894 Professional CVS

Manual

8.894.8001EN / v3 / 2025-09-30

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Technical Communication
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This documentation is an original document.

This documentation has been prepared with great care. However, errors can never be entirely ruled out. Please send comments regarding possible errors to the address above.

Disclaimer

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

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1 Introduction

1.1 Device description

The 894 Professional CVS is a PC-controlled voltammetric measuring device. Together with the **viva** PC software, it represents a measuring system specifically designed for the determination of additives in electroplating baths. In the electroplating industry, the determination of additives is an indispensable step in the production process and plays a significant role in quality assurance. The additives can be quantitatively determined by means of CVS (Cyclic Voltammetric Stripping).

The 894 Professional CVS is very compact in size and requires little space for operation. The measuring head can be removed from the device and put back in place again with a simple hand movement. This allows you to exchange the measuring head with all the electrodes and tubing quickly. The measuring head arm can be tilted upwards, thus enabling convenient placement of the measuring vessel in the holder. A rotating disk electrode (RDE) serves as a working electrode.

The measuring device uses the potentiostatic 3-electrode principle. This principle means that the potential at the working electrode is gauged to the predefined setpoint value with the aid of a reference electrode to which no current is applied. The current flows through a separate auxiliary electrode.

The 894 Professional CVS can be used both for single determinations and sample series. Various sample processors are suitable for this measuring device. Furthermore, you can automate the addition of reagents and auxiliary solutions by using dosing devices of the type 800 Dosino.

The 894 Professional CVS must be started, operated and controlled via the **viva** PC software. The data transfer between the measuring device and the PC takes place via a USB connection. At the end of every determination, the data (voltammogram, results, etc.) is saved in a database.

The present manual describes the hardware of the 894 Professional CVS (installation, start-up, etc.). Operation by means of the **viva** computer software is described in the software documentation (online help and CVS tutorial).

1.2 Displaying accessories

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

1 Searching for a product on the website

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

The search result is displayed.

2 Displaying product information

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

Detailed information regarding the product is displayed.

3 Displaying accessories and downloading the accessories list

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

NOTE

Metrohm recommends keeping the accessories list for reference purposes.

1.3 About the documentation

CAUTION

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

1.3.1 Further information and literature

You can find additional information regarding the 894 Professional CVS in the following publications:

- CVS tutorial
- Multimedia guide "Electrodes in Voltammetry"
- Online help for the **viva** computer software
- Monograph "Voltammetric analysis methods in electroplating"

1.3.2 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 device part in the figure.
1	**Instruction step** Perform the steps one after the other.
Method	**Dialog text**, **parameter** in the software
File ▶ New	Menu or menu item
[Continue]	**Button** or **key**
	**WARNING** This symbol draws attention to a possible life-threatening hazard or risk of injury.
	**WARNING** This symbol draws attention to a possible hazard due to electrical current.
	**WARNING** This symbol draws attention to a possible hazard due to heat or hot instrument parts.

	**WARNING** This symbol draws attention to a possible biological hazard.
	**WARNING** Warning of optical radiation
	**CAUTION** This symbol draws attention to possible damage to devices or device parts.
	**NOTICE** This symbol highlights additional information and tips.

2 Safety

2.1 Intended use

The 894 Professional CVS has been designed for use in the electroplating baths analysis for the quantitative determination of organic additives. The main fields of application are the following electroplating bath types:

- Acidic copper baths
- Tin baths
- Tin-lead baths
- Alkaline zinc baths
- Nickel baths

This device is suitable for processing various chemicals and flammable samples. Therefore, the use of the 894 Professional CVS requires the user to have basic knowledge and experience in handling toxic and caustic substances. Knowledge regarding the application of fire prevention measures prescribed for laboratories is also mandatory.

Before performing any analysis, the user should get acquainted with the hazard and precautionary statements or the R and S-phrases that are valid for the chemicals used. The user should also observe the precautionary measures prescribed.

2.2 Responsibility of the operator

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

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

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

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

2.3 Requirements for operating personnel

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

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

2.4 Safety instructions

2.4.1 General notes on safety

WARNING

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

This device left the factory in a flawless state in terms of technical safety. The following instructions must be observed carefully to preserve this status and ensure non-hazardous operation of the device.

2.4.2 Flammable solvents and chemicals

WARNING

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

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

2.4.3 Electrical safety

Electrical safety when working with the device 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 device. The device could become damaged. There is a considerable risk of 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 device.

Operate this device only with a supply voltage specified for it (refer to the rear of the device).

Protection against electrostatic charges

WARNING

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

Do not fail to pull the power cord out of the power socket before setting up or disconnecting electrical plug connections at the rear of the device.

2.4.4 Personnel safety

WARNING

Handling hazardous substances

Hazardous substances may result in injuries.

Wear protective glasses and work clothes suitable for laboratory work.

WARNING

Uncontrolled splashing of reagents

Splashing reagents may result in injuries.

Operate the 894 Professional CVS only with the measuring head in place and the measuring head arm lowered.

2.4.5 Tubing and capillary connections

CAUTION

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

The leak-tightness of the connections must be checked regularly. If the device is used mainly in unattended operation, then weekly inspections are mandatory.

3 Overview of the instrument

The following figures provide a detailed overview of the parts of the 894 Professional CVS. Some of these parts are not specifically relevant for CVS analyses, but for the sake of completeness they are listed nevertheless; however, they are grayed out and labeled "*Not relevant for CVS analyses*".

3.1 Front

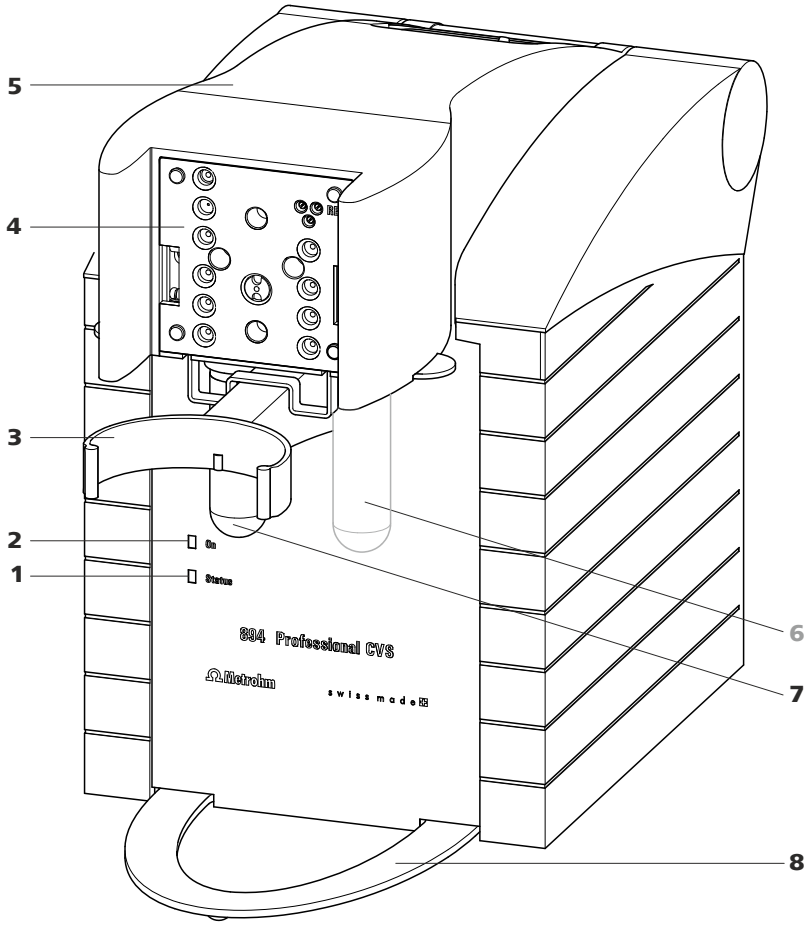


Figure 1 894 Professional CVS front

1 "Status" LED
Continuously on: instrument ready for operation. Blinking regularly: instrument operating. Blinking pattern "LED on a long time - off a short time - on a long time - off a short time, etc.": Standby potential is being applied to the electrodes. Do not remove the electrode cables!

2 "On" LED
Illuminated if the 894 Professional CVS is connected to the power grid.

3 **Holder for measuring vessel** For inserting the measuring vessel.	**4** **Connector plate measuring head arm** For inserting the measuring head.
5 **Measuring head arm (tiltable)**	**6** **Gas washing glass (6.2405.030)** *Not relevant for CVS analyses*.
7 **Decanting glass (6.2405.030)** For the deposition of solid materials that may be present.	**8** **Holder for drip pan** For positioning the drip pan.

3.2 Rear

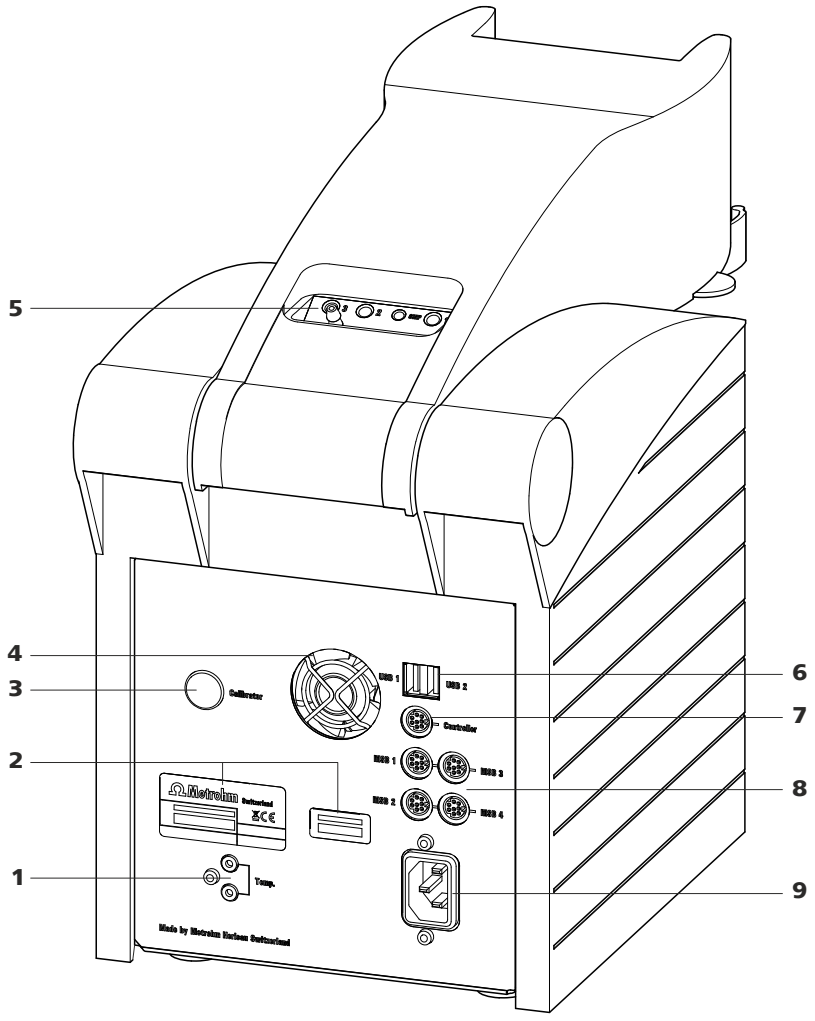


Figure 2 894 Professional CVS rear

1 **Temperature sensor connector (Temp.)** For connecting a temperature sensor of the type Pt1000. Two B sockets, 2 mm.	**2** **Type plates** With serial number.

3 **Calibrator**
For service procedures carried out by Metrohm.

4 **Fan**
Runs during operation.

5 **Tubing connector (measuring head arm)**
See Chapter 3.5, page 16.

6 **USB connectors (USB 1 and USB 2), type A**
For connecting barcode readers, keyboards, etc.

7 **"Controller" connector**
For connecting to a PC with the **viva** computer software installed. Mini DIN, 8-pin.

8 **MSB connectors (MSB 1 to 4)**
Metrohm Serial Bus. For connecting dosing devices (800 Dosino) and Remote Boxes. Mini DIN, 8-pin.

9 **Power socket**

3.3 RDE measuring head

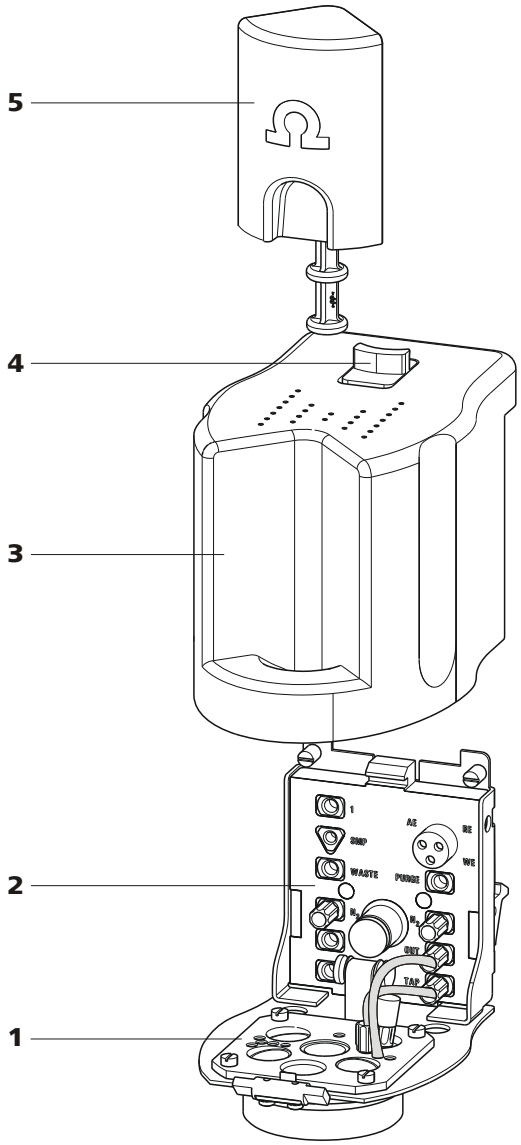


Figure 3 RDE measuring head - Overview

1 Measuring head insert
With openings for inserting electrodes and tubing connections *(see figure 5, page 15)*.

2 Measuring head connector plate
For connecting the RDE measuring head to the connector plate of the measuring head arm *(1-**4**)*.

For connecting the electrodes and tubing *(see figure 4, page 13)*.

3 Measuring head cover
For shielding against electromagnetic interference.

4 Slide lock
For measuring head cover.

5 Stopper (6.2709.100)
For closing the pipetting opening *(5-**22**)*.

3.4 Measuring head connector plate and measuring head insert

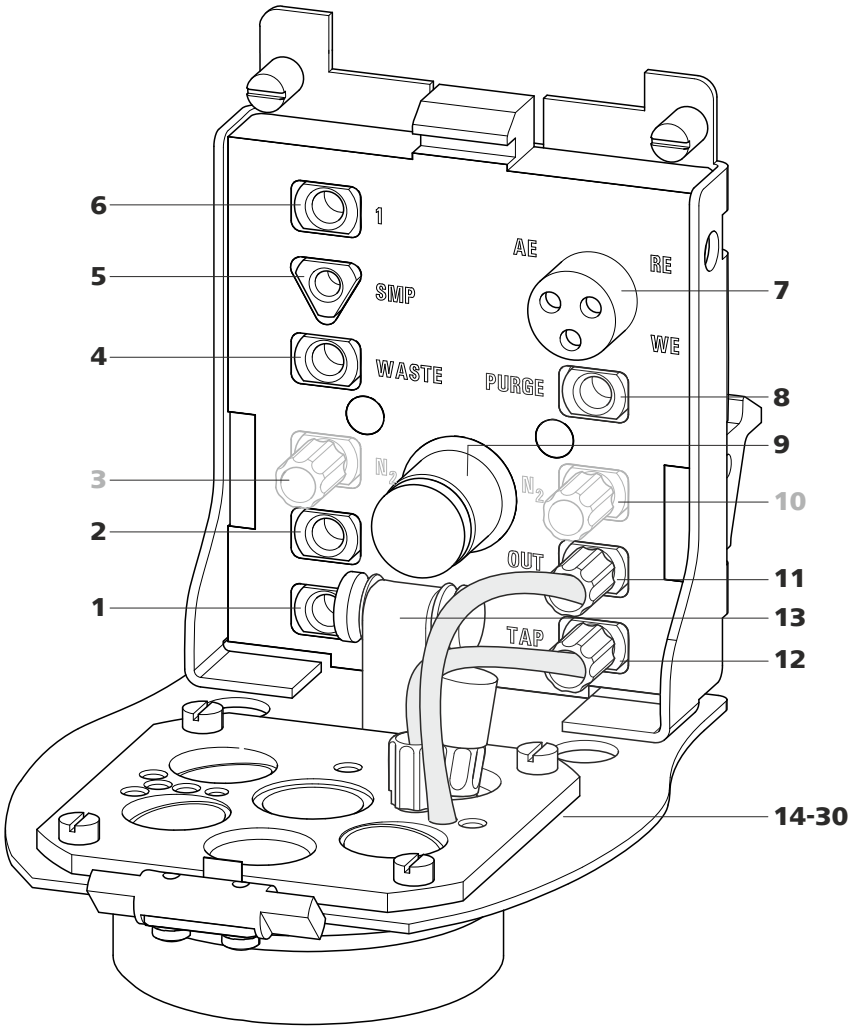


Figure 4 Measuring head connector plate

1 M6 threaded opening (3)
For adding or aspirating solutions. Can be connected to one of the openings ***24*** - ***27*** (FEP tubing from 6.1829.070).

2 M6 threaded opening (2)
For adding or aspirating solutions. Can be connected to one of the openings ***24*** - ***27*** (FEP tubing from 6.1829.070).

3 **M6 threaded opening (N_2)**
With preinstalled stopper. *Not relevant for CVS analyses*.

4 **M6 threaded opening (WASTE)**
For aspirating the measuring solution. Can be connected to one of the openings ***24*** - ***27*** (FEP tubing from 6.1829.070).

5 **UNF 10/32 threaded opening (SMP)**
For the automated sample addition. Must be connected to opening ***28*** (PEEK capillary 6.1831.020).

6 **M6 threaded opening (1)**
For adding or aspirating solutions. Can be connected to one of the openings ***24*** - ***27*** (FEP tubing from 6.1829.070).

7 **Electrode connector (AE, RE, WE)**
With electrode cables, for connecting electrodes.

8 **Threaded opening (PURGE)**
For tubing connection to opening ***19*** - gas inlet. *Not relevant for CVS analyses*.

9 **Drive shaft for rotating disk electrode (RDE)**

10 **M6 threaded opening (N_2)**
With preinstalled stopper. *Not relevant for CVS analyses*.

11 **M6 threaded opening (OUT)**
With preinstalled tubing connection to opening ***18*** - gas outlet. *Not relevant for CVS analyses*.

12 **Guide roller**
Transfers the rotary movement of the motor to the driving axle of the working electrode.

13 **M6 threaded opening (TAP)**
With preinstalled tubing connection to threaded opening ***17*** - gas inlet. *Not relevant for CVS analyses*.

14 - 30: see next figure

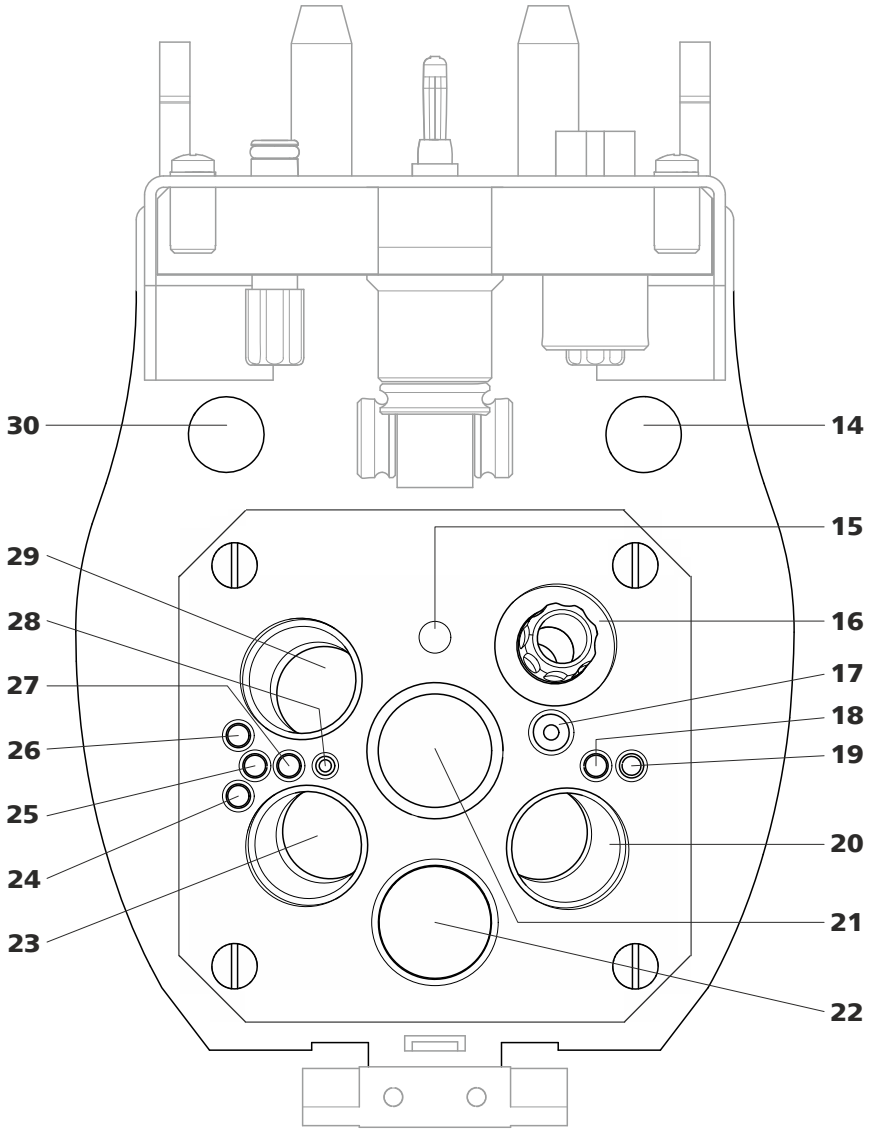


Figure 5 Measuring head insert

14 Opening
For feeding through a four-way micro dosing tip (6.1824.000) from below.

15 Opening
For positioning the driving axle.

16 Threaded opening
With preinstalled screw nipple and stopper. Can be equipped with a four-way micro dosing tip (6.1824.000).

17 M6 threaded opening
With preinstalled tubing connection to the threaded opening ***13*** (TAP) - gas inlet. *Not relevant for CVS analyses*.

18 Opening
With preinstalled tubing connection to threaded opening ***11*** (OUT) - gas outlet. *Not relevant for CVS analyses*.

19 Opening
For tubing connection to threaded opening ***8*** (PURGE) - gas inlet. *Not relevant for CVS analyses*.

20 **Opening for electrode**
For inserting the reference electrode (RE).

21 **Opening for electrode**
For inserting the driving axle for the RDE (working electrode - WE).

22 **Pipetting opening**
For manually dosing solutions. Is closed with a 6.2709.100 stopper *(3-**5**)*.

23 **Opening for electrode**
For inserting the auxiliary electrode (AE).

24 **Opening**
For adding or aspirating solutions. Can be connected with threaded opening ***1***, ***2***, ***3*** or ***WASTE*** (FEP tubing from 6.1829.070).

25 **Opening**
For adding or aspirating solutions. Can be connected with threaded opening ***1***, ***2***, ***3*** or ***WASTE*** (FEP tubing from 6.1829.070).

26 **Opening**
For adding or aspirating solutions. Can be connected with threaded opening ***1***, ***2***, ***3*** or ***WASTE*** (FEP tubing from 6.1829.070).

27 **Opening**
For adding or aspirating solutions. Can be connected with threaded opening ***1***, ***2***, ***3*** or ***WASTE*** (FEP tubing from 6.1829.070).

28 **Opening**
For the automated sample addition. Must be connected to threaded opening ***5*** (SMP) (PEEK capillary 6.1831.020).

29 **Opening for sensor**
For inserting a temperature sensor (Pt1000).

30 **Opening**
For feeding through the temperature sensor cables from above.

3.5 Tubing connector (measuring head arm)

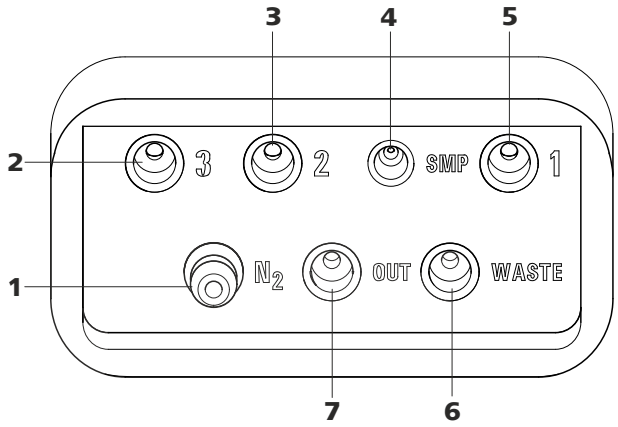


Figure 6 Tubing connector (measuring head arm)

1 **Nipple (N_2)**
Is connected to threaded openings **TAP**, **PURGE** and **N_2** via the measuring head arm. *Not relevant for CVS analyses*.

2 **M6 threaded opening (3)**
For connecting tubing for aspirating or adding solutions.

3 **M6 threaded opening (2)**
For connecting tubing for aspirating or adding solutions.

4 **UNF 10/32 threaded opening (SMP)**
For connecting a PEEK capillary for the automated sample addition.

5 **M6 threaded opening (1)**
For connecting tubing for aspirating or adding solutions.

6 **M6 threaded opening (WASTE)**
For connecting tubing for aspirating the measuring solution.

7 **M6 threaded opening (OUT)**
Not relevant for CVS analyses.

4 Installation

4.1 Setting up the device

4.1.1 Packaging

The product and accessories are supplied in protective special packaging. Keep this packaging to ensure safe transportation of the product. If a transport lock is present, keep this as well for future reuse.

4.1.2 Checks

Inspect the delivery immediately upon receipt:

- Check the delivery against the delivery note to ensure completeness.
- Check the product for damage.
- If the delivery is incomplete or damaged, contact your regional Metrohm representative.

4.1.3 Location

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

Place the instrument in a location of the laboratory which is suitable for operation and free of vibrations and which provides protection against corrosive atmosphere and contamination by chemicals.

The instrument should be protected against excessive temperature fluctuations and direct sunlight. Do not place the instrument in the vicinity of an air-conditioning unit outlet.

4.2 Equipping the RDE measuring head

The RDE measuring head can be used for both VA trace analysis and CVS analysis. If the measuring head is used for the determination of organic additives with CVS, then chapter 3.3.1, step 3 and chapter 3.3.4 can be omitted.

CAUTION

The measuring head insert *(3-**1**)* is made of PTFE. Do not use sharp objects around it to ensure the material is not damaged.

4.2.1 Preparing the RDE measuring head

NOTE

For equipping, Metrohm recommends placing the RDE measuring head in the measuring head holder and only then inserting it onto the measuring head arm.

1 Remove the stopper *(3-**5**)* from the pipetting opening to remove the measuring head cover.

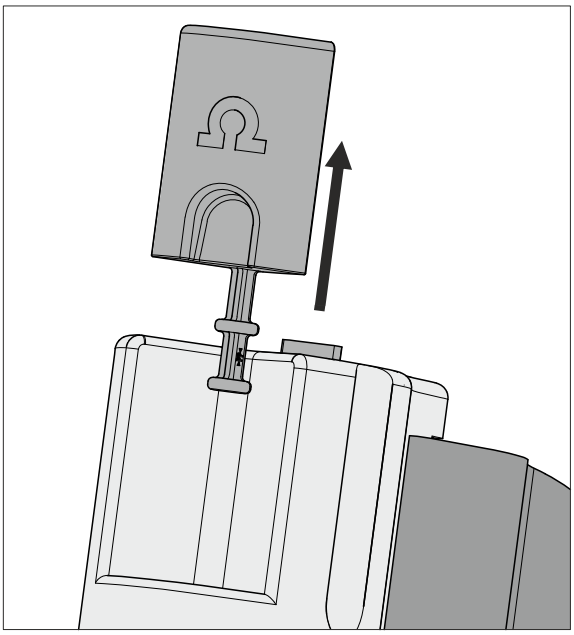


Figure 7 Removing the stopper from the pipetting opening

2 Pull the slide lock *(3-**4**)* on the top of the measuring head cover towards you and, at the same time, tilt the measuring head cover to an angle of approx. 45° and remove it.

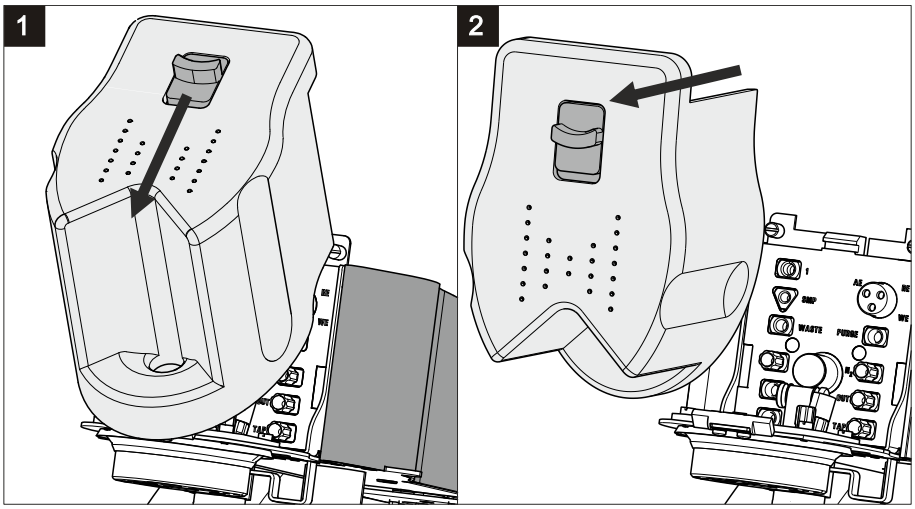


Figure 8 Removing the measuring head cover

3 Connecting the gas inlet

NOTE

Only carry out this step if the RDE measuring head is used for VA trace analysis. If the RDE measuring head is used for CVS analysis, then no gas inlet is necessary.

- Insert the PTFE tubing for adding gas to the solution (6.1829.030) through the opening *(5-**19**)*.
- Pull the transparent inner tubing through as far as it will go.
- Ensure that the green kink protection is protecting the entire piece of tubing.

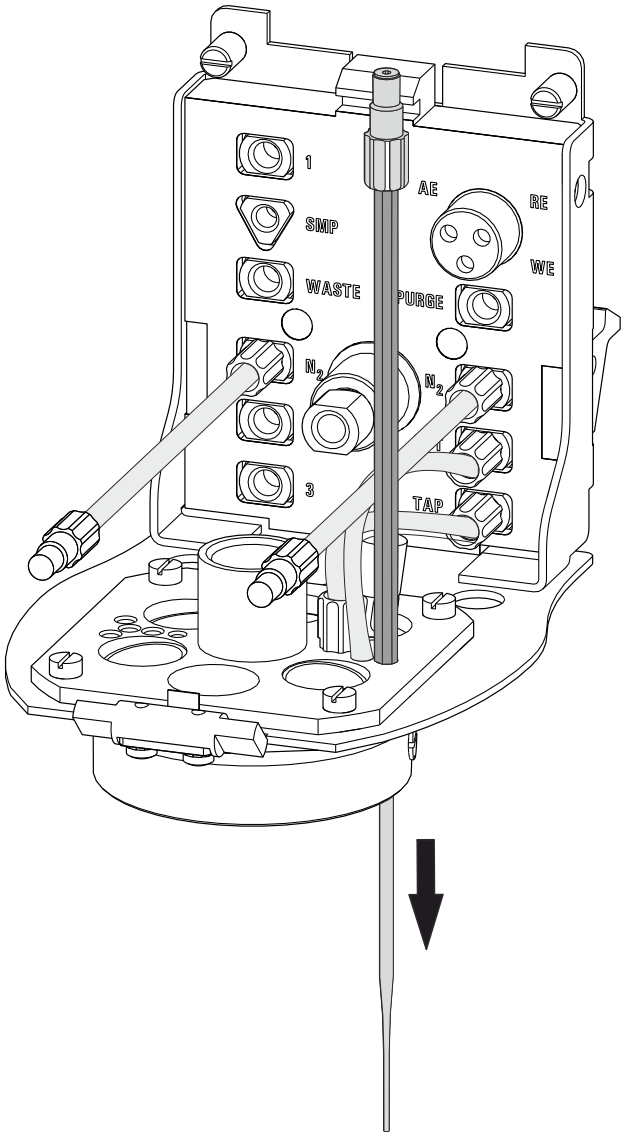


Figure 9 Inserting the gas inlet

- Connect the tubing to the PURGE threaded opening *(4-**8**)* and tighten it hand-tight.
- Finally, tighten the tubing nipple using the wrench provided (6.2739.000).

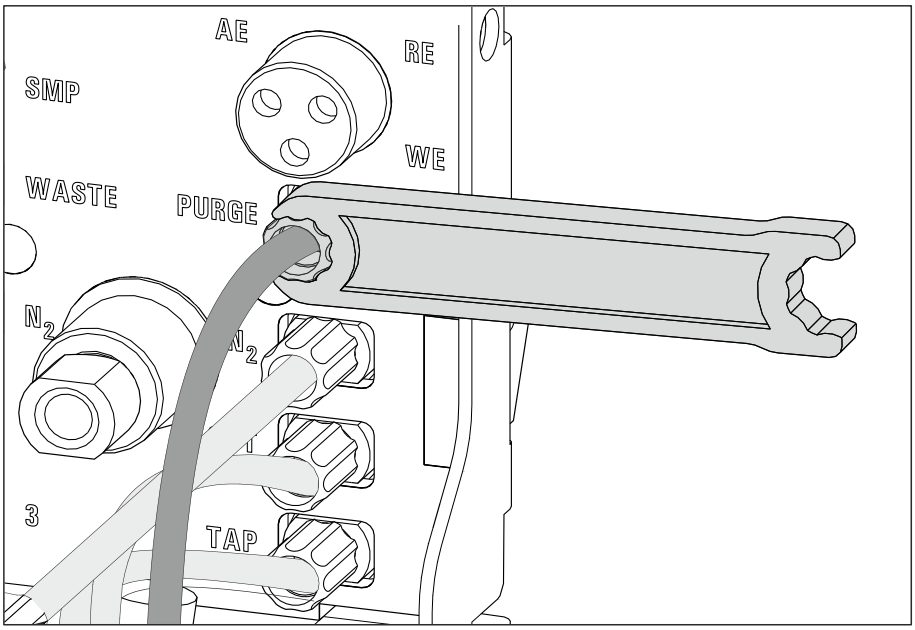


Figure 10 Connecting the gas inlet

4.2.2 Preparing electrodes and inserting them in the RDE measuring head

The 894 Professional CVS uses the potentiostatic three-electrode principle. The following electrodes are used:

- Rotating disk electrode (RDE) as working electrode (WE)
- Reference electrode (RE)
- Auxiliary electrode (AE)

NOTE

Also observe the notes contained in the electrode leaflets that can be downloaded from the *Metrohm website* using the corresponding article number. In addition, you can learn how to best handle the electrodes from the multimedia guide (A.717.0003).

4.2.2.1 Working electrode (WE)

The working electrode consists of the following 2 articles:

- Electrode tip (e.g. 6.1204.610)
- Driving axle for rotating disk electrode (RDE) (e.g. 6.1204.510)

Preparing and inserting the working electrode

Proceed as follows:

1 Preparing the electrode tip

Remove the protective cap from the electrode tip.

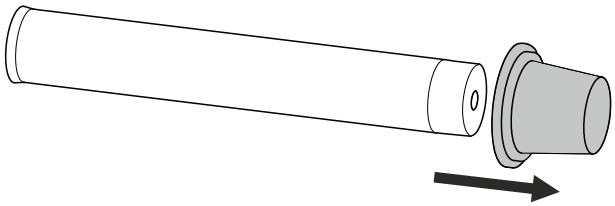


Figure 11 Removing the protective cap from the electrode tip

2 Assembling the working electrode

Hold the driving wheel by the driving axle and tighten the electrode tip to the driving axle.

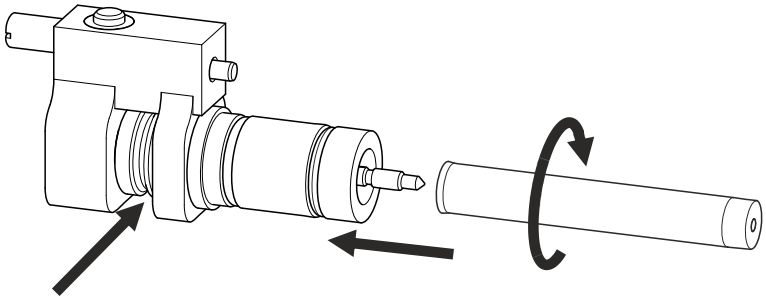


Figure 12 Tightening the electrode tip to the driving axle

3 Inserting the working electrode into the measuring head insert

Insert the working electrode into the opening *(5-**21**)* of the measuring head insert.

Make sure that the pin on the lower part of the driving axle is positioned in the opening *(5-**15**)* of the measuring head insert.

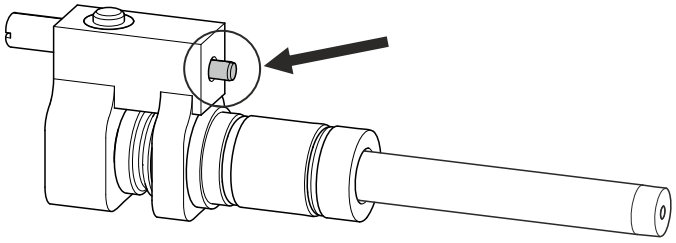


Figure 13 Working electrode, installed

4 Fastening the drive belt

- Slide the drive belt (6.1244.050) over the drive shaft *(4-**9**)*,
- guide it on both sides over the guide roller *(4-**12**)* from below,
- pull it over the working electrode and fasten it in the driving wheel of the driving axle.

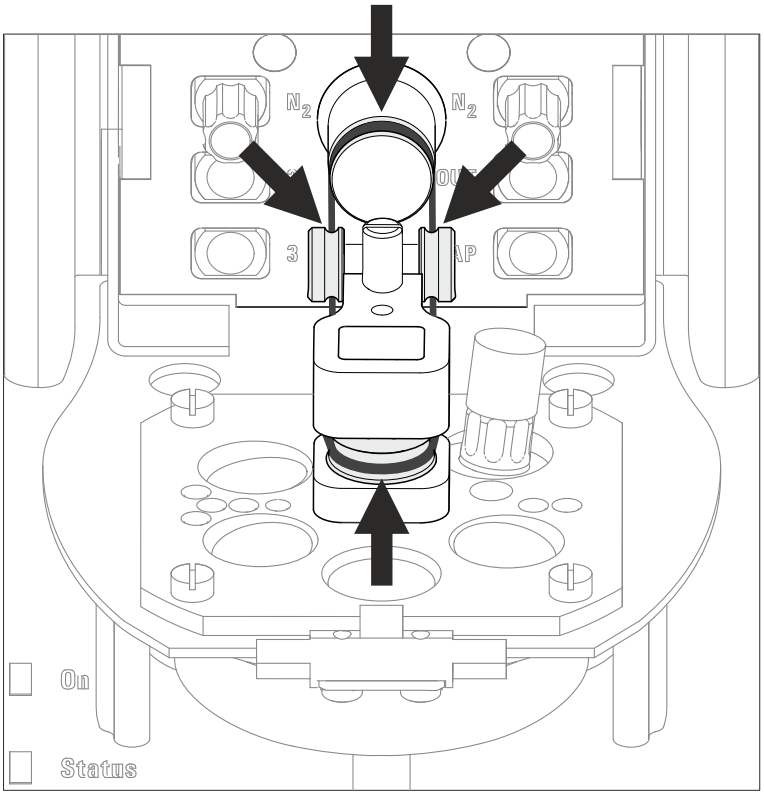


Figure 14 Fastening the drive belt

NOTE

Make sure that the drive belt does not rub against the driving axle or surrounding components (tubing, cables, etc.).

5 Connecting the working electrode

Plug the electrode cable *(4-**7**)* with the **WE** marking on the plug onto the metal contact of the driving axle.

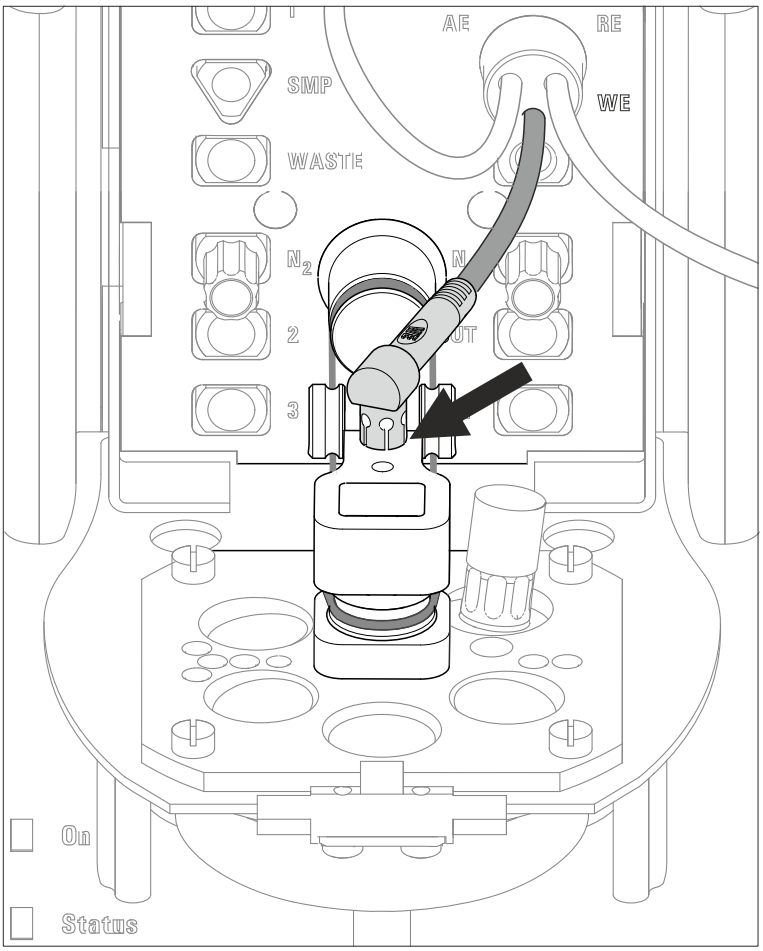


Figure 15 Connecting the working electrode

4.2.2.2 Reference electrode (RE)

The reference electrode consists of the following 2 articles:

- Reference electrode filled with reference electrolyte (e.g. 6.0728.130)
- Electrolyte vessel filled with bridge electrolyte (e.g. 6.1245.010)

Preparing and inserting the reference electrode

Proceed as follows:

1 Remove the reference electrode from the storage vessel.

The reference electrode that is part of the accessories is already filled with reference electrolyte (c(KCl) = 3 mol/L).

2 Fill the electrolyte vessel with bridge electrolyte (e.g. $c(KNO_3)$ = 1 mol/L) in accordance with the information in the electrode leaflet.

3 Allow the bridge electrolyte to react in the electrolyte vessel until the diaphragm is soaked with bridge electrolyte.

4 Place the reference electrode in the filled electrolyte vessel and screw it in place.

The electrolyte solution that is displaced in the electrolyte vessel is forced out of the deaeration openings.

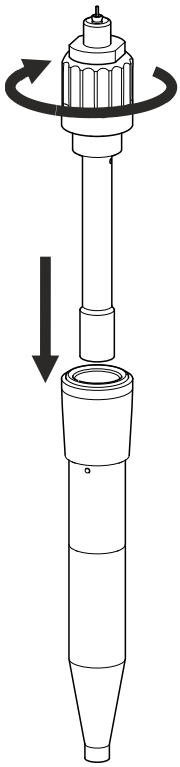


Figure 16 Assembling the reference electrode with the electrolyte vessel

5 Rinse the installed reference electrode with ultrapure water.

6 Insert the installed reference electrode into the opening *(5-**20**)* of the measuring head insert.

7

CAUTION

The electrode cables for the reference and the auxiliary electrode look identical. Observe the markings on the plugs, because the 2 cables must not be mixed up.

Plug the electrode cable with the **RE** marking on the plug onto the metal contact of the reference electrode.

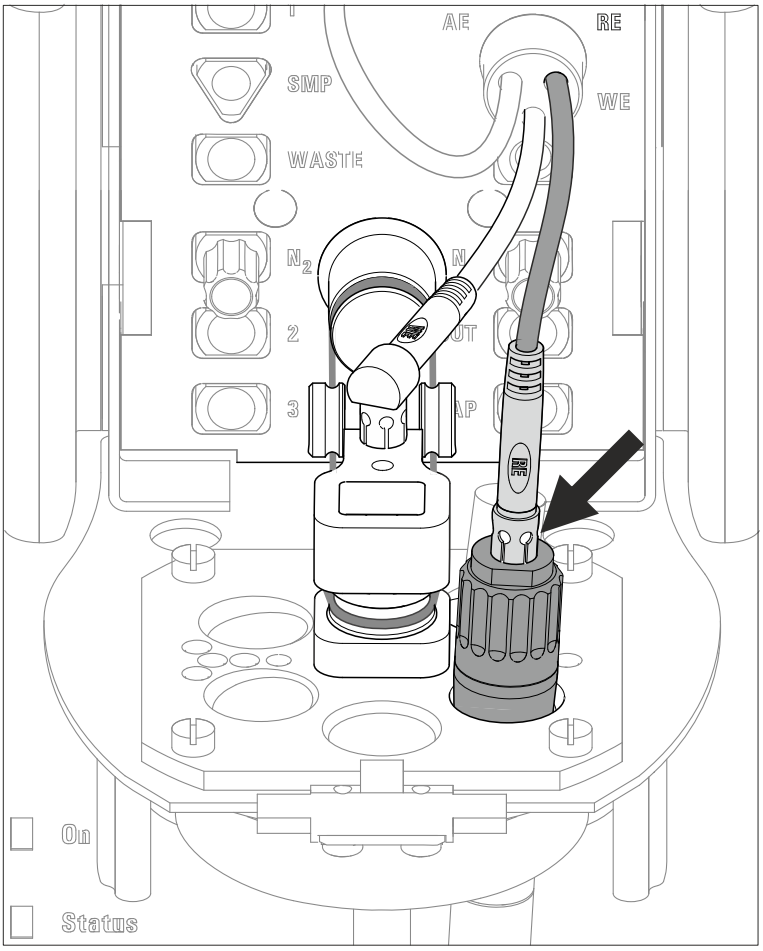


Figure 17 Connecting a reference electrode

4.2.2.3 Auxiliary electrode (AE)

The auxiliary electrode (e.g. 6.0343.100) can be placed directly in the measuring head.

Inserting the auxiliary electrode

Proceed as follows:

1 Insert the auxiliary electrode into the opening *(5-**23**)* of the measuring head insert.

2

CAUTION

The electrode cables for the reference and the auxiliary electrode look identical. Observe the markings on the plugs, because the 2 cables must not be mixed up.

Plug the electrode cable *(4-**7**)* with the **AE** marking on the plug onto the metal contact of the auxiliary electrode.

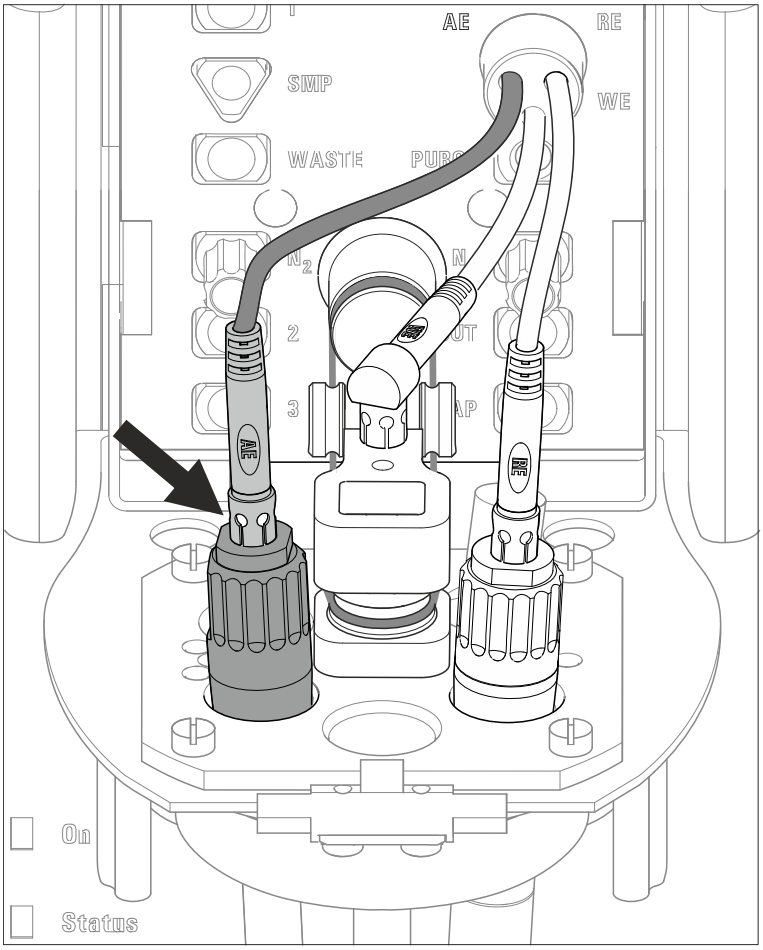


Figure 18 Connecting the auxiliary electrode

4.2.3 Inserting the RDE measuring head

Once the RDE measuring head has been fully equipped, it can be inserted on the measuring head arm. Proceed as follows:

1 **Installing the measuring head cover**

Place the measuring head cover at an angle of approx. 45° in the guide bolt in the front part of the measuring head insert.

Fold back the measuring head cover and gently push it in place.

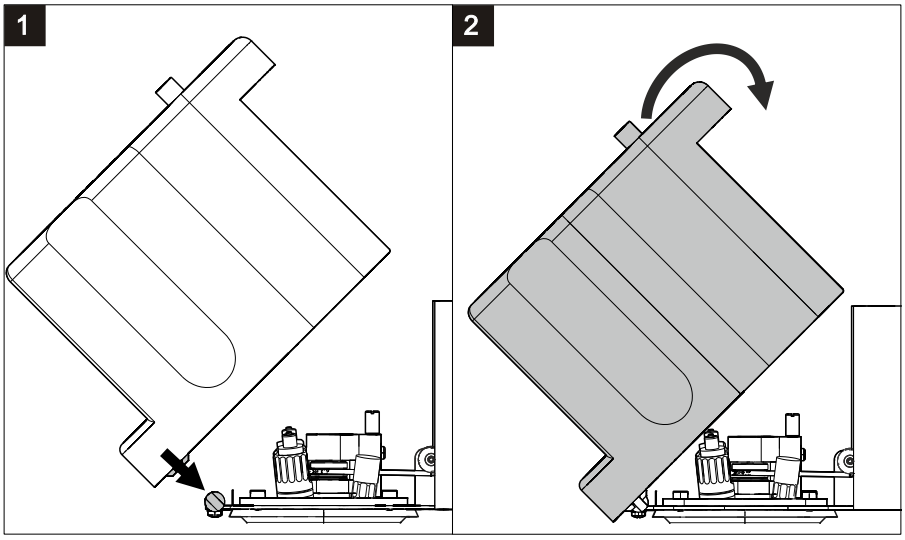


Figure 19 Installing the measuring head cover

The measuring head cover must snap into place with an audible click.

2 Inserting the stopper

Insert the stopper *(3-**5**)* into the pipetting opening.

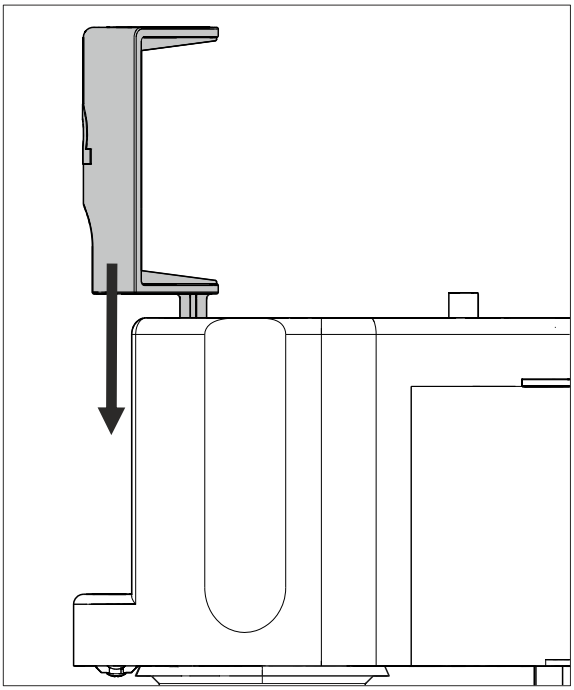


Figure 20 Inserting the stopper in the pipetting opening

3 Inserting the measuring head

WARNING

If the measuring head arm is folded down without due care, this may result in injuries to the hands.

Make sure that your fingers do not get caught between the measuring head arm and the device housing.

CAUTION

Do not apply pressure to the drive disk on the connector plate of the measuring head arm. Otherwise, the stirrer motor may be damaged.

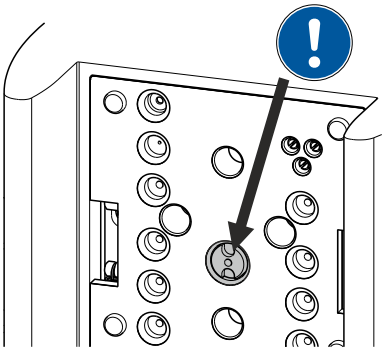


Figure 21 Do not touch the drive disk

Use one hand to hold the measuring head arm on the rear and use the other hand to insert the measuring head into the connector plate of the measuring head arm.

The measuring head must snap into place with an audible click.

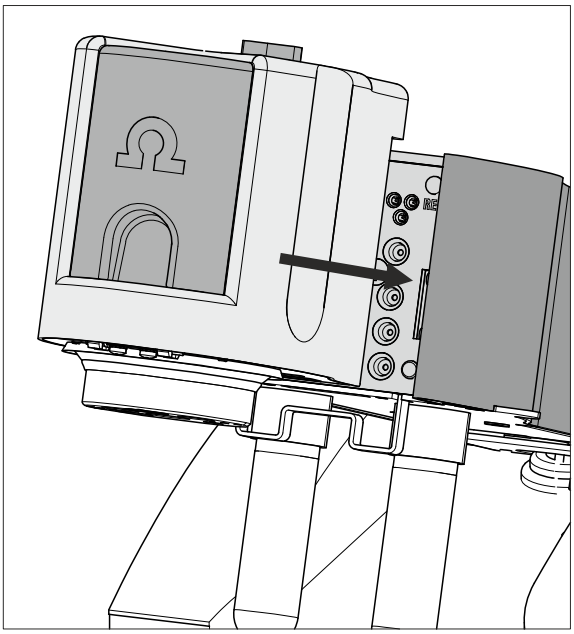


Figure 22 Inserting the measuring head

4.2.4 Connecting the inert gas supply

NOTE

Only connect the inert gas supply if the RDE measuring head is used for VA trace analysis.

If the RDE measuring head is used for CVS analysis, then no inert gas supply is necessary.

Generally, nitrogen (N_2) is used as inert gas in VA trace analysis for purging the measuring solution and for operating the MME pro, the SPE and the RDE. Only nitrogen of sufficient purity may be used for this.

For general polarography/voltammetry:

- 4.5 ($w(N_2)$ = 99.995%)

For analyses in organic solvents; for determinations that result in very high current strengths (such as for determining the smallest concentrations without preceding deposition)

- 5.0 ($w(N_2)$ = 99.999%)

1 Filling the gas washing glass

- Unscrew the gas washing glass *(1-**6**)* from the measuring head arm.

- Fill the gas washing glass as follows:
  - Standard: Fill the gas washing glass halfway with distilled H_2O.
  - For long-term measurement with base electrolytes like acetic acid/acetate buffer solution or ammonia/ammonium chloride buffer solution, add the base electrolyte.
  - For measurements in organic solvents, fill with the solvent being used.
- Screw the gas washing glass back onto the measuring head arm.

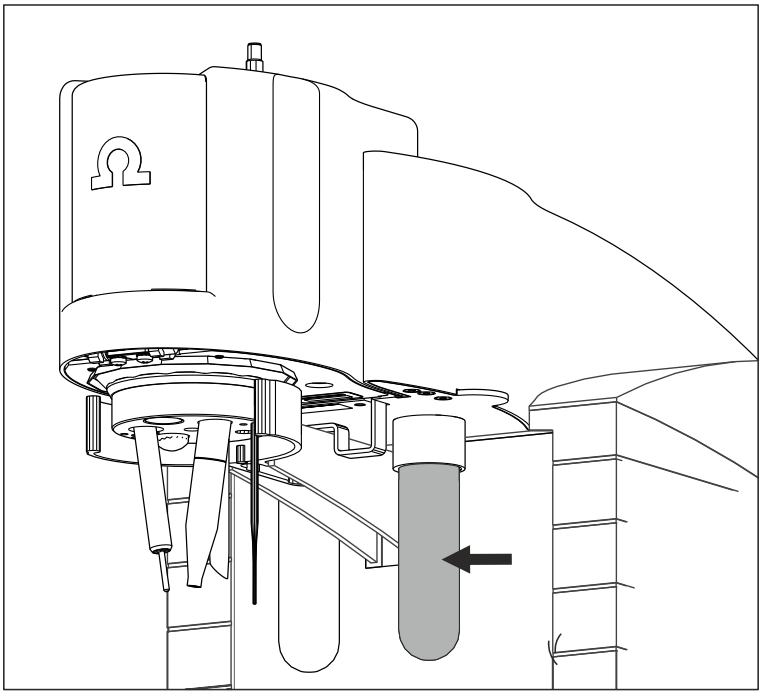


Figure 23 Gas washing glass

2 Connecting the inert gas inlet

- Connect one end of the PVC tubing (6.1801.080) on the **N_2** nipple of the 894 Professional CVS.
- Connect the other end of the PVC tubing (6.1801.080) to the inert gas bottle connection.
- Set the inert gas pressure on the gas bottle to p = 1.0–1.2 bar (or 14.5–17.4 psi or 0.1–0.12 MPa) using the reducing valve.
- Open the gas inlet on the gas bottle.

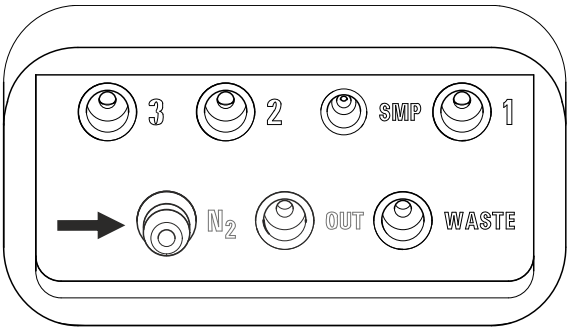


Figure 24 Nipple for inert gas supply

4.3 Establishing the tubing connections

Depending on the peripheral devices you are using with the measuring instrument (manual, semiautomated or automated determinations), different tubing connections have to be established. All tubing connections that can be used are described below.

4.3.1 Removing the measuring head cover

Remove the measuring head cover to establish the tubing connections.

CAUTION

The measuring head insert *(3-**1**)* is made of PTFE. Do not use sharp objects around it to ensure the material is not damaged.

Removing the measuring head cover

1 Remove the stopper *(3-**5**)* from the pipetting opening to remove the measuring head cover.

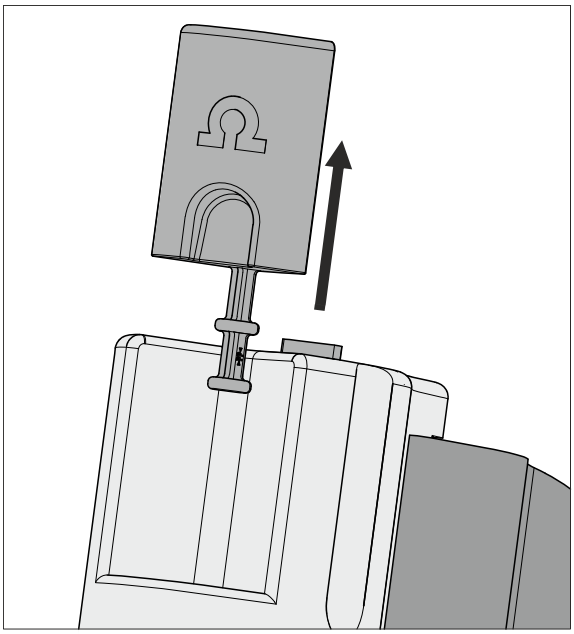


Figure 25 Removing the stopper from the pipetting opening

2 Pull the slide lock *(3-**4**)* on the top of the measuring head cover towards you and, at the same time, tilt the measuring head cover to an angle of approx. 45° and remove it.

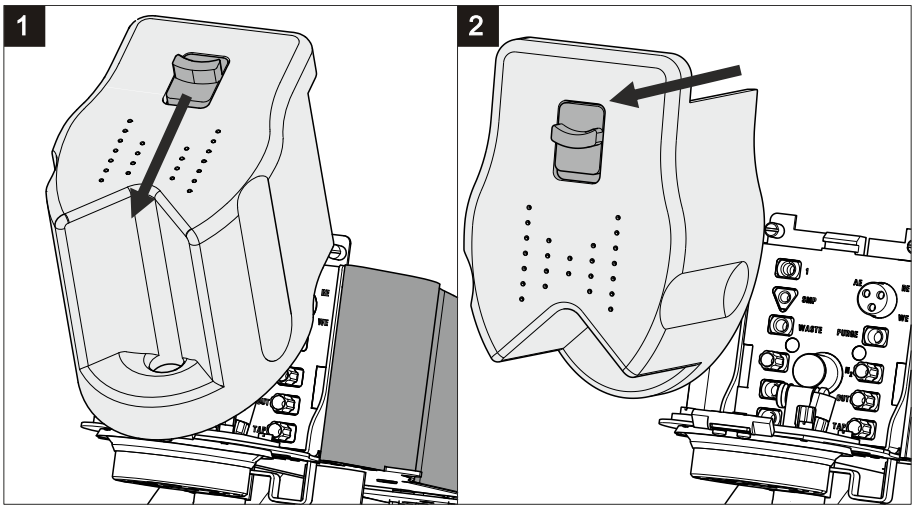


Figure 26 Removing the measuring head cover

4.3.2 Installing the 4-way micro dosing tip

The 4-way micro dosing tip (6.1824.000) can be used to connect the 894 Professional CVS to dosing devices of the type 800 Dosino and to add auxiliary solutions and standard solutions automatically. Information on the electrical connection of dosing devices can be found in *Chapter 4.4.3, page 49*.

Installing a 4-way micro dosing tip in the measuring head

Proceed as follows:

1 Remove the stopper from the screw nipple of the threaded opening *(5-**16**)*.

2 Loosen the screw nipple in the threaded opening a little.

This slightly loosens the O-ring located on the bottom of the screw nipple.

3 Feed the 4-way micro dosing tip through the opening from below *(5-**14**)*.

4 Insert the 4-way micro dosing tip into the screw nipple of the threaded opening *(5-**16**)* until it stops.

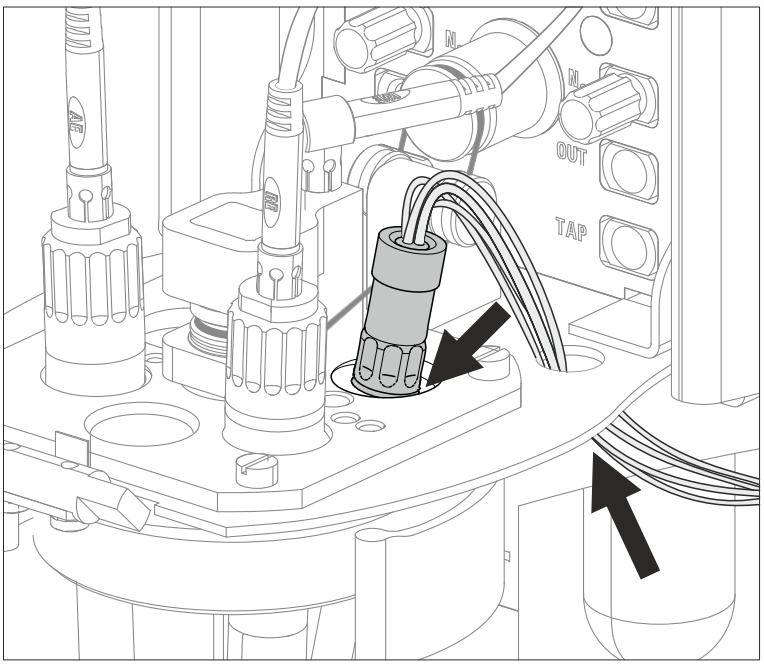


Figure 27 Inserting the 4-way micro dosing tip

5 Tighten the screw nipple in the threaded opening again.

Connecting the PTFE capillaries of the 4-way micro dosing tip to a dosing unit

Proceed as follows:

1 Screw the PTFE capillaries to the dosing units (port 1).

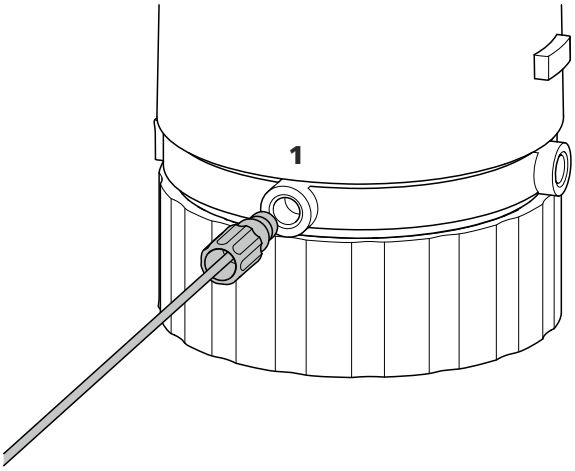


Figure 28 Screwing a PTFE capillary to a dosing unit

Sealing unused PTFE capillaries of the 4-way micro dosing tip

To prevent accidental aspiration of solution from the measuring vessel, unused PTFE capillaries must be sealed. Proceed as follows:

1 Screw a coupling (6.1808.000) to each unused PTFE capillary.

2 Screw a threaded stopper (6.1446.040) to each coupling (6.1808.000).

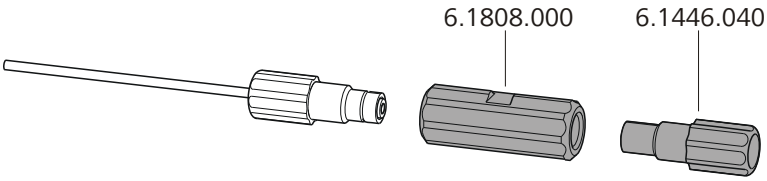


Figure 29 Sealing the PTFE capillary of a 4-way micro dosing tip

4.3.3 Installing capillaries

You can add the samples from a Sample Processor in an automated way by using capillaries. The capillaries are connected to the peristaltic pump installed on the Sample Processor and/or a dosing unit *(see figures in Chapter 6.3.2, page 68)*. Several pressure screws (e.g. 6.2744.010) are required to attach the capillaries.

In order to achieve optimum analysis results, the capillary connections have to be as tight as possible and free of dead volume. Dead volume occurs if 2 capillary ends connected to each other do not fit exactly, thus allowing liquid to escape. There are 2 possible causes for this:

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

We recommend using the capillary cutter (6.2621.080) to obtain exactly flat edges of capillaries.

Installing the capillary in the measuring head

We recommend using a PEEK capillary (e.g. 6.1831.020) in the measuring head. Proceed as follows:

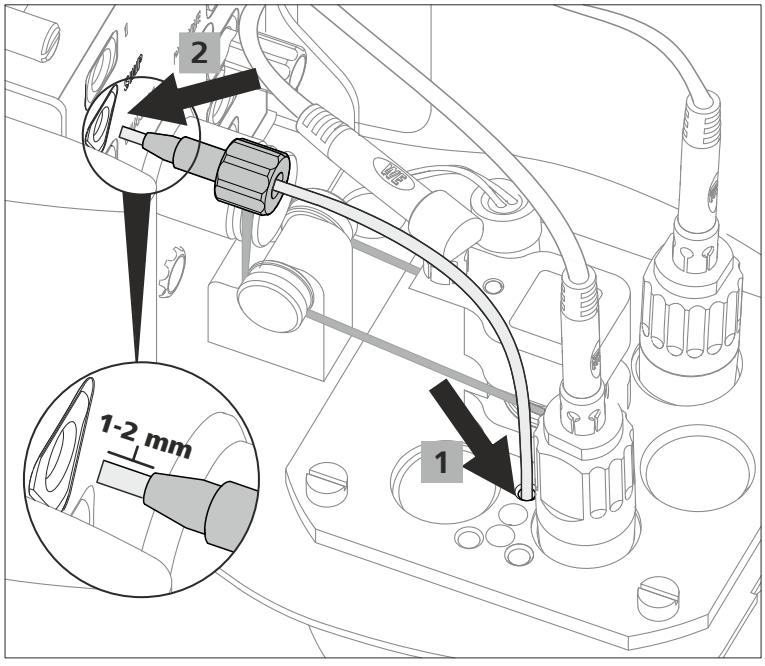


Figure 30 Inserting a PEEK capillary into the measuring head

1 Feed the capillary through the opening *(5-**28**)* of the measuring head insert.

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

3 Push the capillary into the threaded opening **SMP** *(4-**5**)* of the measuring head connector plate until it stops.

4 Only then start turning the pressure screw, while holding the capillary firmly in place.

5 Cut the capillary to the desired length using the capillary cutter.

In order to prevent diffusion between the solution in the capillary and the solution in the measuring vessel, make sure that the end of the capillary is positioned above the measuring solution.

Installing the capillary on the tubing connector of the measuring head arm

We recommend using PTFE capillaries (e.g. 6.1803.020) between the tubing connector of the measuring head arm *(see chapter 3.5, page 16)* and the dosing unit and/or peristaltic pump. Proceed as follows:

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

2 Push the capillary into the threaded opening **SMP** *(4-**5**)* of the tubing connector of the measuring head arm as far as it will go.

3 Only then start turning the pressure screw, while holding the capillary firmly in place.

Connecting a capillary to a dosing unit

To attach the capillary to the dosing unit using a pressure screw, you need an adapter for the thread on the dosing unit. Proceed as follows:

1 Screw the adapter (6.2744.080) to port 2 of the dosing unit.

2 Slide the pressure screw (e.g. 6.2744.010) over the capillary (e.g. 6.1803.020). Ensure that the capillary protrudes 1 to 2 mm from the tip of the pressure screw.

3 Push the capillary into the threaded opening of the adapter until it stops.

4 Only then start turning the pressure screw, while holding the capillary firmly in place.

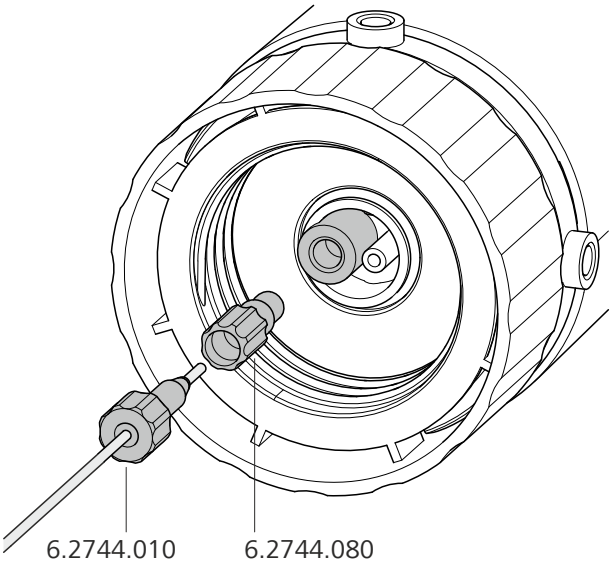


Figure 31 Screwing a capillary to a dosing unit

Connecting a capillary to the peristaltic pump

Proceed as follows:

1 Install the peristaltic pump with all tubing connections (including capillaries).

Proceed in accordance with the information contained in the manual of the Sample Processor.

4.3.4 Installing FEP tubing

With FEP tubing, you can add or aspirate the following solutions:

- Rinsing solution – adding via 843 Pump Station*(see Figure 51, page 73* and *Figure 52, page 74)*
- Waste solution – aspirating via 843 Pump Station *(see Figure 51, page 73* and *Figure 52, page 74)*
- Auxiliary solutions (e.g. buffer, electrolyte, VMS, etc.) – adding via 800 Dosino with dosing unit *(see figure 49, page 71)*

Installing FEP tubing in the measuring head

NOTE

Use the appropriate FEP tubing from the tubing set (6.1829.070): For threaded openings **1** and **WASTE**, use the tubing with the long kink protection; and for threaded openings **2** and **3**, use the tubing with the short kink protection.

Proceed as follows:

1 Insert the conical end of the FEP tubing into one of the openings (**24 - 27**) in the measuring head insert.

2 Carefully pull the conical end of the tubing protruding on the bottom side of the measuring head insert through the opening using the sandpaper supplied.

Pull the tubing through the opening until the kink protection of the tubing sits flush on the opening of the measuring head insert.

3 Screw the tubing nipple of the FEP tubing into the required threaded opening (**1**, **2**, **3** or **WASTE**) of the measuring head connector plate.

4 Cut the FEP tubing on the underside of the measuring head insert to the required length.

In order to prevent diffusion between the solution in the tubing and the solution in the measuring vessel, make sure that the end of the tubing is positioned above the measuring solution. This does not apply to the tubing for draining the measuring solution; this tubing must touch the base of the measuring vessel.

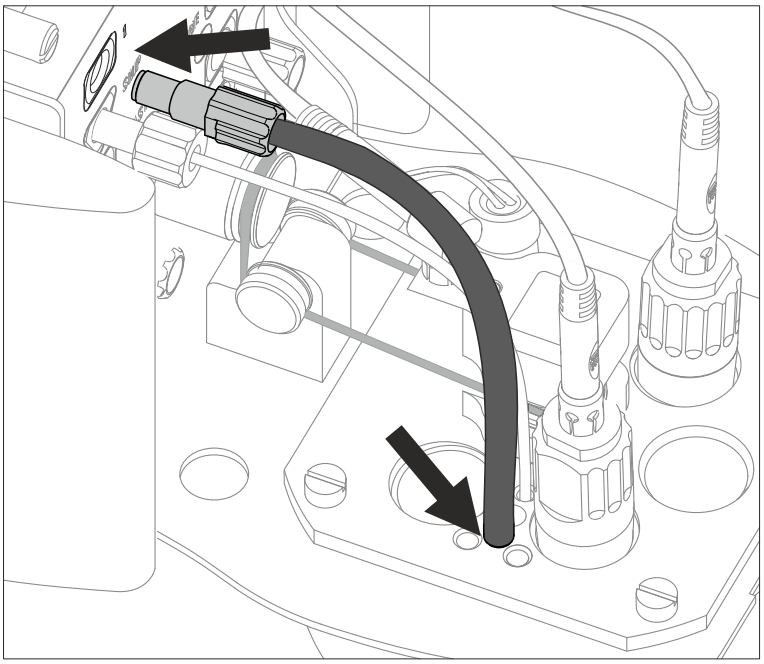


Figure 32 Inserting the FEP tubing into the measuring head

NOTE

If more than 1 piece of tubing is to be installed, we recommend pulling in all of the pieces of tubing into the measuring head insert first and shortening them to the required length.

In order to simplify fastening the tubing nipples to the threaded openings, remove the measuring head from the device *(see chapter 7.3, page 77)* and screw the tubing nipples in place from bottom to top (in the order **3**, **2**, **WASTE**, **1**).

Installing the measuring head cover

The measuring head cover must be on the measuring head during determinations. Proceed as follows:

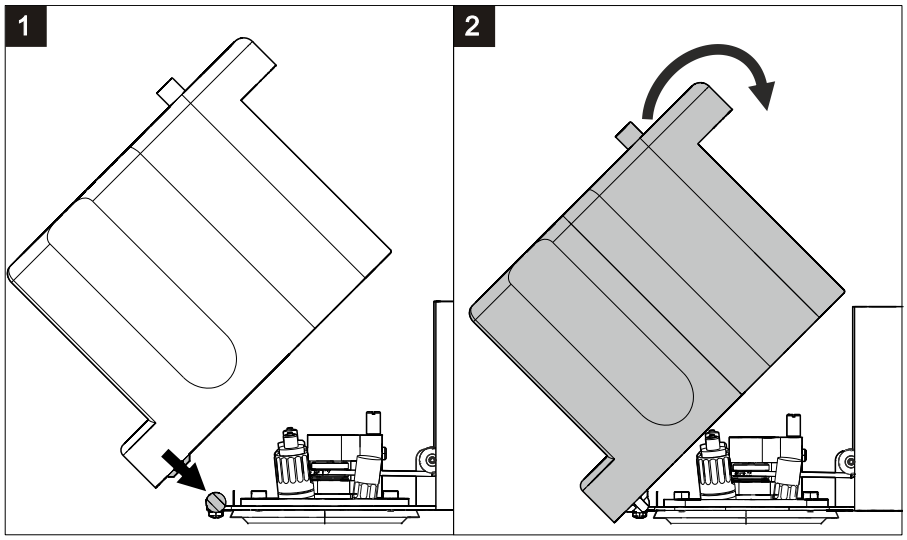


Figure 33 Installing the measuring head cover

1 Place the measuring head cover at an angle of approx. 45° in the guide bolt in the front part of the measuring head insert.

2

WARNING

If the measuring head cover is installed without due care, this may result in injury to the hand.

Make sure that your fingers do not get caught between the measuring head cover and the measuring head.

Fold back the measuring head cover and gently push it in place.

The measuring head cover must snap into place with an audible click.

3 Insert the stopper *(3-**5**)* into the pipetting opening.

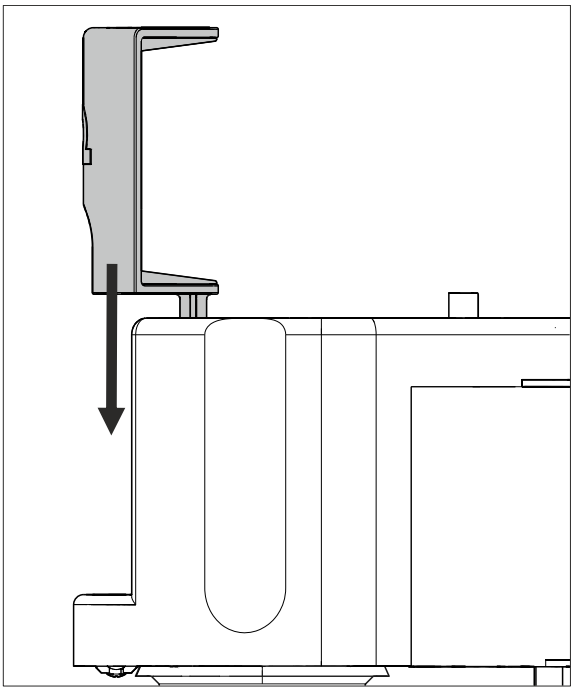


Figure 34 Inserting the stopper in the pipetting opening

Installing a piece of FEP tubing on the tubing connector of the measuring head arm

Proceed as follows:

1 Screw the tubing nipple of the FEP tubing (e.g. 6.1805.530) into the required threaded opening (**1**, **2**, **3** or **WASTE**) of the tubing connector of the measuring head arm *(see figure 51, page 73)*.

Connecting FEP tubing to an 843 Pump Station

Proceed as follows:

1 Install the inlet and outlet tubing on the two pumps or the 843 Pump Station *(see chapter 6.3, page 66)*.

Connecting FEP tubing to a rinsing canister

A bottle cap (6.1602.115) is required to connect a piece of FEP tubing to a rinsing canister. *Figure 51, page 73* provides an overview of the tubing between the rinsing canister, 843 Pump Station and 894 Professional CVS.

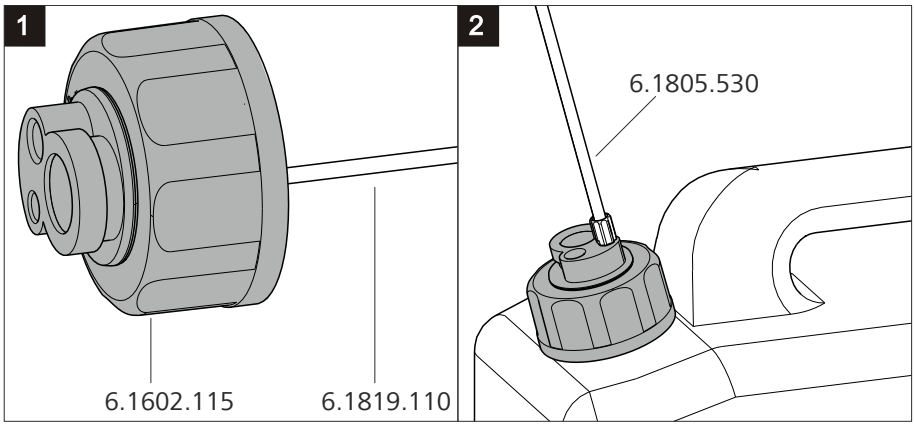


Figure 35 Installing a bottle cap with pieces of tubing on a rinsing canister

Proceed as follows:

1 Insert a piece of FEP tubing (e.g. 6.1819.110) from above into the smallest threaded opening of the bottle cap (6.1602.115) until the tubing flare of the FEP tubing sits flush in the threaded opening.

2 Screw the bottle cap with inserted FEP tubing onto the larger of the two openings of the rinsing canister.

3 Screw the tubing nipple of the FEP tubing (e.g. 6.1805.530) into the smallest threaded opening of the bottle cap.

Connecting FEP tubing to the waste canister

A 5-way tubing connector (6.1828.020) is required to connect FEP tubing to a waste canister. *Figure 51, page 73* provides an overview of the tubing between the waste canister, 843 Pump Station and 894 Professional CVS.

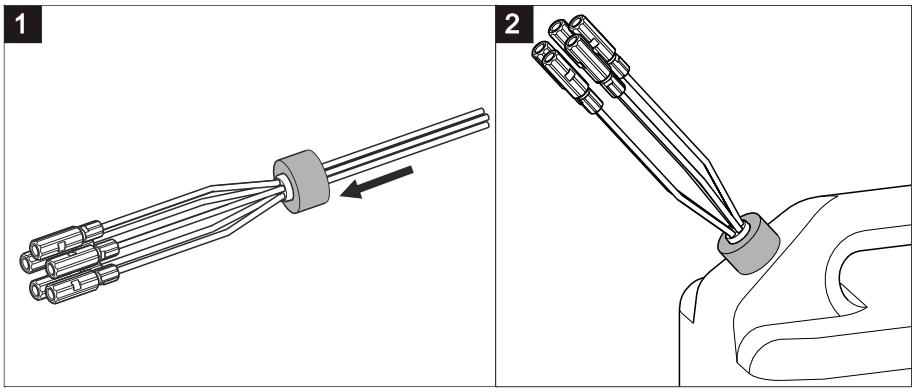


Figure 36 Connecting the five-way tubing connector to a waste canister

Proceed as follows:

1. Unscrew the cap with the hole in the center from the waste canister.
2. Feed each of the 5 tubings from the 5-way tubing connector with the couplings already installed from below through the hole of the unscrewed cap.
3. Screw the cap with the 5-way tubing connector inserted back onto the waste canister.
4. Screw the tubing nipples of the pieces of FEP tubing (e.g. 6.1805.530) to the couplings of the pieces of tubing.

NOTE

In order to ensure that liquid is transported smoothly from and to the canisters, the canisters must not be air-tight. If necessary, loosen the screw caps a little.

Connecting FEP tubing to a dosing unit with auxiliary solution

Proceed as follows:

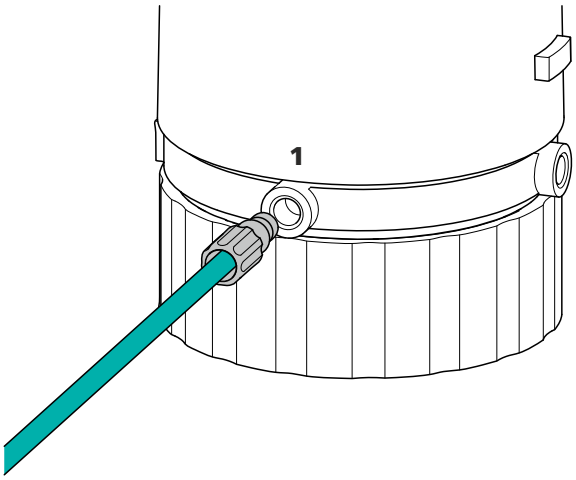


Figure 37 Connecting FEP tubing to the dosing unit (auxiliary solution)

1 Screw the tubing nipple of the FEP tubing (e.g. 6.1805.120) to port 1 of the dosing unit containing the auxiliary solution (e.g. buffer, electrolyte, VMS, etc.).

4.4 Connecting devices electrically

4.4.1 Connecting the instrument to the power grid

WARNING

Electric shock from electrical potential

Risk of injury by touching live components or through moisture on live parts.

- Never open the housing of the instrument while the power cord is still connected.
- Protect live parts (e.g. power supply unit, power cord, connection sockets) against moisture.
- Unplug the power plug immediately if you suspect that moisture has gotten inside the instrument.
- Only personnel who have been issued Metrohm qualifications may perform service and repair work on electrical and electronic parts.

Connecting the power cord

Accessories

Power cord with the following specifications:

- Length: max. 2 m
- Number of cores: 3, with protective conductor

- Instrument plug: IEC 60320 type C13
- Conductor cross-section 3x min. 1.0 mm² / 18 AWG
- Power plug:
  - according to customer requirement (6.2122.XX0)
  - min. 10 A

NOTE

Do not use a not permitted power cord!

1 Plugging in the power cord

- Plug the power cord into the instrument's power socket.
- Connect the power cord to the power grid.

4.4.2 Connecting the 894 Professional CVS

The 894 Professional CVS is connected to the computer with the supplied controller cable.

Connecting the computer

1 Connect the controller cable (6.2151.000) to the "Controller" connector of the 894 Professional CVS.

NOTE

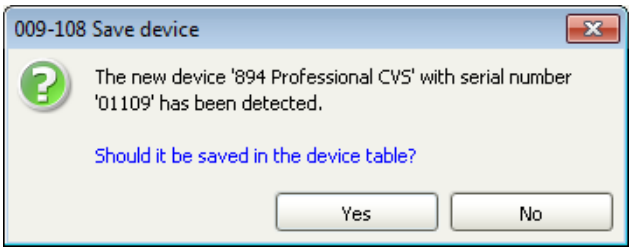
The plug on the controller cable is protected against accidental disconnection by means of a pull-out protection feature. If you wish to pull out the plug, you first need to pull back the outer plug sleeve.

2 Connect the USB plug of the controller cable to an available USB connector on the computer.

Initializing the 894 Professional CVS in viva

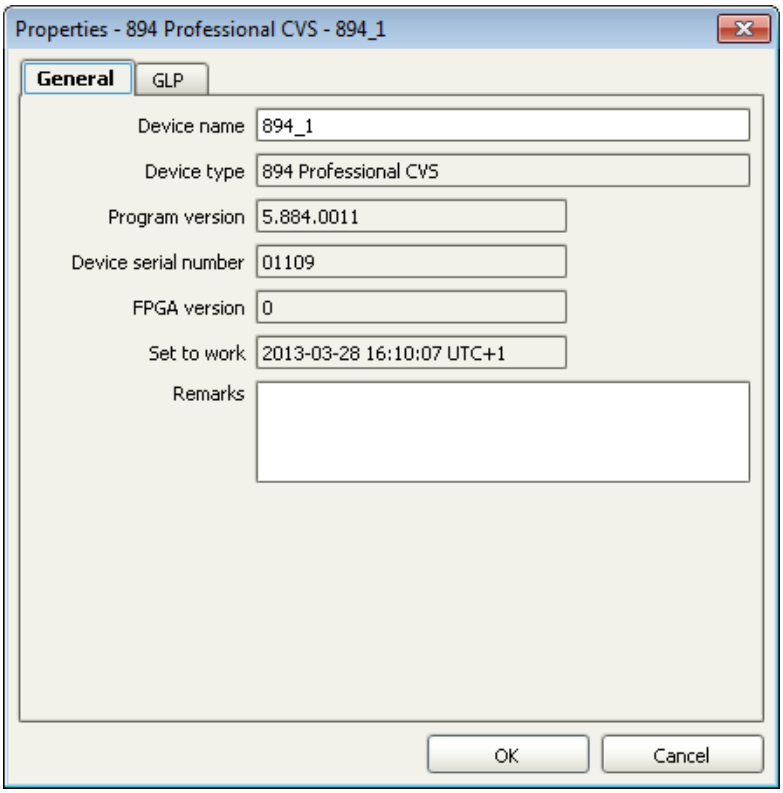
1 Start **viva**.

The following dialog window is displayed:



2 Click on **Yes**.

The following dialog window is displayed:



3 Change the suggested device name if required.

4 Confirm with **OK**.

The instrument will be automatically listed in the device table of the **Configuration** program part.

4.4.3 Connecting an 800 Dosino

Up to 4 dosing devices of the type 800 Dosino can be connected directly to the 894 Professional CVS. As an alternative, the dosing devices can be connected via an 846 Dosing Interface, a sample changer or any other supported instrument that also has MSB outputs.

NOTE

An 800 Dosino is connected to Metrohm instruments via an MSB connector. Make sure that the flat side of the plug matches the marking on the socket.

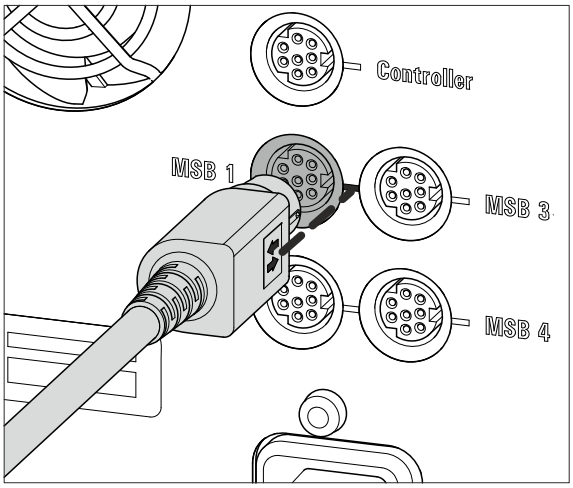


Figure 38 Connecting a dosing device to an MSB socket

NOTE

Information regarding assembling a Dosino with the dosing unit as well as operation and maintenance is available in the manual of the 800 Dosino.

Connecting an 800 Dosino with dosing unit directly to the 894 Professional CVS

1 Connect the connection cable of the 800 Dosino to one of the 4 MSB connectors *(2-**8**)* of the 894 Professional CVS.

The following dialog window is displayed:

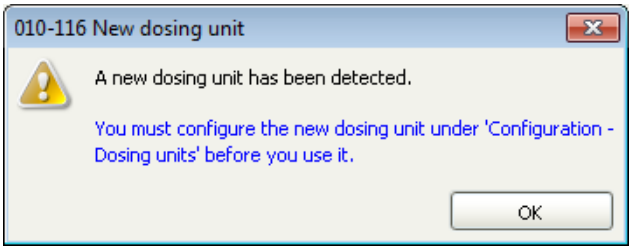
2 Confirm with **OK**.

Initializing a dosing unit in viva

1 Select the 894 Professional CVS in the device table of the **Configuration** section of the program.

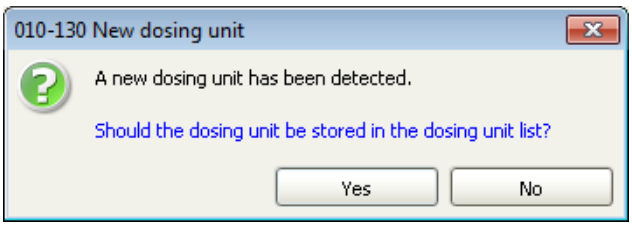
2 In the device table, click on the **Edit** button and select **Initialize**.

If a brand-new dosing unit is connected, the following dialog window is displayed:



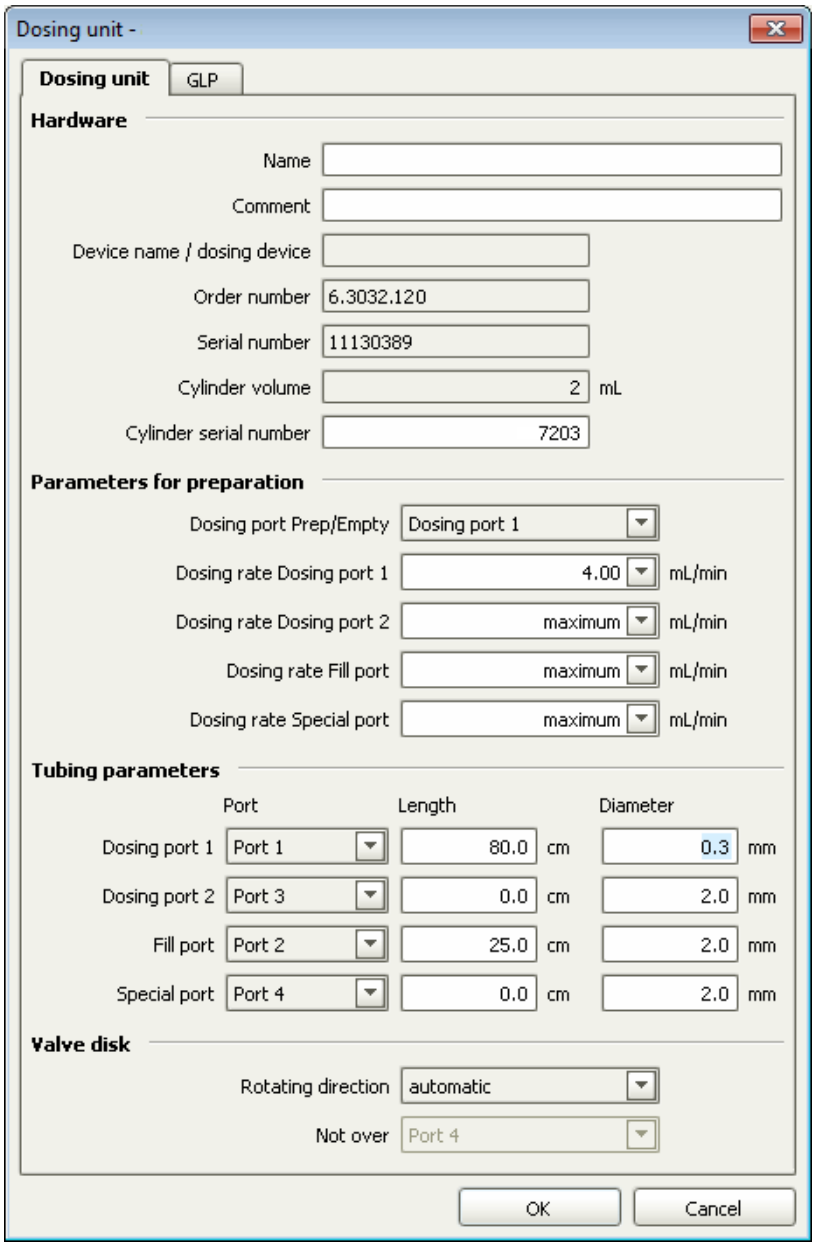
Or:

If a dosing unit is connected that has been previously configured, then the following dialog window is displayed:



3 Click on **OK** if a brand-new dosing unit is used.

The following dialog window is displayed:



4 Configure the new dosing unit in this dialog window.

NOTE

Under **Tubing parameters**, adapt the parameters **Length** and **Diameter** to the actual installation. This ensures that functions such as **Prepare** or **Empty** work properly in **viva**. The lengths and diameters of the tubing connections in the measuring head arm are available in *Chapter 10.1, page 90*.

5 Click on **Yes** if you are using the already configured dosing unit.

The dosing unit will be automatically displayed in the **Dosing units** subwindow of the **Configuration** program part.

NOTE

Check the **Tubing parameters** and adapt them to the actual installation, if necessary.

4.4.4 Connecting a Sample Processor

The following Sample Processors can be used in conjunction with the 894 Professional CVS:

- 858 Professional Sample Processor
- 919 IC Autosampler plus
- 814 USB Sample Processor
- 815 Robotic USB Sample Processor XL

Sample Processors are connected to the power supply with a power supply cable and and to the PC with a controller cable.

WARNING

An incorrect supply voltage can damage the instrument. Operate the instrument only with the supply voltage specified for it.

In order to ensure a constant power supply, we recommend using an uninterruptible power supply (UPS).

Connecting to power supply and PC

Proceed as follows:

1 Connect the Sample Processor to the power supply with the power supply cable (6.2122.0x0).

2 Connect the controller cable (6.2151.000) to the "Controller" connector of the Sample Processor.

NOTE

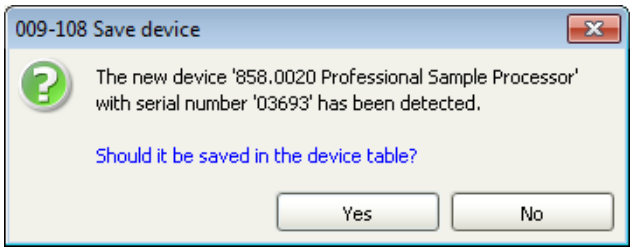
The plug on the controller cable is protected against accidental disconnection by means of a pull-out protection feature. If you wish to pull out the plug, you first need to pull back the outer plug sleeve.

3 Connect the USB plug of the controller cable to an available USB connector on the PC.

NOTE

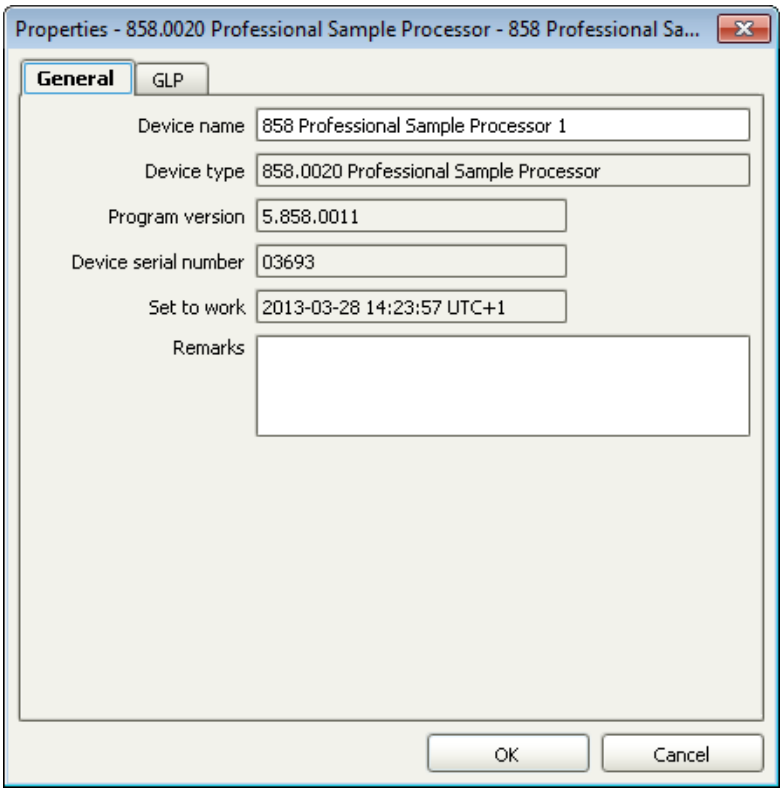
We recommend connecting the Sample Processor directly to the PC and not to one of the two USB connections on the rear of the 894 Professional CVS.

The following dialog window is displayed:



4 Click on **Yes**.

The following dialog window is displayed:



5 Change the suggested instrument name if required.

6 Confirm with **OK**.

The instrument will be automatically listed in the device table of the **Configuration** section of the program.

4.4.5 Connecting an external pump

If solutions are to be added or aspirated via an external pump, we recommend using the 843 Pump Station with membrane pump. The 843 Pump Station is connected to the tower of the Sample Processor with the 6.2141.300 cable.

Connecting an 843 Pump Station

Proceed as follows:

1 Connect the 843 Pump Station to the power grid with the power cord (6.2122.0x0).

2 Insert the remote plug of the cable (6.2141.300) into the "Remote 2" socket of the 843 Pump Station.

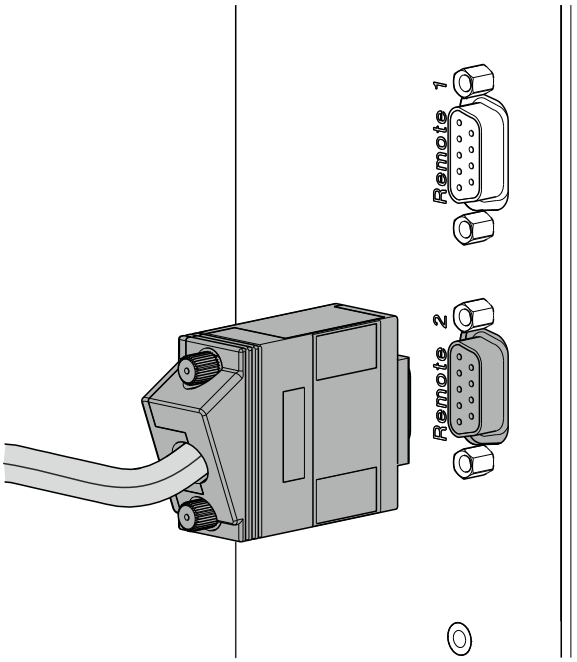


Figure 39 Connecting an external pump using the remote cable

3 Connect the 2 plugs of the cable (6.2141.300) for the pump connectors to the tower of the Sample Processor.

Make sure that the markings on the cables match the markings on the tower ("Ext. Pump 1" and "Ext. Pump 2").

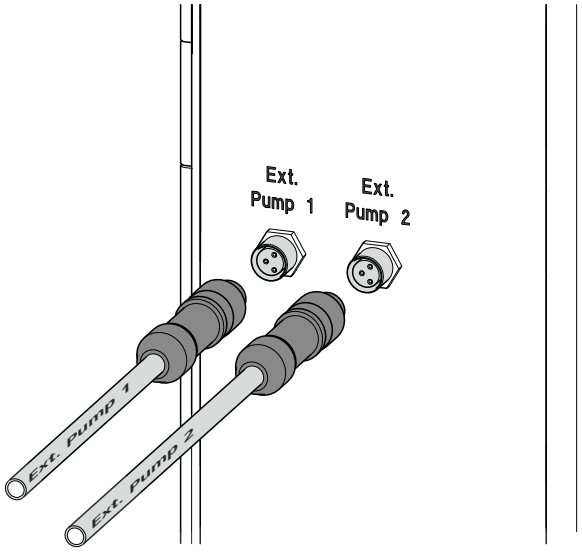


Figure 40 Connecting an external pump to the tower

4.4.6 Connecting USB devices directly to the measuring device

Additional USB devices can be incorporated using the USB interfaces on the measuring device. You can, for example, connect the following USB devices:

- Barcode reader
- Keyboard
- Mouse
- USB hub

NOTE

Use only USB connectors on the PC to connect Metrohm devices with a USB connector.

5 Start-up

The 894 Professional CVS is operated exclusively via the **viva** computer software. You can find information on operating **viva** in the online help and in the CVS tutorial.

Proceed as follows for the initial start-up of the 894 Professional CVS:

Preparing the system for start-up

WARNING

Uncontrolled splashing of reagents

Splashing reagents may result in injuries.

Operate the 894 Professional CVS only with the measuring head in place and the measuring head arm lowered.

WARNING

Drive belt in operation

Hair may become entangled or caught in the running drive belt, for example.

Operate the 894 Professional CVS only with the measuring head cover in place.

1. Insert the measuring head as described in *"Equipping the RDE measuring head", page18*.

2. Equip the measuring head with the electrodes *(see chapter 4.2.2, page 22)*.

3. Establish the tubing connections in the measuring head and those between the 894 Professional CVS and the peripheral devices *(see chapter 4.3, page 33)*.

4. Attach the measuring head cover and the stopper *(3-**5**)* to the measuring head as described in *"Installing the measuring head cover", page 41*.

5 Insert the measuring vessel into the holder *(1-**3**)*.

6

CAUTION

If the measuring head arm is folded down without due care, this may result in injuries to the hands.

Make sure that your fingers do not get caught between the measuring head arm and the device housing.

Lower the measuring head arm.

7 Place the drip pan (6.2711.090) into the drip pan holder *(1-**8**)*.

8 Connect the devices electrically *(see chapter 4.4, page 46)*.

Activating the calibrator

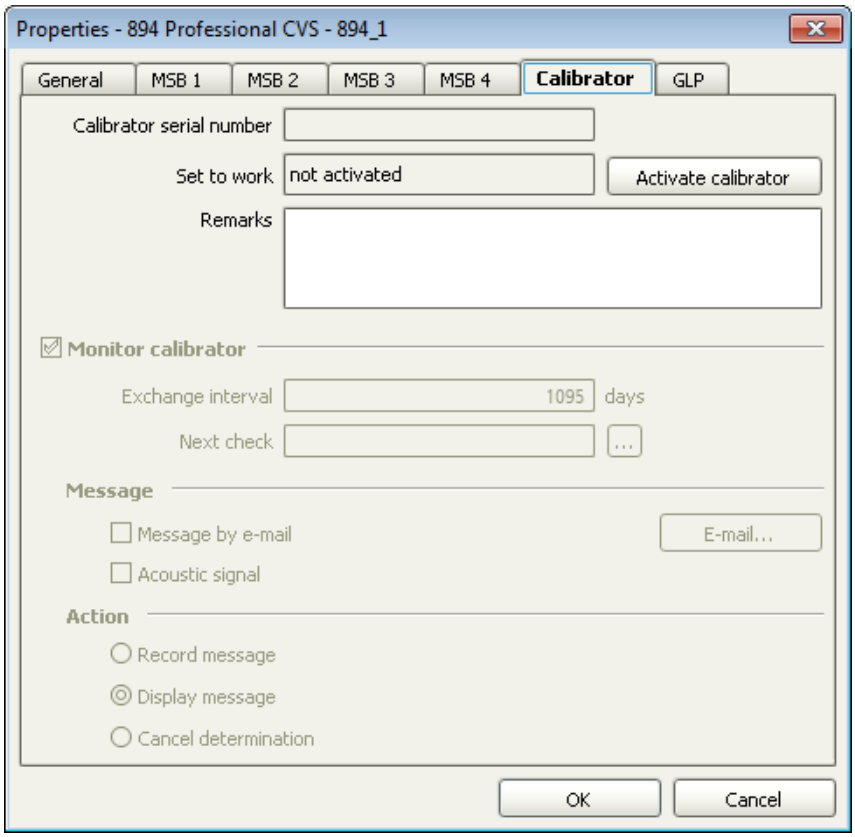
The calibrator built into the 894 Professional CVS guarantees a very high measuring accuracy for 3 years after the initial start-up. You can find more detailed information about the calibrator in *Chapter 7.7, page 83*.

In **viva**, proceed as follows:

1 Select the 894 Professional CVS in the device table of the **Configuration** section of the program.

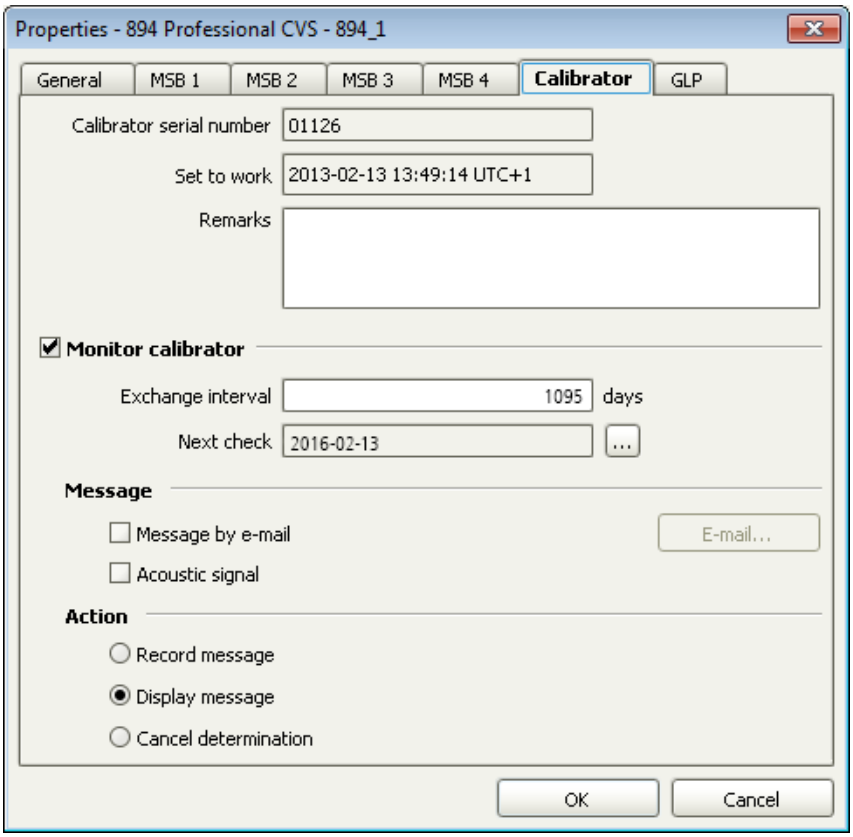
2 In the device table, click on the **Edit** button and select **Properties...**.

3 Open the **Calibrator** tab.



4 Click on **Activate calibrator** and then on **OK**.

The set-to-work date of the calibrator and the calibrator's serial number are displayed on the **Calibrator** tab after the dialog window has been closed and opened again.



NOTE

The calibration certificate is available online. Go to *http://www.metrohm.com/com/Support/zertifikate/instrument-Certificate.html* and enter the serial number of the calibrator and download the certificate.

5 If required, adjust the settings on the **Calibrator** tab (e.g. **Message** or **Action**).

6 System configuration

The following chapters contain figures of possible system configurations for the following operating modes:

- Manual operation
- Semiautomated operation
- Automated operation

The parts that are required in addition to the 894 Professional CVS and the CVS electrode kit are listed for each operating mode.

6.1 Manual operation

In manual operating mode, all solutions are added via the pipetting opening *(5-**22**)*. Therefore, only the three electrodes must be installed on the measuring head and connected; no tubing is required.

You will need the 894 Professional CVS (2.894.0210) and a CVS electrode kit (6.5339.0x0).

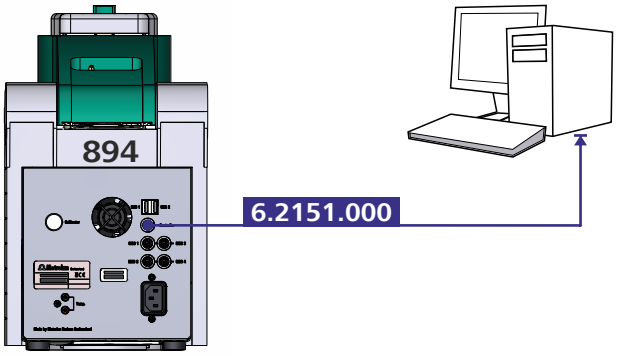


Figure 41 Manual operation - Electrical connection

6.2 Semiautomated operation

In semiautomated operating mode, samples, additives and the VMS can be added either automatically via dosing units or manually via the pipetting opening.

For the system configurations shown in the following figures, you will, depending on the application, need the brightener option (6.5339.500) in addition to the 894 Professional CVS (2.894.1210) and a CVS electrode kit (6.5339.0x0).

6.2.1 Connecting devices electrically

The following figure shows an exemplary electrical connection of the devices in semiautomated operating mode:

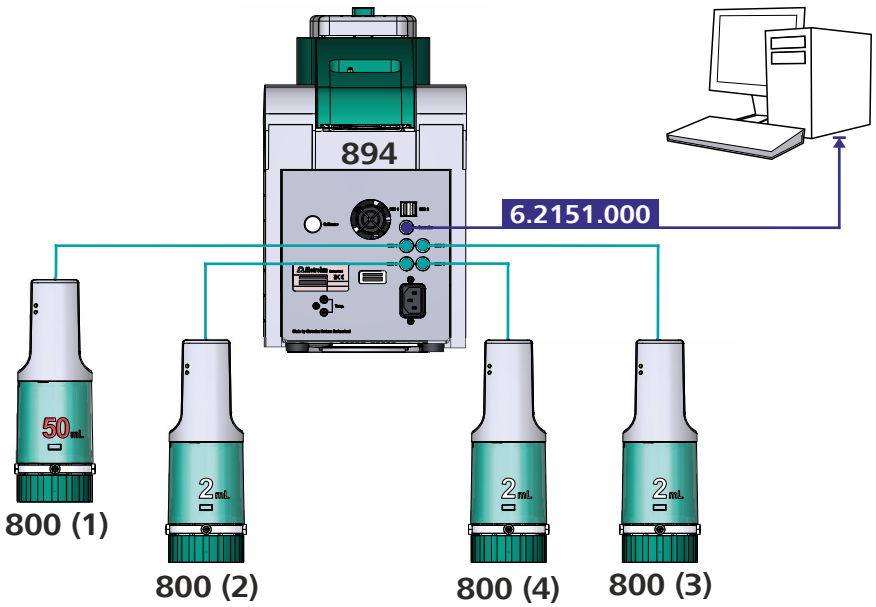


Figure 42 Semiautomated operation – Electrical connections

6.2.2 Establishing the tubing connections

The following figures provide an overview of the tubing configuration options in semiautomated operating mode:

Figure 43	*Semiautomated operation – Tubing setup with two dosing units*
Figure 44	*Semiautomated operation – Tubing setup with four dosing units*
Figure 45	*Semiautomated operation – Tubing setup – Details 894 Professional CVS*

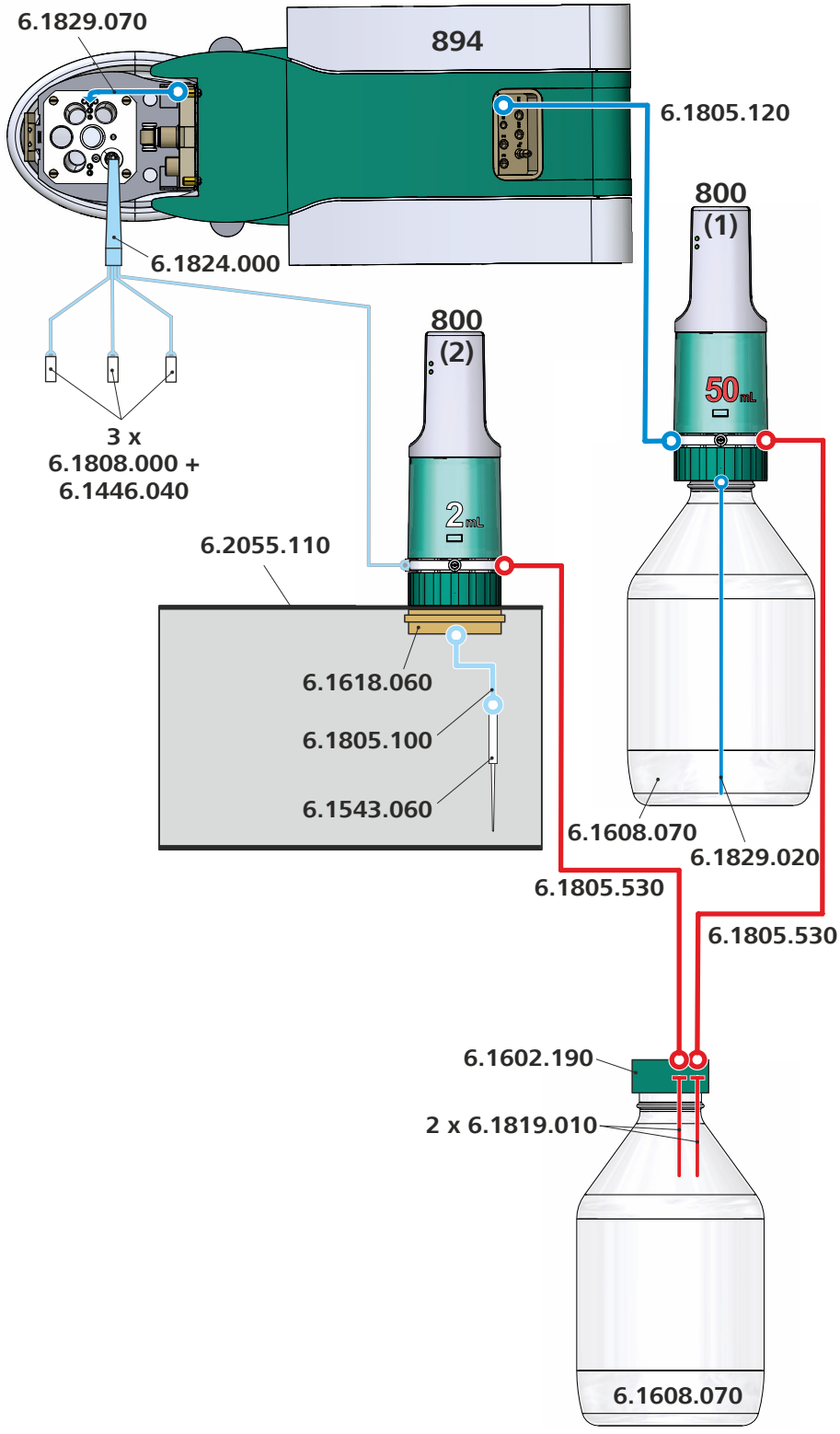


Figure 43 Semiautomated operation – Tubing setup with two dosing units

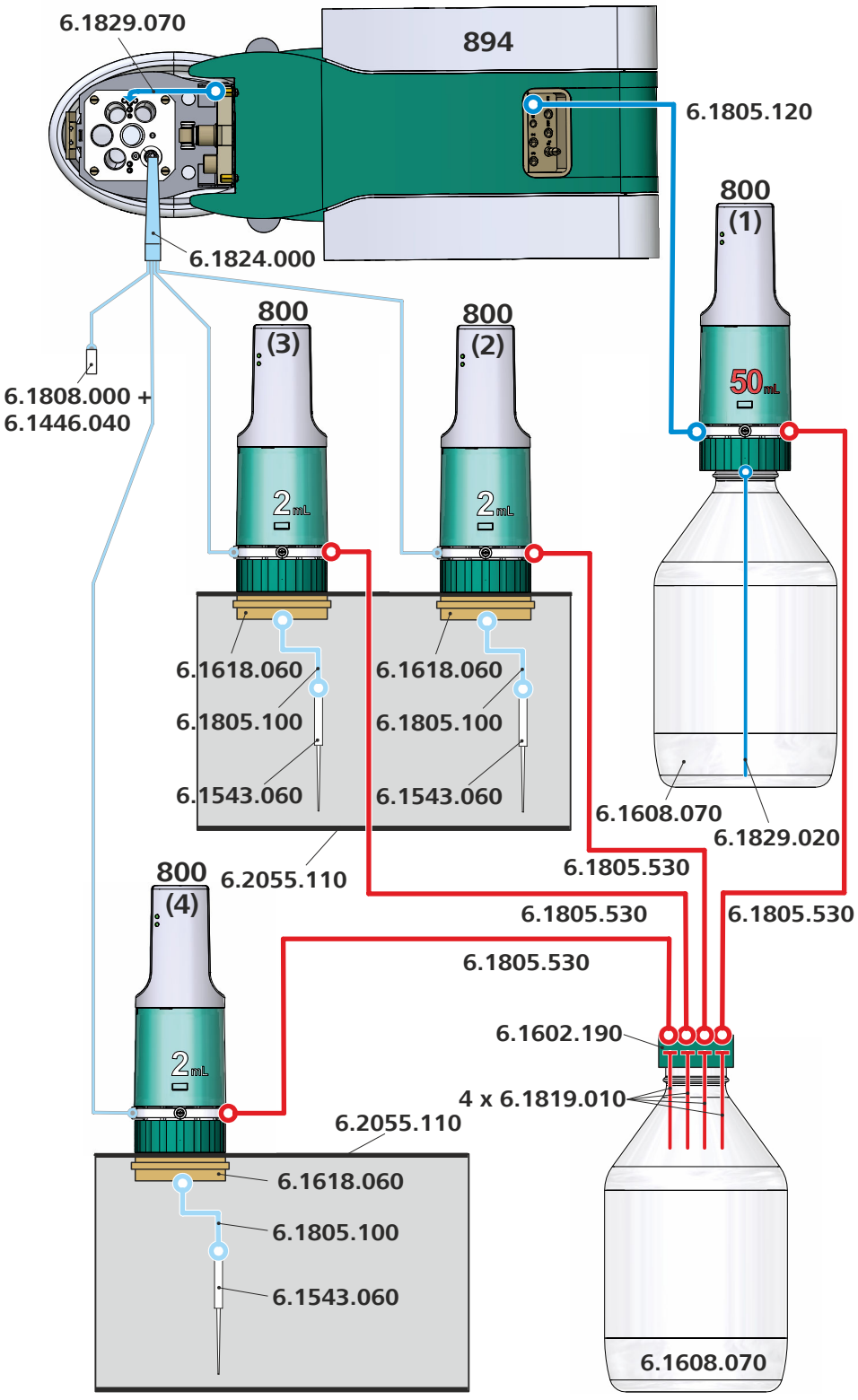


Figure 44 Semiautomated operation – Tubing setup with four dosing units

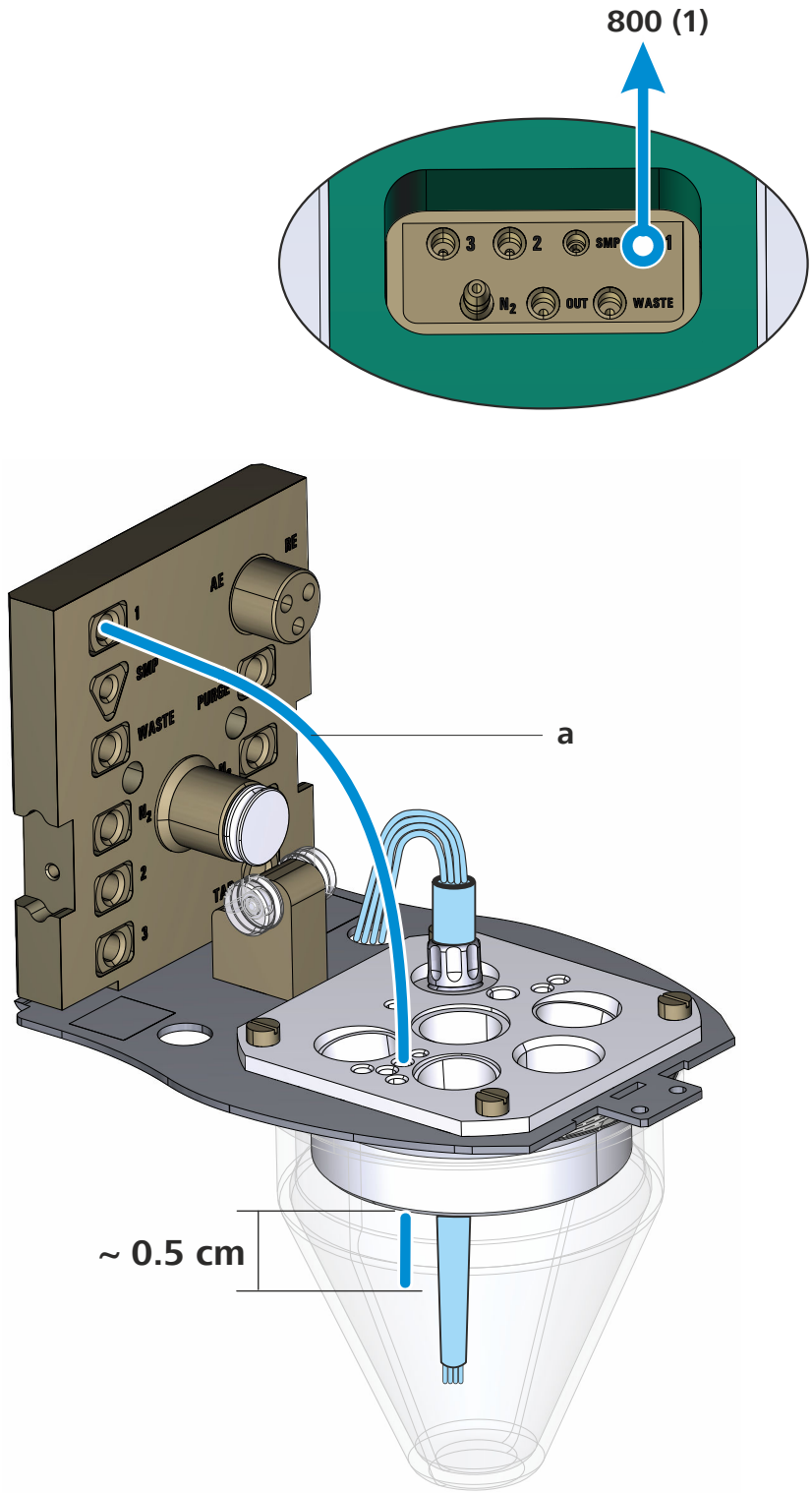


Figure 45 Semiautomated operation – Tubing setup – Details 894 Professional CVS

a **FEP tubing (tubing set 6.1829.070)**
Use the tubing with the long kink protection.

6.3 Automated operation

The 894 Professional CVS can be operated in conjunction with the following Sample Processors:

- 858 Professional Sample Processor
- 919 IC Autosampler plus
- 814 USB Sample Processor
- 815 Robotic USB Sample Processor XL

For the system configurations shown in the following figures, you will need the following options in addition to the 894 Professional CVS (2.894.1210) and a CVS electrode kit (6.5339.0x0):

- Brightener option (6.5339.500)
- 858 Professional Sample Processor (2.858.0110)
- 843 Pump Station (2.843.0240)
- Remote cable (6.2141.300)

6.3.1 Connecting devices electrically

The following figure shows an exemplary electrical connection of the devices in automated operating mode:

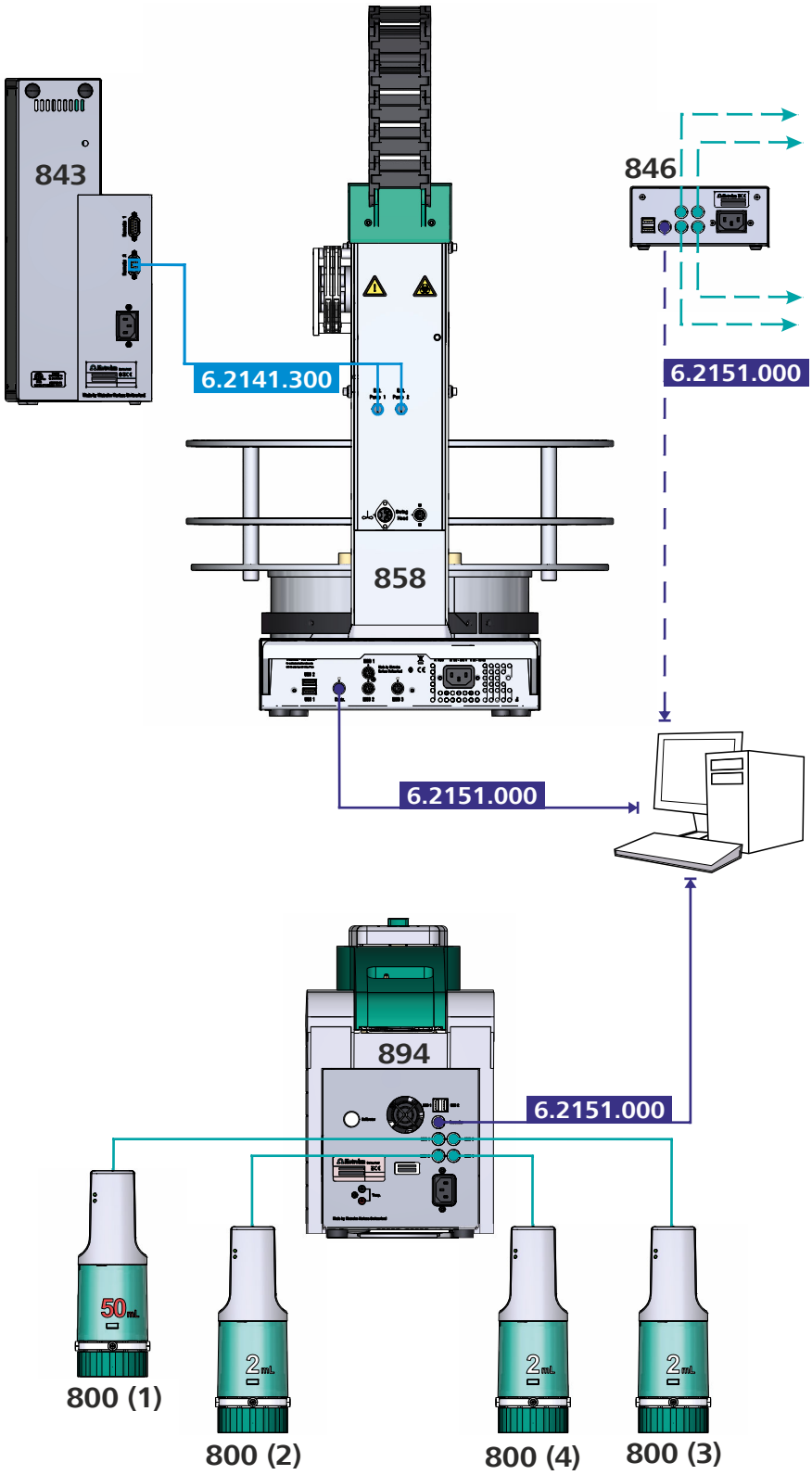


Figure 46 Automated operation – Electrical connections

6.3.2 Establishing the tubing connections

The following figures provide an overview of the tubing setup options in automated operating mode:

Figure 47	*Automated operation – Tubing setup – Overview*
Figure 48	*Automated operation – Tubing setup – Details 894 Professional CVS*
Figure 49	*Automated operation – Tubing setup – 800 Dosino details*
Figure 50	*Automated operation – Tubing setup – 858 Professional Sample Processor details – Guide chain*
Figure 51	*Automated operation – Tubing setup – Adding rinsing solution and pumping out the waste solution*
Figure 52	*Automated operation – Tubing configuration – Rinsing and waste solutions – Details 894 Professional CVS*

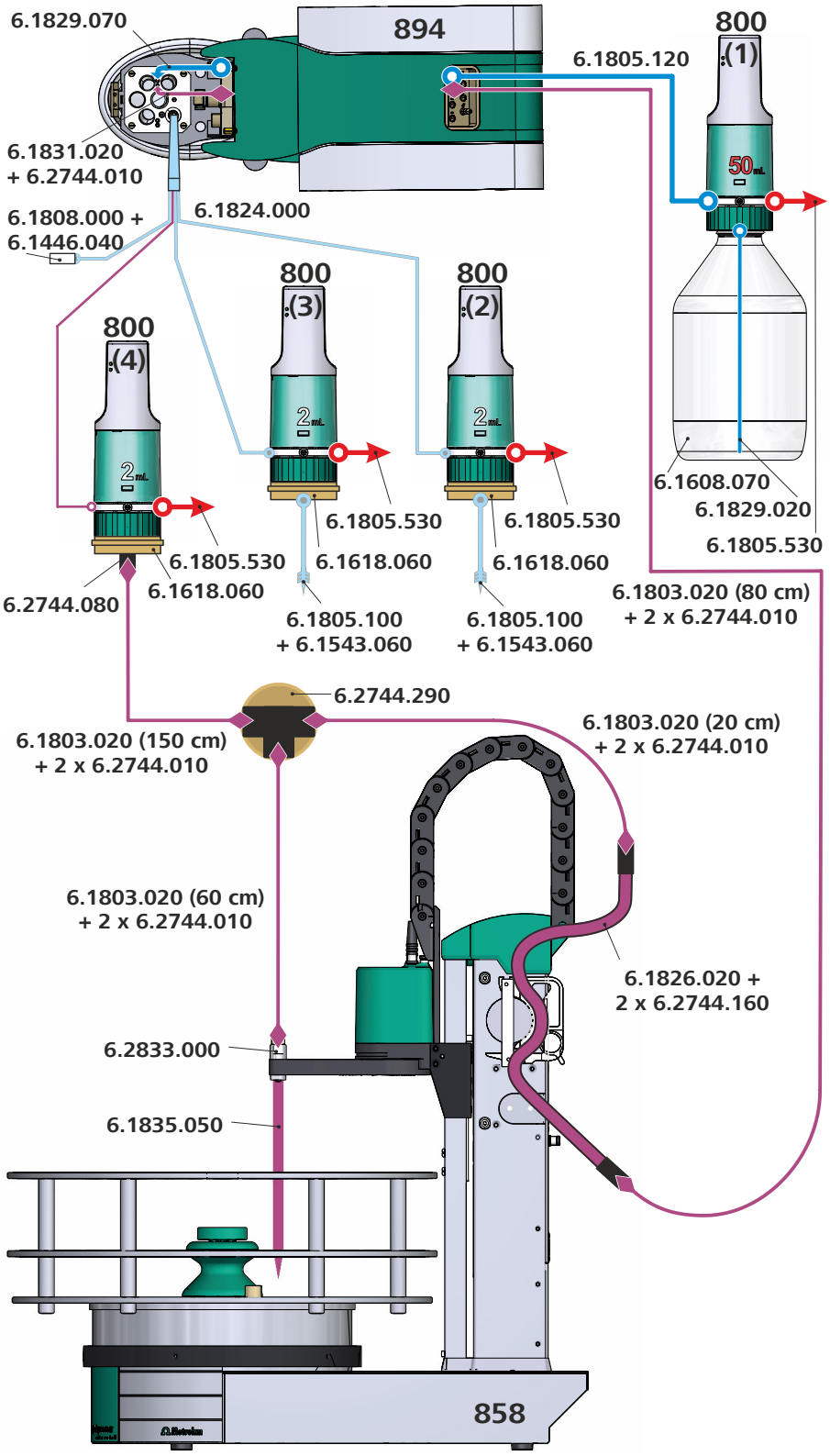


Figure 47 Automated operation – Tubing setup – Overview

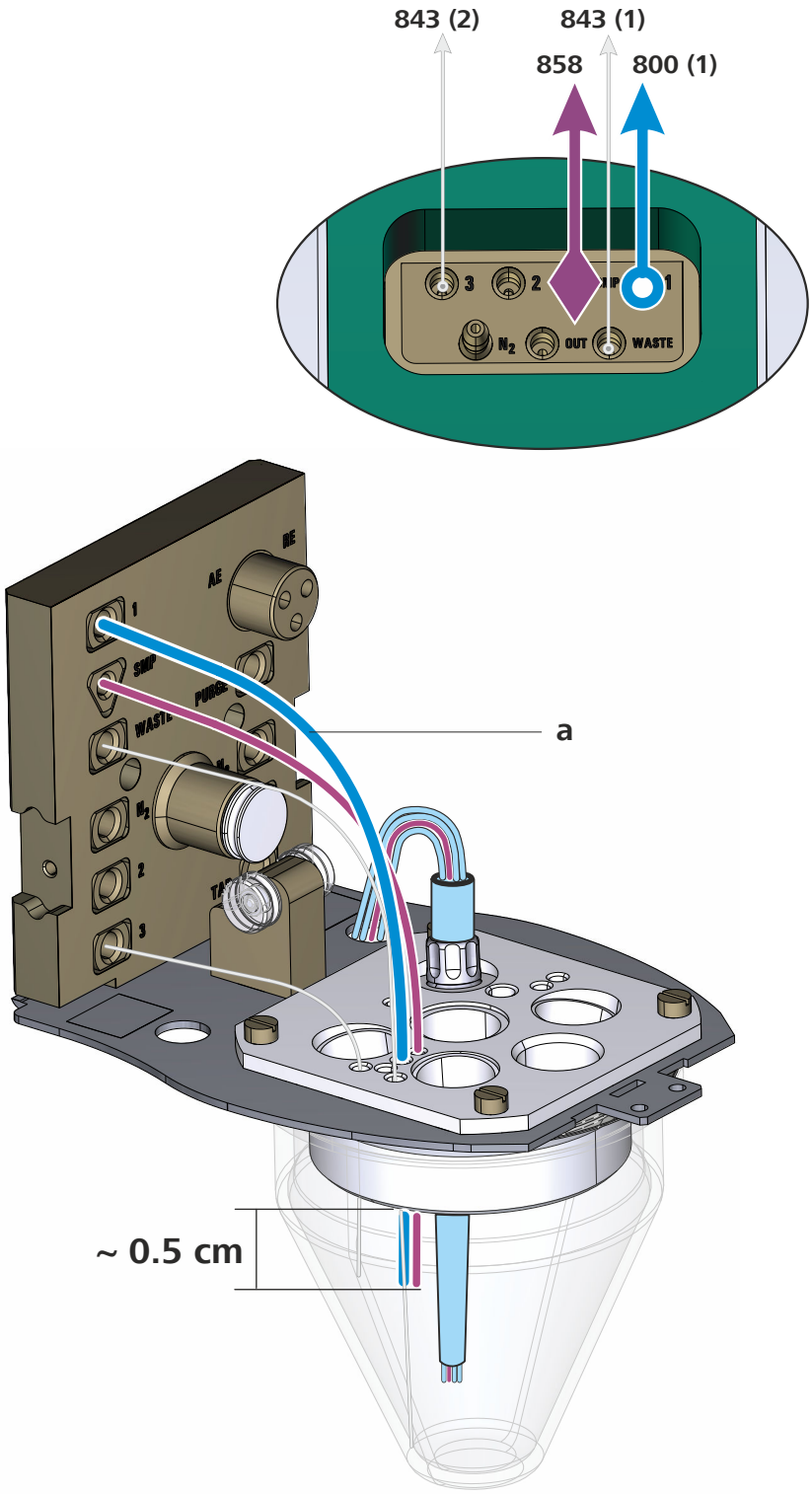


Figure 48 Automated operation – Tubing setup – Details 894 Professional CVS

a **FEP tubing (6.1829.070 tubing set)**
Use the tubing with the long kink protection.

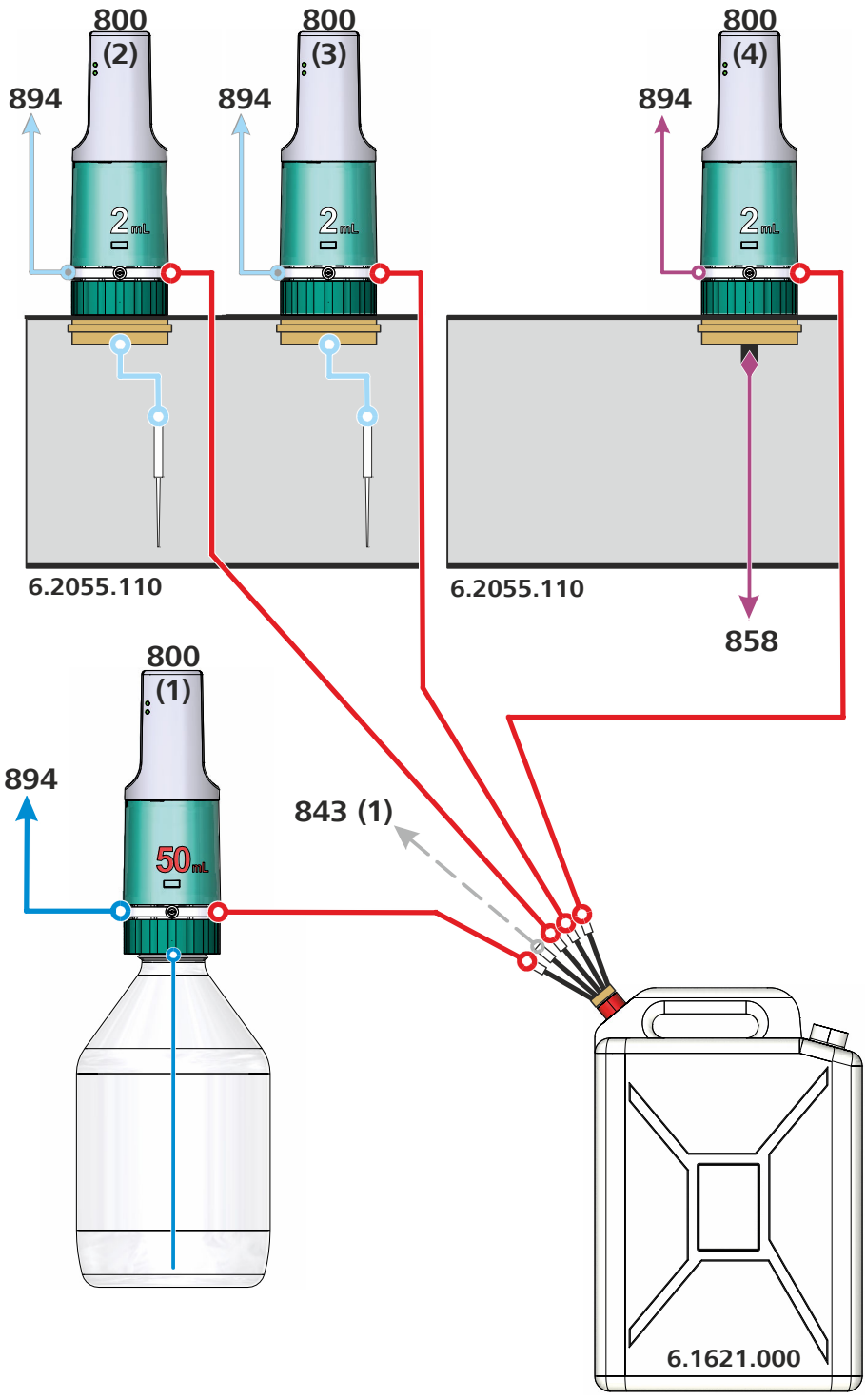


Figure 49 Automated operation – Tubing setup – 800 Dosino details

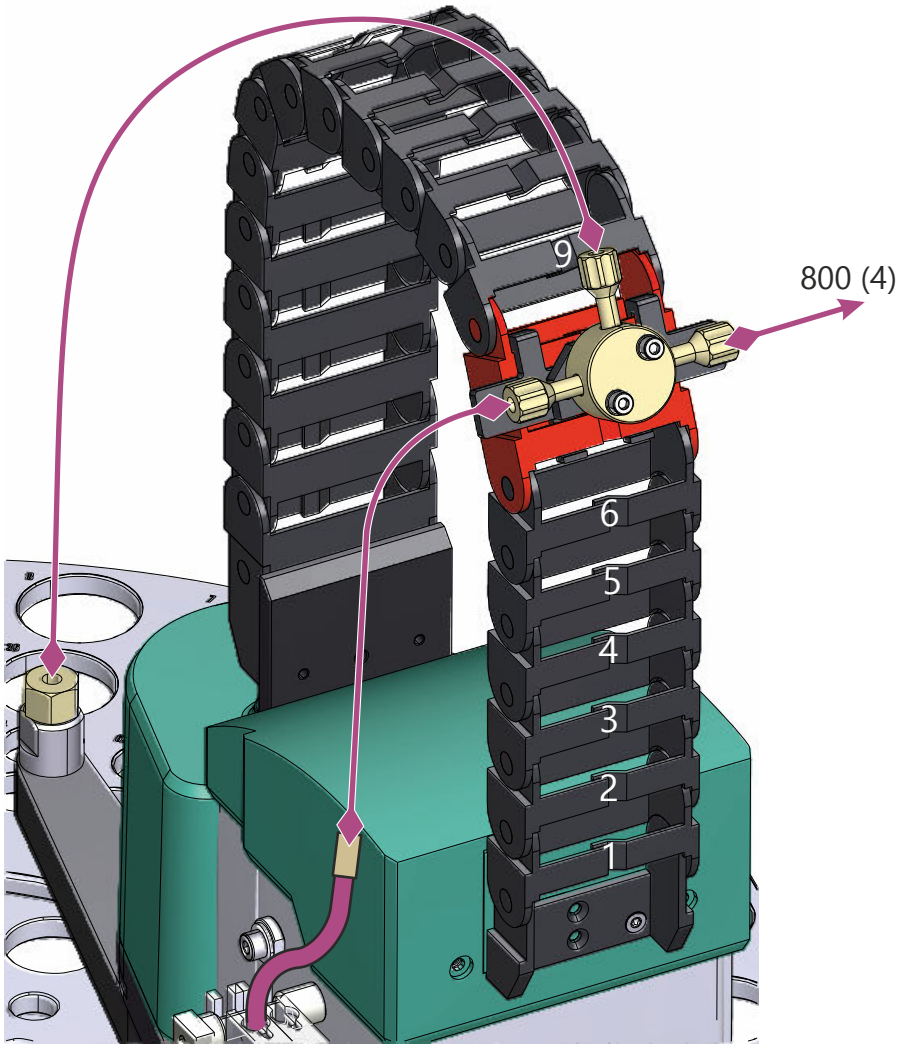


Figure 50 Automated operation – Tubing setup – 858 Professional Sample Processor details – Guide chain

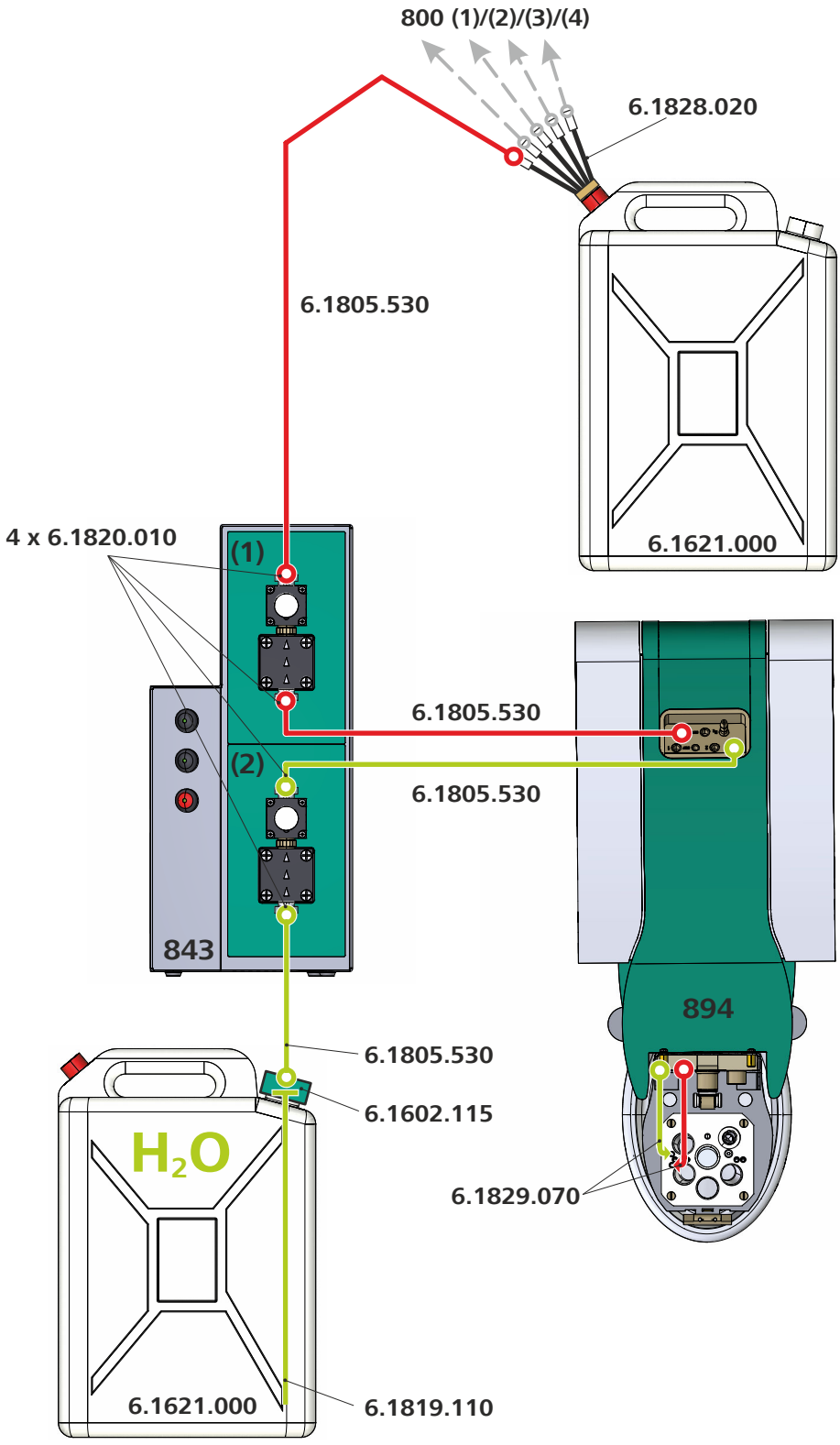


Figure 51 Automated operation – Tubing setup – Adding rinsing solution and pumping out the waste solution

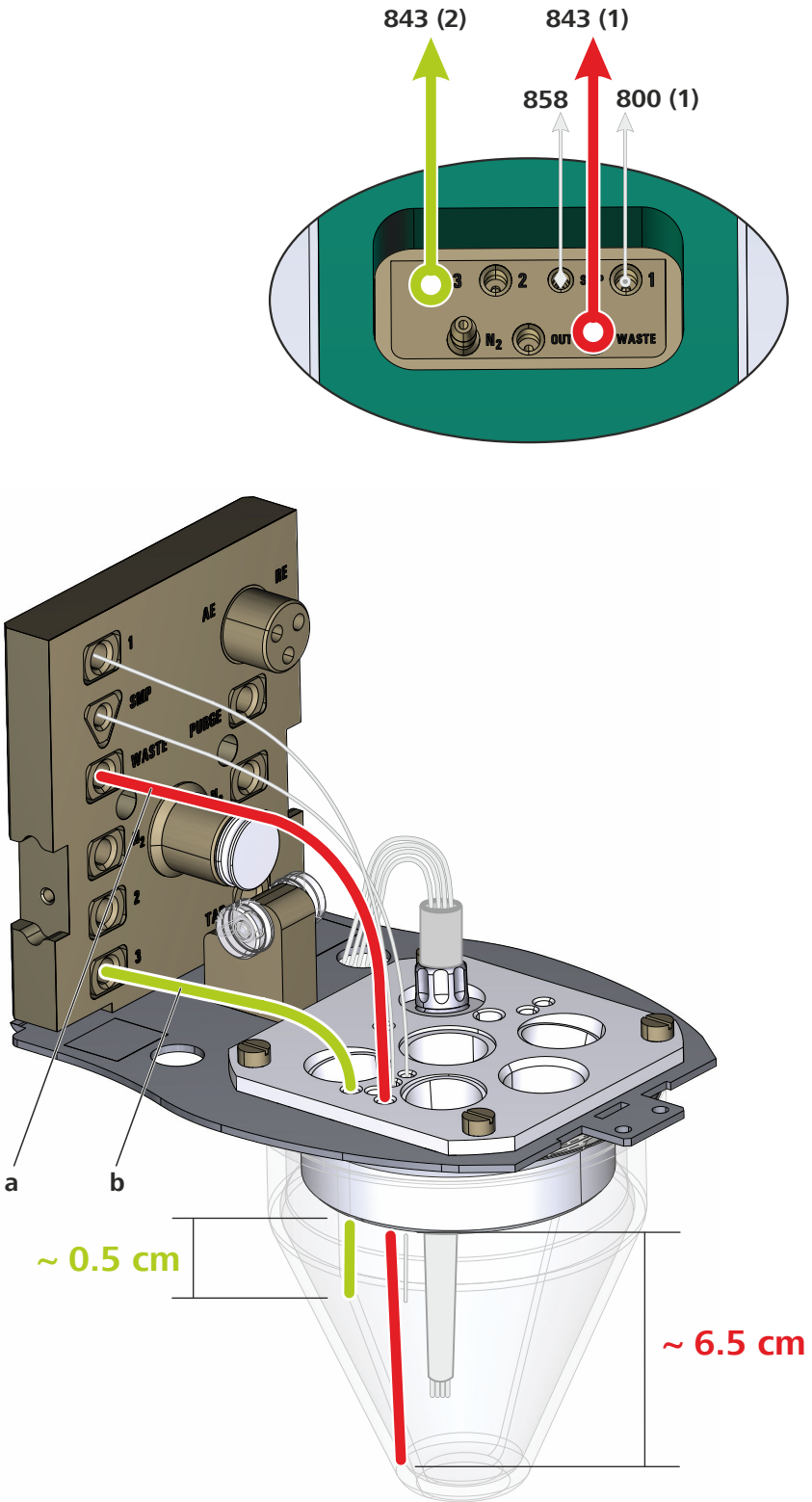


Figure 52 Automated operation – Tubing configuration – Rinsing and waste solutions – Details 894 Professional CVS

a **FEP tubing (6.1829.070 tubing set)**
Use the tubing with the long kink protection.

b **FEP tubing (6.1829.070 tubing set)**
Use the tubing with the short kink protection.

7 Operation and maintenance

7.1 Care

WARNING

Never open the housing of the device. The device could become damaged. There is a considerable risk of injury if live components are touched.

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

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

Clean the housing and the measuring head with a damp cloth. A mild detergent can be used to remove stubborn contaminations.

CAUTION

The device has been designed so that aggressive media are largely prevented from entering the device. However, if liquids should get into the device, unplug the power plug immediately to avoid serious damage to the device electronics. In such a case, contact Metrohm Service.

Spilled chemicals and solvents should be removed immediately. In particular, the plug connections (particularly the power plug) should be protected from contamination.

7.2 Maintenance by Metrohm Service

Maintenance of the instrument is best carried out as part of annual service, which is performed by specialist personnel from Metrohm. A shorter maintenance interval is recommended if you frequently work with caustic and corrosive chemicals. Metrohm Service offers every form of technical advice for maintenance and service of all Metrohm instruments.

7.3 Replacing the measuring head

Make sure that no determinations are being carried out when you replace the measuring head.

WARNING

Leaking of chemical substances

Chemical substances can cause chemical burns and skin damage.

- Empty the tubing before you remove the measuring head.
- Tilt the measuring head arm up before you remove the measuring head.

CAUTION

LED blinking pattern indicates standby potential

The electrodes may be damaged.

Check the blinking pattern of the "Status" LED. The measuring head may not be removed while standby potential is being applied to the electrodes (blinking pattern: on for a long time - off for a short time).

CAUTION

Stirrer motor is in operation

The stirrer motor may be damaged.

Switch off the stirrer motor before you remove or insert the measuring head.

Proceed as follows:

1 Tilt the measuring head arm up.

2 Hold the measuring head with both hands, push the metal clip on the bottom of the measuring head arm upwards and, at the same time, pull the measuring head away.

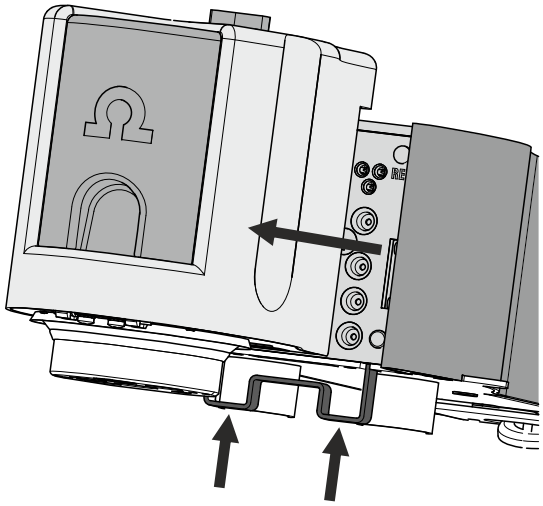


Figure 53 Removing the measuring head

3 Place the measuring head with the electrodes and tubings in the park station.

NOTE

If the measuring head is not used for an extended period, then the reference electrode must be removed from the measuring head and stored separately. Observe the notes on maintenance and care in the electrode leaflet.

4

CAUTION

Do not apply pressure to the drive disk on the connector plate of the measuring head arm, as this could damage the stirrer motor.

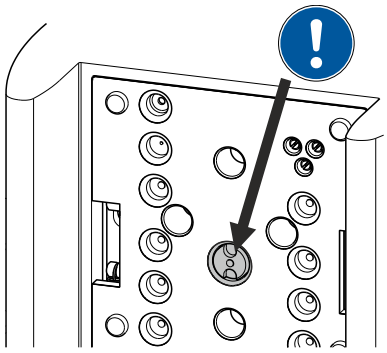


Figure 54 Do not touch the drive disk

Use one hand to hold the rear of the measuring head arm and use the other hand to insert the new measuring head into the connector plate of the measuring head arm.

The measuring head must snap into place with an audible click.

5

WARNING

If the measuring head arm is folded down without due care, this may result in injuries to the hands.

Make sure that your fingers do not get caught between the measuring head arm and the instrument housing.

Lower the measuring head arm again.

7.4 Performing a Dummy cell test

Should you note any problems or irregularities during or after determinations (e.g. noisy curves), you can perform a dummy cell test. In this test, the hardware and the electrode cables up to the measuring head are checked; this allows potential problems to be localized or excluded. The electrodes are not tested with the **Dummy cell test**.

Proceed as follows:

1 Load the **Dummy cell test** method template in **viva**.

2 Plug the 3 electrode cables onto the contacts of the dummy cell (6.2813.050).

Observe the correct assignment of the electrode cables (WE, RE and AE).

3 Place the measuring head cover and the stopper *(3-**5**)* onto the measuring head.

4 Start the determination; at the prompt, select the name of the 894 Professional CVS being used from the list and wait until the measurement is completed.

If the curve meets the following conditions, then defects in the hardware or the electrode cables can be ruled out:

- The curve must be linear.
- At –2.0 V, the current should be –1.67 mA ± 0.33 mA.
- At +2.0 V, the current should be +1.67 mA ± 0.33 mA.

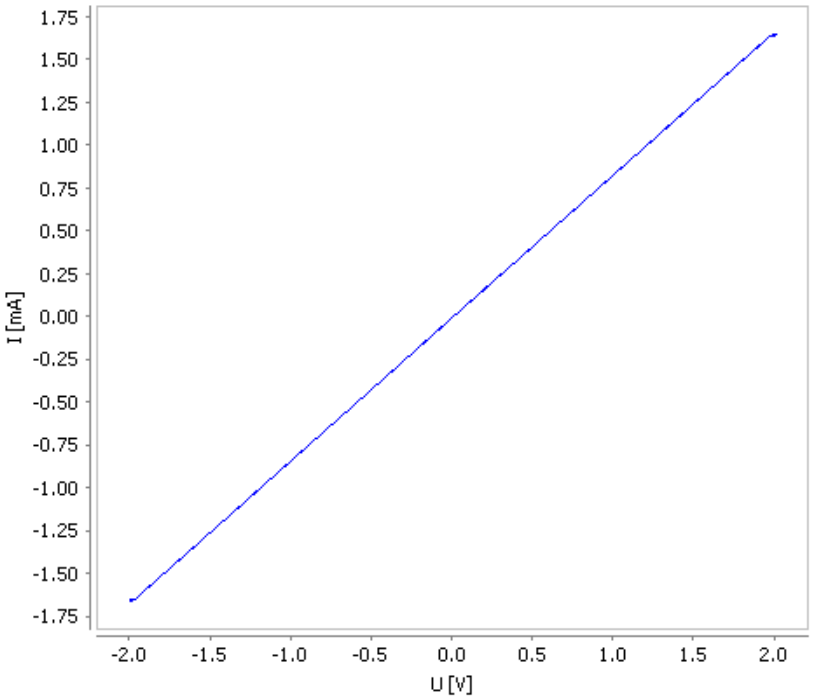


Figure 55 Dummy cell test – Ideal curve progression

5 If the resulting curve is not consistent with this representation and the problems with the determinations persist, contact the local Metrohm Service.

7.5 Replacing electrode cables

It may be the case that one or more of the 3 electrode cables are damaged (e.g. accidental pinching in the measuring head cover). If the electrode cables are damaged, then the proper functioning of the measuring instrument can no longer be ensured. In this case, the entire cable set (6.2112.100) needs to be replaced. Proceed as follows:

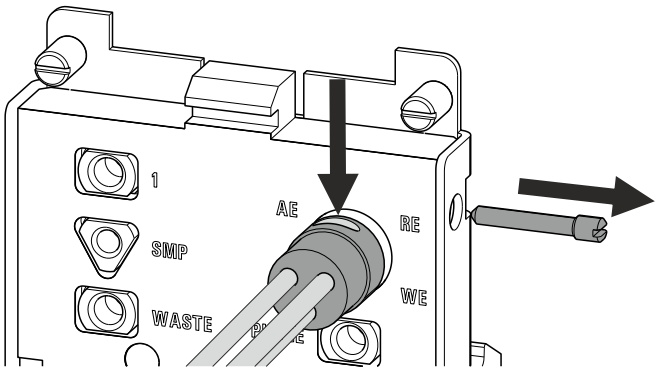


Figure 56 Replacing electrode cables

1 Remove the measuring head from the measuring head arm.

2 Remove the stopper and the measuring head cover from the measuring head *(see Figure 7, page 19* and *Figure 8, page 20)*.

3 Unscrew the screw on the right-hand side of the measuring head connector plate using a screwdriver.

4 Push the triple plug contact forward from the rear through the measuring head connector plate.

5 Remove the cable set.

6 Insert the new cable set.

NOTE

Make sure that the ellipsis-shaped recess on the cylinder is facing up when you insert the new cable set. This is important to ensure that the 3 electrodes are connected to the correct connectors inside the measuring instrument.

7 Carefully tighten the screw on the right-hand side of the measuring head connector plate.

7.6 Adjusting the sample needle in the Sample Processor

If the entire sample volume is to be transferred from the Sample Processor, then the work position on the tower of the Sample Processor has to be set in such a way that the sample needle is located no more than 0.5 mm above the bottom of the sample vial. The work position settings must be defined in **viva**.

If required, adjust the sample needle in **viva** as shown in the figure:

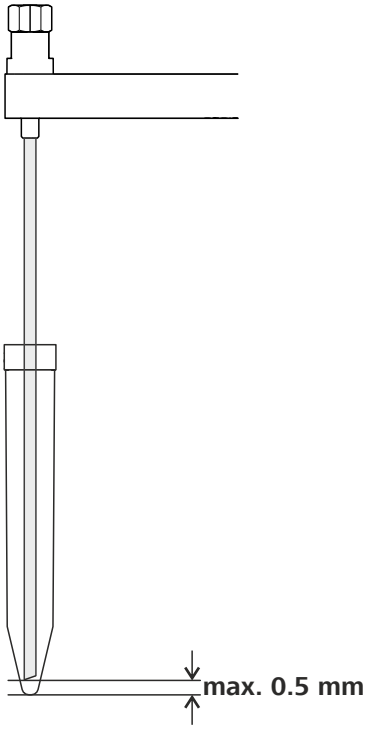


Figure 57 Adjusting the sample needle in the Sample Processor

7.7 Calibrator

The 894 Professional CVS is equipped with a built-in calibrator with precisely specified reference values that are defined in the corresponding calibration certificate. This innovative component permits the performance of voltammetric measurements with increased reliability and precision. The measuring input of the 894 Professional CVS is automatically adjusted to the reference values of the calibrator before each measurement and thus yields stable, precise and reproducible measured values over a long period, even under suboptimal measuring conditions. In this way, the 894 Professional CVS automatically recalibrates itself before each measurement.

When the 894 Professional CVS is started up, a prompt to activate the calibrator appears *(see "Activating the calibrator", page 58)*. The automatic adjustment is active starting with this activation time. The certified reference values of the built-in calibrator are valid for 3 years. For this time period, we guarantee that the adjustment is undertaken correctly and that the automatic calibration is accurate. Once 3 years have elapsed, a message appears in the **viva** computer software stating that the calibrator should be replaced in order to ensure correct adjustment of the measuring input.

Metrohm therefore recommends having the calibrator replaced every 3 years. We can thus guarantee correct automatic self-adjustment of the 894 Professional CVS over the entire service life of the device. Please contact your regional Metrohm representative to replace the calibrator. One of our trained Metrohm service engineers will then replace the calibrator as part of a preventive maintenance procedure.

7.8 Relocating the 894 Professional CVS

If you wish to relocate the 894 Professional CVS within the laboratory, proceed as follows:

Make sure that all electrical and tubing connections are disconnected before carrying the instrument to a new location.

CAUTION

Instrument components breaking off

Lifting the instrument by the measuring vessel holder or the measuring head arm may result in injuries if the instrument is dropped.

Hold the instrument by the drip pan holder and at the rear of the measuring head arm.

1 Remove the drip pan from the holder.

2 If the measuring vessel is filled, tilt the measuring head arm up.

3 Remove the measuring vessel.

4 **WARNING**

If the measuring head arm is folded down without due care, this may result in injuries to the hands.

Make sure that your fingers do not get caught between the measuring head arm and the instrument housing.

Lower the measuring head arm again.

5 Hold the instrument with one hand on the drip pan holder and with the other hand at the rear of the measuring head arm and relocate the instrument.

8 Troubleshooting

8.1 894 Professional CVS

Problem	Cause	Remedy
An electrode cable has broken.	*The cable has accidentally been jammed in the measuring head cover or a cable contact has been kinked.*	Replace the electrode cable set *(see chapter 7.5, page 81)*.
Conditioning takes a long time.	*The reference electrode has not yet reached equilibrium.*	After maintenance of the reference electrode, wait for at least 20 min before starting a measurement.
	The working electrode is contaminated.	Condition the working electrode in pure VMS.
	The electrode tip of the working electrode has been in use for a long period.	▪ Immerse the electrode tip in c(NaOH) = 0.5 mol/L for approx. 10 min and then thoroughly rinse with distilled water. ▪ Replace the electrode tip if necessary.
	VMS is contaminated.	Check reagents for purity. (Only reagents of sufficient purity, i.e. > 99%, should be used.)
	The water quality is poor.	Use distilled water, type-II grade (ASTM D1193-91) or higher.
	The measuring solution has been contaminated as a result of diffusion.	No infeed tubing other than the 4-way micro dosing tip (6.1824.000) may be immersed in the measuring solution.
Solution is leaking between the measuring instrument and the measuring head.	*The measuring head is not correctly locked in place on the measuring head arm.*	Let the measuring head snap into place. The click must be audible.
	The sealing rings have aged or are defective.	Contact your regional Metrohm service representative.
The electrode test fails.	*One or several electrodes are not connected.*	Check the electrode cable connections.
	One or several electrodes are defective.	Perform maintenance in accordance with the electrode leaflet.

Problem	Cause	Remedy
	The measuring vessel contains too little solution or is empty.	Check the fill level in the measuring vessel and add solution if necessary.
The electrode tip of the working electrode and/or the auxiliary electrode shows copper deposits.	*An incorrect potential has been applied because the reference electrode is defective.*	▪ Check the reference electrode; perform maintenance procedure in accordance with the electrode leaflet, if necessary. ▪ Dip the electrode tip of the working electrode and/or the auxiliary electrode into concentrated nitric acid for 1 to 2 seconds and then thoroughly rinse with distilled water.
	An incorrect potential was applied because the reference electrode is not connected.	▪ Check the electrode connectors. ▪ Dip the electrode tip of the working electrode and/or the auxiliary electrode into concentrated nitric acid for 1 to 2 seconds and then thoroughly rinse with distilled water.
	An incorrect potential was applied because the measuring vessel contains too little measuring solution.	▪ All three electrodes must be immersed in the measuring solution. ▪ Dip the electrode tip of the working electrode and/or the auxiliary electrode into concentrated nitric acid for 1 to 2 seconds and then thoroughly rinse with distilled water.
The measured values are widely scattered.	*The solutions are pipetted manually.*	Use an 800 Dosino with dosing unit.
	The solutions are not added via the pipetting opening.	Add solutions only via the pipetting opening *(5-**22**)*.
The measurement curves are noisy.	*Contact problem at the driving axle (6.1204.510 or 6.1204.520).*	▪ Remove the abrasion residue from the driving axle. ▪ Replace the driving axle.
The measuring signal for Cu VMS fluctuates.	*The ambient and/or solution temperature is not constant.*	Keep the ambient and solution temperature stable during measurements (±4 °C).
	The reference potential drifts off.	Perform the maintenance procedure for the reference electrode in accordance with the electrode leaflet. However, for CVS analyses,

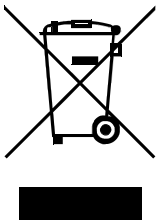
Problem	Cause	Remedy
		replace the reference electrolyte every other day and the bridge electrolyte every day.
	The measuring vessel and the electrodes have been contaminated with organic additives.	Thoroughly rinse the measuring vessel and the electrodes and use fresh VMS.
The measuring vessel overflows.	*Incorrect pump times have been defined in **viva**.*	Adjust the pump times.
	*The volumes defined in the dosing commands in **viva** are too large.*	Reduce the volumes.
The peak is no longer recognized.	*The reference potential has shifted.*	Perform the maintenance procedure for the reference electrode in accordance with the electrode leaflet.
The signal does not decrease in spite of suppressor addition.	*No chloride is contained in the Cu VMS.*	Check the preparation of the Cu VMS and modify it if required.

8.2 Peripheral devices

Problem	Cause	Remedy
The 800 Dosino cannot be actuated by the 894 Professional CVS.	*The connection between the 800 Dosino and the 894 Professional CVS is either interrupted or an error has occurred on the 800 Dosino.*	▪ Check the cable connections. ▪ Disconnect the 894 Professional CVS from the power grid and connect it again. ▪ Check the dosing and filling rate. ▪ Contact your regional Metrohm service representative if necessary.
The data of the dosing unit cannot be read.	*The memory chip of the dosing unit is mechanically damaged or impaired by chemicals.*	▪ Remove the dosing drive and attach it again. ▪ Clean the memory chip and the contact surfaces. ▪ Have the memory chip replaced by your regional Metrohm service representative.
The dosing unit is blocked and/or leaking.	*Crystals have formed (in the cylinder, on the valve disk or in the capillary).*	▪ Check the flow path. ▪ Rinse the dosing unit and the connected tubing and capillaries (**Prepare** function) when the measuring system is not in use.

Problem	Cause	Remedy
		▪ Clean the dosing unit at least every two weeks.
The dosing unit is recognized either not at all or incorrectly.	*The dosing drive was not attached correctly.*	▪ Remove the dosing drive and attach it again. ▪ Check whether the dosing drive is correctly seated. ▪ Disconnect the 894 Professional CVS from the power grid and connect it again. ▪ Contact your regional Metrohm service representative if necessary.
The membrane pumps of the 843 Pump Station do not operate at full pump capacity.	*The cables are not or not correctly connected.*	Connect the cables as described in *Chapter 4.4.5, page 54*.
	The tubing connections are leaking.	Check the tubing connections and tighten, if necessary.
	The rinse and/or waste canister are sealed airtight.	Loosen the lids on the canisters a little or remove them.
The pump time of the peristaltic pump increases.	*The pump tubing of the peristaltic pump has aged or is defective.*	Replace the pump tubing.
The sample is not completely transferred from the Sample Processor to the measuring vessel via the peristaltic pump.	*The PEEK sample needle on the Sample Processor is positioned more than 0.5 mm from the base of the sample vial.*	Position the PEEK sample needle as described in *Chapter 7.6, page 82*.
	The contact pressure set for the tubing cartridge is insufficient.	Set the contact pressure of the tubing cartridge in accordance with the information in the Sample Processor manual.
	The selected pump times are too short.	Prolong the pump times.

9 Recycling and disposal



Properly dispose of chemicals and of the product to reduce negative effects on the environment and public health. Local authorities, waste disposal companies or dealers provide more detailed information on disposal. Observe the WEEE EU directive (WEEE = Waste Electrical and Electronic Equipment) for the proper disposal of waste electronic equipment within the European Union.

10 Appendix

10.1 Tubing lengths in the measuring head arm

The following list provides information about the lengths and diameters of the tubings used in the measuring head arm between the connector plate and the tubing connection port. You will need this information for setting the parameters of the dosing units in **viva** (e.g. for the function **Prepare**).

Connection between connector plate *(1-4)* **…**	**… and tubing connector port of the measuring head arm** ***(see figure 6, page 16)***	**Article number**	**Tubing length in mm**	**Diameter in mm**
Connector **1**	Connector **1**	6.1805.550	250	2.00
Connector **2**	Connector **2**	6.1805.550	250	2.00
Connector **3**	Connector **3**	6.1805.550	250	2.00
Connector **SMP**	Connector **SMP**	6.1831.020	220	0.75
Connector **WASTE**	Connector **WASTE**	6.1805.050 and 6.1805.540	210 and 80	2.00
Connector **OUT**	Connector **OUT**	6.1805.550	250	2.00

10.2 "Status" LED – Various instrument statuses

The "Status" LED on the front of the instrument indicates three different statuses:

Continuously on	The instrument is ready for operation.
Blinking regularly	The instrument is operating.
Blinking pattern "LED on a long time - off a short time - on a long time - off a short time…"	A standby potential is being applied to the electrodes. Do not remove the measuring head or the electrode cables in this instrument status.

11 Technical specifications

11.1 Operating modes

Potentiostat	yes
Galvanostat	yes
Temperature measurement	yes (Pt1000)

11.2 Potentiostat

Maximum output voltage (AE)	
(maximum potential applied)	±25 V
Maximum output current (AE)	
(maximum current applied)	±224 mA
Sweep potential range	±5.0 V
Current measuring ranges	200 pA to 224 mA (Not all ranges are available in all measuring modes.)
Bandwidth	> 800 kHz
Rise time / fall time	300 ns
Noise	5 pA typical

11.3 Galvanostat

Potential measuring ranges	5 mV–5 V

11.4 Temperature measurement

Measuring range (Pt1000)	0 to +100 °C
Accuracy (Pt1000)	±0.5 °C

11.5 Measuring input

Measuring interval	
Sampling rate	100 kHz
Input impedance (RE)	>15 GΩ // <8 pF
Input bias current (RE) at 25 °C	<2 pA
Bandwidth of the electrometer	25 MHz

11.6 Accuracy

Current applied	±(0.2% of the current + 0.2% of the current measuring range)
Current measured	±(0.2% of the current + 0.2% of the current measuring range)
Potential applied	±(0.2% of the potential ± 1 mV)
Potential measured	±(0.2% of the potential ± 1 mV)

11.7 Resolution

Potential applied	15 µV
Potential measured	150 µV
Current applied	0.0031% of the current measuring range
Current measured	0.0031% of the current measuring range
Current measured in the smallest current measuring range (63 pA)	2 fA

11.8 Calibrator

Reference voltage	2.5 V
R17.8	17.8 Ω
R178	178 Ω
R1.9k	1,900 Ω
R18k	18,000 Ω
R180k	180,000 Ω
R1.8M	1,800,000 Ω
R18M	18,000,000 Ω

11.9 Stirrer

Stirring rate	100–3,000 min^{-1}
Stability	±2%

11.10 Hardware

A/D converter	16-bit
D/A converter	16-bit, 4 channels
Integrator	Digital
Interface	USB
MSB	4

11.11 Power connection

Supply voltage	100–240 V (± 10%)
Frequency	50–60 Hz (± 3%)
Power consumption	45 W

11.12 Ambient conditions

Nominal function range	+5 to +45 °C (at max. 80% relative humidity, non-condensing)
Automatic interior temperature monitoring	>70 °C
Storage	+5 to +45 °C (at max. 80% relative humidity, non-condensing)
Altitude / Pressure range	max. 2,000 m. above sea level / min. 780 mbar
Overvoltage category	II
Pollution degree	2

11.13 Reference conditions

Ambient temperature	+25 °C (±3 °C)
Relative humidity	≤60%
Operating temperature status	Device in operation at least 30 min

11.14 Housing data

Dimensions without accessories	
Width	188 mm
Height	294 mm
Depth	406 mm
Weight	7400 g
Dimensions with measuring head and drip pan	
Width	188 mm
Height	322 mm
Depth	452 mm
Material of the housing	
Cover	PP with flame retardation for fire class UL94 V-0
Base	Steel sheet, coated

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