

Multi-Mode-Elektrode pro



Manual

8.110.8018EN / 2020-10-27



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1 Introduction

1.1 Instrument description

The Multi-Mode Electrode pro (MME pro) combines the most important polarographic and voltammetric mercury electrodes in one single construction:

- **Dropping Mercury Electrode (DME)**
This is the classic mercury electrode. The mercury drops fall continuously from the capillary. Drop intervals are synchronized with the voltage steps of the measurement.
- **Static Mercury Drop Electrode (SMDE)**
The SMDE combines the properties of the DME and the HMDE: mercury is forced through the glass capillary until a drop forms at the tip of the capillary. The measurement is performed on the constant surface of this stationary mercury drop (as with the HMDE). For each voltage step, a new drop is produced (as with the DME).
- **Hanging Mercury Drop Electrode (HMDE)**
Mercury is forced through the glass capillary until a drop forms at the tip of the capillary. The entire sweep is performed on the constant surface of the stationary mercury drop.

1.2 Intended use

The Multi-Mode-Elektrode pro serves as a working electrode in voltammetry. It contains mercury as electrode material.

The usage of the Multi-Mode-Elektrode pro therefore requires that the user have basic knowledge in the handling of dangerous substances in laboratories.

The *Mercury Handling Guidelines* (8.000.5054XX) contain important information on mercury and the safe handling of the substance. The safety rules contained therein must be strictly observed. The guidelines can be downloaded from <http://documents.metrohm.com>. Enter the document number into the search field.

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 Content and scope

This manual describes the construction, the installation, and the maintenance of the Multi-Mode Electrode pro (MME pro).

This manual does not describe the installation of the MME pro in the analyzer nor its operation.

1.3.2 Additional documentation

Information on the installation and operation of the MME pro can be found in the manual of the analyzer used.

The multimedia guide *Electrodes in Voltammetry* (A.717.0003) contains short video sequences that illustrate the procedures described in this document. These videos are available at <http://va-electrodes.metrohm.com>.

The MME pro is controlled via a software:

- 884 Professional VA: **viva**







The operation of this software is described in a separate software manual.

If you use another analyzer, please consult the corresponding manual for information on how to operate the MME pro.

1.3.3 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 Carry out these steps in the sequence shown.
Method	Dialog text, parameter in the software
File ► New	Menu or menu item

[Next]	Button or key
	<p>WARNING</p> <p>This symbol draws attention to a possible life-threatening hazard or risk of injury.</p>
	<p>WARNING</p> <p>This symbol draws attention to a possible hazard due to electrical current.</p>
	<p>WARNING</p> <p>This symbol draws attention to a possible hazard due to heat or hot instrument parts.</p>
	<p>WARNING</p> <p>This symbol draws attention to a possible biological hazard.</p>
	<p>CAUTION</p> <p>This symbol draws attention to possible damage to instruments or instrument parts.</p>
	<p>NOTE</p> <p>This symbol highlights additional information and tips.</p>

1.4 Safety instructions

1.4.1 General notes on safety



WARNING

This electrode may only be operated according to the information contained in this documentation.

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

1.4.2 Metallic liquid mercury



WARNING

Mercury is a heavy liquid metal. Highly toxic mercury vapor forms even at room temperature. Breathing in mercury vapor poses the risk of chronic mercury poisoning. Therefore, observe the following points when handling a MME pro containing mercury:

- Do not inhale mercury vapor.
- Only work with open containers of mercury while under a fume cupboard.
- Avoid skin contact with mercury.
- Never store mercury in open containers.
- Keep the laboratory area for work involving mercury well-ventilated.
- Use amalgamation to bind any spilled mercury. Never use a broom or vacuum.
- Only have mercury disposed of by a professional. Never dispose of mercury in household or domestic waste.



NOTICE

For detailed information, observe the *Mercury Handling Guidelines* (8.000.5054XX).

1.4.3 Flammable solvents and chemicals

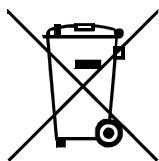


WARNING

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

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

1.4.4 Recycling and disposal



When disposing of the electrode, please also observe the notes concerning recycling and disposal of mercury in the *Mercury Handling Guidelines* 8.000.5054XX.

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

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



2 Overview

2.1 Construction of the MME pro

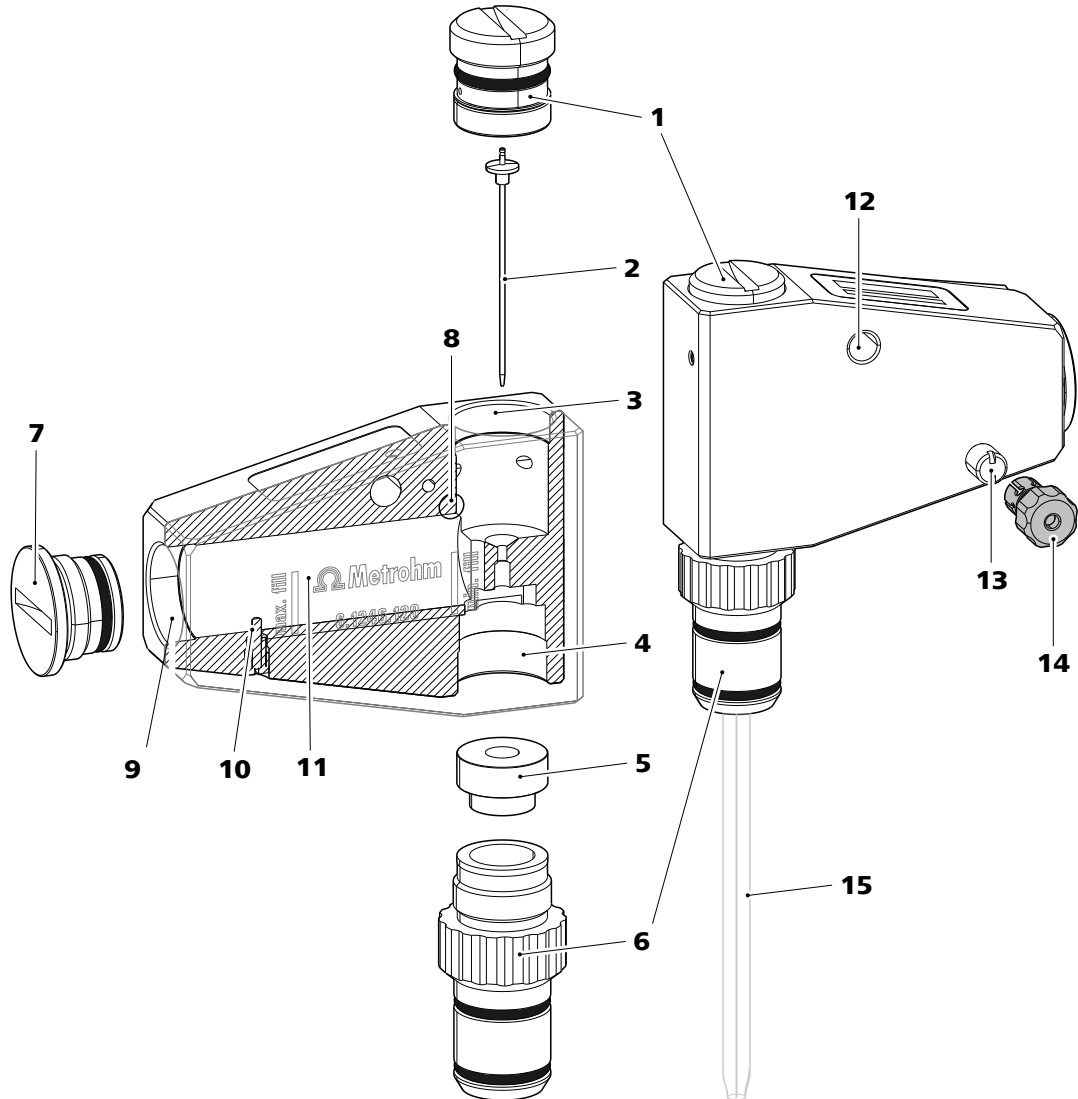


Figure 1 MME pro – Construction

1	Needle holder (6.1247.140)	2	Needle (6.1247.020)
3	Thread For the needle holder (1-1).	4	Thread For the retaining screw (1-6).
5	Silicone seal (6.1247.150)	6	Retaining screw (6.1247.120) For the capillary.

7 Screw cap (6.1247.110) For the mercury filler opening.	8 Connector For inert gas supply to control the needle valve.
9 Thread For the screw cap (1-7).	10 Contact pin Electrical contact with mercury.
11 Mercury reservoir	12 Connector For inert gas supply.
13 Quick connector For WE cable.	14 Adapter (6.2112.130, optional) The adapter is only needed to connect the working electrode cable with terminal to the MME pro.
15 Glass capillary 6.1226.030 or 6.1226.050	

2.2 Tools and auxiliary equipment

The MME pro is supplied with the following tools and auxiliary equipment:

- Electrode stand (6.2615.130)
- Wrench (6.1247.220)
- Mounting ring (6.1247.210)

Electrode stand

There are three ways to place the electrode in the electrode stand, depending on the task to be done. The following figure shows the three ways.

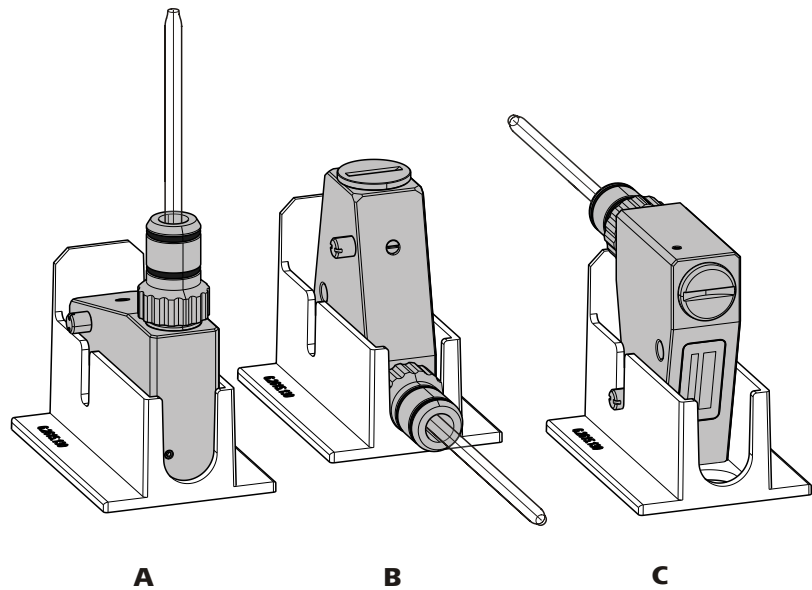


Figure 2 Electrode stand

A Position A

For inserting or replacing the capillary.

B Position B

For filling in mercury or for storing the MME pro.

C Position C

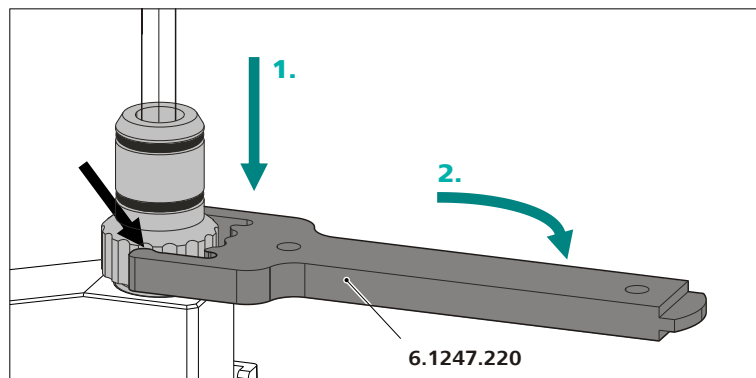
For replacing the needle.

Wrench

The wrench supplied with the MME pro has two functions:

- One end is a screwdriver. You can use it to open and close the needle holder and the screw cap of the mercury filler opening.
- The other end is a torque wrench. You can use it to fasten the retaining screw with exactly the correct torque.

In order to correctly fasten the retaining screw, slide the wrench from the top over the retaining screw. The knobs on the wrench fit exactly into the grooves of the retaining screw thus holding the wrench in place. Turn the handle by pushing it clockwise with one finger until the wrench falls off.



Mounting ring

The mounting ring is used to pull the needle holder out of the electrode body.

Adapter for connecting the working electrode



NOTICE

The adapter is only used together with the 797 VA Computrace. It is not necessary for connecting the MME pro to the 884 Professional VA.

The MME pro is fitted with a quick contact.

Screw the adapter onto the working electrode cable of the 797 VA Computrace once and leave it on. When inserting or removing the electrode from the instrument, you can simply plug the adapter onto the quick contact of the MME pro or pull it off.

3 Preparing the MME pro for use



CAUTION

When handling mercury please observe the relevant safety regulations (see also *Mercury Handling Guidelines* 8.000.5054XX).

In order to ensure that no mercury can escape into the environment, the following procedures must always be carried out in a dry drip pan (6.2711.030).

Mercury which escapes into the drip pan must be completely collected. Larger amounts can be poured out of the drip pan into a closed mercury collection container. Small drops can be collected with the mercury drop catcher (6.2406.000).

Before you can work with the MME pro, the following steps must be carried out:

- Mounting the capillary (see chapter 3.1, page 10).
- Inserting the needle (see chapter 3.2, page 13).
- Filling in mercury (see chapter 3.3, page 15).
- Installing the MME pro in the instrument (see chapter 3.4, page 17).
- Adjusting the needle valve (see chapter 3.5, page 17).
- Testing the electrode function (see chapter 3.6, page 19).

3.1 Mounting the capillary

There are two types of capillaries which can be mounted into the MME pro, depending on the application:

- Silanized capillaries (6.1226.050) are especially suitable for voltammetric determinations at the HMDE in acidic to slightly alkaline solutions which do not contain organic solvents.
- Non-silanized capillaries (6.1226.030) are especially suitable for polarographic determinations at the DME or SMDE and for voltammetric determinations at the HMDE in all types of solutions, especially alkaline solutions with $\text{pH} > 10$ or in solutions containing solvents, where silanized capillaries cannot be used.

Mounting the capillary

To carry out this procedure you need the MME pro and the following accessories:

- Drip pan (6.2711.030)
- Electrode stand (6.2615.130)
- Wrench (6.1247.220)
- Silanized capillary (6.1226.050) or non-silanized capillary (6.1226.030)
- Scissors

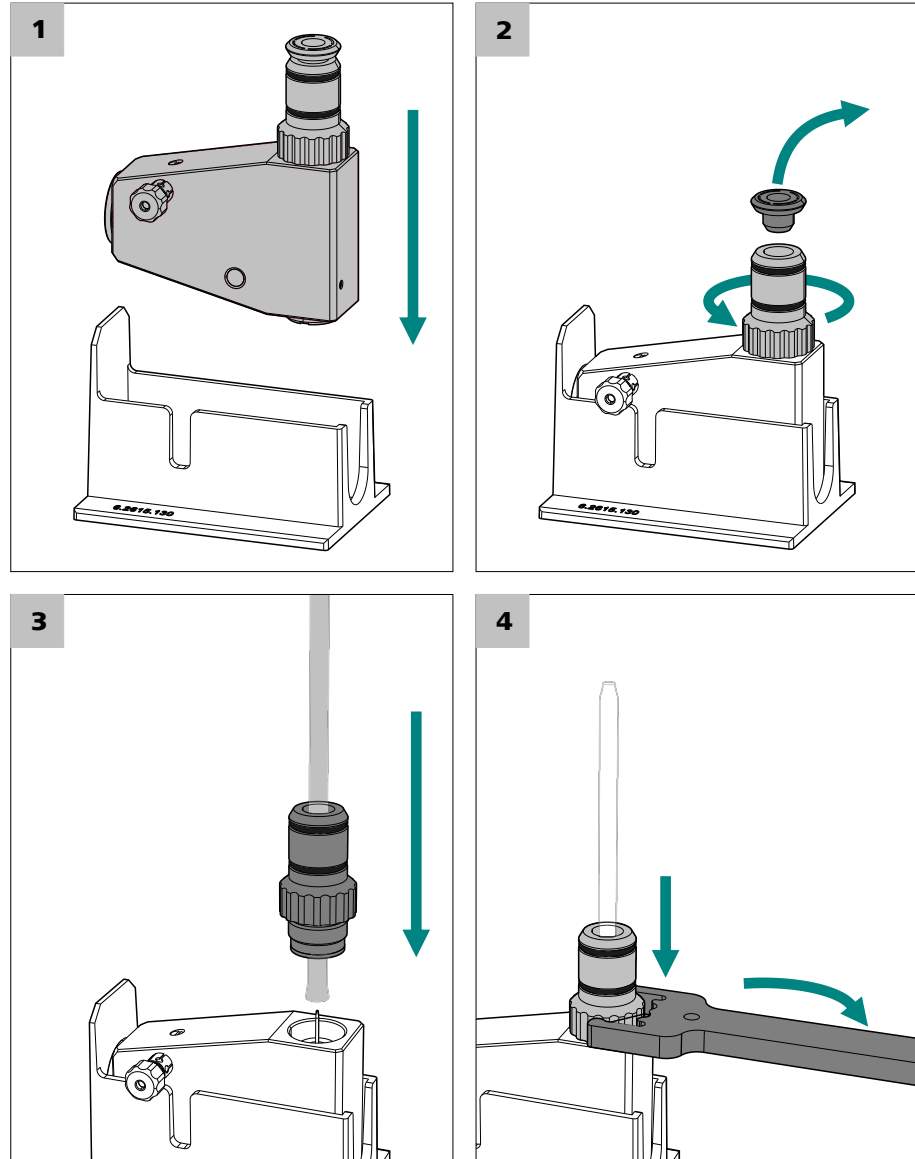


Figure 3 MME pro – Mounting the capillary



CAUTION

In this procedure mercury is used. Always carry out the following steps in a dry drip pan.

1 Placing the MME pro into the electrode stand

- Place the electrode stand into the drip pan.
- Place the MME pro into the electrode stand.
The capillary retaining screw is pointing upwards.

2 Loosening the capillary retaining screw

- Remove the transport locking stopper.
- Loosen the capillary retaining screw either by hand or with the wrench.
The capillary retaining screw must sit loosely in the thread.

3 Inserting the capillary



CAUTION

Only hold the capillary by its sides!

Do not exert pressure on the tip of the capillary!

Each capillary is individually packed in a transparent plastic wrapper.

- Cut open the plastic wrapper with the scissors at the marking and unwrap the capillary.
- Grab the capillary at its sides, insert it through the capillary retaining screw into the electrode body.
- Gently press it through the silicone seal.

4 Fastening the capillary retaining screw

- First, fasten the capillary retaining screw by hand until you feel a slight resistance.
- Then slide the wrench from the top over the capillary retaining screw.
The knobs on the wrench fit exactly into the grooves of the capillary retaining screw thus holding the wrench in place.
- Turn the handle by pushing it clockwise with one finger until the wrench falls off.
Now the capillary retaining screw is correctly fastened.

**NOTICE**

Do not apply the wrench a second time.

3.2 Inserting the needle

**CAUTION**

In this procedure mercury is used. Always carry out the following steps in a dry drip pan.

Inserting the needle

To insert the needle you need the MME pro and the following accessories:

- Drip pan (6.2711.030)
- Electrode stand (6.2615.130)
- Needle (6.1247.020)
- Mounting ring (6.1247.210)
- Wrench (6.1247.220)
- Scissors

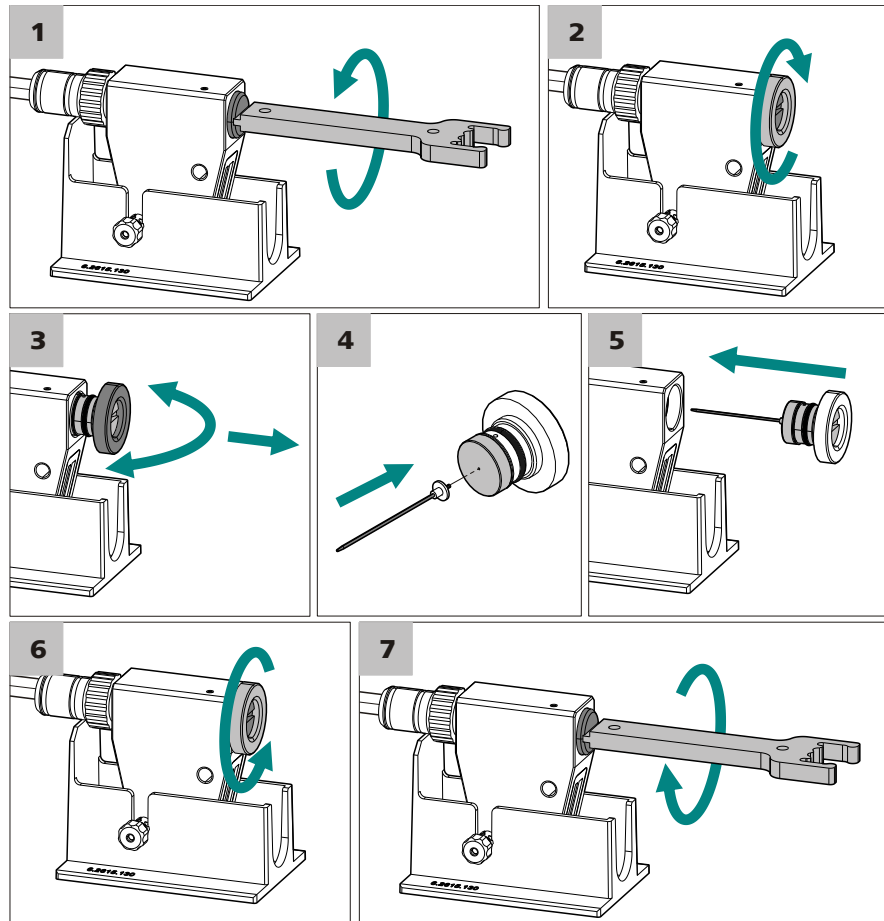


Figure 4 MME pro – Inserting the needle

1 Loosening the needle holder

- Place the electrode stand into the drip pan.
- Place the MME pro into the electrode stand.
- Use the wrench to loosen the needle holder, turn out the screw as far as it will go.

2 Screwing on the mounting ring

- Screw the mounting ring onto the needle holder in clockwise direction.

3 Pulling out the needle holder

- Hold the mounting ring tight and pull out the needle holder by carefully jiggling it from side to side.

4 Inserting the needle



NOTICE

Do not touch the needle with bare hands!

Each needle is individually wrapped.

- Cut open the wrapper of the new needle with the scissors and unwrap the white plastic part only. Do not yet completely remove the wrapper.
- Insert the needle into the hole of the membrane and press in as far as the white marking. Now, remove the wrapper.

5 Inserting the needle holder

- Insert the needle holder with the new needle into the MME pro. Press in as far as it will go.

6 Removing the mounting ring

- Remove the mounting ring turning it counterclockwise.

7 Fastening the needle holder

- Use the wrench to tighten the needle holder by turning it clockwise until the black sealing ring becomes visible in the electrode body.

3.3 Filling in or refilling mercury



CAUTION

In this procedure mercury is used. Always carry out the following steps in a dry drip pan.

Filling in mercury

To carry out this procedure you need the MME pro and the following accessories:

- Drip pan (6.2744.030)
- Electrode stand (6.2615.130)
- Wrench (6.1247.220)
- Syringe (6.2816.020) with needle (6.2816.030)



- Mercury
- Mercury drop catcher (6.2406.000)

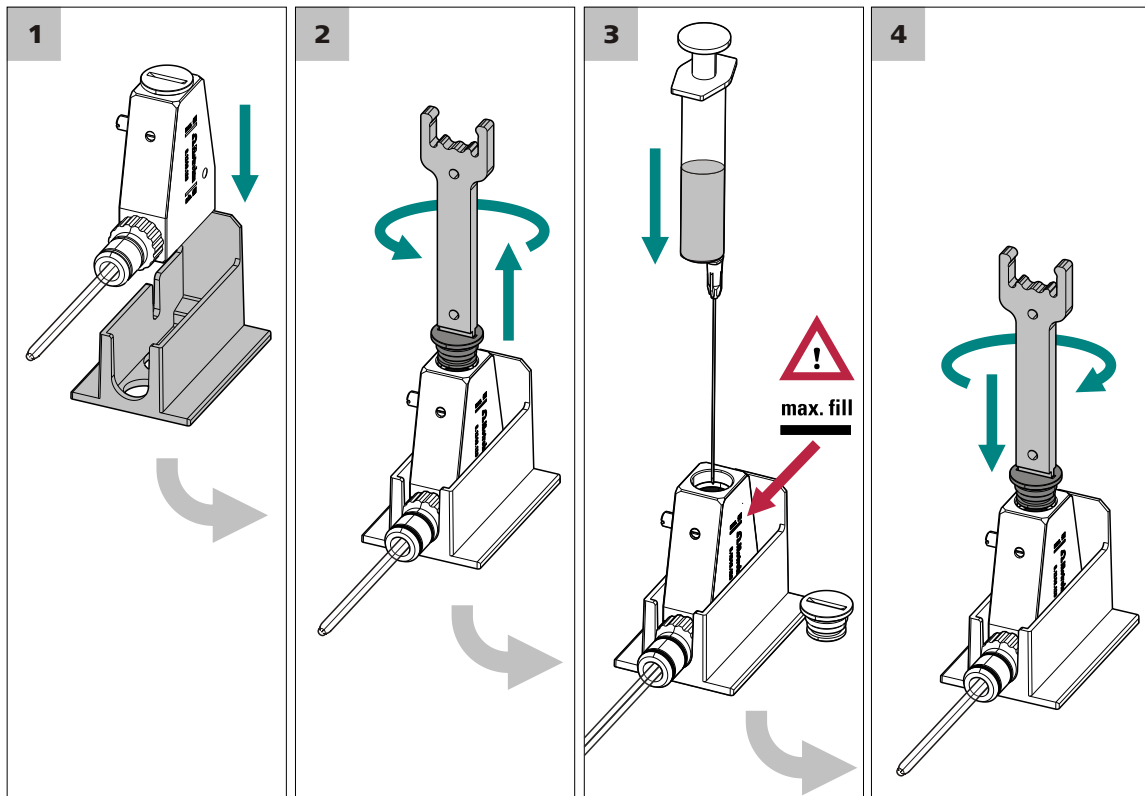


Figure 5 MME pro – Filling in mercury

1 Placing the MME pro into the electrode stand

- Place the electrode stand into the drip pan.
- Place the MME pro into the electrode stand. The mercury filler opening is pointing upwards.

2 Opening the screw cap

- Open the screw cap (1-7) at the mercury filler opening with the wrench and remove it.

3 Filling in mercury

Using the syringe, carefully fill in the mercury into the mercury reservoir.



NOTICE

Only fill in mercury until it reaches the marking **max. fill**.

4 Closing the screw cap

Insert the screw cap into the mercury filler opening and fasten it with the wrench as far as it will go.

3.4 Mounting the MME pro onto the measuring head

Before you can adjust the needle valve and test the electrode function, you must mount the MME pro onto the measuring head of the instrument.



NOTICE

Before you can mount the MME pro onto the measuring head of the instrument, you must place an **empty** measuring vessel into the measuring stand.

If the measuring vessel is not empty, then liquid can enter through the capillary into the MME pro. If this happens, the MME pro must be extensively cleaned and the capillary must be disposed of.

- Mount the MME pro onto the measuring head according to the instructions in the manual of the instrument.
- Connect the inert gas tubings with the connectors (1-**8**) and (1-**12**).
- Plug the working electrode cable (for the 797 VA Computrace with the attached adapter) onto connector (1-**13**).

For a detailed description see the manual of the analyzer.

3.5 Adjusting the needle valve

Adjusting the needle valve

Before you can adjust the needle valve, the following requirements must be fulfilled:

- The MME pro is mounted onto the measuring head of the analyzer and the inert gas supply is connected.
- An **empty** measuring vessel is placed under the MME pro.
- The instrument is connected to a PC on which the **viva** software is installed and running.

3.6 Testing the electrode function



NOTICE

If you use another software than viva, then follow the instructions on adjusting the needle valve in the manual of your analyzer.

Preparing the test

- 1 ▪ Fill 20 mL of water and a few drops of KCl solution into the measuring vessel.

DME test

- 1 ▪ Click on **[Manual]** in the control bar of **viva** on the left. The window for the manual control opens.
 - Select **884 Professional VA** in the voltammetry device section in the **Manual control** window. Select the instrument with the electrode to be tested.
 - On the respective **Electrodes** tab, select the **MME** electrode in the **Sensor type** selection list.
 - Then select the **DME** mode in the **Operating mode** selection list.
 - Click on **[Start]** under **Drop formation** in order to switch on the **MME** in the **DME** operating mode.

Mercury drops are continuously forming at the tip of the capillary, which serve as the actual electrode.

- 2 ▪ Watch the drop formation. Drop formation is functioning properly if the drop is falling from the capillary at regular intervals.

SMDE test

- 1 ▪ Click on **[Manual]** in the control bar of **viva** on the left. The window for the manual control opens.
 - Select **884 Professional VA** in the voltammetry device section in the **Manual control** window. Select the instrument with the electrode to be tested.



- On the respective **Electrodes** tab, select the **MME** electrode in the **Sensor type** selection list.
- Then select the **SMDE** mode in the **Operating mode** selection list.
- Click on **[Start]** under **Drop formation** in order to switch on the **MME** in the **SMDE** operating mode.

Mercury drops are continuously forming at the tip of the capillary, which serve as the actual electrode.

- 2** ▪ Watch the drop formation.
Drop formation is functioning properly when each impact of the tapping mechanism removes an identically large drop from the capillary.

HMDE test

- 1** ▪ Click on **[Manual]** in the control bar of **viva** on the left. The window for the manual control opens.
- Select **884 Professional VA** in the voltammetry device section in the **Manual control** window.
Select the instrument with the electrode to be tested.
 - On the respective **Electrodes** tab, select the **MME** electrode in the **Sensor type** selection list.
 - Then select the **HMDE** mode in the **Operating mode** selection list.
 - Click on **[Start]** under **Drop formation** in order to switch on the **MME** in the **HMDE** operating mode.

Mercury drops are continuously forming at the tip of the capillary, which serve as the actual electrode.

- 2** ▪ Watch the drop formation.
Drop formation is functioning properly when the old drop is knocked off and a new drop is formed. The drop must neither become larger over time nor fall off.

4 Storing the MME pro

If the MME pro is not used for measurements, we recommend two ways of storing it:

- short term storage (less than 1 week)
- long term storage (more than 1 week)

Short term storage

- 1 You can leave the MME pro in the measuring stand.
- 2 Fill the measuring vessel with ultrapure water.
- 3 Store the reference electrode separately.

Long term storage

1 Rinsing the capillary

After having concluded the measurements, rinse the outside of the capillary thoroughly with ultrapure water.

This prevents blockage of the capillary by crystallized salts.

2 Storing the MME pro

Place the MME pro into the electrode stand, with the capillary lying horizontally (**2-B**). Store exposed to air.

5 Maintenance

5.1 Small maintenance



CAUTION

When handling mercury please observe the relevant safety regulations (see also *Mercury Handling Guidelines* 8.000.5054XX).

In order to ensure that no mercury can escape into the environment, the following procedures must always be carried out in a dry drip pan (6.2711.030).

Mercury which escapes into the drip pan must be completely collected. Larger amounts can be poured out of the drip pan into a closed mercury collection container. Small drops can be collected with the mercury drop catcher (6.2406.000).

A small maintenance consists of the following tasks:

1. Removing the MME pro from the measuring head (see chapter 5.1.1, page 22).
2. Refilling mercury (see chapter 3.3, page 15).
3. Replacing the capillary (see chapter 5.1.3, page 24).
4. Replacing the needle (see chapter 5.1.4, page 27).
5. Adjusting the needle valve (see chapter 3.5, page 17).

5.1.1 Removing the MME pro from the measuring head



NOTICE

Before you remove the MME pro from the measuring head, make sure that the electrode is switched off.

1 Disconnecting the inert gas supply

- Disconnect the inert gas tubings from the connectors (1-8) and (1-12).

2 Disconnecting the electrode cable

- Pull off the electrode cable from the connector (1-13).

5.1.2 Filling in or refilling mercury



CAUTION

In this procedure mercury is used. Always carry out the following steps in a dry drip pan.

Filling in mercury

To carry out this procedure you need the MME pro and the following accessories:

- Drip pan (6.2744.030)
- Electrode stand (6.2615.130)
- Wrench (6.1247.220)
- Syringe (6.2816.020) with needle (6.2816.030)
- Mercury
- Mercury drop catcher (6.2406.000)

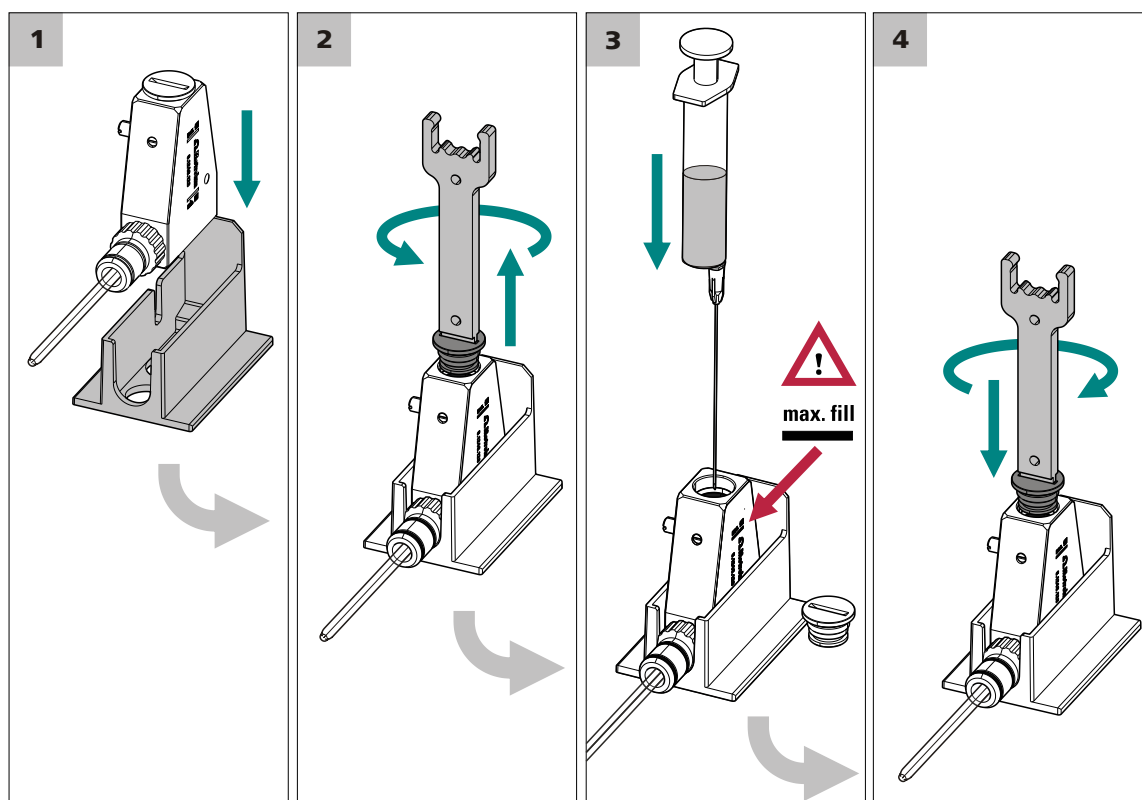


Figure 6 MME pro – Filling in mercury

1 Placing the MME pro into the electrode stand

- Place the electrode stand into the drip pan.



- Place the MME pro into the electrode stand.
The mercury filler opening is pointing upwards.

2 Opening the screw cap

- Open the screw cap (1-7) at the mercury filler opening with the wrench and remove it.

3 Filling in mercury

Using the syringe, carefully fill in the mercury into the mercury reservoir.



NOTICE

Only fill in mercury until it reaches the marking **max. fill**.

4 Closing the screw cap

Insert the screw cap into the mercury filler opening and fasten it with the wrench as far as it will go.

5.1.3 Replacing the capillary



CAUTION

In this procedure mercury is used. Always carry out the following steps in a dry drip pan.

There are two types of capillaries which can be mounted into the MME pro, depending on the application:

- Silanized capillaries (6.1226.050) are especially suitable for voltammetric determinations at the HMDE in acidic to slightly alkaline solutions which do not contain organic solvents.
- Non-silanized capillaries (6.1226.030) are especially suitable for polarographic determinations at the DME or SMDE and for voltammetric determinations at the HMDE in all types of solutions, especially alkaline solutions with $\text{pH} > 10$ or in solutions containing solvents, where silanized capillaries cannot be used.

Replacing the capillary

To replace the capillary you need the MME pro and the following accessories:

- Drip pan (6.2711.030)

- Electrode stand (6.2615.130)
- Wrench (6.1247.220)
- Silanized capillary (6.1226.050) or non-silanized capillary (6.1226.030)
- Scissors

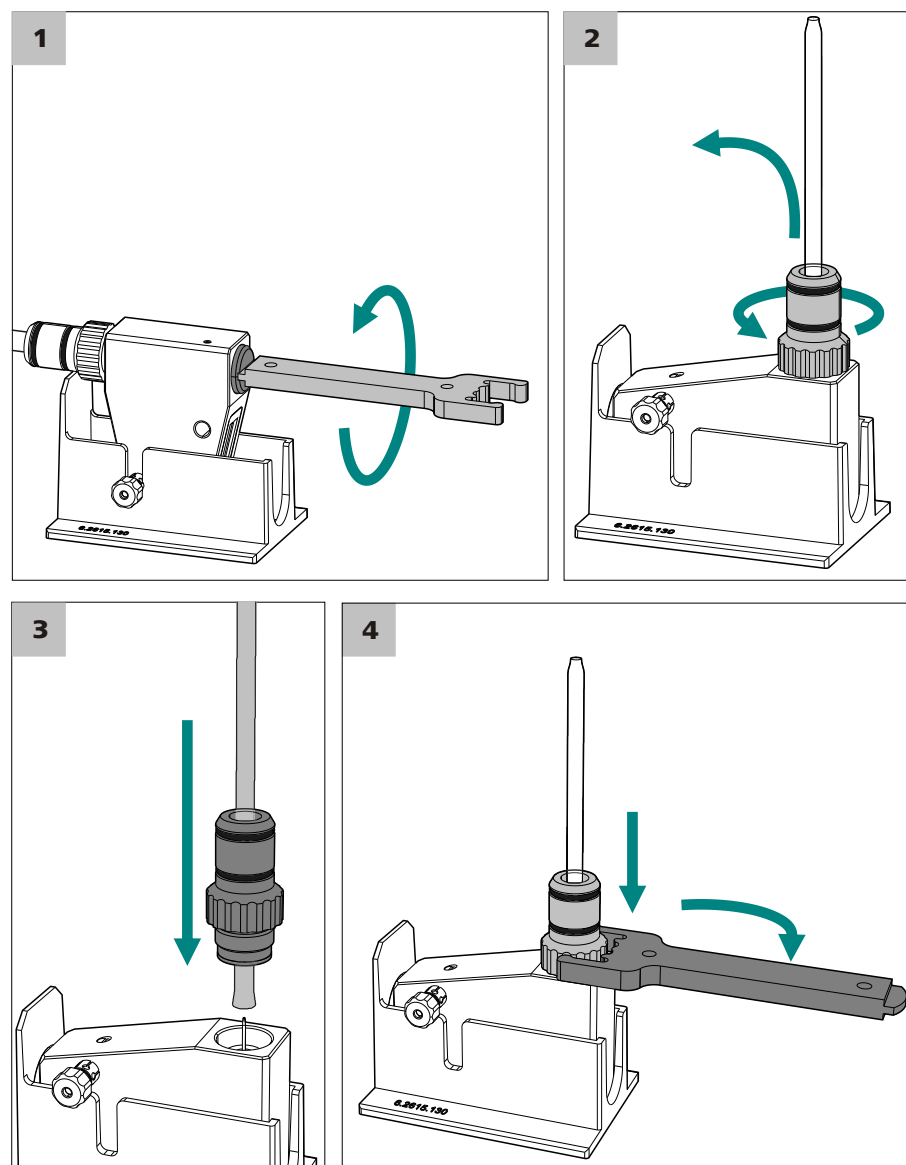


Figure 7 MME pro – Replacing the capillary

1 Loosening the needle holder

- Place the electrode stand into the drip pan.
- Place the MME pro into the electrode stand.
- Loosen the needle holder using the wrench turning it counter-clockwise 1–2 rotations.

The black sealing ring must remain visible!

2 Removing the old capillary



CAUTION

Do not touch the needle!

- Turn the MME pro in the electrode stand.
- Loosen the capillary retaining screw and lift it so far that you can see the lower end of the capillary, the end with the broad opening.
- Check whether there is still mercury in the opening.
If there is mercury left in the capillary, then gently knock at the capillary, this will cause the mercury to flow back into the electrode body.
- With one hand, hold down the capillary retaining screw, with the other hand pull the capillary out of the holder.

3 Inserting the new capillary



CAUTION

Only hold the capillary by its sides!

Do not exert pressure on the tip of the capillary!

Each capillary is individually packed in a transparent plastic wrapper.

- Cut open the plastic wrapper with the scissors at the marking and unwrap the capillary.
- Grab the capillary at its sides, insert it through the capillary retaining screw into the electrode body.
- Gently press it through the silicone seal.

4 Fastening the capillary retaining screw

- First, fasten the capillary retaining screw by hand until you feel a slight resistance.
- Then slide the wrench from the top over the capillary retaining screw.
The knobs on the wrench fit exactly into the grooves of the capillary retaining screw thus holding the wrench in place.
- Turn the handle by pushing it clockwise with one finger until the wrench falls off.
Now the capillary retaining screw is correctly fastened.

**NOTICE**

Do not apply the wrench a second time.

See also the video *Replace capillary* in the multimedia guide *Electrodes in Voltammetry*.

5.1.4 Replacing the needle

**CAUTION**

In this procedure mercury is used. Always carry out the following steps in a dry drip pan.

Replacing the needle

To replace the needle you need the MME pro and the following accessories:

- Drip pan (6.2711.030)
- Electrode stand (6.2615.130)
- New needle (6.1247.020)
- Mounting ring (6.1247.210)
- Wrench (6.1247.220)
- Scissors

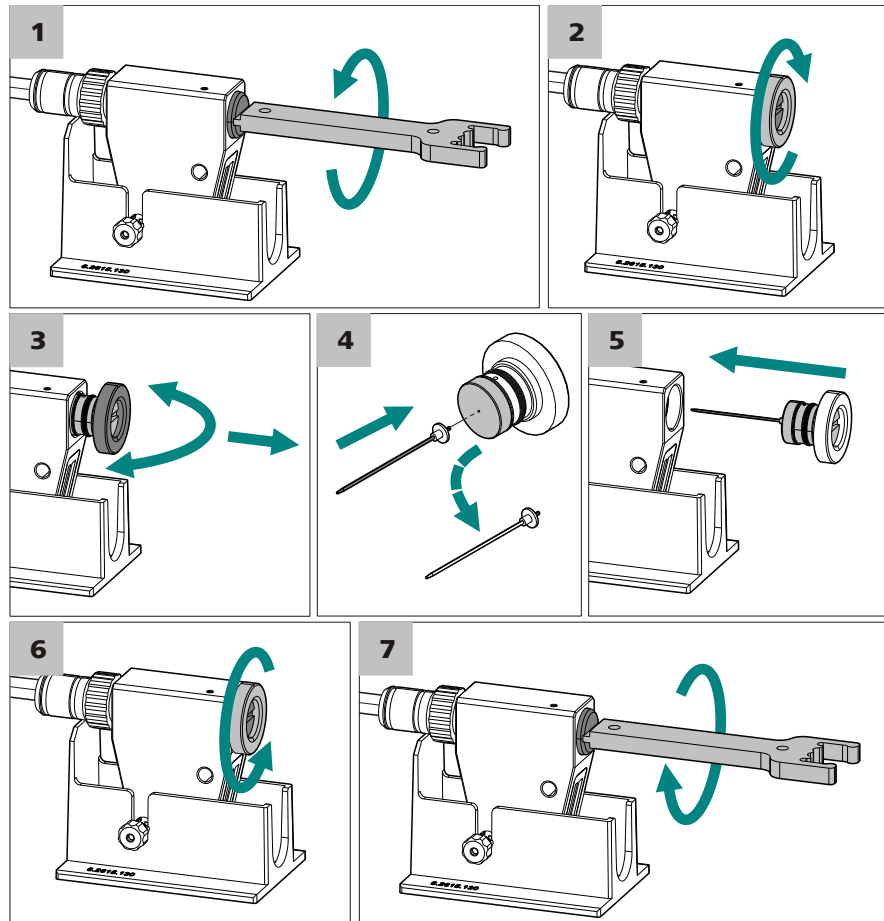


Figure 8 MME pro – Replacing the needle

1 Loosening the needle holder

- Place the electrode stand into the drip pan.
- Place the MME pro into the electrode stand.
- Use the wrench to loosen the needle holder, turn out the screw as far as it will go.

2 Screwing on the mounting ring

- Screw the mounting ring onto the needle holder in clockwise direction.

3 Pulling out the needle holder

- Hold the mounting ring tight and pull out the needle holder by carefully jiggling it from side to side.

4 Replacing the needle



NOTICE

Do not touch the needle with bare hands!

Each needle is individually wrapped.

- Pull the old needle out of the membrane of the needle holder.
- Cut open the wrapper of the new needle with the scissors and unwrap the white plastic part only. Do not yet completely remove the wrapper.
- Insert the needle into the hole of the membrane and press in as far as the white marking. Now, remove the wrapper.

5 Inserting the needle holder

- Insert the needle holder with the new needle into the MME pro. Press in as far as it will go.

6 Removing the mounting ring

- Remove the mounting ring turning it counterclockwise.

7 Fastening the needle holder

- Use the wrench to tighten the needle holder by turning it clockwise until the black sealing ring becomes visible in the electrode body.

See also the video *Replace the needle* in the multimedia guide *Electrodes in Voltammetry*.

5.1.5 Adjusting the needle valve

Adjusting the needle valve

Before you can adjust the needle valve, the following requirements must be fulfilled:

- The MME pro is mounted onto the measuring head of the analyzer and the inert gas supply is connected.
- An **empty** measuring vessel is placed under the MME pro.
- The instrument is connected to a PC on which the **viva** software is installed and running.

5.2 Large maintenance

Large maintenance consists of the following tasks:

1. Removing the MME pro from the measuring head (*see chapter 5.1.1, page 22*).
2. Emptying the mercury reservoir (*see chapter 5.2.2, page 31*).
3. Removing the capillary (*see chapter 5.2.3, page 32*).
4. Removing the needle (*see chapter 5.2.4, page 34*).
5. Cleaning the electrode body (*see chapter 5.2.5, page 35*).
6. Mounting the capillary (*see chapter 5.2.6, page 36*).
7. Inserting the needle (*see chapter 5.2.7, page 38*).
8. Filling in mercury (*see chapter 5.2.8, page 40*).
9. Mounting the MME pro onto the measuring head (*see chapter 3.4, page 17*).
10. Adjusting the needle valve (*see chapter 3.5, page 17*).
11. Testing the electrode function (*see chapter 3.6, page 19*).

5.2.1 Removing the MME pro from the measuring head



NOTICE

Before you remove the MME pro from the measuring head, make sure that the electrode is switched off.

1 Disconnecting the inert gas supply

- Disconnect the inert gas tubings from the connectors (1-8) and (1-12).

2 Disconnecting the electrode cable

- Pull off the electrode cable from the connector (1-13).

5.2.2 Emptying the mercury reservoir



CAUTION

In this procedure mercury is used. Always carry out the following steps in a dry drip pan.

To empty the mercury reservoir you need the following accessories:

- Drip pan (6.2711.030)



- Electrode stand (6.2615.130)
- Wrench (6.1247.220)
- Mercury collection container
- Mercury drop catcher (6.2406.000)

1 Placing the MME pro into the electrode stand

- Place the electrode stand into the drip pan.
- Place the MME pro into the electrode stand.
The mercury filler opening is pointing upwards (*see Figure (2-B), Page 8*).

2 Opening the mercury reservoir

- Use the wrench to remove the screw cap from the mercury filler opening.
- Use the mercury drop catcher to collect mercury adhering to the screw cap.
- Place the screw cap into the drip pan.

3 Pouring out the mercury

- Pour the mercury from the mercury reservoir into the mercury collection container.
- Knock the MME pro lightly to remove remaining mercury from the hollow spaces and pour it into the mercury collection container.

Collect small amounts of dispersed mercury with the mercury drop catcher.

5.2.3 Removing the capillary



CAUTION

In this procedure mercury is used. Always carry out the following steps in a dry drip pan.

To remove the capillary you need the following accessories:

- Drip pan (6.2711.030)
- Electrode stand (6.2615.130)
- Mercury drop catcher (6.2406.000)

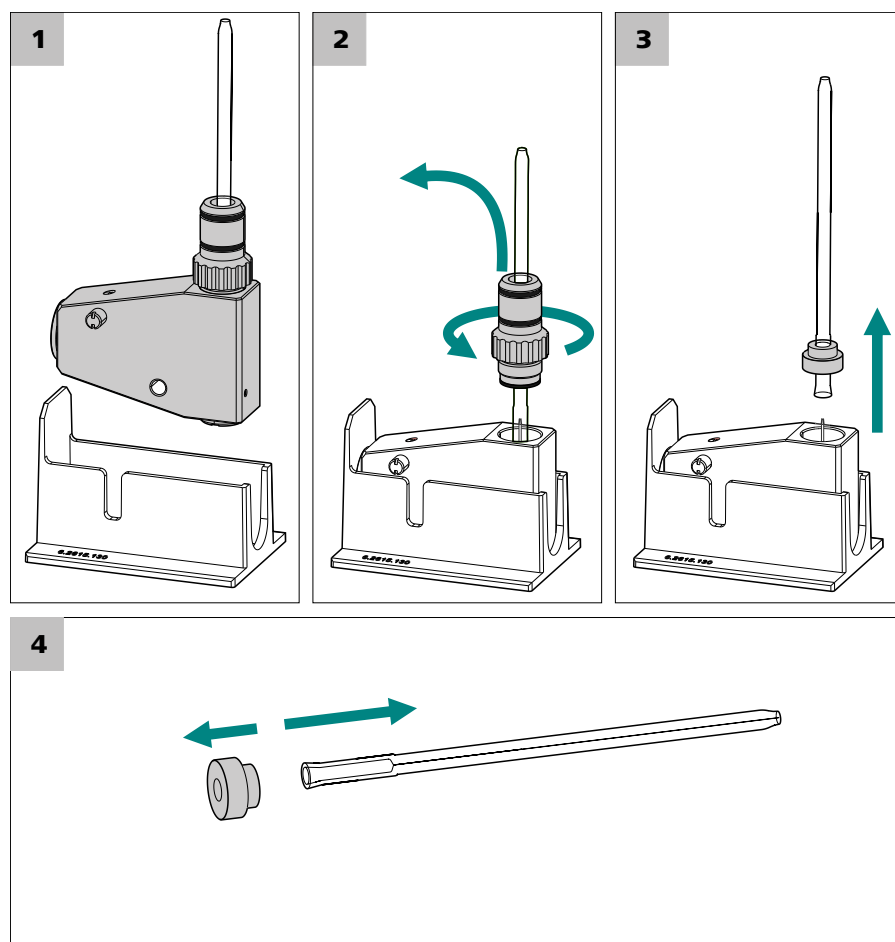


Figure 9 MME pro – Removing the capillary

1 Placing the MME pro into the electrode stand

- Place the electrode stand into the drip pan.
- Place the MME pro into the electrode stand.
The capillary retaining screw is pointing upwards.

2 Removing the capillary retaining screw

Loosen the capillary retaining screw and remove it.

3 Removing the capillary

Pull capillary and the seal out of the MME pro.

4 Removing the seal

Pull the capillary out of the seal.

The seal can be reused if it is undamaged.

5 Collecting the mercury

Collect mercury adhering to the seal using the mercury drop catcher.
Place the seal into the drip pan.

6 Disposing of the capillary

Professionally dispose of the capillary.

5.2.4 Removing the needle



CAUTION

In this procedure mercury is used. Always carry out the following steps in a dry drip pan.

To remove the needle, you need the following accessories:

- Drip pan (6.2711.030)
- Mounting ring (6.1247.210)
- Wrench (6.1247.220)
- Mercury drop catcher (6.2406.000)

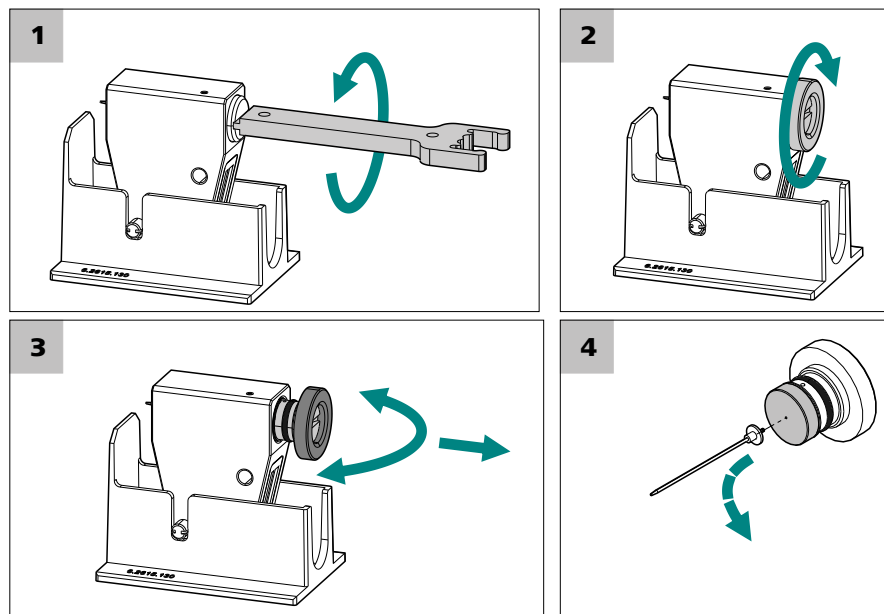


Figure 10 MME pro – Removing the needle

1 Loosening the needle holder

Use the wrench to loosen the needle holder, turn out the screw as far as it will go.

2 Screwing on the mounting ring

Screw on the gray mounting ring and carefully pull the needle holder out of the MME pro.

Hold the mounting ring tight and pull out the needle holder by carefully jiggling it from side to side.

3 Pulling out the needle holder

Pull the needle out of the membrane of the needle holder.

4 Removing the needle

Dispose of the needle.

5.2.5 Cleaning the electrode body**NOTICE**

The electrode body must not be rinsed with water nor with solvents (ethanol).

Before you can clean the electrode body, the following requirements must be fulfilled:

- The capillary is removed.
- The needle holder and the needle are removed.
- The screw cap of the mercury filler opening is removed and the mercury reservoir is empty.

1 Wipe out all the openings of the electrode body with a lint-free cloth.

To be able to reach the entire mercury reservoir, you could use, for instance, a used capillary.

**NOTICE**

If the electrode body is very dirty, it can be wiped clean with a lint-free cloth tempered with ultrapure water or ethanol. Let it dry thoroughly afterwards.

2 Clean the contact pin (*1-10*) particularly well.

See also the video in the multimedia guide.

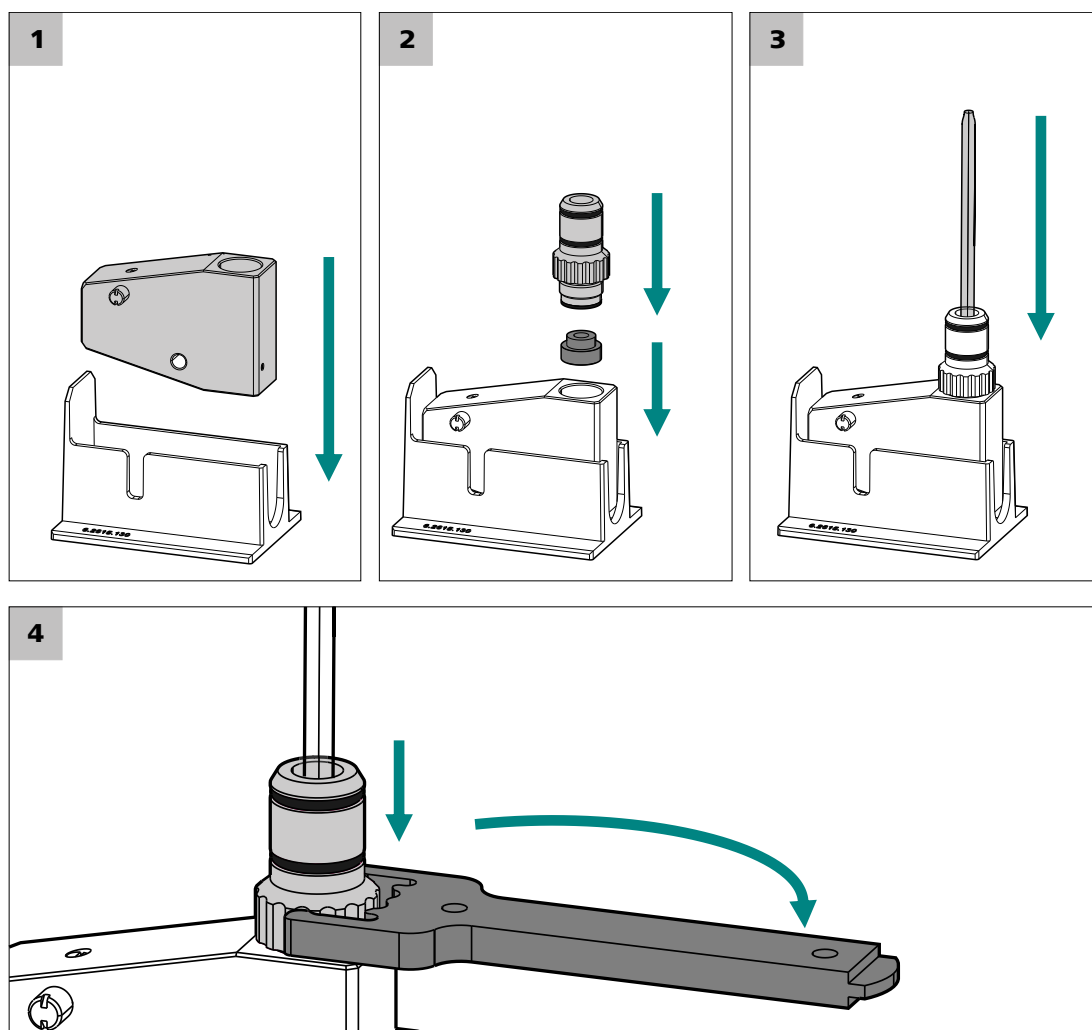


Figure 11 MME pro – Mounting the capillary

1 Placing the MME pro into the electrode stand

- Place the electrode stand into the drip pan.
- Place the MME pro into the electrode stand.
The thread for the capillary retaining screw is pointing upwards.

2 Inserting the silicone seal

- Insert the silicone seal. Use the capillary retaining screw to push it into position.
- Place the capillary retaining screw loosely into the opening.



3 Inserting the capillary



CAUTION

Only hold the capillary by its sides!

Do not exert pressure on the tip of the capillary!

Each capillary is individually wrapped.

- Cut open the plastic wrapper with the scissors at the marking and unwrap the capillary.
- Grab the capillary at its sides, insert it through the capillary retaining screw into the electrode body.
- Gently press it through the silicone seal.

4 Fastening the capillary retaining screw

- First, fasten the capillary retaining screw by hand until you feel a slight resistance.
- Then slide the wrench from the top over the capillary retaining screw.

The knobs on the wrench fit exactly into the grooves of the capillary retaining screw thus holding the wrench in place.

- Turn the handle by pushing it clockwise with one finger until the wrench falls off.

Now the capillary retaining screw is correctly fastened.



NOTICE

Do not apply the wrench a second time.

5.2.7 Inserting the needle



CAUTION

In this procedure mercury is used. Always carry out the following steps in a dry drip pan.

Inserting the needle

To insert the needle you need the MME pro and the following accessories:

- Drip pan (6.2711.030)

- Electrode stand (6.2615.130)
- New needle (6.1247.020)
- Wrench (6.1247.220)
- Scissors

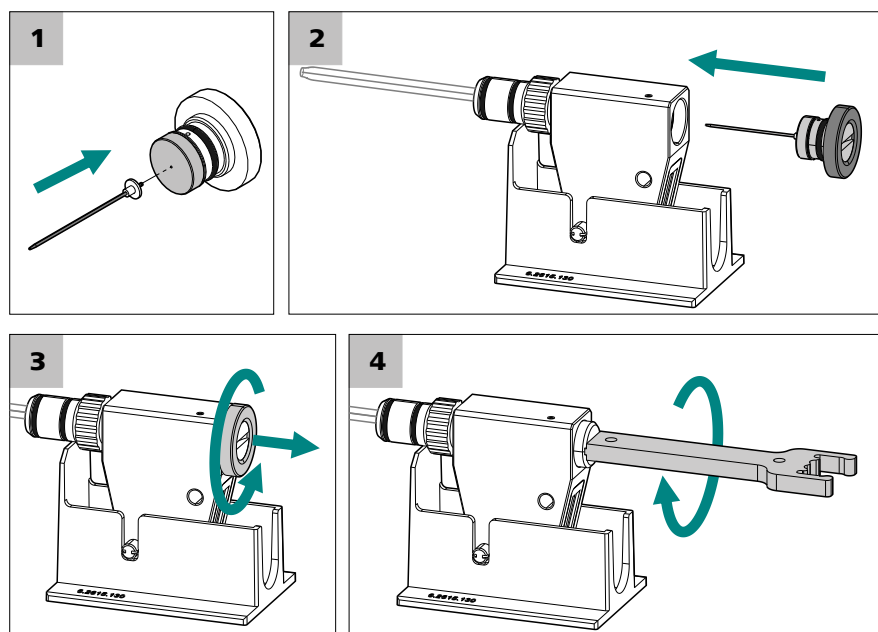


Figure 12 MME pro – Inserting the needle

1 Inserting a new needle

Each needle is individually wrapped in a plastic wrapper.



NOTICE

Do not touch the needle with bare hands!

- Cut open the wrapper of the new needle with the scissors and unwrap the white plastic part only. Do not yet completely remove the wrapper.
- Insert the needle into the hole of the membrane and press in as far as the white marking. Now, remove the wrapper.

2 Inserting the needle holder

- Insert the needle holder with the new needle into the MME pro. Press in as far as it will go.

3 Removing the mounting ring

- Unscrew the mounting ring and remove it.



4 Fastening the needle holder

- Use the wrench to tighten the needle holder by turning it clockwise until the black sealing ring becomes visible in the electrode body.

See also the video *Replace the needle* in the multimedia guide *Electrodes in Voltammetry*.

5.2.8 Filling in mercury



CAUTION

In this procedure mercury is used. Always carry out the following steps in a dry drip pan.

Filling in mercury

To carry out this procedure you need the MME pro and the following accessories:

- Drip pan (6.2744.030)
- Electrode stand (6.2615.130)
- Wrench (6.1247.220)
- Syringe (6.2816.020) with needle (6.2816.030)
- Mercury
- Mercury drop catcher (6.2406.000)

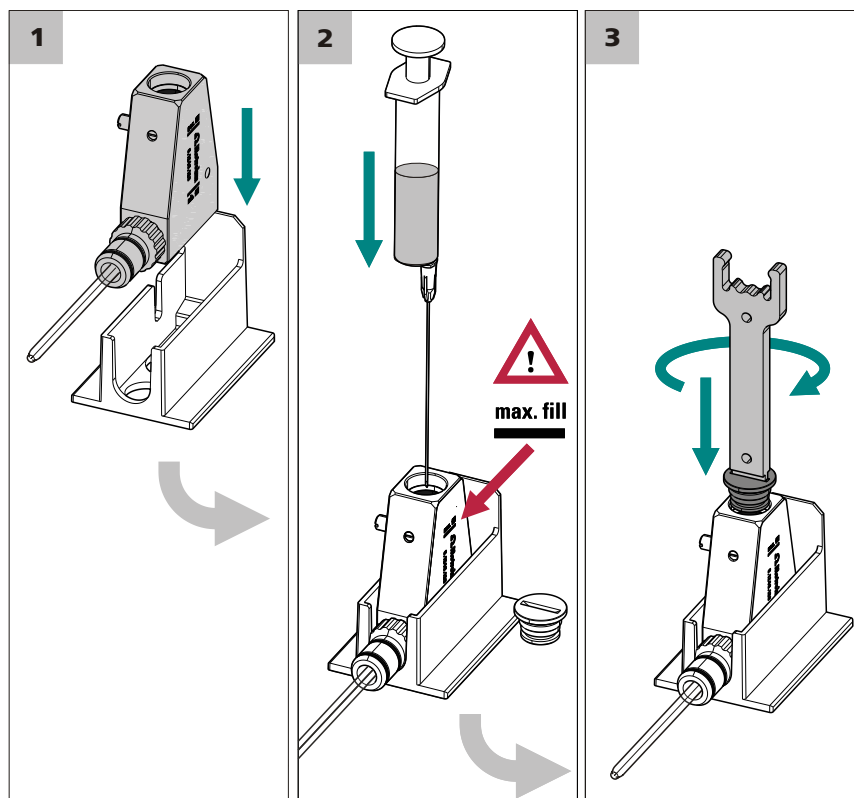


Figure 13 MME pro – Filling in mercury

1 Placing the MME pro into the electrode stand

- Place the electrode stand into the drip pan.
- Place the MME pro into the electrode stand.
The mercury filler opening is pointing upwards.

2 Filling in mercury

Using the syringe, carefully fill in the mercury into the mercury reservoir.



NOTICE

Only fill in mercury until it reaches the marking **max. fill**.

3 Closing the screw cap

Place the screw cap (1-7) back into the mercury filler opening and fasten it with the wrench as far as it will go.

5.2.9 Mounting the MME pro onto the measuring head

Before you can adjust the needle valve and test the electrode function, you must mount the MME pro onto the measuring head of the instrument.



NOTICE

Before you can mount the MME pro onto the measuring head of the instrument, you must place an **empty** measuring vessel into the measuring stand.

If the measuring vessel is not empty, then liquid can enter through the capillary into the MME pro. If this happens, the MME pro must be extensively cleaned and the capillary must be disposed of.

- Mount the MME pro onto the measuring head according to the instructions in the manual of the instrument.
- Connect the inert gas tubings with the connectors (1-8) and (1-12).
- Plug the working electrode cable (for the 797 VA Computrace with the attached adapter) onto connector (1-13).

For a detailed description see the manual of the analyzer.

5.2.10 Adjusting the needle valve

Adjusting the needle valve

Before you can adjust the needle valve, the following requirements must be fulfilled:

- The MME pro is mounted onto the measuring head of the analyzer and the inert gas supply is connected.
- An **empty** measuring vessel is placed under the MME pro.
- The instrument is connected to a PC on which the **viva** software is installed and running.



NOTICE

If you use another software than viva, then follow the instructions on adjusting the needle valve in the manual of your analyzer.

For adjusting the needle valve you need the wrench (6.1247.220) or a coin which will fit the slot of the screw.

1 Preparing

- Place an empty measuring vessel under the MME pro.
- Set the inert gas supply to 1.0 to 1.2 bar, in order to pressurize the electrode.
- Create a mercury drop at the electrode.

Procedure:

- Click on **[Manual]** in the control bar of **viva** on the left. The window for the manual control opens.
- Select **884 Professional VA** in the voltammetry device section in the **Manual control** window. Select the instrument with the electrode to be tested.
- Open the main valve on the respective **Electrodes** tab.
- Click on **[Open]** at the main valve.
- The button turns red and shows **[Close]**.
- As soon as a drop of mercury appears at the tip of the capillary, fill approximately 20 mL of water and a few drops of KCl solution into the measuring vessel.

2 Rough adjustment

- With the wrench, rotate the screw of the needle holder (*1-1*) clockwise until the mercury stops dropping.
Check: After each half rotation of the screw, knock off the drop and check if a new drop is forming.

3 Fine adjustment

- Rotate the screw slowly counterclockwise until a new drop is forming.
- Reseal the capillary with a small rotation in clockwise direction (ca. 10°).
- Rotate the screw clockwise by another quarter rotation (90–100°).

The MME pro is now ready for operation.

5.2.11 Testing the electrode function



NOTICE

If you use another software than viva, then follow the instructions on adjusting the needle valve in the manual of your analyzer.

- 2 ▪ Watch the drop formation.
Drop formation is functioning properly when each impact of the tapping mechanism removes an identically large drop from the capillary.

HMDE test

- 1 ▪ Click on **[Manual]** in the control bar of **viva** on the left.
The window for the manual control opens.
 - Select **884 Professional VA** in the voltammetry device section in the **Manual control** window.
Select the instrument with the electrode to be tested.
 - On the respective **Electrodes** tab, select the **MME** electrode in the **Sensor type** selection list.
 - Then select the **HMDE** mode in the **Operating mode** selection list.
 - Click on **[Start]** under **Drop formation** in order to switch on the **MME** in the **HMDE** operating mode.

Mercury drops are continuously forming at the tip of the capillary, which serve as the actual electrode.

- 2 ▪ Watch the drop formation.
Drop formation is functioning properly when the old drop is knocked off and a new drop is formed. The drop must neither become larger over time nor fall off.

6 Technical specifications

<i>Electrode types</i>	<ul style="list-style-type: none"> ▪ DME (Dropping Mercury Electrode) ▪ HMDE (Hanging Mercury Drop Electrode) ▪ SMDE (Static Mercury Drop Electrode)
<i>Drop surface</i>	0.15–0.60 mm ² (HMDE and SMDE)
<i>Glass capillary</i>	
<i>Non-silanized glass capillary (6.1226.030)</i>	For polarography at the DME or SMDE and voltammetry at the HMDE in alkaline solutions and in solvents. Inner diameter = 0.05 mm
<i>Silanized glass capillary (6.1226.050)</i>	For voltammetry at the HMDE in acidic, neutral and slightly alkaline solutions (pH < 10). No solvents. Inner diameter = 0.05 mm
<i>Mercury reservoir</i>	6 mL corresponds to 81.2 g (for approximately 200,000 mercury drops)
<i>Mercury quality</i>	Mercury, min. purity w(Hg) = 99.9995%
<i>Inert gas supply</i>	Inert gas (in general ultrapure nitrogen N ₂ min "4.5" (= 99.995%) Pressure = 1.0–1.2 bar

7 Accessories

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

Downloading the accessories list

- 1** Enter <https://www.metrohm.com/> into your Internet browser.
- 2** Enter the article number (e.g. **6.1246.120**) into the search field.
The search result is displayed.
- 3** Click on the product.
Detailed information regarding the product is shown on various tabs.
- 4** On the **Included parts** tab, click on **Download the PDF**.
The PDF file with the accessories data is created.



NOTICE

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



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