909 UV Digester

Manual

8.909.8001EN

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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://documents.metrohm.com*.

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1 Introduction

1.1 Instrument description

The 909 UV Digester is used for the digestion of aqueous samples moderately loaded with organic material. Its primary use is sample preparation for analyses in voltammetry, ion chromatography, AAS and ICP-AES. The digestion of samples is based on the photolytic generation of hydroxyl radicals, whose formation is initiated by a hydrogen peroxide radical initiator. The hydroxyl radicals immediately react with the organic compounds and work to break them down. The temperature and time for digestion can be entered conveniently using the operating unit. The temperature is controlled automatically using air cooling and the UV lamp's emitter power (medium pressure mercury lamp), which is regulated between 100% and 50% as needed.

The 909 UV Digester combines the wet end and control unit in one housing. The UV lamp is located in the center of the wet end. The sample vessels are inserted in the sample holder encircling the UV lamp. The fan for air cooling is located in the lower portion of the wet end. The control unit consists of the operating unit and all of the electronics including the electronic ballast for regulating the UV lamp. The 909 UV Digester is used as a standalone instrument.

1.1.1 Supply voltage

The 909 UV Digester can be operated only with a supply voltage of 220 to 240 V. Therefore, for a supply voltage of 100 to 120 V, a transformer has to be connected between the power and the instrument. You can find details on the transformer's specifications in Chapter *Technical specifications, page 39*.

1.1.2 Intended use

The 909 UV Digester is a sample preparation instrument that can be used in analytical laboratories for preparing samples for the following analysis processes:

- Voltammetry
- Ion chromatography
- AAS
- ICP-AES

Chemicals and flammable substances can be used as a sample additive or auxiliary reagent in this instrument. Usage of the 909 UV Digester therefore requires the user to have basic knowledge and experience in handling toxic and caustic substances. Knowledge with respect to the application

of the fire prevention measures prescribed for laboratories is also mandatory.

1.2 Function description

Through the effects of UV radiation, dissolved organic matter that disrupts the trace analysis of heavy metals is decomposed. However, the UV radiation itself does not cause the digestion of the organic sample components; rather, hydroxyl radicals that form break down the organic matter. Hydroxyl radicals are initially formed from the added hydrogen peroxide that functions as the initiator for the radical chain reaction. Subsequently, additional hydroxyl radicals are generated from the water if the temperature is high enough. Depending on the sample matrix, it may be necessary to add more H_2O_2 during digestion.

$$H_2O_2 \xrightarrow{UV} 2\,OH\bullet$$

$$H_2O \xrightarrow{UV} H\bullet + OH\bullet$$

Spectrum of the UV lamp

The following figure shows a typical spectrum for the UV lamp. Certain deviations from this spectrum are possible; this can be traced back to production-related factors.

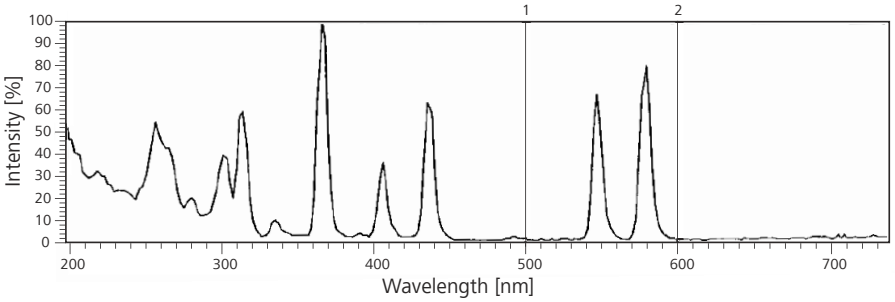


Figure 1 UV lamp spectrum

1.3 About the documentation

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.

1.3.1 Symbols and conventions

The following symbols and formatting may appear in this documentation:

*(5-**12**)*	**Cross-reference to figure legend** The first number refers to the figure number, the second to the instrument part in the figure.
1	**Instruction step** Carry out these steps in the sequence shown.
Method	**Dialog text**, **parameter** in the software
File ▶ New	Menu or menu item
[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 hazardous UV radiation.
	**Warning** This symbol draws attention to a possible biological hazard.

Caution

This symbol draws attention to possible damage to instruments or instrument parts.

Note

This symbol marks additional information and tips.

1.4 Safety instructions

1.4.1 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.

1.4.2 Electrical safety

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

Warning

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

Warning

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

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

Supply voltage

Warning

An incorrect supply voltage can damage the instrument.

Operate this instrument only with a supply voltage specified for it (refer to the rear of the instrument). Use a transformer if necessary (for specifications for the transformer *see Chapter 9.4.2, page 40*).

Protection against electrostatic charges

Warning

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

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

1.4.3 Personnel safety

Warning

Hazardous chemical substances

Chemical substances can cause chemical burns and skin damage.

Correctly install the UV protective shield and wear protective glasses, protective gloves and work clothes appropriate for laboratory work when operating the 909 UV Digester.

Warning

Harmful UV radiation

UV radiation damages the eyes.

Protect your eyes from UV light during operation. Correctly install the UV protective shield and wear UV protective glasses.

The 909 UV Digester has to be operated in a closed fume cupboard or in a closed laboratory and may be operated only by trained personnel.

Attach the supplied UV warning shield included in the accessories to the fume cupboard.

Warning

Escaping ozone

Ozone can damage mucous membranes.

The 909 UV Digester has to be operated in a closed fume cupboard or in a closed laboratory and may be operated only by trained personnel.

Warning

Hot surfaces

The UV lamp, sample vessels and sample holder become very hot during operation. The UV lamp can reach a temperature of 900 °C.

Skin contact during and immediately after a radiating procedure will cause burns.

Avoid skin contact until the instrument is completely cool or wear heat-insulated gloves if necessary.

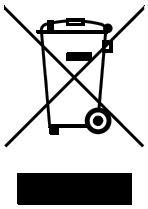
1.4.4 Flammable solvents and chemicals

Warning

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

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

1.4.5 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

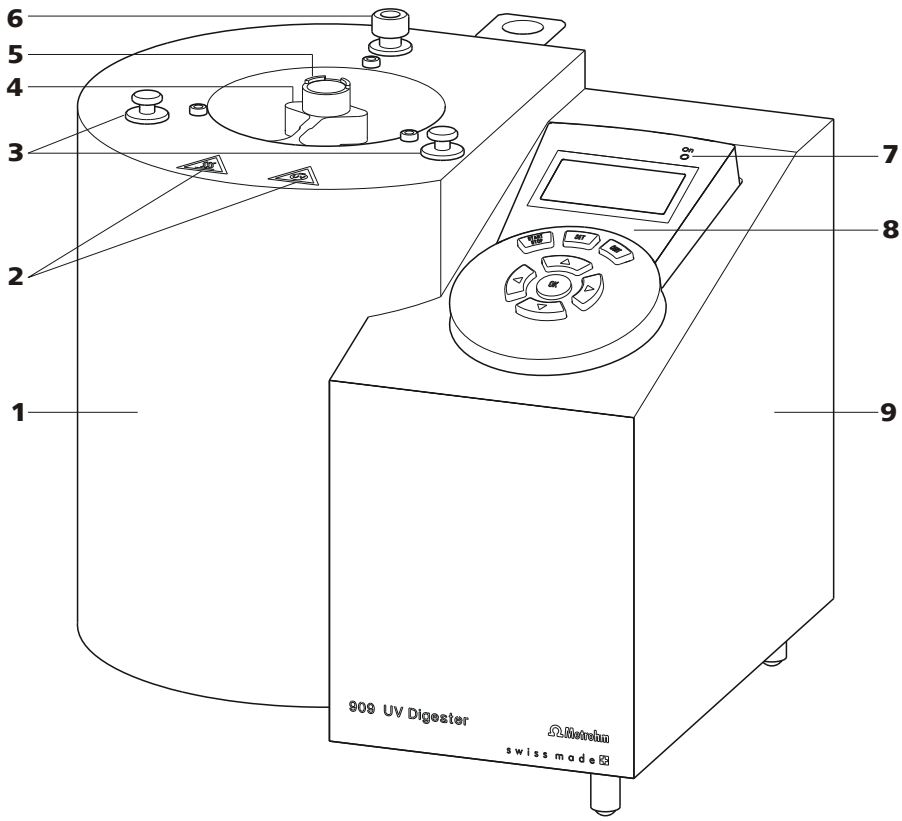


Figure 2 Front 909 UV Digester

1 **Wet end**	**2** **Warning symbols** "UV radiation" and "Hot surfaces".
3 **Stops** For positioning the UV protective shield.	**4** **Lamp holder** With upper lamp socket.
5 **Holder** For inserting the sample holder.	**6** **Stop** With hex socket head screw, for mounting the UV protective shield.
7 **"On" LED** Lights up if the instrument is switched on.	**8** **Operating unit** With keyboard and display.
9 **Control unit**	

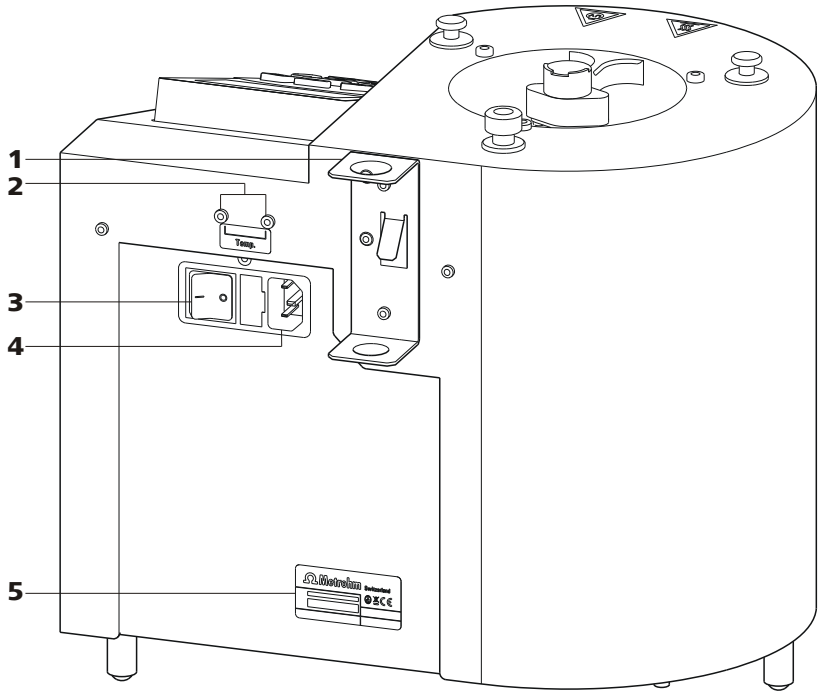


Figure 3 Rear 909 UV Digester

1	**Holder** For storage vessel for temperature sensor.
2	**Temperature sensor connection (Temp.)** For connecting the Pt1000 temperature sensor. Two B sockets, 2 mm.
3	**Power switch** For switching the instrument on and off.
4	**Power socket**
5	**Type plate** Contains the serial number.

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.

In the wet end of the 909 UV Digester, ozone from the air is released due to the UV radiation. Set up the instrument in a fume cupboard or closed laboratory at a location in the laboratory that is suitable for operation and free of vibrations. The location should be protected from corrosive atmospheres and contamination from chemicals.

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

3.2 Inserting the UV lamp

The UV lamp (6.2804.090) is included in the scope of delivery for the 909 UV Digester.

Caution

Spots on the quartz tube

Spots will be burned into the quartz glass if you touch the UV lamp's quartz tube with bare hands and put it into operation without cleaning it first. This lowers the power of the UV lamp.

Always use the cotton glove included with the UV lamp to install the lamp and only touch the UV lamp at the two flattened ends. Remove any grease spots or dust particles stuck to the quartz tube before starting the UV lamp.

Proceed as follows to insert the UV lamp:

1 Ensure that the power for the 909 UV Digester has been disconnected.

2 Remove the sample holder from the wet end if it has already been inserted.

3 Put on the cotton glove included with the UV lamp.

4 Wipe off any spots on the quartz tube using a clean towel wetted with pure alcohol.

5 Hold the UV lamp by one of the two flattened ends and guide it downward into the wet end.

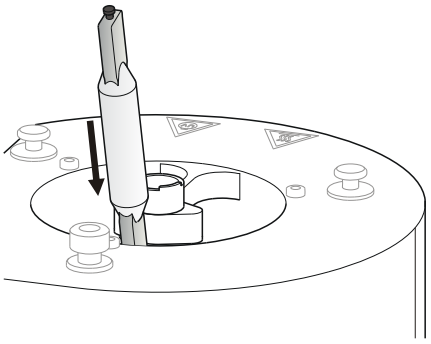


Figure 4 Guiding the UV lamp downward into the wet end

6 Insert the metal contact projecting on the lower end of the UV lamp into the lower lamp socket and press it down gently.

7 While holding the UV lamp down, click the metal contact projecting upwards into the upper lamp socket.

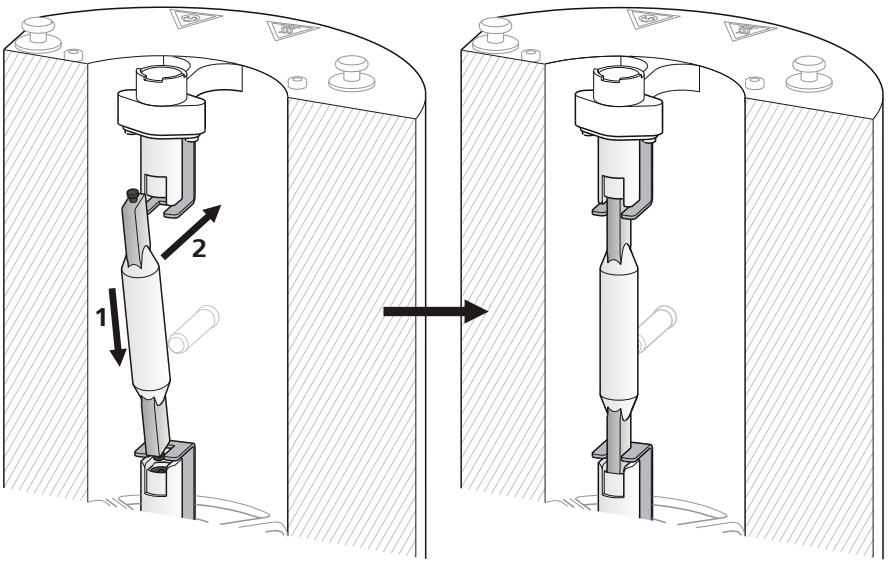


Figure 5 Installing the UV lamp in the wet end

3.3 Mounting the UV protective shield

A UV protective shield (6.2745.100) pre-installed on a metal ring is included in the scope of delivery for the 909 UV Digester.

Proceed as follows:

1 Using the hex key (6.2621.100), unscrew the stop's hex socket head screw *(2-**6**)* on the back of the housing and remove the stop.

Keep the stop with the hex socket head screw in reach. It will have to be screwed back in place on the housing afterwards.

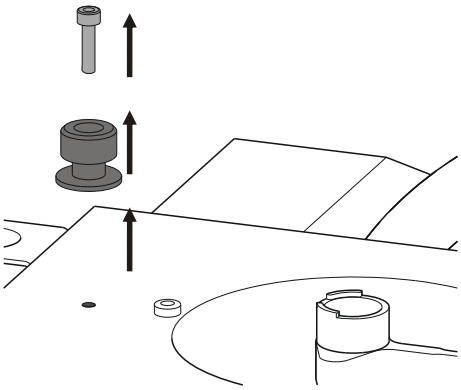


Figure 6 Removing the stop

2 Place the UV protective shield over the wet end's opening so that the metal ring rests on the two front stops *(2-**3**)*.

Ensure that the UV protective shield is positioned towards the front.

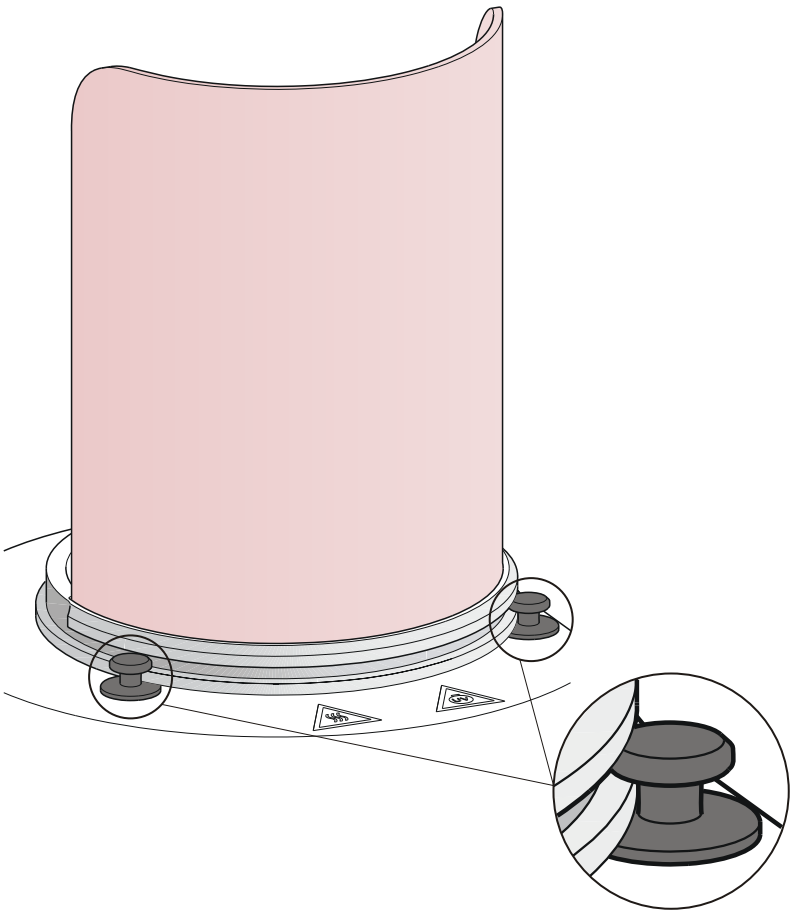


Figure 7 Positioning the UV protective shield over the wet end

3 Place the stop removed earlier over the threaded hole in the back on the housing.

Ensure that the metal ring for the UV protective shield is located in the slot between the lower and upper part of the stop.

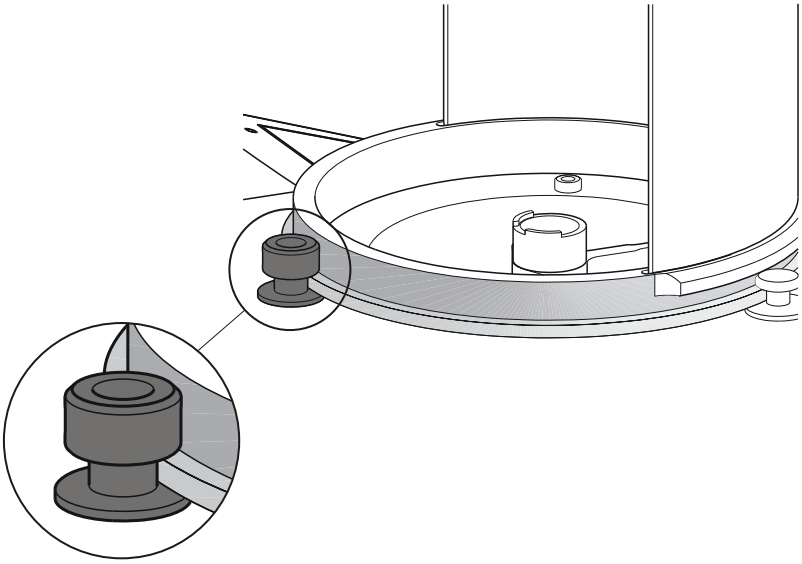


Figure 8 Positioning the stop over the threaded hole

4 Screw the stop back in place on the housing with the hex socket head screw.

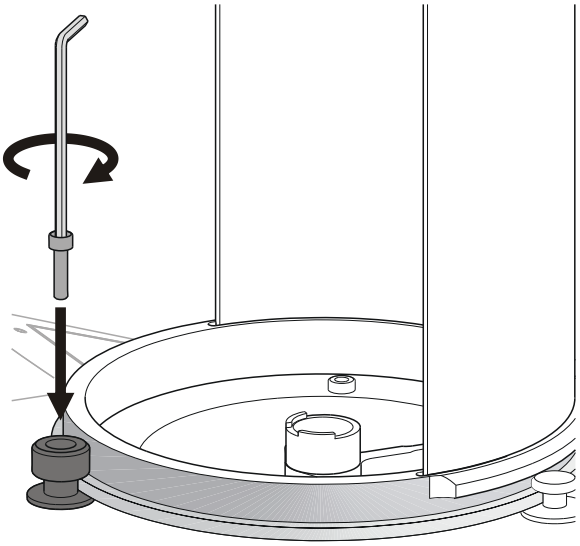


Figure 9 Screwing the stop in place

Check whether the UV protective shield can be turned back all the way to the stop *(2-**6**)* on both sides.

3.4 Preparing and connecting the temperature sensor

The temperature sensor (6.1110.010) is included in the scope of delivery for the 909 UV Digester.

Preparing

Proceed as follows:

1 Remove the temperature sensor from the storage vessel.

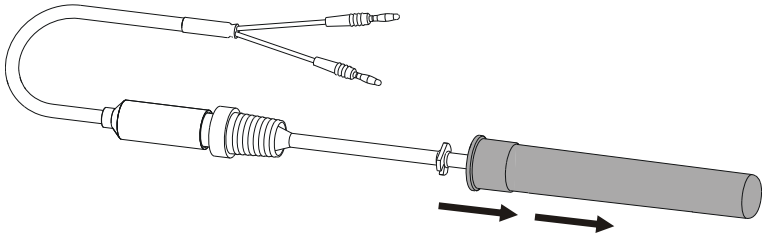


Figure 10 Removing the temperature sensor from the storage vessel

2 Remove the spacer in the lower part of the glass tube.

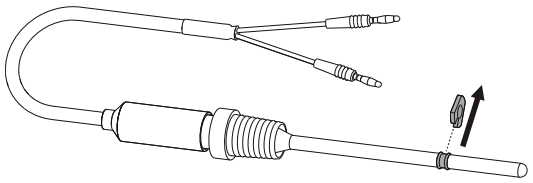


Figure 11 Removing the spacer from the temperature sensor

Keep the spacer in reach. It will have to be attached back on the glass tube afterwards.

3 Remove the SGJ sleeve.

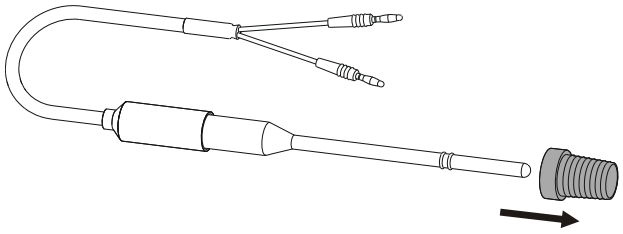


Figure 12 Removing the SGJ sleeve from the temperature sensor

4 Guide the thermometer plug (6.1446.190) over the temperature sensor from the bottom until it is flush with the head of the temperature sensor.

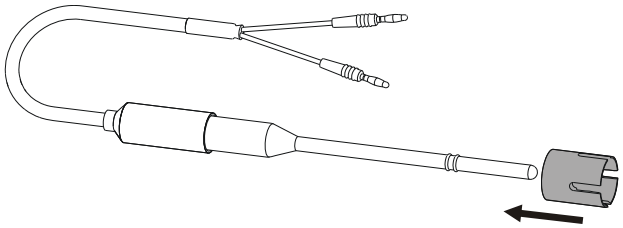


Figure 13 Attaching the thermometer plug on the temperature sensor

5 Insert the spacer back into the notch in the glass tube.

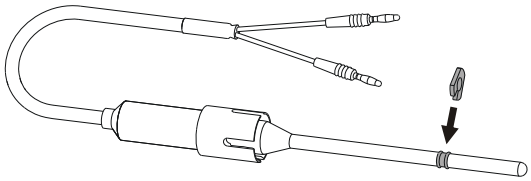


Figure 14 Attaching the spacer to the temperature sensor

The spacer ensures that the temperature sensor is positioned in the middle of the sample, thereby ensuring optimal temperature measurement.

Inserting the storage vessel for the temperature sensor

1 Insert the storage vessel (6.2008.040) included in the scope of delivery in the holder *(3-**1**)* on the rear of the instrument.

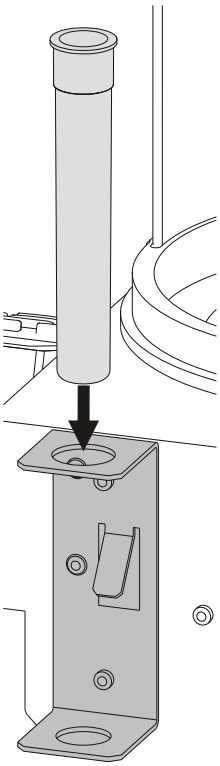


Figure 15 Inserting the storage vessel for the temperature sensor into the holder

For storing the temperature sensor between digestion processes.

2 Insert the temperature sensor equipped with the temperature plug and spacer into the storage vessel.

Connecting

Proceed as follows:

1 Insert the plugs for the temperature sensor into the **Temp.** sockets.

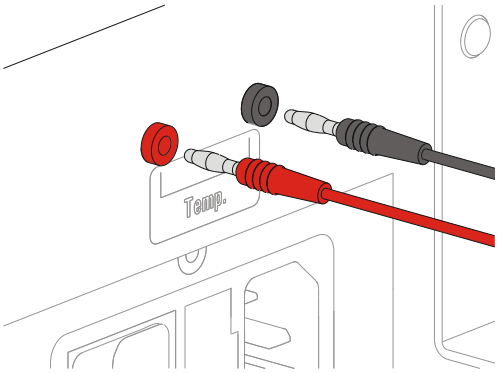


Figure 16 Connecting a temperature sensor

Note

Always insert the red plug into the red socket. This is the only way that shielding against electrical interference can be ensured.

3.5 Inserting the sample holder

The sample holder has to be fully filled to ensure uniform temperature distribution in the samples *(see "Preparing samples", page 26)*.

Proceed as follows:

1 Guide the sample holder on the mounting bracket into the wet end so that the slot between sample positions **1** and **12** ends up located at the front at the lamp holder *(2-**4**)*.

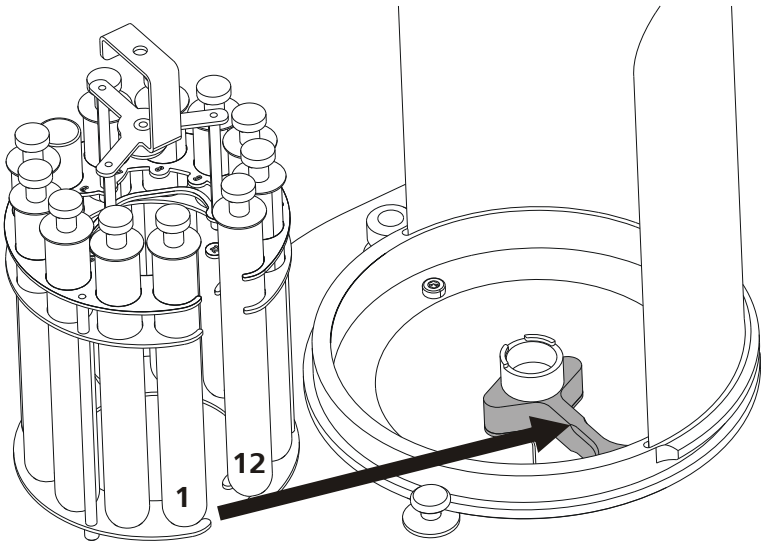


Figure 17 Guiding the sample holder into the wet end

Ensure that the cylindrical guide on the bottom of the sample holder's mounting bracket clicks in place in the holder *(2-**5**)*.

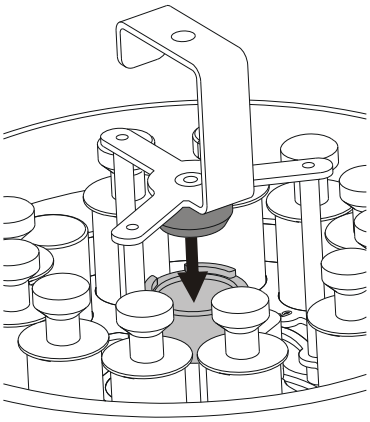


Figure 18 Positioning the cylindrical guide for the sample holder

2 Always insert the temperature sensor into the sample vessel filled with sample at **Position 6** of the sample holder.

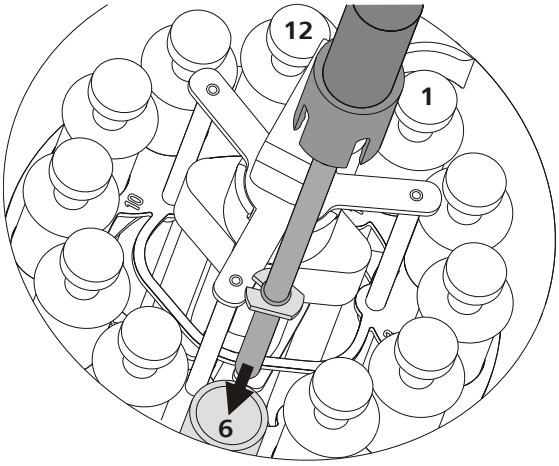


Figure 19 Inserting the temperature sensor at sample position 6

3.6 Connecting the power supply cable

Warning

An incorrect supply voltage can damage the instrument.

The 909 UV Digester is designed for 220 to 240 V. You need to use a transformer if your power supply provides 100 to 120 V. You can find the specification for the transformer in *Chapter 9.4.2, page 40*.

Proceed as follows to connect the instrument to the power supply.

Without a transformer

1 Connect the UV Digester to the power supply using the power supply cable included in the scope of delivery.

With a transformer

1 Connect the transformer to the power supply.

2 Connect the UV Digester to the transformer using the power supply cable included in the scope of delivery.

4 Operation

4.1 Switching the instrument on and off

The toggle switch for switching on and off is located on the rear of the instrument *(3-**3**)*.

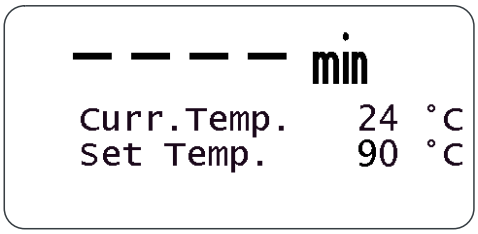
After switching on the instrument, the main dialog is displayed with the most recently configured parameters.

When starting for the first time, the standard parameters **Sample Temp. = 90 °C** and **Rad. Time = 90 min** appear.

4.2 Dialog window overview

The following four dialogs are available for operating the 909 UV Digester:

4.2.1 Main dialog

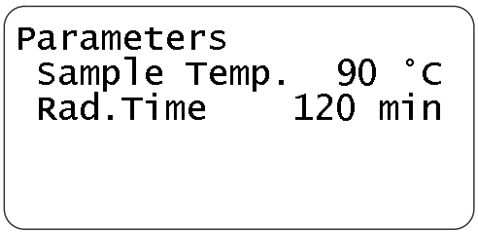


The main dialog is displayed after switching on the 909 UV Digester.

The following information is displayed:

- The temperature currently being measured in the sample (**Curr. Temp.**).
- The sample setpoint temperature configured in the **Parameters** dialog (**Set Temp.**).

4.2.2 "Parameters" dialog



You can open the **Parameters** dialog from the main dialog by pressing the **[SET]** key.

You must configure the following parameters in this dialog:

- The sample setpoint temperature (**Sample Temp.**).
- The radiating time (**Rad. Time**).

Sample Temp.

Setpoint temperature for the samples.

Input range	**80 - 100 °C** (Increment: **1**)
Default value	**90 °C**

Rad. Time

Radiating time for the samples.

Input range	**1 - 999 min** (Increment: **1**)
Default value	**90 min**

Note

- The configured parameters can be modified during digestion.
- The configured parameters remain stored in the instrument after it is switched off.

4.2.3 "Lamp info" dialog

You can open the **Lamp info** dialog from the main dialog by pressing the **[OK]** key twice.

The following information is displayed:

- The cumulative number of operating hours for the current UV lamp in use since the last replacement (**Hours**).
- The number of times the current UV lamp in use has been switched on since the last replacement (**Ignitions**).

4.2.4 "Lamp setup" dialog

You can open the **Lamp setup** dialog by pressing and holding the **[SET]** key while switching on the 909 UV Digester.

You have to edit the following parameters if you have inserted a new UV lamp:

- Reset the counters back to zero for the cumulative operating hours and number of times the lamp has been switched on (**Reset Counters**).
- Configure the number of operating hours for the new UV lamp until the next replacement (**Replace after**).

Replace after

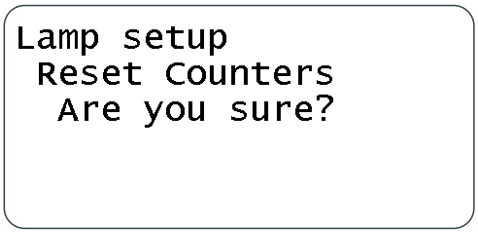
Maximum number of operating hours for the UV lamp until the next replacement.

Input range	**0 - 1000 h** (Increment: **1**)
Default value	**750 h** We recommend replacing the UV lamp after 750 h of operating time.

Reset counters

For resetting both counters for cumulative operating hours and the number of times the UV lamp has been switched on (ignitions) to 0.

Confirming with **[OK]** triggers the following confirmation prompt:



Selection	**[OK]** | **[QUIT]**

[OK]
Both counters are reset to 0.

[QUIT]
Both counters remain at their current values.

Caution

The counters cannot be reset during the ongoing service life of a UV lamp currently in use.

4.3 The keypad

Below you will find an overview of the operating unit's keypad and the functions of the keys in the various dialog windows.

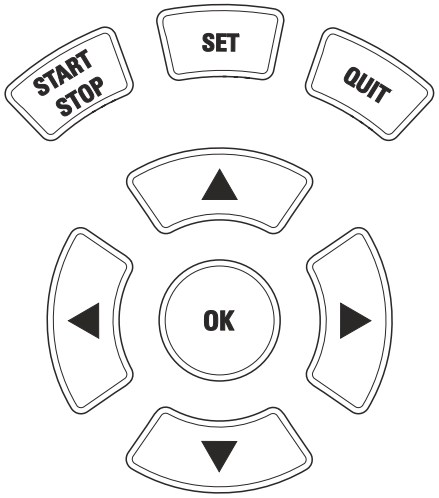


Figure 20 Keypad for the operating unit

4.3.1 The key functions

Key	Main dialog	Parameters	Lamp info	Lamp setup
[START STOP]	▪ Start lamp radiating. ▪ Stop lamp radiating.	–	–	–
[SET]	Open the **Parameters** dialog.	–	–	–
[QUIT]	Acknowledge an error message.	Depending on the cursor position: ▪ Discard a change. ▪ Leave the dialog.	Leave the dialog.	Depending on the cursor position: ▪ Discard a change. ▪ Leave the dialog.
[OK]	Open the **Lamp info** dialog.	Depending on the cursor position: ▪ Save a change and switch to the next parameter. ▪ Save a change and leave the dialog.	Display the number of cumulative operating hours and times the lamp has been switched on (ignitions).	Depending on the cursor position: ▪ Save a change. ▪ Trigger the confirmation prompt for resetting the counters. ▪ Reset the counters to zero.

Key	Main dialog	Parameters	Lamp info	Lamp setup
[▲]	Increase the display's contrast.	Depending on the cursor position: ▪ Go up one line. ▪ Page up by one value list.	Go up one line.	Depending on the cursor position: ▪ Go up one line. ▪ Page up by one value list.
[▼]	Decrease the display's contrast.	Depending on the cursor position: ▪ Go down one line. ▪ Page down by one value list.	Go down one line.	Depending on the cursor position: ▪ Go down one line. ▪ Page down by one value list.
[►]	–	Depending on the cursor position: ▪ Move the cursor to the value range. ▪ Move the cursor one position to the right.	–	Depending on the cursor position: ▪ Move the cursor to the value range. ▪ Move the cursor one position to the right.
[◄]	–	Depending on the cursor position: ▪ Move the cursor to the value range. ▪ Move the cursor one position to the left.	–	Depending on the cursor position: ▪ Move the cursor to the value range. ▪ Move the cursor one position to the left.

4.4 The display

4.4.1 Display elements

Figure 21 Main dialog - Display elements

1	**Radiating time** Shows the remaining radiating time since the UV lamp was started.	**2**	**Temperature display** Shows the current temperature measured in the sample.
3	**Temperature display** Shows the configured sample setpoint temperature.	**4**	**Status line** Contains the current status or an error message along with the respective symbol.

4.4.2 Status display

The following symbols and the respective text can be displayed in the status line:

Symbol	Text	Meaning
	**Heating**	The samples are being heated.
	**Temp. reached**	The configured sample setpoint temperature has been reached.
	**Lamp cooling**	The samples are being cooled.
	Various error messages	*see Chapter 8.1, page 37*.

4.5 Changing numerical values

The various parameters can be selected using the arrow keys **[▼]** and **[▲]**. The colors on the current line are reversed.

Change parameters as follows:

1 Use the arrow keys **[►]** or **[◄]** to select a numerical value.

The selected digit is displayed in black on white. The colors for the rest of the line remain reversed.

2 Change the digit using the arrow keys **[▲]** or **[▼]**.

3 Select the next digit and change it, etc.

4 Apply the modified value with the **[OK]** key.

Press **[QUIT]** if the previous value is to be restored.

5 Carrying out sample digestion

The following steps can be used as a model describing the steps for sample digestion using the 909 UV Digester. You can find additional useful tips on analysis methods in the Application Bulletins and Application Notes listed in *Chapter 6, page 31*.

Preparing the 909 UV Digester

1 Installing the 909 UV Digester *(see Chapter 3, page 9)*.

2 Set the sample setpoint temperature to the desired value *(see "Sample Temp.", page 21)*.

3 Set the radiating time to the desired period *(see "Rad. Time", page 21)*.

Preparing samples

Warning

Samples with increased organic load

Overflowing chemical substances can cause chemical burns and skin damage. They can also damage the instrument.

Ensure that the sample vessel with the temperature sensor has the same sample as the rest of the sample vessels. Otherwise the PTFE stoppers can be pushed out during heating and the sample can overflow.

Wear protective glasses, protective gloves and work clothes suitable for laboratory work.

1 Add, at most, 12 mL of sample to be broken down per sample vessel.

Note

Use the provided sample vessels

Only use the sample vessels made of quartz glass (6.2414.000) that have been provided. Normal reagent glasses do not let UV radiation through and do not ensure complete digestion. Clean the sample glasses before use as described in *Chapter 7.2.3, page 36*.

2 Add nitric acid ($w(HNO_3)$ = 65%, for trace analysis) and hydrogen peroxide ($w(H_2O_2)$ = 30%, for trace analysis).

Samples with a low organic load are offset with the following reagent concentrations:

- 0.01 mL HNO_3 ($w(HNO_3)$ = 65%, for trace analysis)
- 0.05 mL H_2O_2 ($w(H_2O_2)$ = 30%, for trace analysis)

The sample volume, the volume of the reagents and the digestion parameters must be adjusted accordingly for samples with increased organic load.

3 Place the PTFE stopper (6.1446.100) on the sample vessels. Leave the sample vessel at **Position 6** free for measuring the temperature.

4 Insert the sample holder into the wet end *(see Chapter 3.5, page 17)*.

Note

Fully filled sample holder

Only a fully filled sample holder enables even temperature distribution to the samples. If you use fewer than twelve samples, fill the remaining sample vessels with distilled water.

5 Insert the temperature sensor (6.1110.010) with attached thermometer plug (6.1446.190) and spacer into the sample vessel at **Position 6** and press it down.

Starting sample digestion

1

Warning

Hazardous UV radiation

UV radiation damages the eyes.

Protect your eyes from UV light during operation. Position the UV protective shield on the front of the instrument and wear UV protective glasses.

The 909 UV Digester has to be operated in a closed fume cupboard or in a closed laboratory and may be operated only by trained personnel.

Press the **[START / STOP]** key.

The UV lamp is switched on. You can track the current temperature and time until the end of radiating on the display.

You can top off the hydrogen peroxide ($w(H_2O_2)$ = 30%, for trace analysis) as needed during radiating. This may be necessary for samples with a larger organic load.

Note

The digestion temperature and radiating time can be modified during the digestion process. Proceed as described in *Chapter 4.2.2, page 20* as needed.

Procedure after sample digestion

Sample digestion ends and the UV lamp is switched off automatically once the configured radiating time elapses. The fan cools the samples for 10 min.

Proceed as follows after sample digestion:

1 Wait for the samples to cool (the fan switches off after 10 min).

2 Remove the sample holder with the samples from the wet end.

Note

Leave the PTFE stoppers on the sample vessels until you are ready to continue using the samples.

3 Switch off the 909 UV Digester or carry out additional sample digestion processes.

Canceling sample digestion

Proceed as follows if you would like to stop a sample digestion process before the radiating time has elapsed:

1 Press the **[START / STOP]** key.

The UV lamp is switched off.

2 Wait for the samples to cool (the fan switches off after 10 min).

3 Remove the sample holder with the samples from the wet end.

4 Switch off the 909 UV Digester or carry out additional sample digestion processes.

Note

Opened samples smell like ammonia or fish (amine)

If an open sample smells like ammonia or fish, you need to increase the amount of acid and/or H_2O_2 being added.

Note

Nitrite interference

Nitrite forms from the effects of UV radiation on nitrate. It is voltammetrically active and shows a wide peak at –1.2 V. This peak can overlap with signals from metals such as zinc, thereby causing interference. You can prevent this reaction in two ways:

- Add acid to the sample solutions using HCl instead of HNO_3.
- Reduce the nitrite using sulfamic acid: add 0.025 mL (β(sulfamic acid) = 40 g/L) to 10 mL of open, hot sample solution.

6 Application examples

You can find useful examples of analysis methods in the Application Bulletins and Application Notes below.

Table 1 Application Bulletins

Application Bulletin No.	Analytes
74	Tl, Sb, Bi, Fe, Cu, V
96	Hg
116	Cr
117	Se
123	Fe, Mn
131	Al
146	Mo
176	Sn, Pb
186	Al
207	Ag
220	Pt, Rh
226	As
231	Zn, Cd, Pb, Cu, Tl, Ni, Co
242	W
243	Cr
266	Ti, U

Table 2 Application Notes

Application Note No.	Title
V-83	Zinc, cadmium, lead and copper in waste water after UV digestion
V-84	Total chromium in waste water after UV digestion
V-89	Mercury in waste water
V-92	Nickel in white wine

Application Note No.	Title
V-93	Zinc, cadmium, lead and copper in red wine
V-94	Rhodium and platinum in red wine
V-96	Platinum in urine
V-106	Nickel and cobalt in waste water
V-107	Tin in waste water
V-108	Thallium in waste water
V-109	Selenium in waste water
V-110	Chromium in waste water
V-120	Nickel in glycol after UV digestion
V-121	Determination of total iron in waste water of UV digestion
V-176	Total selenium in tap water after reduction of selenium(VI) to selenium(IV) by means of UV Digester
V-201	Nickel and cobalt in red wine

7 Operation and maintenance

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.

7.1 General

The 909 UV Digester requires appropriate care. Excess contamination of the instrument may result in functional disruptions and a reduction in the lifetime of the sturdy mechanics and electronics of the instrument.

Severe contamination can also have an influence on sample digestion. Regular cleaning of exposed parts can prevent this to a large extent.

Spilled chemicals and solvents must be removed immediately. In particular, the power plug should be protected from contamination.

Warning

Hot surfaces

The UV lamp, sample vessels and sample holder become very hot during operation. The UV lamp can reach a temperature of 900 °C.

Skin contact during and immediately after sample digestion will cause burns.

Only clean the wet end once it has cooled completely.

7.2 Care

7.2.1 Maintaining and replacing the UV lamp

Keep the following information in mind so that the lifetime of the UV lamp is not shortened unnecessarily:

- Clean the UV lamp as needed using a clean towel wetted with pure alcohol. This lets you remove particles from the quartz glass that have not yet been burned in.
  Do not touch any part of the UV lamp other than the two flattened ends during cleaning and wear the provided cotton glove when removing or installing the lamp.
- Avoid switching the UV lamp on and off unnecessarily. Each time the lamp is switched on shortens its lifetime.

Removing the old UV lamp

Warning

Risk of electric shock due to defective electronic components

Coming into contact with potentially defective electronic components in the instrument could result in an electric shock.

Ensure that the instrument is unplugged before replacing the UV lamp.

Proceed as follows:

1. Ensure that the wet end has cooled completely.
2. Remove the sample holder from the wet end if it has been inserted.
3. Put on the glove included with the UV lamp.
4. Hold the UV lamp by the upper flattened end and gently press it down.
5. While holding the UV lamp down, release the upper end from the lamp socket.
6. Take the UV lamp out of the lower lamp socket and remove it from the wet end.

Inserting the new UV lamp

1 Insert the new UV lamp in accordance with *Chapter 3.2, page 9*.

Configuring parameters for the new UV lamp

1 Reset the counters to zero for the number of operating hours and the number of times the lamp has been switched on under **Lamp setup ▸ Reset Counters** *(see "Reset counters", page 22)*.

2 Set the number of operating hours for the new UV lamp under **Lamp setup ▸ Replace after** *(see "Replace after", page 22)*.

We recommend **750 h** of operating time.

7.2.2 Clearing a jammed fan

The wet end with inserted sample holder is designed so that no parts such as PTFE stoppers can fall down. If the fan happens to get jammed anyway, keep the following safety instruction in mind:

Warning

Jammed fan

Improper work on the fan may result in injuries.

Ensure that the instrument is unplugged before clearing the jammed fan.

Proceed as follows to remove PTFE stoppers that have fallen into the wet end of the 909 UV Digester:

1 Remove the sample holder.

2 Turn the instrument upside down.

3 Gently shake the overturned instrument until the PTFE stoppers come out.

7.2.3 Cleaning sample glasses

Clean the sample glasses after each sample digestion process:

Proceed as follows:

1. Thoroughly rinse the sample glasses with double-distilled water.
2. Place the sample glasses in dilute nitric acid overnight or until their next use.
3. Rinse the sample glasses again using double-distilled water.

7.3 Quality Management and qualification 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 **"Metrohm Quality Management"** available from your local Metrohm representative.

Qualification

Please contact your local Metrohm representative for support in qualification of instruments and software. The **Installation Qualification** (IQ) and **Operational Qualification** (OQ) are offered by Metrohm representatives as a service. They are carried out by trained employees using standardized qualification documents and in accordance with the currently applicable requirements of the regulated industry. Further information on this can be found in the brochure **"Analytical Instrument Qualification – Confidence in quality with IQ/OQ"**.

Maintenance

The electronic and mechanical functional groups of Metrohm instruments can and should be checked by specialist personnel from Metrohm as part of a regular preventive maintenance schedule. Please ask your local Metrohm representative regarding the precise terms and conditions involved in concluding a corresponding maintenance agreement. Further information on this can be found in the brochure **"Metrohm Care Contracts – Protect your investment the smart way"** available from your local Metrohm representative.

8 Troubleshooting

8.1 Error messages

The following error messages can occur when operating the 909 UV Digester. Follow the instructions in the "Remedy" column and acknowledge each of the error messages by pressing the **[QUIT]** button.

Error message	Cause	Remedy
Max. temp. reached	The temperature in the wet end is above 105 °C. The UV lamp is switched off automatically.	▪ Check the sample matrix and adjust it if necessary. ▪ Check whether sample fluid may have evaporated and refill the sample if necessary. ▪ Check the fan and clear it if jammed *(see Chapter 7.2.2, page 35)*. ▪ Contact your local Metrohm Service department.
Adj. data missing	The instrument is not ready for operation since the checksum for the calibration data was incorrect when the instrument was switched on.	▪ Switch the instrument off and back on. ▪ Contact your local Metrohm Service department.
Lamp exhausted	The maximum lifetime configured for the UV lamp in the **Lamp setup** dialog has been reached.	Replace the UV lamp *(see Chapter 7.2.1, page 34)*.
No sensor connectd	The temperature sensor is either not connected or incorrectly connected.	▪ Check the temperature sensor's connection. ▪ Connect the temperature sensor.

Error message	Cause	Remedy
Check Sensor/Lamp	No increase in temperature is being recorded. Possible causes: ▪ The temperature sensor has not been inserted in the sample. ▪ The sample holder including the temperature sensor has not been inserted into the wet end. ▪ The UV lamp is defective. ▪ The electronics are defective.	▪ Insert the temperature sensor into the sample. ▪ Insert the sample holder including the temperature sensor into the instrument. ▪ Replace the UV lamp *(see Chapter 7.2.1, page 34)*. ▪ Contact your local Metrohm Service department.
Dev. busy cooling	The UV lamp is too hot to be switched on again.	Wait for the end of the cooling process (**Lamp cooling** status message disappears).
Thermo switch open	The instrument is defective. Overtemperature protection is switching off the electronic ballast.	Contact your local Metrohm Service department.

8.2 Additional faults and their remedy

Problem	Cause	Remedy
The configured digestion temperature cannot be saved.	*The entered temperature is outside the input range of* ***80 - 100 °C***.	Set a temperature within the input range.

9 Technical specifications

9.1 Radiating

Digestion temperature	+80 - +100 °C
Ambient temperature	+5 - +35 °C
Duration	1 - 999 min
Power	600 - 300 W
Control accuracy	±3 °C

9.2 Mercury vapor lamp

UV-A radiation	315 - 400 nm 35 W
UV-B radiation	280 - 315 nm 40 W
UV-C radiation	200 - 280 nm 70 W
Dimensions	
Length	137 - 139 mm
Outer diameter	approx. 16 mm

9.3 Temperature measuring input

A measuring input for the Pt1000 type temperature sensor.

Accuracy	±0.2 °C (under reference conditions)
Measuring range	–20.0 - +150.0 °C

9.4 Power connection

9.4.1 220 - 240 V power connection

Supply voltage	220 - 240 V (± 10%)
Frequency	50 - 60 Hz (± 3%)
Power consumption	630 W
Fuse	6.3 ATH

9.4.2 100 - 127 V power connection with a transformer

Specification for the transformer	
Input voltage	110 V typical
Output voltage	230 V typical
Frequency	50 - 60 Hz
Power	> 700 VA

9.5 Safety specifications

This instrument fulfills the following electrical safety requirements:

CE marking in accordance with the EU directives:

- 2006/95/EC (Low Voltage Directive, LVD)
- 2004/108/EC (EMC Directive, EMC)

Federal Inspectorate for Heavy Current Installations ESTI (Accreditation Number SCESp 033)

- Safety mark for certification type 2 in accordance with NEV (type testing with market monitoring, EMC conformity)

Design and testing	According to EN/IEC/UL 61010-1, CSA-C22.2 No. 61010-1, protection class I, EN/IEC 61010-2-010, EN/IEC 60529.
Safety instructions	This document contains safety instructions which have to be followed by the user in order to ensure safe operation of the instrument.

9.6 Electromagnetic compatibility (EMC)

Emission

Standards fulfilled

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

Immunity

Standards fulfilled

- 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 61000-4-11
- EN/IEC 61000-4-14
- EN/IEC 61000-4-28

9.7 Ambient temperature

Nominal function range	+10 - +35 °C (Humidity < 80%)
Storage	–20 - +70 °C (Humidity < 95%)
Transport	–40 - +70 °C (Humidity < 95%)

9.8 Reference conditions

Ambient temperature	+25 °C (± 3 °C)
Supply voltage	230 V
Relative humidity	≤ 60%
Operating temperature status	Instrument in operation at least 30 min
Validity	After adjustment

9.9 Dimensions

Width	330 mm
Height	290 mm
With UV protective shield	500 mm
Depth	310 mm
Weight (without accessories)	10.90 kg
Material of housing	Metal, surface-treated

10 Warranty (guarantee)

Metrohm guarantees that the deliveries and services it provides are free of defects in materials, design or manufacturing.

The general warranty period is 36 months (exclusions below) from the date of delivery or 18 months in the event of continuous operation. The warranty remains valid on the condition that the servicing is provided by a service organization authorized by Metrohm at defined intervals and with a defined scope.

The warranty period for anion suppressors of the type "MSM" is 120 months from the date of delivery or 60 months in the case of continuous operation.

The warranty period for IC separation columns is 90 days after start-up.

For third-party components that are recognizable as such, the manufacturer's warranty regulations apply.

Consumables and materials with limited storage life and glass breakage in the case of electrodes or other glass parts are excluded from the warranty.

Warranty claims cannot be asserted if the ordering party has failed to meet its payment obligations according to schedule.

During the warranty period, Metrohm undertakes either to replace free of charge or to credit the purchaser for any modules or components that can be shown to be faulty. Any transport or customs fees that may apply are the ordering party’s responsibility.

The precondition for this is that the ordering party has to specify the article number, the article designation, an adequate error description, the delivery date and (if applicable) the serial number or chip data in the Support Tracker. Metrohm then decides whether a replacement or a credit note is to be issued or whether the faulty part has to be returned using the Return Material Authorization (RMA). If a replacement or credit note is issued, the ordering party undertakes to store the faulty part for at least 24 months in accordance with the current storage directives (in compliance with ESD guidelines) and to hold it in readiness for onsite inspection or for return shipment to Metrohm. Metrohm reserves the right to invoice the ordering party for these articles, including retroactively, in the event of noncompliance with these preconditions.

The same warranty periods that are specified for a corresponding new part apply to parts that are replaced or repaired within the above-mentioned warranty periods. However, replacement or repair of a part does not extend the warranty period of the entire system.

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.

Metrohm also offers a 120 month spare parts availability guarantee and a 60 month PC software support warranty, calculated from the date on which the product is withdrawn from the market. The content of this warranty is the ability of the customer to obtain functioning spare parts or appropriate software support at market prices during the time of the warranty period.

If Metrohm AG is unable to meet this obligation due to circumstances beyond the control of Metrohm AG, then the ordering party shall be offered alternative solutions at preferential conditions.

11 Accessories

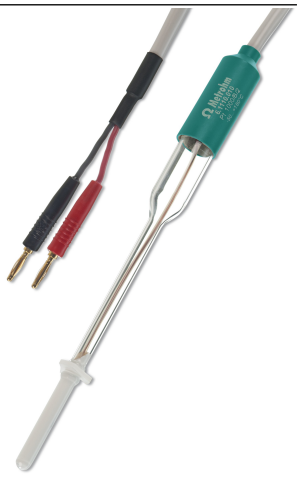
Note

Subject to change without notice.

11.1 Scope of delivery

2.909.0014 909 UV Digester

Qty.	Order no.	Description
1	1.909.0014	**909 UV Digester 220-240 V/50-60 Hz** Digestion instrument for UV photolysis of water samples with low to medium organic load. For sample preparation in trace element determination by means of voltammetry, ion chromatography and spectroscopy (AAS, ICP). Integrated instrument with operating unit and wet end. With air cooling and automatic control of digestion temperature and time. For 12 samples with a maximum of 12 mL sample volume each. Instrument for 220 - 240 V and 50 - 60 Hz.
1	6.1110.010	**Pt1000 temperature sensor** Pt1000 temperature sensor (Class B), 1 mm plug for 909 UV Digester Shaft material: Glass Measuring range: -50 ... 180 Measuring unit: °C Max. installation length (mm): 120 SGJ sleeve: Flexible SGJ sleeve Shaft diameter top (mm): 12 Shaft diameter bottom (mm): 5 Min. immersion depth (mm): 20 Electrode plug-in head: Fixed cable (l = 0.5 m) with plug 2 x 1 mm



Qty.	Order no.	Description	
12	6.1446.100	**PTFE stopper for UV quartz sample vessel 12 mL** For quartz sample vessel 6.2414.000 Material: PTFE black Height (mm): 35 Outer diameter (mm): 19	
1	6.1446.190	**Thermometer stopper for Pt1000 temperature sensor** For 6.1110.010 Pt1000 temperature sensor and 6.2414.000 12 mL quartz sample vessel. Material: PP Material remark: Stopper Material 2: Nitrile rubber Material remark 2: O-ring Height (mm): 22 Outer diameter (mm): 18 Inner diameter (mm): 12.2	
1	6.2008.040	**Storage vessel** Together with 6.2008.050 storage vessel holder provides a support for the electrode on 6.3032.XXX dosing units.	

Qty.	Order no.	Description	
1	**6.2041.240**	**Sample holder for 12 quartz sample vessels 12 mL** For 909 UV Digester. Material: Stainless steel (AISI 304) Height (mm): 185 Outer diameter (mm): 100	
12	**6.2414.000**	**Quartz sample vessel 12 mL** For UV Digester Material: Quartz Outer diameter (mm): 15.6 Length (mm): 125 Volume (mL): 12	
1	**6.2621.100**	**Hexagon key 3 mm** Hexagon key 3 mm for IC Sample Processors Length (mm): 73	

Qty.	Order no.	Description
1	6.2745.100	**UV protective shield**

For 909 UV Digester.

Material:	Plexiglas (PMMA)
Material remark:	Protective shield
Material 2:	Aluminum
Material remark 2:	Mounting ring
Height (mm):	212
Outer diameter (mm):	160
Inner diameter (mm):	140

Qty.	Order no.	Description
1	6.2804.090	**UV mercury vapor lamp**

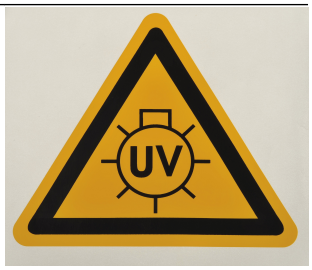
Medium pressure mercury vapor lamp for 909 UV Digester

Material:	Quartz
Outer diameter (mm):	16 ... 18
Length (mm):	137 ... 139

Qty.	Order no.	Description
1	6.2225.000	**UV warning plate**

For 909 UV Digester

Material:	PVC
Width (mm):	100
Height (mm):	92



Qty.	Order no.	Description
1	6.2122.0x0	**Power supply cable with IEC 60320 line socket, type C13**

Cable plug according to customer requirements.

Switzerland:	SEV 1011, Type 12 6.2122.020
Germany, ...:	CEE 7, Type VII 6.2122.040
USA, ...:	NEMA 5-15, Type 498 6.2122.070
Length:	1.5 m

Qty.	Order no.	Description
1	8.909.8001EN	**909 UV Digester Manual**

11.2 Optional accessories

2.909.0014 909 UV Digester

Qty.	Order no.	Description
1	6.2042.050	**Spacer for Pt1000 temperature sensor**

Material: PTFE
Height (mm): 1.5
Outer diameter (mm): 11.5
Inner diameter (mm): 4.8

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