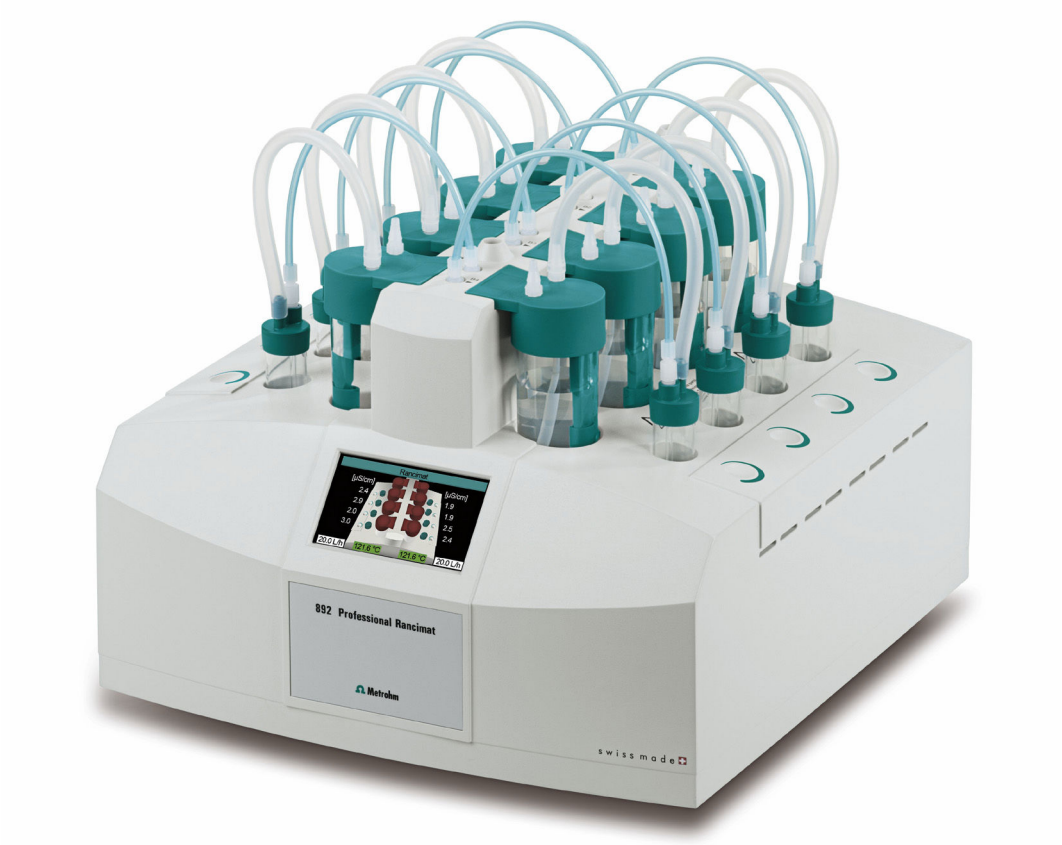
892 Professional Rancimat



Manual

8.892.8001EN / v7 / 2024-06-06

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Manual

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Technical Communication
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This documentation is an original document.

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.

Disclaimer

Deficiencies arising from circumstances that are not the responsibility of Metrohm, such as improper storage or improper use, etc., are expressly excluded from the warranty. Unauthorized modifications to the product (e.g., conversions or attachments) exclude any liability on the part of the manufacturer for resulting damage and its consequences. Instructions and notes in the Metrohm product documentation must be strictly followed. Otherwise, Metrohm's liability is excluded.

Table of contents

Table of figures

1 Introduction

1.1 Device description

The 892 Professional Rancimat is a computer-controlled measuring device for determining the oxidation stability of samples containing oil and fat.

It is equipped with two **heating blocks** each with 4 measuring positions. Each block can be heated individually, i.e., 4 samples can each be measured at two different temperatures or 8 samples at the same temperature. The measurements at the individual measuring positions can be started individually for this.

The 892 Professional Rancimat is **controlled** by means of the **StabNet** computer software and a computer that is connected via the USB interface. Up to 4 instruments can be controlled and monitored by each computer, hence allowing a maximum of 32 samples to be analyzed at the same time. The evaluation algorithm of the computer software determines the break point of the Rancimat curve and thus the induction time fully automatically. Besides the **induction time**, the so-called **stability time**, i.e., the time until a defined conductivity change has been achieved, can also be determined. In the case of conductivity changes (stages) which do not have anything to do with the autoxidation, the evaluation can be suspended for definite time intervals. The results determined can be further processed mathematically. In particular, the induction times can be converted to the standard temperatures defined in the respective standards.

Each Rancimat curve can also be evaluated **manually**. A computer-supported tangential method is available for this, in which you can position the tangents anywhere on your curves. This makes evaluations possible in extreme cases as well.

The results of the determinations are saved in a database together with all method and determination data. Determinations can be searched for, sorted, filtered, exported and printed in the **Database** program part. Apart from graphically displaying single and multiple curves, the software is also capable of conducting recalculations with changed parameters and extrapolating the results to a certain temperature.

1.2 Displaying accessories

Up-to-date information on the scope of delivery and on optional accessories can be found on the Metrohm website.

1 Searching for a product on the website

- Go to *https://www.metrohm.com*.
- Click on 🔍.
- Enter the article number of the product (e.g. **2.1001.0010**) into the search field and press **[Enter]**.

The search result is displayed.

2 Displaying product information

- To display the products matching the search term, click on **Product models**.
- Click on the desired product.

Detailed information regarding the product is displayed.

3 Displaying accessories and downloading the accessories list

- To display the accessories, scroll down to **Accessories and more**.
  - The **scope of delivery** is displayed.
  - Click on **[Optional parts]** for the optional accessories.
- To download the accessories list, click on **[Download accessories PDF]** under **Accessories and more**.

NOTE

Metrohm recommends keeping the accessories list for reference purposes.

1.3 Symbols and conventions

The following symbols and formatting may appear in this documentation:

*(5-**12**)*	**Cross-reference to figure legend** The first number refers to the figure number, the second to the instrument part in the figure.
1	**Instruction step** Perform the steps one after the other.
Method	**Dialog text**, **parameter** in the software
File ▶ New	Menu or menu item
[Continue]	**Button** or **key**
	**WARNING** This symbol draws attention to a possible life-threatening hazard or risk of injury.
	**WARNING** This symbol draws attention to a possible hazard due to electrical current.
	**WARNING** This symbol draws attention to a possible hazard due to heat or hot instrument parts.
	**WARNING** This symbol draws attention to a possible biological hazard.
	**WARNING** Warning of optical radiation
	**CAUTION** This symbol draws attention to possible damage to instruments or instrument parts.
	**NOTICE** This symbol highlights additional information and tips.

2 Safety

WARNING

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

This device 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.

Hot reaction vessels

WARNING

The reaction vessels can become very hot.

Avoid any contact with the hot reaction vessels. Place these in the vessel holders provided for cooling down.

Flammable substances

WARNING

The heating block of the 892 Professional Rancimat can be heated to 229.9 °C.

Flammable substances may ignite at such temperatures.

Adjust the oven's maximum heating temperature to the sample that is to be analyzed.

2.1 Responsibility of the operator

The operator must ensure that basic regulations on occupational safety and accident prevention in chemical laboratories are observed. The operator has the following responsibilities:

- Instruct personnel in the safe handling of the product.
- Train personnel in the use of the product according to the user documentation (e.g. install, operate, clean, eliminate faults).
- Train staff on basic occupational safety and accident prevention regulations.
- Provide personal protective equipment (e.g. protective glasses, gloves).
- Provide suitable tools and equipment to carry out the work safely.

The product may be used only when it is in perfect condition. The following measures are required to ensure the safe operation of the product:

- Check the condition of the product before use.
- Remedy defects and malfunctions immediately.
- Maintain and clean the product regularly.

2.2 Requirements for operating personnel

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

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

2.3 Electrical safety

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

WARNING

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

WARNING

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

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

Supply voltage

WARNING

An incorrect supply voltage can damage the instrument.

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

Protection against electrostatic charges

WARNING

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

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

2.4 Tubing and capillary connections

CAUTION

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

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

2.5 Flammable solvents and chemicals

WARNING

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

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

2.6 Danger from biological substances

If the instrument is used for biological hazardous substances, it must be marked in accordance with regulations.

In case of a return shipment to Metrohm or a Metrohm Service partner, the instrument or component has to be decontaminated and the hazard symbol for biological hazardous substances must be removed. A declaration of decontamination must be enclosed.

WARNING

Danger of infection and poisoning from biological hazardous substances

Poisoning from toxins and/or infections from samples contaminated with microorganisms.

- Wear protective equipment.
- Use exhaust equipment when working with vaporizing hazardous substances.
- Dispose of biologically contaminated substances properly.

3 Overview of the instrument

3.1 Front of the instrument

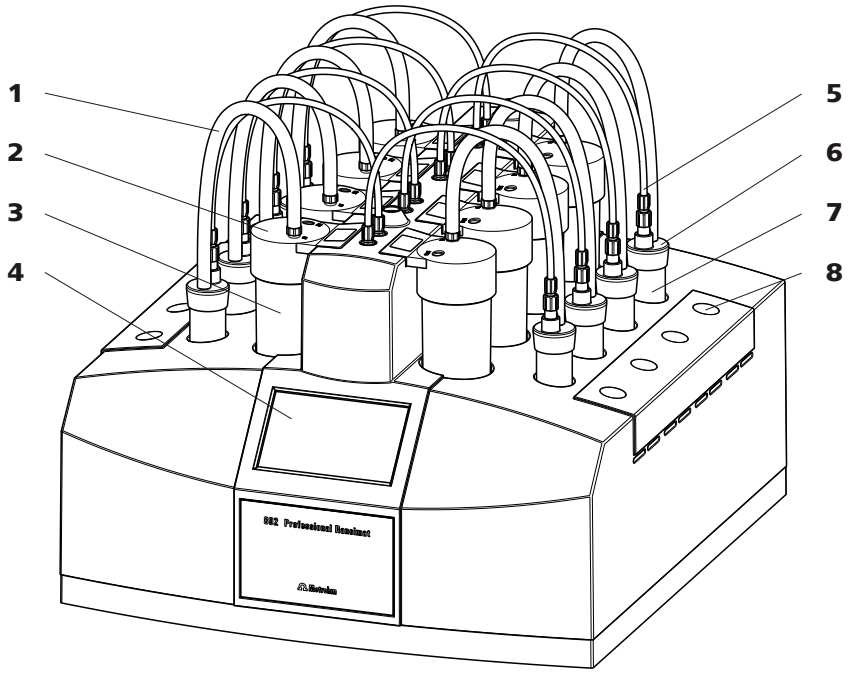


Figure 1 Front 892 Professional Rancimat

1	**Silicone tubing (6.1816.010)** For connecting the reaction vessel to the measuring vessel.	**2**	**Measuring vessel cover (6.0913.130)** Contains an integrated conductivity measuring cell.
3	**Measuring vessel (6.1428.107)**	**4**	**Instrument display** Displays the status of the instrument and the individual measuring positions.
5	**FEP tubing 250 mm (6.1805.080)** For supplying air into the reaction vessel.	**6**	**Reaction vessel cover (6.2753.107)**
7	**Reaction vessels (6.1429.040)**	**8**	**Start buttons**

3.2 Rear of the instrument

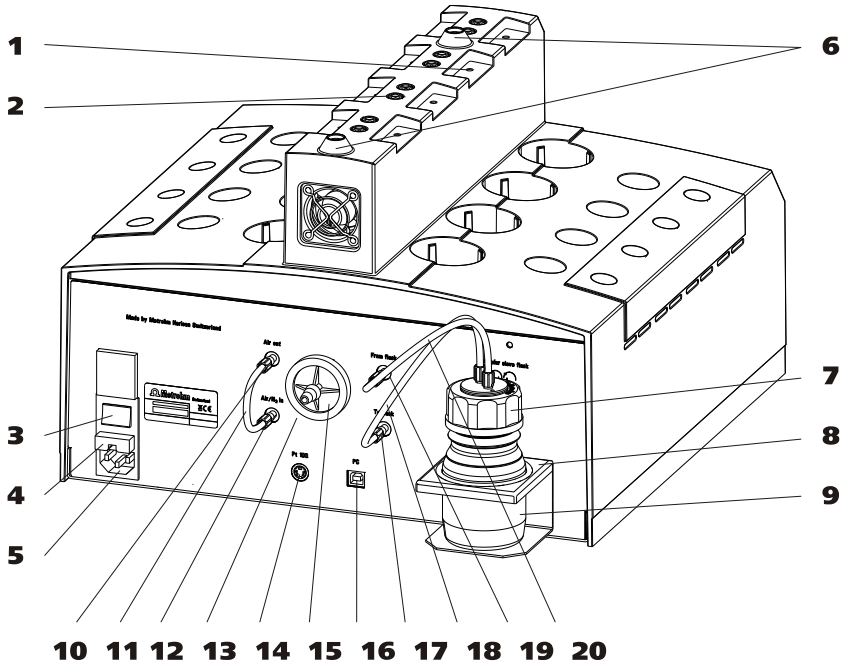


Figure 2 892 Professional Rancimat rear

1	**Electrode connector** For connecting the conductivity measuring cell integrated in the measuring vessel cover.
2	**Air supply connector** For connecting the FEP tubing 250 mm.
3	**Power switch** For switching the instrument on and off. I = ON / 0 = OFF.
4	**Fuse holder** For replacing fuses *(see chapter 4.3.2, page 25)*.
5	**Power socket** For important information on the power connection, see *Chapter 4.3*.
6	**Collection tube holder** For fastening the optional exhaust air collection tube (6.2757.000).
7	**Drying flask cap (6.1602.145)** Cap for the drying flask.
8	**Bottle holder** For fastening the drying flask.
9	**Drying flask (6.1608.050)** Drying flask filled with molecular sieve (6.2811.000).
10	**"Air out" connector**
11	**FEP tubing 130 mm (6.1805.010)** For connecting the **Air out** connector to the **Air/N_2 in** connector during normal operation with the internal air pump.
12	**"Air/N_2 in" connector**

13 **Type plate** Contains specifications concerning supply voltage and serial number.	**14** **Pt100 connector** For connecting an external temperature sensor.
15 **Dust filter (6.2724.010)**	**16** **USB connector** For connecting the computer.
17 **"To flask" connector**	**18** **FEP tubing 250 mm (6.1805.080)** For supplying the air from the internal pump to the drying flask.
19 **"From flask" connector**	**20** **FEP tubing 250 mm (6.1805.080)** For supplying the air from the drying flask to the reaction vessels.

3.3 Instrument display

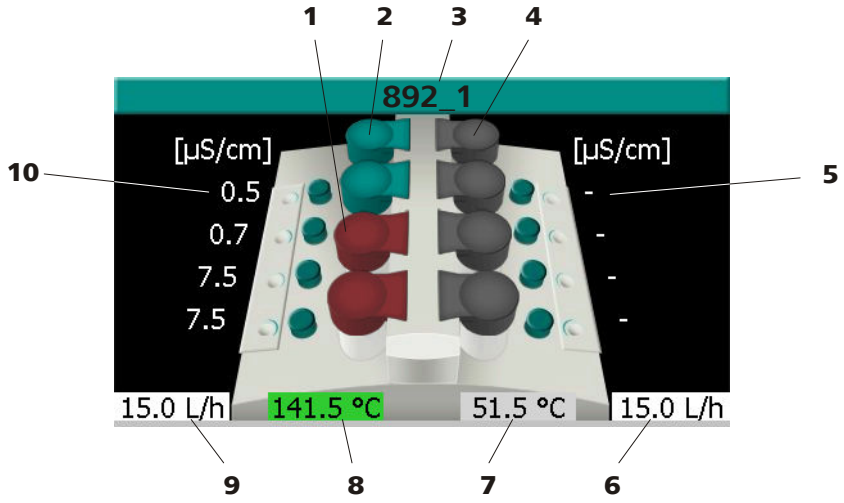


Figure 3 Instrument display

1 **Measuring vessel cover red** This measuring position is not available for a determination (determination is running or multiple determination has not yet been completed).	**2** **Measuring vessel cover green** A determination can be started on this measuring position.
3 **Instrument name** The instrument name display corresponds to the configuration in StabNet.	**4** **Measuring vessel cover gray** This measuring position is not available for starting a determination (instrument not connected to computer or no method loaded).

5 Conductivity display block B
Shows the measured conductivity.

Dash (-) is displayed = Conductivity cannot be displayed (no sensor connected or no valid measuring signal).

6 Gas flow display block B
Shows the gas flow measured on block B (gray background: gas flow switched off; white background: gas flow switched on).

7 Temperature display block B
Shows the temperature measured on block B (gray background: heater switched off; red background: temperature not stable; green background: temperature stable).

8 Temperature display block A
Shows the temperature measured on block A (gray background: heater switched off; red background: temperature not stable; green background: temperature stable).

9 Gas flow display block A
Shows the gas flow measured on block A (gray background: gas flow switched off; white background: gas flow switched on).

10 Conductivity display block A
Shows the measured conductivity.

Dash (-) is displayed = Conductivity cannot be displayed (no sensor connected or no valid measuring signal).

4 Installation

4.1 Setting up the device

4.1.1 Packaging

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

4.1.2 Checks

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

4.1.3 Setup location

CAUTION

Heat accumulation

Placing the instrument in a tight space or covering the housing may lead to overheating and subsequent damage to the instrument.

- Set the device up freestanding, to allow the air to circulate around the instrument.
- Do not cover the device.

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 to the extent possible.

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

NOTE

In order to improve accessibility of the measuring positions, the instrument can also be placed on the optionally available turning ring (6.2059.000).

4.2 Mounting accessories

4.2.1 Mounting the internal air supply

The gas in the 892 Professional Rancimat is normally supplied using the **internal air pump**, which aspirates **laboratory air**. For air supply and air purification, the following accessories must be mounted on the rear of the 892 Professional Rancimat:

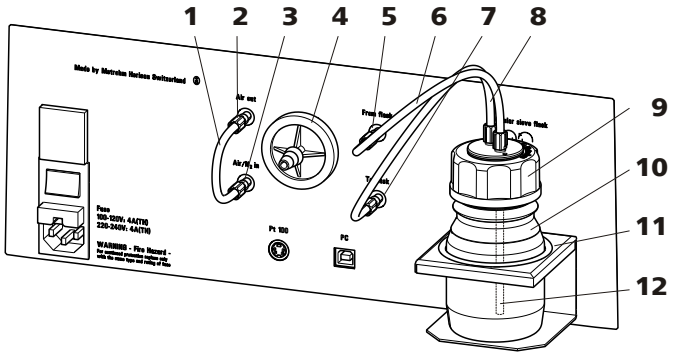


Figure 4 Mounting accessories for the air supply

1	**FEP tubing 130 mm (6.1805.010)**	**2**	**"Air out" connector**
3	**"Air/N_2 in" connector**	**4**	**Dust filter (6.2724.010)**
5	**"From flask" connector**	**6**	**FEP tubing 250 mm (6.1805.080)** For supplying the air from the drying flask to the reaction vessel.
7	**"To flask" connector**	**8**	**FEP tubing 250 mm (6.1805.080)** For supplying the air from the internal pump to the drying flask.
9	**Drying flask cap (6.1602.145)** Lid for the drying flask.	**10**	**Drying flask (6.1608.050)** Drying flask filled with molecular sieve (6.2811.000).
11	**Bottle holder** For fastening the drying flask.	**12**	**Filter tube (6.1821.040)**

Mount the accessories for the air supply as follows:

1 Mounting the dust filter

- Insert the dust filter on the connector marked with **Filter** on the rear of the 892 Professional Rancimat.
- If the laboratory air is heavily contaminated, a tubing for supplying fresh air can be connected to the dust filter.

NOTE

The dust filter serves for filtering the air aspirated through the air pump and must be replaced at periodic intervals *(see chapter 6.2, page 46)*.

2 Mounting the drying flask

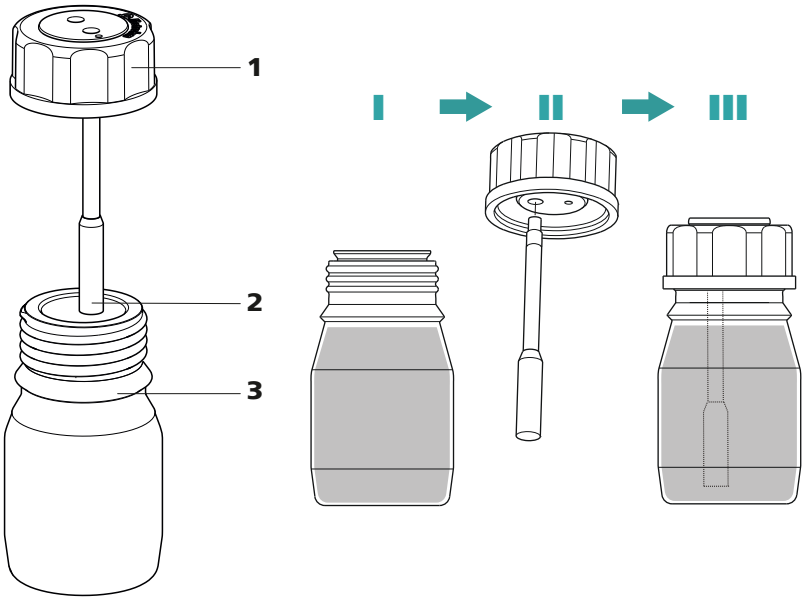


Figure 5 Drying flask - Individual parts

1 Drying flask cap (6.1602.145)	**2 Filter tube (6.1821.040)**
3 Bottle (6.1608.050)	

- **[I]** – Fill the molecular sieve (6.2811.000) into the drying flask.
- **[II]** – Screw the filter tube on the bottom side of the drying flask cap into the opening marked with a dot (on the upper side).
- **[III]** – Screw the drying flask cap with mounted filter tube onto the drying flask and insert it in the bottle holder on the rear of the 892 Professional Rancimat.
- Screw one end of the FEP tubing 250 mm to the opening on the drying flask cap marked with a dot.
- Screw the other end of the FEP tubing to the **From flask** connector on the rear of the 892 Professional Rancimat.
- Screw one end of the second FEP tubing 250 mm to the second opening on the drying flask cap.
- Screw the other end of the second FEP tubing to the **To flask** connector.

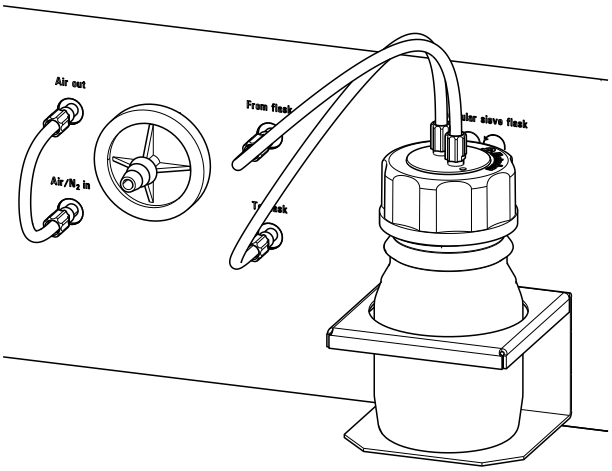


Figure 6 Drying flask mounted in place

NOTE

The molecular sieve serves to adsorb interfering oxidizing gases as well as water from the aspirated air.

You can regenerate it in the drying oven at +140 - +180 °C for 24 to 48 h *(see chapter 6.3, page 47)*.

3 Mount the FEP tubing for the air supply

- Screw one end of the FEP tubing 130 mm to the **Air out** connector.
- Screw the other end of the FEP tubing to the **Air/N_2 in** connector.

4.2.2 Mounting the external air supply

If the laboratory air is heavily contaminated, an external gas supply with synthetic air can be provided.

For this, the corresponding accessories must be mounted on the rear of the 892 Professional Rancimat.

NOTE

If air is supplied externally, the gas flow cannot be regulated in the computer program.

The gas flow must be set manually using the reducing valve and the gas flow display.

Mount the accessories for the external air supply as follows:

1 Mounting the FEP tubing

- Screw one end of the FEP tubing 130 mm to the **Air/N_2 in** connector *(2-**12**)* on the rear of the 892 Professional Rancimat.
- Screw the tubing adapter M6/olive (6.1808.020) onto the other end of the FEP tubing.

2 Connecting the gas supply

- Mount the compressed air bottle on the M6/olive tubing adapter (6.1808.020).
- Adjust the air flow by means of the reducing valve at the compressed air bottle.

4.2.3 Assembling the reaction and measuring vessels

The following figure shows in detail how the accessory parts for measuring the oxidation stability have to be mounted and connected to one another.

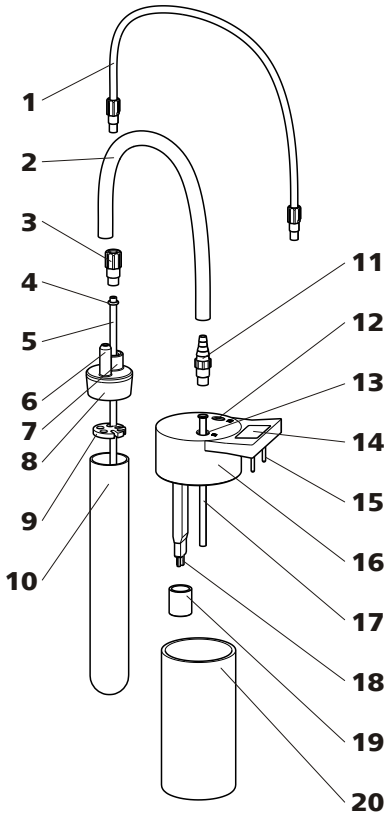


Figure 7 Equipping the reaction and measuring vessels

1	**FEP tubing 250 mm (6.1805.080)** For supplying air into the reaction vessel.	**2**	**Silicone tubing (6.1816.010)** For connecting the reaction vessel to the measuring vessel.
3	**Thread adapter M8/M6 (6.1808.090)**	**4**	**O-ring (6.1454.040)**
5	**Air tube (6.2418.100)**	**6**	**Tubing connector** For connecting the silicone tubing.
7	**Thread adapter M8/M6 connector**	**8**	**Reaction vessel cover (6.2753.107)**
9	**Foam barrier (6.1451.010)** Optional foam barrier.	**10**	**Reaction vessel (6.1429.040)**
11	**Tubing adapter M8/olive (6.1808.050)** For connecting the silicone tubing to the **In** opening.	**12**	**Opening "Out"** For removing the air from the measuring vessel.
13	**Opening "In"** For supplying the air to the measuring vessel.	**14**	**Label field** For attaching labels (e.g. 6.2250.000 laminated labels).
15	**Connector plug**	**16**	**Measuring vessel cover (6.0913.130)** Contains an integrated conductivity measuring cell.

17 PTFE cannula (6.1819.080) For supplying the air to the measuring solution.	**18 Electrode**
19 Protection ring	**20 Measuring vessel (6.1428.107)**

Proceed as follows to mount the measuring vessel and the reaction vessel:

1 Mounting the measuring vessel cover

- Screw the PTFE cannula from above into the **In** opening of the measuring vessel cover.
- Screw the M8/olive tubing adapter into the **In** opening of the measuring vessel cover.
- Pour 50 - 80 mL of deionized water into the measuring vessel (the exact quantity depends on the application).
- Place the measuring vessel cover onto the measuring vessel.

2 Mounting the reaction vessel cover

- Place the O-ring (6.1454.040) over the upper end of the air tube.
- Feed the air tube (6.2418.xx0) into the connector of the reaction vessel cover (6.2753.107) from above.
- Gently screw the M8/M6 thread adapter into the connector while pressing the air tube against the thread adapter from below. Then fix the air tube onto the reaction vessel cover by firmly tightening the thread adapter.
- *Optional:* If determinations are being carried out with highly foaming samples, clamp the foam barrier (6.1451.010) onto the air tube.
- Blow out the reaction vessel with nitrogen to free it from foreign substances (e.g. dust or cardboard shreds).
- Before putting the cover in place, briefly rotate the upper part of the reaction vessel in your hand. This slightly lubricates the glass and facilitates removal of the lids after the measurement.
- Place the reaction vessel cover on the reaction vessel.

NOTE

When mounted without foam barrier, the air tube must be in a vertical position in the reaction vessel.

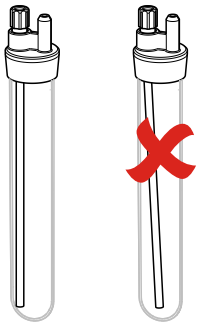


Figure 8 Mounting the air tube: correct - incorrect

WARNING

The foam barrier can melt if it projects too deeply into the heating block.

Ensure that the foam barrier is **at least 7 cm** above the base of the reaction vessel.

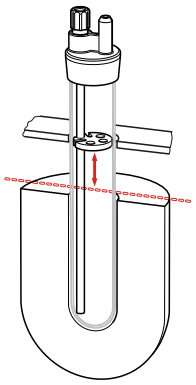


Figure 9 Mounting the foam barrier

4.2.4 Inserting vessels / Establishing tubing connections

After you have assembled the reaction and measuring vessels, insert them in the 892 Professional Rancimat and establish the tubing connections *(see chapter 3.1, page 9)* as follows:

1 Inserting the measuring vessel

- Fill distilled water into the measuring vessel.
- Place the measuring vessel cover onto the measuring vessel.
- Insert the measuring vessel into the openings provided on the 892 Professional Rancimat. While doing so, carefully guide the connector plug into the electrode connector.
- Connect the white silicone tubing to the M8/olive tubing adapter of the measuring vessel cover.

2 Mounting the tubing for the air supply

- Screw the FEP tubing 250 mm to the air supply connections of the 892 Professional Rancimat.

3 Inserting the reaction vessel

- Fill the reaction vessel with the sample.
- After the required reaction temperature has been reached, insert the reaction vessel with the mounted reaction vessel cover in the openings provided on the 892 Professional Rancimat.

4 Establishing the tubing connections

- Connect the white silicone tubing that is connected to the measuring vessel cover to the tubing connector of the reaction vessel cover.
- Screw the FEP tubing 250 mm which is connected to the M8/olive tubing adapter of the 892 Professional Rancimat to the M8/M6 thread adapter of the reaction vessel cover.

NOTE

The optional clear glass measuring vessels (6.1428.030) may also be used in place of the polystyrene measuring vessel (6.1428.107).

In contrast to the polystyrene vessel, the measuring vessel (6.1428.030) can also be cleaned with acetone.

4.2.5 Mounting the exhaust air collection tube

The optional exhaust air collection tube (6.2757.000) can be mounted on the 892 Professional Rancimat for targeted removal of the exhaust air.

NOTE

A total of 8 pieces of silicone tubing (6.1816.010) (220 mm) are required in addition to the exhaust air collection tube.

Proceed as follows to mount the collection tube:

1 Mounting the exhaust air collection tube

- Insert the exhaust air collection tube with both support pins into the collection tube holders on the 892 Professional Rancimat in such a way that the connector to the exhaust air removal is located to the rear.

2 Connecting the measuring vessels

- Screw the M8/olive tubing adapter into the **Out** opening of the measuring vessel cover.
- Connect one end of the silicone tubing to the M8/olive tubing adapter.
- Insert the other end of the silicone tubing into the corresponding opening on the collection tube.
- Seal the unused openings on the collection tube with the enclosed stoppers.

3 Connecting the exhaust air collection tube

- Connect a suitable tubing to the connector of the exhaust air collection tube and connect it to an active suction device (e.g. water-jet pump).

4.2.6 Mounting the oil separator

If samples with a high content of highly volatile compounds are used, there is a risk that the sample is transferred to the measuring vessel in the vapor phase. This can compromise the conductivity measurement. The amount of oil contained in the vapor phase can be reduced by means of the oil separator (6.2753.200). The use of the oil separator is recommended if the conductivity measurement is compromised by the presence of the sample in the measuring vessel.

NOTE

An additional 8 pieces of silicone tubing (6.1816.010) are required if 8 oil separators are used.

NOTE

The oil separators must be cleaned after each measurement *(see chapter 5.3.5, page 42)*.

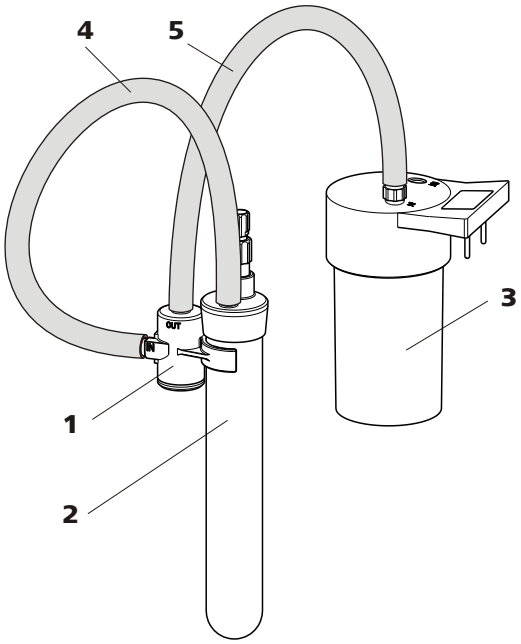


Figure 10 Mounting the oil separator

1 Oil separator (6.2753.200) Oil separator with sealing cover (bottom).	**2 Reaction vessel**
3 Measuring vessel	**4 Silicone tubing to the oil separator**
5 Silicone tubing to the measuring vessel	

Proceed as follows to mount the oil separator:

1 Clamping the oil separator in place

- Clamp an oil separator in place on the side of each reaction vessel (sealing cover on the bottom).

2 Attaching the silicone tubing to the oil separator

- Attach one end of the silicone tubing to the tubing connector of the reaction vessel.
- Attach the other end of the silicone tubing to the inlet opening **IN** of the oil separator.

3 Attaching the silicone tubing to the measuring vessel

- Attach one end of the silicone tubing to the outlet opening **OUT** of the oil separator.
- Attach the other end of the silicone tubing to the tubing connector of the measuring vessel.

4.3 Power connection

WARNING

There is a risk of fire if the instrument is operated with an incorrect mains fuse!

Follow the regulations below for the mains connection.

4.3.1 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.

4.3.2 Replacing fuses

The fuse holder of the 892 Professional Rancimat contains two fuses:

- Two **slow-acting 4 A** fuses

WARNING

Ensure that the instrument is never put into operation with fuses of another type, otherwise there is a risk of fire!

Proceed as follows to replace defective fuses:

1 Pulling out the power cord

- Pull the power cord out of the power socket of the 892 Professional Rancimat.

2 Removing the fuse holder

- Release the fuse holder located on the rear of the instrument above the power socket by pressing the catch spring and pull out the holder completely.

3 Replacing the fuses

- Carefully remove the defective fuses from the fuse holder and replace them with two new **slow-acting 4 A** fuses:

4 Inserting the fuse holder

- Push the fuse holder back into the instrument until it latches into place.

4.3.3 Switching the instrument on and off

The power switch *(2-**3**)* is used to switch the 892 Professional Rancimat on and off. The instrument display is switched on when the instrument is switched **on**.

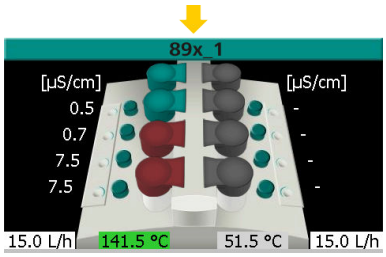


Figure 11 Instrument display with instrument name

The instrument 892 Professional Rancimat has been recognized by the **StabNet** computer program and the instrument name entered has been transmitted.

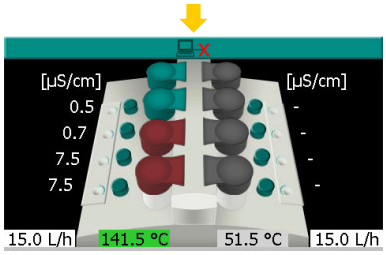


Figure 12 Instrument display with "no connection" symbol

The USB connection between the instrument 892 Professional Rancimat and the computer has been interrupted and the corresponding symbol is displayed.

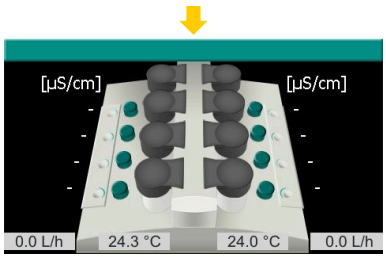


Figure 13 Instrument display without instrument name and symbol

The instrument 892 Professional Rancimat is connected to the computer but the **StabNet** computer program has been closed.

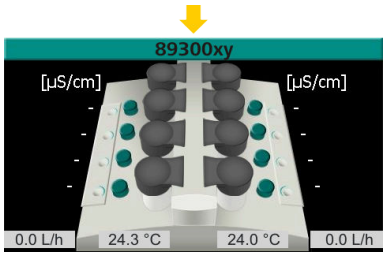


Figure 14 Instrument display with serial number

The instrument 892 Professional Rancimat has been started, but the **StabNet** computer program was not previously started.

4.4 Connecting a computer

4.4.1 Connecting the 892 Professional Rancimat and the computer

NOTE

The **StabNet** computer program has to be installed before you can connect the instrument to the computer.

The **StabNet** computer program allows you to control up to 4 instruments.

Connect and set up the 892 Professional Rancimat as follows:

1. Establish a connection between the USB interface *(2-**16**)* of the 892 Professional Rancimat and the required USB interface on the computer using the USB cable (6.2151.130).
2. Start the **StabNet** computer program.
3. Switch on the 892 Professional Rancimat using the power switch.
4. Wait for the instrument 892 Professional Rancimat to be detected and installed.
5. Enter the instrument information into the dialog fields of the 892 Professional Rancimat configuration.

NOTE

You will find detailed information regarding the **StabNet** computer program in the Tutorial.

The instrument name entered in the configuration must appear on the instrument display *(3-**3**)*.

5 Operation

5.1 Rancimat method

The decay of vegetable and animal fats, which can be perceived in the initial stage through a deterioration of odor and taste (rancidity), is to a great extent the result of chemical modifications caused by the effect of atmospheric oxygen. These oxidation processes, which progress slowly at ambient temperatures, are referred to as **autoxidation**. They start with radical reactions on unsaturated fatty acids and undergo a process involving multiple stages resulting in diverse decomposition products, in particular peroxides as primary oxidation products and alcohols, aldehydes and carboxylic acids as secondary oxidation products.

In the **Rancimat method**, the sample is exposed to an air flow at a constant temperature between 100 - 140 °C. Highly volatile, secondary oxidation products (for the most part formic acid and acetic acid) are transferred into the measuring vessel with the air flow, where they are absorbed in the measuring solution (distilled water). Here the conductivity is continuously registered. The organic acids can thus be detected by an increase in the conductivity. The time until these secondary reaction products occur is referred to as the induction time or induction period, which is a good characteristic for the oxidation stability.

The Rancimat method has been developed as an automated variant of the extremely complex AOM (active oxygen method) for determining the **induction time** of fats and oils. This method has become established over the course of time and has been incorporated in various national and international standards, e.g. AOCS Cd 12b-92 and ISO 6886.

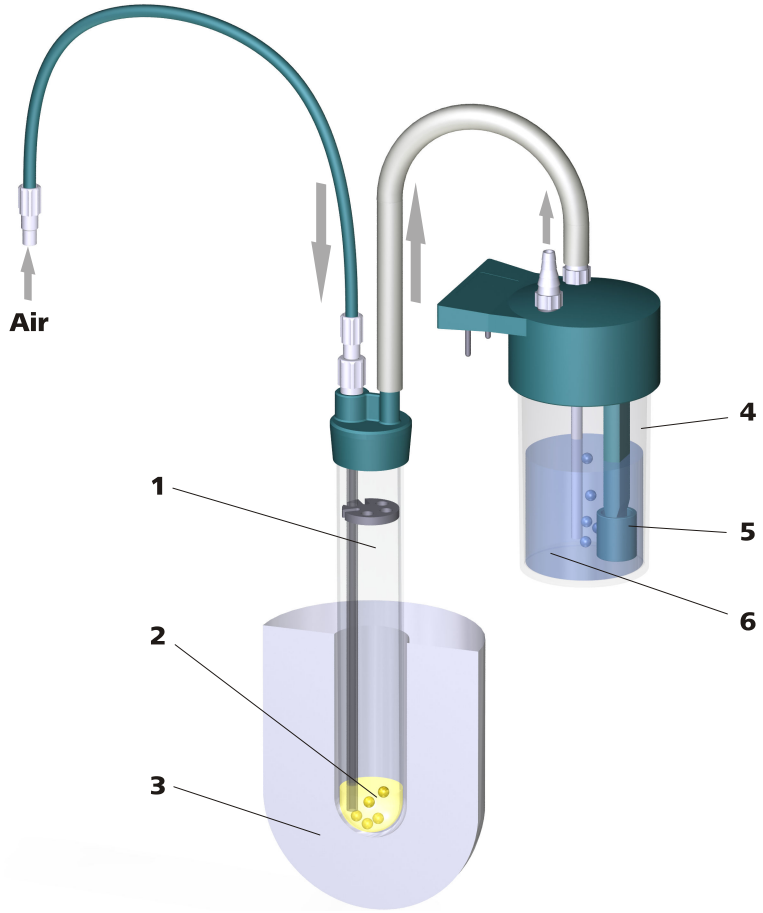


Figure 15 Measuring arrangement (schematic representation)

1	**Reaction vessel**	**2**	**Sample**
3	**Heating block**	**4**	**Measuring vessel**
5	**Conductivity measuring cell**	**6**	**Measuring solution**

5.2 Calibration functions

5.2.1 Determining the cell constant

The cell constant of the conductivity sensor (6.0913.130) is normally 1.1 ± 0.1 cm-1. This accuracy is sufficient for an **induction time** determination since only the shape of the curve is evaluated. For the determination of the **stability time**, however, the conductivity change is measured in absolute terms. As a rule, the time until an increase in conductivity of 50 µS/cm is determined. The cell constant for the conductivity measuring cell being used has to be calibrated in order to be able to measure the conductivity correctly.

The cell constants can be either entered manually or determined automatically by means of a defined standard solution, e.g. the conductivity standard 100 µS/cm (6.2324.010).

NOTE

You will find detailed information regarding the **StabNet** computer program in the Tutorial.

5.2.2 Determining the temperature correction

Temperature correction indicates the deviation of the current sample temperature from the temperature of the heating block and forms part of the method as a parameter.

The temperature correction can be determined automatically with the calibrated, external temperature sensor Pt100. 3 temperature values and 3 resistance values are required for the measurement with the temperature sensor. One temperature value and one resistance value belong together in each case. The values can be found in the certificate of the temperature sensor (see *Certificate Finder*).

Metrohm recommends recalibrating the temperature sensor every 2 years. The double measurement uncertainty (k=2) is a maximum of ± 50 mK. The recalibration can be carried out by Metrohm.

CAUTION

Do not bend the temperature sensor Pt100. Otherwise the sensor may become damaged or break. Consequently, the calibration values are invalid.

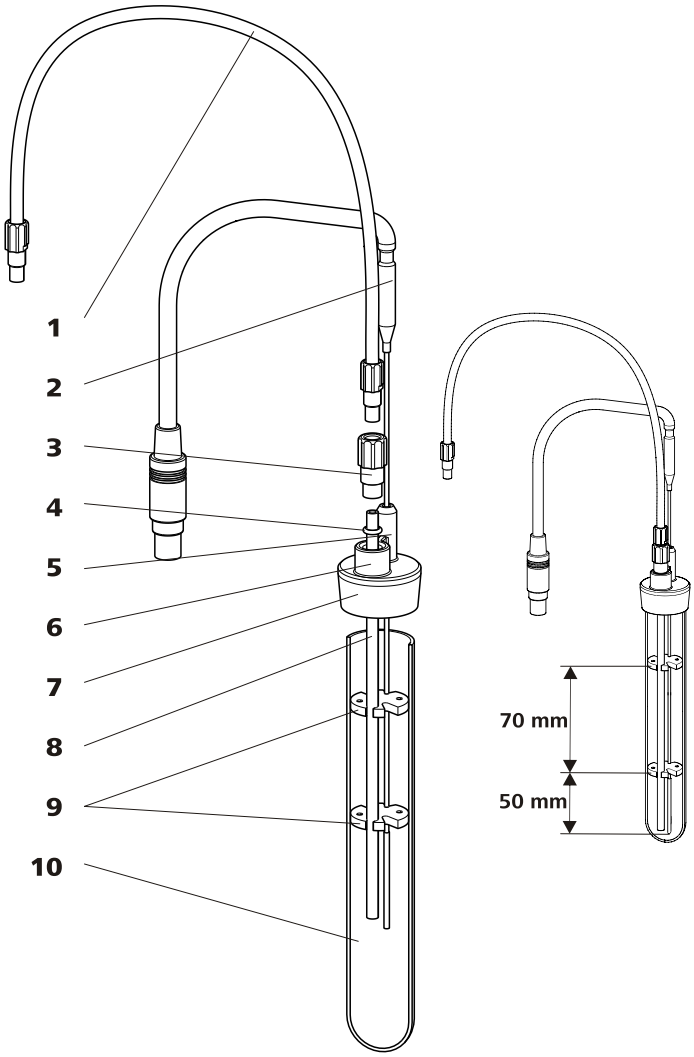


Figure 16 Assembling the reaction vessel for determining the temperature correction

1	**FEP tubing 250 mm (6.1805.080)** For supplying air into the reaction vessel.	**2**	**Pt100 temperature sensor (6.1111.010)**
3	**Thread adapter M8/M6 (6.1808.090)**	**4**	**O-ring (6.1454.040)**
5	**Temperature sensor opening** For inserting the temperature sensor.	**6**	**Connector** For connecting the thread adapter M8/M6.
7	**Reaction vessel cover (6.2753.107)**	**8**	**Air tube (6.2418.100)**
9	**Spacer (6.2042.040)**	**10**	**Reaction vessel (6.1429.040)**

Preparing the determination of the temperature correction

The figure shows in detail how the accessory parts are to be assembled for the determination of the temperature correction. Proceed as follows:

1 Preparing the reaction vessel cover

- Mount the air tube on the reaction vessel cover.
- Clamp the first spacer at a distance of approx. 12 cm from the lower end onto the air tube.
- Clamp the second spacer at a distance of approx. 5 cm from the lower end onto the air tube.
- Insert the temperature sensor from above into the temperature sensor opening and fasten it in the corresponding openings of the spacers.

2 Preparing the reaction vessel

- Fill the reaction vessel with 5 g silicone oil (6.2326.000).
- Place the reaction vessel cover with the temperature sensor on the reaction vessel.
- Push the temperature sensor all the way down (the sensor must touch the vessel base).

3 Inserting and connecting the reaction vessel

- Insert the reaction vessel with the mounted reaction vessel cover in the measuring position 2 or 3 of the required heating block.
- Screw one end of the FEP tubing 250 mm to the M8/M6 thread adapter of the reaction vessel cover.
- Screw the other end of the FEP tubing to the corresponding connector of the 892 Professional Rancimat.
- Connect the temperature sensor to the Pt100 connector *(2-**14**)* on the rear of the 892 Professional Rancimat.

NOTE

You will find detailed information regarding the **StabNet** computer program in the Tutorial.

5.3 Determinations

5.3.1 Preparing a sample

NOTE

Use **new reaction vessels and air tubes** for each measurement. Blow out the reaction vessels with nitrogen before use.

This chapter contains information on how to prepare the following samples:

- Pure, clear oils *(see page 34)*
- Non-liquid, pure fats *(see page 34)*
- Samples containing oil and fat *(see page 35)*
- Emulsion fats *(see page 37)*
- Solid samples (e.g. PVC) *(see page 38)*

Preparing pure, clear oils

Prepare oil that is completely pure and clear as follows:

1 Weighing in the sample

- Place the reaction vessel on a scale using a 6.2628.000 holder.
- Weigh the sample material directly in the reaction vessel. Normally, **3 g** of sample material are used for vegetable oils.

2 Checking the filling level

- Make sure that the quantity of sample material in the reaction vessel is sufficient so that the air tube is immersed deeply enough. If this is not the case, add more sample material.

Preparing non-liquid, pure fats

Prepare non-liquid, pure fat as follows:

1 Weighing in the sample

either

- Completely **liquefy** the fat in a water bath or in a drying oven at a temperature exceeding its melting point by 10 °C.
- Place the reaction vessel on a scale using a 6.2628.000 holder.
- Then transfer **3 g sample material** to the reaction vessel using preheated pipettes.

or

- Place the reaction vessel on a scale using a 6.2628.000 holder.
- Weigh in the fat as **solid**.
  For this, weigh in **3 g sample material** directly in the reaction vessel and insert it briefly in the heated block of the 892 Professional Rancimat, so that the fat melts.

2 Checking the filling level

- Make sure that the quantity of melted sample material in the reaction vessel is sufficient so that the air tube is immersed deeply enough. If this is not the case, add more sample material.

Preparing samples containing oil and fat

Oils and fats made from products containing oil and fat must be extracted with petroleum ether (low-boiling) while being protected from light as follows:

1 Crushing the samples

- Finely and homogeneously grind oilseed fruit, cocoa beans as well as other solids in coarse form in a knife mill or another suitable crushing apparatus (if possible, metal-free).

NOTE

Oil/fat extraction through pressing has not proven effective in practice.

2 Extraction

- Prepare a 300 mL Erlenmeyer flask with standard ground-joint.
- Weigh in between 50 and 100 g (depending on the oil/fat content) of the sample in powder form (e.g. milk powder, cocoa powder, hazelnut powder) or the finely ground material.
- Cover the sample material with a layer of approx. 1 cm of petroleum ether (low-boiling).
- Extract the oil or fat while continuously stirring for around 12 h and keeping it protected from light.

NOTE

In order to carry out at least one double determination on the 892 Professional Rancimat, you have to extract approx. 10 g pure oil or fat, allowing for a certain transfer loss (for more than two determinations, an accordingly higher amount is necessary).

- Prepare a clean 250 mL round-bottom flask with standard ground-joint and a folded filter.
- Filtrate, if possible protected from light. Rewash the residue with a little petroleum ether.

NOTE

If the folded filter becomes blocked (e.g. due to the consistency of the sample material), a Soxhlet apparatus should be used for solid/liquid separation. You can use up to 40 g of sample material per batch.

3 Distillation and filtration

- Distill the petroleum ether from the clear, perhaps slightly yellow extract.

NOTE

It is safest and easiest if you do this in a rotary evaporator; in a slight vacuum, protected from direct light (cover the water bath e.g. with aluminum foil) and at a temperature of +30 - 35 °C the petroleum ether can gently and efficiently be removed.

- Dry the oil/fat sample after the distillation has been completed for approx. 30 min at a pressure of < 1,330 Pa (13.3 mbar).
- Filtrate the oil/fat sample now present together with **water-free Na_2SO_4** with a folded filter. If necessary, work in the drying oven at a temperature exceeding the melting point of this fat by 10 °C.

4 Further sample preparation

- Treat the isolated oil/fat samples afterwards just as pure oils and fats.

NOTE

If the isolated oil/fat samples are not immediately analyzed, you have to store the samples **in a cool place and protected from light**; for storing the samples, you should cover them in their vessels with a nitrogen layer. This type of storage does not provide complete protection against unintended and uncontrolled changes in the oxidation stability, but it represents a useful preservation in many cases.

You can find further information on the treatment of oil and fat samples in **Rancidity in Foods**, Allen J.C., Hamilton R.J., *Applied Science Publishers*, London and New York, 1983.

Preparing emulsion fats

You can use emulsion fats like pure substances and prepare them as follows:

1 Weighing in the sample

- Weigh in the sample.

NOTE

As the water evaporates right at the beginning of the analysis and is carried away by the air blown through, you have to use correspondingly more sample material.

2 Mounting the foam barrier

- Mount the foam barrier (*see figure 9, page 20*), as the samples can **foam heavily**.

NOTE

If the emulsion fat samples are not immediately analyzed, you need to store the samples **in a cool place and protected from light**; for storing the samples, you should cover them in their vessels with a nitrogen layer. This type of storage does not provide complete protection against unintended and uncontrolled changes in the oxidation stability, but it provides useful preservation in many cases.

Solid samples (e.g. nuts)

Prepare the sample as follows:

1 Place the reaction vessel on a scale using a 6.2628.000 holder.

2 If necessary, pulverize the sample material and weigh it directly in the reaction vessel. Normally, **0.5 g** of sample material is used.

Alternatively you can melt the emulsion fats (e.g. butter, margarine) at a temperature exceeding the melting point of these fats by 10 °C (i.e. at approx. +50 °C) centrifuge them and pipette off the resultant oil phase.

5.3.2 Preparing the instrument and the accessories

The cleanliness of instrument and accessory parts is an indispensable prerequisite for **reliable, reproducible and correct analysis results**. Even the slightest contamination could catalytically accelerate the oxidative decomposition and lead to completely incorrect results. Therefore, always observe the instructions for use of measuring and reaction vessels in this chapter.

Check and prepare the instruments and vessels as follows:

1 **Checking the positions for reaction vessels**

- Check whether the positions in the heating block are clean and empty.
  Blow out contamination and dust in the positions with nitrogen.
  If the instrument is not used, always seal the corresponding positions with the stoppers.

2 **Filling the measuring vessels**

NOTE

Only use **measuring vessels** and accessories which are **absolutely clean** and in a **flawless condition**.

- Fill the cleaned measuring vessels with **60 mL distilled water** each.
  For analysis times of more than 24 h approx. 7 mL more distilled water must be added per day to compensate for the evaporation loss, so that the electrodes remain safely immersed.

3 Inserting the measuring vessels

- Place the clean measuring vessel covers equipped with a PTFE cannula on the measuring vessels.
- Insert the measuring vessels with the measuring vessel covers into the openings provided for this on the 892 Professional Rancimat while carefully guiding the connector plugs of the cover into the electrode connectors.

4 Weighing in samples

NOTE

Use **new reaction vessels and air tubes** for each measurement. Blow out the reaction vessels with nitrogen before use so that any adhering particles are removed.

- Weigh in **3 g of the samples** in each reaction vessel *(see chapter 5.3.1, page 34)*.

5 Mounting the accessories

- Hold the upper edge of the reaction vessel in your hand (e.g. in the recess between your thumb and index finger) and rotate the glass once.
  This serves to cover the degreased glasses with a light **fat film** so that the vessel covers can be removed more easily after the determination.
- Insert an air tube into the connector of the reaction vessel cover, fix it with the O-ring and fasten it by screwing in the M8/M6 thread adapter.
- Place the reaction vessel cover on the reaction vessel. Turn the cover in such a way that the air tube is as close as possible to the vessel wall.
- Connect the white silicone tubing to the tubing connector of the reaction vessel cover.
- Place the prepared reaction vessel in the vessel holder.

5.3.3 Preparing the determination

1 Selecting the method (StabNet)

- In the Workplace program part, click on the symbol within the block A area and select a **Method** for block A.
- If required, also select a method for block B.

NOTE

Different methods with different temperatures can be selected for block A and block B.

The gas flow for the two blocks **A** and **B** cannot be switched on and off individually for each block but only collectively. If methods with different gas flows are loaded on the two blocks, then the value from the block in which the gas flow is switched on is used.

2 Starting the heater (StabNet)

- In the **Workplace** program part, click on the **[Start]** button for **Heater** within the block A area.
- If required, also switch on the heater for **Block B**.

The color of the temperature display on the 892 Professional Rancimat changes to red during the heating phase.

The color of the temperature display on the 892 Professional Rancimat changes to green once the setpoint temperature has been reached.

Heating period to 120 °C: approx. 45 min.

Heating period to 200 °C: approx. 60 min.

NOTE

If you wish to switch off the heating, click on the **[Stop]** button.

3 Enter sample identification (StabNet)

- Enter the sample identifications **Ident** and **Info 1 - 3** for all sample positions used.

The entries for **Ident** and **Info 1 - 3** can be selected from the **Text templates**.

NOTE

The **Info 2** and **Info 3** info fields can be activated in the sub-window **Properties - Sample data** in the **Method** program part.

4 Connecting and inserting reaction vessels

NOTE

The temperature defined in the method has to be reached before you insert the reaction vessels, i.e., the temperature display has to be **green**.

- Seal the unused positions with stoppers or empty reaction vessels for protection against impurities.
- Connect the white silicone tubing which is connected to the reaction vessel covers to the M8/olive tubing adapter of the measuring vessel covers.
- Screw the pieces of FEP tubing 250 mm to the M8/M6 thread adapters of the reaction vessel covers and the air supply connectors of the 892 Professional Rancimat.
- Insert the prepared reaction vessels into the recesses of the heating block.
- Press the start button to start the data recording immediately after inserting each single reaction vessel.

5.3.4 Cleaning the accessories

1 Cleaning the measuring vessels and accessories

- Clean used **measuring vessels** after pouring off the measuring solution with ethanol or 2-propanol (**do not use acetone!**) or in the dishwasher.
  Pre-clean with dishwashing detergent in the case of severe contamination.
- Pre-clean with dishwashing detergent in the case of severe contamination.
- Thoroughly rinse with distilled water.
- Clean the **measuring vessel covers**, the **PTFE cannula** and the **electrodes** with acetone or 2-propanol or in the dishwasher and thoroughly rinse with distilled water.
  Pre-clean with dishwashing detergent in the case of severe contamination.
  Remove the protective ring to facilitate cleaning of the electrodes.

2 Cleaning the reaction vessels and accessories

- Dispose of used **reaction vessels** and **air tubes** and use new reaction vessels and air tubes for the next measurement.

- Clean the **reaction vessel covers** with acetone or 2-propanol or in the dishwasher and rinse with distilled water.
  Pre-clean with dishwashing detergent in the case of severe contamination.
- Then heat the **reaction vessel covers** in the drying oven for 2 hours at 80 °C.

NOTE

Replace the reaction vessel covers if they no longer sit tightly on the reaction vessel or the material is brittle.

3 Cleaning the tubing

- Clean the **silicone tubing** with acetone or 2-propanol or in the dishwasher and rinse with distilled water.
  Pre-clean with dishwashing detergent in the case of severe contamination.
- Then heat the **silicone tubing** in the drying oven for 2 hours at 80 °C.

5.3.5 Cleaning the oil separator

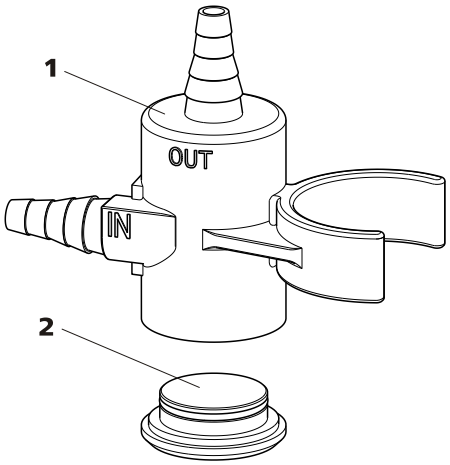


Figure 17 Oil separator (6.2753.200), disassembled

1 Body
Body with the **IN** and **OUT** connectors.

2 Base
Base with O-ring (6.1454.050) used for sealing the oil separator.

1 Disassembling the oil separator

- Remove the base.

NOTE

Remove the base carefully.

Do not use sharp or pointed tools.

2 Cleaning the oil separator bodies

- Clean the **oil separator bodies** with acetone or 2-propanol or in the dishwasher and rinse with distilled water.
  Pre-clean with dishwashing detergent in the case of severe contamination.
- Then heat the **oil separator bodies** in the drying oven for 2 hours at 80 °C.

3 Cleaning the oil separator bases

- Clean the **oil separator bases** with 2-propanol or in the dishwasher and rinse with distilled water.
  Pre-clean with dishwashing detergent in the case of severe contamination.
- Then heat the **oil separator bases** in the drying oven for 2 hours at 80 °C.
- Mount new O-rings where necessary.

NOTE

Do not allow the oil separator bases to come into contact with **acetone** for extended periods of time.

NOTE

Replace the O-rings if they no longer sit tightly on the body or if the material is brittle.

4 Assembling the oil separator

- Press the base onto the body by hand until it sits flush.

6 Operation and maintenance

6.1 General notes

6.1.1 Care

The 892 Professional Rancimat requires appropriate care. Excess contamination of the instrument may result in functional disruptions and a reduction in the service life of the otherwise sturdy mechanics and electronics.

Spilled chemicals and solvents should be removed immediately. Above all, the plug connections on the rear of the instrument (in particular the power socket) should be protected from contamination.

CAUTION

Although this is largely prevented by design measures, the power plug should be unplugged immediately if aggressive media have found their way into the interior of the instrument to prevent serious damage to the instrument electronics. In such cases, Metrohm Service must be informed.

6.1.2 Maintenance by Metrohm Service

Maintenance of the 892 Professional Rancimat is best carried out as part of annual service, which is performed by specialist personnel from Metrohm. If you are frequently working with caustic and corrosive chemicals, we recommend a shorter maintenance interval.

Metrohm Service offers every form of technical advice for maintenance and service of all Metrohm instruments.

6.1.3 Cleaning the instrument

WARNING

Danger of poisoning and chemical burns from chemical hazardous substances

Poisoning and/or chemical burns through contact with aggressive chemical substances.

- Only use detergents that do not cause any unwanted side reactions with the materials to be cleaned.
- Clean contaminated surfaces.
- Wear protective equipment.
- Use exhaust equipment when working with vaporizing hazardous substances.
- Dispose of chemically contaminated materials (e.g. cleaning material) properly.

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.
- Protect live parts (e.g. power supply unit, power cord, connection sockets) from moisture.
- If you suspect that moisture has gotten into the instrument, disconnect the instrument from the energy supply. Then, notify Metrohm Service.
- Only personnel who have been issued Metrohm qualification may perform service and repair work on electric and electronic parts.

Cleaning the surfaces of the product

Prerequisites

- The product is disconnected from the power grid.

1 Clean the surfaces with a damp cloth.

NOTE

If the suspicion arises that liquids have found their way into the product, disconnect the instrument from the power grid and contact your Metrohm service engineer.

NOTE

Water or ethanol can be used as a cleaning medium.

NOTE

The connectors at the rear of the product must only be cleaned with a dry cloth.

6.2 Replacing the dust filter

The dust filter *(2-**15**)* is mounted on the opening marked with **Filter** on the rear of the instrument and serves for filtration of the air aspirated through the air pump. It must be checked at periodic intervals and replaced in the case of more intense contamination (6.2724.010).

Figure 18 Dust filter - conditions

1 Dust filter new
New dust filters are white on the intake side.

2 Dust filter used
Used dust filters are discolored on the intake side.

3 Dust filter full
Full dust filters have a dark to black color on the intake side and must be exchanged.

6.3 Regenerating or replacing the molecular sieve

NOTE

Regenerate the molecular sieve regularly.

The intervals at which you have to regenerate the molecular sieve depends on the **humidity** in the laboratory and also on the **frequency of use** of the instrument.

The molecular sieve filled in the drying flask *(2-**9**)* serves to adsorb disruptive oxidizing gases as well as of the water from the aspirated air.

You can regenerate the molecular sieve in the drying oven at approx. +140 - +180 °C for 24 to 48 h. You can order a new molecular sieve under the order number 6.2811.000.

CAUTION

Do **not** fill the hot molecular sieve directly into the drying flask after regeneration, as otherwise the plastic filter on the filter tube will melt.

Wait until the molecular sieve has cooled down before filling.

7 Troubleshooting

7.1 Problems

Problem	Cause	Remedy
The pump is louder than normal.	*The air flow is blocked somewhere before or after the pump.*	▪ Check dust filter and replace it if necessary. ▪ Check filter tube on the drying flask cap for blockages and, if necessary, gently tap on it to remove them.
	Extra air is aspirated from elsewhere other than the dust filter. There is a leak somewhere in the system before the pump.	▪ Check the FEP tubing for cracks, kinks, etc. and fasten it tightly. Replace it if necessary. ▪ Place the drying flask cap correctly on the drying flask and screw tight.
No air flow can be detected in the reaction vessel (it does not bubble), although the pump is running.	*The air supply is blocked.*	▪ Remove the FEP tubing from the thread adapter. Here, a slight air flow must be perceptible. If this is not the case, please contact Metrohm Service. ▪ Check FEP tubing for blockages. If necessary, clean or replace. ▪ Check the thread adapter and the air tube on the reaction vessel cover for blockages. If necessary, clean or replace.
	The FEP tubing for the air supply is defective.	Check the FEP tubing for cracks, kinks etc. If necessary, replace.
	The FEP tubing for the air supply is not connected correctly.	Tighten the FEP tubing on both sides.
	The air tube does not immerse in the sample.	▪ Press the reaction vessel cover all the way down. ▪ Use more sample.
No air flow can be detected in the measuring vessel (it does not bubble), although an air flow can be discerned in the reaction vessel.	*The connection is blocked.*	▪ Check the tubing connector on the reaction vessel cover for blockage and, if necessary, clean. ▪ Check the silicone tubing for blockage and, if necessary, clean. ▪ Check the tubing adapter and the PTFE cannula on the measuring vessel cover for blockage and, if necessary, clean.

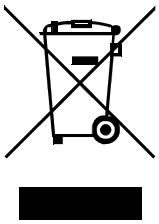
Problem	Cause	Remedy
	The connection is leaking.	Check the silicone tubing for leakages and, if necessary, replace.
	The reaction vessel cover does not sit correctly or tightly enough.	▪ If the reaction vessel cover is oblique or not completely mounted, press it all the way down. ▪ If the reaction vessel cover is loose on the reaction vessel despite correct assembly, the cover has to be replaced.
	The connection is wrongly connected.	▪ Make sure that the PTFE cannula for air supply is connected to the **In** opening of the measuring vessel cover. ▪ Make sure that the silicone tubing is connected to the tubing adapter that is mounted on the **In** opening. ▪ Make sure that the reaction vessel is connected to the measuring vessel that belongs to the corresponding measuring position.
The induction times are not reproducible for multiple determinations.	*The reaction vessels used are not clean.*	▪ Clean the reaction vessels of particles (dust, cardboard, etc.) with nitrogen before weighing in the sample. ▪ Only use new, unused reaction vessels.
	The reaction vessels used are scratched on the inside.	Only use new, unused reaction vessels.
	The reaction vessel cover does not sit correctly or tightly enough.	▪ If the reaction vessel cover is oblique or not completely mounted, press it all the way down. ▪ If the reaction vessel cover is loose on the reaction vessel despite correct assembly, the cover has to be replaced.
	The connection to the measuring vessel is not mounted correctly.	Ensure that no air can escape through leaks when transferring from the reaction vessel to the measuring vessel.

Problem	Cause	Remedy
	The temperature in different positions of a heating block differs, as sample has burnt on at one or more places in the recess of the heating block.	If necessary, carefully remove contamination from the **cold** heating block.
	The sample is not homogenous.	Homogenize the sample.
The stability times are not reproducible for multiple determinations.	*The cell constant was not determined or does not correspond to the value entered.*	▪ Determine the cell constant. ▪ Make sure that the assignment of the conductivity sensors is correct, so that the determined cell constant actually corresponds to the measuring cell used. ▪ Make sure that the measuring cell is not contaminated. Clean if necessary.
	The conductivity measuring cell is contaminated.	Check the measuring cell and, if necessary, clean.
	See also: The induction times are not reproducible for multiple determinations.	
The induction time is longer/shorter than expected.	*The temperature is not selected correctly.*	▪ Make sure that the correct method for the determination has been selected. ▪ Check whether the **Sample temperature** and the **Temperature correction** are indicated correctly in the method.
	See also: The induction times are not reproducible for multiple determinations.	
The stability time is longer/shorter than expected.	*The conductivity change is not correctly defined.*	Make sure that the value defined for the conductivity change in the method is correct.
	See also: The stability times are not reproducible for multiple determinations.	
	See also: The induction time is longer/shorter than expected.	

Problem	Cause	Remedy
The measurement curves are extremely noisy.	*The air supply for the measuring solution is directed to the conductivity measuring cell.*	Loosen the tubing adapter on the measuring vessel cover and turn the PTFE cannula such that the air is no longer directed to the electrode and fix it in this position.
	Gas bubbles adhere to the conductivity measuring cell during measurement.	▪ Make sure that the measuring cell is clean and free of fat. If necessary, clean thoroughly. ▪ In some cases, ultrapure water contains a large proportion of dissolved air. In this case, degas the ultrapure water before the measurement for 5 to 10 min in a vacuum.
	During the measurement, sample evaporates in the reaction vessel and condenses in the measuring vessel. This results in contamination of the conductivity measuring cell, which in turn promotes adherence of gas bubbles.	▪ Keep the measuring time as short as possible, by about 4 to 6 h. The induction time can be reduced by about half by increasing the temperature by 10 °C. ▪ Reduce the temperature to such an extent that sample evaporation is minimized or eliminated. However, this can substantially extend the measuring time. The induction time approximately doubles by reducing the temperature by 10 °C. ▪ Use an oil separator (6.2753.200).
The curve shows a step which means that the induction time is no longer determined correctly.	*Side reactions occur at the start or during the measurement. These reactions cause the conductivity in the measuring cell to rise.*	▪ Use the **Evaluation suppression** in the method. ▪ In addition to **Endpoint(s)** activate also **Conductivity** (e.g. 200 µS/cm) as stop criterion in the method and select the **Stop once all the criteria have been fulfilled** option. The evaluation parameters can be optimized on the basis of this curve, or the curve can be evaluated manually. ▪ Increase the **Evaluation sensitivity** method parameter.

Problem	Cause	Remedy
The curve shows a step at the start of the measurement, which has not occurred in previous measurements.	*The reaction vessel cover and/or the tubing still contain residues from previous measurements. These residues are then transferred to the measuring vessel with the flow of warm air during a new measurement.*	▪ Thoroughly clean the reaction vessel cover and the silicone tubing. ▪ Replace the reaction vessel cover and the silicone tubing from time to time. ▪ If an oil separator has been used, thoroughly clean it.
The induction time is not evaluated automatically, although a significant break point can be noticed in the curve.	*The **Evaluate induction time** option is deactivated in the method.*	Activate the evaluation of the induction time in the method.
	*The **Evaluation suppression** option preventing the evaluation of the curve in the corresponding time period is defined in the method.*	Deactivate the corresponding option in the method.
	Automatic detection of the induction time is not yet possible.	Keep the determination running until the induction time is automatically found.
	The curve progression is too flat, with the result that automatic detection of the induction time is not possible.	▪ Reduce the **Evaluation sensitivity** method parameter. ▪ Evaluate the curves manually using tangents.
	*An inappropriately high value was used in the method for the **Evaluation sensitivity**. This value makes a curve evaluation impossible.*	Enter a lower value (e.g. 1.0) for the **Evaluation sensitivity** option in the method.
The measurement aborts without an endpoint being found.	*The measurement has been stopped manually.*	Keep the measurement running until the endpoint is automatically found.
	A time or conductivity defined as a stop criterion in the method is reached before the endpoint.	▪ Activate the **Stop once all the criteria have been fulfilled** option in the method. ▪ Increase the value for time or conductivity. ▪ Deactivate time or conductivity as stop criterion.

8 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.

9 Technical specifications

9.1 General data

Number of instruments that can be connected	1–4
Number of samples per instrument	1–8 (4 each per heating block)
Sample amount	Several grams / several milliliters

9.2 Temperature control and measurement

Sample temperature setting range	50–220 °C
Temperature correction	±0–9.9 °C (Can be entered manually or determined automatically using the external temperature sensor.)
Temperature measuring range	0–300 °C
Resolution	0.1 °C
Maximum deviation of the heating block temperature from the set value (50–220 °C)	±0.3 °C
Reproducibility of the set temperature	typ. ±0.2 °C
Maximum temperature difference between different measuring positions per block	typ. < 0.3 °C
Temperature fluctuations	typ. < 0.1 °C (With operating temperature attained, reaction vessels inserted and identically filled and 20 L/h air throughput.)

Shutdown temperature	260 ± 15 °C (Resetting and troubleshooting carried out by Metrohm Service.)
Heating time for the instrument	approx. 45 min (from 20 °C to 120 °C) approx. 60 min (from 20 °C to 220 °C)
External temperature of the instrument	< 50 °C (at operating temperature 220 °C)

9.3 External temperature sensor

Sensor	4-pin for sensor Pt100 (6.1111.010)

9.4 Conductivity measurement

Sensor	Conductivity measuring cell, integrated in the measuring vessel cover (6.0913.130)
Electrode	Conductivity measuring cell with 2 stainless steel electrodes
Measuring principle	AC current measurement with 1 kHz frequency and approx. 1.0 V amplitude (peak to peak)
Cell constant	1.0–1.2 (The exact value can be entered manually or determined automatically)
Measuring range	0–400 µS/cm (at c = 1)
Resolution	0.1 µS/cm
Display range	0–999 µS/cm
Maximum deviation from measured value	±(0.5 µS/cm + 1% of the measured value)

9.5 Gas flow regulation

Pump	Membrane pump (brushless motor)
Volumetric flow range	1–25 L/h at 25 °C and 1013 mbar
Maximum deviation from the set range	±(0.25 L/h + 5% of the measured value)
Maximum permissible pressure, "Air/N_2 in" connector	3 bar

9.6 USB interface

USB connector	USB plug type B

9.7 Power connection

Nominal voltage range	100 - 120 V and 220 - 240 V ± 10% (autosensing)
Frequency	50 and 60 Hz (autosensing)
Power consumption	450 VA_{max}
Fuse	Diameter 5 mm, length 20 mm 4.0 ATH (slow-acting)

9.8 Ambient conditions

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. 2,000 m.a.s.l. sea level / min. 800 mbar
Overvoltage category	II
Pollution degree	2

9.9 Dimensions/Material

Width	383 mm
Height	277 mm (without accessories)
Depth	462 mm
Weight	16.1 kg (without accessories)
Lid material	Baydur®110 FR-6 with flame retardation for fire class UL94VO, CFC-free
Base material	Steel sheet, coated

Index