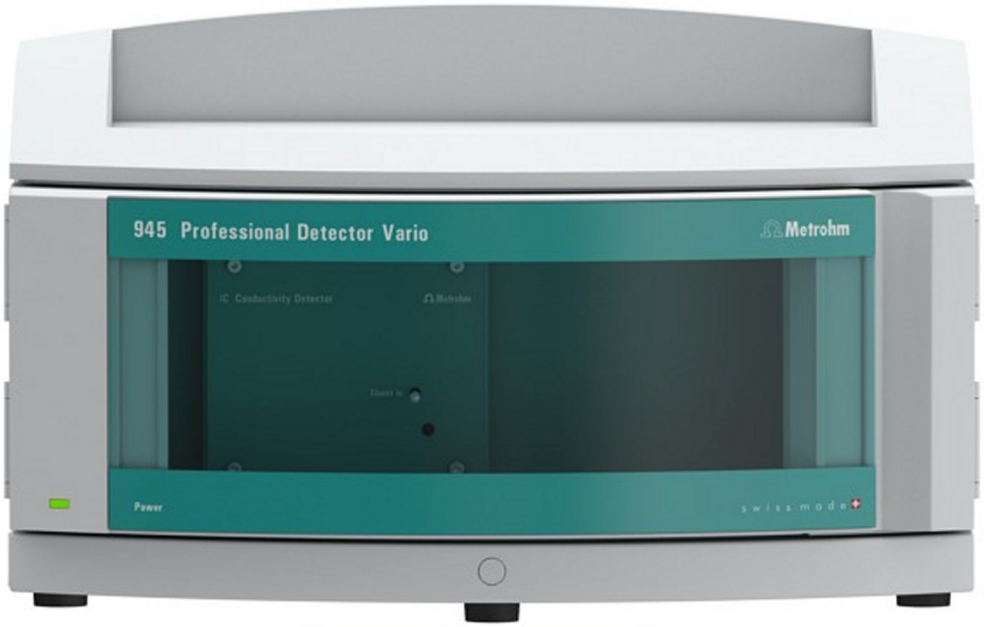
945 Professional Detector Vario



945 Professional Detector Vario – Conductometry

Manual

8.945.8001EN / v5 / 2023-12-31

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2.945.0010

Manual

8.945.8001EN / v5 / 2023-12-31

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

Table of contents

Table of figures

1 Introduction

1.1 Instrument description

The **945 Professional Detector Vario – Conductometry** is an intelligent stand-alone detector equipped with a high-performance conductivity detector.

As a stand-alone detector, it can be combined with instruments such as those of the 940 Professional IC Vario family for which all available detector connectors have already been assigned to conductivity detectors (AnCat systems or other multi-channel systems) when an additional conductivity detector is required.

The 945 Professional Detector Vario – Conductometry allows AnCat systems or other multi-channel systems to be implemented also with the instruments of the 930 Compact IC Flex family and with the 883 Basic IC plus, which are equipped with only one detector connector, which is normally occupied by a conductivity detector.

The 942 Extension Module Vario, 891 Professional Analog Out and 800 Dosinos, Remote Boxes, etc. can all be operated through the 945 Professional Detector Vario – Conductometry. This opens up the flexibility of Metrohm IC systems considerably.

The instrument is comprised of the following modules:

Conductivity detector

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

1.2 Intended use

The 945 Professional Detector Vario – Conductometry is used as an independent conductivity detector in an IC system. It is used for the precise measurement of the conductivity during the ion chromatographic determination of cations and anions.

The present instrument is used for working with chemicals and flammable samples. Therefore, the use of the 945 Professional Detector Vario – Conductometry requires the user to have basic knowledge and experience in handling toxic and caustic substances. Knowledge regarding the application of fire prevention measures prescribed for laboratories is also mandatory.

1.3 Safety instructions

1.3.1 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.

1.3.2 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.

The device is to be operated only with the door closed.

1.3.3 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.

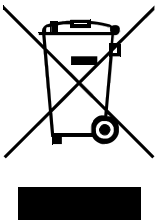
1.3.4 Flammable solvents and chemicals

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.

1.3.5 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.

1.4 About the documentation

CAUTION

Read through this documentation carefully before putting the device into operation. The documentation contains information and warnings which the user must follow in order to ensure safe operation of the device.

1.4.1 Content and scope

This document describes the **945 Professional Detector Vario – Conductometry**, 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 make up the rest of the manual.

You will find additional information on the installation and maintenance of the IC instrument and the Sample Processor in the respective manuals.

Additional information on the configuration and operation with MagIC Net can be found in the *"MagIC Net Tutorial"* or in the MagIC Net online help.

1.4.2 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** Carry out these steps in the sequence shown.
Method	**Dialog text**, **parameter** in the software
File ► New	Menu or menu item
[Next]	**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.
	**CAUTION** This symbol draws attention to possible damage to instruments or instrument parts.
	**NOTE** This symbol highlights additional information and tips.

2 Overview of the device

2.1 Front

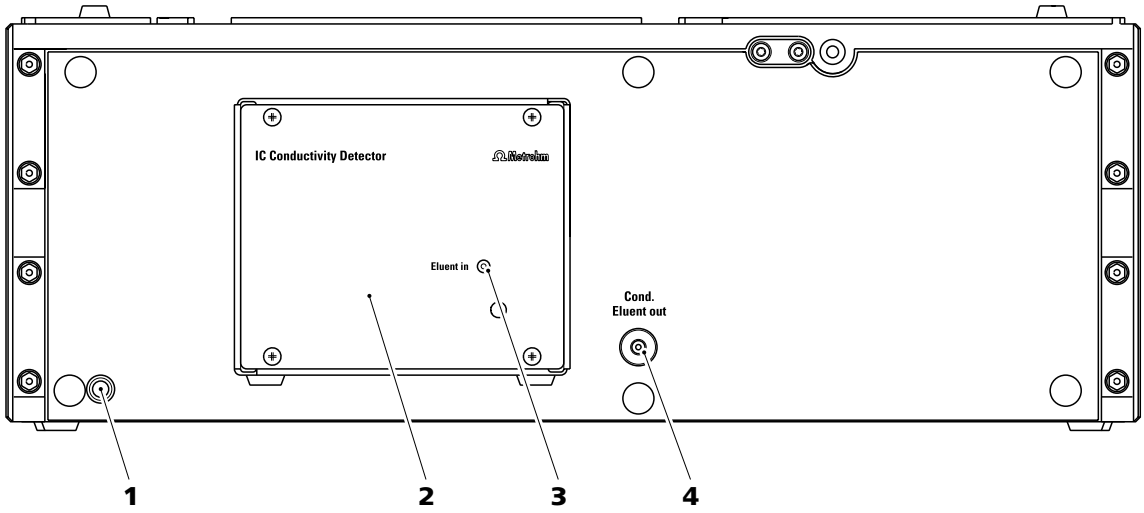


Figure 1 Front

1 **Power LED** Standby indicator.	**2** **Conductivity detector** Permanently installed.
3 **Detector inlet capillary** Permanently installed.	**4** **Coupling** For connecting the detector outlet capillary. Labeled *Cond. Eluent out*.

2.2 Rear

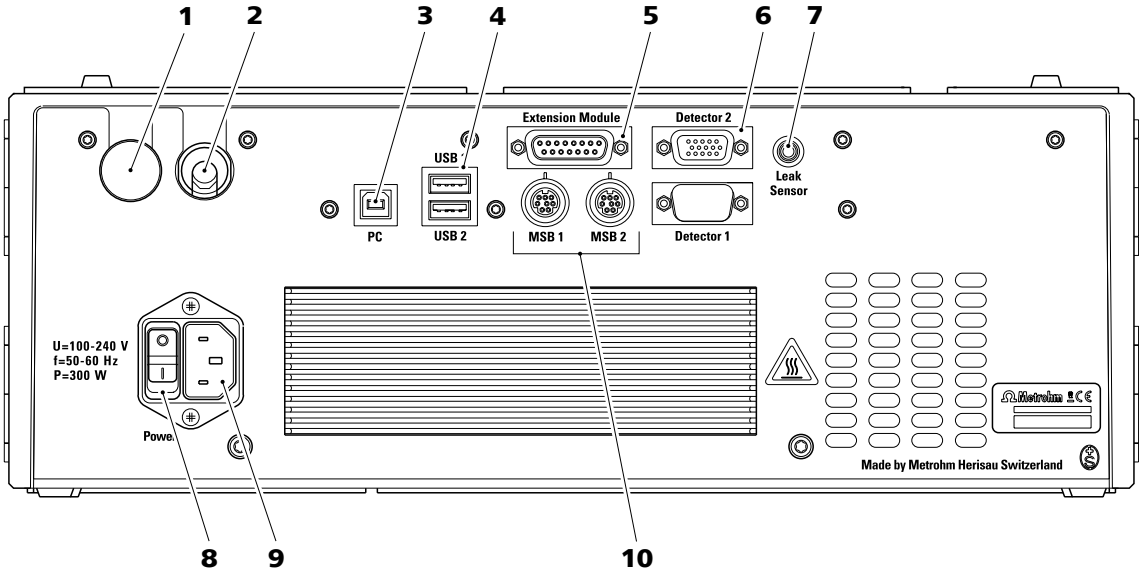


Figure 2 Rear

1 **Stopper** Closes off the unused cable feed-through.	**2** **Cable feed-through** Output for the detector cable.
3 **PC connection socket** For connecting the instrument to the computer with the USB cable (6.2151.020).	**4** **USB connection sockets** Two USB connection sockets, labeled *USB 1* and *USB 2*.
5 **Extension Module connection socket** For connecting a 942 Extension Module Vario or an 891 Professional Analog Out. Labeled *Extension Module*.	**6** **Detector connection sockets** For the connection of the installed detector, labeled *Detector 1* and *Detector 2*. The detector connection sockets which are not used must be covered with a lid.
7 **Leak sensor connection socket** For connecting the leak sensor connection cable, labeled *Leak Sensor*.	**8** **Power switch** For switching the instrument on and off.
9 **Power socket** For connecting the power supply cable (6.2122.0x0).	**10** **MSB connection sockets** Two MSB connection sockets (labeled *MSB 1* and *MSB 2*) for connecting MSB devices. (MSB = Metrohm Serial Bus)

3 Installation

3.1 Base tray and bottle holder

3.1.1 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
- One 944 Professional UV/VIS Detector Vario
- One 945 Professional Detector Vario
- Or another instrument with the same-sized footprint

3.1.2 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.

3.1.2.1 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)

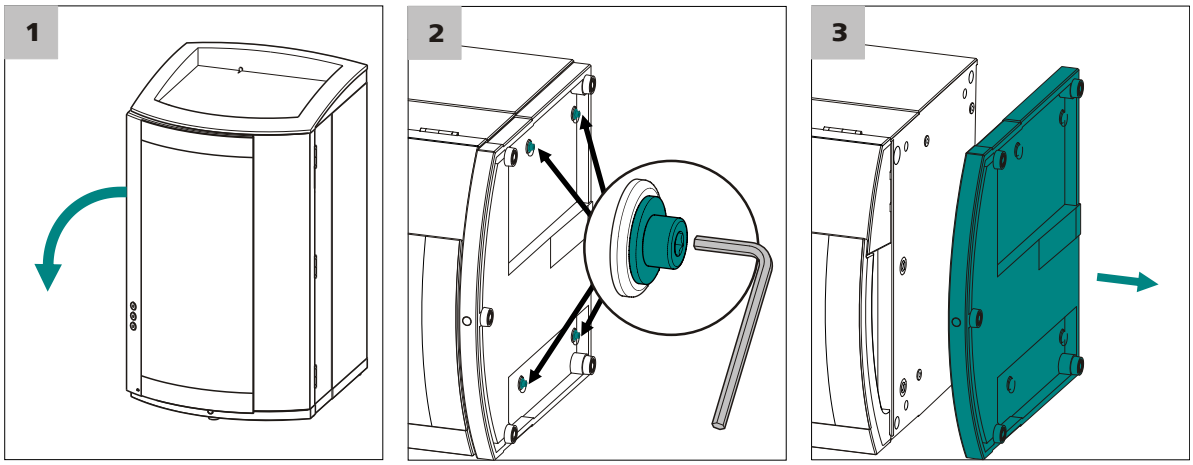


Figure 3 Removing the base tray

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.

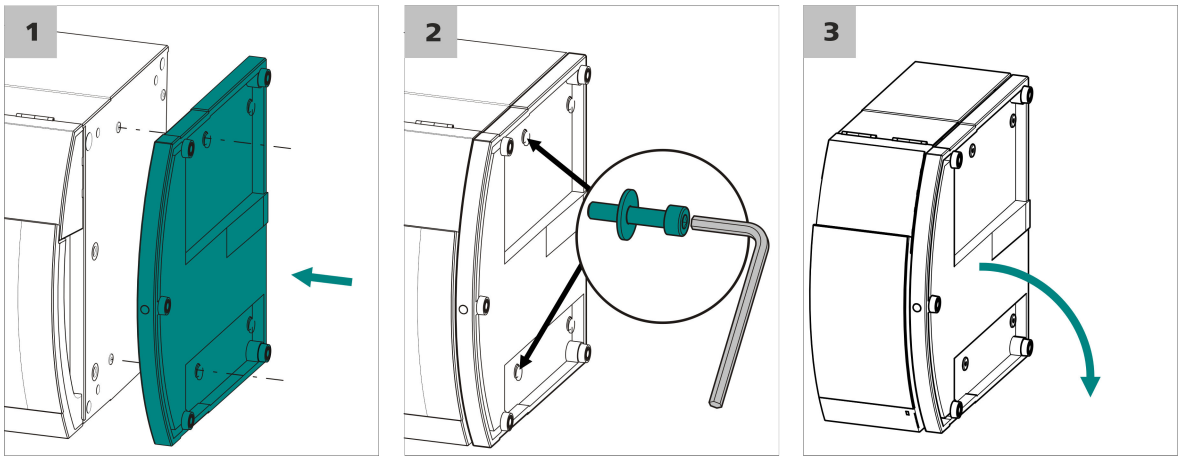
Mounting the base tray

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)



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 11)*.

3.1.2.2 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)

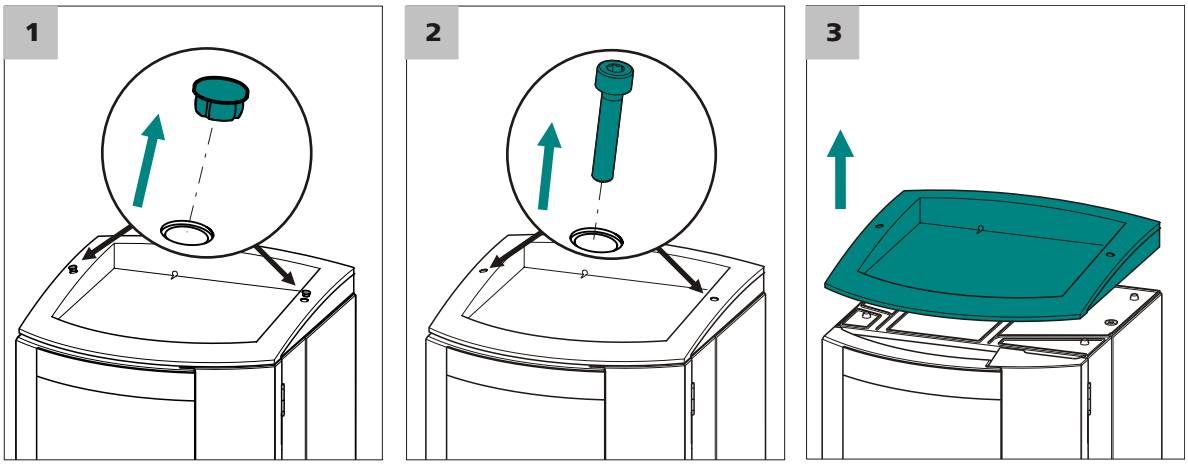


Figure 4 Removing the bottle holder

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)

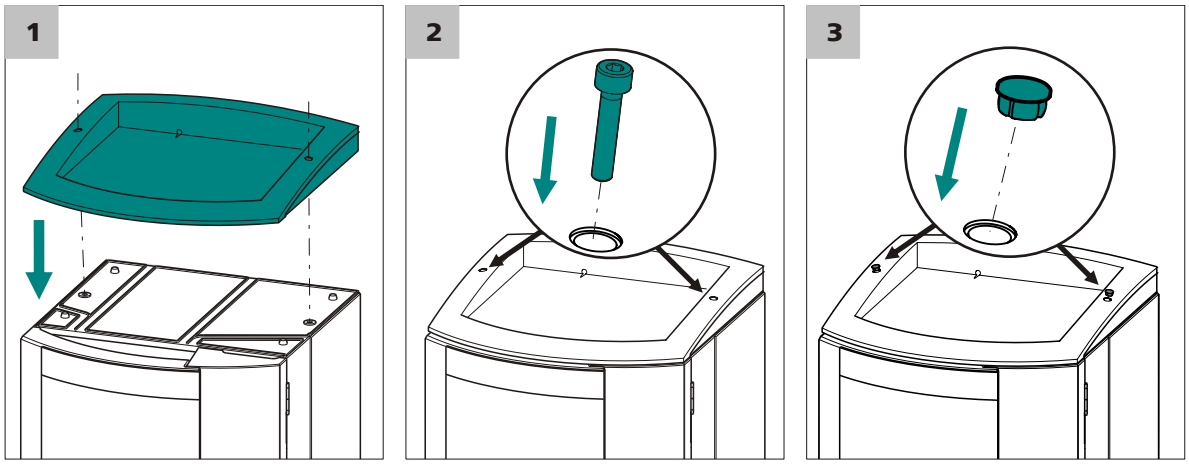


Figure 5 Mounting the bottle holder

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.

3.2 Conductivity detector

3.2.1 Connecting the detector capillaries

Accessories

For this step you need the following accessories:

- PEEK capillary (6.1831.030)
- Pressure screw (6.2744.010)

Connecting the detector outlet capillary

1 ▪ Use a pressure screw (6.2744.010) to screw one end of the PEEK capillary (6.1831.030) firmly to the coupling *Cond. Eluent out*.

2 ▪ Fasten the other end of the PEEK capillary (6.1381.030) to the waste collector (6.5336.000) or guide it into a sufficiently large waste container and fasten it there.
OR if the application requires a subsequent amperometric detection:

- Connect the other end of the PEEK capillary (6.1381.030) to the *Eluent in* connector on the amperometric detector.

NOTE

The detector outlet capillary must be free of blockages in order to generate sufficient backpressure (the measuring cell is tested to 5 MPa = 50 bar backpressure).

Connecting the detector inlet capillary

The detector inlet capillary is connected differently depending on the equipment of the IC instruments:

- For instruments without suppression, directly to the separation column *(see "Connecting the detector inlet capillary to the separation column", page 14)*.
- For instruments with chemical suppression, to the suppressor *(see "Connecting the detector inlet capillary to the suppressor", page 14)*.
- For instruments with sequential suppression, to the MCS *(see "Connecting the detector inlet capillary to the MCS", page 15)*.

NOTE

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

Connecting the detector inlet capillary to the separation column

1 Connecting the detector inlet

- Fasten the detector inlet capillary *(6-**1**)* using a short PEEK pressure screw (6.2744.070) *(6-**2**)* directly to the outlet of the column *(6-**3**)*.

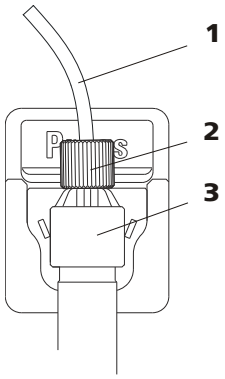


Figure 6 Connection detector–separation column

1 Detector inlet capillary	**2 PEEK pressure screw, short (6.2744.070)**
3 Separation column	

Connecting the detector inlet capillary to the suppressor

1 Connecting the detector inlet

- Connect the detector inlet capillary *(7-**1**)* and the capillary of the suppressor *(7-**2**)* labeled *out* to each other using a coupling (6.2744.040) *(7-**3**)* and two short PEEK pressure screws (6.2744.070) *(7-**4**)*.

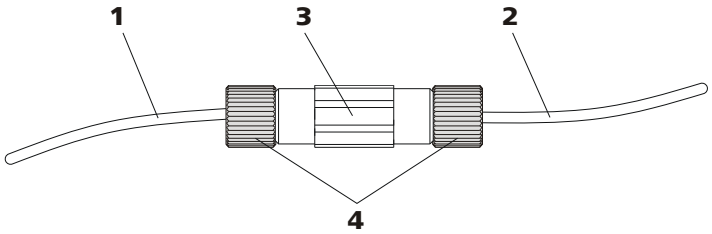


Figure 7 Connection detector–suppressor

1 Detector inlet capillary	**2 Suppressor outlet capillary** Labeled *out*.
3 Coupling (6.2744.040)	**4 PEEK pressure screws, short (6.2744.070)**

Connecting the detector inlet capillary to the MCS

1 Connecting the detector inlet

- Fasten the detector inlet capillary *(8-**1**)* with one long PEEK pressure screw (6.2744.090) *(8-**2**)* to the outlet of the MCS *(8-**3**)*.

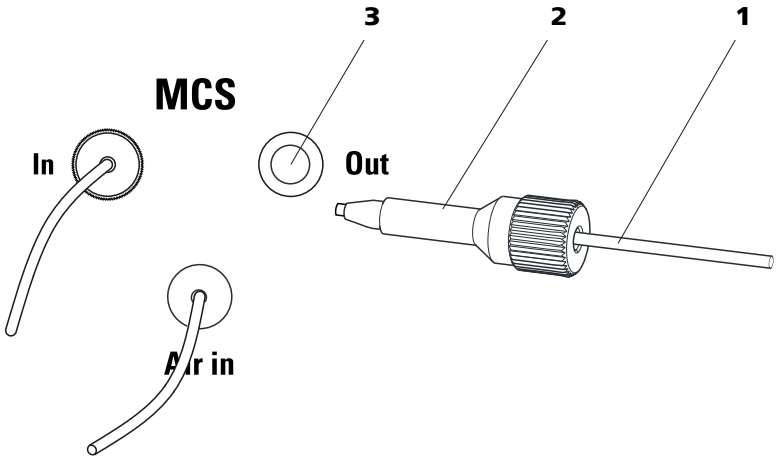


Figure 8 Connection detector–MCS

1 Detector inlet capillary	**2 PEEK pressure screw, long (6.2744.090)**
3 MCS outlet	

3.3 Connecting the instrument to a computer

NOTE

If the instrument is connected to the computer, then it must be switched off.

Accessories

For this step, you need the following accessories:

- USB connecting cable (6.2151.020)

Connecting the USB cable

1 Insert the USB cable into the connection socket on the rear of the instrument labeled *PC*.

2 Insert the other end into a USB port on the computer.

3.4 Connecting the instrument to the power grid

WARNING

Electric shock from electrical potential

Risk of injury by touching live components or through moisture on live parts.

- Never open the housing of the instrument while the power cord is still connected.
- Protect live parts (e.g. power supply unit, power cord, connection sockets) against moisture.
- Unplug the power plug immediately if you suspect that moisture has gotten inside the instrument.
- Only personnel who have been issued Metrohm qualifications may perform service and repair work on electrical and electronic parts.

Connecting the power cord

Accessories

Power cord with the following specifications:

- Length: max. 2 m
- Number of cores: 3, with protective conductor

- Instrument plug: IEC 60320 type C13
- Conductor cross-section 3x min. 1.0 mm^2 / 18 AWG
- Power plug:
  - according to customer requirement (6.2122.XX0)
  - min. 10 A

NOTE

Do not use a not permitted power cord!

1 Plugging in the power cord

- Plug the power cord into the instrument's power socket.
- Connect the power cord to the power grid.

4 Operation and maintenance

4.1 General notes

4.1.1 Care

WARNING

Untrained personnel may not open the instrument's housing.

The instrument requires appropriate care. Excess contamination of the instrument may result in malfunctions and a reduction in the service life of the sturdy mechanical and electronic components.

CAUTION

Even though design measures ensure that this will largely be prevented, the detector should be switched off without delay in the event that aggressive media have found their way into the interior of the detector. This is the only way to prevent extreme damage to the instrument electronics. In such cases, Metrohm Service must be informed.

Spilled chemicals and solvents should be removed immediately. In particular, the plug connections (particularly the power plug) should be protected from contamination.

Do not use scouring agents for cleaning the tray.

4.1.2 Maintenance by Metrohm Service

Maintenance of the instrument is best carried out as part of annual service, which is performed by specialist personnel from Metrohm. A shorter maintenance interval is recommended if you frequently work with caustic and corrosive chemicals. Metrohm Service provides professional technical consultation at all times for the maintenance and servicing of all Metrohm instruments.

4.1.3 Operation

CAUTION

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

4.1.4 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 (if present) with methanol/ultrapure water (1:4).
- Rinse all pump tubings of the peristaltic pump with ultrapure water.

4.2 Conductivity detector

4.2.1 Maintenance

CAUTION

The conductivity detector must not be opened!

WARNING

When **rinsing the detector without column**, the pressure must not exceed **5 MPa**.

In order to ensure this, set the maximum pressure of the high-pressure pump to **5 MPa** in MagIC Net.

4.2.2 Remedying blockage

The conductivity detector can become blocked if the ends of the detector inlet capillary or the detector outlet capillary are pressed together too tightly.

If this is the case, detach and shorten the detector inlet capillary or the detector outlet capillary by a few millimeters.

If the conductivity detector is still blocked even if the capillary ends are free then it can be rinsed in the direction opposite the normal flow direction. Proceed as follows:

1. Detach the detector inlet capillary or the detector outlet capillary from the system.
2. Connect the detector outlet capillary directly to the outlet of the high-pressure pump.

3 In MagIC Net, set the maximum pressure of the high-pressure pump to 5 MPa.

4 Rinse the detector thoroughly with eluent.

5 Troubleshooting

5.1 Problems and their solutions

Problem	Cause	Remedy
The pressure in the system markedly increases.	*The conductivity detector is blocked.*	*(see chapter 4.2.2, page 19)* ▪ Shorten the capillary ends by a few millimeters. ▪ Rinse the detector opposite the normal flow direction.
Conductivity detector is not recognized in the software	*No connection.*	▪ Check the connection of the detector cable. ▪ Switch the instrument off and (after 15 seconds) on again.

6 Technical specifications

6.1 Reference conditions

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

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

6.2 Conductivity detector

Type	▪ Microprocessor-controlled Digital Signal Processing (DSP technology) ▪ Intelligent detector with 6 reference chromatograms
Measuring range	0 - 15,000 µS/cm without range switching
Noise	< 0.1 nS at 1 µS/cm
Linearity deviations	▪ < 0.1% for conductivity values higher than 16 µS/cm ▪ < 1% for conductivity values lower than 16 µS/cm
Drift	< 0.2 nS/cm per hour
Measuring rate	10 measurements per second for optimum results without filtering
Resolution	0.0047 nS/cm
Baseline	Noise < 0.2 nS/cm typical for sequential suppression
Conductivity detector	
Cell volume	0.8 µL
Cell constant	▪ Individual calibration data saved in the detector ▪ Adjustable in the range: 13.0 - 21.0 /cm
Electrodes	Ring-shaped electrodes made from stainless steel
Materials in contact with eluent	Chemically inert PCTFE
Maximum operating pressure	5.0 MPa (50 bar)
Cell temperature	20 - 50 °C in increments of 5 °C

Temperature stability	< 0.001 °C
Temperature compensation	0 - 5%/K adjustable, default 2.3%/K
Heating time	< 30 minutes (40 °C)

6.3 Energy supply

Nominal voltage range	100–240 V (± 10%)
Nominal frequency range	50–60 Hz (± 3%)
Power consumption	▪ 65 W for typical analysis application ▪ 25 W standby (conductivity detector to 40 °C)
Power supply unit	▪ up to 300 W maximum, electronically monitored ▪ internal fuse 3.15 A

6.4 Leak sensor

Type	electronic, no calibration necessary

6.5 Ambient conditions

Operation	
Nominal function range	+5 to +45 °C at max. 80% relative humidity, non-condensing
Storage	+5 to +45 °C at max. 80% relative humidity, non-condensing
Altitude / Pressure range	max. 3,000 m.a.s.l. sea level / min. 700 mbar
Overvoltage category	II
Pollution degree	2

6.6 Housing

Dimensions	
Width	365 mm
Height	131 mm
Depth	380 mm
Material of housing	Polyurethane hard foam (PUR) with flame retardation for fire class UL94V0, CFC-free, coated
Controls	
Indicators	LED for standby operation
On/off switch	On the rear of the instrument

6.7 Interfaces

USB	
Input	1 USB upstream, type B (for connection to the PC)
Output	2 USB downstream, type A
MSB	2 MSB 8-pin mini-DIN (female) (for Dosino, stirrer, remote lines, etc.)
Detector	2 15-pin high density DSUB (female)
Cell recognition	1 on the front of the instrument
Leak sensor	1 jack plug
Further connections	▪ 1 15-pin DSUB (female)

7 Accessories

Up-to-date information on the scope of delivery and optional accessories for your product can be found on the Internet. You can download this information using the article number as follows:

Downloading the accessories list

1. Enter *https://www.metrohm.com/* into your Internet browser.
2. Enter the article number (e.g. **2.945.0010**) into the search field.
   The search result is displayed.
3. Click on the product.
   Detailed information regarding the product is shown on various tabs.
4. On the **Included parts** tab, click on **Download the PDF**.
   The PDF file with the accessories data is created.

NOTE

Once you have received your new product, we recommend downloading the accessories list from the Internet, printing it out and keeping it together with the manual for reference purposes.

Index