

# 894 Professional CVS



## Manual – Short Instructions

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# **894 Professional CVS**

## **Manual – Short Instructions**

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# 1 About these Short Instructions

This short instruction manual contains important chapters from the comprehensive manual. In addition to an introduction, safety instructions and an overview of the instrument, you will also find information about installing and starting up the 894 Professional CVS as well as a chapter on troubleshooting. You can download the detailed manual as a PDF file from the Internet.

## Downloading the manual

You can find the detailed manual on the Internet under <https://www.metrohm.com/>:

1. Enter the order number of your instrument as the search term (e. g. **2.894.X210**)
2. Click on **>More information**.
3. Click on **Documents**.  
All available documents for the instrument will be displayed.
4. Click on the PDF link to download the desired manual.



## 2 Introduction

### 2.1 Instrument description

The 894 Professional CVS is a PC-controlled voltammetric measuring instrument. 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 instrument 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 instrument uses the potentiostatic three-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 instrument. 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 instrument 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** PC software is described in the software documentation (online help and Tutorial CVS).

## 2.2 Intended use

The 894 Professional CVS has been designed for use in the analysis of electroplating baths 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 instrument 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 risk and safety phrases that are valid for the chemicals used. The user should also observe the precautionary measures prescribed.

## 2.3 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.

### 2.3.1 Further information and literature







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

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



## 2.3.2 Symbols and conventions

The following symbols and formatting may appear in this documentation:

<i>(5-12)</i>	<b>Cross-reference to figure legend</b> The first number refers to the figure number, the second to the instrument part in the figure.
<b>1</b>	<b>Instruction step</b> Carry out these steps in the sequence shown.
<b>Method</b>	<b>Dialog text, parameter</b> in the software
<b>File ▶ New</b>	Menu or menu item
<b>[Next]</b>	<b>Button</b> or <b>key</b>
	<b>WARNING</b> This symbol draws attention to a possible life-threatening hazard or risk of injury.
	<b>WARNING</b> This symbol draws attention to a possible hazard due to electrical current.
	<b>WARNING</b> This symbol draws attention to a possible hazard due to heat or hot instrument parts.
	<b>WARNING</b> This symbol draws attention to a possible biological hazard.
	<b>CAUTION</b> This symbol draws attention to possible damage to instruments or instrument parts.
	<b>NOTE</b> This symbol highlights additional information and tips.

## 2.4 Safety instructions

### 2.4.1 General notes on safety



#### WARNING

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

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

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

### 2.4.3 Electrical safety

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



#### WARNING

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



#### WARNING

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

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



### Supply voltage



#### WARNING

---

An incorrect supply voltage can damage the instrument.

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

### Protection against electrostatic charges



#### WARNING

---

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

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

#### 2.4.4 Personnel safety



#### WARNING

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##### 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

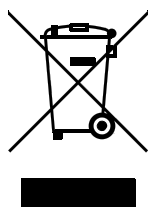


### CAUTION

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

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

## 2.4.6 Recycling and disposal



This product is covered by European Directive 2012/19/EU, WEEE – Waste Electrical and Electronic Equipment.

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

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



## 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

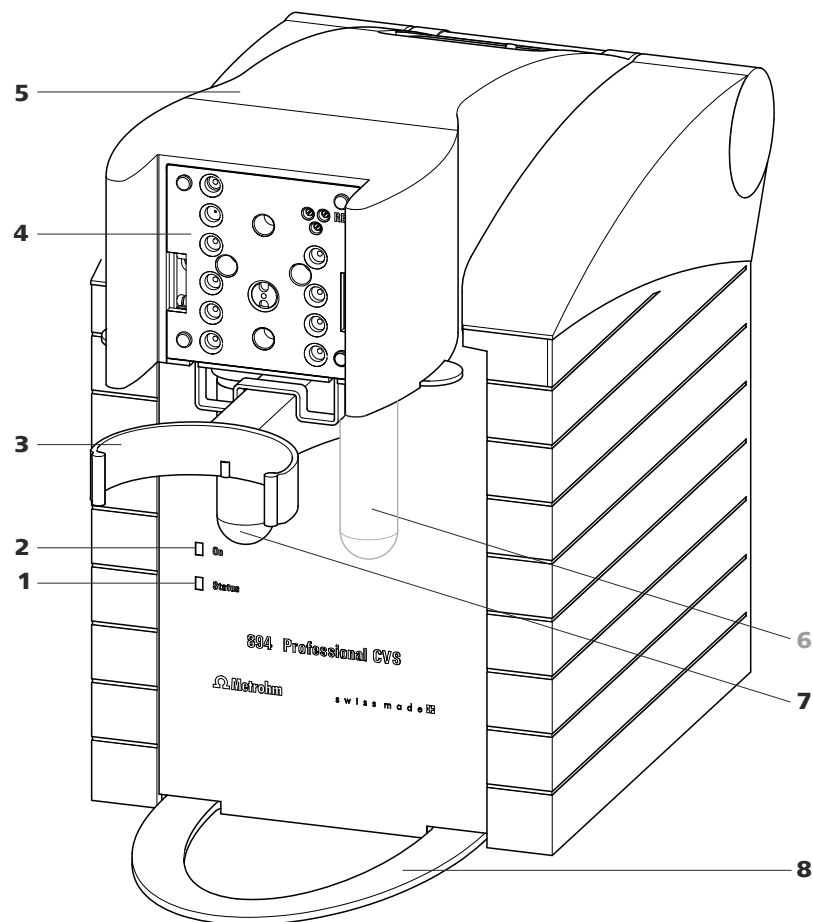


Figure 1 894 Professional CVS front

#### 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.



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

### 3.2 Rear

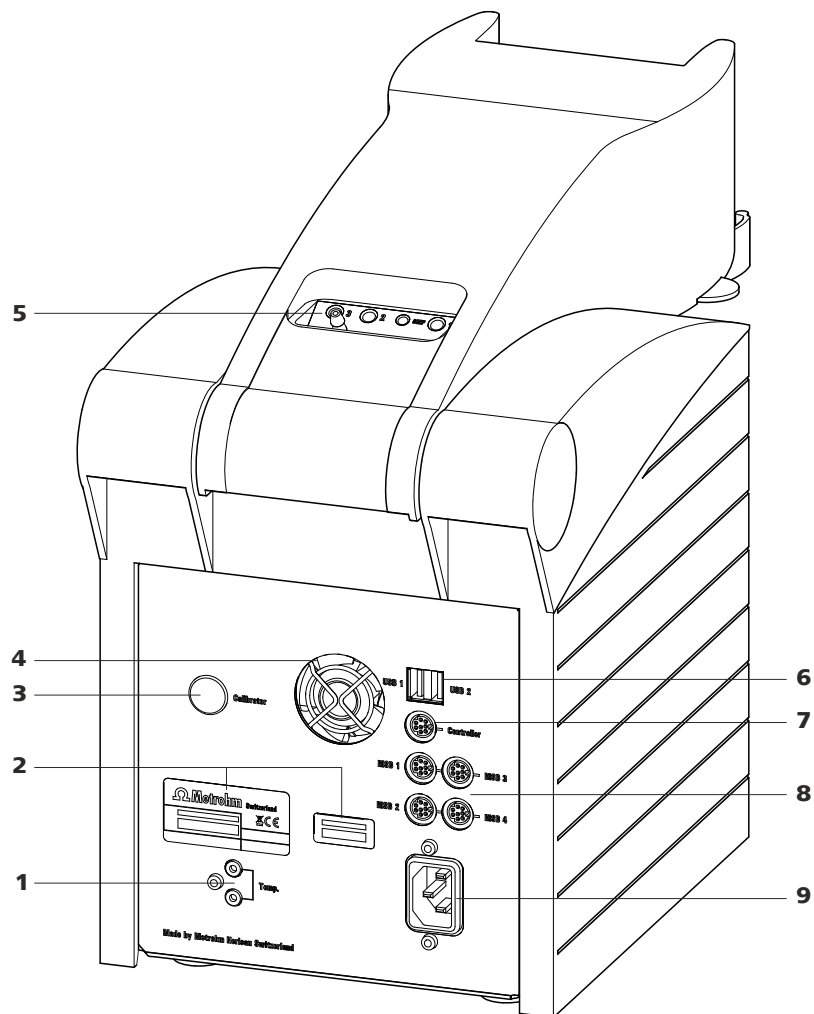


Figure 2 894 Professional CVS rear

<p><b>1 Temperature sensor connector (Temp.)</b> For connecting a temperature sensor of the type Pt1000. Two B sockets, 2 mm.</p>	<p><b>2 Type plates</b> With serial number.</p>
---	---

**3 Calibrator**

For service procedures carried out by Metrohm.

**5 Tubing connector (measuring head arm)**

See Chapter 3.5, page 15.

**7 "Controller" connector**

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

**9 Power socket****4 Fan**

Runs during operation.

**6 USB connectors (USB 1 and USB 2), type A**

For connecting barcode readers, keyboards, etc.

**8 MSB connectors (MSB 1 to 4)**

Metrohm Serial Bus. For connecting dosing devices (800 Dosino) and Remote Boxes. Mini DIN, 8-pin.

### 3.3 RDE measuring head

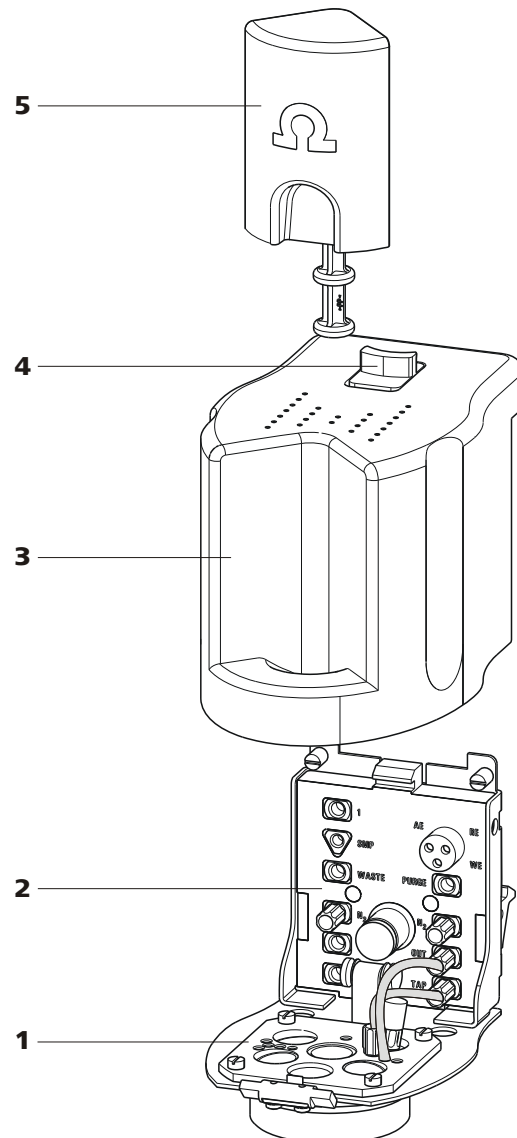


Figure 3 RDE measuring head - Overview

#### 1 Measuring head insert

With openings for inserting electrodes and tubing connections (see Figure 5, page 14).

#### 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 12).



**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

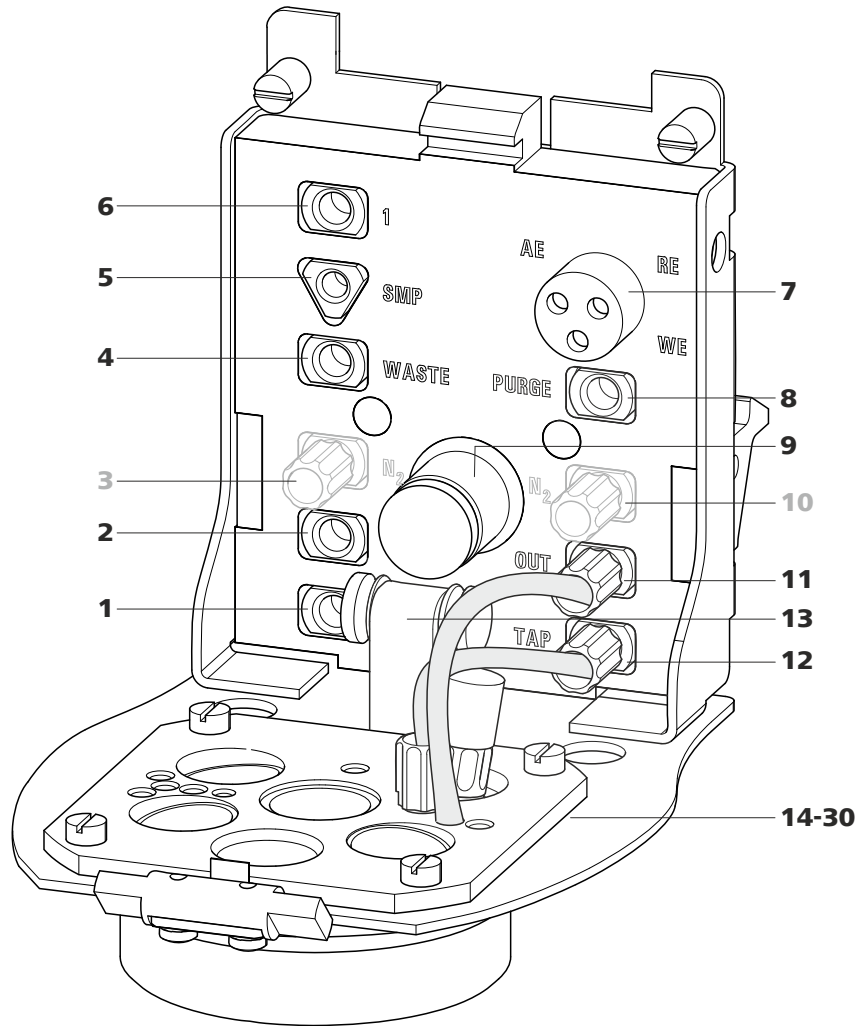


Figure 4 Measuring head connector plate

**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).

<p><b>3 M6 threaded opening (N<sub>2</sub>)</b> With preinstalled stopper. <i>Not relevant for CVS analyses.</i></p>	<p><b>4 M6 threaded opening (WASTE)</b> For aspirating the measuring solution. Can be connected to one of the openings <b>24 - 27</b> (FEP tubing from 6.1829.070).</p>
<p><b>5 UNF 10/32 threaded opening (SMP)</b> For the automated sample addition. Must be connected to opening <b>28</b> (PEEK capillary 6.1831.020).</p>	<p><b>6 M6 threaded opening (1)</b> For adding or aspirating solutions. Can be connected to one of the openings <b>24 - 27</b> (FEP tubing from 6.1829.070).</p>
<p><b>7 Electrode connector (AE, RE, WE)</b> With electrode cables, for connecting electrodes.</p>	<p><b>8 Threaded opening (PURGE)</b> For tubing connection to opening <b>19</b> - gas inlet. <i>Not relevant for CVS analyses.</i></p>
<p><b>9 Drive shaft for rotating disk electrode (RDE)</b></p>	<p><b>10 M6 threaded opening (N<sub>2</sub>)</b> With preinstalled stopper. <i>Not relevant for CVS analyses.</i></p>
<p><b>11 M6 threaded opening (OUT)</b> With preinstalled tubing connection to opening <b>18</b> - gas outlet. <i>Not relevant for CVS analyses.</i></p>	<p><b>12 Guide roller</b> Transfers the rotary movement of the motor to the driving axle of the working electrode.</p>
<p><b>13 M6 threaded opening (TAP)</b> With preinstalled tubing connection to threaded opening <b>17</b> - gas inlet. <i>Not relevant for CVS analyses.</i></p>	<p><b>14 - 30: see next figure</b></p>

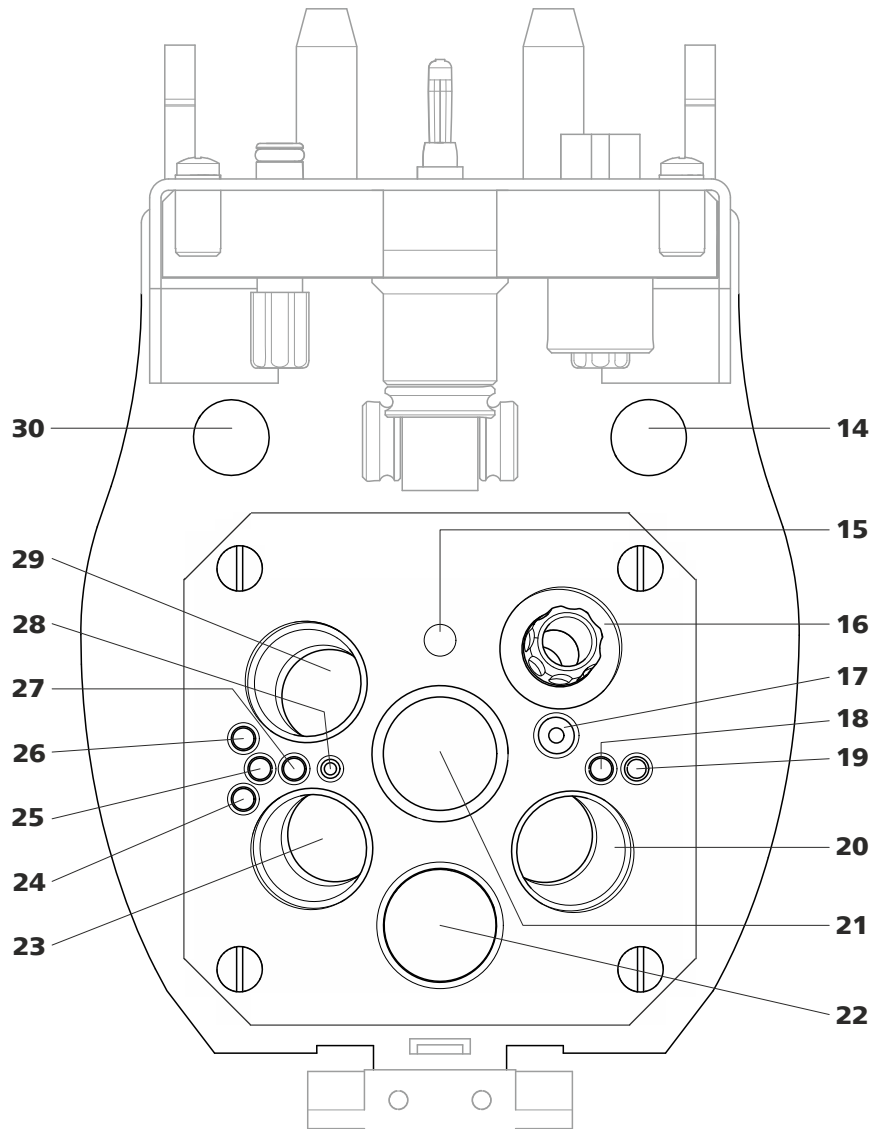


Figure 5 Measuring head insert

<p><b>14 Opening</b> For feeding through a four-way micro dosing tip (6.1824.000) from below.</p>	<p><b>15 Opening</b> For positioning the driving axle.</p>
<p><b>16 Threaded opening</b> With preinstalled screw nipple and stopper. Can be equipped with a four-way micro dosing tip (6.1824.000).</p>	<p><b>17 M6 threaded opening</b> With preinstalled tubing connection to the threaded opening <b>13</b> (TAP) - gas inlet. <i>Not relevant for CVS analyses.</i></p>
<p><b>18 Opening</b> With preinstalled tubing connection to threaded opening <b>11</b> (OUT) - gas outlet. <i>Not relevant for CVS analyses.</i></p>	<p><b>19 Opening</b> For tubing connection to threaded opening <b>8</b> (PURGE) - gas inlet. <i>Not relevant for CVS analyses.</i></p>

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

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

**24 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).

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

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

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

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

**25 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).

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

### 3.5 Tubing connector (measuring head arm)

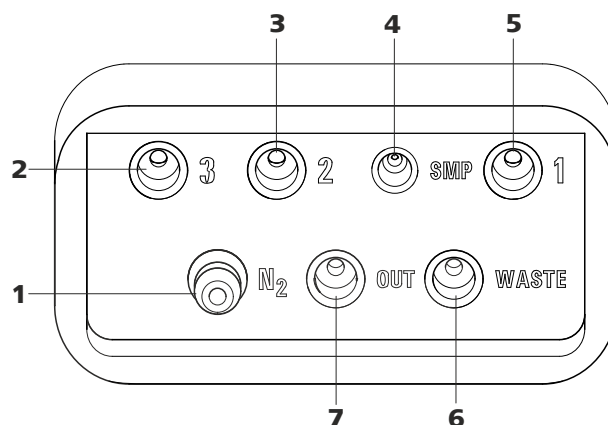


Figure 6 Tubing connector (measuring head arm)

**1 Nipple (N<sub>2</sub>)**  
Is connected to threaded openings **TAP**, **PURGE** and **N<sub>2</sub>** 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.

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

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

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

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



## 4 Installation

### 4.1 Setting up the instrument

#### 4.1.1 Packaging

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

#### 4.1.2 Checks

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

#### 4.1.3 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

We recommend equipping the RDE measuring head directly on the measuring head arm.

#### Preparing the measuring head

The measuring head is supplied with a measuring head cover mounted in place. The measuring head must first be placed on the measuring head arm. Proceed as follows:

- 1 Tilt the measuring head arm up.



2

**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.

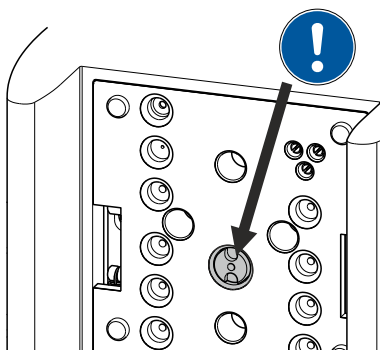


Figure 7 Do not touch the drive disk

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.

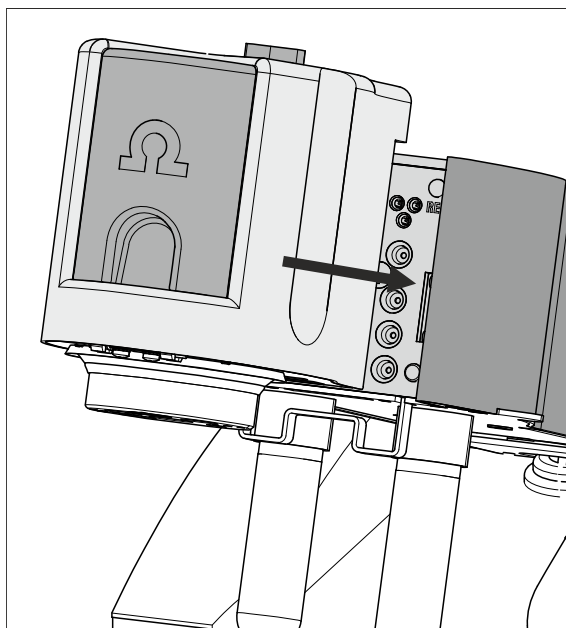


Figure 8 Inserting the measuring head

3 Remove the stopper from the pipetting opening.

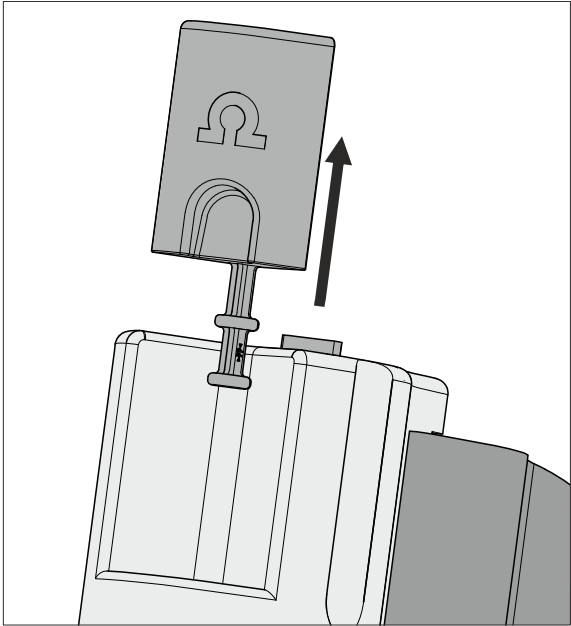


Figure 9 Removing the stopper from the pipetting opening

- 4** Pull the slide lock 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.

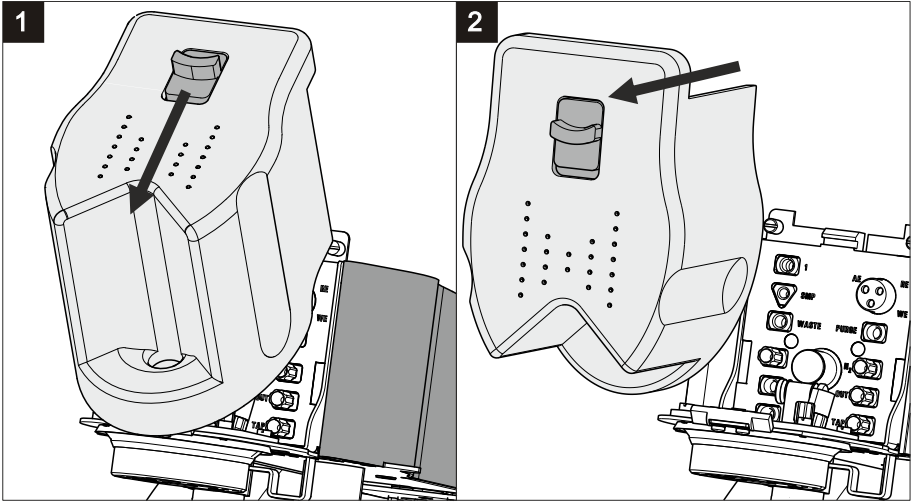


Figure 10 Removing the measuring head cover



5

**WARNING**

If the measuring head arm is lowered 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.

**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 Connecting the gas inlet****1 Connecting the gas inlet**

- 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.

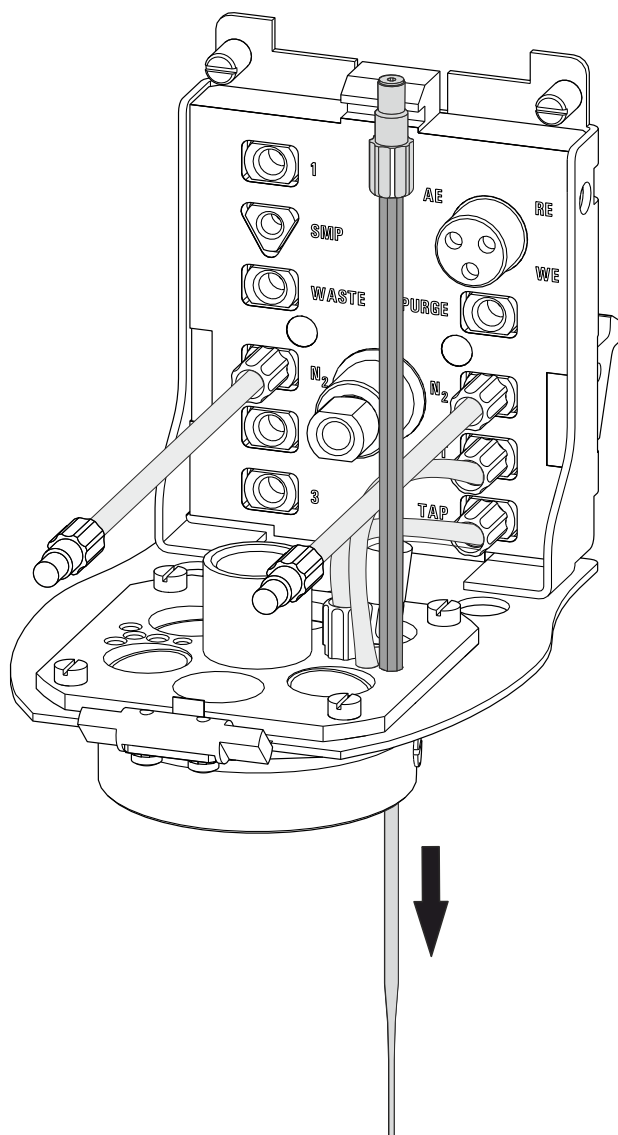


Figure 11 Inserting the gas inlet

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

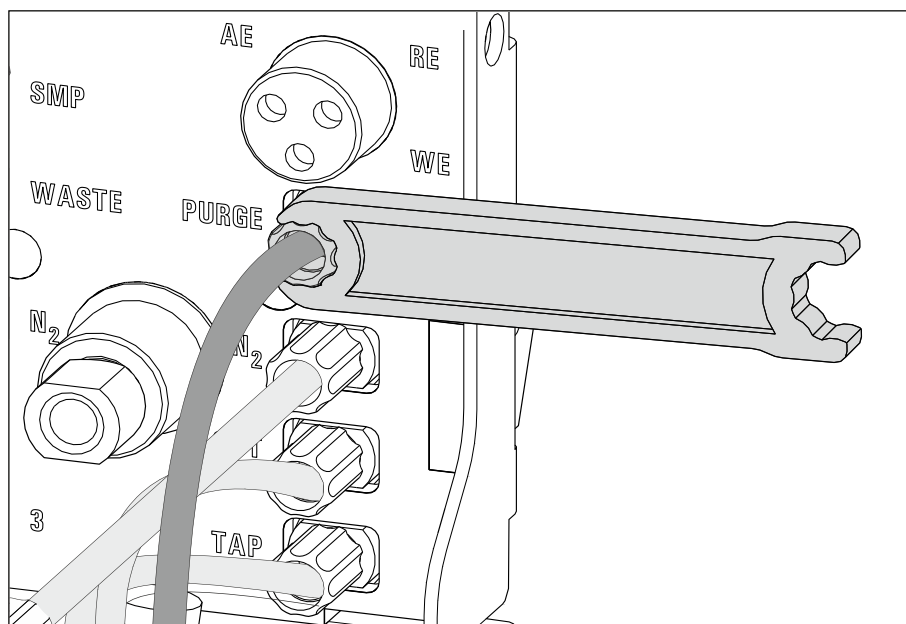


Figure 12 Connecting the gas inlet

#### 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

Please also observe the notes contained in the electrode leaflets supplied with the electrodes. In addition, you can learn how to best handle the electrodes from the multimedia guide (A.717.0002).



#### NOTE

If you are using the instrument for voltammetric applications, the gas inlet has to be connected beforehand (*see Chapter 4.2.1, page 20*). If the instrument is only going to be used for CVS applications, the gas inlet does not have to be connected.

### 4.2.2.1 Working electrode (WE)

The working electrode consists of the following two 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.

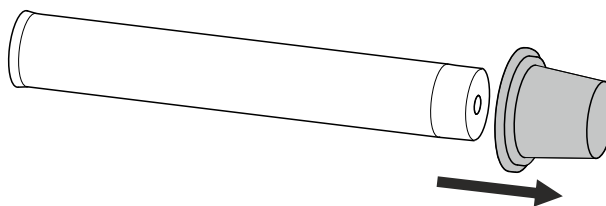


Figure 13 Removing the protective cap from the electrode tip

##### 2 Assembling the working electrode

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

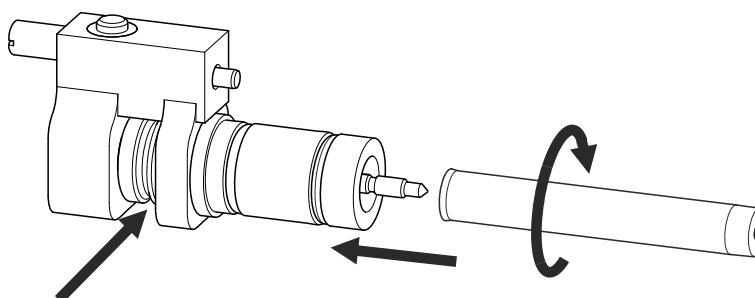


Figure 14 Tightening the electrode tip to the driving axle

##### 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.

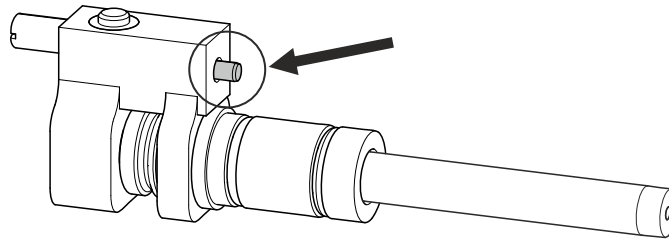


Figure 15 Working electrode, installed

#### 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.

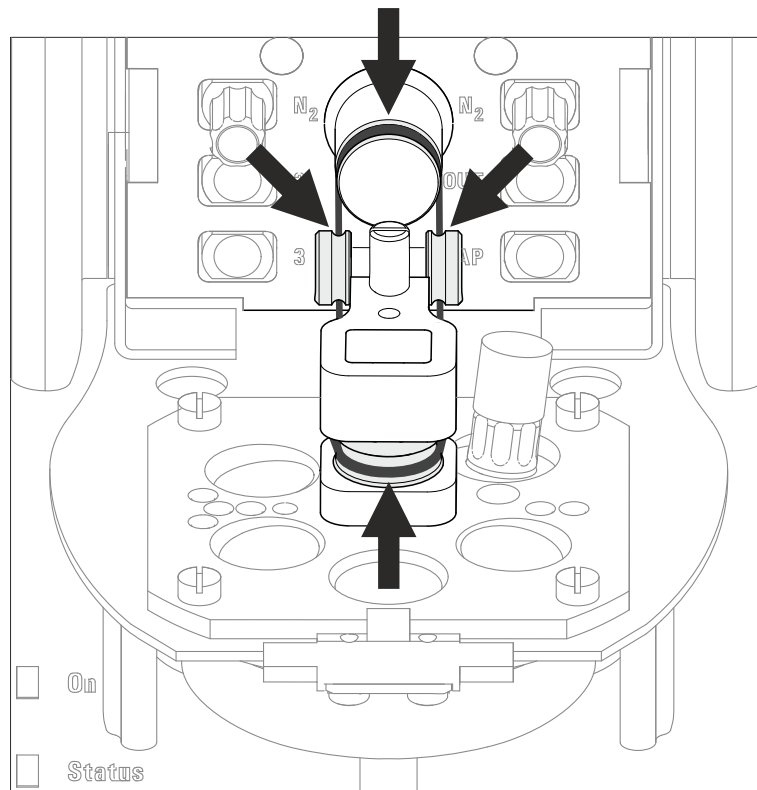


Figure 16 Fastening the drive belt



#### 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.

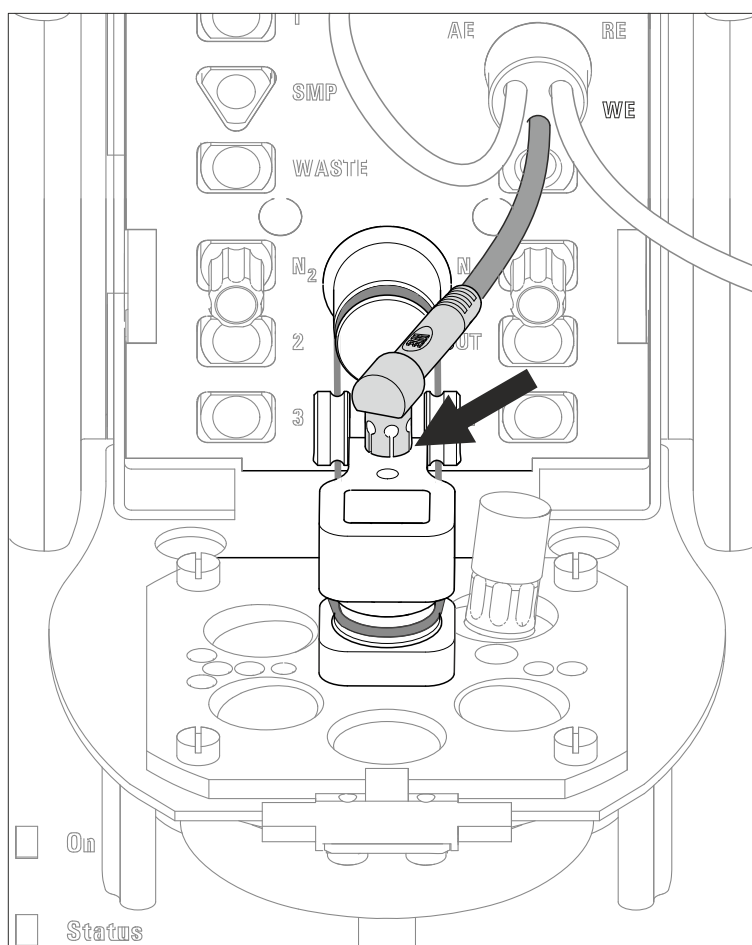


Figure 17 Connecting the working electrode

### 4.2.2.2 Reference electrode (RE)

The reference electrode consists of the following two 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 ( $c(\text{KCl}) = 3 \text{ mol/L}$ ).



- 2** Fill the electrolyte vessel with bridge electrolyte (e.g.  $c(\text{KNO}_3) = 1$  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.

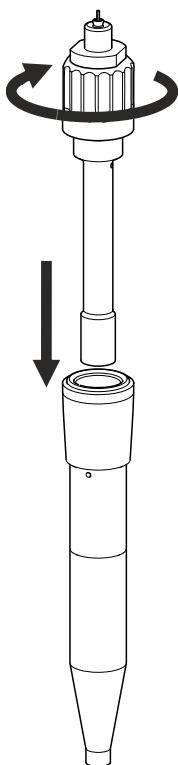


Figure 18 *Assembling the reference electrode with the electrolyte vessel*

- 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 are identical. Observe the markings on the plugs, because the two 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.

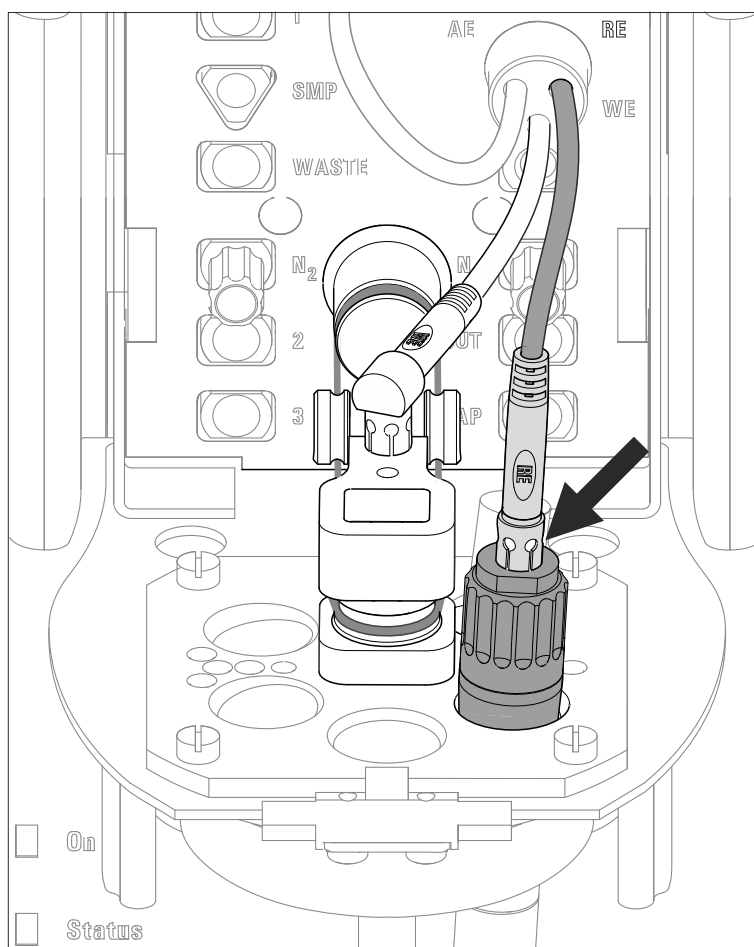


Figure 19 Connecting a reference electrode

#### 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 are identical. Observe the markings on the plugs, because the two 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.

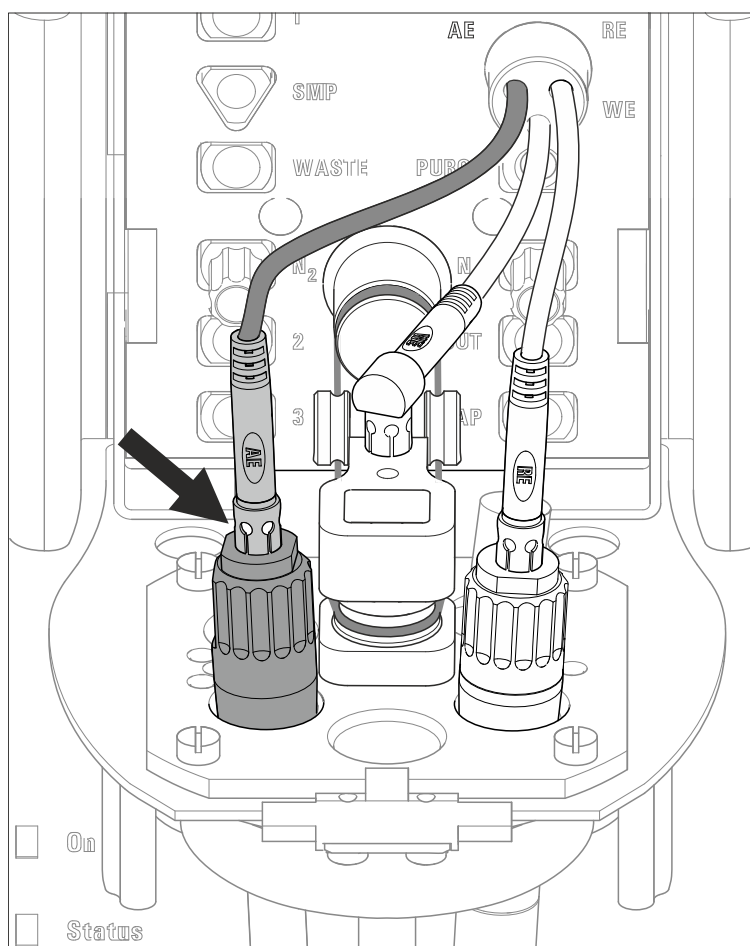


Figure 20 Connecting the auxiliary electrode

## 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 Installing the four-way micro dosing tip

The four-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 dose auxiliary solutions and standard solutions automatically. Information on the electrical connection of dosing devices can be found in the manual.

#### Installing a four-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 four-way micro dosing tip through the opening from below (5-14).
- 4** Insert the four-way micro dosing tip into the screw nipple of the threaded opening (5-16) until it stops.

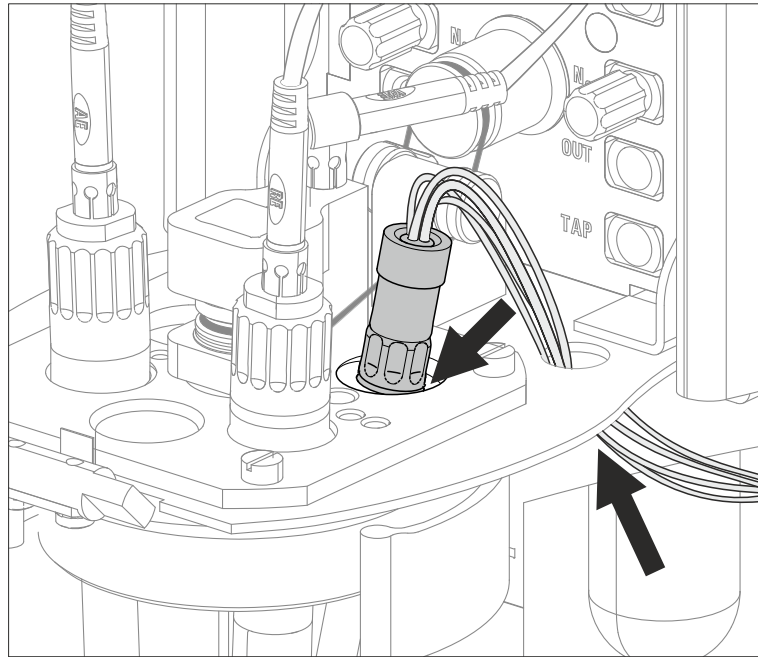


Figure 21 Inserting the four-way micro dosing tip

- 5 Tighten the screw nipple in the threaded opening again.

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

Proceed as follows:

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

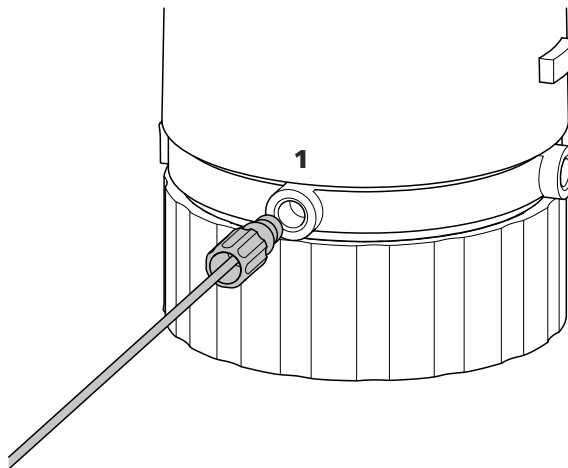


Figure 22 Screwing a PTFE capillary to a dosing unit

### Sealing unused PTFE capillaries of the four-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).

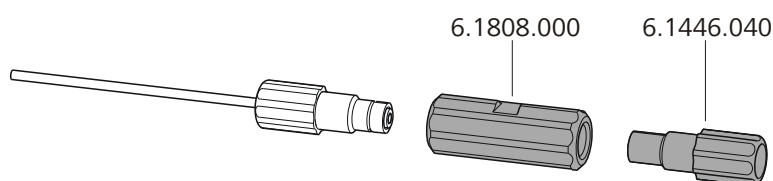


Figure 23 Sealing the PTFE capillary of a four-way micro dosing tip

#### 4.3.2 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. Several pressure screws (e.g. 6.2744.010) are required to attach the capillaries. A figure illustrating the tubing setup for an automated system can be found in the chapter *Automated operation* in the detailed manual.

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 two capillary ends connected to each other do not fit exactly, thus allowing liquid to escape. There are two 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:

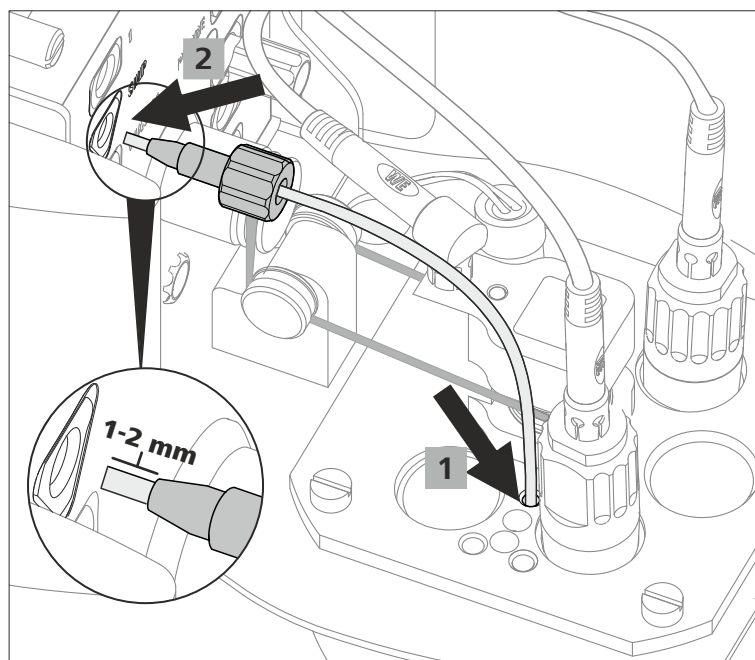


Figure 24 Inserting a PEEK capillary into the measuring head

- 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 15*) 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 until it stops.
- 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.

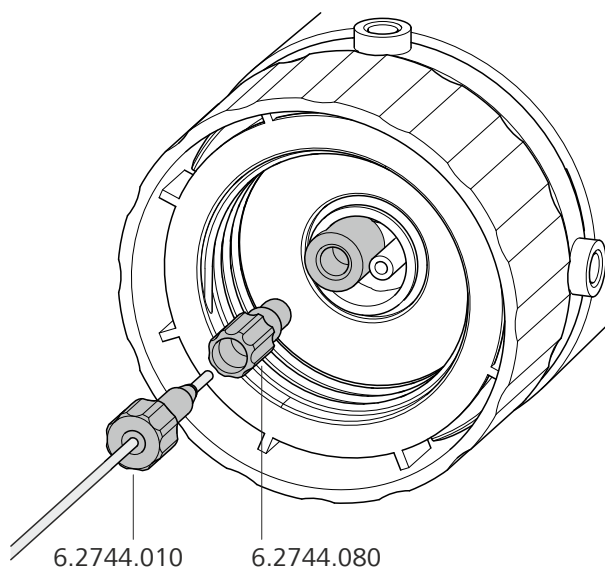


Figure 25 Screwing a capillary to a dosing unit

### 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.

#### 4.3.3 Installing FEP tubing

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

- Rinsing solution – adding via 843 Pump Station
- Waste solution – aspirating via 843 Pump Station
- Auxiliary solutions (e.g. buffer, electrolyte, VMS, etc.) – adding via 800 Dosino with dosing unit

You can find several illustrations of the tubing setup with FEP tubing in the chapter *Automated operation* in the detailed manual.

## 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 bottom of the measuring vessel.

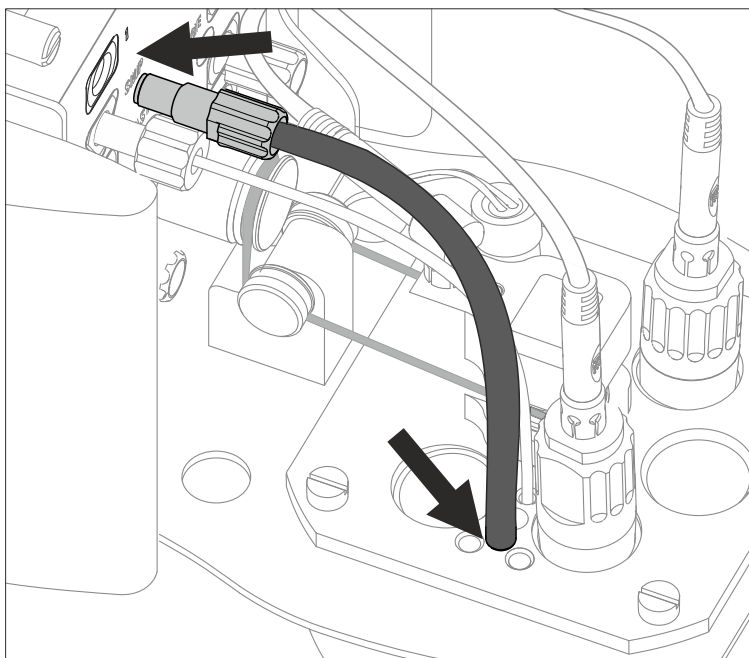


Figure 26 Inserting a piece of FEP tubing into the measuring head



#### NOTE

If more than one 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 instrument 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:

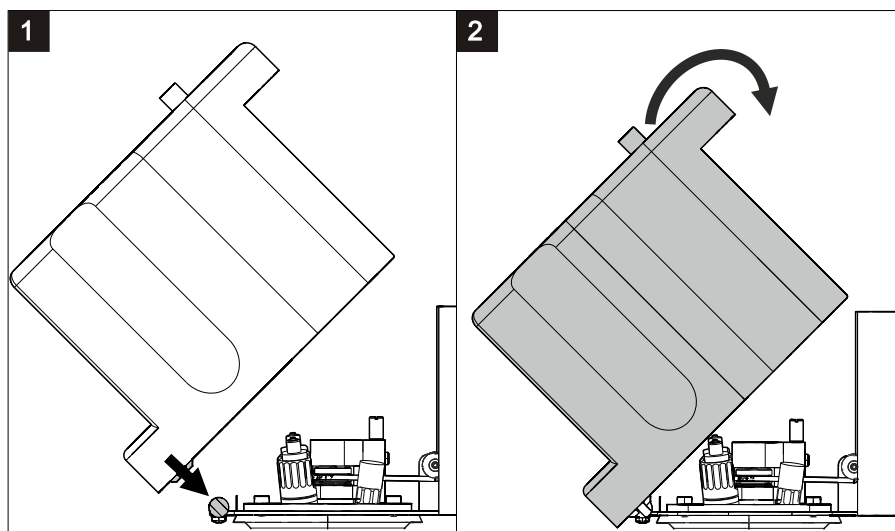


Figure 27 Installing the measuring head cover

- 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.

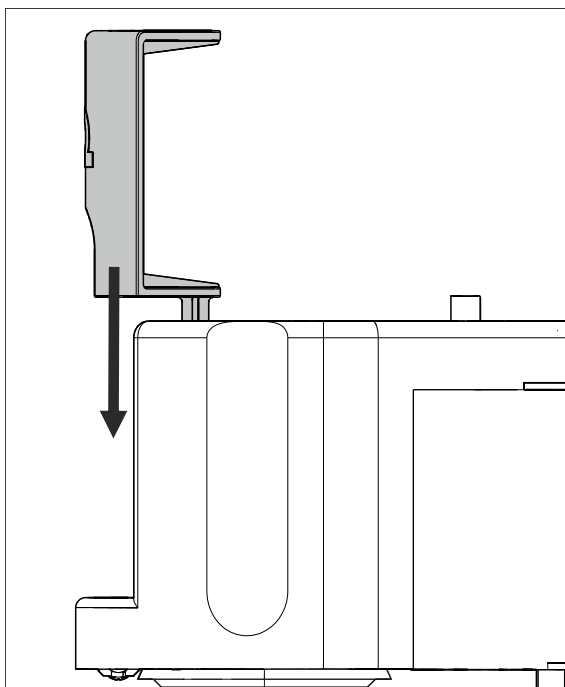


Figure 28 Inserting the stopper in the pipetting opening

### 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.

An illustration of this tubing connection can be found in the chapter *Automated operation* in the detailed manual.

### 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 .

### 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. A figure illustrating the tubing setup between the rinsing canister, the 843 Pump Station and the 894 Professional CVS can be found in the chapter *Automated operation* in the detailed manual.

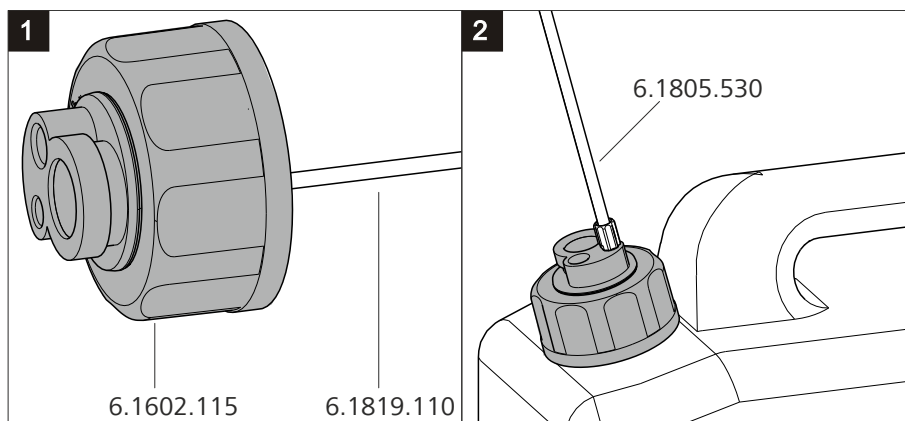


Figure 29 Installing a bottle cap with pieces of tubing on a rinsing canister

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 five-way tubing connector (6.1828.020) is required to connect FEP tubing to a waste canister. A figure illustrating the tubing setup between the waste canister, the 843 Pump Station and the 894 Professional CVS can be found in the chapter *Automated operation* of the detailed manual.

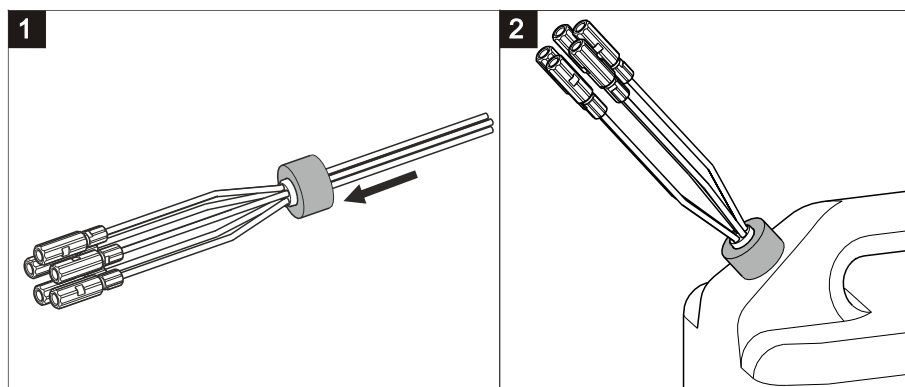


Figure 30 Connecting the five-way tubing connector to a waste canister

Proceed as follows:

- 1 Unscrew the cap with the hole in the center from the waste canister.
- 2 Feed each of the five pieces of tubing from the five-way tubing connector with the couplings already installed through the hole of the unscrewed cap from below.
- 3 Screw the cap with the five-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:



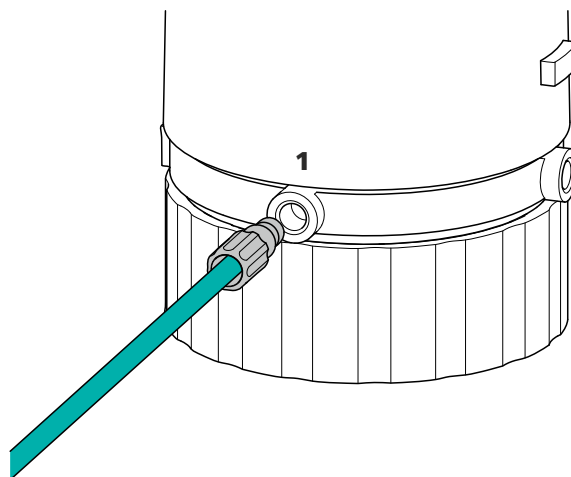


Figure 31 Connecting FEP tubing to the dosing unit (auxiliary solution)

- 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 instruments 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, connecting socket) from moisture.
- Unplug the power plug immediately if you suspect that moisture has gotten inside the instrument.
- Only personnel who have been issued Metrohm qualification may perform service and repair work on electrical and electronic parts.

##### Connecting the power cord

#### Accessories

Power cord, three-core with IEC 60320 instrument plug type C13. Conductor cross-section 1 mm<sup>2</sup> / 18 AWG. Power plug according to customer requirement (6.2122.XX0).



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 PC with the supplied controller cable.

### Connecting the PC

Proceed as follows:

- 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.

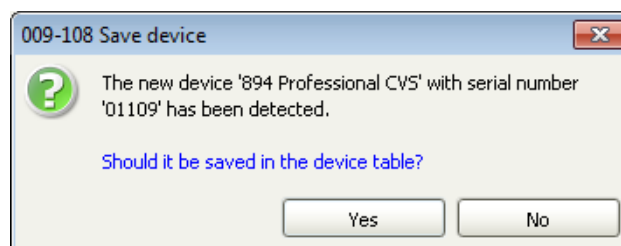
- 2 Connect the USB plug of the controller cable to an available USB connector on the PC.

### Initializing the 894 Professional CVS in viva

Proceed as follows:

- 1 Start **viva**.

The following dialog window is displayed:



- 2 Click on **Yes**.

The following dialog window is displayed:

Properties - 894 Professional CVS - 894\_1

General GLP

Device name 894\_1

Device type 894 Professional CVS

Program version 5.884.0011

Device serial number 01109

FPGA version 0

Set to work 2013-03-28 16:10:07 UTC+1

Remarks

OK Cancel

**3** Change the suggested instrument name if required.

**4** Confirm with **OK**.

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

## 5 Start-up

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

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

### Preparing the system for starting 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 *"Preparing the measuring head"*, page 17.
- 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 29).
- 4** Attach the measuring head cover and the stopper (3-5) to the measuring head as described in *"Installing the measuring head cover"*, page 36.

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

6



#### CAUTION

If the measuring head arm is lowered carelessly, this may result in injuries to the hand.

Make sure that you do not trap a finger between the measuring head arm and the instrument 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 41).

### Activating the calibrator

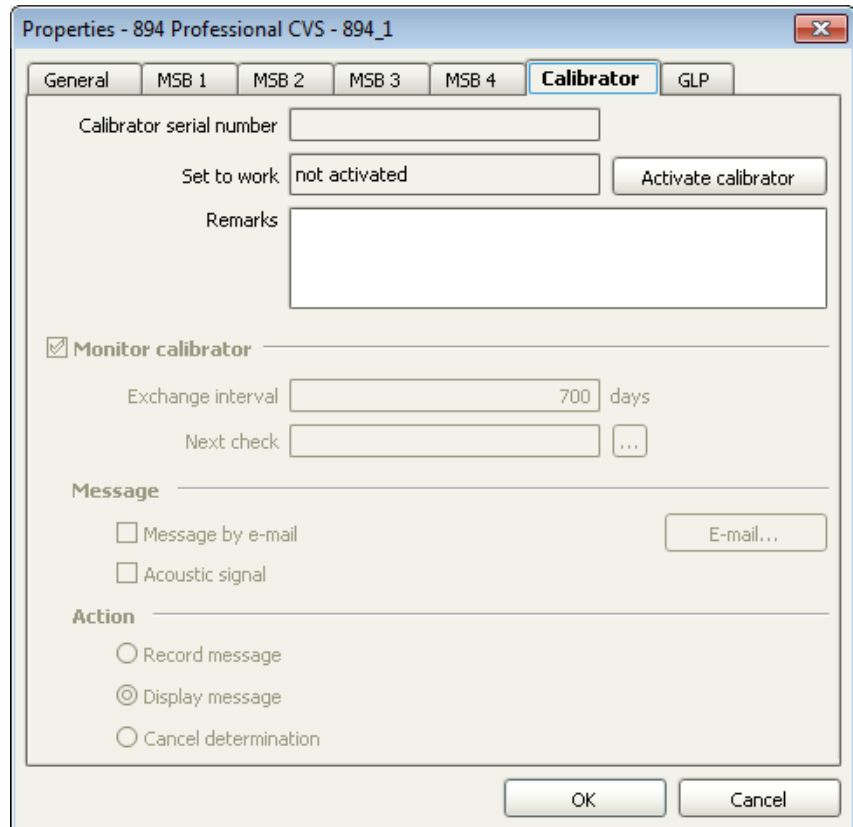
The calibrator built into the 894 Professional CVS guarantees a very high measuring accuracy for two years after the initial start-up. You can find more detailed information in the chapter *Calibrator* of the detailed manual.

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.

Properties - 894 Professional CVS - 894\_1

General MSB 1 MSB 2 MSB 3 MSB 4 **Calibrator** GLP

Calibrator serial number 01126

Set to work 2013-02-13 13:49:14 UTC+1

Remarks

**Monitor calibrator**

Exchange interval 700 days

Next check 2015-01-14 ...

**Message**

Message by e-mail E-mail...

Acoustic signal

**Action**

Record message

Display message

Cancel determination

OK Cancel



#### NOTE

The calibration certificate is available online. Go to <http://www.metrohm.com/com/Support/zertifikate/instrumentCertificate.html> and enter the serial number of the calibrator to download the certificate.

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



## 6 Troubleshooting

### 6.1 894 Professional CVS

<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
<b>An electrode cable has broken.</b>	<i>The cable has accidentally been jammed in the measuring head cover or a cable contact has been kinked.</i>	Replace the electrode cable set .
<b>Conditioning takes a long time.</b>	<i>The reference electrode has not yet reached equilibrium.</i>	After maintenance of the reference electrode, wait for at least 20 min before starting a measurement.
	<i>The working electrode is contaminated.</i>	Condition the working electrode in pure VMS.
	<i>The electrode tip of the working electrode has been in use for a long period.</i>	<ul style="list-style-type: none"> <li>▪ Immerse the electrode tip in <math>c(\text{NaOH}) = 0.5</math> mol/L for approx. 10 min and then thoroughly rinse with distilled water.</li> <li>▪ Replace the electrode tip if necessary.</li> </ul>
	<i>VMS is contaminated.</i>	Check reagents for purity. (Only reagents of sufficient purity, i.e. > 99%, should be used.)
	<i>The water quality is poor.</i>	Use distilled water, type-II grade (ASTM D1193-91) or higher.
	<i>The measuring solution has been contaminated as a result of diffusion.</i>	No infeed tubing other than the four-way micro dosing tip (6.1824.000) may be immersed in the measuring solution.
<b>Solution is leaking between the measuring instrument and the measuring head.</b>	<i>The measuring head is not correctly locked in place on the measuring head arm.</i>	Let the measuring head snap into place. The click must be audible.
	<i>The sealing rings have aged or are defective.</i>	Contact Metrohm Service.
<b>The electrode test fails.</b>	<i>One or several electrodes are not connected.</i>	Check the electrode cable connections.
	<i>One or several electrodes are defective.</i>	Perform maintenance in accordance with the electrode leaflet.



<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
	<i>The measuring vessel contains too little solution or is empty.</i>	Check the fill level in the measuring vessel and add solution if necessary.
<b>The electrode tip of the working electrode and/or the auxiliary electrode shows copper deposits.</b>	<i>An incorrect potential has been applied because the reference electrode is defective.</i>	<ul style="list-style-type: none"> <li>▪ Check the reference electrode; perform maintenance procedure in accordance with the electrode leaflet, if necessary.</li> <li>▪ 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.</li> </ul>
	<i>An incorrect potential was applied because the reference electrode is not connected.</i>	<ul style="list-style-type: none"> <li>▪ Check the electrode connectors.</li> <li>▪ 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.</li> </ul>
	<i>An incorrect potential was applied because the measuring vessel contains too little measuring solution.</i>	<ul style="list-style-type: none"> <li>▪ All three electrodes must be immersed in the measuring solution.</li> <li>▪ 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.</li> </ul>
<b>The measured values are widely scattered.</b>	<i>The solutions are pipetted manually.</i>	Use an 800 Dosino with dosing unit.
	<i>The solutions are not added via the pipetting opening.</i>	Add solutions only via the pipetting opening (5-22).
<b>The measurement curves are noisy.</b>	<i>Contact problem at the driving axle (6.1204.510 or 6.1204.520).</i>	<ul style="list-style-type: none"> <li>▪ Remove the abrasion residue from the driving axle.</li> <li>▪ Replace the driving axle.</li> </ul>
<b>The measuring signal for Cu VMS fluctuates.</b>	<i>The ambient and/or solution temperature is not constant.</i>	Keep the ambient and solution temperature stable during measurements ( $\pm 4$ °C).
	<i>The reference potential drifts off.</i>	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.
	<i>The measuring vessel and the electrodes have been contaminated with organic additives.</i>	Thoroughly rinse the measuring vessel and the electrodes and use fresh VMS.
<b>The measuring vessel overflows.</b>	<i>Incorrect pump times have been defined in <b>viva</b>.</i>	Adjust the pump times.
	<i>The volumes defined in the dosing commands in <b>viva</b> are too large.</i>	Reduce the volumes.
<b>The peak is no longer recognized.</b>	<i>The reference potential has shifted.</i>	Perform the maintenance procedure for the reference electrode in accordance with the electrode leaflet.
<b>The signal does not decrease in spite of suppressor addition.</b>	<i>No chloride is contained in the Cu VMS.</i>	Check the preparation of the Cu VMS and modify it if required.

## 6.2 Peripheral devices

Problem	Cause	Remedy
<b>The 800 Dosino cannot be actuated by the 894 Professional CVS.</b>	<i>The connection between the 800 Dosino and the 894 Professional CVS is either interrupted or an error has occurred on the 800 Dosino.</i>	<ul style="list-style-type: none"> <li>▪ Check the cable connections.</li> <li>▪ Disconnect the 894 Professional CVS from the power grid and connect it again.</li> <li>▪ Check the dosing and filling rate.</li> <li>▪ Contact Metrohm Service if necessary.</li> </ul>
<b>The data of the dosing unit cannot be read.</b>	<i>The data chip of the dosing unit is mechanically damaged or impaired by chemicals.</i>	<ul style="list-style-type: none"> <li>▪ Remove the dosing drive and attach it again.</li> <li>▪ Clean the data chip and the contact surfaces.</li> <li>▪ Have the data chip replaced by Metrohm Service.</li> </ul>
<b>The dosing unit is blocked and/or leaking.</b>	<i>Crystals have formed (in the dosing cylinder, on the valve disk or in the capillary).</i>	<ul style="list-style-type: none"> <li>▪ Check the flow path.</li> <li>▪ Rinse the dosing unit and the connected tubing and capillaries (<b>Prepare</b> function) when the measuring system is not in use.</li> <li>▪ Clean the dosing unit at least every two weeks.</li> </ul>

<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
<b>The dosing unit is recognized either not at all or incorrectly.</b>	<i>The dosing drive was not attached correctly.</i>	<ul style="list-style-type: none"> <li>▪ Remove the dosing drive and attach it again.</li> <li>▪ Check whether the dosing drive is correctly seated.</li> <li>▪ Disconnect the 894 Professional CVS from the power grid and connect it again.</li> <li>▪ Contact Metrohm Service if necessary.</li> </ul>
<b>The membrane pumps of the 843 Pump Station do not operate at full pump capacity.</b>	<i>The cables are not or not correctly connected.</i>	Connect the cables in accordance with the instructions in the comprehensive manual.
	<i>The tubing connections are leaking.</i>	Check the tubing connections and tighten, if necessary.
	<i>The rinse and/or waste canister are sealed airtight.</i>	Loosen the caps on the canisters a little or remove them.
<b>The pump time of the peristaltic pump increases.</b>	<i>The pump tubing of the peristaltic pump has aged or is defective.</i>	Replace the pump tubing.
<b>The sample is not completely transferred from the Sample Processor to the measuring vessel via the peristaltic pump.</b>	<i>The PEEK sample needle on the Sample Processor is positioned more than 0.5 mm from the bottom of the sample vial.</i>	Position the PEEK sample needle in accordance with the instructions in the detailed manual.
	<i>The contact pressure set for the tubing cartridge is insufficient.</i>	Set the contact pressure of the tubing cartridge in accordance with the information in the Sample Processor manual.
	<i>The selected pump times are too short.</i>	Prolong the pump times.

## 7 Accessories

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

### Downloading the accessories list

- 1** Type <https://www.metrohm.com/> into your Internet browser.
- 2** Under **Find products, accessories, and applications by**, enter the article number (e.g. **2.894.X210**).  
The search result is displayed.
- 3** Under **Products**, click on **More information**.  
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 will be created.



#### NOTE

When you receive your new instrument, 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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