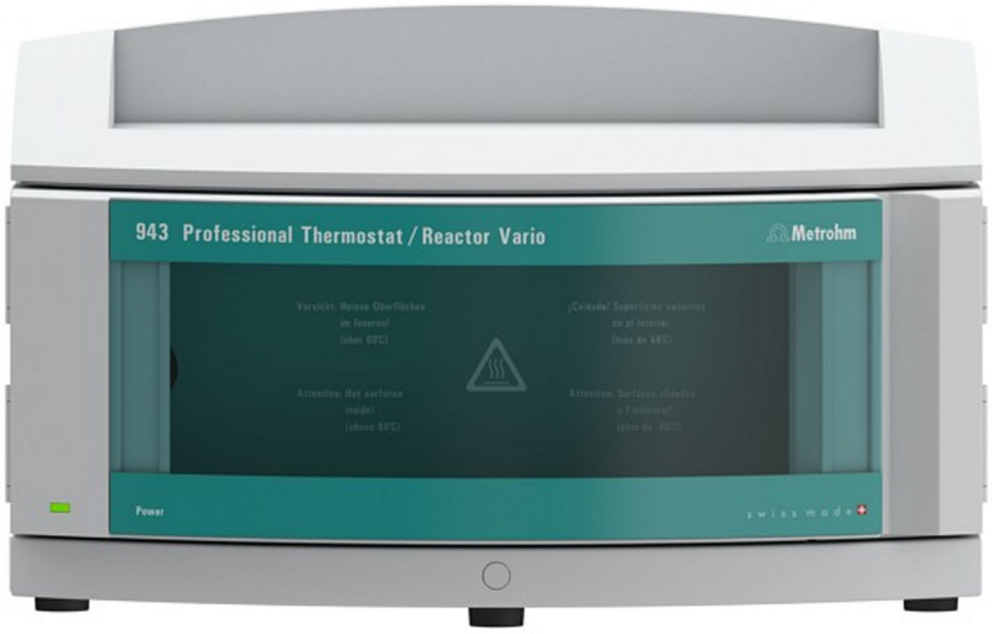
Professional Thermostat/Reactor Vario



943 Professional Thermostat/Reactor Vario

Manual

8.943.8001EN / v4 / 2023-12-31

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Professional Thermostat/Reactor Vario

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2.943.0110 / 2.943.0210

Manual

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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.

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1 Introduction

1.1 Instrument description

The **943 Professional Thermostat/Reactor Vario** is an instrument of the Metrohm Professional IC line of instruments, which was conceived to be used for two different functions.

The main area of application for the 943 Professional Thermostat/Reactor Vario is detection preparation in an IC system with photometric detection. For many applications, photometric detection requires post-column derivatization, also known as post-column reaction (PCR). However, there are also applications that require precolumn derivatization; the 943 Professional Thermostat/Reactor Vario can be used for those as well. One such system consists of a 940 Professional IC Vario, the 943 Professional Thermostat/Reactor Vario and the 944 Professional UV/VIS Detector Vario. The 942 Extension Module Vario can also be used for pumping reagents or preparing samples.

The second area of application for the 943 Professional Thermostat/Reactor Vario is column heating. A 942 Extension Module Vario – ONE/Deg and a 943 Professional Thermostat/Reactor Vario together cover all of the functions of an IC instrument. With a suitable detector an isocratic analysis system can be configured without a dedicated ion chromatograph.

The 943 Professional Thermostat/Reactor Vario is available in two model versions, each with a different set of accessories, to support each function:

- **2.943.0110 Professional Reactor Vario**
  For use as a precolumn reactor or post-column reactor: A 943 Professional Thermostat/Reactor Vario with the 6.2845.100 accessory set consisting of a reactor plate with an attached reactor block. For demanding applications, the reactor plate can be equipped with up to four reactor blocks.
- **2.943.0210 Professional Thermostat Vario**
  For use as a column thermostat: A 943 Professional Thermostat/Reactor Vario with the 6.2845.600 accessory set consisting of a column plate with attached column block for 2 separation columns and a preheating capillary.

These accessory sets can easily be inserted into the interior of the 943 Professional Thermostat/Reactor Vario.

In an empty state, the oven on the 943 Professional Thermostat/Reactor Vario can be heated to a maximum of 150 °C. If the accessories for the Professional Reactor (6.2845.100) are inserted, the maximum temperature

is 120 °C; with the accessories for the Professional Thermostat (6.2845.600), the maximum temperature is 80 °C.

The 943 Professional Thermostat/Reactor Vario is operated with the **MagIC Net** software. A USB cable is used to connect it to a computer where MagIC Net has been installed. The software automatically detects the instrument and checks its functional readiness. MagIC Net controls and monitors the instrument and documents the heat output and reagent flow rates in a database.

Additional information on operating MagIC Net can be found in the document *"MagIC Net Tutorial"* or in the software's online help.

1.2 Intended use

The main function of the 943 Professional Thermostat/Reactor Vario is post-column derivatization (PCR). In the process, chemicals are brought to a reaction in a heated atmosphere. It is also possible to perform pre-column reactions.

This device is suitable for processing chemicals and flammable samples. Therefore, the use of the 943 Professional Thermostat/Reactor Vario 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 About the documentation

This manual describes both of the 943 Professional Thermostat/Reactor Vario model variants. Chapters that apply to both model variants are not specifically marked. Chapters that only relate to one of the model variants have the number and name of the model variant in the title (e.g. "Installing the Professional Reactor Vario (2.943.0110)" or "Installing the Professional Thermostat Vario (2.943.0210)").

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 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.

1.5 Safety instructions

1.5.1 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.

1.5.2 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.

1.5.3 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.

1.5.4 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.

1.5.5 Optical radiation

WARNING

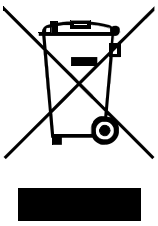
Health hazards due to optical radiation

Risk group 3

Damage to eyes and skin.

- Avoid eye and skin exposure to unshielded product.
- Do not look at operating lamp.
- Switch off the device before removing the lamp.
- Wear personal protective equipment (e.g. protective glasses, gloves).

1.5.6 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.

2 Overview of the device

2.1 Front

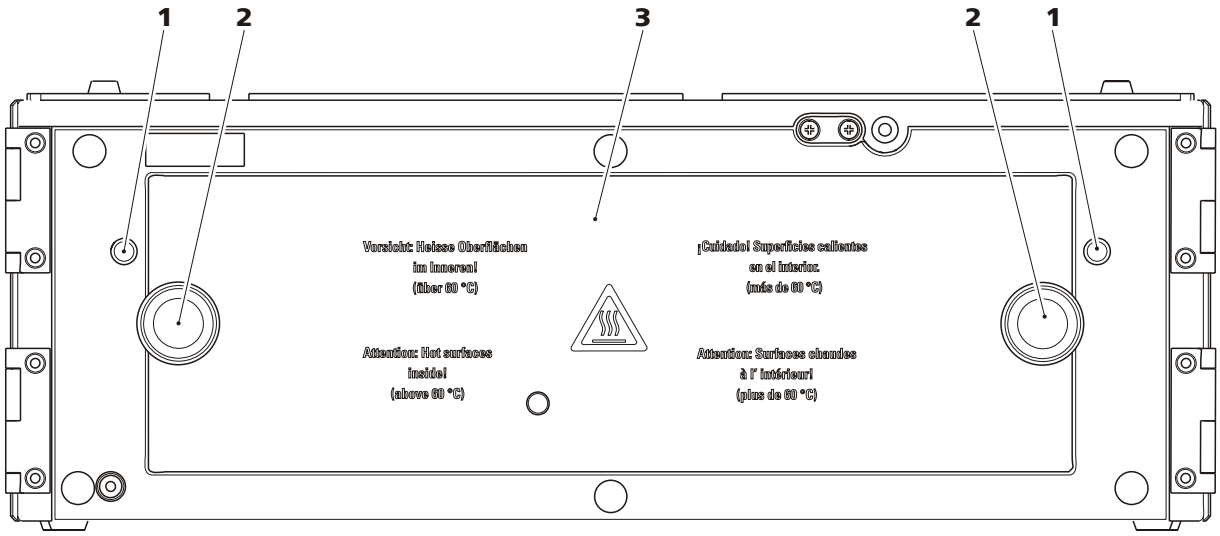


Figure 1 Front

1 **Capillary feed-throughs** For feeding through the capillaries into the oven.	**2** **Knurled screws** For opening and closing the oven door.
3 **Oven door**	

2.2 Rear

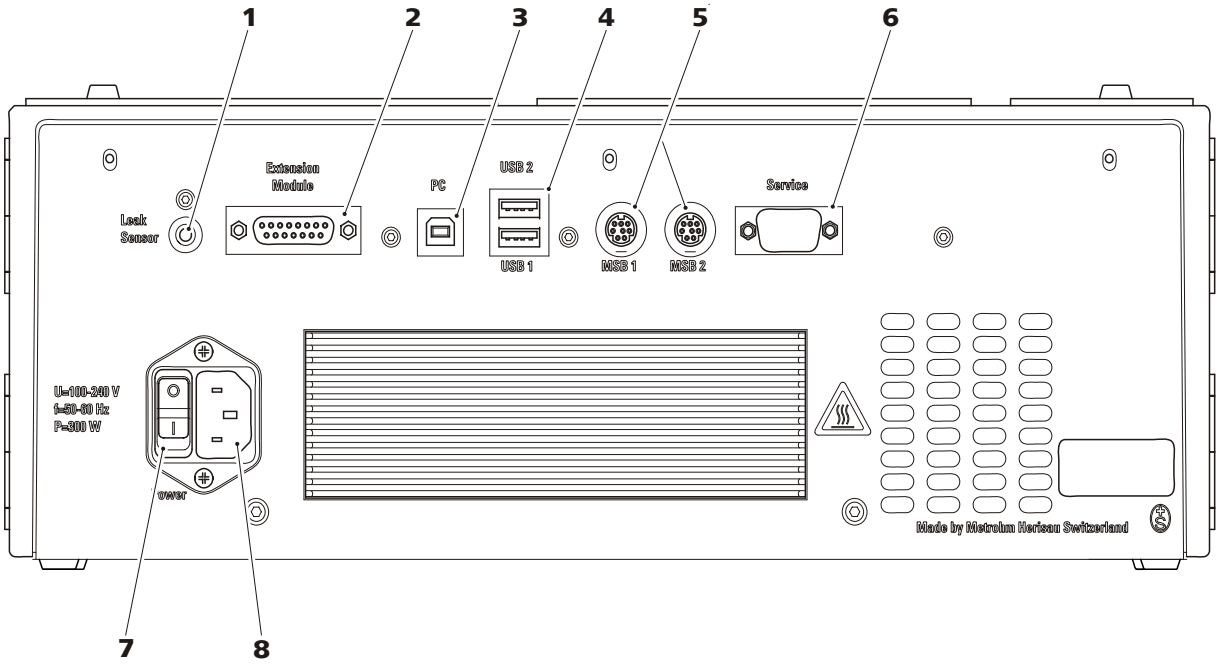


Figure 2 Rear

1	**Leak Sensor connection socket** For connecting the leak sensor.	**2**	**Extension Module connection socket** For connecting an Extension Module.
3	**PC connection socket** For connecting the instrument to the computer with the USB cable (6.2151.020).	**4**	**USB connection sockets** 2 USB connection sockets (labeled *USB 1* and *USB 2*).
5	**MSB connection sockets** 2 MSB connection sockets (labeled *MSB 1* and *MSB 2*) for connecting MSB devices. MSB = Metrohm Serial Bus.	**6**	**Service connection socket** Connector for service.
7	**Power switch** For switching the instrument on and off. I = On O = Off	**8**	**Power socket** For connecting the power cord.

2.3 Openings and ducts for capillaries

Several openings have been built in for feeding through capillaries and cables. There are 2 openings provided next to the oven door for feeding capillaries into the oven, one on the right and one on the left. Up to 5 capillaries can be routed into the oven using each of these capillary feed-throughs.

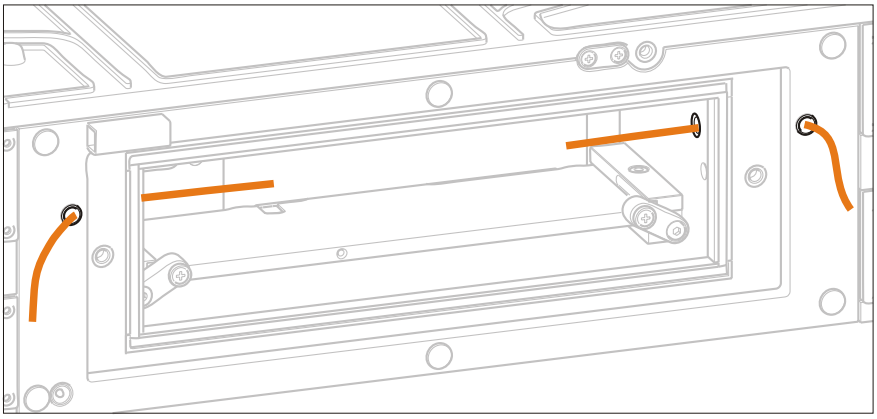


Figure 3 Openings for capillaries

Use the capillary ducts on the top and bottom of the instrument to feed capillaries into and out of the instrument and between instruments. These ducts have been designed so that capillaries can be fed between instruments or between the instrument and the base plate or bottle holder.

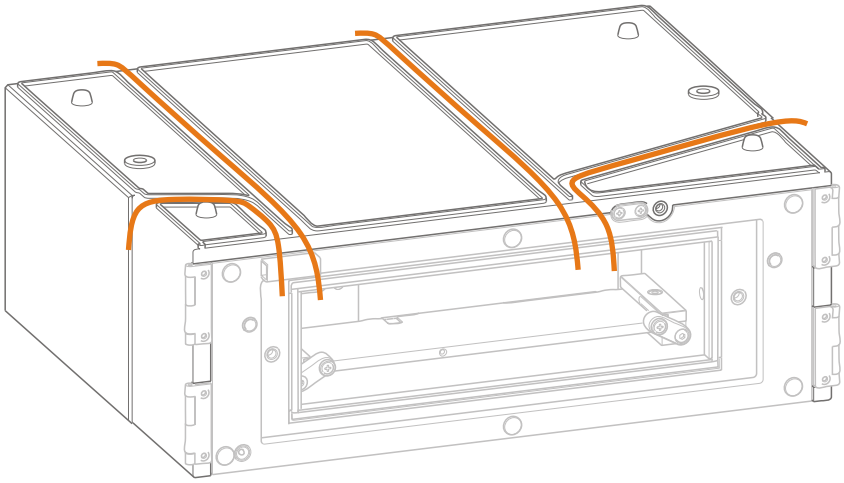


Figure 4 Ducts for capillaries

2.4 Accessories for Professional Reactor Vario (2.943.0110)

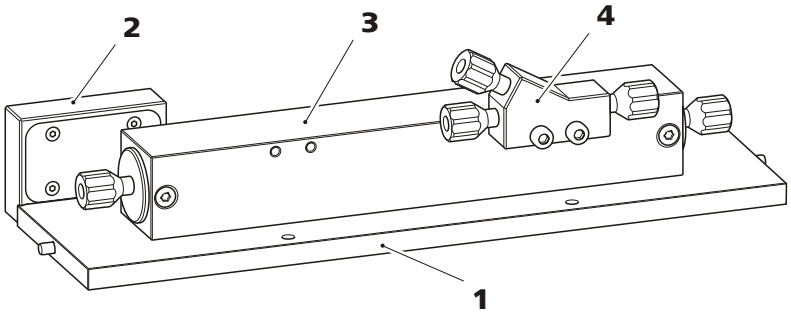


Figure 5 Reactor plate (6.2845.100)

1	**Heating plate**	**2**	**Contact block** Connection between the reactor plate and the 943.
3	**Reactor (6.2845.200)**	**4**	**Y connector (6.2744.330)**

2.5 Accessories for Professional Thermostat Vario (2.943.0210)

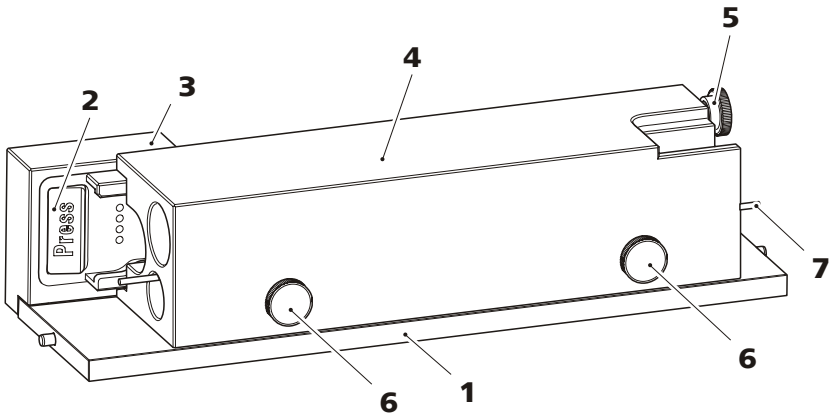


Figure 6 Column plate (6.2845.600)

1	**Heating plate**	**2**	**Column holder** With column recognition chip.
3	**Contact block** Connection between the column plate and the 943.	**4**	**Column block** With bore holes for a maximum of 2 columns of 150 mm each and a preheating capillary.

5 **Knurled screw**
For fixing the column in place.

6 **Knurled screw**
For fixing the preheating capillary in place.

7 **Preheating capillary**

3 Installation

3.1 Setting up the device

3.1.1 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.

3.1.2 Checks

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

3.1.3 Setup 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.

The distance between the rear of the device and the wall must be large enough to ensure air circulation on the cooling plate.

3.2 Setup configurations

3.2.1 Professional Reactor Vario (2.943.0110)

In addition to the 943 Professional Thermostat/Reactor Vario, an IC system with photometric detection and precolumn or post-column derivatization consists of the following instruments:

- Any 940 Professional IC Vario instrument, or
  Any 930 Compact IC Flex instrument
- The 944 Professional UV/VIS Detector Vario
- Optionally: a 942 Extension Module Vario for transporting the reagent solution
- optionally, if the reagent is pumped with a high-pressure pump: a Metrosep BP 1 Guard/2.0 backpressure column (6.1015.100)

An IC system with photometric detection and precolumn or post-column derivatization can be set up in various configurations.

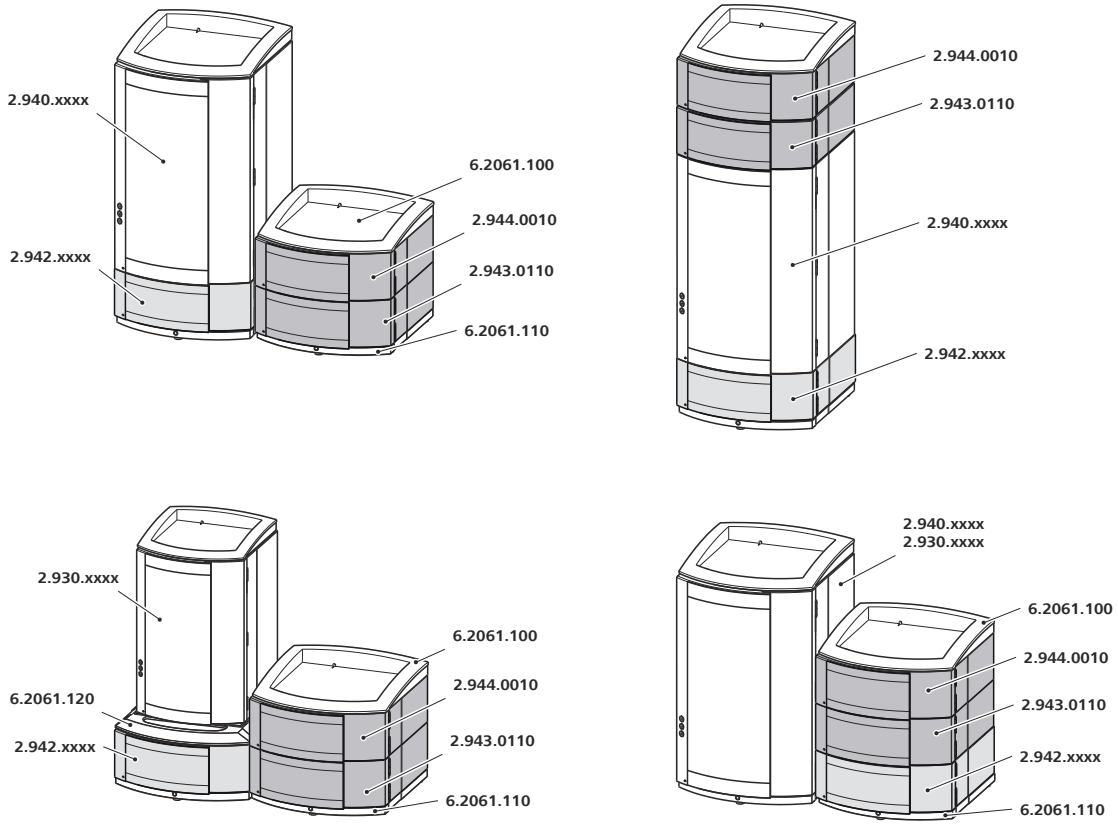


Figure 7 Setup configurations – Professional Reactor Vario

Notes on the setup configurations

If you want to set up the instruments in two stacks, we recommend you order the following accessories to protect the instruments of the second stack:

- Bottle holder (ProfIC) (6.2061.100)
- Base tray with sensor for Professional IC devices (6.2061.110)

If you would like to combine a 930 Compact IC Flex instrument with the 943 Professional Thermostat/Reactor Vario, the 944 Professional UV/VIS Detector Vario and/or the 942 Extension Module Vario, you need the System Connector (6.2061.120) to accommodate the different base sizes.

3.2.2 Professional Thermostat Vario (2.943.0210)

In order to build an isocratic IC analysis system without a dedicated ion chromatograph (940, 930), you will require the 943 Professional Thermostat/Reactor Vario and the following instruments:

- One 942 Extension Module Vario ONE/Deg (2.942.1060)
- Any detector (e.g. the 944 Professional UV/VIS Detector Vario (2.944.0010))

- Optionally: Another 942 Extension Module Vario for sample preparation

We recommend the following setup for an isocratic IC analysis system with photometric detection (without a dedicated ion chromatograph):

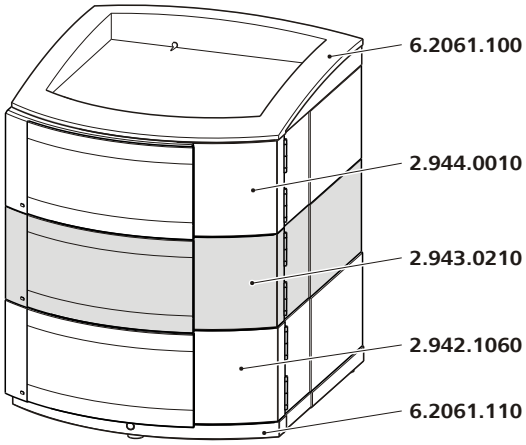


Figure 8 Proposed setup – Professional Thermostat

3.3 Base tray and bottle holder

3.3.1 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

3.3.2 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.

3.3.2.1 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)

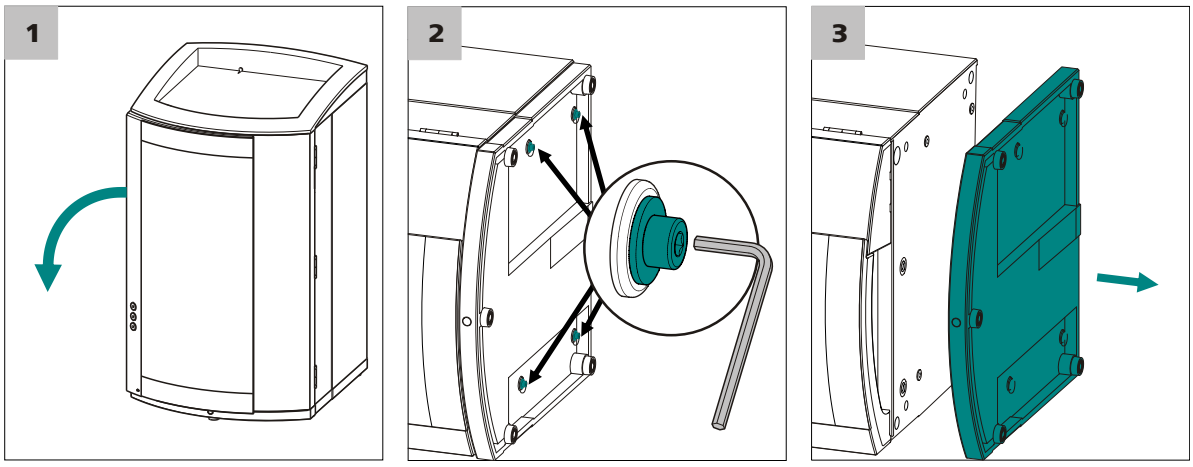


Figure 9 Removing the base tray

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)

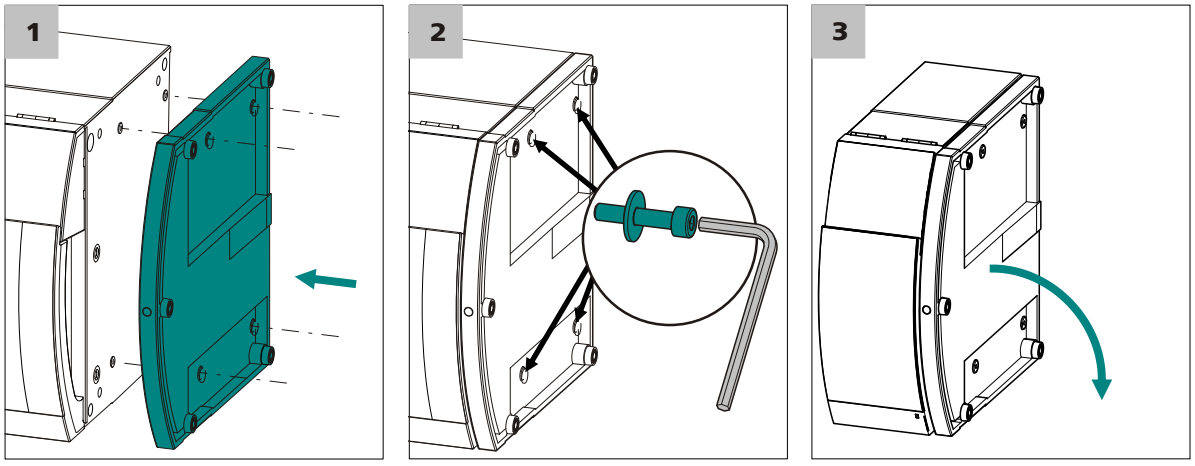


Figure 10 Mounting the base tray

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 18)*.

3.3.2.2 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)

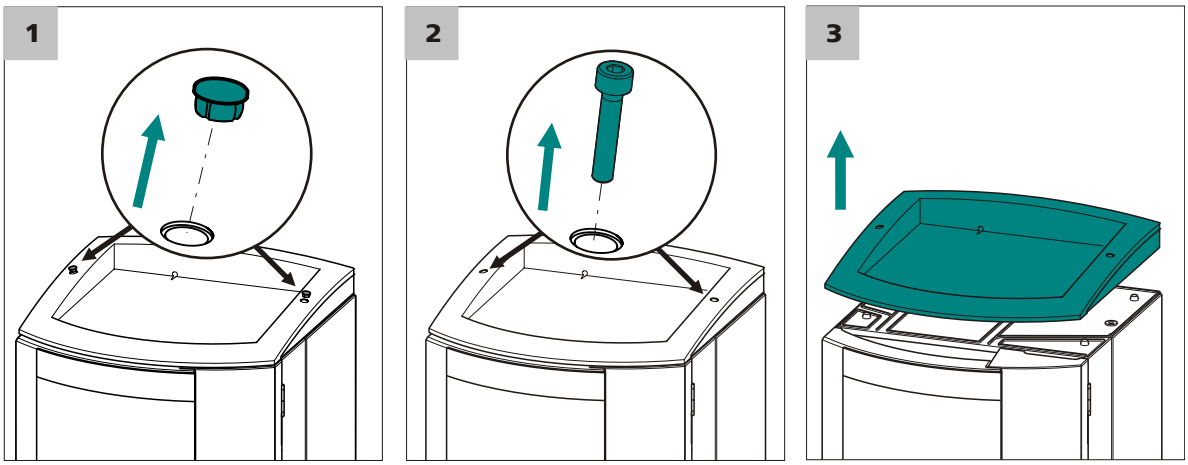


Figure 11 Removing the bottle holder

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)

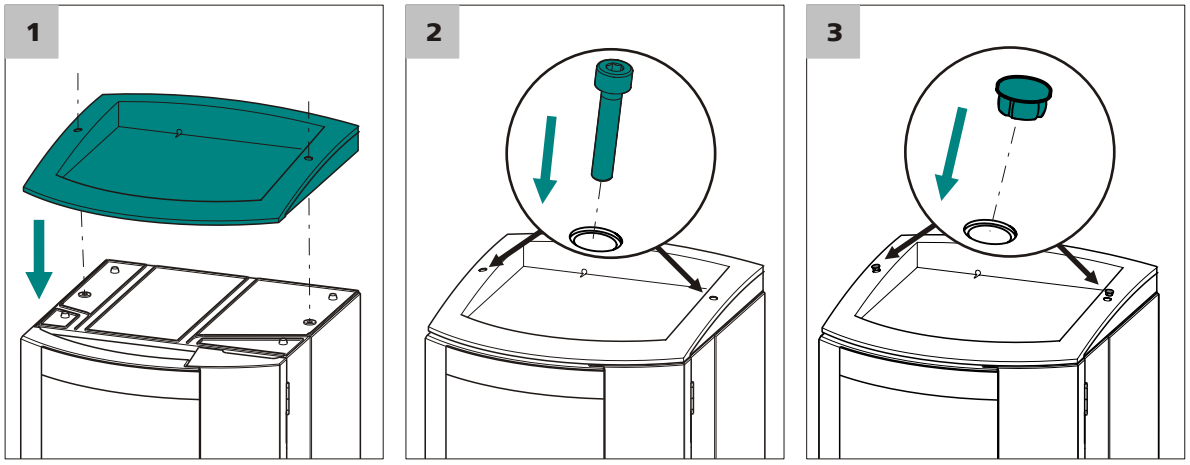


Figure 12 Mounting the bottle holder

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.

3.4 Installations on the rear of the instrument

3.4.1 Connecting the leak sensor

The leak sensor detects leaking liquid that collects in the instrument's base tray.

In order for the leak sensor to be activated, the leak sensor connector *(13-**2**)* has to be connected, the instrument switched on and the leak sensor switched to **active** in the software.

Connecting the leak sensor

1
- Pull the cable for the leak sensor *(13-**3**)* out of the rear of the base tray.
- Insert the leak sensor connector *(13-**2**)* into the leak sensor connection socket *(13-**1**)*.

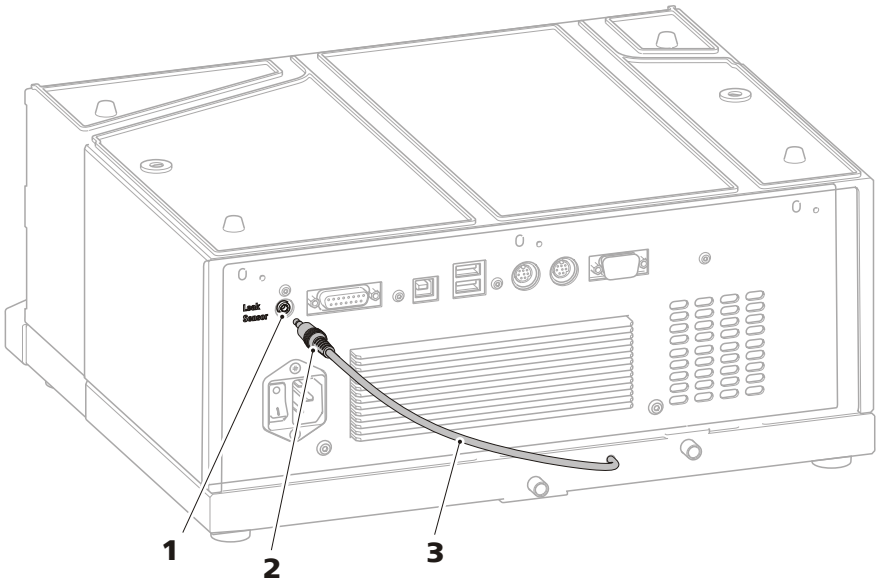


Figure 13 Connecting the leak sensor

1 Leak sensor connection socket Labeled "Leak Sensor".	**2 Leak sensor connector**
3 Leak sensor connection cable Is firmly mounted to the base plate.	

3.5 Opening/closing the oven door

The heatable interior of the 943 Professional Thermostat/Reactor Vario is sealed with a well-insulated oven door. The door has to be opened to insert the accessories necessary for the application into the oven. Proceed as follows:

Opening the oven door

WARNING

Surfaces inside of the oven and the oven door can be hotter than 60 °C.

Risk of burns.

Let the oven cool down after use and open the oven door carefully. Place the oven door on a fire-resistant surface.

1 Loosen both knurled screws on the oven door and carefully remove the oven door.

2 Place the oven door on a fire-resistant surface.

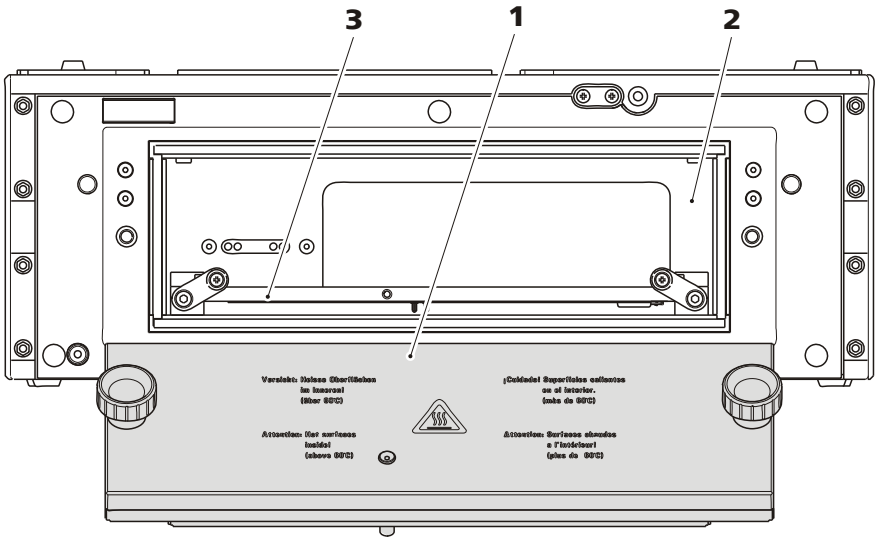


Figure 14 Front – open

1 Oven door	**2 Oven interior**
3 Heating plate	

Before the determination can be started, the oven door must be tightly closed. Proceed as follows:

Closing the oven door

1 Attach the oven door to the opening. Ensure that no capillaries are being pinched while doing so.

2 Tighten the two knurled screws on the oven door by hand.

3.6 Installing accessories

3.6.1 Professional Reactor Vario (2.943.0110)

If the 943 Professional Thermostat/Reactor Vario is equipped with a reactor plate (6.2845.100), the 943 Professional Thermostat/Reactor Vario fulfills the function of a precolumn or post-column reactor.

The easiest way to connect capillaries is outside the oven.

All capillaries must be fed into or out of the oven through the capillary feed-throughs on the left and right side of the oven door.

If you have placed the 943 Professional Thermostat/Reactor Vario under or next to the IC instrument, proceed as follows:

1. Feed the capillaries into the oven.
2. Connect the capillaries to the reactor.
3. Insert the reactor plate.

Start with *"Feeding capillaries into the oven", page 23*.

If you have placed the 943 Professional Thermostat/Reactor Vario on top of the IC instrument, proceed as follows:

1. Connect the capillaries to the reactor.
2. Insert the reactor plate.
3. Feed the capillaries out of the oven.

Start with *"Connecting the capillaries", page 23*.

To pump the reagent, you need either an additional high-pressure pump or an additional peristaltic pump. If you pump the reagent with a high-pressure pump, you must install the Metrosep BP 1 Guard/2.0 backpressure column (6.1015.100) between the reactor and the pulsation absorber.

NOTE

In order to keep the dead volume as low as possible, make sure that capillary connections are as short as possible.

Always shorten capillaries with the capillary cutter (6.2621.080) to obtain smooth, evenly cut capillary ends.

Feeding capillaries into the oven

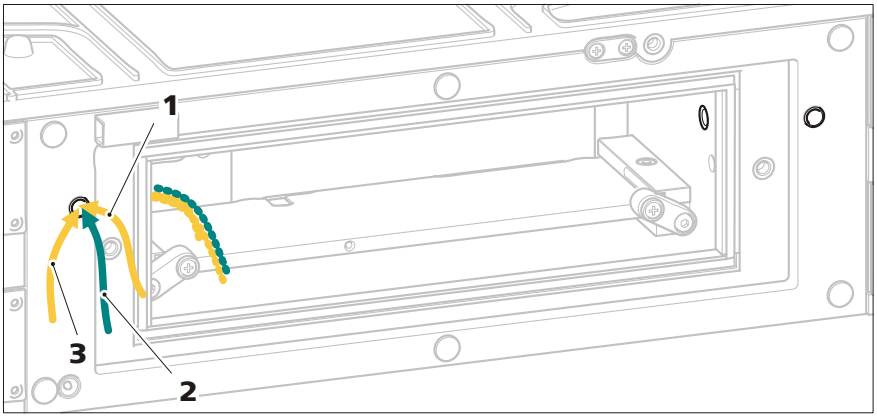


Figure 15 Feeding capillaries into the oven – reactor

1 Reactor input capillary	**2 Reagent inlet capillary**
3 Reactor output capillary	

1 Feeding capillaries into the oven

- Feed the reactor input capillary, the reagent inlet capillary (section of 6.1831.100) and the reactor output capillary into the oven through both capillary feed-throughs on the left and right side of the oven door.

Connecting the capillaries

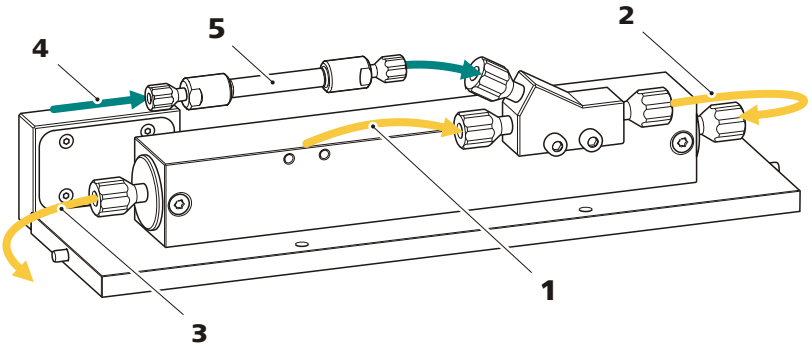


Figure 16 Reactor plate – capillaries connected

1 Reactor input capillary	**2 Connection capillary** Section of PEEK capillary (6.1831.100).

3 **Reactor output capillary**
Section of the PEEK capillary (6.1831.100) or PTFE capillary (6.1803.150)(*).

4 **Reagent inlet capillary**
Section of PEEK capillary (6.1831.100).

5 **Backpressure column**
Metrosep BP 1 Guard/2.0 (6.1015.100), only if the reagent is pumped with a high-pressure pump.

(*) During bromate determination using the triiodide method, the triiodide is partly absorbed by the PEEK capillary. This results in peak widening and a reduced limit of detection. Therefore, we recommend using the PTFE capillary (6.1803.150) for bromate determination using the triiodide method.

To connect the capillaries, you need the following accessories:

- A long PEEK capillary (6.1831.100)
- A capillary cutter (6.2621.080)
- If the reagent is pumped via a high-pressure pump: a Metrosep BP 1 Guard/2.0 backpressure column (6.1015.100)

1 Connecting the reactor input capillary

- Screw the reactor input capillary *(16-**1**)* onto one or both of the Y connector inputs.
- Connect the output from the Y connector and the reactor input using a short piece of PEEK capillary (6.1831.100) *(16-**2**)*.

2 Connecting the reagent inlet capillary

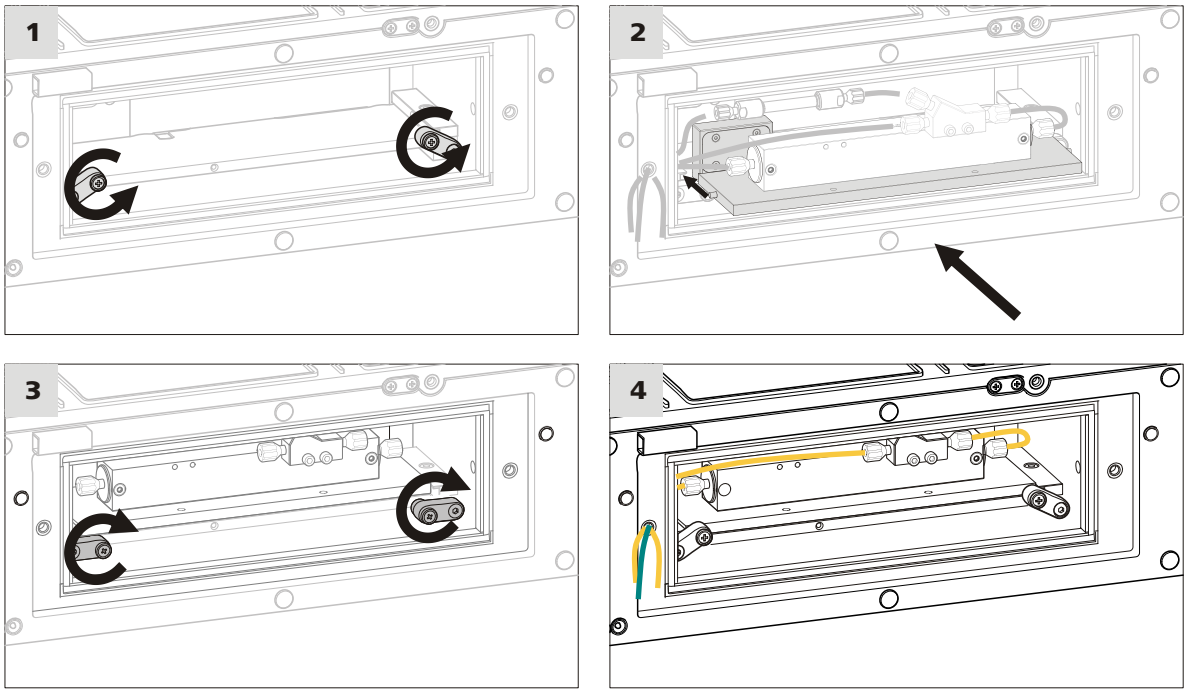
- For reagent delivery, attach a section of the PEEK capillary (6.1831.100) to the second Y connector input.
- Attach the backpressure column *(16-**5**)* to the other end.
- Attach another section of the PEEK capillary (6.1831.100) *(16-**4**)* to the other end of the backpressure column.

3 Connecting the reactor output capillary

- Attach a section of the PEEK capillary (6.1831.100) *(16-**3**)* to the reactor output.

Inserting the reactor plate (6.2845.100)

To insert the reactor plate, you need a 2.5 mm hex key (6.2621.140).



1 Lowering the latches

Loosen the outer screws of both latches with the 2.5 mm hex key (6.2621.140) by turning them counterclockwise.

The latches open and unblock the insertion rails of the heating plate.

2 Inserting the reactor plate

- Insert the reactor plate into the oven by fitting the two bolts at the sides of the reaction plate into the insertion rails of the heating plate.
- Slide the reactor plate into the oven as far as it will go. Take care not to jam or pinch the capillaries.

3 Lifting the latches

Tighten the outer screws of both latches with the 2.5 mm hex key (6.2621.140) by turning them clockwise.

The latches lift and fix the column holder on the heating plate.

4 Connecting the capillaries to the system

If the free capillary ends are not yet guided through the capillary feed-throughs, guide them out of the oven.

- Connect the loose end of the reactor input capillary *(16-**1**)* with the outlet of the separation column.

- Connect the loose end of the reactor output capillary *(16-**3**)* with the detector inlet.
- Connect the loose end of the reagent input capillary *(16-**4**)* with either
  - an unused high-pressure pump (recommended), and make sure that the Metrosep BP 1 Guard/2.0 backpressure column (6.1015.100) is installed between the pulsation absorber and the reactor,
    or
  - a peristaltic pump,
    or
  - a Dosino.

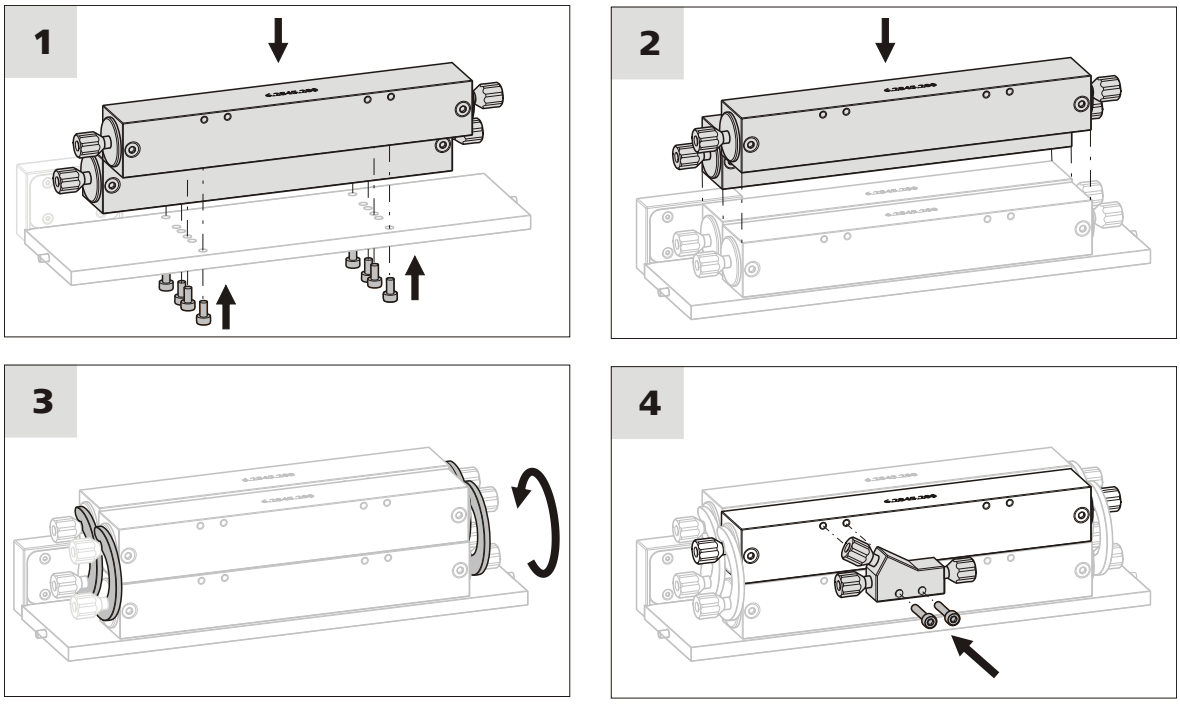
The reaction capillary inside the reactor is 2 m long and has a volume of 393 µL. This is sufficient for most applications. Should an application require a longer reaction time, or if the 943 Professional Thermostat/Reactor Vario is used in a two-channel IC system, the reactor plate can be equipped with additional reactors (6.2845.200). A maximum of four reactors can be mounted on the reactor plate.

To mount additional reactors, proceed as follows:

Optional: attaching additional reactors

To attach additional reactors, you need the following accessories:

- Reactor, complete (6.2845.200)
- 2.5 mm hex key (6.2621.140)



1 Attaching two reactors

The originally mounted reactor is attached to the reactor plate with four screws turned in from the bottom of the plate.

- Remove the four screws using the 2.5 mm hex key.
- Reattach the reactor at the back edge of the reactor plate.
- Attach a second reactor from the accessory set (6.2845.200) at the front edge of the reactor plate using the included screws and the 2.5 mm hex key.

2 Attaching additional reactors

- Place two additional reactors on top of the other two.

3 Fastening the reactors

- Fasten each reactor on both sides to the reactor below using the included clips.

4 Mounting the Y connector

Y connectors (6.2744.330) are used to add the reagent. These are supplied with each reactor (6.2845.200). You can attach several Y connectors to the reactor block.

- Attach the Y connectors to the reactor using the included screws.

3.6.2 Professional Thermostat Vario (2.943.0210)

If the 943 Professional Thermostat/Reactor Vario is equipped with a column plate (6.2845.600), the 943 Professional Thermostat/Reactor Vario fulfills the function of a column thermostat.

The easiest way to connect capillaries is outside the oven.

All capillaries must be fed into or out of the oven through the capillary feed-throughs on the left and right side of the oven door.

If you have placed the 943 Professional Thermostat/Reactor Vario under or next to the IC instrument, proceed as follows:

1. Feed the capillaries into the oven.
2. Connect the capillaries to the columns.
3. Insert the column plate.

Start with *"Feeding capillaries into the oven", page 23*.

If you have placed the 943 Professional Thermostat/Reactor Vario on top of the IC instrument, proceed as follows:

1. Connect the capillaries to the columns.
2. Insert the column plate.
3. Feed the capillaries out of the oven.

Start with *"Connecting the capillaries", page 23*.

NOTE

In order to keep the dead volume as low as possible, make sure that capillary connections are as short as possible.

Always shorten capillaries with the capillary cutter (6.2621.080) to obtain smooth, evenly cut capillary ends.

Feeding capillaries into the oven

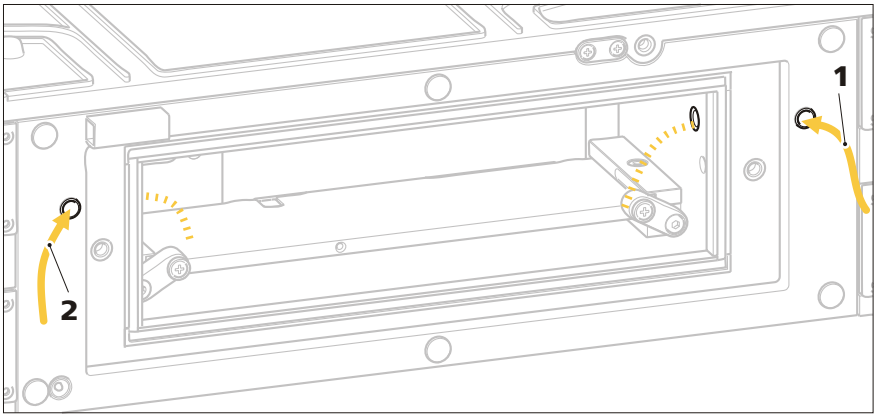


Figure 17 Feeding capillaries into the oven – thermostat

1 Column input capillary	**2 Column output capillary**

1 Feeding capillaries into the oven

- Guide the column input capillary and the column output capillary through the two capillary feed-throughs at the left and right side of the oven door.

Two columns, each with a maximum length of 150 mm, fit in the column block. If one of the two columns is an iColumn, the system automatically ensures that the oven is not heated above the maximum operating temperature of the column saved on the chip. However, columns without a chip may be used; you have to set the maximum oven temperature manually in that case.

The second bore hole of the column block can also hold additional columns and/or guard columns with a total length of 150 mm. For applications requiring a 250 mm column, you can combine a 150 mm iColumn with a 100 mm column that supports attaching a guard column. The following figure illustrates how the preheating capillary and the columns are connected.

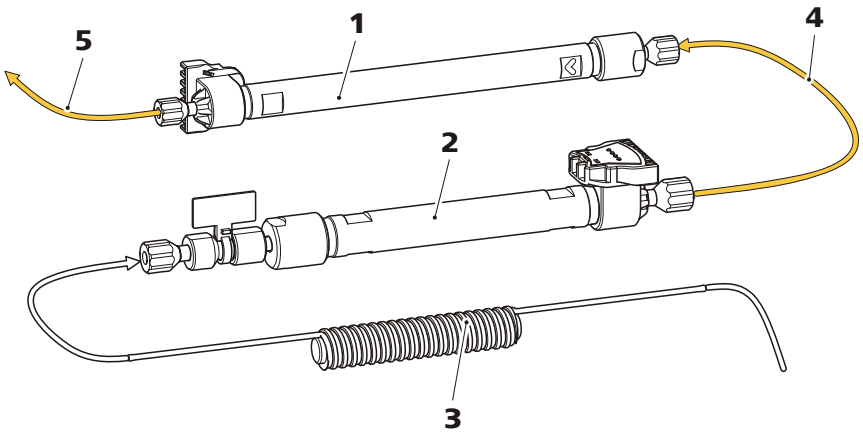


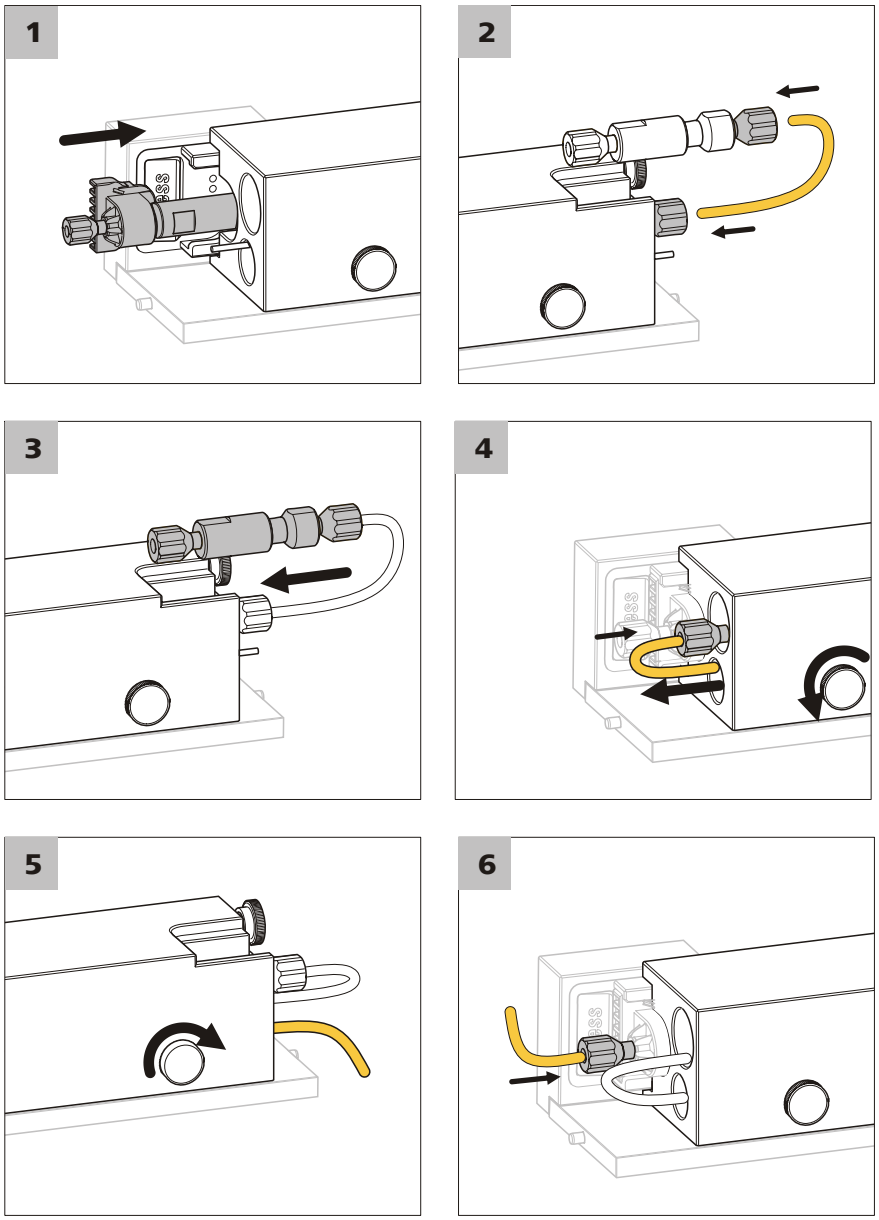
Figure 18 Connecting the columns

1	**Main column** iColumn clicked into the column holder. Maximum length: 150 mm.
2	**Auxiliary column** Either a second column (of 100 mm length) with attached guard column or just a guard column.
3	**Preheating capillary** Part of the accessories (6.2845.600).
4	**Capillary** Connection between main column and auxiliary column.
5	**Capillary** Connection between main column and detector.

Connecting and inserting columns

To install the columns, you need:

- Main column: an intelligent separation column (iColumn) with a maximum length of 150 mm (e.g. Metrosep A Supp 15 - 150/4.0)
- Auxiliary column: a guard column compatible with the main column (e.g. Metrosep A Supp 15 S-Guard/4.0) or
  A second column compatible with the main column (e.g. Metrosep A Supp 15 - 100/4.0) with attached guard column (Metrosep A Supp 15 Guard/4.0)
- Sections of the included capillary (6.1831.100)
- A capillary cutter (6.2621.080)



1 Inserting the main column

- Slide the main column into the rear lower bore hole of the column block.
- Click the head of the column into the column holder at the contact block.

2 Connecting the auxiliary column

- Connect the input of the main column with the output of the guard column. Use the connection capillary included with the guard column.

- If you want to use a second column with an attached guard column, use a section of the capillary (6.1831.100) to connect the two columns.

3 Inserting the auxiliary column

- Slide the auxiliary column into the upper bore hole of the column block.

4 Connecting the preheating capillary

The preheating capillary *(18-**3**)* is inserted in the lower bore hole of the column block and secured from sliding out with two knurled screws situated at the front of the column block.

- Before connecting the preheating capillary, loosen these knurled screws and pull the preheating capillary out of the bore hole.
- Connect the preheating capillary and the input of the auxiliary column.

5 Inserting the preheating capillary

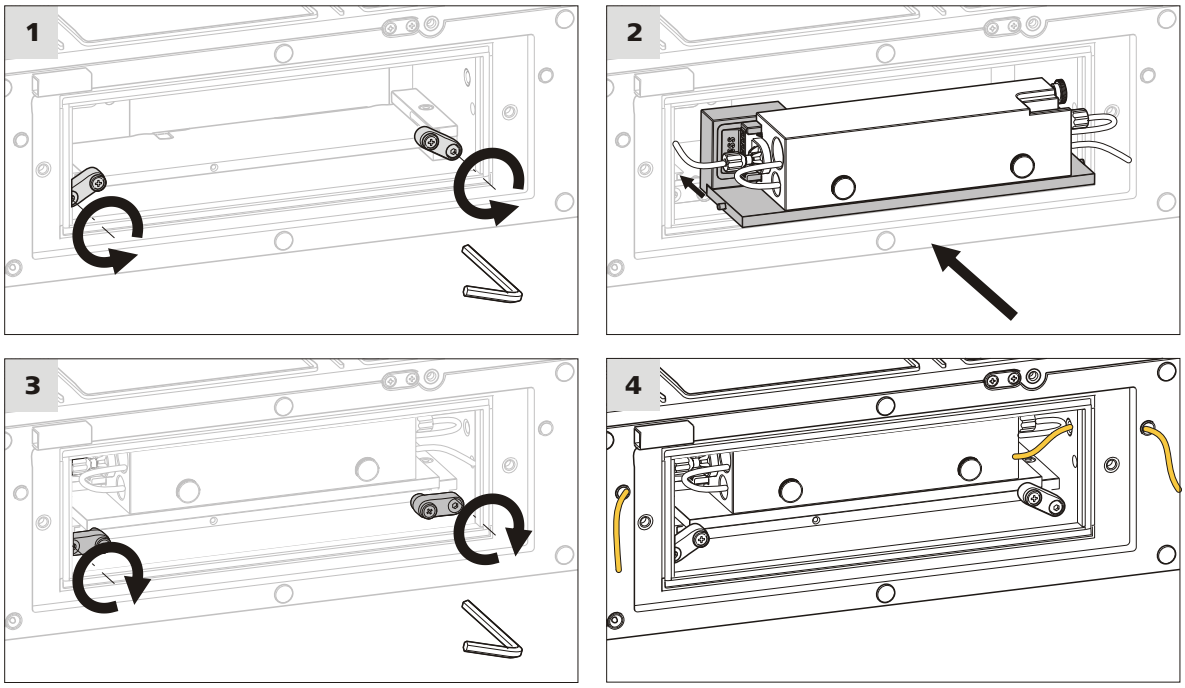
- Slide the preheating capillary back into its bore hole.
- Use the two knurled screws to secure it from sliding out.

6 Connecting the column output capillary

- Attach a section of the capillary (6.1831.100) *(18-**5**)* to the outlet of the column.

Inserting the column plate

To insert the column plate, you need a 2.5 mm hex key (6.2621.140).



1 Lowering the latches

Loosen the outer screws of both latches with the 2.5 mm hex key (6.2621.140) by turning them counterclockwise.

The latches open and unlock the insertion rails of the heating plate.

2 Inserting the column plate

- Insert the column plate into the oven by fitting the two bolts at the sides of the column plate into the insertion rails of the heating plate.
- Slide the column plate into the oven as far as it will go. Take care not to jam or pinch the capillaries.

3 Lifting the latches

Tighten the outer screws of both latches with the 2.5 mm hex key (6.2621.140) by turning them clockwise.

The latches lift and fix the column holder on the heating plate.

4 Connecting the capillaries to the system

In case the free capillary ends are not yet guided through the capillary feed-throughs, guide them out of the oven.

- Connect the free end of the preheating capillary with the injection valve.

- Connect the free end of the column output capillary with the detector.

3.7 Connecting the device

3.7.1 Connecting the instrument to a computer

NOTE

The instrument must be switched off when being connected to a computer.

Accessories

For this step, you need the following accessories:

- USB connecting cable (6.2151.020)

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.

3.7.2 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. 0.75 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 Start-up

The 943 Professional Thermostat/Reactor Vario is put into operation together with other instruments such as a 940 Professional IC Vario and the 944 Professional UV/VIS Detector Vario.

Putting the 943 Professional Thermostat/Reactor Vario into operation

1 Start MagIC Net.

2 Connect the 943 Professional Thermostat/Reactor Vario to the computer and switch it on.

The 943 Professional Thermostat/Reactor Vario is recognized automatically by MagIC Net.

5 Operation

The instrument is operated via MagIC Net software only. Additional information on operating MagIC Net can be found in the document *"MagIC Net Tutorial"* or in the software's online help.

6 Operation and maintenance

6.1 Care

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

The instrument must be cleaned immediately if chemicals or solvents are spilled on it. In particular, the plug connections (particularly the power plug) must be protected against contamination.

CAUTION

The instrument has been designed so that liquid is largely prevented from being able to get inside the instrument. However, unplug the power plug immediately if you suspect that corrosive media have gotten inside the instrument. This is the only way to prevent extreme damage to the device electronics. Notify Metrohm Service.

WARNING

Untrained personnel may not open the device's housing.

6.2 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. Regional Metrohm service representatives offer every form of technical advice for maintenance and service of all Metrohm devices.

6.3 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 or moving it.

7 Troubleshooting

7.1 Problems and their solutions

Problem	Cause	Remedy
The baseline is drifting.	*Thermal equilibrium is not yet attained.*	Condition the instrument with the oven switched on.
The baseline is not steady.	*There is a leak in the oven.*	Carefully open the oven door, check the capillary connections and tighten the pressure screws more.

8 Technical specifications

8.1 Reference conditions

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

Ambient temperature	+25 °C (±3 °C)
Device status	> 40 min in operation

8.2 Instrument

IC system	Metal-free system for use as a thermostat for intelligent reactors and intelligent columns.
Intelligent components	iColumns, iReactors
Connectors for external components	▪ up to three Extension Module units for transporting the reagent solution ▪ up to two Dosino units ▪ Analog data output (optional)

8.3 Leak sensor

Type	electronic, no calibration necessary

8.4 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

8.5 Housing

Dimensions	
Width	365 mm
Height	131 mm
Depth	380 mm
Base tray, housing and cover plate material	Polyurethane hard foam (PUR) with flame retardation, UL 94 V-0, CFC-free, coated
Controls	
Indicators	LED for standby indicator
On/off switch	On the rear of the instrument

8.6 Weight

2.943.0110	10.07 kg
2.943.0210	10.36 kg
Device without accessories	7.7 kg

8.7 Reactor / Column thermostat

Number of reactors	up to 4
Number of columns	up to 2
Temperature range	0 to +150 °C, adjustable in 0.1 °C increments
Maximum temperature	
With column plate	80 °C
With reactor	120 °C
With HT reactor	150 °C
Stability	less than 0.05 °C deviation
Reproducibility	better than ± 0.2 °C
Temperature accuracy	< 1 °C (typical)

Heating time	< 10 min from 20 °C to 40 °C
Maximum pressure	
Reactor	2 MPa
Heating type	Resistor type thermostat for intelligent reactors and intelligent separation columns
Safety shutdown	
Function	Automatic switch off when maximum temperature is exceeded
Maximum temperature	nominal 169 °C, response time: immediately

8.8 Energy supply

Nominal voltage range	100–240 V (± 10%)
Nominal frequency range	50–60 Hz (± 3%)
Power consumption	40 W during typical analysis application 15 W standby (Ready)
Power supply unit	▪ up to 300 W maximum, electronically monitored ▪ internal fuse 3.15 A

8.9 Interfaces

USB	
Inlet	1 plug, type B (for connecting to a computer)
Outlet	2 plugs type A
MSB	
Number	2 Mini DIN plugs, 8-pin (female) for Dosino, stirrer, remote lines, etc.
Column recognition	for an intelligent reactor or an intelligent column
Leak sensor	1 jack plug
Further connections	
Extension Module	1 15-pin DSUB (female)

Analog output (optional)	1 15-pin DSUB (female)
Service	1 15-pin high-density DSUB (female)

9 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. **2.943.0110 / 2.943.0210**) 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.

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