886 Professional Thermostat/Reactor

Manual

8.886.8002EN

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2.886.0110 / 2.866.0210

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Although all the information given in this documentation has been checked with great care, errors cannot be entirely excluded. Should you notice any mistakes please send us your comments using the address given above.

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

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1 Introduction

1.1 Instrument description

The **886 Professional Thermostat / Reactor** is an instrument of the Metrohm Professional line of instruments, which was conceived to be used for two different functions.

The main function of the 886 Professional Thermostat / Reactor is detection preparation in an IC system with photometric detection. In IC systems with photometric detection, a post-column derivatization (PCR) is required for most applications. An IC system with photometric detection consists of an 850 Professional IC instrument, the 886 Professional Thermostat / Reactor, and the 887 Professional UV/VIS Detector. Additionally, 872 extension modules can be used to transfer reagent solutions and/or for sample preparation.

The second function of the 886 Professional Thermostat / Reactor is that of a column thermostat. A 872 Extension Module – IC Module together with an 886 Professional Thermostat / Reactor provide all the functions of an IC instrument. By adding a suitable detector, an isocratic analytical system can be built without a dedicated IC instrument.

The 886 Professional Thermostat / Reactor is available in two model versions each with different set of accessories, to support each function:

- **2.886.0110 Professiopost columnnal Reactor**
  For the use as a pre-column or post-column reactor. 886 Professional Thermostat / Reactor with accessory set 6.2845.100 consisting of a reactor plate with one reactor. For sophisticated applications, the reactor plate can be equipped with up to four reactors.
- **2.886.0210 Professional Thermostat**
  For the use as a column thermostat: 886 Professional Thermostat / Reactor with accessories set 6.2845.600 consisting of a column plate with a fitted column block for two separation columns and a preheating capillary.

These accessories sets can be inserted into the the oven of the 886 Professional Thermostat / Reactor, which can be heated up to 150 °C as a maximum.

The oven of the 886 Professional Thermostat / Reactor can be heated up to maximum 150 °C if it is empty. With the accessories for the Professional Reactor (6.2845.100) inserted, the maximum temperature is 120 °C; with the accessories for the Professional Thermostat (6.2845.600) inserted, 80 °C.

The 886 Professional Thermostat / Reactor is operated with **MagIC Net** software. It is connected via a USB cable to a PC on which MagIC Net is installed. The software automatically recognizes the instrument and checks its functional readiness. MagIC Net controls and monitors the instrument, and documents heating power and reagent flow rates in a database.

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

1.2 Intended use

The main function of the 886 Professional Thermostat / Reactor 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 instrument is suitable for processing chemicals and flammable samples. The usage of the 886 Professional Thermostat / Reactor therefore requires that the user has basic knowledge and experience in the handling of toxic and caustic substances. Knowledge with respect to the application of the fire prevention measures prescribed for laboratories is also mandatory.

1.3 About the documentation

This manual describes both model versions of the 886 Professional Thermostat / Reactor. Chapters which are valid for both model versions are not especially marked. Chapters, however, which are only valid for one of the model versions are marked in the title with the number and name of the corresponding model version (e.g. "Installing the 2.886.0110 Professional Reactor" or "Installing the 2.886.0210 Professional Thermostat").

Caution

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

1.4 Symbols and conventions

The following symbols and styles are used in this documentation:

*(5-**12**)*	**Cross-reference to figure legend** The first number refers to the figure number, the second to the instrument part in the figure.
1	**Instruction step** Carry out these steps in the sequence shown.
	**Warning** This symbol draws attention to a possible life hazard or risk of injury.
	**Warning** This symbol draws attention to a possible hazard due to electrical current.
	**Warning** This symbol draws attention to a possible hazard due to heat or hot instrument parts.
	**Warning** This symbol draws attention to a possible biological hazard.
	**Caution** This symbol draws attention to a possible damage of instruments or instrument parts.
	**Note** This symbol marks additional information and tips.

1.5 Safety instructions

1.5.1 General notes on safety

Warning

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

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

1.5.2 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.

Mains voltage

Warning

An incorrect mains voltage can damage the instrument.

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

Protection against electrostatic charges

Warning

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

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

1.5.3 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.

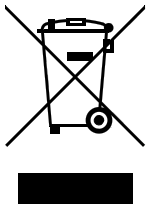
1.5.4 Flammable solvents and chemicals

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. laboratory flue).
- Keep all sources of flame far from the workplace.
- Clean up spilled fluids and solids immediately.
- Follow the safety instructions of the chemical manufacturer.

1.5.5 Recycling and disposal



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

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

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

2 Overview of the instrument

2.1 Front

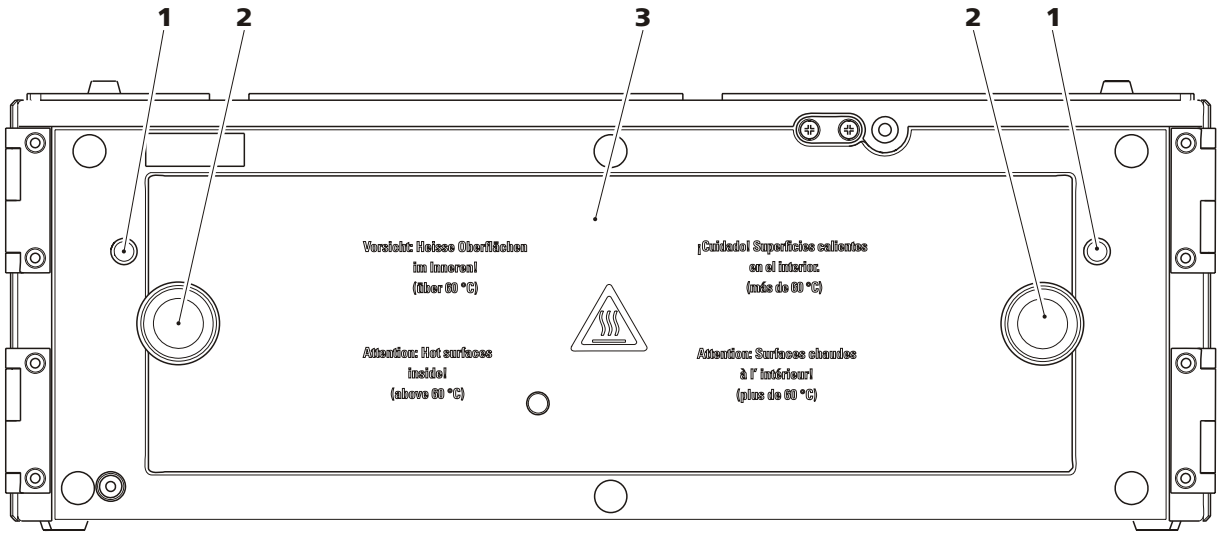


Figure 1 Front

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

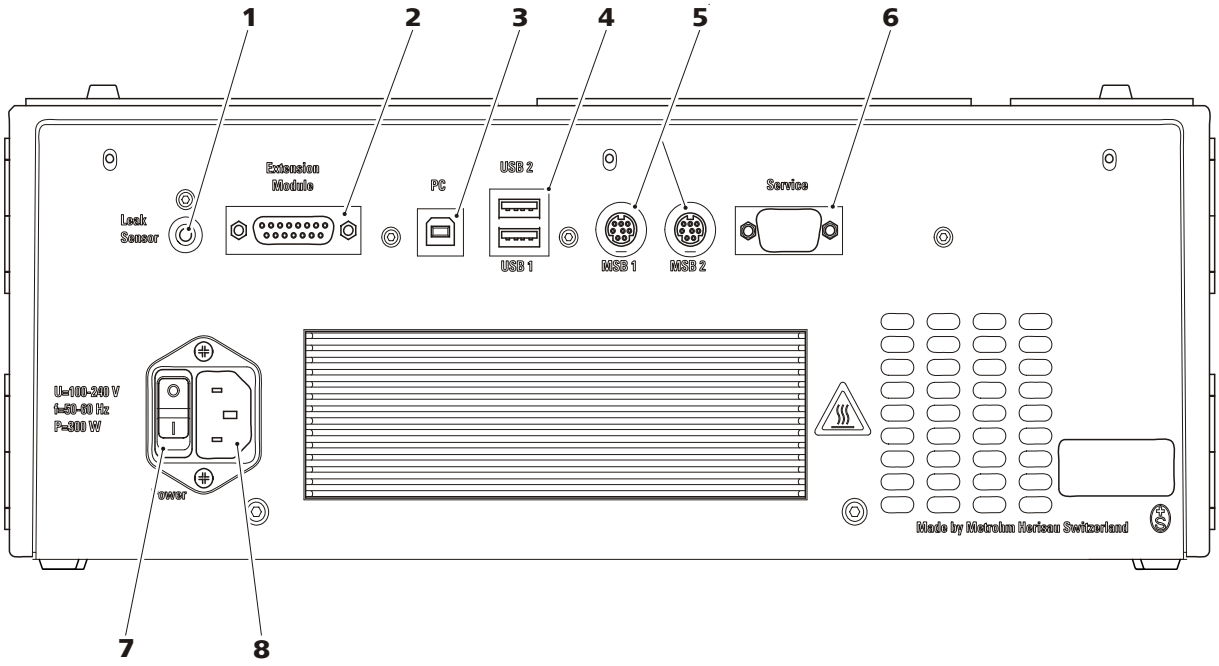


Figure 2 Rear

1 **Leak sensor connection socket** For connecting the leak sensor.	**2** **Extension Module connection socket** To connect 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 with *USB 1* and *USB 2*).
5 **MSB connection sockets** 2 MSB connection sockets (labeled with *MSB 1* and *MSB 2*) for connecting MSB devices. MSB = Metrohm Serial Bus	**6** **Service connection socket** Connector for service.
7 **Mains switch** For switching the instrument on and off. I = On O = Off	**8** **Mains connection socket** For plugging in the mains cable.

2.3 Accessories for 2.886.0110 Professional Reactor

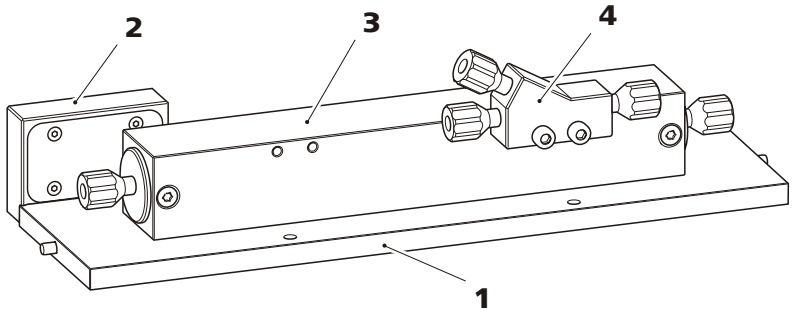


Figure 3 6.2845.100 Reactor plate

1 Heating plate	**2 Contact block** Connection between reactor plate and 886.
3 Reactor (6.2845.200)	**4 Y connector (6.2744.330)**

2.4 Accessories for 2.886.0210 Professional Thermostat

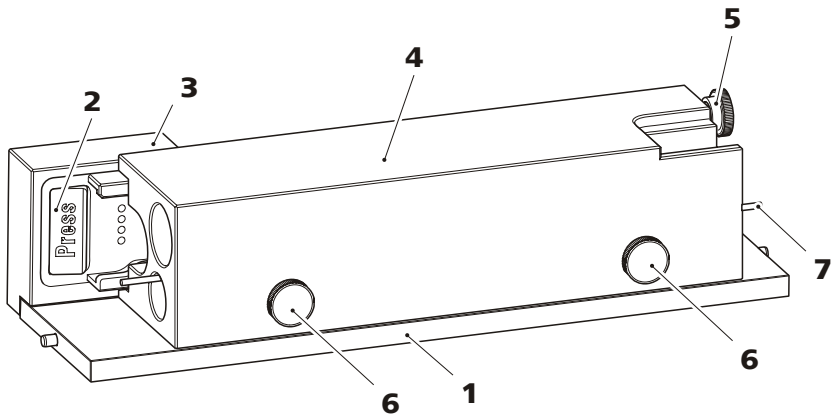


Figure 4 6.2845.600 Column plate

1 Heating plate	**2 Column holder** With column recognition chip.
3 Contact block Connection between column plate and 886.	**4 Column block** With bore holes for maximum two columns of 150 mm length and a preheating capillary.
5 Knurled screw For fixing the column.	**6 Knurled screw** For fixing the preheating capillary.
7 Preheating capillary	

3 Installation

3.1 Setting up the instrument

3.1.1 Packaging

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

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 Location

The instrument has been developed for operation indoors and may not be used in explosive environments.

Place the instrument in a location of the laboratory which is suitable for operation, free of vibrations, protected from corrosive atmosphere, and contamination by chemicals.

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

3.2 Proposed setup

3.2.1 2.886.0110 Professional Reactor

An IC system with photometric detection and pre-column or post-column derivatization consists of the 886 Professional Thermostat / Reactor and:

- any 850 Professional IC instrument, or
  any 881 Compact IC pro instrument, or
  any 882 Compact IC plus instrument
- the 887 Professional UV/VIS Detector
- optionally: an 872 Extension Module 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 pre-column or post-column derivatization can be set up in in various combinations.

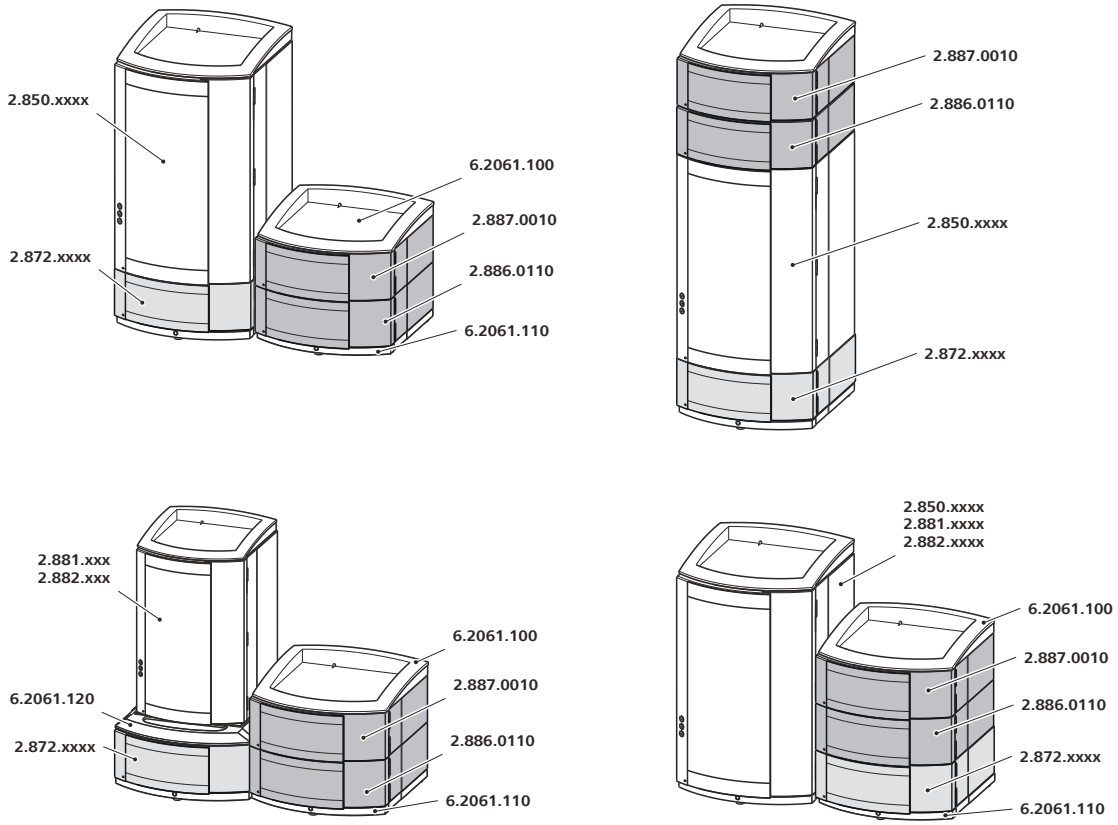


Figure 5 Proposed Setup – Professional Reactor

Note for proposed setup

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

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

If you want to stack a 881 Compact IC pro or an 882 Compact IC plus instrument with a 886 Professional Thermostat / Reactor, the 887 Professional UV/VIS Detector and/or a 872 Extension Module, you will require the 6.2061.120 System Connector to adapt the different support surfaces.

3.2.2 2.886.0210 Professional Thermostat

In order to build an isocratic IC analysis system without a dedicated IC instrument (850, 881, 882), you will require the 886 Professional Thermostat / Reactor and the following instruments:

- a 2.872.0030 Extension Module – IC Module
- any detector (e.g. the 2.887.0010 Professional UV/VIS Detector)
- optionally an additional 872 Extension Module for sample preparation

For an isocratic IC analysis system with photometric detection (without dedicated IC instrument) we recommend the following set up:

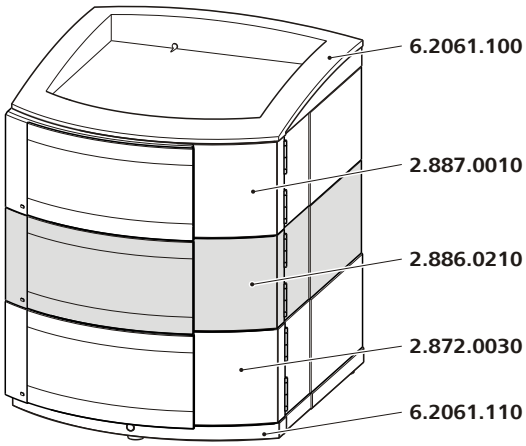


Figure 6 Proposed setup – Professional Thermostat

3.3 Mounting base tray and bottle holder (optional)

The 6.2061.110 base tray and 6.2061.100 bottle holder protect IC instruments from dust, dirt and leaking fluids. If more than one instrument of the Professional IC family is used, these can be set up in one or more stacks. We recommend that a bottle holder and a base tray be mounted on/below each stack of instruments.

Bottle holder and base tray must be removed or mounted every time one of the following instruments is mounted on or under an 850 Professional IC instrument:

- One or more 872 Extension Module.
- An 886 Professional Thermostat / Reactor.
- An 887 Professional UV/VIS Detector.
- or another instrument of the same support surface.

3.3.1 Removing / mounting the base tray

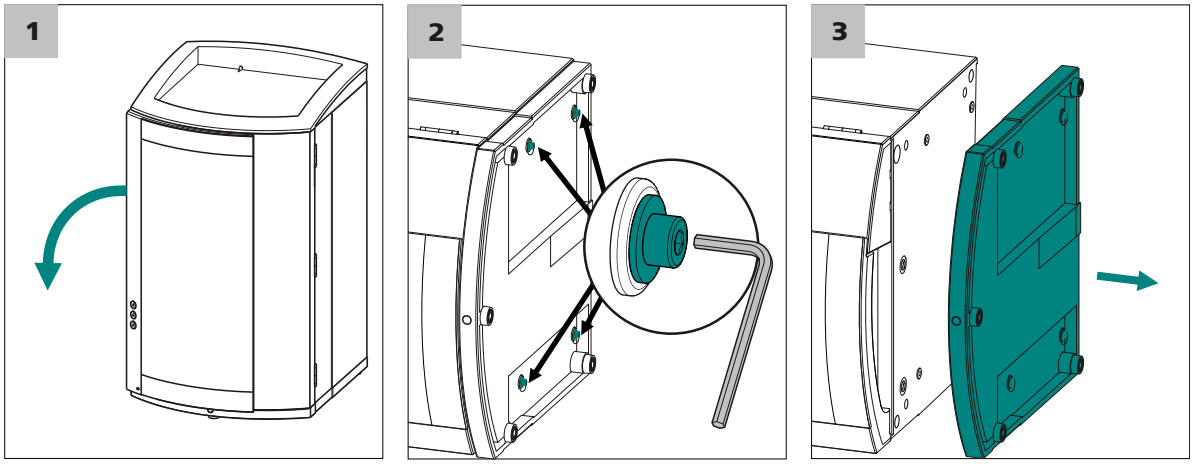
The base tray must be removed, in case you want to place another instrument under the IC instrument. Proceed as follows:

Removing the base tray

Before you can remove the base tray, the following preconditions must be met:

- The instrument is switched off.
- The bottle holder is cleared.
- All connections at the rear of the instrument are disconnected.
- There are no loose parts in the instrument.

To remove the base tray, you need the 6.2621.100 hexagon key 3 mm.



1 Tilt the instrument sideways and lay it down flat.

2 Loosen the cylinder screws with the 3 mm hexagon key and remove them and their washers.

3 Remove base tray.

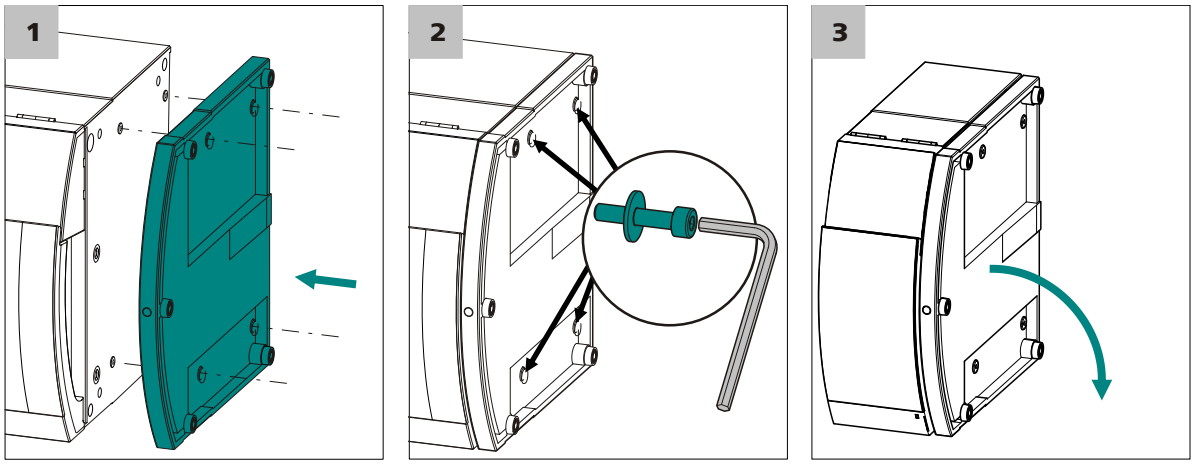
The base tray must always be mounted under the lowermost instrument of the stack. Proceed as follows:

Mounting the base tray

Before you can mount the base tray, the following preconditions must be met:

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

To mount the base tray, you need the 3 mm hexagon key (6.2621.100).



1 Attach the base tray so that the openings in the base tray match exactly the screw threads in the bottom of the instrument.

2 Slide the four washers onto the four cylinder screws, insert the screws and tighten them with the 3 mm hexagon key.

3 Set the instrument up on the base tray.

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

3.3.2 Removing / mounting the bottle holder

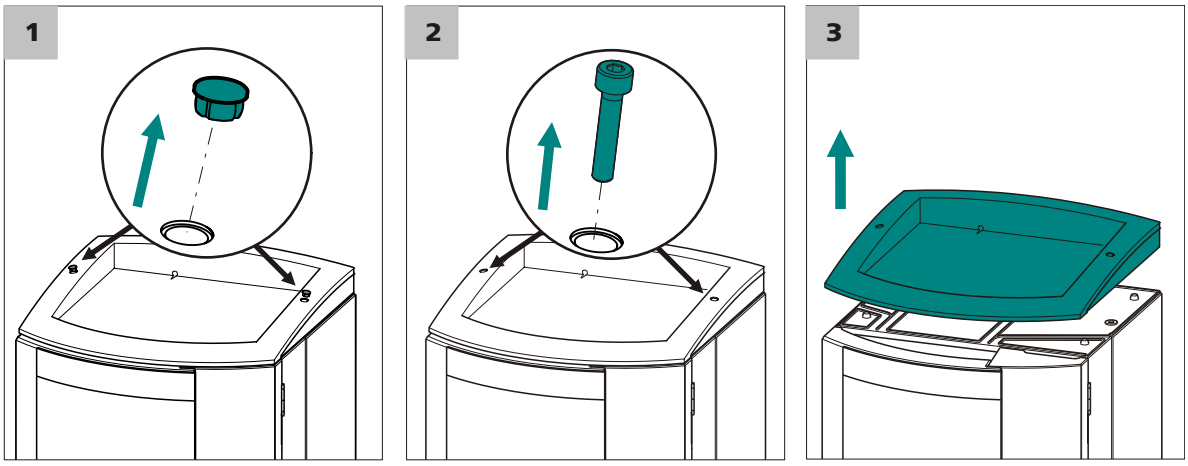
The bottle holder must be removed in case you want to mount another instrument on top of the IC instrument. Proceed as follows:

Removing the bottle holder

Before you can remove the bottle holder, the following preconditions must be met:

- The instrument is switched off.
- The bottle holder is cleared.
- Drainage tubing is disconnected from the drainage tubing connection of the bottle holder.

To remove the bottle holder, you need a 3 mm hexagon key (6.2621.100).



1 Remove the two covering stoppers.

2 Loosen the two cylinder screws with the 3 mm hexagon key and remove them.

3 Remove the bottle holder.

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

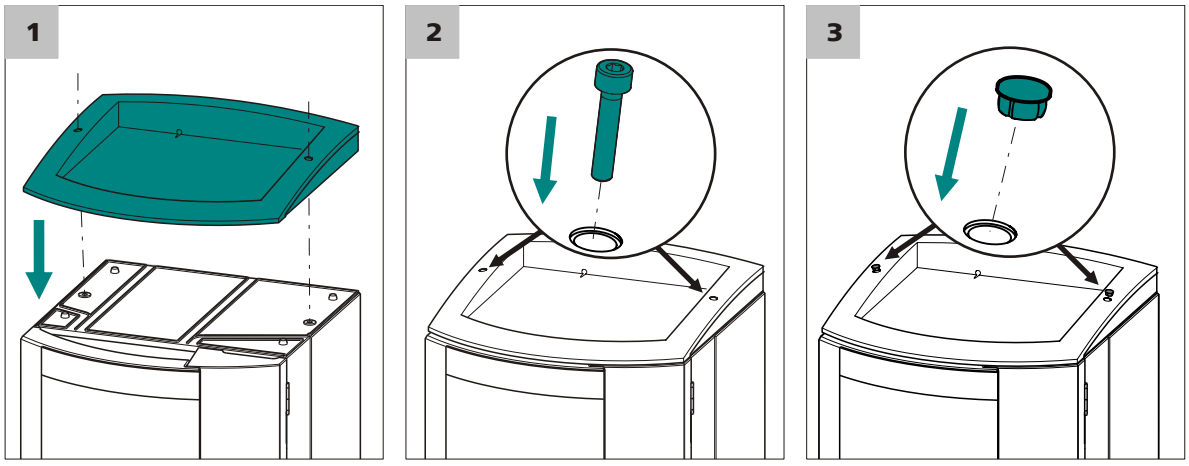
Proceed as follows:

Mounting the bottle holder

Before you can mount the bottle holder, the following preconditions must be met:

- The instrument is switched off.

To mount the bottle holder, you need a 6.2621.100 hexagon key 3 mm.



1 Attach the bottle holder onto the topmost instrument so that the openings in the bottle holder exactly match the screw threads on the top surface of the instrument.

2 Insert the two cylinder screws and tighten them with the 3 mm hexagon key.

3 Insert covering stoppers .

After having attached the bottle holder, all connections which were undone at the beginning of the process, must be reconnected. Proceed as follows:

Restoring the loosened connections

1 Connect the USB cable.

2 Connect the MSB cable.

3 Plug in the mains cable.

4 Reconnect drainage tubings *(see manual of the IC instrument)*.

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

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)*.

3.4 Capillary connections in the IC system

This chapter contains general information concerning the capillary connections in the IC instruments and systems.

Generally speaking, capillary connections between two components of an IC system are made up of one connection capillary and two pressure screws with which the capillary is connected to the respective components.

Pressure screws

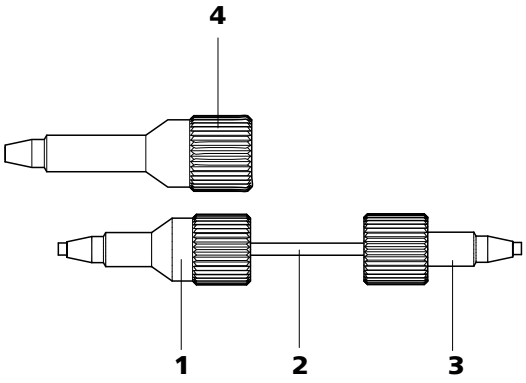


Figure 7 Connection of capillaries with pressure screws

1 **PEEK pressure screw (6.2744.014)** Use on the injection valve.	**2** **Connection capillary**
3 **PEEK pressure screw, short (6.2744.070)** For use on the high pressure pump, the purge valve, the inline filter, the pulsation absorber, the guard column and the separation column.	**4** **PEEK pressure screw, long (6.2744.090)** Use on special components. Is not used on all instruments.

Note

In order to keep the dead volume as low as possible, capillary connections should generally be as short as possible.

Note

For an improved overview, capillary and tubing connections can be bundled with the 6.1815.010 spiral band.

Connection capillaries

PEEK capillaries and PTFE capillaries are used in the IC system.

PEEK capillaries (polyetheretherketone)

PEEK capillaries are temperature-resistant up to 100°C, stable under pressure up to 400 bar, flexible, chemically inert and exhibit an extremely smooth surface. They can be readily cut down to the desired length with the 6.2621.080 capillary cutter.

Usage:

- PEEK capillaries (6.1831.010) with an internal diameter of 0.25 mm for the entire high pressure range.
- PEEK capillaries (6.1831.030) with an internal diameter of 0.75 mm for sample handling in the ultra trace range.

PTFE capillaries (polytetrafluoroethylene)

PTFE capillaries are transparent and enable visual tracing of the liquids to be pumped. They are chemically inert, flexible and temperature-resistant up to 80°C.

Usage:

PTFE capillaries (6.1803.0x0) are used for the low pressure range.

- PTFE capillaries with internal diameter of 0.5 mm for sample handling.
- PTFE capillaries with internal diameter of 0.97 mm for sample handling as well as for rinsing solutions (they do not have to be in the scope of delivery of the instrument).

Capillary connections

In order to achieve optimum analysis results, capillary connections in an IC system must be absolutely tight and free of dead volume. Dead volume occurs if two capillary ends connected to each other do not fit exactly, thus allowing liquid to escape. There are two possible reasons for this:

- The capillaries do not have exactly cut edges.
- The two capillary ends do not completely meet.

One prerequisite for dead volume free capillary connection is, that both capillary ends are cut exactly plane. Therefore we recommend only to cut PEEK capillaries with the capillary cutter (6.2621.080).

Creating dead volume free capillary connections

To create dead volume free capillary connections, proceed as follows:

1. Slide the pressure screw over the capillary. Ensure that the capillary protrudes 1–2 mm from the tip of the pressure screw.

2 Plug the capillary all the way into the connection or coupling until the stop.

3 Only then start turning the pressure screw, while keeping the capillary pressed in space.

Colored sleeves for PEEK capillaries

The enclosed set of varicolored sleeves for PEEK capillaries (6.2251.000) serves to easily differentiate the various flows of liquid in the system through color coding. Each capillary leading a given liquid (e. g. eluent) can be highlighted with sleeves of the same color.

To highlight a capillary, proceed as follows:

1 Slide a sleeve of a selected color over a capillary an move it to an easily visible position.

If the capillary heats up, the sleeve shrinks and adapts to the form of the capillary.

3.5 Installations on the rear of the instrument

3.5.1 Connecting the leak sensor

The leak sensor detects escaping liquid which collects in the base tray of the instrument.

To activate the leak sensor, the leak sensor connector plug *(8-**2**)* must be connected, the instrument switched on and the leak sensor switched to **active** in the software.

Connecting the leak sensor

1
- Pull the cable of the leak sensor *(8-**3**)* out of the rear of the base tray.
- Plug the leak sensor connector plug *(8-**2**)* into the leak sensor connection socket *(8-**1**)* on the rear of the instrument.

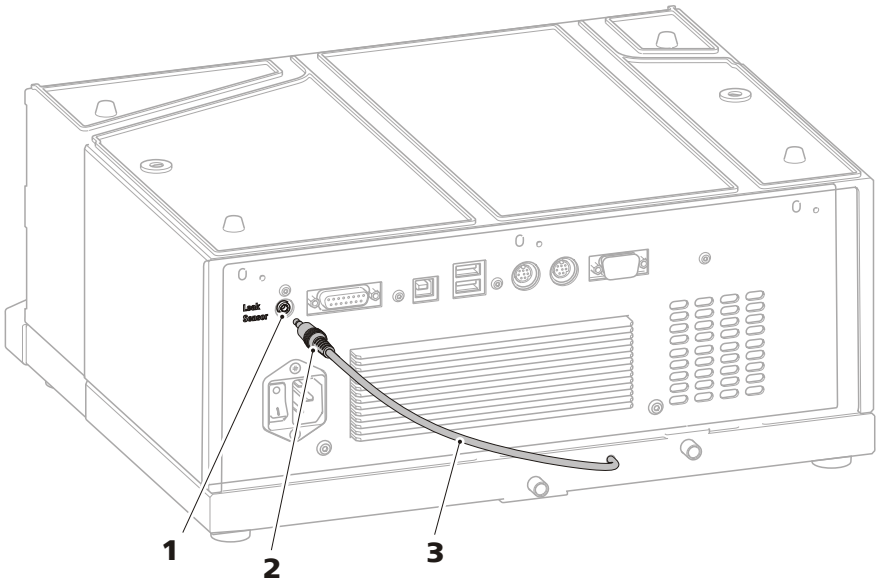


Figure 8 Connecting the leak sensor

1 **Leak sensor connection socket** Is labeled with "Leak Sensor".	**2** **Leak sensor connector plug**
3 **Leak sensor connection cable** Is firmly mounted on the rear of the instrument.	

3.6 Capillary and cable feed-throughs

Several openings have been integrated for feeding through capillaries and cables. To feed through capillaries into the oven, two openings are provided, one each left and right of the oven door. Up to five capillaries can be fed into the oven through each of the two capillary feed-throughs.

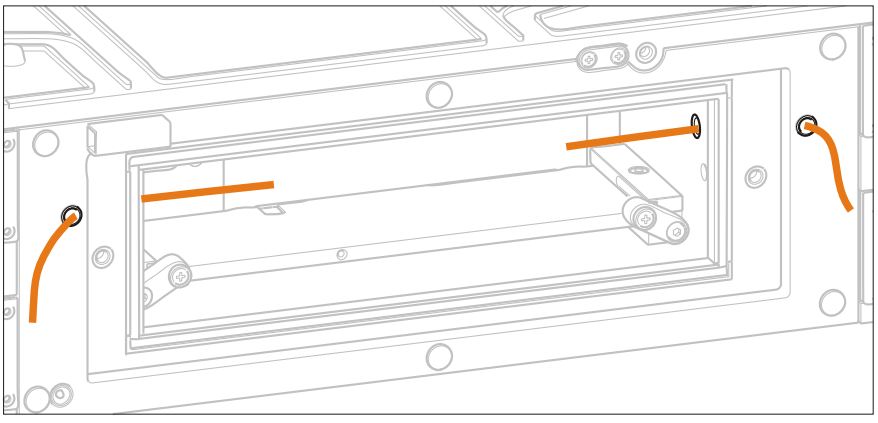


Figure 9 Capillary feed-throughs – oven

To guide capillaries to or away from the instrument or to guide them between two instruments, use the capillary feed-throughs on top or at the

bottom of the instrument. These are designed to guide capillaries between two instruments or between instrument an base plate or instrument an bottle holder.

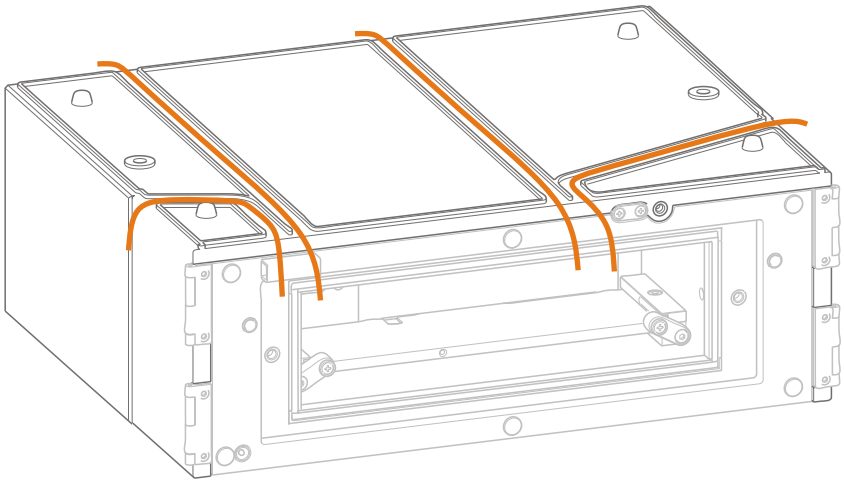


Figure 10 Capillary feed-throughs – instrument

3.7 Opening / closing oven door

The heatable interior of the 886 Professional Thermostat / Reactor is closed with a well isolating oven door. In order to insert the required accessories into the oven, the oven door must be opened. 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 oven door carefully. Place oven door on a fire resistant surface.

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

2 Place oven door on a fire resistant surface.

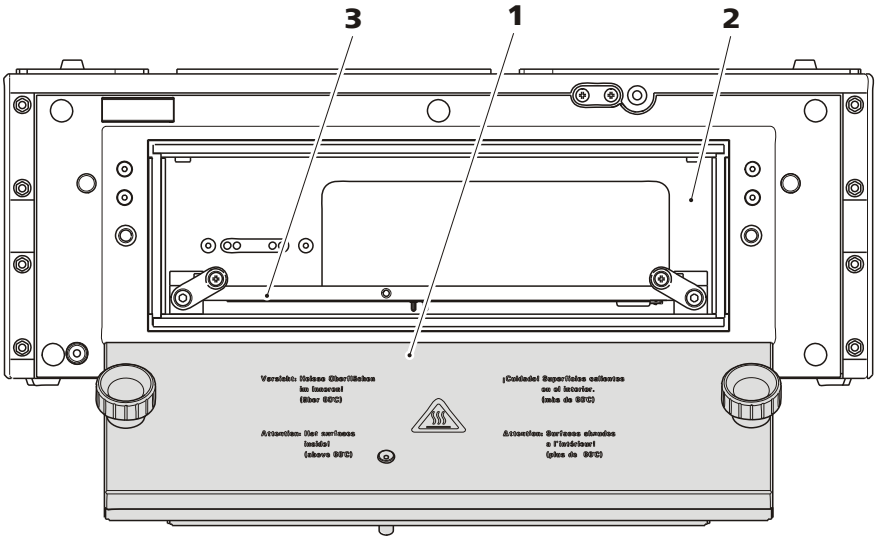


Figure 11 Front – open

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 oven door

1. Place oven door onto opening. Make sure that no capillaries are pinched.

2. Tighten both knurled screws at the front of the oven by hand.

3.8 Installing accessories

3.8.1 2.886.0110 Professional Reactor

Equipped with the 6.2845.100 reactor plate, the 886 Professional Thermostat / Reactor provides the functionality of a pre- 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 at the right and left side of the oven door *(see Figure 9, page 20)*.

If you have placed the 886 Professional Thermostat / Reactor under or next to the IC instrument, proceed as follows:

1. Feeding capillaries into the oven

2. Connect capillaries to the reactor
3. Insert reactor plate

Start with *"Feeding capillaries into the oven", page 24*.

If you have placed the 886 Professional Thermostat / Reactor on top of the IC instrument, proceed as follows:

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

Start with *"Connect the capillaries", page 24*

To deliver the reagent, you need either an additional high pressure pump or an additional peristaltic pump. If you deliver the reagent with a high pressure pump, you must install the 6.1015.100 Metrosep BP 1 Guard/2.0 backpressure column 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 6.2621.080 capillary cutter to obtain flawless level cut capillary ends.

Feeding capillaries into the oven

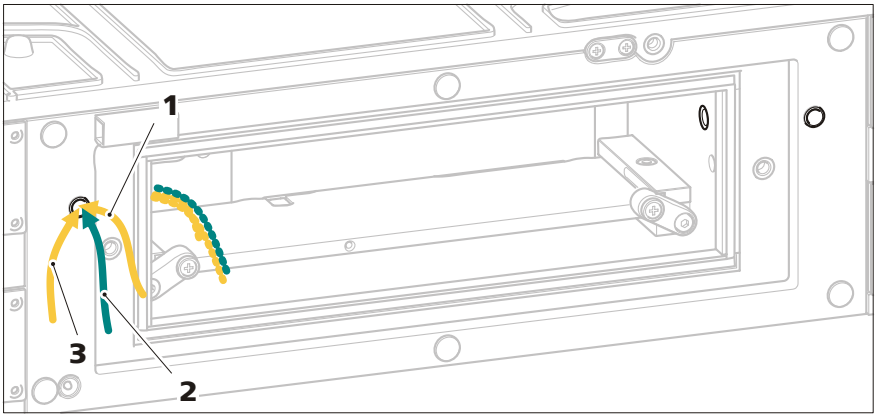


Figure 12 Feeding capillaries into the oven – reactor

1 Reactor inlet capillary	**2** Reagent inlet capillary
3 Reactor outlet capillary	

1 Feed capillaries into the oven

- Guide the reactor inlet capillary, the reagent inlet capillary (section of 6.1831.100), and the reactor outlet capillary through the two capillary feed-throughs on the right and left side of the oven door *(see Figure 9, page 20)* into the oven.

Connect the capillaries

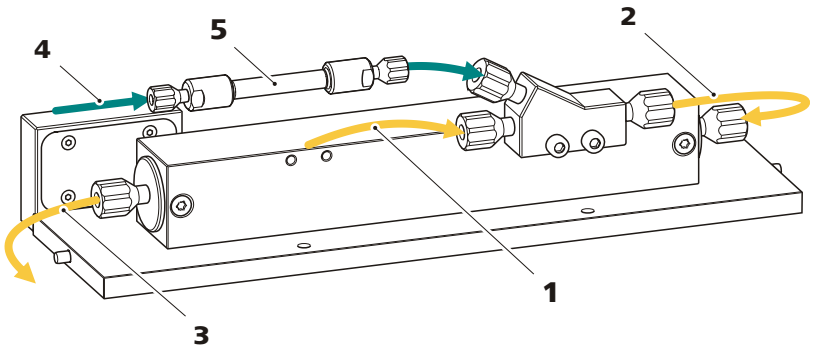


Figure 13 Reactor plate – capillaries connected

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

3 **Reactor outlet capillary**
Section of PEEK capillary (6.1831.100) or the 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)

* In bromate determination with the tri-iodide method, the tri-iodide is partially absorbed by the PEEK capillary, which leads to peak widening and a lower detection limit. Therefore, for this application, we recommend to use the PTFE capillary (6.1803.150).

To connect the capillaries, you need the following accessories:

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

1 Connect the reactor inlet capillary

- Attach the column outlet capillary *(13-**1**)* to one of the two Y connector inlets.
- Connect the Y connector output and reactor input with a short section of the 6.1831.100 PEEK capillary *(13-**2**)*.

2 Connect the reagent inlet capillary

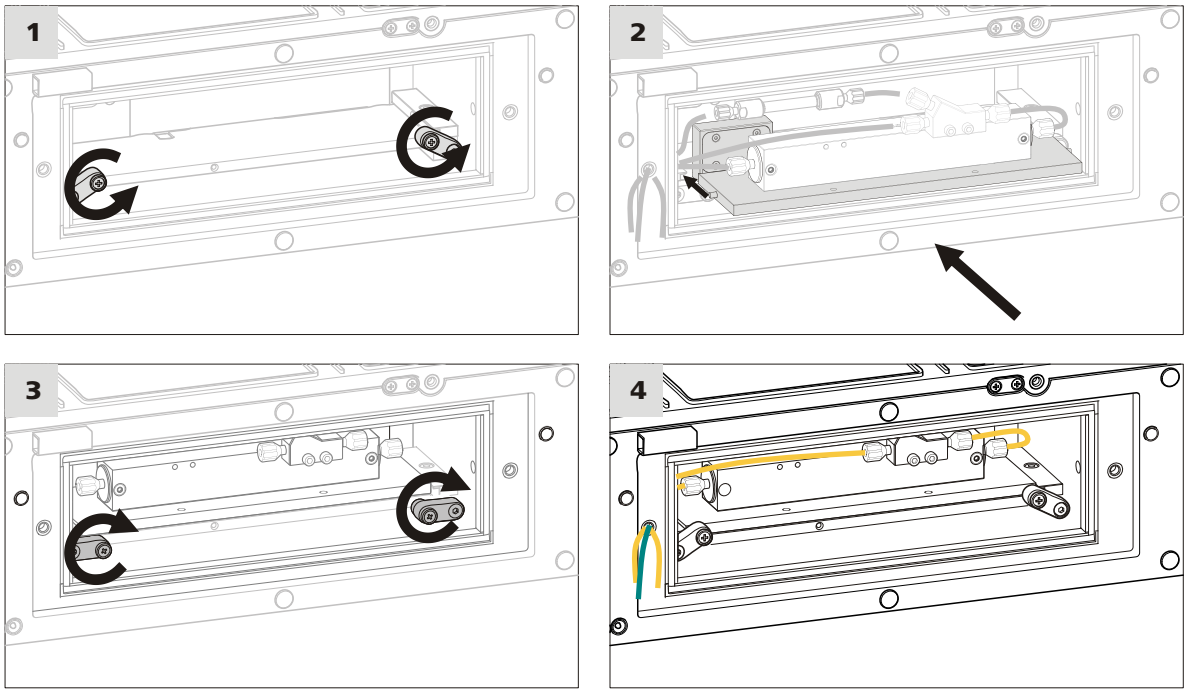
- For reagent delivery, attach a section of the 6.1831.100 PEEK capillary to the second Y connector inlet.
- Attach the backpressure column *(13-**5**)* at he other end.
- Attach another section of the 6.1831.100 PEEK capillary to the other end of the backpressure column *(13-**4**)*.

3 Connect the reactor outlet capillary

- Attach a section of the 6.1831.100 PEEK capillary *(13-**3**)* at the reactor output.

Inserting the reactor plate (6.2845.100)

To insert the reactor plate, you need the 6.2621.140 hexagon key 2.5 mm.



1 Lowering the latches

Loosen the outer screws of both latches with the 6.2621.140 2.5 mm hexagon key turning them counterclockwise.

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

2 Insert 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 Lift the latches

Tighten the outer screws of both latches with the 6.2621.140 hexagon key 2.5 mm turning them clockwise.

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

4 Connect 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 loose end of the reactor inlet capillary *(13-**1**)* with the outlet of the separation column.

- Connect the loose end of the reactor outlet capillary *(13-**3**)* with the detector inlet.
- Connect the loose end of the reagent inlet capillary *(13-**4**)* with either
  - an unused high pressure pump (recommended), and make sure that the 6.1015.100 Metrosep BP 1 Guard/2.0 back-pressure column is installed between the reactor and the pulsation absorber,
    or
  - an unused peristaltic pump.

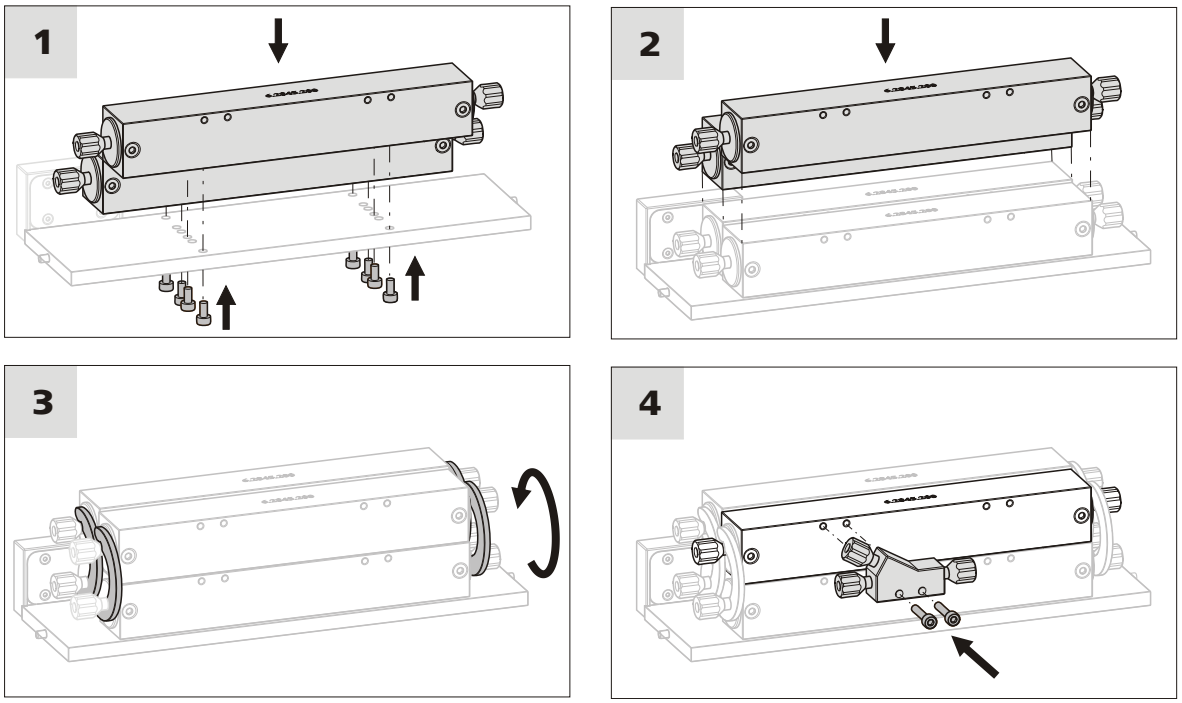
The reaction capillary inside the reactor is 2 m long and has a volume of 393 µL. This is sufficient for most applications. Should an application require a longer reaction time, or if the 886 Professional Thermostat / Reactor is used in a two channel IC system, the reactor plate can be equipped wit additional 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:

- 6.2845.200 Reactor complete
- 6.2621.140 hexagon key 2.5 mm



1 Attach 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 hexagon key.
- Reattach the reactor at the far end of the reactor plate.
- Attach a second reactor from the 6.2845.200 accessory set at the front end of the reactor plate using the the included screws and the 2.5 mm hexagon key.

2 Attach additional reactors

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

3 Fasten the reactors

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

4 Mount the Y connector

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

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

3.8.2 2.886.0210 Professional Thermostat

Equipped with the 6.2845.600 column holder, the 886 Professional Thermostat / Reactor provides the functionality 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 at the right and left side of the oven door.

If you have placed the 886 Professional Thermostat / Reactor under or next to the IC instrument, proceed as follows:

1. Feeding capillaries into the oven
2. Connect the capillaries with the columns
3. Insert column holder

Start with *"Feeding capillaries into the oven", page 24*.

If you have placed the 886 Professional Thermostat / Reactor on top of the IC instrument, proceed as follows:

1. Connect the capillaries with the columns
2. Insert column plate
3. Guide capillaries out of the oven

Start with *"Connect the capillaries", page .24*

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 6.2621.080 capillary cutter to obtain flawless level cut capillary ends.

Feeding capillaries into the oven

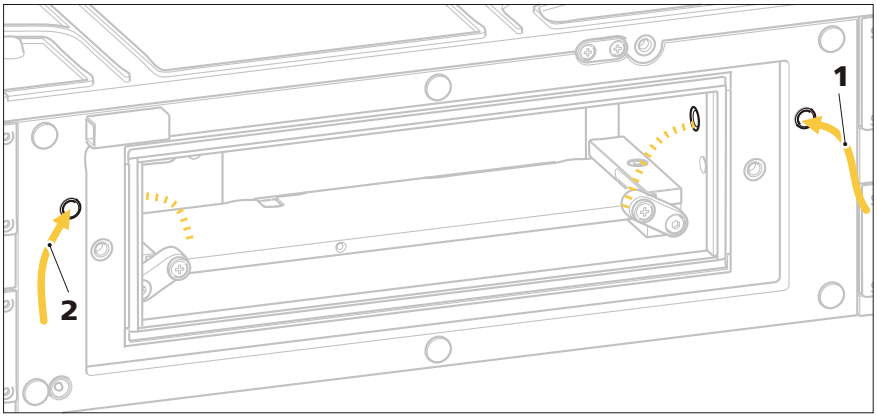


Figure 14 Feeding capillaries into the oven – thermostat

1 Column inlet capillary	**2 Column outlet capillary**

1 Feed capillaries into the oven

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

The column holder can hold two columns with a maximum length of 150 mm. If one of the columns is an iColumn, the system ensures that the oven is not heated up higher than the standard operating temperature of the column. You can also use columns without chip, in this case you have to set the maximum oven temperature manually.

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 second 100 mm column and an on column guard column. The following figure illustrates how the preheating capillary and the columns are connected.

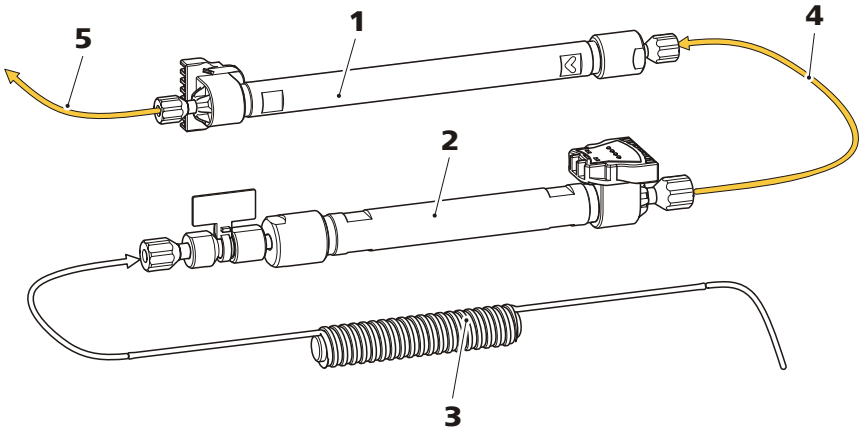


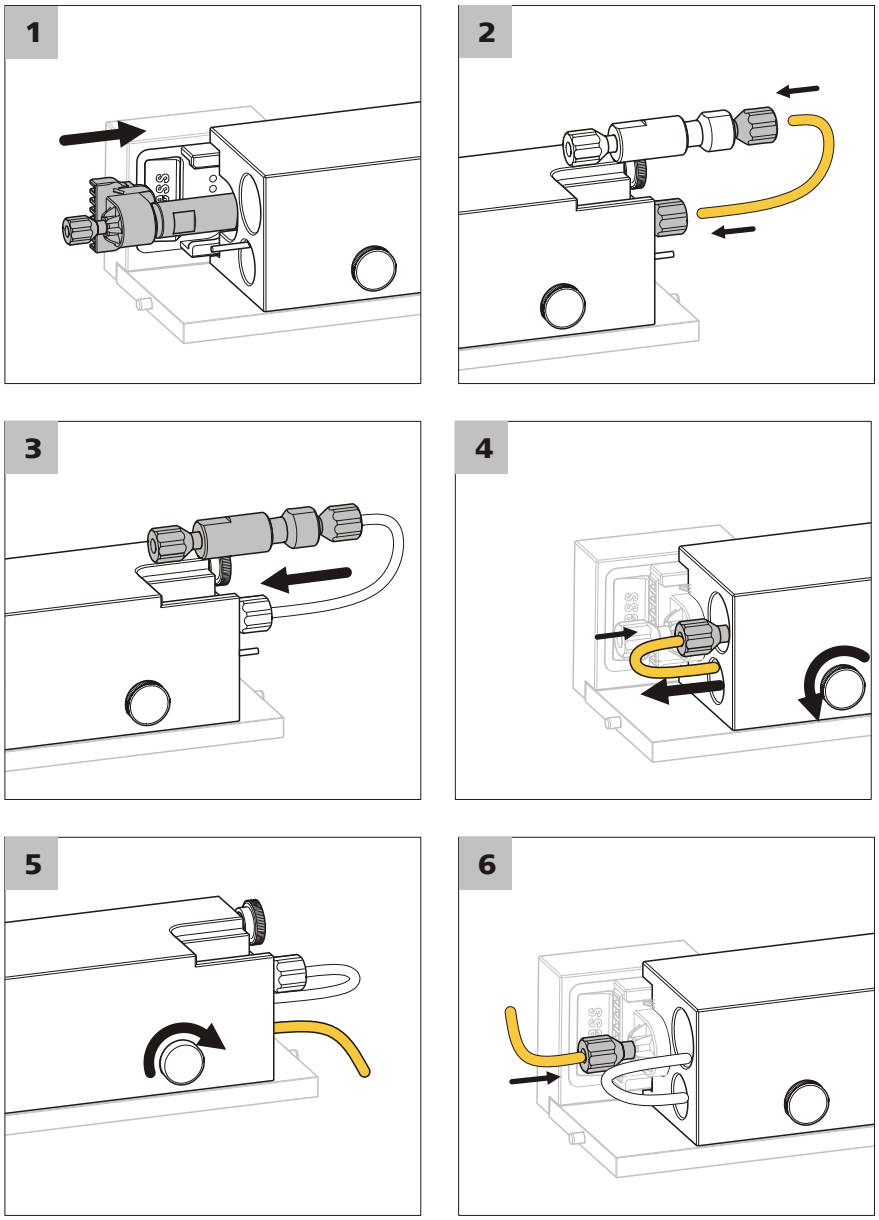
Figure 15 Connecting the columns

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 on column guard system or guard column only.
3 **Preheating capillary** Part of accessories set 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) of maximum 150 mm length (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 an on column guard column (Metrosep A Supp 15 Guard/4.0)
- sections of the included capillary 6.1831.100
- the capillary cutter (6.2621.080)



1 Insert main column

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

2 Connect 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 on column guard column, use a section of the 6.1831.100 capillary to connect the two columns.

3 Insert additional column

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

4 Connect preheating capillary

The preheating capillary *(15-**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 Insert preheating capillary

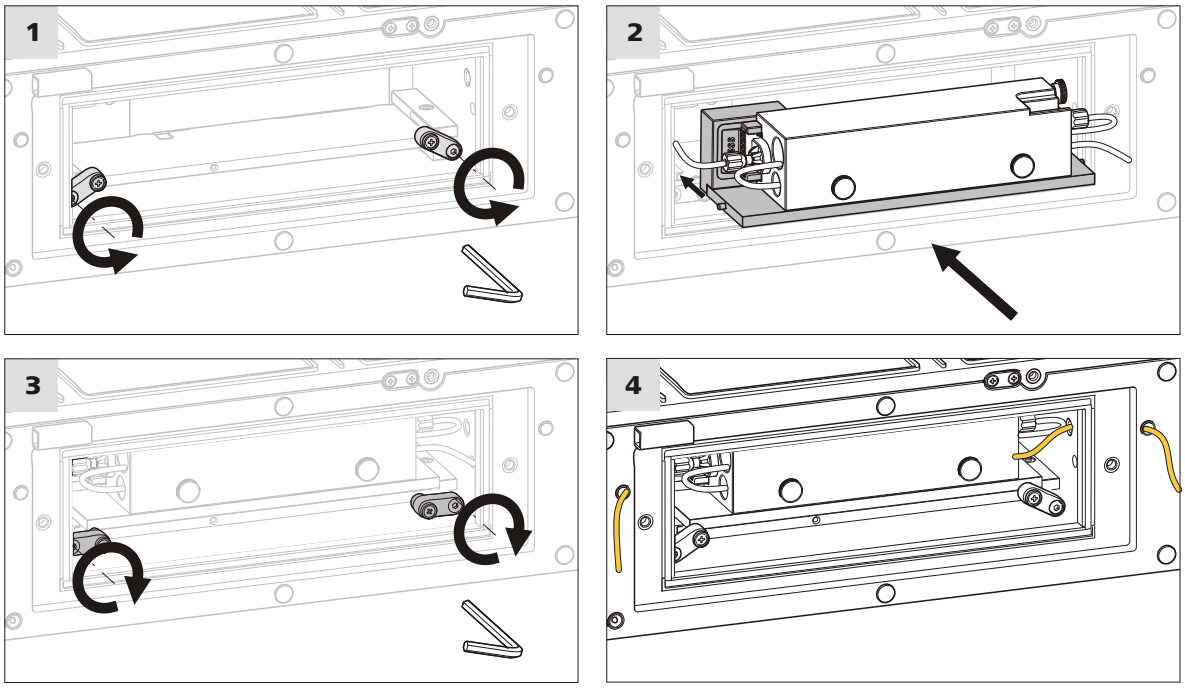
- Slide the preheating capillary back into its bore hole.
- Secure it from sliding out by fastening the two knurled screws.

6 Connect column outlet capillary

- Attach a section of the 6.1831.100 capillary *(15-**5**)* to the outlet of the column.

Inserting the column plate

To insert the column plate, you need the 6.2621.140 hexagon key 2.5 mm.



1 Lower the latches

Loosen the outer screws of both latches with the 6.2621.140 hexagon key 2.5 mm turning them counterclockwise.

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

2 Insert 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 Lift the latches

Tighten the outer screws of both latches with the 6.2621.140 hexagon key 2.5 mm turning them clockwise.

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

4 Connect 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 outlet capillary with the detector.

3.9 Connecting the instrument

3.9.1 Connecting the instrument to the PC

Note

The instrument must be switched off when connecting the PC.

1 Connecting the USB cable

Connect the PC connection socket of the instrument to a USB connector of the computer via the 6.2151.020 USB cable.

3.9.2 Connecting the instrument to mains supply

Warning

The power supply unit must not get wet. Protect it against the direct effect of liquids.

Mains cable

Which mains cable is supplied depends on the location:

- 6.2122.020 with plug SEV 12 (Switzerland, …)
- 6.2122.040 with plug CEE(7), VII (Germany, …)
- 6.2122.070 with plug NEMA 5-15 (USA, …)

The mains cable is three-core and provided with a plug with grounding. If another plug has to be mounted, the yellow/green conductor (IEC standard) must be connected to the protective ground (protection class I).

1 Connecting the mains cable

- Plug the mains cable into the mains connection socket .
- Connect the mains cable to the mains supply.

2 Switching the instrument on and off

Switch the instrument on and off with the mains switch .

4 Start-up

The 886 Professional Thermostat / Reactor is set up together wit other instruments, e.g. an 850 Professional IC and the 887 Professional UV/VIS Detector.

Putting the 886 Professional Thermostat / Reactor into operation

1. Start MagIC Net.

2. Connect the 886 Professional Thermostat / Reactor to PC and switch on.

   The 886 Professional Thermostat / Reactor 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 "*Tutorial for MagIC Net*" or in the online help.

6 Handling and maintenance

6.1 General notes

6.1.1 Care

Warning

The instrument housing must not be opened by untrained personnel.

The instrument requires appropriate care. Excess contamination of the instrument may result in functional disruptions and a reduction in the service life of the sturdy mechanics and electronics.

Caution

Although this is prevented to a great extent by design measures, the mains plug should be unplugged immediately if aggressive media has penetrated the inside of the instrument, so as to avoid serious damage to the instrument electronics. In such cases, the Metrohm Service must be informed.

Spillages of chemicals and solvents should be cleaned up immediately. In particular, the plug connections on the rear panel of the instrument (especially the mains plug) should be protected from contamination.

6.1.2 Maintenance by Metrohm Service

Maintenance of the instrument is best carried out as part of an annual service, which is performed by specialist personnel from Metrohm. If working frequently with caustic and corrosive chemicals, a shorter maintenance interval is recommended. The Metrohm service department offers every form of technical advice for maintenance and service of all Metrohm instruments.

6.1.3 Operation

Caution

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

6.1.4 Shutting down

If the instrument is not used for a longer period, the whole IC system (except the columns) must be rinsed salt free with methanol/ultrapure water (1:4), in order to prevent eluent salts and reagents from forming crystals which may cause subsequent damage.

Rinsing salt free the IC system

To rinse the system, proceed as follows:

1. Remove the separation column from the eluent path. Connect the connection capillaries directly with each other using a coupling (6.2744.040).

2. Rinse the IC system with methanol/ultrapure water (1:4) for 15 minutes.

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

6.2 Door

Caution

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

Caution

Never hold the instrument at the door when lifting or moving.

7 Quality Management and validation with Metrohm

Quality Management

Metrohm offers you comprehensive support in implementing quality management measures for instruments and software. Further information on this can be found in the brochure **«Quality Management with Metrohm»** available from your local Metrohm agent.

Validation

Please contact your local Metrohm agent for support in validating instruments and software. Here you can also obtain validation documentation to provide help for carrying out the **Installation Qualification** (IQ) and the **Operational Qualification** (OQ). IQ and OQ are also offered as a service by the Metrohm agents. In addition, various application bulletins are also available on the subject, which also contain **Standard Operating Procedures** (SOP) for testing analytical measuring instruments for reproducibility and correctness.

Maintenance

Electronic and mechanical functional groups in Metrohm instruments can and should be checked as part of regular maintenance by specialist personnel from Metrohm. Please ask your local Metrohm agent regarding the precise terms and conditions involved in concluding a corresponding maintenance agreement.

Note

You can find information on the subjects of quality management, validation and maintenance as well as an overview of the documents currently available at *www.metrohm.com/com/* under **Support**.

8 Troubleshooting

8.1 Problems and their solutions

Problem	Cause	Remedy
Marked drop in pressure	*Leak in the system.*	Check all capillary connections and seal leaks, if necessary *(see Chapter 3.4, page 17)*.
Drift of the baseline	*Thermal equilibrium not yet attained.*	Condition instrument with the column heater switched on.
	Leak in the system.	Check all capillary connections and seal leaks, if necessary *(see Chapter 3.4, page 17)*.
Extreme spread of the peaks in the chromatogram. Splitting (dual peaks)	*Capillary connections – dead volume in the system.*	Check connections *(see Chapter 3.4, page 17)* (use PEEK capillaries with an internal diameter of 0.25 mm between the injection valve and detector).

9 Technical specifications

9.1 Reference conditions

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

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

9.2 Instrument

IC system	Metal free system for heating intelligent reactors and columns.
Intelligent components	iColumns, iReactors, Dosinos
Connections for external components	▪ up to three extension modules for reagent delivery etc. ▪ up to two Dosinos ▪ Analog data output (optional)

9.3 Leak sensor

Type	Electronic, no calibration necessary

9.4 Ambient conditions

Operation	
Ambient temperature	+5…+45 °C
Humidity	20…80 % relative humidity
Storage	
Ambient temperature	–20…+70 °C
Transport	
Ambient temperature	–40…+70 °C

9.5 Housing

Dimensions	
Width	365 mm
Height	131 mm
Depth	380 mm
Material of base tray, housing and covering plate	Polyurethane hard foam (PUR) with flame retardation
Operating elements	
Indicators	LED for power display
On/Off switch	On the rear of the instrument

9.6 Reactor / Column thermostat

Number of reactors	up to 4
Number of columns	up to 2
Adjustable temperature range	0 °C…+150 °C, adjustable in steps of 0.1 °C
Stability	less than 0.05 °C deviation
Reproducibility	better than ± 0.2 °C
Temperature accuracy	< 1 °C (typical)
Heating up 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

9.7 Mains connection

Required voltage	100…240 V ± 10 % (auto-sensing)
Required frequency	50…60 Hz ± 3 (auto-sensing)
Power consumption	40 W input power (typical anion analysis) 15 W input power at standby (idle)
Power supply unit	▪ Up to 300 W maximum, electronically monitored ▪ internal fuse 3.15 A

9.8 Interfaces

USB	
Input	1 USB Upstream, type B (connection to PC).
Output	2 USB Downstream, type A
MSB	
Number	2 MSB MiniDin 8-pol female for iDosino, Stirrers, Remote, etc.
column recognition	for an intelligent reactor or an intelligent column
Leak sensor	1 jack plug
Further connections	
Extension module	1 DSUB 15-pin (female)
Analog Output (optional)	1 DSUB 15-pin (female)
Service	1 DSUB 15-pin high density (female)

9.9 Safety specification

Design / Test

- EN/IEC 61010-1
- UL 61010-1
- CSA-C22.2 No. 61010-1
- Protection class I

9.10 Electromagnetic compatibility (EMC)

Emission

- EN/IEC 61326-1
- EN/IEC 61000-6-3
- EN 55011 / CISPR 11
- EN/IEC 61000-3-2
- EN/IEC 61000-3-3

Immunity

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

9.11 Weight

1.886.0010 7.7 kg (without accessories)

10 Warranty (guarantee)

Metrohm guarantees that the deliveries and services it provides are free from material, design or manufacturing errors. The warranty period is 36 months from the day of delivery; for day and night operation it is 18 months. The warranty remains valid on condition that the service is provided by an authorized Metrohm service organization.

Glass breakage is excluded from the warranty for electrodes and other glassware. The warranty for the accuracy corresponds to the technical specifications given in this manual. For components from third parties that make up a considerable part of our instrument, the manufacturer's warranty provisions apply. Warranty claims cannot be pursued if the Customer has not complied with the obligations to make payment on time.

During the warranty period Metrohm undertakes, at its own choice, to either repair at its own premises, free of charge, any instruments that can be shown to be faulty or to replace them. Transport costs are to the Customer's account.

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

11 Accessories

Note

Subject to change without notice.

11.1 Scope of delivery

11.1.1 2.886.0110 Professional Reactor

2.886.0110 886 Professional Reactor

Qty.	Order no.	Description
1	1.886.0010	**886 Professional Thermostat / Reactor**
1	6.2122.0x0	**Mains cable with C13 line socket IEC-60320-C13** Cable plug according to customer requirements. Switzerland: Type SEV 12 6.2122.020 Germany, …: Type CEE(7), VII 6.2122.040 USA, …: Type NEMA/ASA 6.2122.070
1	6.1015.100	**Metrosep BP 1 Guard/2.0** Backpressure column for the Professional Reactor

Qty.	Order no.	Description	
1	6.1803.150	**PTFE capillary i.d. 0.25 mm / 1 m**	
2	6.1831.100	**PEEK capillary 0.25 mm i.d. / 1 m** Material: PEEK Outer diameter (inches): 1/16 Inner diameter (mm): 0.25 Length (m): 1	
1	6.2151.020	**Cable USB A - USB B / 1.8 m** USB connecting cable Length (m): 1.8	
1	6.2621.100	**Hexagon key 3 mm** Hexagon key 3 mm. For IC sample changer Length (mm): 73	

Qty.	Order no.	Description	
1	6.2621.140	**Hexagon key 2.5 mm**	
1	6.2744.010	**Pressure screw 5x** With UNF 10/32 connector. For connecting PEEK capillaries Material: PEEK Length (mm): 26	
1	6.2744.014	**Pressure screw 2x** With UNF 10/32 connector. For connecting PEEK capillaries Material: PEEK Length (mm): 26	
1	6.2845.100	**Reactor plate complete to Professional Reactor** Intelligent reactor plate with reactor for PCR applications.	

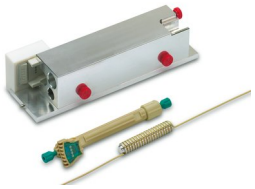
11.1.2 2.886.0210 Professional Thermostat

2.886.0210 886 Professional Thermostat

Qty.	Order no.	Description
1	1.886.0010	**886 Professional Thermostat / Reactor**
1	6.2122.0x0	**Mains cable with C13 line socket IEC-60320-C13** Cable plug according to customer requirements. Switzerland: Type SEV 12 6.2122.020 Germany, ….: Type CEE(7), VII 6.2122.040 USA, …: Type NEMA/ASA 6.2122.070
1	6.1831.100	**PEEK capillary 0.25 mm i.d. / 1 m** Material: PEEK Outer diameter (inches): 1/16 Inner diameter (mm): 0.25 Length (m): 1
1	6.2151.020	**Cable USB A - USB B / 1.8 m** USB connecting cable Length (m): 1.8

Qty.	Order no.	Description	
1	6.2621.100	**Hexagon key 3 mm** Hexagon key 3 mm. For IC sample changer Length (mm): 73	
1	6.2621.140	**Hexagon key 2.5 mm**	
1	6.2744.040	**2 x UNF 10/32 coupling** For connecting 1/16 in. capillaries. For IC instruments Material: PEEK Length (mm): 24	
1	6.2744.070	**Pressure screw short** Short version. With UNF 10/32 connector. 5 pieces. For connecting PEEK capillaries Material: PEEK Length (mm): 21	

Qty.	Order no.	Description
1	6.2845.600	**Column holder complete to Professional Thermostat** Intelligent column holder for the Professional Thermostat



11.2 Optional accessories

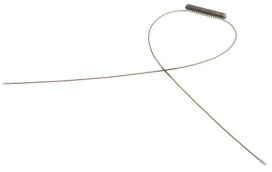
11.2.1 2.886.0110 Professional Reactor

2.886.0110 886 Professional Reactor

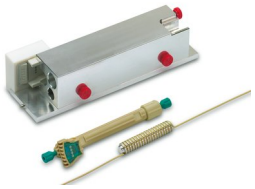
Order no.	Description
6.1602.200	**Bottle attachment 2 x M6, 1 x M8 to 6.1608.120** Bottle attachment for PP eluent bottle.

Order no.	Description
6.1608.120	**PP eluent bottle, 2 L** Eluent bottle for applications where glass should be avoided.

Order no.	Description
6.1836.020	**Preheating capillary with core, 1.44 m** Preheating capillary to Professional Reactor / Thermostat



Order no.	Description
6.2061.100	**Bottle holder (ProfIC)** Bottle holder for Professional IC instruments
6.2061.110	**Base tray with sensor for Professional IC systems**
6.2061.120	**System Connector** Connects an IC module with the footprint of a Professional IC with a Compact IC
6.2744.330	**Y-Connector 3 x UNF 10/32**
6.2845.110	**Reactor plate HT complete to Professional Reactor** Reactor plate with reactor for PCR applications at high temperatures (> 120 °C).
6.2845.200	**Reactor complete to 6.2845.100** Spare reactor for the reactor plate

Order no.	Description	
6.2845.600	**Column holder complete to Professional Thermostat** Intelligent column holder for the Professional Thermostat	
6.5333.000	**IQ/OQ Kit for IC** The IQ/OQ Kit for IC contains all parts and standard solutions required for IQ/OQ in ion chromatography.	
6.6059.021	**MagIC Net™ 2.x Multi: 1 additional license** 1 additional license	
6.6059.022	**MagIC Net™ 2.x Multi: 5 additional licenses** 5 additional licenses	
6.6059.023	**MagIC Net™ 2.x Multi: 10 additional licenses** 10 additional licenses	
6.6059.232	**MagIC Net™ 2.3 Professional CD 1 license** Professional PC program for controlling intelligent Professional IC systems, Compact IC instruments and their peripherals such as various Autosamplers, 800 Dosino, 771 Compact Interface, etc. The software permits control, data acquisition, evaluation and monitoring as well as report generation of ion chromatographic analyses. Graphical user interface for routine operations, extensive database programs, method development, configuration and manual system control; very flexible user administration, efficient database operations, extensive data export functions, individually configurable report generator, control and monitoring of all system components and the chromatography results. MagIC Net™ Professional complies fully with FDA Regulation 21 CFR Part 11 as well as GLP. Dialog languages: German, English, French, Spanish, Chinese, Korean, Japanese, et. al. 1 license.	

11.2.2 2.886.0210 Professional Thermostat

2.886.0210 886 Professional Thermostat

Order no.	Description
6.1015.100	**Metrosep BP 1 Guard/2.0** Backpressure column for the Professional Reactor
6.1602.200	**Bottle attachment 2 x M6, 1 x M8 to 6.1608.120** Bottle attachment for PP eluent bottle.
6.1608.120	**PP eluent bottle, 2 L** Eluent bottle for applications where glass should be avoided.
6.2061.100	**Bottle holder (ProfIC)** Bottle holder for Professional IC instruments

Order no.	Description	
6.2061.110	**Base tray with sensor for Professional IC systems**	
6.2061.120	**System Connector** Connects an IC module with the footprint of a Professional IC with a Compact IC	
6.2744.330	**Y-Connector 3 x UNF 10/32**	
6.2845.100	**Reactor plate complete to Professional Reactor** Intelligent reactor plate with reactor for PCR applications.	
6.2845.110	**Reactor plate HT complete to Professional Reactor** Reactor plate with reactor for PCR applications at high temperatures (> 120 °C).	
6.2845.200	**Reactor complete to 6.2845.100** Spare reactor for the reactor plate	
6.5333.000	**IQ/OQ Kit for IC** The IQ/OQ Kit contains all parts and standard solutions required for IQ/OQ in ion chromatography.	

Order no.	Description
6.6059.021	**MagIC Net™ 2.x Multi: 1 additional license** 1 additional license
6.6059.022	**MagIC Net™ 2.x Multi: 5 additional licenses** 5 additional licenses
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