.

4.9.3 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

5 Set to work

The extension module is put into operation together with the IC instrument.

Putting IC instrument into operation with extension modules

1. Start MagIC Net.
2. Connect the 872 Extension Module to the 850 Professional IC.
3. Connect the 850 Professional IC instrument to the PC and switch on.

   The extension module is recognized automatically by MagIC Net.
4. Follow the other instructions in the chapter *Initial start-up* of the manual for the 850 Professional IC.
5. Deaerate the high pressure pump at the same time *(see Chapter 4.6.2, page 31)*.

6 Operation and maintenance

6.1 General information

6.1.1 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 prevented to a great extent 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.

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.

6.1.2 Maintenance by Metrohm Service

Maintenance of the instrument is best carried out as part of an annual service, which is performed by specialist personnel from Metrohm. 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.

6.1.3 Operation

Caution

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

6.1.4 Shutting down

If the instrument is shut down for a longer period of time, the entire IC system must be rinsed as follows to rid it of salts in order to prevent eluent salts from forming crystals which may cause subsequent damage.

- rinse all capillaries and the Dosino with methanol/ultra pure water (1:4),
- rinse all pump tubings of the peristaltic pump with ultra pure water.

6.2 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.

6.3 Eluent

6.3.1 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.

6.3.2 Operation

6.3.2.1 Supply bottle

The supply bottle with the eluent must be connected as indicated in *chapter 4.4.1, page 23*. 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.

6.3.2.2 Aspiration filter

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

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

6.3.2.3 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.

6.4 High pressure pump

6.4.1 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 23)*.

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 6.3.2.3, page 42)*.

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.

6.4.2 Maintenance

Caution

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

Pump head maintenance

An unstable baseline (pulsation, flow fluctuations) is in many cases the result of contaminated valves *(31-**2**)*, *(31-**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 *(18-**2**)* and unscrew the coupling *(18-**9**)*, the pump head input capillary *(18-**7**)* and the eluent aspiration tubing from the pump head.
3. Unscrew the pump head output capillary *(18-**13**)* from the pump head.
4. Remove pump head from the pump housing by loosening the 4 fastening screws *(18-**5**)* using the 6.2621.030 hexagon key. The main

piston is on the left (viewed from the front), and the auxiliary piston is on the right.

Cleaning/replacing the zirconium oxide piston

Clean one piston after the other as follows:

1 Removing the piston cartridge from the pump head

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

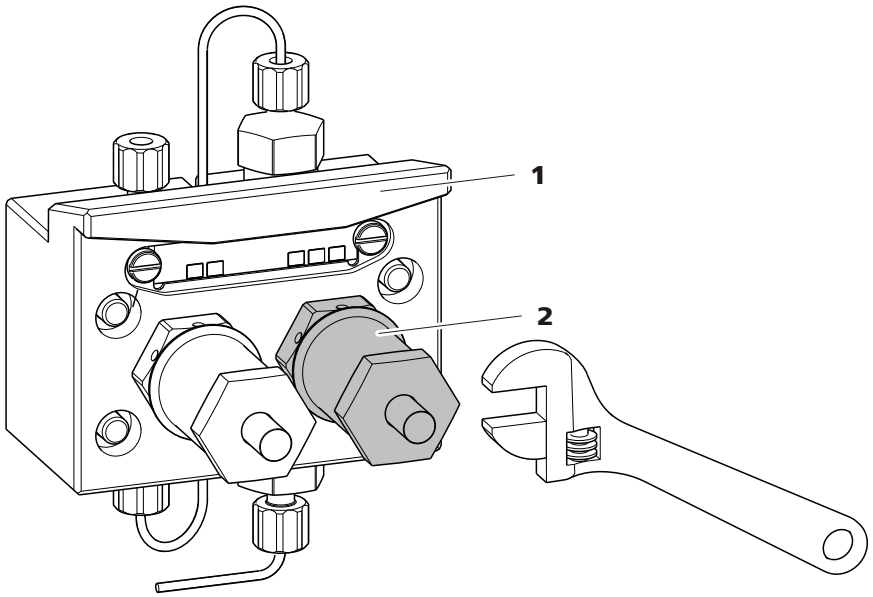


Figure 25 Removing piston

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

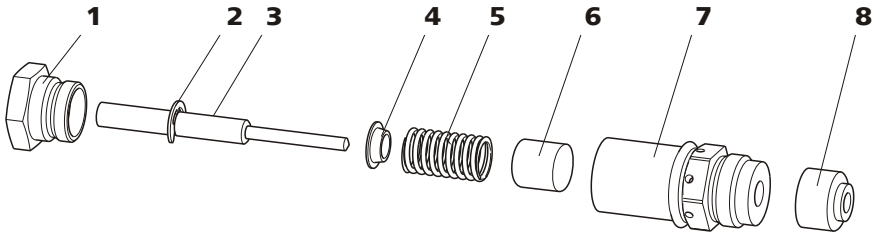


Figure 26 Components of the piston cartridge

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 27, page 46)* is necessary in order to remove the piston seal from the pump head. It consists of two parts: a tip for removing the old piston seal and a sleeve for inserting the new piston seal.

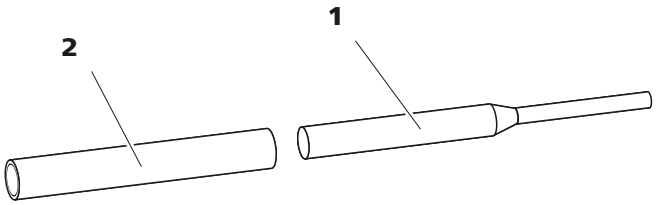


Figure 27 Tool for piston seal 6.2617.010

1 Pin
Pin for removing the old piston seal.

2 Sleeve
Sleeve for inserting the new piston seal.

Caution

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

1 Removing the piston seal

Caution

Avoid touching the sealing surface in the pump head *(18-**4**)* with the tool.

Screw the special tool for the piston seal *(27-**1**)* with the narrow side just as far into the piston seal as the same can be removed.

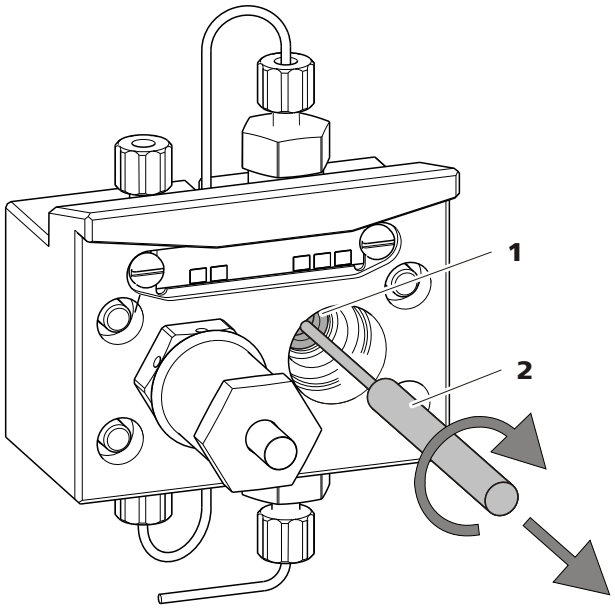


Figure 28 Removing the piston seal

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

2 Inserting the new piston seal into the tool

Insert the new piston seal tightly by hand into the recess of the sleeve of the tool for the piston seal *(27-**2**)*. The sealing springs must be visible from the outside.

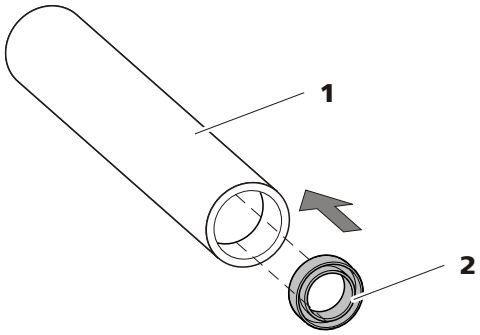


Figure 29 Insert the piston seal into the tool

1 Tool for piston seal 6.2617.010 Sleeve for inserting the new piston seal.	**2 Piston seal** Order number: 6.2741.020

3 Inserting the new piston seal into the pump head

Guide the sleeve of the tool for the piston seal *(27-**2**)* with inserted piston seal into the pump head and press the seal with the wide end of the tool for the piston seal *(27-**1**)* into the pump head recess.

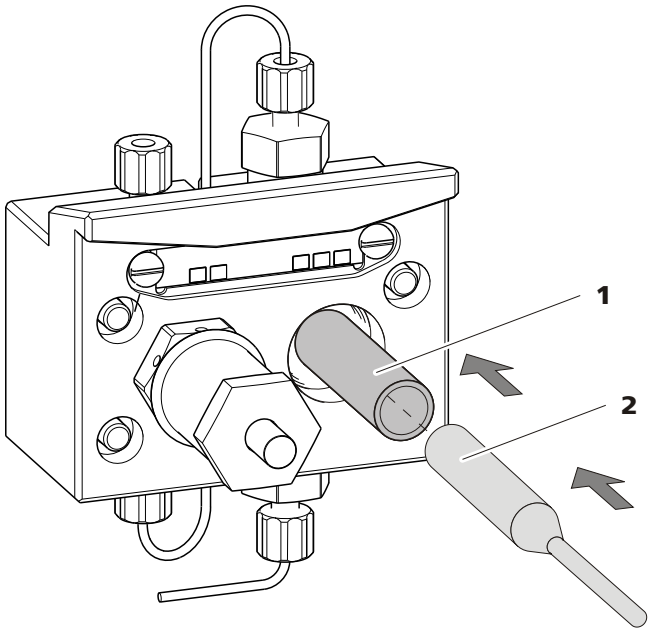


Figure 30 Inserting the piston seal into the pump head

4 Replacing the piston cartridge

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

Cleaning the inlet valve and outlet valve

1 Removing valves

- Unscrew the connection capillary for the auxiliary piston *(18-**1**)* from the outlet valve holder.
- Unscrew the holders for the inlet and outlet valves and remove valves.

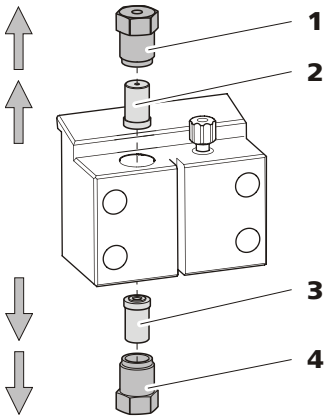


Figure 31 Removing valves

1	**Outlet valve holder**	**2**	**Outlet valve** Order number: 6.2824.160
3	**Inlet valve** Order number: 6.2824.170	**4**	**Inlet valve holder**

2 Cleaning undissected valve

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

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

Note

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

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

3 Dismantling valve

Dismantle every valve separately.

Note

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

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

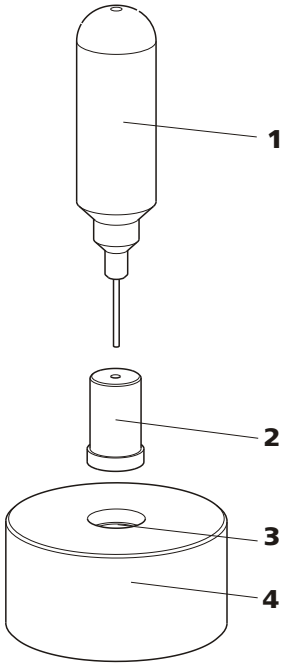


Figure 32 Dismantling valve

1 Needle For pushing the valve components out of the valve housing.	**2 Valve**
3 Holder	**4 Recess** For collecting the valve components.

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

Note

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

- The inlet valve and the outlet valve consist of the same, just differently arranged components *(see Figure 33, page 51)*.

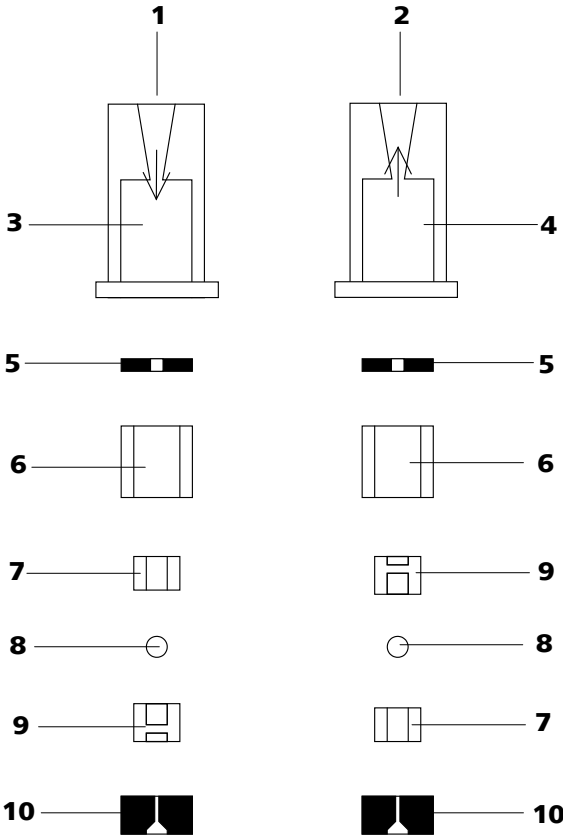


Figure 33 Components of the inlet valve and outlet valve

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

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 33, page 51*.

- 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 33, page 51)*.

- 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 wether 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 33, page 51)*.

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 *(31-**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 *(31-**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 *(18-**5**)*. Firmly tighten the screws with the 6.2621.030 hexagon key.

2 Screw connection capillaries *(18-**1**)*, *(18-**7**)* and *(18-**13**)* onto the pump head again.

6.5 Inline filter

6.5.1 Maintenance

The 6.2821.120 inline filters comprise the filter housing *(34-**2**)*, the filter screw *(34-**4**)* and the flter *(34-**3**)*. New filters *(34-**3**)* are available under the order number 6.2821.130 (10 items).

The 6.2821.130 filters *(21-**3**)* should be changed every 3 months (more frequently at higher backpressure).

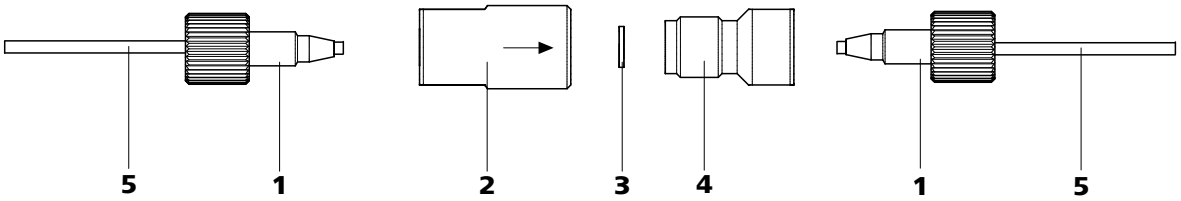


Figure 34 Changing the filter

1 PEEK pressure screws, short 6.2744.070	**2 Filter housing** Housing of the inline filter. Part of the 6.2821.120 accessories.
3 6.2821.130 filter Packaging contains 10 items.	**4 Filter screw** Screw of the inline filter. Part of the 6.2821.120 accessories.
5 Connection capillaries	

Changing the filter

The flow must be stopped before changing the filter.

1 Removing the inline filter

- Unscrew the pressure screws *(34-**1**)* from the inline filter.

2 Unscrewing the filter screw

- Screw the filter screw *(34-**4**)* out of the filter housing *(34-**2**)* with the aid of two 6.2621.000 adjustable wrenches.

3 Inserting the filter

- Remove the old filter *(34-**3**)* with tweezers.
- Place the new filter *(34-**3**)* flat in the filter housing with tweezers *(34-**2**)*.

4 Mounting filter screw

- Screw the filter screw *(34-**4**)* back into the filter housing *(34-**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 *(34-**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.

6.6 Inline sample preparation

To protect the separation column 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 manual of the *IC Equipment for Ultrafiltration*).

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

If the concentration of the sample is too high, the sample 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.

For an overview of all Metrohm inline sample preparation methods go to the following website:*http://misp.metrohm.com*

6.7 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. ##NO_MATCH##.

Ascertaining the transfer time

To ascertain the transfer time, proceed as follows:

1 Emptying the sample path

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

2 Aspirating the sample and measuring time

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

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

Checking the rinsing time

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

1 Preparing two samples

- **Sample A**: A typical sample for the application.
- **Sample sample B**: Ultrapure 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 the 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 modified by varying the rinsing time – thus allowing the rinsing time required for the application to be ascertained.

6.8 Injection valve

6.8.1 Protection

To prevent contamination of the injection valve, a 6.2821.120 inline filter *(see Chapter 4.7, page 33)* should be mounted between the high pressure pump and the pulsation damper.

6.9 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**.

7 Troubleshooting

7.1 Problems and their solutions

Problem	Cause	Remedy
Marked rise in pressure	*6.2821.120 inline filter blocked.*	Replace 6.2821.130 filter *(see Chapter 6.5, page 53)*.
	Injection valve – valve blocked.	Have the valve cleaned (by Metrohm service technicians).
Drift of the baseline	*Eluent – Evaporation of the organic solvent in the eluent.*	Check the eluent bottle attachment *(see Figure 14, page 25)*.
Peak areas lower than expected	*Sample – leak in the sample path.*	Check the sample path.
	Sample – blockage in the sample path.	Check the sample path.
	Sample – sample loop not (completely) filled.	Prolong the sample transfer time.
Very noisy baseline	*High pressure pump – contaminated pump valves.*	Clean pump valves *(see Chapter 6.4.2, page 43)*.
	Eluent – Leak in the eluent path.	Check the eluent path
	Eluent – Blockage in the eluent path.	Check the eluent path
	High pressure pump – defective piston seals.	Replace piston seals *(see Chapter 6.4.2, page 43)*.
	Pulsation damper not connected.	Connect pulsation damper *(see Chapter 4.8, page 34)*.
Background conductivity too high	*Incorrect eluent.*	Change eluent *(see Chapter 6.3.2.3, page 42)*.
Individual peaks greater than expected	*Sample – carry-over of the samples from previous measurement.*	Rinse system longer between two samples.
Poor reproducibility of the retention times	*Eluent – Leak in the eluent path.*	Check the eluent path

Problem	Cause	Remedy
	Eluent – Blockage in the eluent path.	Check the eluent path
Precision problems - significant scattering of the measured values	*Injection valve – sample loop.*	Check installation of the sample loop *(see Chapter 4.9.1, page 35)*.
	Sample – rinsing volume too low.	Increase rinsing time *(see Chapter 6.7, page 55)*.
	Injection valve – defective.	Request Metrohm Service.
Unexpected change to the retention times in the chromatograms	*Eluent – Gas bubbles in the eluent.*	Check connections of the eluent degasser *(see Chapter 4.5, page 27)*.
	High pressure pump – defective.	Request Metrohm Service.
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 6.1446.040 threaded stopper.

8 Technical specifications

8.1 Reference conditions

The technical specifications listed in this chapter refers to the following reference conditions:

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

8.2 Instrument

IC system	Metal-free IC system
Material	Painted polyurethane hard foam without CFCs, fire class V0
Intelligent components	MagIC Net

8.3 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

8.4 Housing

Dimensions

Width	365 mm
Height	131 mm
Depth	380 mm
Material of base tray, housing and bottle holder	Polyurethane hard foam (PUR) with flame retardation for fire class UL94V0, CFC-free, coated

8.5 Eluent degasser

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

8.6 High pressure pump

Type

- Serial dual-piston pump
- Intelligent pump head recognition
- Chemically inert
- Metal-free pump heads
- Materials in contact with eluent: PEEK, ZrO_2, 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	Isocratic or gradient (extendable to quaternary)
Profile	Step, linear, convex and concave
Resolution	< 1 nL/min flow increments

8.7 Injection valve

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

8.8 Interfaces

Auxiliary	1 DSUB plug 15-pin (female)
Analog Output	Analog Output (optional)

8.9 Safety specification

Design / testing	▪ EN/IEC 61010-1 ▪ UL 61010-1 ▪ CSA-C22.2 No. 61010-1 ▪ Protection class III

8.10 Electromagnetic compatibility (EMC)

Emission
- EN/IEC 61326-1
- EN/IEC 61000-6-3
- EN 55011 / CISPR 11

Immunity
- EN/IEC 61326-1
- EN/IEC 61000-6-1
- EN/IEC 61000-4-2
- EN/IEC 61000-4-3

8.11 Weight

1.872.0030 7.7 kg (without accessories)

9 Conformity and warranty

9.1 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

872 Extension Module

The 872 Extension Module is an expansion tool for upgrading all 850 Professional IC instruments.

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

Electromagnetic compatibility

Emission:	EN/IEC 61326-1: 2006, EN/IEC 61000-6-3: 2004, EN 55011 / CISPR 11: 2003
Immunity:	EN/IEC 61326-1: 2006, EN/IEC 61000-6-1: 2007, EN/IEC 61000-4-2: 2001, EN/IEC 61000-4-3: 2002.

Safety specifications

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

CE

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: 2006	Electrical equipment for measurement, control and laboratory use – EMC requirements
EN 61010-1: 2001	Safety requirements for electrical equipment for measurement, control and laboratory use

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, 31 March, 2008

D. Strohm

Vice President, Head of R&D

Ch. Buchmann

Vice President, Head of Production

Responsible for Quality Assurance

9.2 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.

9.3 Warranty (Guarantee)

Metrohm guarantees that the deliveries and services it provides are free of errors in materials, design or manufacturing.

The general warranty period is 36 months (exclusions below) from the date of delivery or 18 months in the event of continuous operation. The warranty remains valid on the condition that the service is provided by an authorized Metrohm Service Organization at defined intervals and with a defined scope.

The warranty period for the suppressors "MSM II" and "MSM-HC" is 120 months from the date of delivery or 60 months in the event of continuous operation.

The warranty period for IC separation columns is 12 months from the date of delivery or 6 months in the event of continuous operation. The technical specifications contained in the manual are authoritative for warranty of accuracy.

For third-party components that are recognizable as such, the manufacturer's warranty regulations apply.

Consumables and materials with limited storage life and glass breakage in the case of electrodes or other glass parts are excluded from the warranty.

Warranty claims cannot be asserted if the customer has failed to meet his payment obligations according to schedule.

During the warranty period, Metrohm undertakes either to replace free of charge or to credit the purchaser for any instruments, assemblies or components that can be shown to be faulty. Any transport or customs fees that may apply are the ordering party’s responsibility.

The precondition for this is that the ordering party must use the Return Material Authorization (RMA) to report the faulty part, along with specification of the article number, the article designation, an adequate error description, the delivery date and (if applicable) the serial number. In addi-

tion, the ordering party undertakes to store the faulty part for at least 2 years in accordance with current storage directives (in compliance with ESD guidelines) and to hold it in readiness for onsite inspection or for return shipment to Metrohm. Metrohm reserves the right to invoice the ordering party for these articles, including retroactively, in the event of noncompliance with these pre-conditions.

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

Metrohm also offers a 120-month spare parts warranty and a 5-year PC software support warranty, calculated from the date on which the product is withdrawn from the market. The content of this warranty is the ability of the customer to obtain functioning spare parts or appropriate software support at market prices during the time of the warranty period.

If Metrohm AG is unable to meet this obligation due to circumstances beyond the control of Metrohm AG, then the ordering party shall be offered alternative solutions at preferential conditions.

10 Accessories

Note

Subject to change without notice.

10.1 Scope of delivery

2.872.0030 872 Extension Module – IC Module

Qty.	Order no.	Description
1	1.872.0030	**872 Extension Module – IC Module**
1	6.1602.160	**Eluent bottle attachment GL 45** For eluent bottles; with connections for drying tube and aspiration tubing. Opening ground joint: A-14/15
1	6.1608.070	**Eluent bottle / 2 L / GL 45** Material: Clear glass Height (mm): 262 Volume (mL): 2000

Qty.	Order no.	Description	
1	**6.1609.000**	**Adsorbing tube, large and bent**	

For filling with adsorber material.

Material:	Glass
Height (mm):	129
Inner diameter (mm):	32
SGJ size:	B-14/15

2	**6.1803.040**	**PTFE capillary 0.5 mm i.d. / 1 m**	

Capillary for sample handling in IC.

Material:	PTFE
Outer diameter (inches):	1/16
Inner diameter (mm):	0.5
Length (m):	1

1	**6.1825.230**	**PEEK sample loop 10 µL**	

For injection valve, with 2 PEEK pressure screws

Material:	PEEK (metal-free)
Outer diameter (inches):	1/16
Volume (mL):	0.01

Qty.	Order no.	Description	
1	**6.1831.010**	**PEEK capillary 0.25 mm i.d. / 3 m** For all IC components. Material: PEEK Outer diameter (inches): 1/16 Inner diameter (mm): 0.25 Length (m): 3	
1	**6.1834.080**	**Aspiration tubing, 2 m** Aspiration tubing for Professional IC instruments Material: PTFE Outer diameter (mm): 2.5 Inner diameter (mm): 1.5 Length (m): 2	
1	**6.2023.020**	**Clip for SGJ 14/15** Clip for SGJ 14/16 Material: POM	
1	**6.2156.060**	**Cable Extension Module - Professional IC, 40 cm** Cable connecting the extension module with a Professional IC instrument Length (m): 0.4	

Qty.	Order no.	Description	
1	6.2617.010	**Tool for piston seal** For removing and assembling the piston seal for all standard pump heads	
1	6.2621.000	**Adjustable wrench** Max. opening: 20 mm. For IC instruments Length (mm): 150	
1	6.2621.030	**Hexagon key 4 mm** Length (mm): 73	
1	6.2621.050	**1/4 in. wrench** For 1/4 in. screws. For IC instruments Length (mm): 73	

Qty.	Order no.	Description	
1	6.2621.080	**Capillary cutter**	
	For plastic capillaries. Used with IC instruments		
	Length (mm):	118	
1	6.2621.100	**Hexagon key 3 mm**	
	Hexagon key 3 mm for IC Sample Processors		
	Length (mm):	73	
2	6.2739.000	**Wrench**	
	For tightening connectors		
	Length (mm):	68	
1	6.2744.010	**Pressure screw 5x**	
	With UNF 10/32 connection. For the connection of PEEK capillaries		
	Material:	PEEK	
	Length (mm):	26	

Qty.	Order no.	Description
1	6.2744.014	**Pressure screw 2x**

With UNF 10/32 connection. For the connection of PEEK capillaries

Material: PEEK
Length (mm): 26

1	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

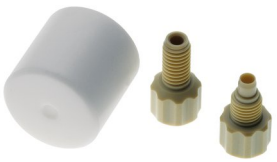
1	6.2744.120	**Coupling pressure screw / Luer-F**

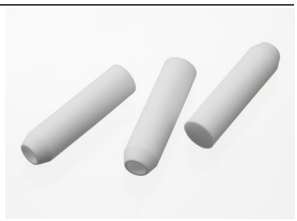
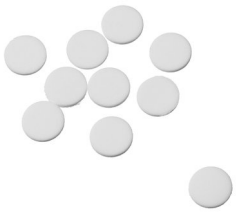
Connection pressure screw and syringe.

Material: PEEK

1	6.2744.210	**Tubing adaptor for aspiration filter (ProfIC)**

For Professional IC instruments



Qty.	Order no.	Description	
1	6.2816.020	**Syringe 10 mL with Luer connection** For various applications in IC and VA Material: PP Length (mm): 102 Volume (mL): 10	
1	6.2816.040	**Purging needle** With PTFE tubing and Luer connection. For syringes. For aspirating eluents.	
1	6.2821.090	**Aspiration filter** Pore size 20 µm, set of 5 pieces. For 6.1834.000 Aspiration tubing and 6.1821.040 and 6.1821.050 Filter tubes. Material: PE Outer diameter (mm): 9.5 Length (mm): 35.5	
1	6.2821.130	**Spare filter for inline filter** Spare filters for inline filter.	
1	8.872.8004EN	**Manual for 872 Extension Module, 2.872.0030 IC Module, English**	

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