

942 Extension Module Vario SeS/PP



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Manual

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Manual

Technical Communication
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1 Introduction

1.1 Instrument description

942 Extension Module Vario are extension modules used to expand existing 940 Professional IC Vario devices with additional functions. Each 940 Professional IC Vario device can be expanded with up to 3 942 Extension Module Vario devices.

The **942 Extension Module Vario SeS/PP** can be used in IC systems where an additional module for sequential suppression is needed.

The 942 Extension Module Vario is operated using **MagIC Net** software, just like the IC device. If a 942 Extension Module Vario is connected to a 940 Professional IC Vario device, MagIC Net automatically detects the 942 Extension Module Vario and checks its functional capability. It controls and monitors the entire IC system including all connected devices; it evaluates the measured data and manages it in a database.

The 942 Extension Module Vario SeS/PP consists of the following components:

Peristaltic pump

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

Metrohm Suppressor Module (MSM)

The chemical suppressor MSM consists of the suppressor drive, a rotor and, where applicable, an adapter. The suppressor drive gives you the flexibility to use different rotors according to the principle "one drive – many rotors". Suppressor rotors with different capacities and construction or a rotor for sample preparation (SPM Rotor) are readily interchangeable with appropriate adapters as needed. The rotors are not included in the instrument's scope of delivery. The rotor required for the application and any adapter that is required must be ordered separately.








Metrohm CO₂ Suppressor (MCS)

The Metrohm CO₂ Suppressor (MCS) removes the CO₂ from the eluent stream. This lowers the background conductivity, improves detection sensitivity, and minimizes the injection peak and the system peak.

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

1.3.2 Symbols and conventions

The following symbols and formatting may appear 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
	Perform the steps one after the other.
Method	Dialog text, parameter in the software
File ► New	Menu or menu item
[Continue]	Button or key
	WARNING
	This symbol draws attention to a possible life-threatening 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.
	WARNING
	Warning of optical radiation
	CAUTION
	This symbol draws attention to possible damage to instruments or instrument parts.
	NOTICE
	This symbol highlights additional information and tips.

2.3 Requirements for operating personnel

Only qualified personnel may operate the product. Qualified personnel are persons who meet the following requirements:

- Basic regulations on occupational safety and accident prevention for chemical laboratories are known and complied with.
- Knowledge of handling hazardous chemicals is present. Personnel have the ability to recognize and avoid potential dangers.
- Knowledge regarding the application of fire prevention measures for laboratories is available.
- Safety-relevant information is communicated and understood. The personnel can operate the product safely.
- The user documentation has been read and understood. The personnel operate the product according to the instructions in the user documentation.

2.4 Safety instructions

2.4.1 General notes on safety



WARNING

Operate this instrument only according to the information contained in this documentation.

This instrument 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.

2.4.2 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.

Supply voltage**WARNING**

An incorrect supply voltage can damage the instrument.

Only operate this instrument with a supply 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.

Do not fail to pull the power cord out of the power socket before you set up or disconnect electrical plug connections at the rear of the instrument.

2.4.3 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.

2.4.4 Flammable solvents and chemicals

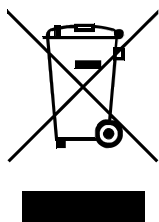


WARNING

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. fume cupboard).
- Keep all sources of flame far from the workplace.
- Clean up spilled liquids and solids immediately.
- Follow the safety instructions of the chemical manufacturer.

2.4.5 Recycling and disposal



Properly dispose of chemicals and of the product to reduce negative effects on the environment and public health. Local authorities, waste disposal companies or dealers provide more detailed information on disposal. Observe the WEEE EU directive (WEEE = Waste Electrical and Electronic Equipment) for the proper disposal of waste electronic equipment within the European Union.

3.2 Rear

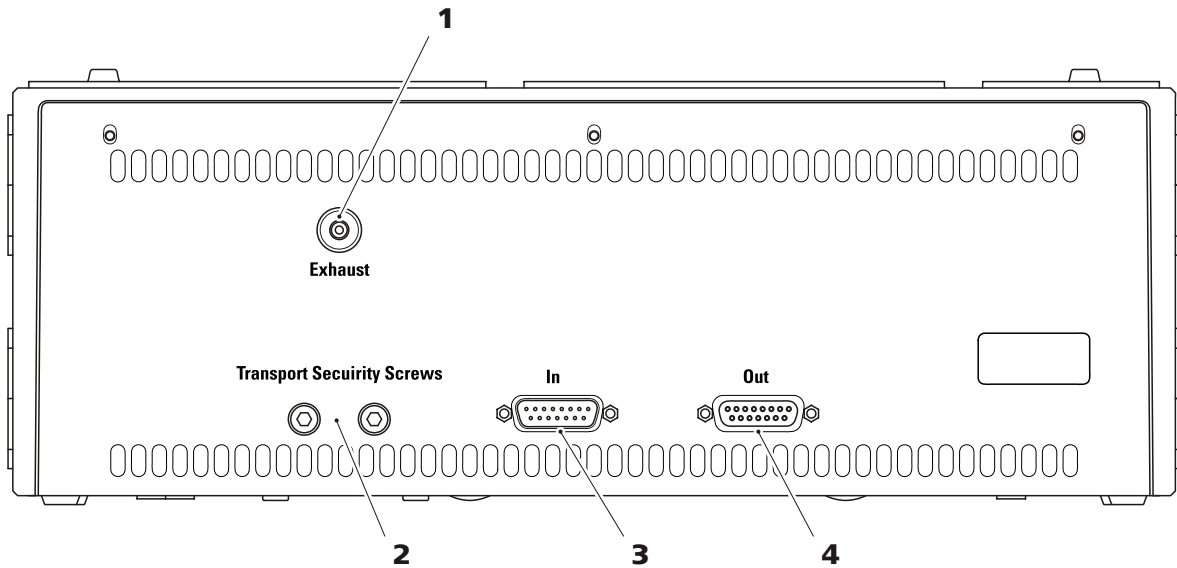


Figure 2 Rear

1 Exhaust opening

For extracting the air from the vacuum chamber. Labeled *Exhaust*.

2 Transport locking screws

For securing the vacuum pump when transporting the instrument.

3 "In" connection

To connect the Extension Module to the IC instrument or to a previous Extension Module.

4 "Out" connection

To connect an additional Extension Module.

3.3 Extension Module and 940 Professional IC Vario

The 942 Extension Module Vario units are fitted directly to the 940 Professional IC Vario and connected to it via the connection cable provided. Extension modules have no power supply of their own, but rather draw the electricity they require from the instrument to which they are connected.

Extension modules can be placed in 3 different ways:

- Installed between the instrument and bottle holder (**3-A**).
- Installed between the instrument and base tray (**3-B**).
- Stacked next to the instrument (**3-C**). In this case, we recommend ordering a separate base tray (6.2061.110) and a separate bottle holder (6.2061.100) for the stack.

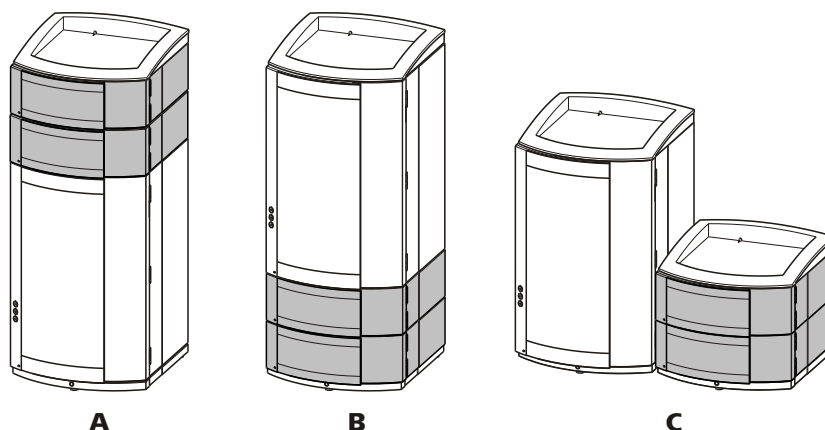


Figure 3 Proposed setup

A Extension module on top

Between the 940 Professional IC Vario and the bottle holder.

B Extension module below

Between the base plate and the 940 Professional IC Vario.

C Extension module separately

Next to the 940 Professional IC Vario with its own base plate and bottle holder.

Up to three extension modules can be connected to an 940 Professional IC Vario. The following restrictions are to be taken into account:

Restrictions

Together, the 940 Professional IC Vario and its extension modules must not contain more than 4 identical components, this means that:

- 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, incl. SPM),
- BUT**
- Only a maximum of 3 degassers
 - And a maximum of 3 CO₂ suppressors (MCS)



NOTE

If all four high-pressure pumps are being used simultaneously, then all of them must not be operating with their maximum flow for long periods.

Position the Extension Module in such a way that the capillary connections can be kept as short as possible. If several extension modules are being used, they should all be installed at the same location above or below each other. If this is not possible, extension modules that are farther apart have to be connected together using a longer connecting cable (6.2156.070).

4 Installation

4.1 Setting up the instrument

4.1.1 Packaging

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

4.1.2 Checks

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

4.1.3 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 and free of vibrations and which provides protection against corrosive atmosphere and contamination by chemicals.

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

4.2 Transport locking screws

To avoid damage to the vacuum pump drive during transport, the pump is secured with transport locking screws. These are located at the rear of the instrument and labeled with **Transport security screws**.

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

Accessories

For this step you need:

- 4 mm hex key (6.2621.030)

Removing the transport locking screws

- 1 Remove all of the transport locking screws with the hex key.

Store the transport locking screws in a safe place. Reinsert the transport locking screws each time you transport the instrument a significant distance.



CAUTION

The pumps may be damaged if you transport the instrument without inserting the transport locking screws.

4.3 Base tray and bottle holder

4.3.1 Basic information on base tray and bottle holder

The base tray (6.2061.110) and bottle holder (6.2061.100) protect IC instruments from dust, dirt and leaking fluids. The supply bottles for eluent and auxiliary solutions can be positioned neatly on the bottle holder.

In a complex IC system, several different instruments may be used, such as an analyzer, an extension module and a detector. These instruments can be set up in one or more stacks. We recommend that a base tray and bottle holder be mounted for each stack of IC instruments.

The bottle holder and base tray must be removed or set up if one of the following instruments is to be mounted on or under a 940 Professional IC Vario:

- One or more 942 Extension Module Vario
- Or another instrument with the same-sized footprint

4.3.2 Mounting base tray and bottle holder (optional)

The base tray and bottle holder come fully assembled on a new ion chromatograph. To install an Extension Module on the ion chromatograph, remove the bottle holder and put it back on top of the topmost instrument. To install an Extension Module under the ion chromatograph, remove the base tray and set it under the lowest instrument.

4.3.2.1 Removing/mounting the base tray

Remove the base tray to install another instrument under the IC instrument.



CAUTION

Do not pinch capillaries or leak sensor cables

Capillaries are fed through the guide ducts between the base tray and the instrument. Pinches in the leak sensor cable or the capillaries may lead to malfunctions.

- Unplug the leak sensor cable before you remove the base tray.
- Remove all the capillaries from the capillary ducts before you remove the base tray.

Removing the base tray

Prerequisites

- The instrument is switched off.
- The bottle holder is cleared.
- All of the cable connections on the rear have been disconnected.
- The capillaries are removed from the guide ducts between the instrument and the base tray.
- There are no loose parts in the instrument.

Accessories

- 3 mm hex key (6.2621.100)

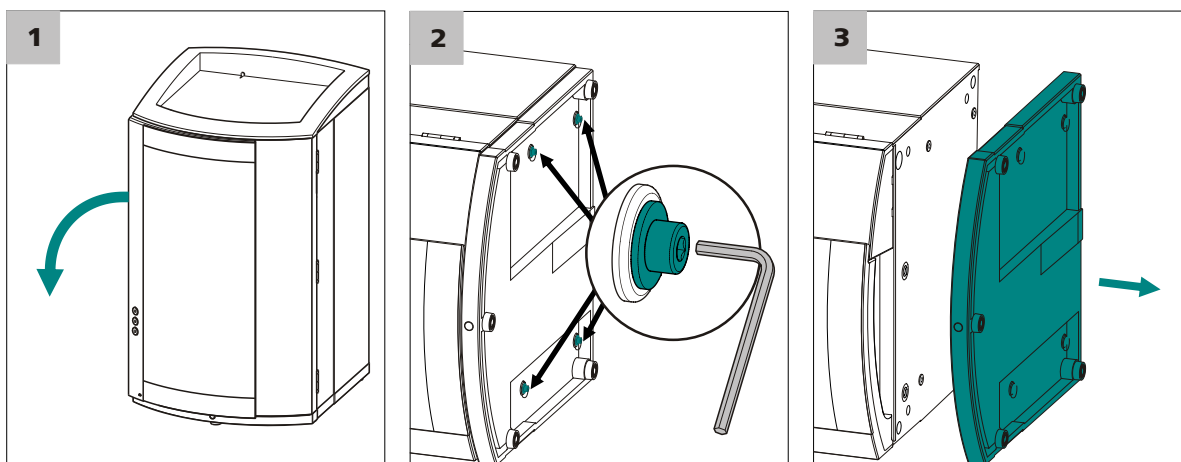


Figure 4 Removing the base tray

- 1 Tilt the instrument sideways and lay it down flat.
- 2 Loosen the 4 cylinder screws with the 3 mm hex key. Remove the cylinder screws and their washers.
- 3 Remove the base tray.

Always mount the base tray under the lowermost instrument of the stack.

Mounting the base tray

Prerequisites

- The instrument is switched off.
- The bottle holder is cleared.
- All of the cable connections on the rear have been disconnected.
- There are no loose parts in the instrument.
- The instrument is lying on its side, and the bottom surface is visible.



Accessories

- 3 mm hex key (6.2621.100)

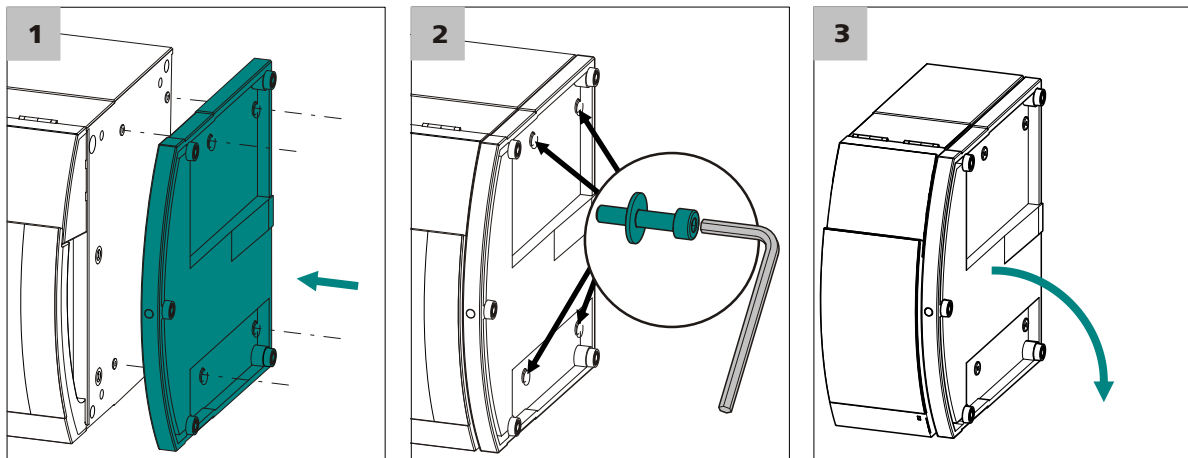


Figure 5 Mounting the base tray

- 1 Mount the base tray in such a way that the openings in the base tray match exactly the screw threads in the bottom of the instrument.
- 2 Slide the washers onto the cylinder screws. Insert the cylinder screws with the washers and tighten them with the 3 mm hex key.
- 3 Set the instrument back up on the base tray.

Stack other instruments in the required order. Mount the bottle holder (6.2061.100) onto the topmost instrument on the stack (see "Mounting the bottle holder", page 15).

4.3.2.2 Removing/mounting the bottle holder

Remove the bottle holder if you want to install another instrument onto the IC instrument.

Removing the bottle holder

Prerequisites

- The instrument is switched off.
- The bottle holder is cleared.
- Drainage tubing is disconnected from the drainage tubing connection of the bottle holder.
- The capillaries are removed from the guide ducts between the instrument and the bottle holder.

Accessories

- 3 mm hex key (6.2621.100)

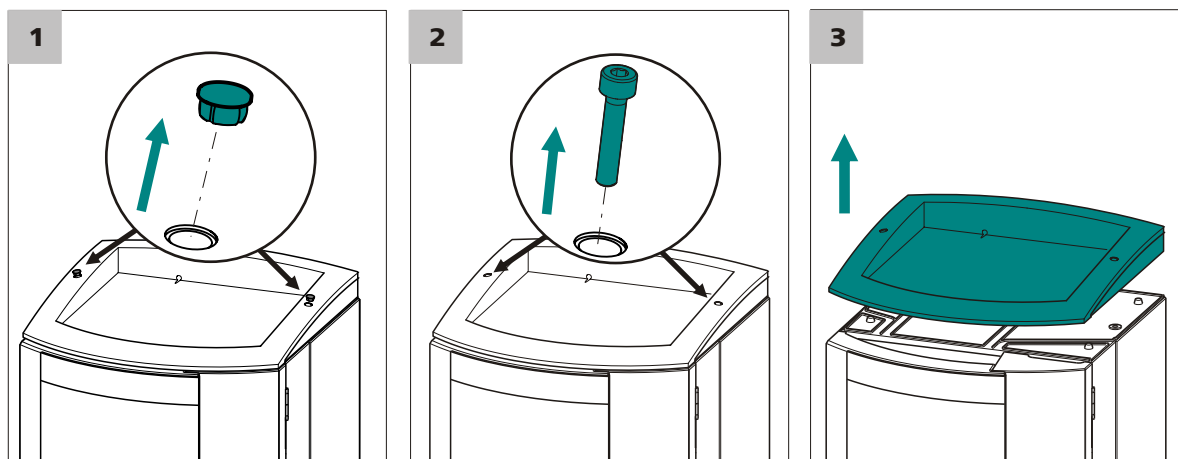


Figure 6 Removing the bottle holder

- 1 Remove the 2 covering stoppers.
- 2 Loosen the 2 cylinder screws with the 3 mm hex key and remove them.
- 3 Remove the bottle holder.

Stack other instruments in the required order. Mount the bottle holder (6.2061.100) onto the topmost instrument on the stack.

Mounting the bottle holder

Prerequisite

- The instrument is switched off.

Accessories

- 3 mm hex key (6.2621.100)

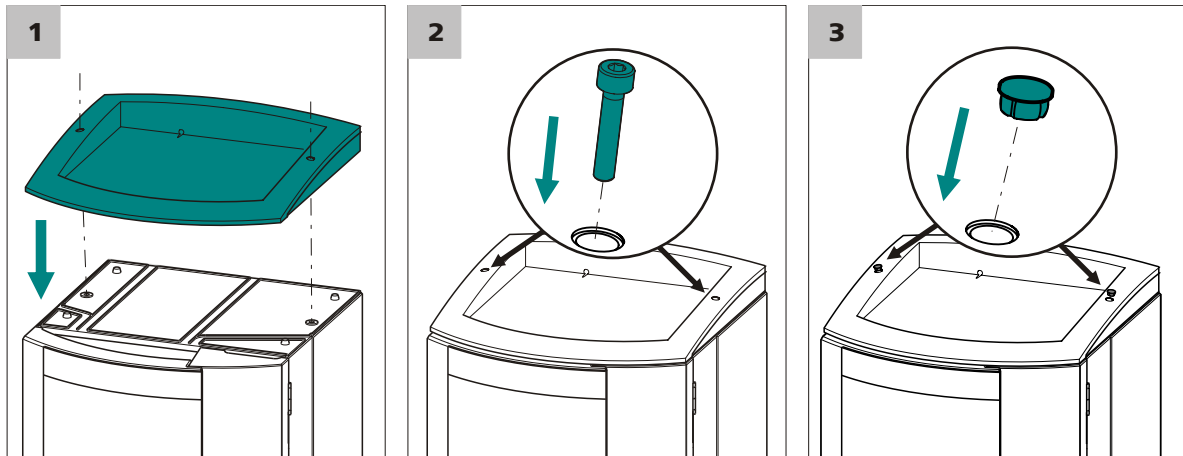


Figure 7 Mounting the bottle holder

- 1 Mount the bottle holder onto the topmost instrument in such a way that the openings in the bottle holder exactly match the screw threads on the top surface of the instrument.
- 2 Insert the 2 cylinder screws and tighten them with the 3 mm hex key.
- 3 Insert both covering stoppers.

After attaching the bottle holder, restore all connections that were loosened at the beginning of the process.

Restoring the loosened connections

- 1 Plug in all necessary USB cables.
- 2 Plug in all necessary MSB cables.
- 3 Plug in the power cord.
- 4 Mount the drainage tubing again (*see manual of the IC instrument*).
A longer section of silicone tubing (6.1816.020) may have to be cut to size and mounted (*see also the manual for the IC instrument*).
- 5 If one of the instruments in the stack is equipped with a leak sensor connection socket, connect the leak sensor (*see manual of the IC instrument*).
- 6 Restore any capillary connections that may have been removed.

4.4 Peristaltic pump

4.4.1 Installing the peristaltic pump

Installing the pump tubing

Pump tubing can differ in terms of material, diameter and thus flow rate. Different pump tubing is used depending on the application.

Table 1 Pump tubings









Order number	Name	Material	Inner diameter	Use
6.1826.310	Pump tubing LFL (orange/green), 3 stoppers	PVC (Tygon®)	0.38 mm	Pump tubing for bromate determination using the triiodide method.
6.1826.320	Pump tubing LFL (orange/yellow), 3 stoppers	PVC (Tygon®)	0.48 mm	For acceptor solutions for Inline Dialysis and for Inline Ultrafiltration.
6.1826.330	Pump tubing LFL (orange/white), 3 stoppers	PVC (Tygon®)	0.64 mm	No special applications.
6.1826.340	Pump tubing LFL (black/black), 3 stoppers	PVC (Tygon®)	0.76 mm	For sample solution in Inline Dialysis.
6.1826.360	Pump tubing LFL (white/white), 3 stoppers	PVC (Tygon®)	1.02 mm	For sample transfer.
6.1826.380	Pump tubing LFL (gray/gray), 3 stoppers	PVC (Tygon®)	1.25 mm	For Inline Dilution.
6.1826.390	Pump tubing LFL (yellow/yellow), 3 stoppers	PVC (Tygon®)	1.37 mm	For sample solution in Inline Ultrafiltration.
6.1826.420	Pump tubing PharMed® (orange/yellow), 3 stoppers	Ismaprene	0.51 mm	For suppressor solutions.

Selecting the pump tubing and adapter

- 1 Select pump tubing suitable for the application (*see table 1, page 17*).
- 2 Select an adapter suitable for the pump tubing. The adapters are included with the pump tubing connection with locking nut and filter (6.2744.180).



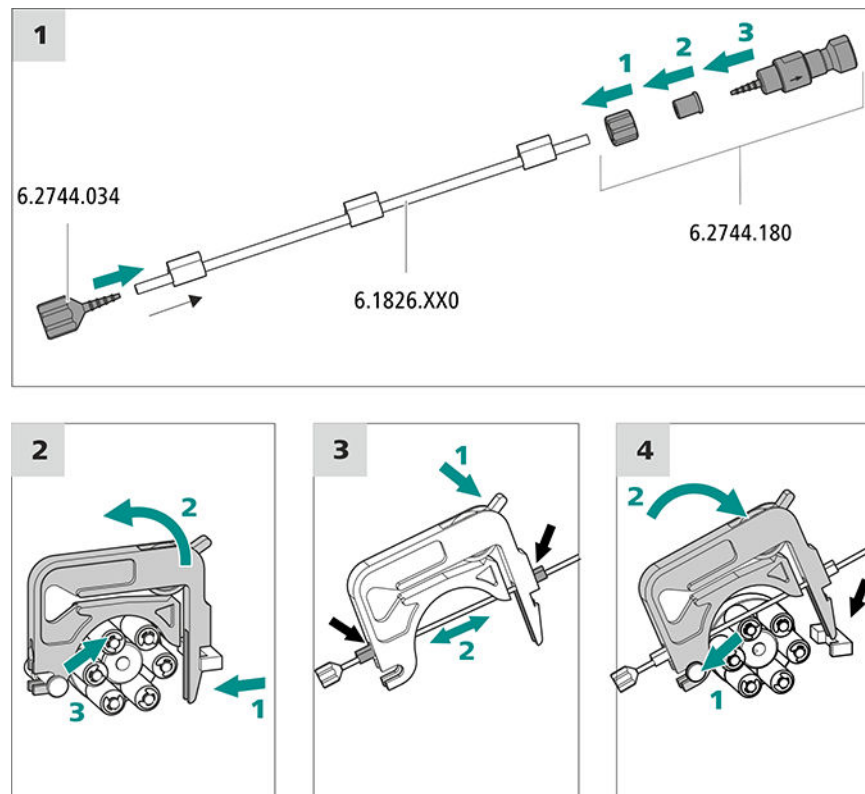
Table 2 Pump tubing and suitable adapters

Pump tubing	Adapter
6.1826.310 (orange/green)	
6.1826.320 (orange/yellow)	
6.1826.330 (orange/white)	
6.1826.340 (black/black)	
6.1826.360 (white/white)	
6.1826.380 (gray/gray)	
6.1826.390 (yellow/yellow)	
6.1826.420 (orange/yellow)	

Installing the pump tubing

For this step, you need the following accessories:

- Tubing cartridge (6.2755.000)
- Pump tubing (6.1826.XXX)
- Coupling olive/UNF 10/32 (6.2744.034)
- Pump tubing connection with locking nut and filter (6.2744.180):
Includes a locknut, 3 adapters and a tubing olive with filter holder.
- 2 × pressure screw, short (6.2744.070)



1 Connecting the pump tubing

- Attach the coupling olive/UNF 10/32 (6.2744.034) to the pump tubing inlet. Push the end of the pump tubing over at least the second notch of the olive so that the pump tubing is firmly in place.
- Assemble the pump tubing connection with locking nut and filter (6.2744.180) at the pump tubing exit:
 - Push the locknut onto the pump tubing.
 - Push the appropriate adapter onto the pump tubing.
 - Place the tubing olive with the filter holder into the pump tubing so that the pump tubing is firmly in place; push the end of the pump tubing over at least the second notch of the olive.
 - Tighten it using the union nut.

2 Removing the tubing cartridge

- Press in the tubing cartridge's snap-action lever.
- Tilt the tubing cartridge upwards.
- Unhook the tubing cartridge from the mounting bolt.



3 Inserting the pump tubing

- Press the tubing cartridge's contact pressure lever down all the way.
- Place the pump tubing in the tubing cartridge. Fit the tubing cartridge between two stoppers. The stoppers must snap into the corresponding holder of the tubing cartridge.

4 Inserting the tubing cartridge

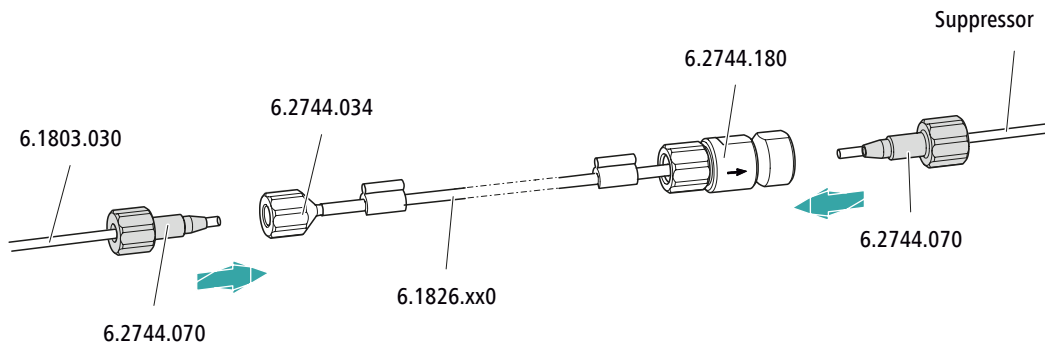
- Hang the tubing cartridge in the mounting bolt and press it in the cartridge holder until you hear the snap-action lever snap in.

Connecting capillaries for regeneration solution

Accessories

For this step, you need the following accessories:

- Aspiration capillary (6.1803.030)
- 2 × pressure screw, short (6.2744.070)



On the pump tubing's connect this accessory
Inlet	Tighten the aspiration tubing (6.1803.030) to the tubing olive (6.2744.034) using a pressure screw (6.2744.070).
Output	Tighten the regenerant suppressor capillary to the pump tubing connection with locking nut and filter (6.2744.180) using a pressure screw (6.2744.070).

Next steps

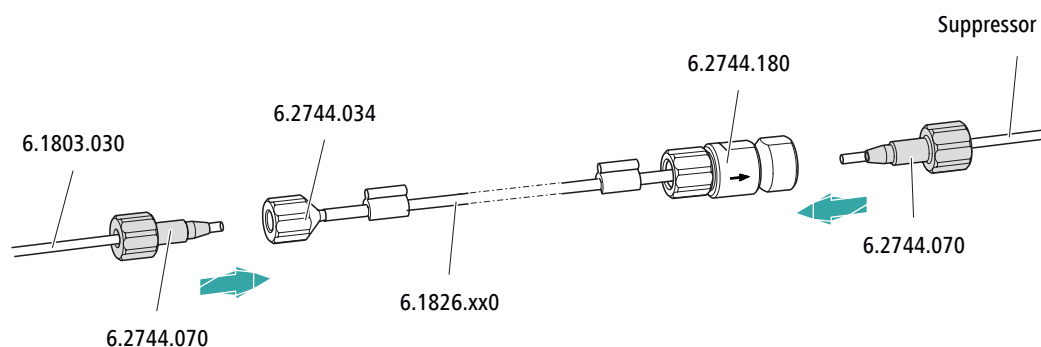
- Connect the loose end of the aspiration capillary to the bottle with the regeneration solution.

Connecting capillaries for rinsing solution (as an alternative to STREAM)

Accessories

For this step, you need the following accessories:

- Aspiration capillary (6.1803.030)
- 2 × pressure screw, short (6.2744.070)



On the pump tubing's connect this accessory
Inlet	Tighten the aspiration tubing (6.1803.030) to the tubing olive (6.2744.034) using a pressure screw (6.2744.070).
Output	Tighten the rinsing solution suppressor capillary to the pump tubing connection with locking nut and filter (6.2744.180) using a pressure screw (6.2744.070).

Next steps

- Connect the loose end of the aspiration capillary to the bottle with the rinsing solution.

Setting the flow rate

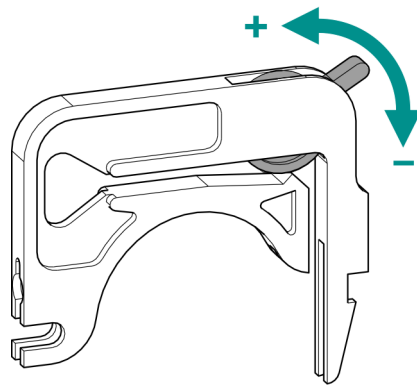
The flow rate of the peristaltic pump depends on many factors:

- The inner diameter of the pump tubing
- The rotational speed of the drive
- The contact pressure of the tubing cartridge



NOTE

Pieces of pump tubing are consumables. The service life of the pump tubing depends on the contact pressure, among other factors.

Setting the contact pressure correctly

- 1
 - Fully loosen the contact pressure lever , i.e. press it all the way down.
 - In the software, activate the drive of the peristaltic pump with the desired speed.
 - Raise the contact pressure lever one step at a time until liquid flows.
 - When liquid starts flowing, raise the contact pressure lever by an additional two ratchet increments.

The contact pressure is now set optimally.

4.4.2 Mode of operation for 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 based on the displacement principle. The pump tubing is clamped between the rollers (8-5) and the tubing cartridge (8-2). During operation, the peristaltic pump drive rotates the roller hub (8-6), so that the rollers (8-5) advance the liquid in the pump tubing.

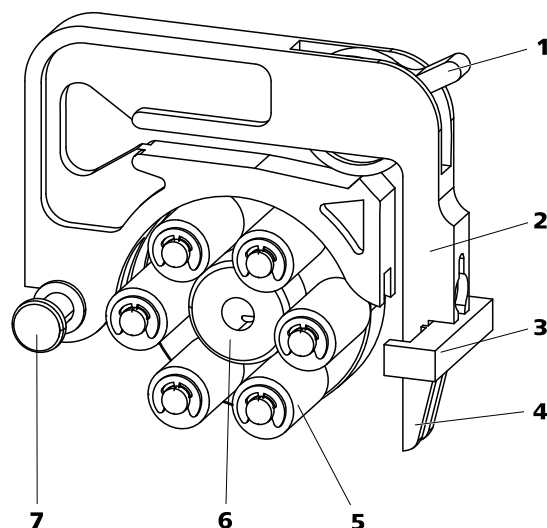


Figure 8 Peristaltic pump

1	Contact pressure lever	2	Tubing cartridge (6.2755.000)
3	Cartridge holder	4	Snap-action lever
5	Rollers	6	Roller hub
7	Mounting bolt		

4.5 Metrohm Suppressor Module (MSM)

The small rotors, such as the MSM Rotor A (6.2832.000) and the MSM-LC Rotor A (6.2844.000), must first be fitted into the adapter (6.2842.020), which can then be inserted into the suppressor housing.

A connecting piece (6.2835.010) is used for all rotors for connecting the Metrohm Suppressor Module (MSM) to the IC system.



NOTE

The instruments are supplied without rotor and without adapter.

The suitable rotor and the adapter, if required, must be ordered separately.

4.5.1 Inserting the rotors

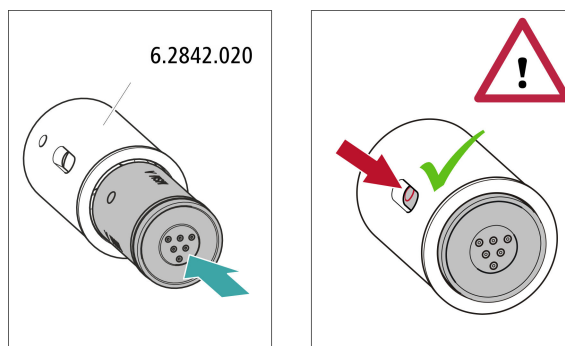
Accessories

For this step, you need the following accessories:

- Optional: Adapter (6.2842.020)
- Connecting piece (6.2835.010)

Inserting small rotors

You need the adapter (6.2842.020) in order to insert a small rotor into the suppressor drive.



1 Inserting the rotor into the adapter



CAUTION

An incorrectly inserted rotor may be **destroyed** during start-up.

- Clean the sealing surface of the rotor with ethanol using a lint-free cloth.
- Insert the rotor into the adapter so that the tubing connections on the rear of the rotor fit into the corresponding recesses inside the adapter and one of the 3 holes of the rotor is visible in the slot of the adapter.

2 Inserting the adapter

Insert the adapter into the suppressor drive just like a large rotor (see "Inserting large rotors", page 24).

4.5.2 Connecting the Metrohm Suppressor Module (MSM)

The 3 entries and exits of the suppressor units, numbered 1, 2 and 3 on the connecting piece, each have 2 permanently installed PTFE capillaries.

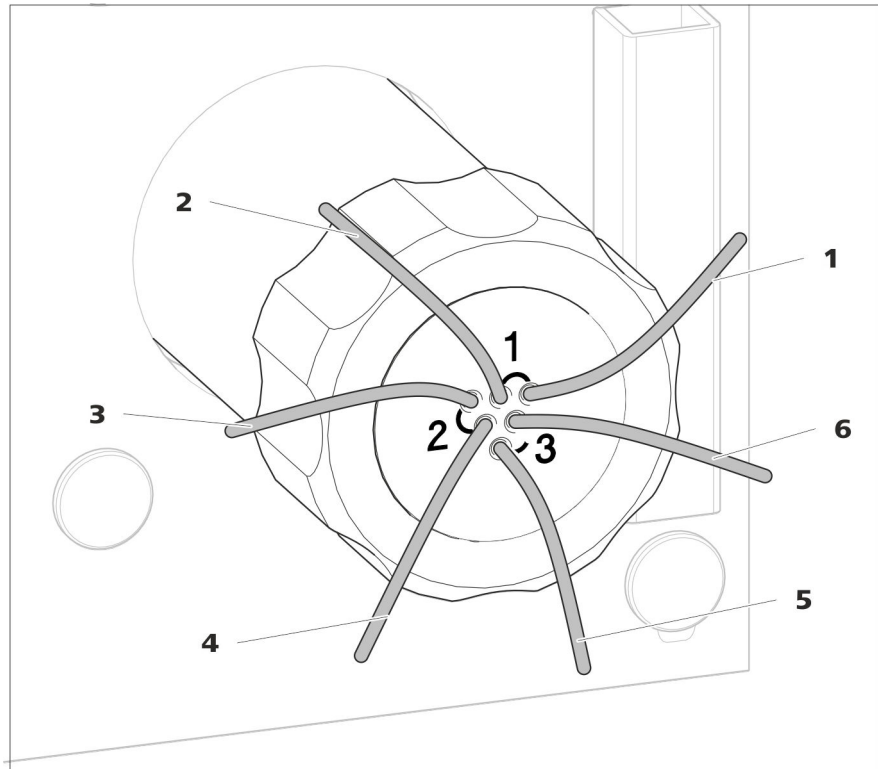
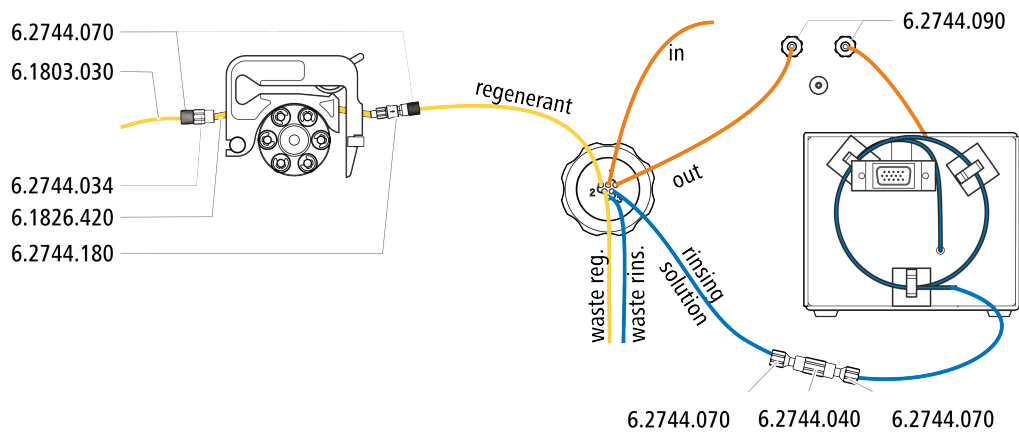
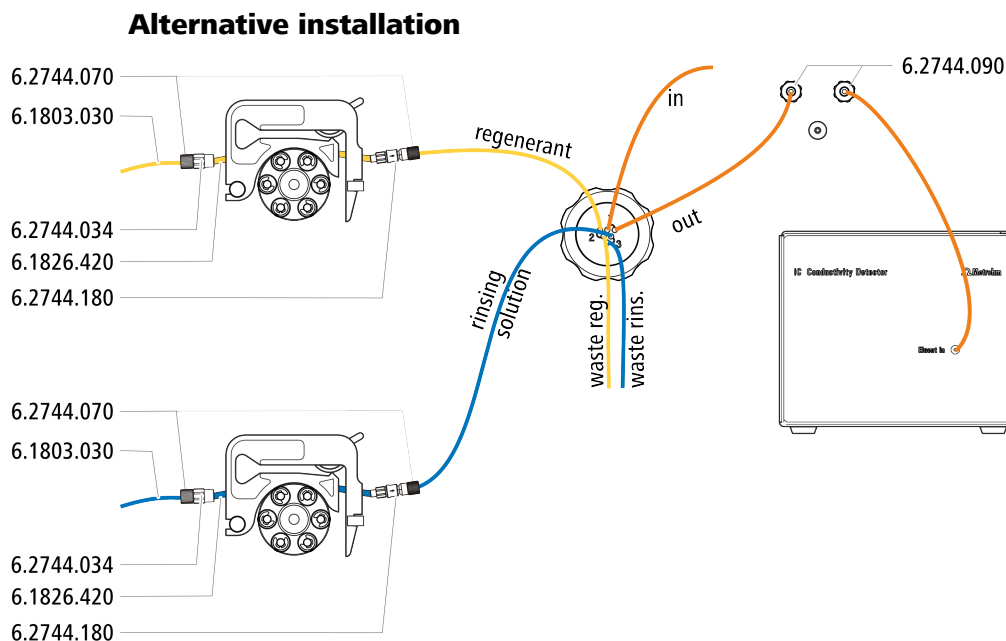


Figure 9 Metrohm Suppressor Module (MSM) – Connection capillaries

1 out Outlet capillary for the eluent.	2 in Inlet capillary for the eluent.
3 regenerant Inlet capillary for the regeneration solution.	4 waste reg. Outlet capillary for the regeneration solution; to the waste container.
5 waste rins. Outlet capillary for the rinsing solution; to the waste container.	6 rinsing solution Inlet capillary for the rinsing solution.

Recommended installation





4.5.2.1 Installing the eluent path

The eluent path is connected with the capillaries *in* and *out*.

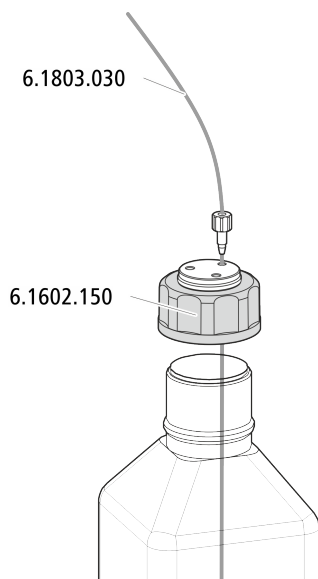
- 1 Connect the capillary labeled *in* to the exit of the separation column using a short pressure screw (6.2744.070).
- 2 Use a long pressure screw (6.2744.090) to connect the capillary labeled *out* to the inlet of the MCS (see chapter 4.6.2, page 31).

4.5.2.2 Installing bottles with auxiliary solutions

Accessories

To connect the bottles of the auxiliary solutions, you will need the following accessories:

- Accessories from the accessory kit: IC Vario/Flex SeS (6.5000.020)



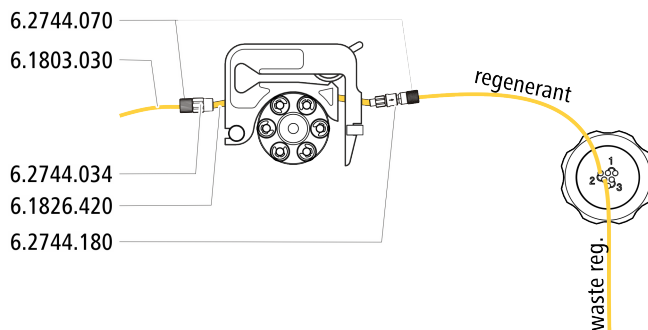
4.5.2.3 Connecting the regeneration solution

The regeneration solution is connected to the *regenerant* capillary.

Connecting the regeneration solution to the peristaltic pump

For this step, you need the following accessories:

- Pump tubing (6.1826.420)
- Tubing olive with filter and locking nut (6.2744.180)
- Tubing olive (6.2744.034)
- Tubing cartridge of the peristaltic pump



- 1** Prepare a tubing cartridge of the peristaltic pump for the regeneration solution (see chapter 4.4.1, page 17).
- 2** Connect the capillary labeled *regenerant* to the exit of the pump tubing using a pressure screw (6.2744.070).
- 3** Connect the PTFE capillary from the regeneration solution bottle to the inlet of the pump tubing.

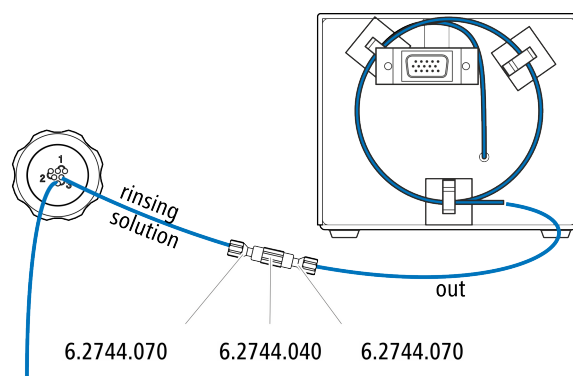
4.5.2.4 Connecting the rinsing solution

Various possibilities exist for rinsing the Metrohm Suppressor Module:

- Rinsing solution via STREAM (recommended)
Use the eluent from the conductivity detector as rinsing solution.
- Rinsing solution via peristaltic pump
Prepare the rinsing solution in a separate bottle and convey it with the peristaltic pump.

The rinsing solution is connected to the *rinsing solution* capillary.

Connecting the rinsing solution inlet with STREAM



- 1 Connect the detector outlet capillary of the conductivity detector and the capillary labeled *rinsing solution* to each other using a coupling (6.2744.040) and two pressure screws (6.2744.070).



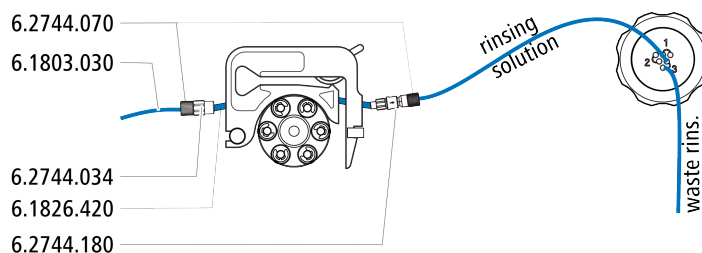
NOTE

The detector outlet capillary must not be shortened.

Connecting the rinsing solution inlet to the peristaltic pump

For this step, you need the following accessories: (not contained in its entirety in the standard accessories):

- Pump tubing (6.1826.420)
- Tubing olive with filter and locking nut (6.2744.180)
- Tubing olive (6.2744.034)
- Tubing cartridge (6.2755.000)
- 2 short pressure screws (6.2744.070)
- PTFE capillary (6.1803.030) (connected with the bottle with the rinsing solution)



- 1 Prepare a tubing cartridge of the peristaltic pump for the regeneration solution (see chapter 4.4.1, page 17).
- 2 Connect the capillary labeled *rinsing solution* to the exit of the pump tubing using a pressure screw (6.2744.070).
- 3 Connect the PTFE capillary from the rinsing solution bottle to the inlet of the pump tubing.

4.6 Metrohm CO₂ Suppressor (MCS)

4.6.1 General information on the MCS



NOTE

The Metrohm CO₂ Suppressor (MCS) is used only in conjunction with conductivity detection with chemical suppression.

The Metrohm CO₂ Suppressor (MCS) removes the CO₂ from the eluent stream. This lowers the background conductivity, improves detection sensitivity and minimizes the injection peak and carbonate peak.

CO₂ can enter the eluent flow through the sample itself or can develop due to the suppression reaction in the suppressor. Connecting the MCS between the suppressor and detector minimizes the carbonate peak in the chromatogram.

The MCS essentially consists of a degassing cell containing a capillary made from a fluoropolymer membrane. The capillary is permeable to gases. The degassing cell is connected to the vacuum pump. In the degassing cell, the eluent is directed through the capillary made of a fluoropolymer membrane. At the same time, the vacuum pump generates a vacuum and draws in the air from the outside. The pressure and concentration difference this creates in the degassing cell relative to inside the capillary causes the CO₂ to be diffused out of the eluent flow. The ambient air is drawn in by the CO₂ Absorber to filter out the CO₂ from the air.

4.6.2 Connecting the MCS

The MCS is connected between the Metrohm Suppressor Module (MSM) and the conductivity detector.

Connecting the MCS

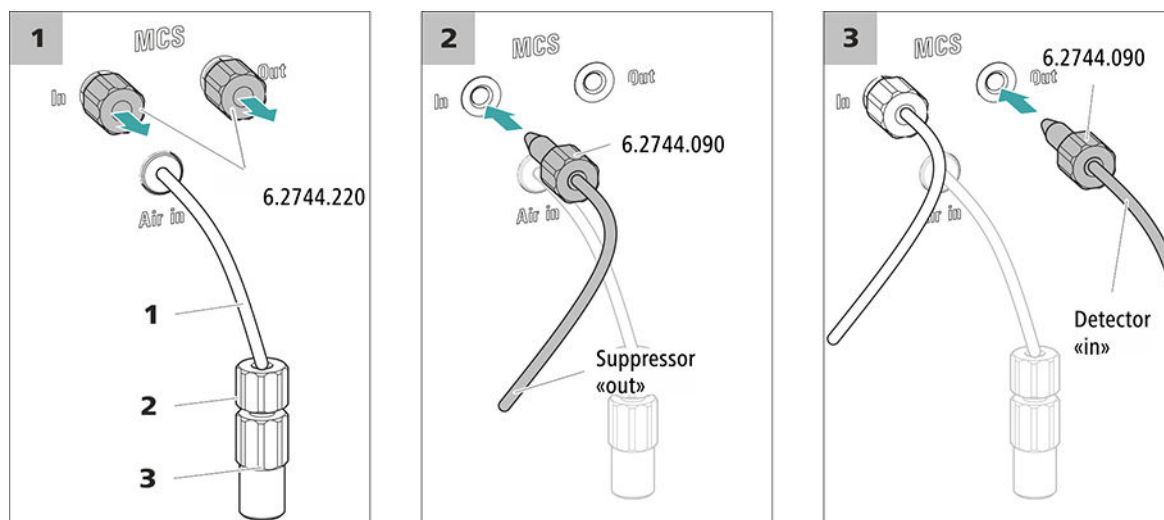


Figure 10 Connecting the MCS

1 Air aspiration capillary

For aspirating air with low CO₂ content (via the CO₂ Absorber).

3 Luer coupling (6.2744.120)

Mounted on the air aspiration capillary with a pressure screw (6.2744.070).

2 Pressure screw, short (6.2744.070)

Installed on the air aspiration capillary.

1 Removing the threaded stoppers

Remove and keep the two threaded stoppers (6.2744.220) from the inlet and outlet of the MCS.

2 Connection from the suppressor

Use a long pressure screw (6.2744.090) to connect the capillary of the MSM labeled **out** to the input of the MCS (labeled **In**).

3 Connection to the detector

Connect the inlet capillary of the conductivity detector with a long pressure screw (6.2744.090) to the MCS outlet (labeled **Out**).

**CAUTION**

If the MCS is not used, then the inlet and outlet must be sealed with the threaded stoppers (6.2744.220).

4.6.3 Installing the CO₂ Absorber

The aspirated air must have the lowest CO₂ content possible in order for the CO₂ to be removed from the eluent efficiently. In order to achieve this, the air is aspirated through the CO₂ Absorber (6.2837.100).

Accessories

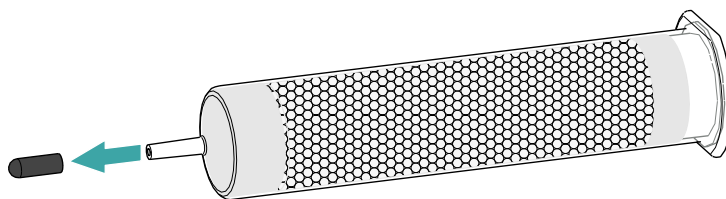
For this step, the following accessories are required:

- CO₂ Absorber (6.2837.100)
The CO₂ Absorber is in the accessory kit: Vario/Flex SeS (6.5000.020).

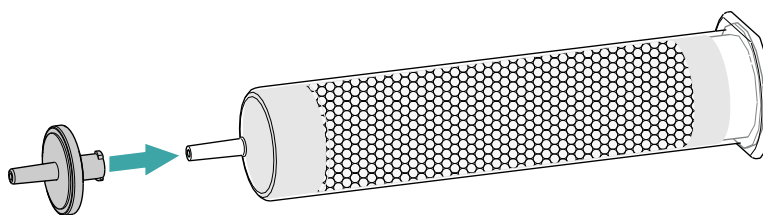
Preparing the CO₂ Absorber

Prepare the CO₂ Absorber for use as follows:

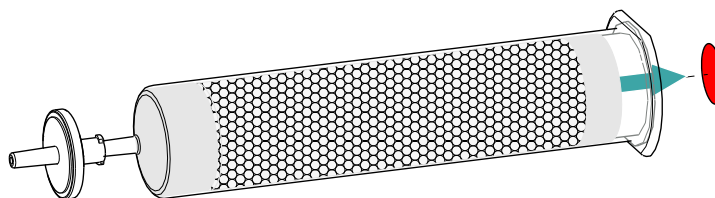
- 1** Remove the protective cap from the tip of the CO₂ Absorber.



- 2** Attach the dust filter to the tip of the CO₂ Absorber.



- 3** Remove the label from the lid of the CO₂ Absorber.



As a result, the small opening in the lid of the CO₂ Absorber is opened, through which the air is then aspirated.

The CO₂ Absorber is now ready for installation.



NOTE

The new CO₂ Absorber (6.2837.100) works **without** upstream H₂O adsorber cartridge.

Installing the CO₂ Absorber

Accessories

- Prepared CO₂ Absorber (6.2837.100)



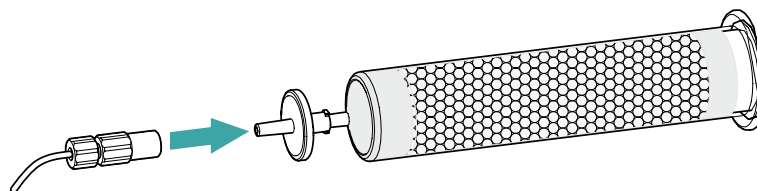
CAUTION

The following preparatory steps absolutely must be carried out for CO₂ suppression to operate correctly.

Install the CO₂ Absorber as follows:

1 Connecting the CO₂ Absorber

Attach the capillary connected to the Metrohm CO₂ Suppressor's (MCS) **Air in** connector to the tip of the CO₂ Absorber.



2 Placing the CO₂ Absorber in the instrument

- Place the CO₂ Absorber into the instrument's detector chamber.

4.7 Connecting an Extension Module



CAUTION

The 940 Professional IC Vario **has to be switched off** when connecting the Extension Module!

Accessories

For this step you need the following accessories:

- 6.2156.060 cable Extension Module - Professional IC, 40 cm or
- 6.2456.070 cable Extension Module - Professional IC, 1 m (optional accessory)

The connection sockets are located on the rear of the instrument.

Connecting the Extension Module to the IC instrument

- 1 Plug the connecting cable (6.2156.060) into the **In** connection socket on the Extension Module and tighten it in place.
- 2 Plug the other end of the connecting cable into the **Extension Module** connection socket on the IC instrument and tighten it in place.

Only one Extension Module can be connected directly to the IC instrument. The second Extension Module has to be connected to the first and the third to the second.

Connecting an Extension Module to another Extension Module

- 1 Plug the connecting cable (6.2156.060) or the longer connecting cable (6.2156.070) into the **In** connection socket on the second Extension Module and tighten it in place.
- 2 Plug the other end of the connecting cable into the **Out** connection socket on the first Extension Module and tighten it in place.

5 Start-up

The 942 Extension Module Vario SeS/PP is put into operation together with the IC device.

The following preconditions must be met before initial start-up:

- The peristaltic pump is installed and connected.
- A rotor is correctly inserted.
- The MCS is connected.
- The 942 Extension Module Vario SeS/PP is connected to the 940 Professional IC Vario.

You can find additional information on carrying out initial start-up in the *Start-up* chapter in the manual for the IC device and the MagIC Net online help.

6 Operation and maintenance

6.1 Servicing the door



CAUTION

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



CAUTION

Never hold the instrument by the door when lifting it. Only hold the instrument by the housing.

6.2 Peristaltic pump

6.2.1 Notes on operating the peristaltic pump

The flow rate of the peristaltic pump depends on the drive speed (set using the software), the contact pressure and, above all, the inner diameter of the pump tubing. Depending on the application, different pump tubing is used. Select pump tubing that best matches your application (*see table 1, page 17*).



CAUTION

The service life of the pump tubing primarily depends on the contact pressure.

If the peristaltic pump is switched off for long periods, lift up the tubing cartridges on the right side by releasing the snap-action levers. This ensures that the contact pressure will be maintained once it has been set.



CAUTION

The pump tubing (6.1826.xxx) is made of PVC or PP and therefore must not be used for rinsing with solutions containing organic solvents. In this case, use different pump tubing or use another pump for rinsing.

6.2.2 Servicing the peristaltic pump

6.2.2.1 Replacing the pump tubing

Pieces of pump tubing inserted into the peristaltic pump are consumables with a limited service life.

Pieces of pump tubing with 3 stoppers are tensioned in the tubing cartridge so that they end up positioned between two stoppers. This results in two possible positions for the tubing cartridge. Once the pump tubing exhibits significant signs of wear, it can be tensioned a second time in the other respective position.

Maintenance interval Replace the pump tubing every 2 months.

Replace the pump tubing every 4 weeks if the peristaltic pump is being used continuously.

6.2.2.2 Replacing the filter

The filters inserted into the pump tubing connection with locking nut and filter (6.2744.180) must be replaced regularly.

Maintenance interval We recommend replacing the filters (6.2821.130) (11-2) every 3 months. The filters may need to be replaced more frequently, depending on the application.

Accessories For this step, you need the following accessories:

- 1 filter from the spare filter set (6.2821.130)
- 2 adjustable wrenches (6.2621.000)
- Tweezers

Replacing the filter

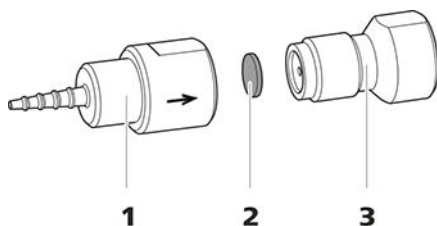


Figure 11 Pump tubing connection – Replacing the filter

1 Tubing olive

2 Filter (6.2821.130)

Pack contains 10 pieces.

3 Filter screw

1 Unscrewing the filter screw

- Unscrew the filter screw (11-3) from the tubing olive (11-1) using the two adjustable wrenches.

2 Replacing the filter

- Remove the old filter (11-2) using tweezers.
- Use tweezers to place the new filter (11-2) on the filter screw (11-3) so that it is **flat** and press it firmly into place with the rear of the tweezers.

3 Installing the filter screw

- Screw the filter screw (11-3) back into the tubing olive (11-1) and start by tightening it by hand. Tighten using the two adjustable wrenches.

6.3 Metrohm Suppressor Module (MSM)

6.3.1 Notes for operating the Metrohm Suppressor Module (MSM)



NOTE

The suppressor units must never be regenerated in the same flow direction the eluent is pumped. Therefore, always mount the inlet and outlet capillaries according to the diagram outlined in *Chapter Connecting the Metrohm Suppressor Module (MSM)*, page 25.

The Metrohm Suppressor Module (MSM) consists of three suppressor units, which, in rotation, are (1) used for suppression, (2) regenerated

with regeneration solution and (3) rinsed with ultrapure water or with suppressed eluent. In order to record each new chromatogram under comparable conditions, work is normally performed with a freshly regenerated and rinsed suppressor unit.



CAUTION

The Metrohm Suppressor Module (MSM) must never be switched over if liquid is not flowing through it, since otherwise it may become jammed. If the Metrohm Suppressor Module (MSM) is in a dry state, it must be rinsed for at least five minutes before it may be switched over.



CAUTION

The Metrohm Suppressor Module (MSM) must be regenerated (*see chapter 6.3.3.2, page 40*), cleaned (*see chapter 6.3.3.4, page 43*) or replaced (*see chapter 6.3.3.5, page 45*) if the capacity of the Metrohm Suppressor Module (MSM) is reduced or if the backpressure is high.

6.3.2 Taking care of the suppressor housing



CAUTION

The transparent suppressor housing can become fogged.

The suppressor housing is made of PMMA (poly(methyl methacrylate)). It can become scratched and foggy if cleaned improperly. This can make viewing the rotor difficult or impossible.

- Do **not use any scouring agents** for cleaning.
- Do **not use any solvents** for cleaning.

6.3.3 Servicing the Metrohm Suppressor Module (MSM)



NOTE

The following chapters equally apply to the suppressor and the sample preparation module (SPM).



6.3.3.1 Parts of the Metrohm Suppressor Module (MSM)

The SPM is made up of the same parts as the Metrohm Suppressor Module (MSM).

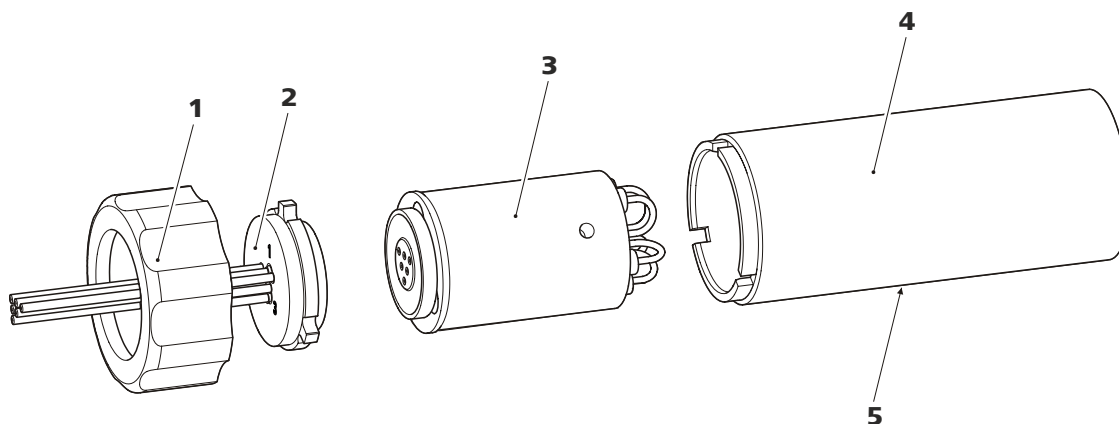


Figure 12 Parts of the Metrohm Suppressor Module (MSM)

1	Union nut	2	Connecting piece
3	Rotor	4	Housing
5	Slot in the housing		

6.3.3.2 Regenerating the anion suppression rotor

If the anion suppressor units are loaded with certain heavy metals (such as iron) or organic contamination for long periods, then the standard regeneration solution may no longer be able to completely remove them. This constantly reduces the capacity of the suppressor units, which results in reduced phosphate sensitivity in mild cases and a large increase in the baseline in severe cases.

If such capacity problems occur at one or more positions, all anion suppressor units must be regenerated with one of the following solutions:

Regeneration solutions

- **Contamination with heavy metals or elevated backpressure:**
1 mol/L H₂SO₄ + 0.1 mol/L oxalic acid
- **Contamination with organic cationic complexing agents:**
0.1 mol/L H₂SO₄ / 0.1 mol/L oxalic acid / acetone 5%
- **Heavy contamination with organic substances:**
0.2 mol/L H₂SO₄ / acetone ≥ 20%
- **Contamination by certain environmental samples**
1 mol/L H₃PO₄

**NOTE**

If phosphoric acid has been used once as regeneration solution in an IC system, you will have to continue using phosphoric acid for regeneration. Regenerating it with sulfuric acid again can lead to problems in the baseline.

**CAUTION**

Pump tubing made of PVC must not be used for solutions containing organic solvents.

We recommend using the high-pressure pump for regeneration.

Regenerating the anion suppressor rotor**1 Disconnecting the Metrohm Suppressor Module (MSM) from the IC system**

- Disconnect the capillaries of the MSM labeled **regenerant** and **rinsing solution** from the IC system.

2 Regenerating the Metrohm Suppressor Module (MSM)

Regenerate the three suppressor units one after the other for approx. 15 minutes using one of the solutions mentioned above.

- Connect the capillary labeled **regenerant** to the outlet of the high-pressure pump using a coupling (6.2744.040).
- Set the flow of the high-pressure pump to 0.5 mL/min in the software.
- Connect the regeneration solution to the high-pressure pump.
- Switch on the high-pressure pump.
If the pressure decreases during regeneration, slowly increase the flow of the pump to a maximum of 2 mL/min. When doing so, make sure that the pressure does not exceed 2 MPa!
- After approx. 15 minutes, switch off the high-pressure pump.
- In the software, use the **Step** command to switch to the next suppressor unit and regenerate it as described above.
- As soon as all three suppressor units have been regenerated, disconnect the capillary labeled **regenerant** from the coupling.



3 Rinsing the Metrohm Suppressor Module (MSM)

After regeneration, each of the three suppressor units must be rinsed with degassed ultrapure water for about 15 minutes.

- Connect the capillary labeled **rinsing solution** to the outlet of the high-pressure pump using a coupling (6.2744.040).
- Set the flow of the high-pressure pump to 0.5 mL/min in the software.
- Connect the ultrapure water to the high-pressure pump.
- Switch on the high-pressure pump.
If the pressure decreases during rinsing, slowly increase the flow of the pump to a maximum of 2 mL/min. When doing so, make sure that the pressure does not exceed 2 MPa!
- After approx. 15 minutes, switch off the high-pressure pump.
- In the software, use the **Step** command to switch to the next suppressor unit and rinse it as described above.
- As soon as all three suppressor units have been rinsed, disconnect the capillary labeled **rinsing solution** from the coupling.

4 Connecting the Metrohm Suppressor Module (MSM) to the IC system

- Reconnect the capillaries of the MSM labeled **regenerant** and **rinsing solution** to the IC system.
- Reconnect the entry and the exit of the high-pressure pump to the IC system.

6.3.3.3 Regenerating the cation suppression rotor

If the cation suppressor units are exposed to certain contaminations for prolonged periods, then these contaminations can no longer be removed completely with the standard regeneration solution. The performance of the suppressor units declines continuously, as indicated by a rise of the baseline or asymmetrical peaks.

If such problems occur at one or more positions, then treat all of the cation suppressor units as follows:

Regenerating the cation suppressor

1 Stopping the regeneration solution

Stop the regeneration solution feed.

2 Regenerating the first cation suppressor unit

Rinse the system with eluent until the suppressor unit is completely exhausted (indicated by a significant increase in conductivity). This can take up to 240 minutes under standard conditions.

3 Regenerating the second cation suppressor unit

In the software, use the **Step** command to switch to the next suppressor unit. Repeat step 2.

4 Regenerating the third cation suppressor unit

In the software, use the **Step** command to switch to the next suppressor unit. Repeat step 2.

5 Restoring the regeneration solution

As soon as all three suppressor units are completely exhausted, restore the regeneration solution feed.

6 Equilibrating the system

Equilibrate the system as usual (*see chapter "Conditioning" in the manual for the ion chromatograph*).

6.3.3.4 Cleaning the Metrohm Suppressor Module (MSM)

In the following cases, it may be necessary to clean the Metrohm Suppressor Module (MSM):

- Increased backpressure at the MSM's connection tubing.
- Irremediable blockage of the MSM (solutions can no longer be pumped through the MSM).
- Irremediable jamming of the MSM (MSM can no longer be switched over).

Cleaning the Metrohm Suppressor Module (MSM)**1 Disconnecting the Metrohm Suppressor Module (MSM) from the IC system**

- Switch off the instrument.
- Disconnect all capillaries of the MSM from the IC system.

2 Dismantling the Metrohm Suppressor Module (MSM)

- Unscrew the union nut (12-1) from the housing (12-4).



- Pull the connecting piece (12-2) out of the housing together with the rotor (12-3).
If the rotor gets stuck in the housing, you can push it out as follows:
Put a pointed object into the slot in the housing and use it to push out the rotor.
- Loosen the connecting piece from the rotor with a turning movement.

3 Rinsing the capillaries

- Connect each of the six PTFE capillaries connected to the connecting piece (12-2) in sequential order to the high-pressure pump and pump ultrapure water through them.
- Check whether water comes out at the connecting piece.

If one of the capillaries remains blocked, the connecting piece (see "Replacing parts of the Metrohm Suppressor Module (MSM)", page 46) must be replaced (order number 6.2835.010).

4 Cleaning the rotor

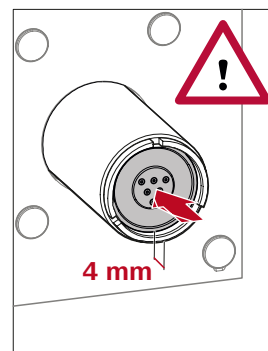
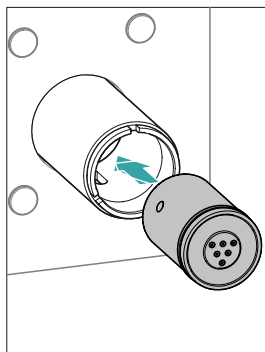
- Clean the sealing surface of the rotor (12-3) with ethanol using a lint-free cloth.

5 Inserting the rotor



CAUTION

The rotor may be destroyed during start-up if it is not inserted correctly.



- Insert the rotor (12-3) into the housing (12-4) in such a way that the tubing connections on the rear of the rotor fit into the corresponding recesses inside the housing and one of the three holes of the rotor is visible from below in the slot of the housing (12-5).

**NOTE**

The rotor's sealing surface is located approx. 4 mm deep inside the suppressor drive if the rotor is inserted correctly.

If this is not the case, then the rotor must be moved into the correct position using careful turning. If the rotor cannot be turned or removed, it can be moved into the correct position from below by means of a pointed object (e.g. a screwdriver).

6 Cleaning the connecting piece

- Clean the sealing surface of the connecting piece (12-2) with ethanol using a lint-free cloth.

7 Inserting the connecting piece

See also Chapter 4.5.1, page 23

- Insert the connecting piece (12-2) into the housing in such a way that connector 1 is on top and the three pins of the connecting piece fit into the corresponding recesses on the housing.
- Reattach the union nut (12-1) and tighten by hand (do not use a tool).

8 Connecting and conditioning the Metrohm Suppressor Module (MSM)

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

6.3.3.5 Replacing parts of the Metrohm Suppressor Module (MSM)

Parts of the Metrohm Suppressor Module (MSM) may need to be replaced in the following cases:

- Irremediable loss of suppressor capacity (reduced phosphate sensitivity and/or significant rise in the baseline).
- Irremediable blockage of the MSM (solutions can no longer be pumped through the MSM).

Both the rotor and the connecting piece can be replaced.

Replacing parts of the Metrohm Suppressor Module (MSM)**1 Disconnecting the Metrohm Suppressor Module (MSM) from the IC system**

- Switch off the instrument.
- Disconnect all capillaries of the MSM from the IC system.

2 Dismantling the Metrohm Suppressor Module (MSM)

- Unscrew the union nut (12-1) from the housing (12-4).
- Pull the connecting piece (12-2) out of the housing together with the rotor (12-3).

If the rotor gets stuck in the housing, you can push it out as follows:

Put a pointed object into the slot in the housing and use it to push out the rotor.

- Loosen the connecting piece from the rotor with a turning movement.

3 Cleaning the new rotor

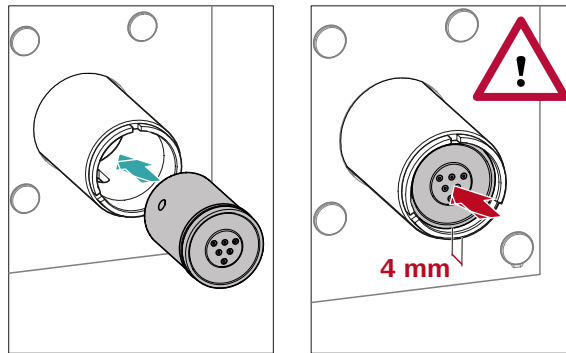
- Clean the sealing surface of the new rotor (12-3) with ethanol using a lint-free cloth.

4 Inserting the new rotor**CAUTION**

The rotor may be destroyed during start-up if it is not inserted correctly.

**NOTE**

The adapter (6.2842.020) (see "Inserting small rotors", page 25) is required in order to insert a small rotor into the suppressor drive.



- Insert the new rotor (12-3) into the housing (12-4) in such a way that the tubing connections on the rear of the rotor fit into the corresponding recesses inside the housing and one of the three holes of the rotor is visible from below in the slot of the housing (12-5).



NOTE

The rotor's sealing surface is located approx. 4 mm deep inside the suppressor drive if the rotor is inserted correctly.

If this is not the case, then the rotor must be moved into the correct position using careful turning. If the rotor cannot be turned or removed, it can be moved into the correct position from below by means of a pointed object (e.g. a screwdriver).

5 Cleaning the new connecting piece

- Clean the sealing surface of the new connecting piece (12-2) with ethanol using a lint-free cloth.

6 Inserting the new connecting piece

See also Chapter 4.5.1, Page 23

- Insert the connecting piece (12-2) into the housing in such a way that connector 1 is on top and the three pins of the connecting piece fit into the corresponding recesses on the housing.
- Reattach the union nut (12-1) and tighten by hand (do not use a tool).

7 Connecting and conditioning the Metrohm Suppressor Module (MSM)

- Reconnect all capillaries of the MSM to the IC system.
- Before switching the MSM over for the first time, rinse the three suppressor units with solution for five minutes.

7 Troubleshooting

7.1 Problems and their solutions

Problem	Cause	Remedy
The baseline has a large amount of noise.	<i>MCS – The CO₂ Absorber is depleted.</i>	Replace the CO ₂ Absorber (<i>see chapter 6.4.1, page 48</i>).
	<i>MCS – The vacuum pump is defective.</i>	Contact the regional Metrohm service representative.
The pressure in the system markedly increases.	<i>The MSM is blocked.</i>	<ul style="list-style-type: none"> ▪ Regenerate the MSM (<i>see chapter 6.3.3.2, page 40</i>). Note: 6.2821.180 pump tubing connection with filter must be used.
	<i>The MSM is not connected.</i>	Connect the CO ₂ suppressor.
Peak areas are lower than expected.	<i>MCS – The CO₂ suppressor is not connected.</i>	Connect the CO ₂ suppressor.
The peristaltic pump is pumping too little.	<i>Peristaltic pump – Contact pressure too weak.</i>	Correctly set the contact pressure (<i>see "Setting the contact pressure correctly", page 22</i>).
	<i>Peristaltic pump – Filter blocked.</i>	Replace the filter (<i>see "Replacing the filter", page 38</i>).
	<i>Peristaltic pump – Pump tubing defective.</i>	Replace the pump tubing (<i>see chapter 6.2.2.1, page 37</i>).
MSM – Insufficient flow of regeneration solution or rinsing solution.	<i>Peristaltic pump – Contact pressure too weak.</i>	Correctly set the contact pressure .
	<i>Peristaltic pump – Filter blocked.</i>	Replace the filter (<i>see chapter 6.2.2.2, page 37</i>).
	<i>Peristaltic pump – Pump tubing defective.</i>	Replace the pump tubing.
The background conductivity is too high.	<i>The MSM is not connected.</i>	Connect the MSM (<i>see chapter 4.5, page 23</i>).
	<i>MSM – No or insufficient flow of regeneration solution or rinsing solution.</i>	Check the flow of the regeneration solution and of the rinsing solution .
	<i>MCS – The CO₂ suppressor is not connected.</i>	Connect the CO ₂ suppressor.



Problem	Cause	Remedy
Baseline increasing strongly.	<i>Insufficient flow of regeneration solution or rinsing solution.</i>	See problem "MSM – Insufficient flow of regeneration solution or rinsing solution." See problem "SPM – Insufficient flow of regeneration solution or rinsing solution."
	<i>MSM – Reduced capacity.</i>	Regenerate the MSM (see chapter 6.3.3.2, page 40).
	<i>SPM – Reduced capacity.</i>	Regenerate the SPM (see chapter 6.3.3.2, page 40).
Precision problems - the measured values are highly scattered.	<i>MCS – The vacuum is too low.</i>	<ul style="list-style-type: none"> ▪ Check the connectors. If they are OK: ▪ Contact the regional Metrohm service representative.
SPM – Insufficient amount of regeneration solution or rinsing solution is being pumped.	<i>There is a leak in the system.</i>	Check all connections.
	<i>Peristaltic pump – Contact pressure too weak.</i>	Correctly set the contact pressure (see "Setting the contact pressure correctly", page 22).
	<i>Peristaltic pump – Filter blocked.</i>	Replace the filter (see chapter 6.2.2.2, page 37).
	<i>SPM – Backpressure too high.</i>	Clean the SPM (see chapter 6.3.3.4, page 43) or replace parts (see chapter 6.3.3.5, page 45).
	<i>Peristaltic pump – Pump tubing defective.</i>	Replace the pump tubing.

8 Technical specifications

8.1 Reference conditions

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

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

8.2 Ambient conditions

Operation

<i>Nominal function range</i>	+5 to +45 °C at max. 80% relative humidity, non-condensing
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<i>Storage</i>	+5 to +45 °C at max. 80% relative humidity, non-condensing
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8.3 Housing

Dimensions

<i>Width</i>	365 mm
<i>Height</i>	131 mm
<i>Depth</i>	380 mm

<i>Base tray, housing and bottle holder material</i>	Polyurethane hard foam (PUR) with flame retardation for fire class UL 94 V-0, CFC-free, coated
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<i>IP degree of protection</i>	IP 20
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8.4 Weight

2.942.0500 6.7 kg (without accessories)

8.5 Peristaltic pump

<i>Type</i>	2-channel peristaltic pump
<i>Rotation direction</i>	Clockwise/counterclockwise
<i>Rotational speed</i>	0–42 rpm in 7 levels of 6 rpm each
<i>Pumping characteristics</i>	0.3 mL/min at 18 rpm; with standard pump tubing (6.1826.420)
<i>Pump tubing material</i>	Recommended: PharMed® (Ismaprene)

8.6 Metrohm Suppressor Module (MSM)

<i>Resistance to solvents</i>	No restriction
<i>Switching time</i>	typ. 100 ms

8.7 Interfaces

<i>In</i>	1 15-pin D-sub plug (male) Connection to the ion chromatograph or to another Extension Module.
<i>Out</i>	1 15-pin D-sub plug (female) Connection to another Extension Module or to an 891 Professional Analog Out (optional).

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