

894 Professional CVS



Manual

8.894.8001EN / 2017-08-15



Metrohm AG

CH-9100 Herisau

Switzerland

Phone +41 71 353 85 85

Fax +41 71 353 89 01

info@metrohm.com

www.metrohm.com

894 Professional CVS

Manual

Technical Communication
Metrohm AG
CH-9100 Herisau
techcom@metrohm.com

This documentation is protected by copyright. All rights reserved.

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.

Table of contents

1	Introduction	1
1.1	Instrument description	1
1.2	Intended use	2
1.3	About the documentation	2
1.3.1	Further information and literature	2
1.3.2	Symbols and conventions	3
1.4	Safety instructions	4
1.4.1	General notes on safety	4
1.4.2	Flammable solvents and chemicals	4
1.4.3	Electrical safety	4
1.4.4	Personnel safety	5
1.4.5	Tubing and capillary connections	6
1.4.6	Recycling and disposal	6
2	Overview of the instrument	7
2.1	Front	7
2.2	Rear	8
2.3	RDE measuring head	10
2.4	Measuring head connector plate and measuring head insert	11
2.5	Tubing connector (measuring head arm)	14
3	Installation	16
3.1	Setting up the instrument	16
3.1.1	Packaging	16
3.1.2	Checks	16
3.1.3	Location	16
3.2	Equipping the RDE measuring head	16
3.2.1	Connecting the gas inlet	19
3.2.2	Preparing electrodes and inserting them in the RDE measuring head	21
3.3	Establishing the tubing connections	28
3.3.1	Installing the four-way micro dosing tip	28
3.3.2	Installing capillaries	30
3.3.3	Installing FEP tubing	33
3.4	Connecting instruments electrically	40
3.4.1	Connecting the instrument to the power grid	40
3.4.2	Connecting the 894 Professional CVS	41
3.4.3	Connecting an 800 Dosino	43



4	Start-up	47
5	System configuration	51
5.1	Manual operation	51
5.2	Semiautomated operation	52
5.2.1	Connecting devices electrically	52
5.2.2	Establishing the tubing connections	52
5.3	Automated operation	56
5.3.1	Connecting devices electrically	56
5.3.2	Establishing the tubing connections	58
6	Operation and maintenance	65
6.1	Care	65
6.2	Maintenance by Metrohm Service	66
6.3	Replacing the measuring head	66
6.4	Performing a Dummy cell test	68
6.5	Replacing electrode cables	70
6.6	Adjusting the sample needle in the Sample Processor ...	71
6.7	Calibrator	72
6.8	Relocating the 894 Professional CVS	72
6.9	Quality management and qualification with Metrohm ...	74
7	Troubleshooting	75
7.1	894 Professional CVS	75
7.2	Peripheral devices	77
8	Appendix	79
8.1	Tubing lengths in the measuring head arm	79
8.2	"Status" LED – Various instrument statuses	79
9	Technical specifications	80
9.1	Operating modes	80
9.2	Potentiostat	80
9.3	Galvanostat	81
9.4	Temperature measurement	81
9.5	Measuring input	81
9.6	Accuracy	81
9.7	Resolution	82



9.8	Calibrator	82
9.9	Stirrer	82
9.10	Hardware	83
9.11	Power connection	83
9.12	Ambient temperature	83
9.13	Reference conditions	83
9.14	Housing data	84
10	Accessories	85
	Index	86



Table of figures

Figure 1	894 Professional CVS front	7
Figure 2	894 Professional CVS rear	8
Figure 3	RDE measuring head - Overview	10
Figure 4	Measuring head connector plate	11
Figure 5	Measuring head insert	13
Figure 6	Tubing connector (measuring head arm)	14
Figure 7	Do not touch the drive disk	17
Figure 8	Inserting the measuring head	17
Figure 9	Removing the stopper from the pipetting opening	18
Figure 10	Removing the measuring head cover	18
Figure 11	Inserting the gas inlet	20
Figure 12	Connecting the gas inlet	21
Figure 13	Removing the protective cap from the electrode tip	22
Figure 14	Tightening the electrode tip to the driving axle	22
Figure 15	Working electrode, installed	23
Figure 16	Fastening the drive belt	23
Figure 17	Connecting the working electrode	24
Figure 18	Assembling the reference electrode with the electrolyte vessel	25
Figure 19	Connecting a reference electrode	26
Figure 20	Connecting the auxiliary electrode	27
Figure 21	Inserting the four-way micro dosing tip	29
Figure 22	Screwing a PTFE capillary to a dosing unit	29
Figure 23	Sealing the PTFE capillary of a four-way micro dosing tip	30
Figure 24	Inserting a PEEK capillary into the measuring head	31
Figure 25	Screwing a capillary to a dosing unit	33
Figure 26	Inserting a piece of FEP tubing into the measuring head	35
Figure 27	Installing the measuring head cover	36
Figure 28	Inserting the stopper in the pipetting opening	37
Figure 29	Installing a bottle cap with pieces of tubing on a rinsing canister	38
Figure 30	Connecting the five-way tubing connector to a waste canister	39
Figure 31	Connecting FEP tubing to the dosing unit (auxiliary solution)	40
Figure 32	Connecting a dosing device to an MSB socket	43
Figure 33	Manual operation - Electrical connection	51
Figure 34	Semiautomated operation – Electrical connections	52
Figure 35	Semiautomated operation – Tubing setup with two dosing units	53
Figure 36	Semiautomated operation – Tubing setup with four dosing units	54
Figure 37	Semiautomated operation – Tubing setup – Details 894 Professional CVS	55
Figure 38	Automated operation – Electrical connections	57
Figure 39	Automated operation – Tubing setup – Overview	59
Figure 40	Automated operation – Tubing setup – Details 894 Professional CVS	60
Figure 41	Automated operation – Tubing setup – 800 Dosino details	61
Figure 42	Automated operation – Tubing setup – 858 Professional Sample Processor details – Guide chain	62



Figure 43	Automated operation – Tubing setup – Adding rinsing solution and pumping out the waste solution	63
Figure 44	Automated operation – Tubing configuration – Rinsing and waste solutions – Details 894 Professional CVS	64
Figure 45	Removing the measuring head	67
Figure 46	Do not touch the drive disk	68
Figure 47	Dummy cell test – Ideal curve progression	69
Figure 48	Replacing electrode cables	70
Figure 49	Adjusting the sample needle in the Sample Processor	71

1 Introduction

1.1 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).



1.2 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.

1.3 About the documentation



CAUTION

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

1.3.1 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"

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 instrument part in the figure.
1	Instruction step
	Carry out these steps in the sequence shown.
Method	Dialog text, parameter in the software
File ▶ New	Menu or menu item
[Next]	Button or key
	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.
	CAUTION
	This symbol draws attention to possible damage to instruments or instrument parts.
	NOTE
	This symbol highlights additional information and tips.

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.

1.4.4 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.



1.4.5 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.

1.4.6 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.

2 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".

2.1 Front

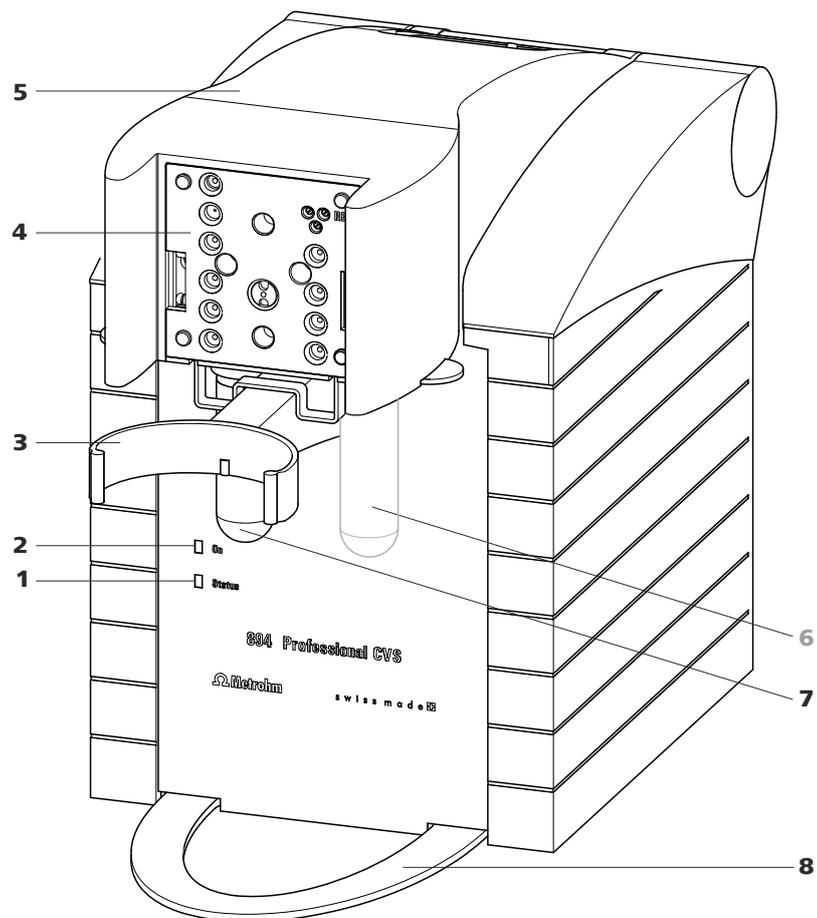


Figure 1 894 Professional CVS front

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) <i>Not relevant for CVS analyses.</i>
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.

2.2 Rear

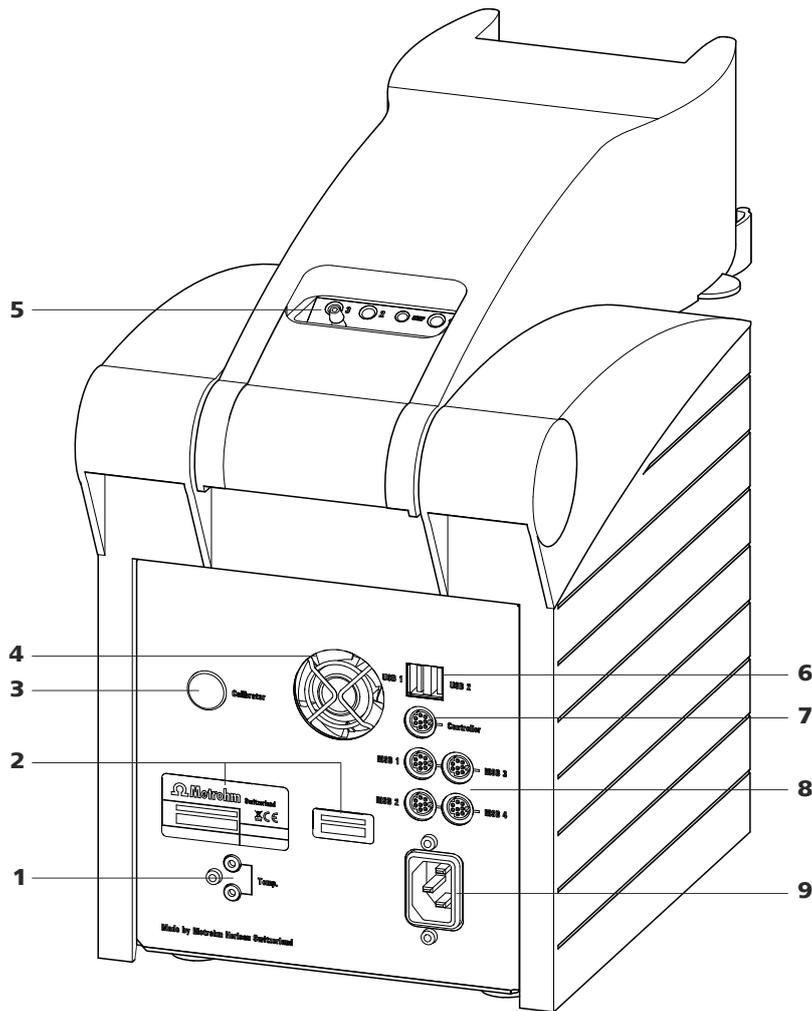


Figure 2 894 Professional CVS rear

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.

5 Tubing connector (measuring head arm)
See Chapter 2.5, page 14.

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.



2.3 RDE measuring head

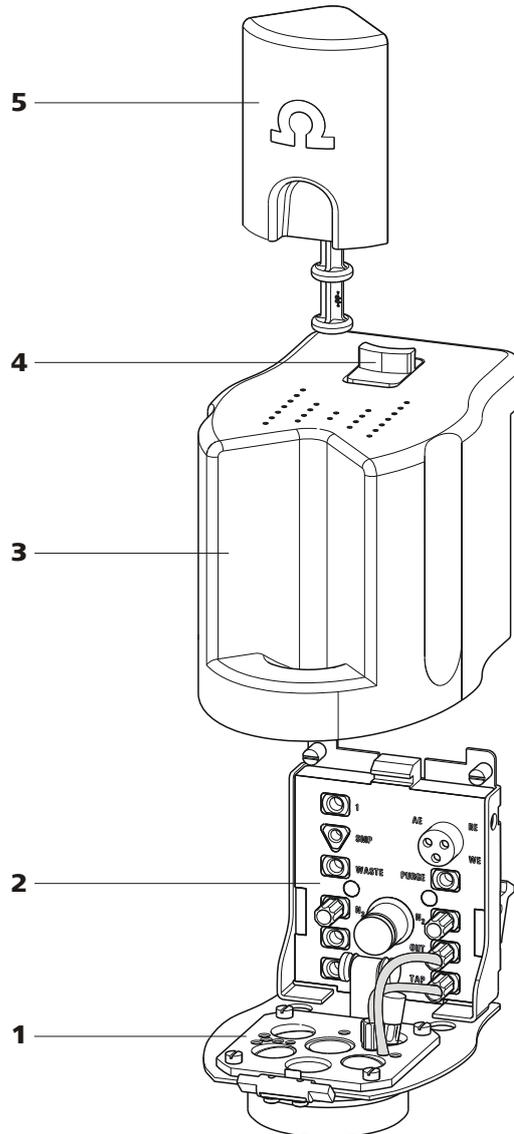


Figure 3 RDE measuring head - Overview

1 Measuring head insert

With openings for inserting electrodes and tubing connections (see Figure 5, page 13).

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 11).

- 3 Measuring head cover**
For shielding against electromagnetic interference.
- 5 Stopper (6.2709.100)**
For closing the pipetting opening (5-22).

- 4 Slide lock**
For measuring head cover.

2.4 Measuring head connector plate and measuring head insert

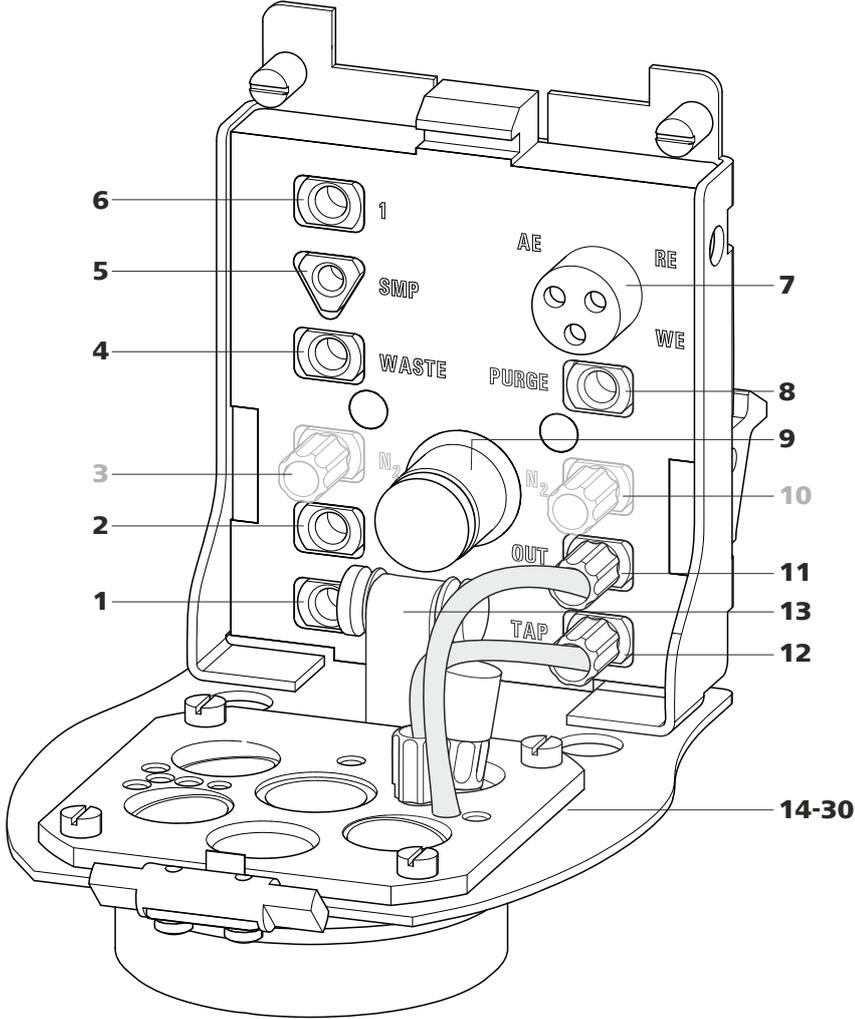


Figure 4 Measuring head connector plate

- 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 (N₂) With preinstalled stopper. <i>Not relevant for CVS analyses.</i>	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. <i>Not relevant for CVS analyses.</i>
9 Drive shaft for rotating disk electrode (RDE)	10 M6 threaded opening (N₂) With preinstalled stopper. <i>Not relevant for CVS analyses.</i>
11 M6 threaded opening (OUT) With preinstalled tubing connection to opening 18 - gas outlet. <i>Not relevant for CVS analyses.</i>	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. <i>Not relevant for CVS analyses.</i>	14 - 30: see next figure

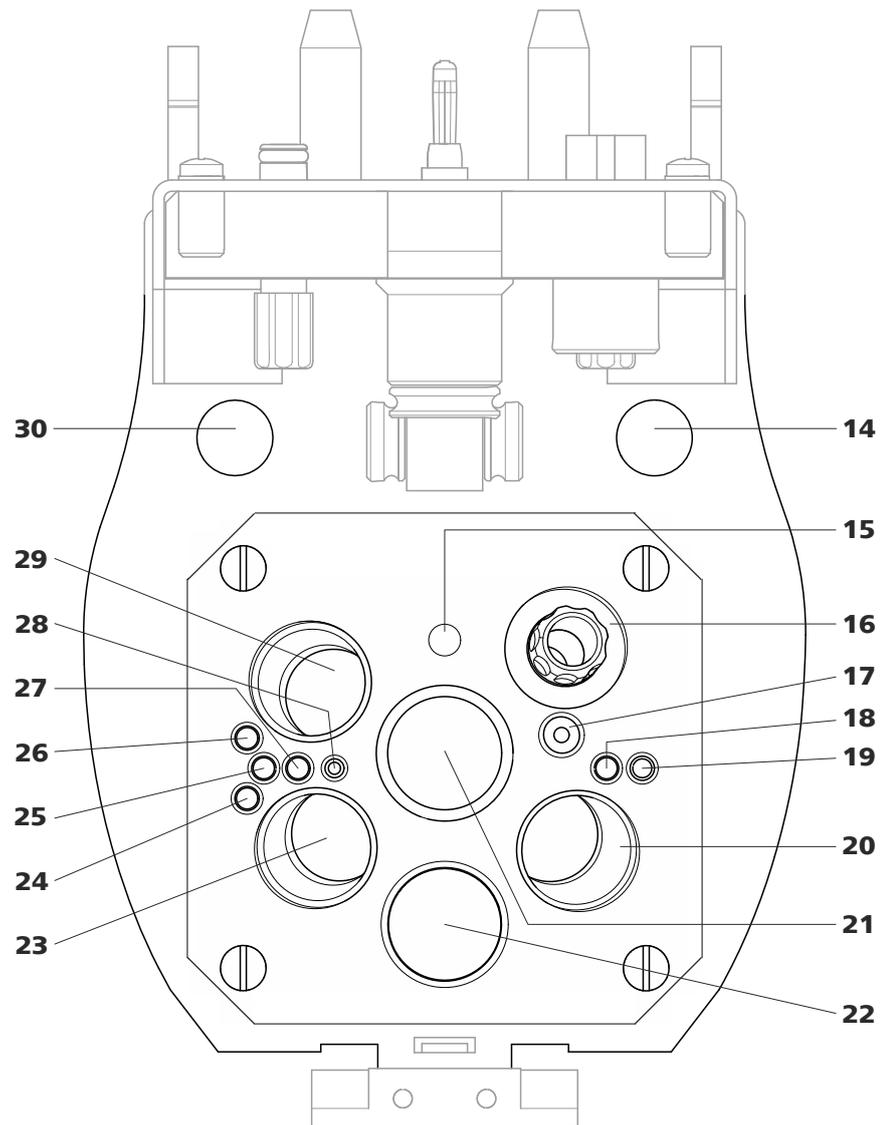


Figure 5 Measuring head insert

14 Opening

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

16 Threaded opening

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

18 Opening

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

15 Opening

For positioning the driving axle.

17 M6 threaded opening

With preinstalled tubing connection to the threaded opening **13** (TAP) - gas inlet. *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).

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).

2.5 Tubing connector (measuring head arm)

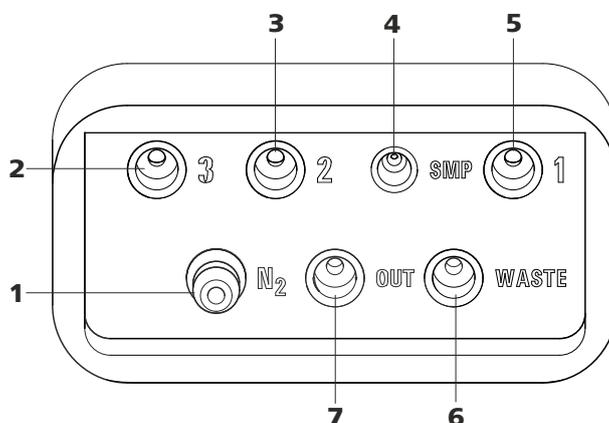


Figure 6 Tubing connector (measuring head arm)

1 Nipple (N₂)

Is connected to threaded openings **TAP**, **PURGE** and **N₂** via the measuring head arm. *Not relevant for CVS analyses.*

2 M6 threaded opening (3)

For connecting tubing for aspirating or adding solutions.



3 Installation

3.1 Setting up the instrument

3.1.1 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.

3.1.2 Checks

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

3.1.3 Location

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

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.

3.2 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.

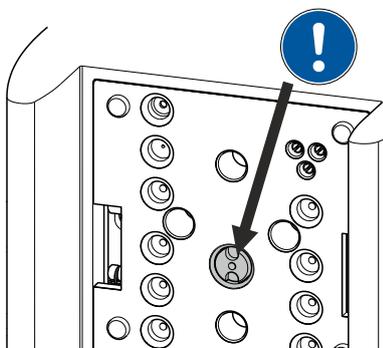


Figure 7 Do not touch the drive disk

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.

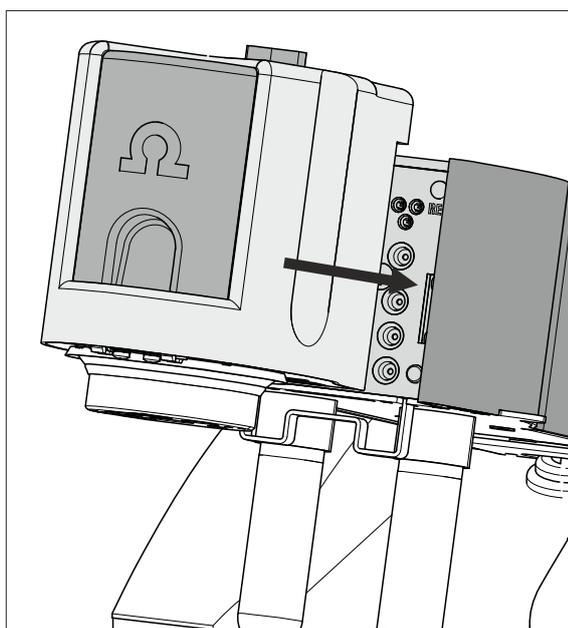


Figure 8 Inserting the measuring head

3

Remove the stopper from the pipetting opening.

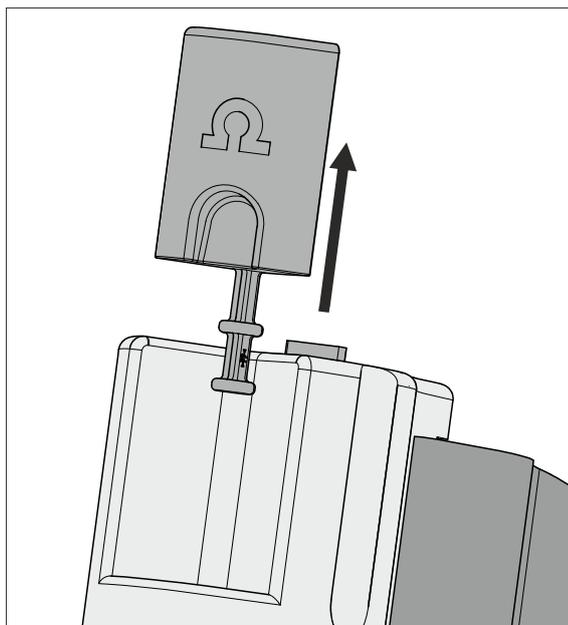


Figure 9 Removing the stopper from the pipetting opening

- 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.

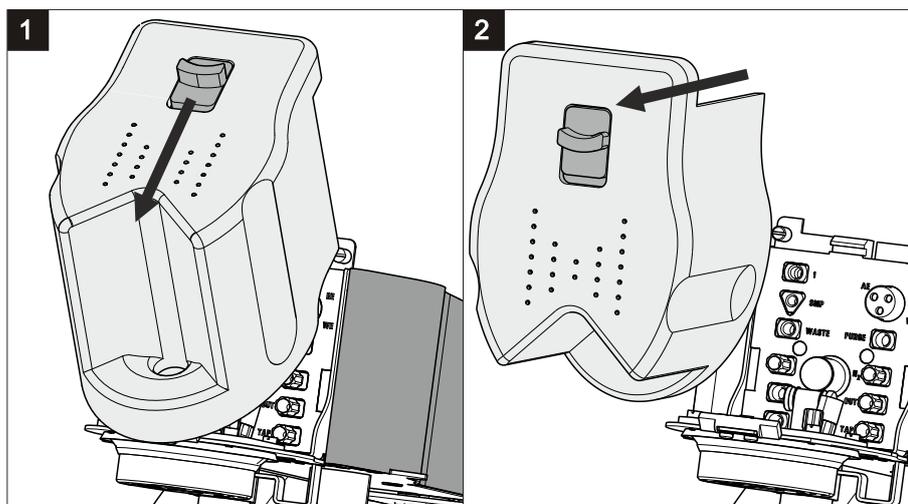


Figure 10 Removing the measuring head cover

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.

3.2.1 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.

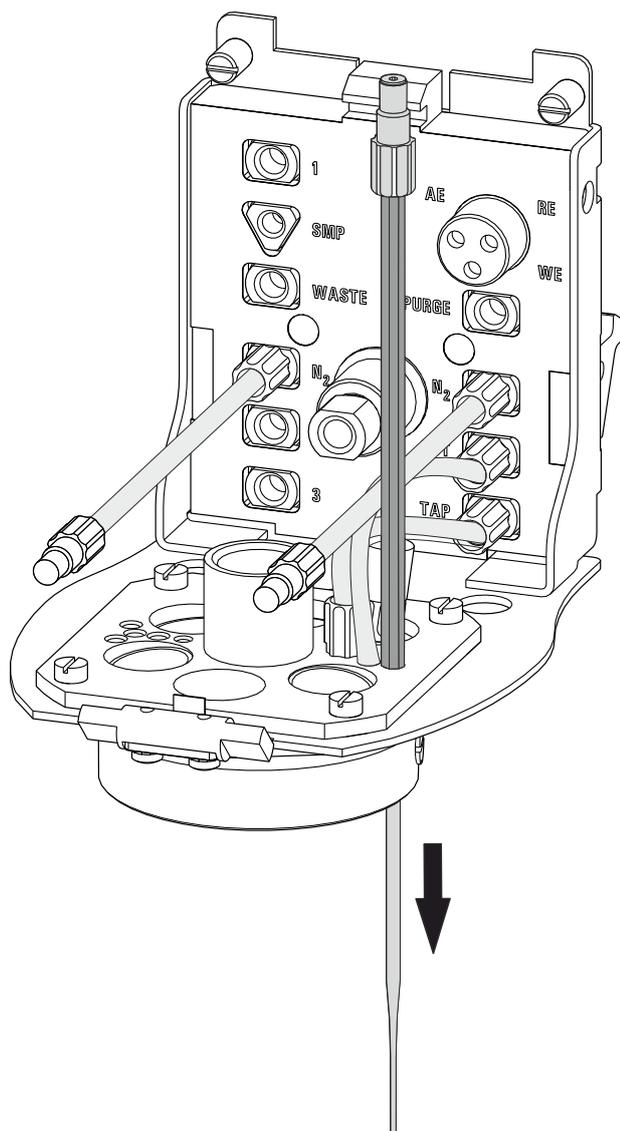


Figure 11 Inserting the gas inlet

- 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).

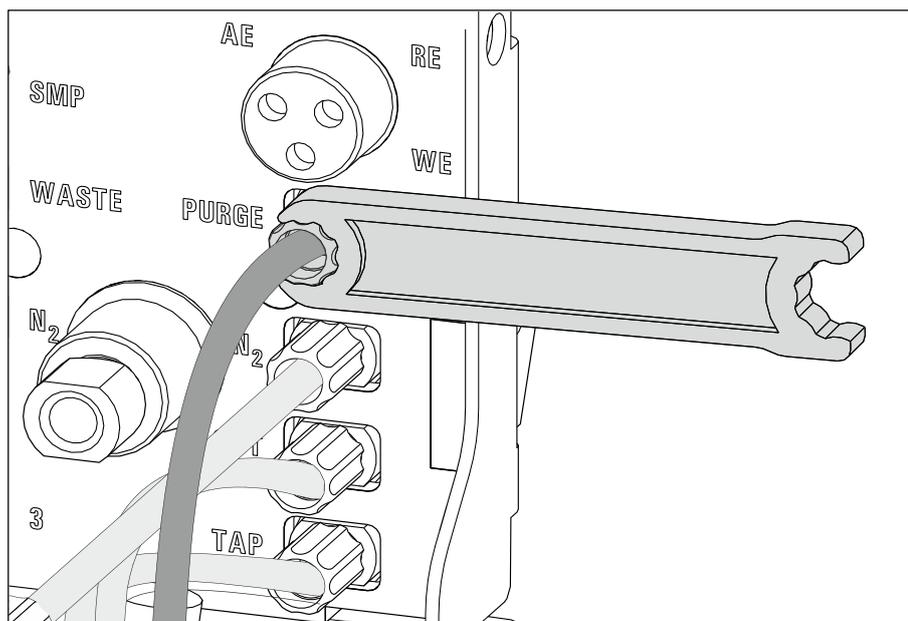


Figure 12 Connecting the gas inlet

3.2.2 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 3.2.1, page 19). If the instrument is only going to be used for CVS applications, the gas inlet does not have to be connected.



3.2.2.1 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.

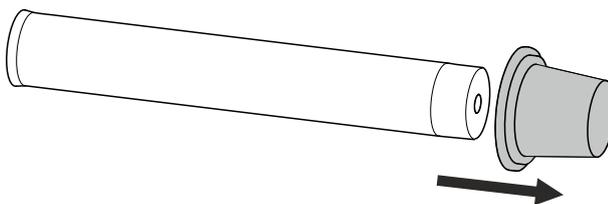


Figure 13 Removing the protective cap from the electrode tip

2 Assembling the working electrode

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

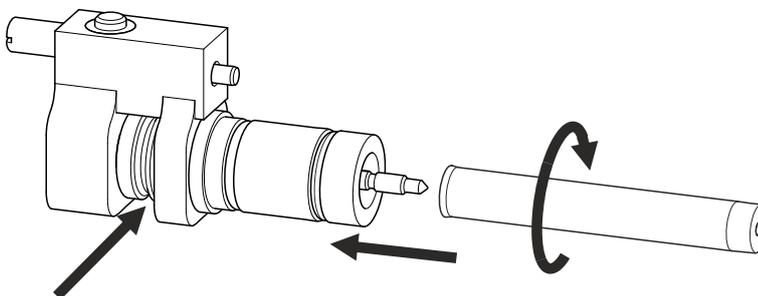


Figure 14 Tightening the electrode tip to the driving axle

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.



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.

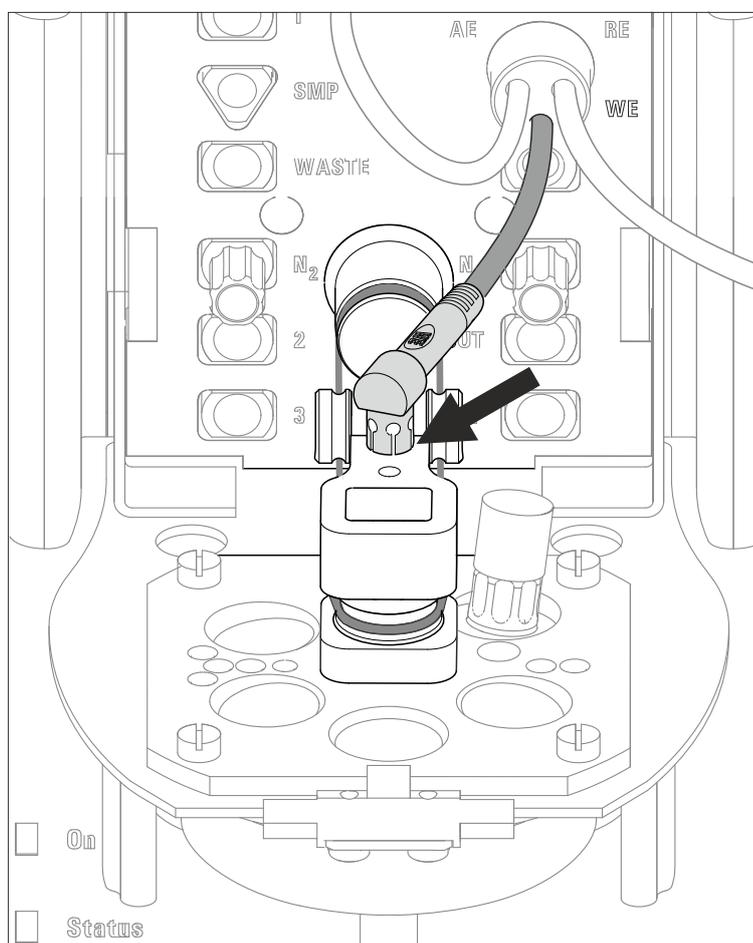


Figure 17 Connecting the working electrode

3.2.2.2 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. $c(\text{KNO}_3) = 1 \text{ mol/L}$) 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.

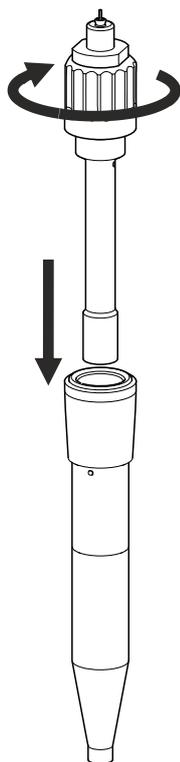


Figure 18 Assembling the reference electrode with the electrolyte vessel

- 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.

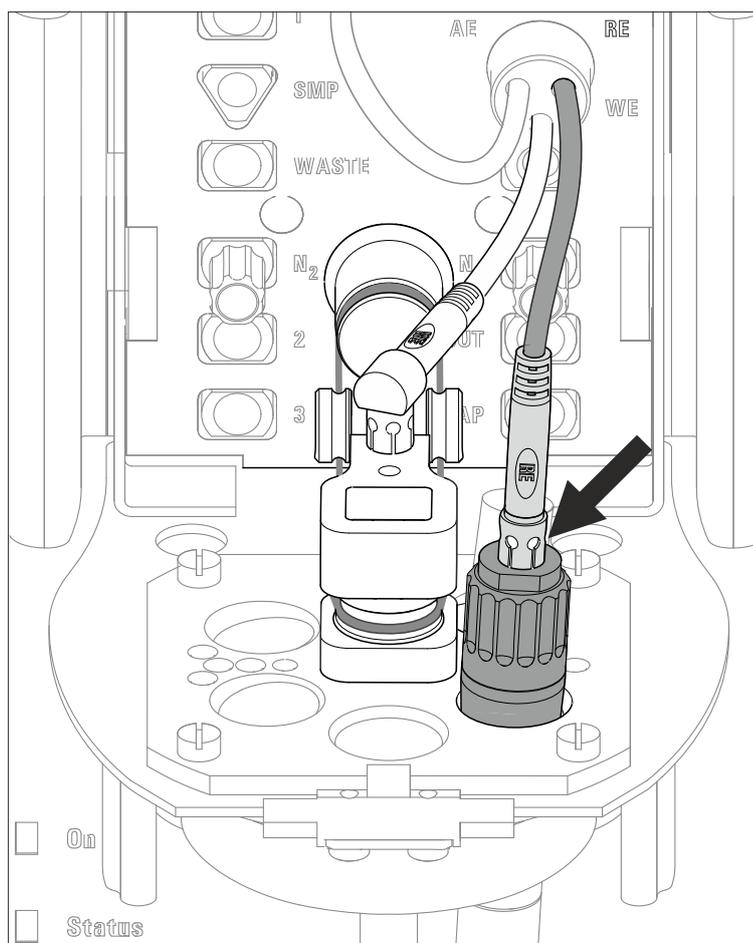


Figure 19 Connecting a reference electrode

3.2.2.3 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.

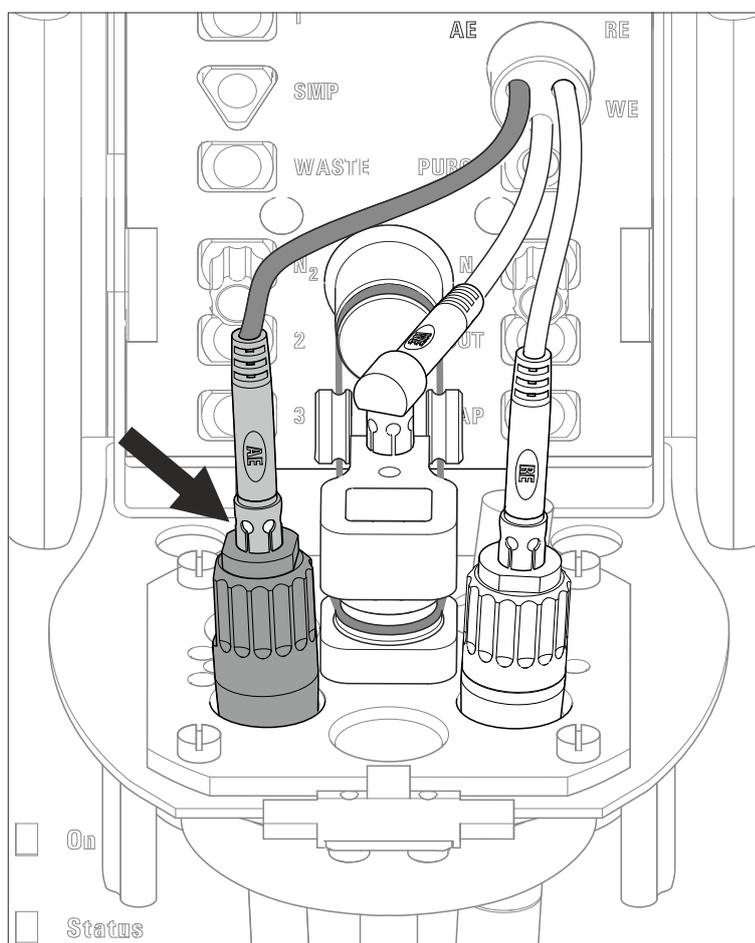


Figure 20 Connecting the auxiliary electrode



3.3 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.

3.3.1 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 *Chapter 3.4.3, page 43*.

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.

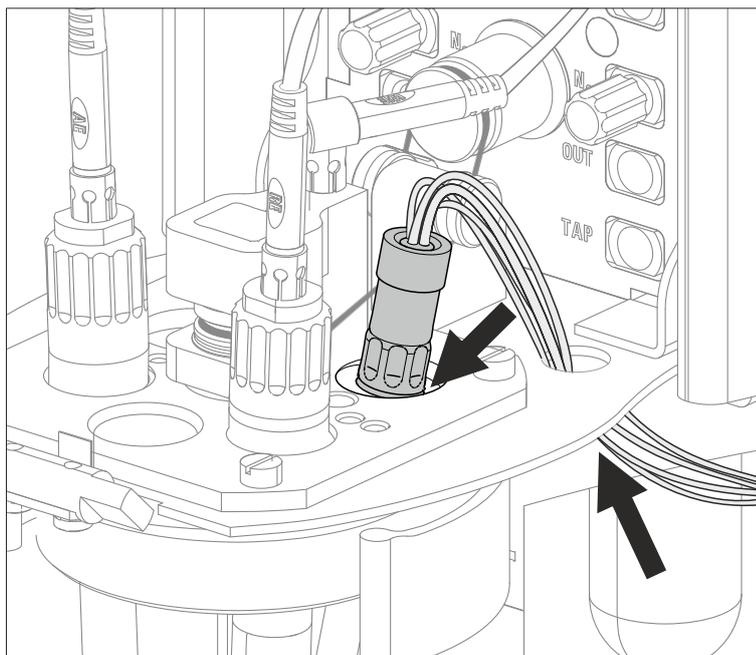


Figure 21 Inserting the four-way micro dosing tip

- 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).

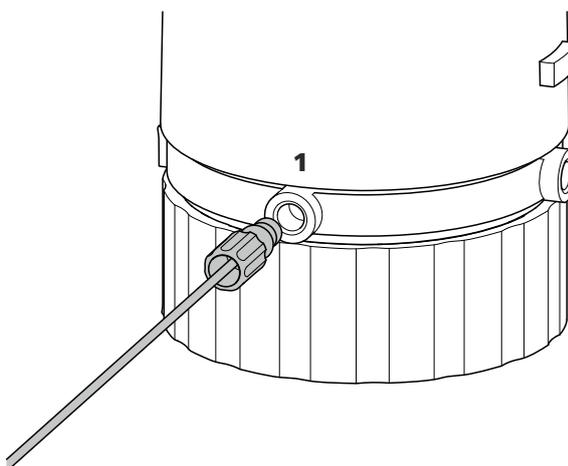


Figure 22 Screwing a PTFE capillary to a dosing unit



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).

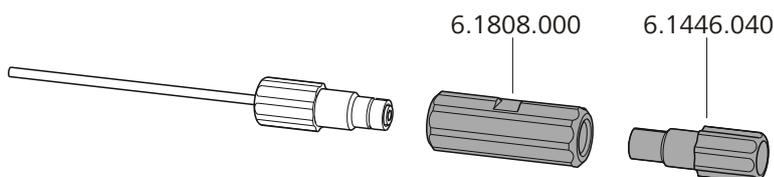


Figure 23 Sealing the PTFE capillary of a four-way micro dosing tip

3.3.2 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 (*see figures in Chapter 5.3.2, page 58*). 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 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:

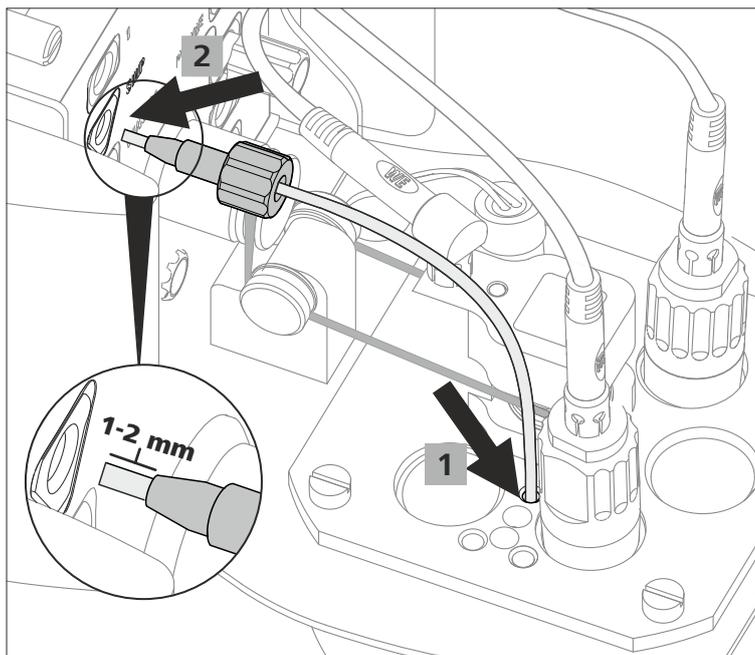


Figure 24 Inserting a PEEK capillary into the measuring head

- 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 2.5, page 14*) 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.

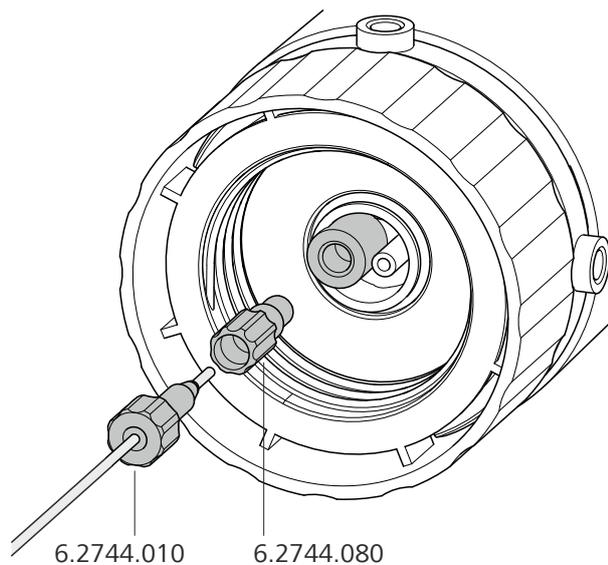


Figure 25 Screwing a capillary to a dosing unit

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.

3.3.3 Installing FEP tubing

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

- Rinsing solution – adding via 843 Pump Station (see Figure 43, page 63 and Figure 44, page 64)
- Waste solution – aspirating via 843 Pump Station (see Figure 43, page 63 and Figure 44, page 64)
- Auxiliary solutions (e.g. buffer, electrolyte, VMS, etc.) – adding via 800 Dosino with dosing unit (see Figure 41, page 61)



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.

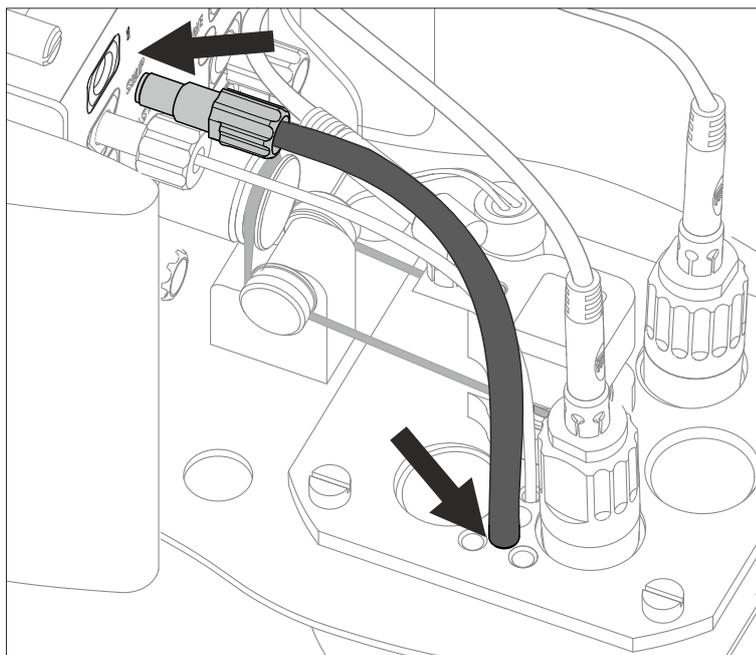


Figure 26 Inserting a piece of FEP tubing into the measuring head



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:

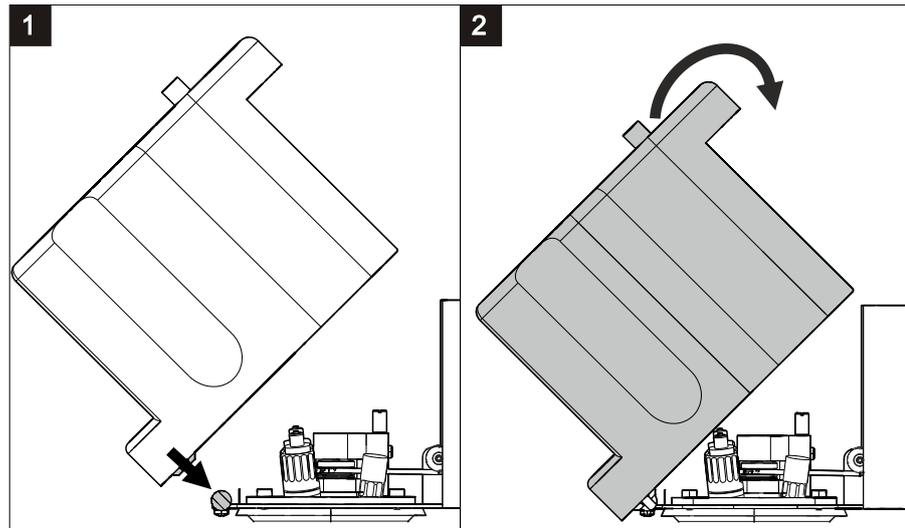


Figure 27 Installing the measuring head cover

- 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.

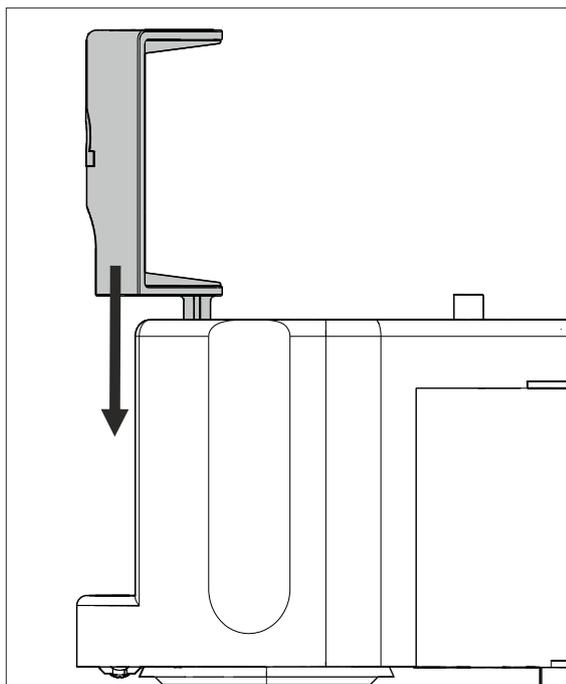


Figure 28 Inserting the stopper in the pipetting opening

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 (see Figure 43, page 63).

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. Figure 43, page 63 provides an overview of the tubing between the rinsing canister, 843 Pump Station and 894 Professional CVS.

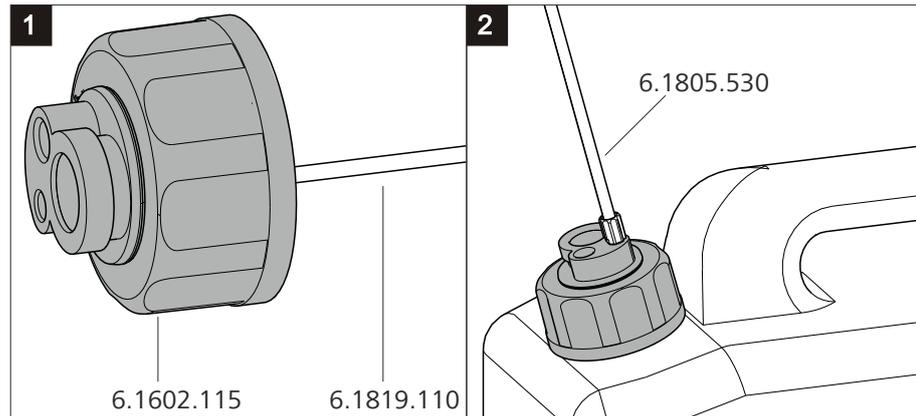


Figure 29 Installing a bottle cap with pieces of tubing on a rinsing canister

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. *Figure 43, page 63* provides an overview of the tubing between the waste canister, 843 Pump Station and 894 Professional CVS.

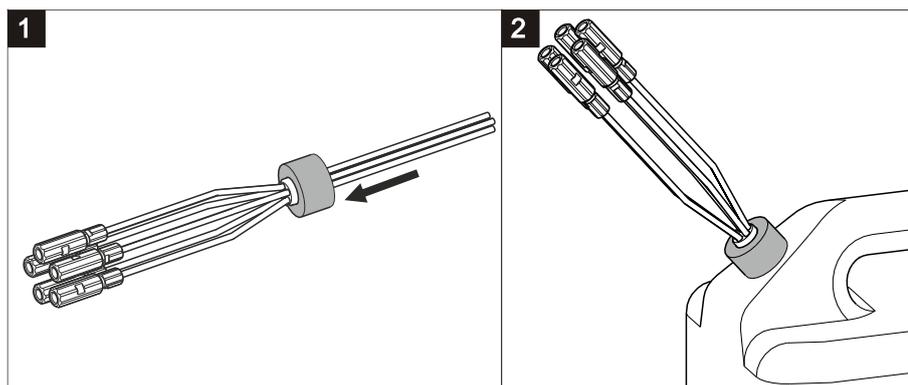


Figure 30 Connecting the five-way tubing connector to a waste canister

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:

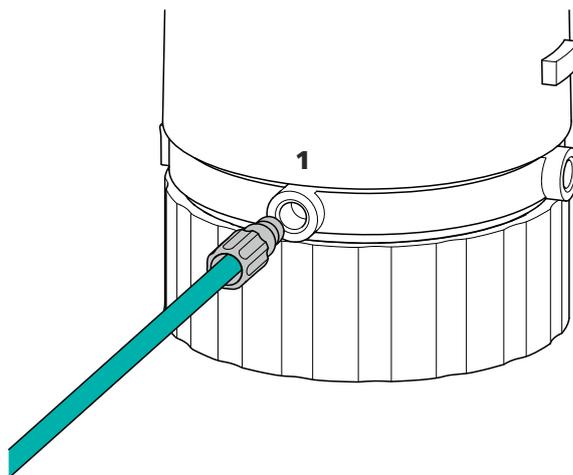


Figure 31 Connecting FEP tubing to the dosing unit (auxiliary solution)

- 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.).

3.4 Connecting instruments electrically

3.4.1 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 mm² / 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.

The power cord is three-core and provided with a plug with grounding. If another plug has to be mounted, connect the yellow/green conductor (IEC standard) to the protective ground (protection class I).

3.4.2 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:

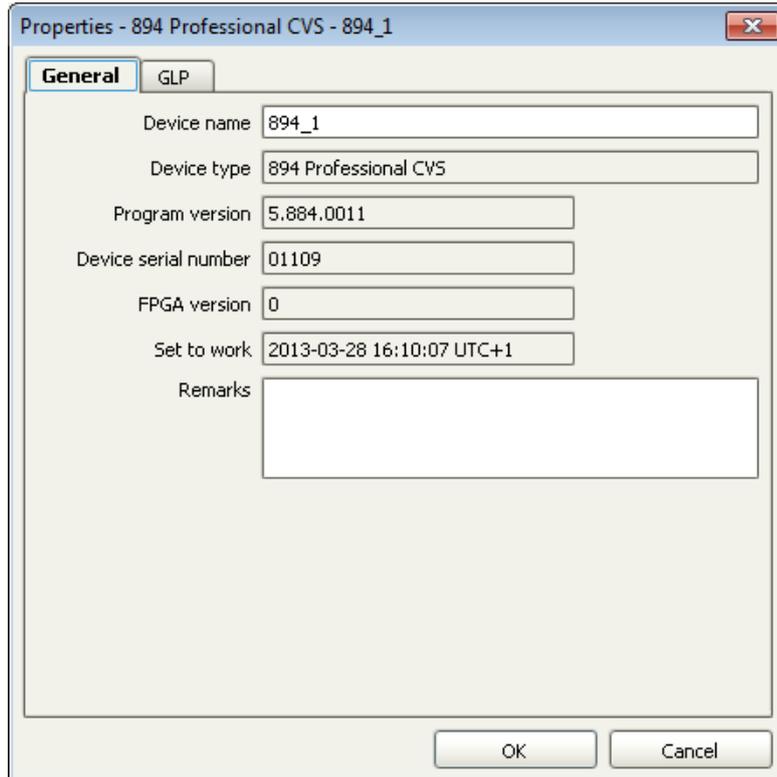
- 1 Start **viva**.

The following dialog window is displayed:



- 2 Click on **Yes**.

The following dialog window is displayed:



- 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.

3.4.3 Connecting an 800 Dosino

You can connect up to four dosing devices of the type 800 Dosino directly to the 894 Professional CVS. As an alternative, you can connect the dosing devices via an 846 Dosing Interface, a sample changer or any other supported instrument that 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.

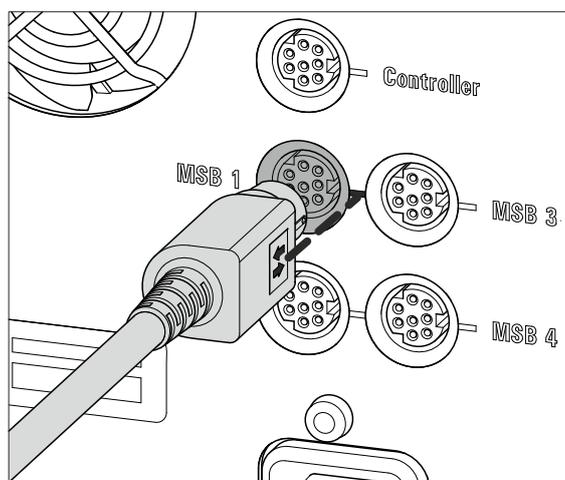


Figure 32 Connecting a dosing device to an MSB socket



NOTE

Information regarding assembling a Dosino with the dosing unit as well as operation and maintenance can be found in the manual of the 800 Dosino.

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

Proceed as follows:

- 1 Connect the connection cable of the 800 Dosino to one of the four MSB connectors of the 894 Professional CVS.

The following dialog window is displayed:



- 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 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.



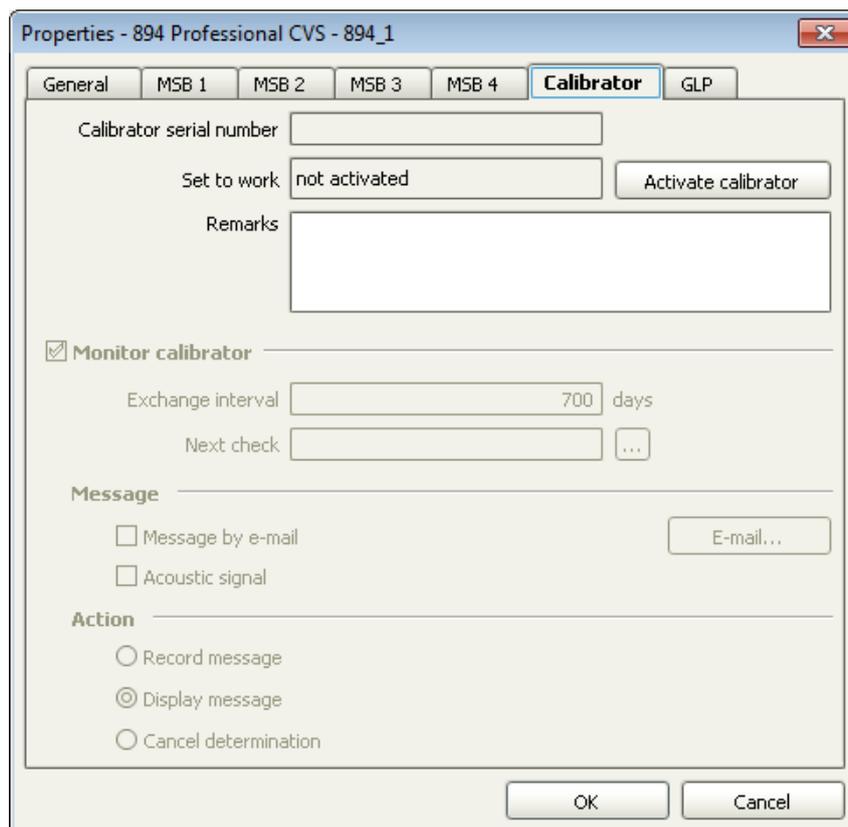
WARNING

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 16.
- 2** Equip the measuring head with the electrodes (see Chapter 3.2.2, page 21).
- 3** Establish the tubing connections in the measuring head and those between the 894 Professional CVS and the peripheral devices (see Chapter 3.3, page 28).
- 4** Attach the measuring head cover and the stopper (3-5) to the measuring head as described in "*Installing the measuring head cover*", page 35.



- 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

Set to work

Remarks

Monitor calibrator

Exchange interval days

Next check ...

Message

Message by e-mail

Acoustic signal

Action

Record message

Display message

Cancel determination



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**).

5 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.

5.1 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).

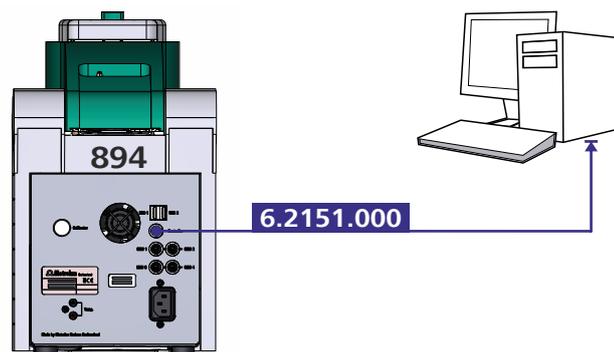


Figure 33 Manual operation - Electrical connection

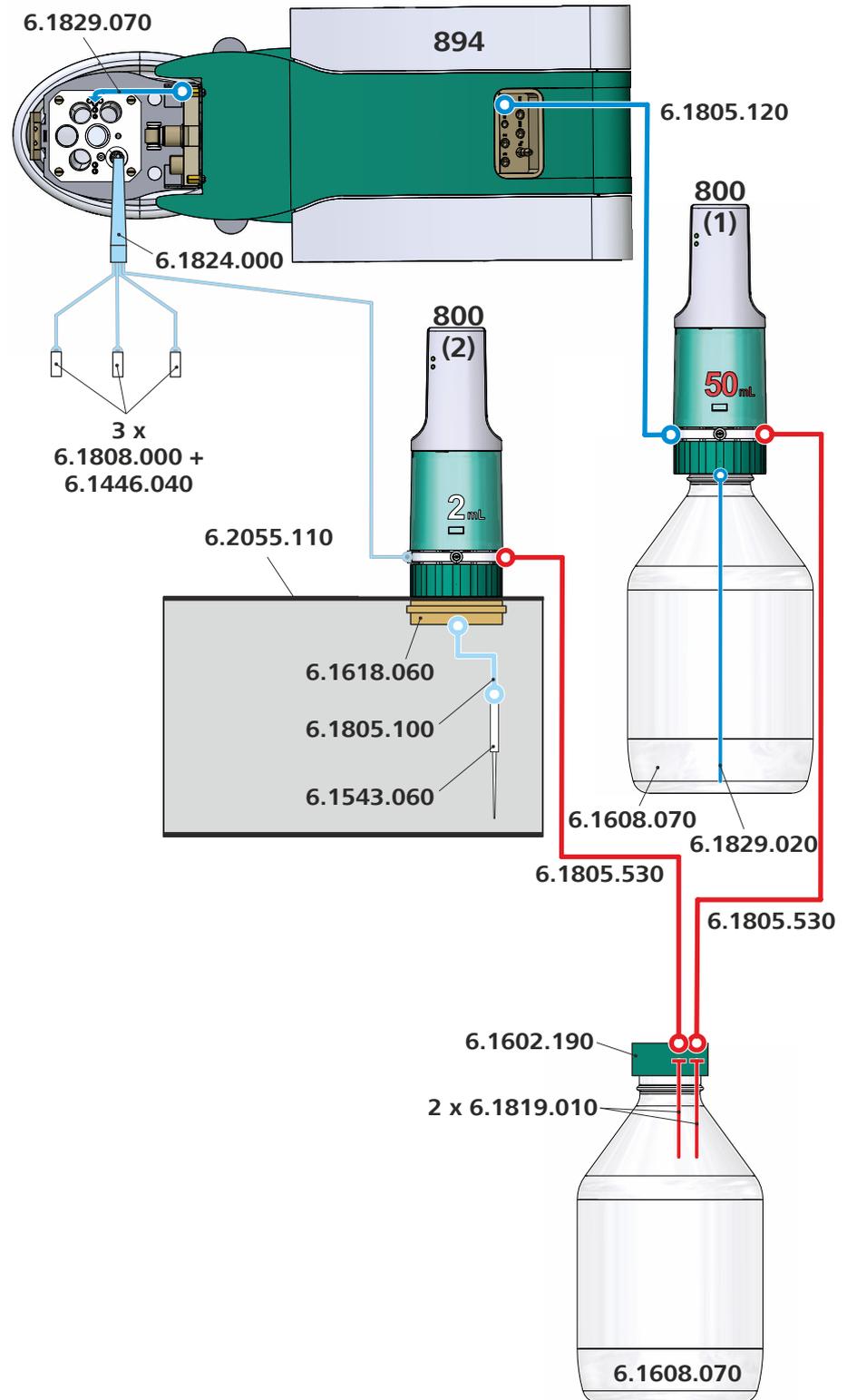


Figure 35 Semiautomated operation – Tubing setup with two dosing units

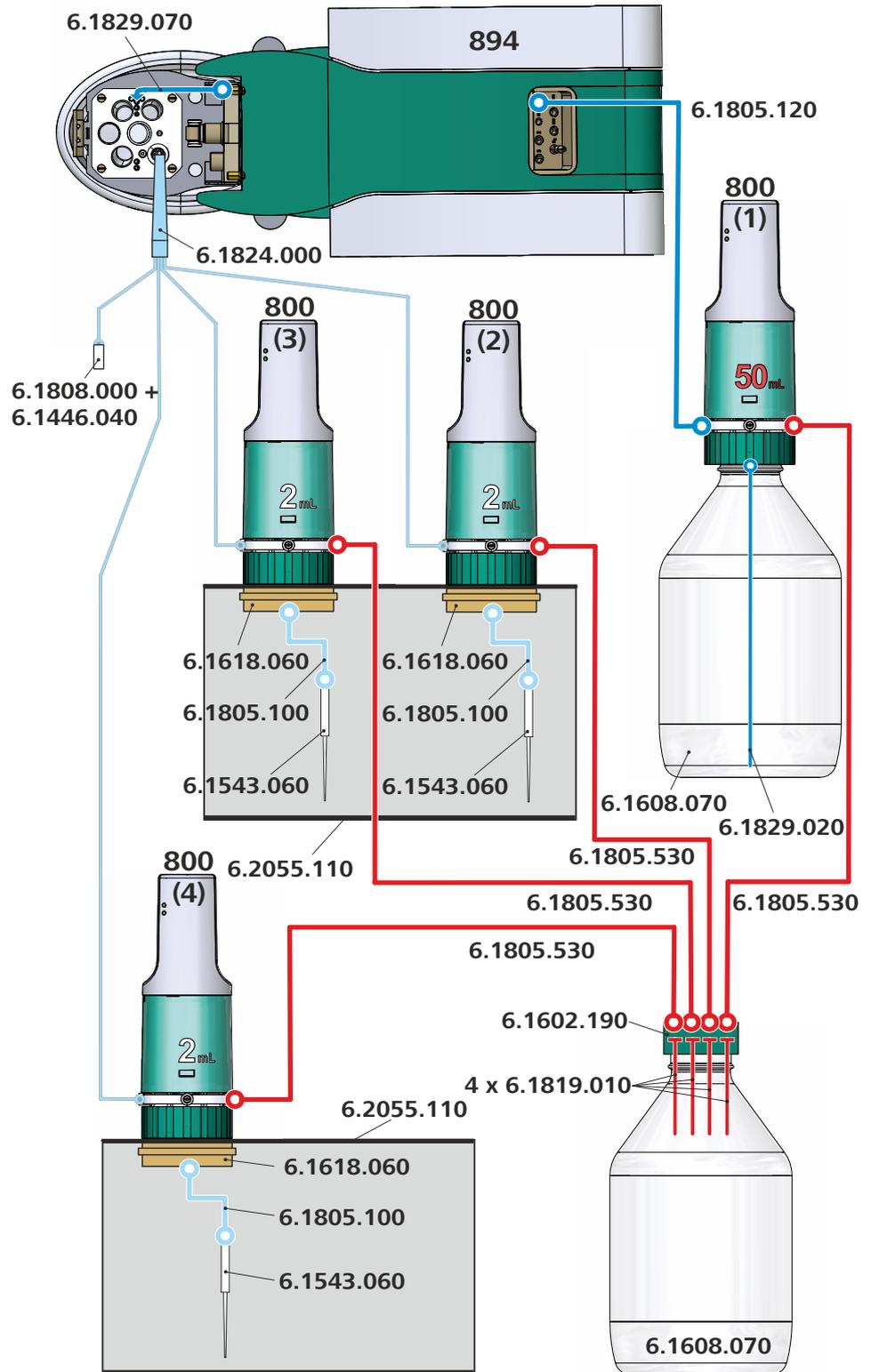


Figure 36 Semiautomated operation – Tubing setup with four dosing units

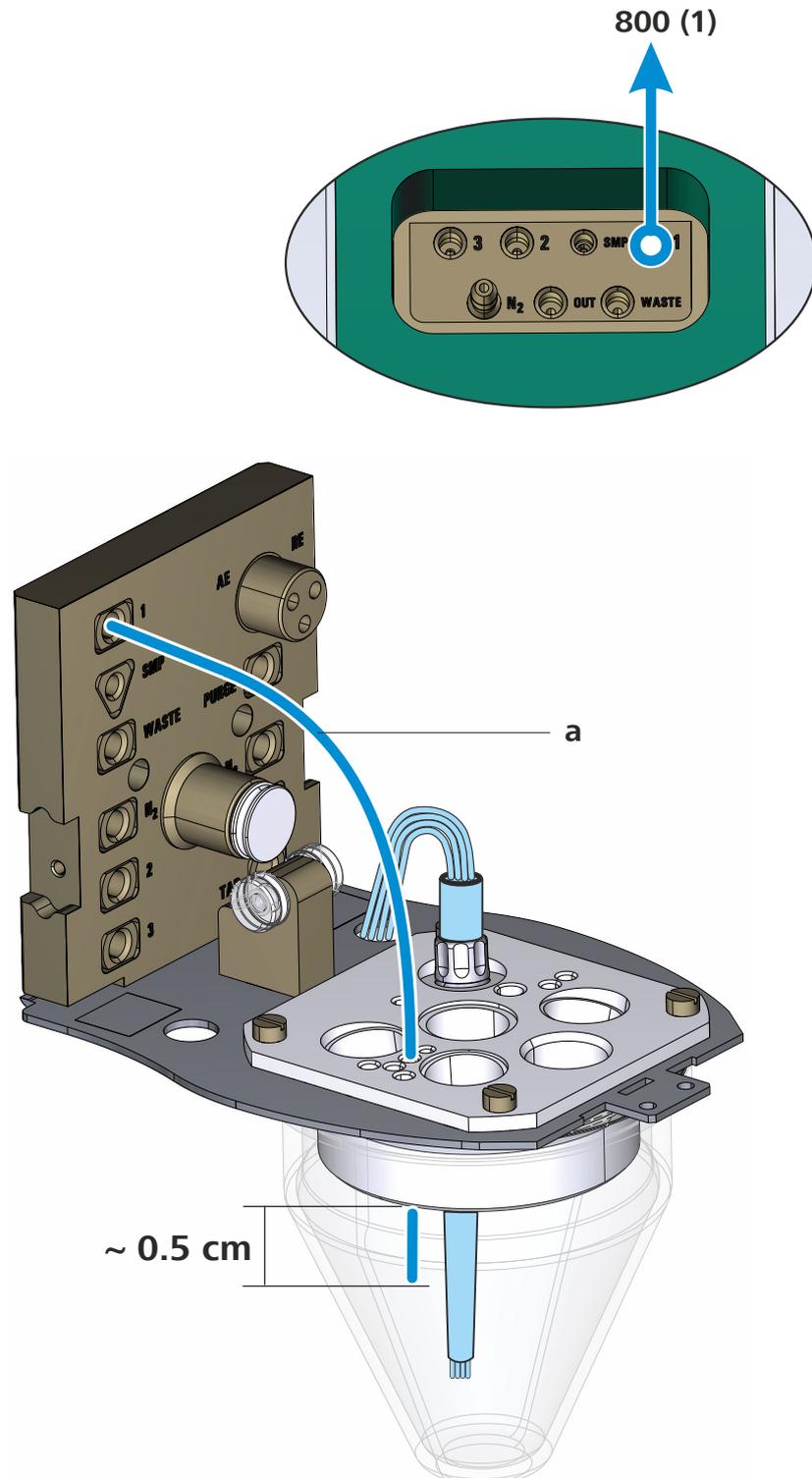


Figure 37 Semiautomated operation – Tubing setup – Details 894 Professional CVS

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



5.3 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)

5.3.1 Connecting devices electrically

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

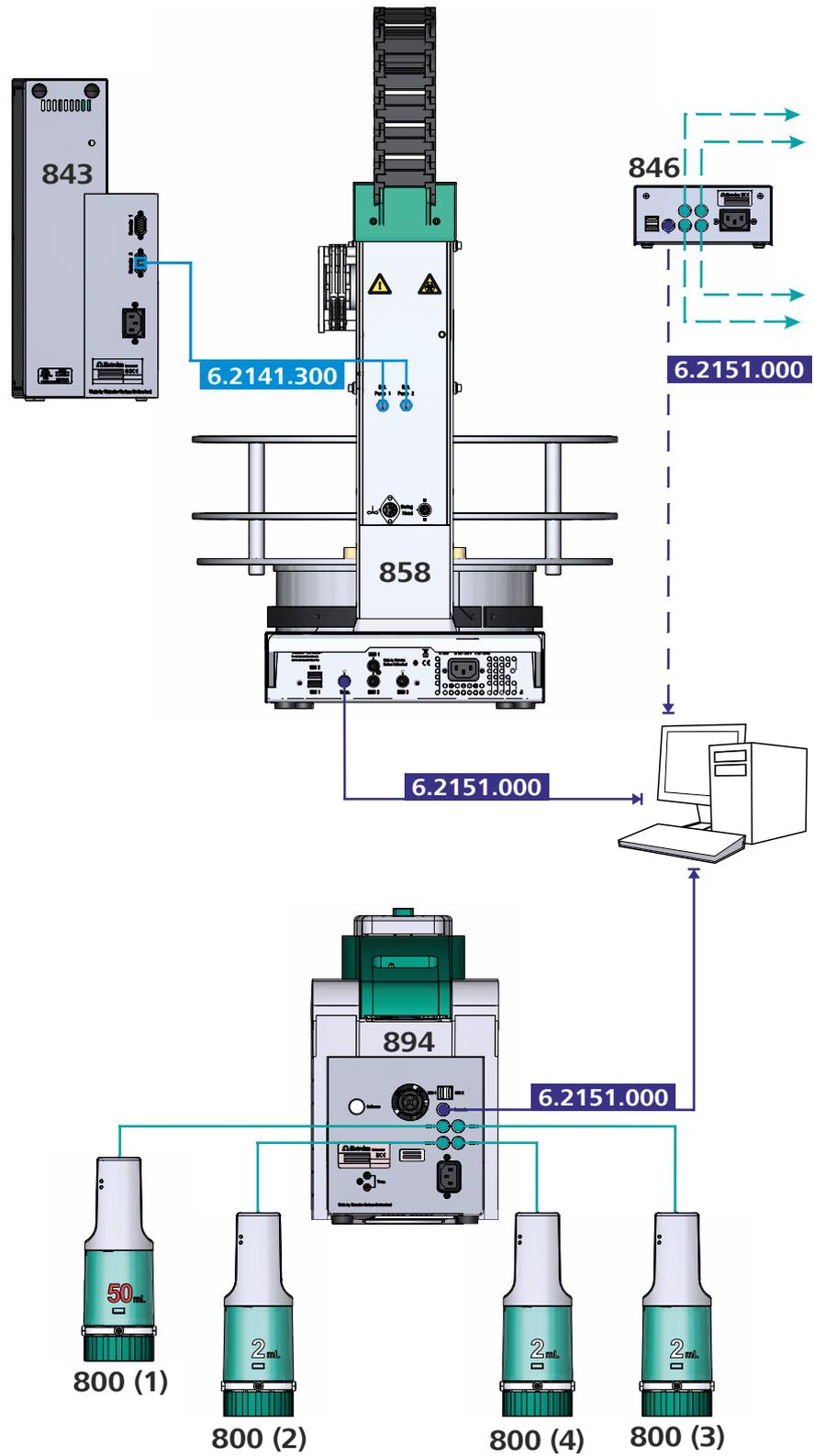


Figure 38 Automated operation – Electrical connections



5.3.2 Establishing the tubing connections

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

<i>Figure 39</i>	<i>Automated operation – Tubing setup – Overview</i>
<i>Figure 40</i>	<i>Automated operation – Tubing setup – Details 894 Professional CVS</i>
<i>Figure 41</i>	<i>Automated operation – Tubing setup – 800 Dosino details</i>
<i>Figure 42</i>	<i>Automated operation – Tubing setup – 858 Professional Sample Processor details – Guide chain</i>
<i>Figure 43</i>	<i>Automated operation – Tubing setup – Adding rinsing solution and pumping out the waste solution</i>
<i>Figure 44</i>	<i>Automated operation – Tubing configuration – Rinsing and waste solutions – Details 894 Professional CVS</i>

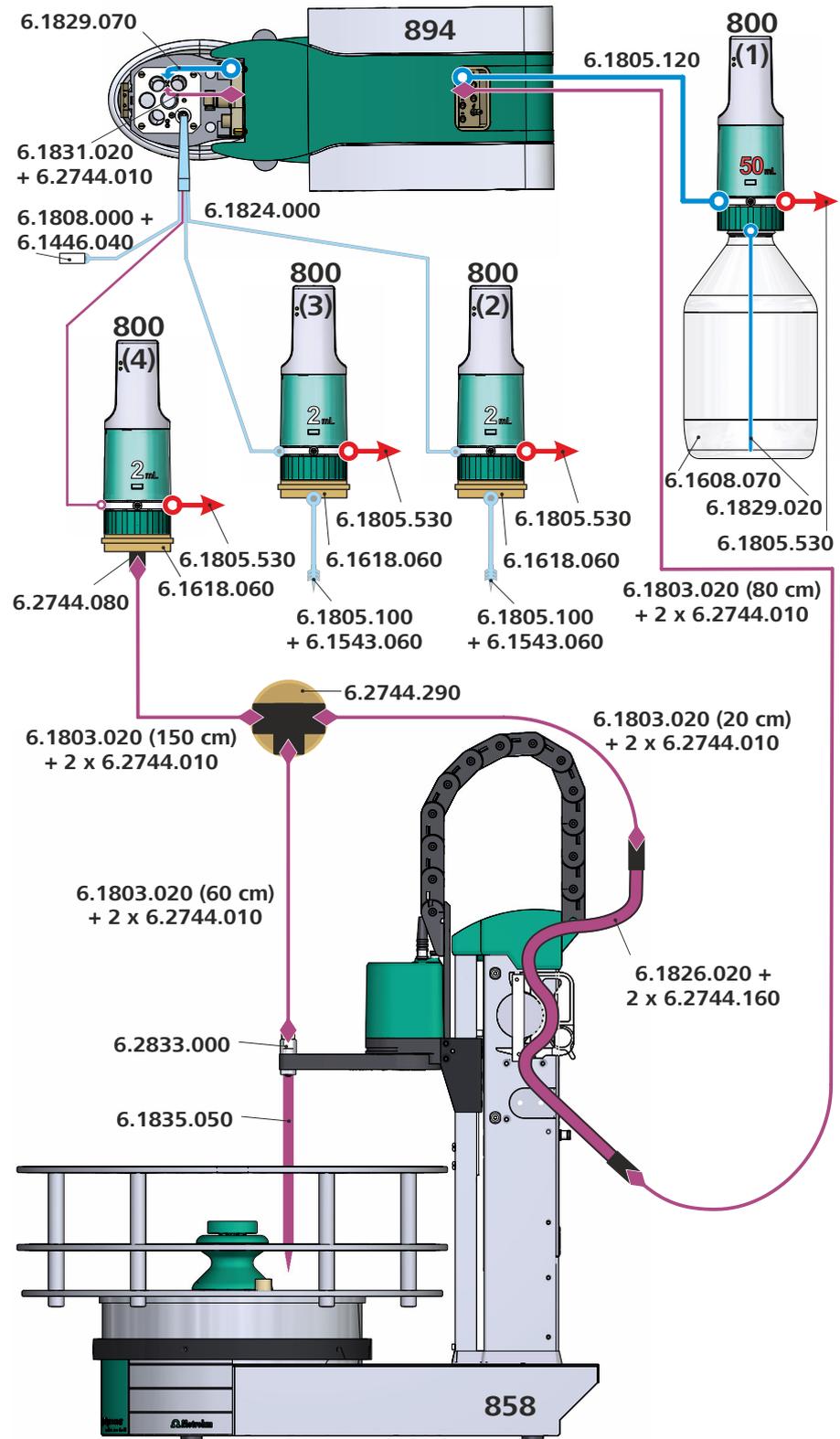


Figure 39 Automated operation – Tubing setup – Overview

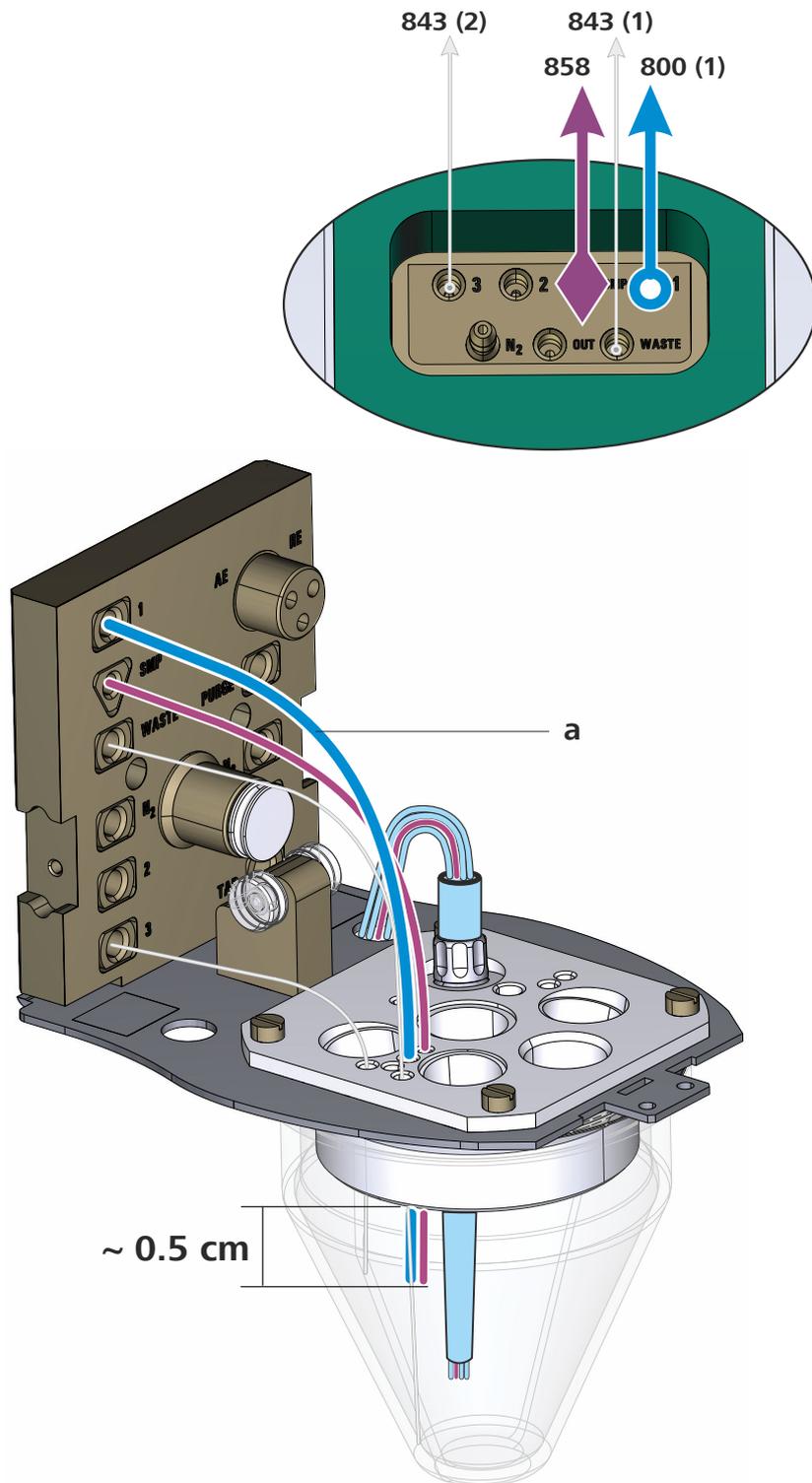


Figure 40 Automated operation – Tubing setup – Details 894 Professional CVS

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

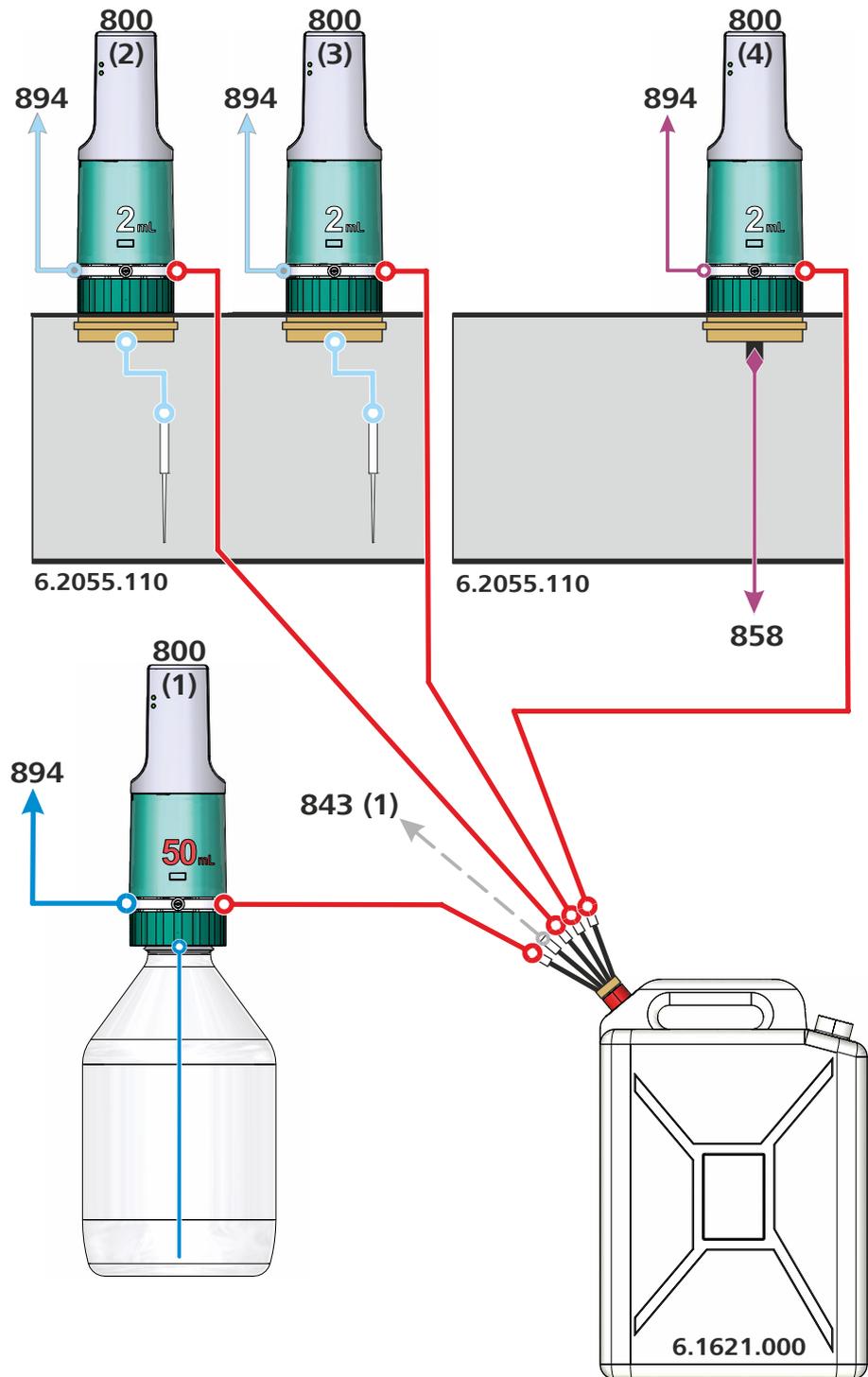


Figure 41 Automated operation – Tubing setup – 800 Dosino details

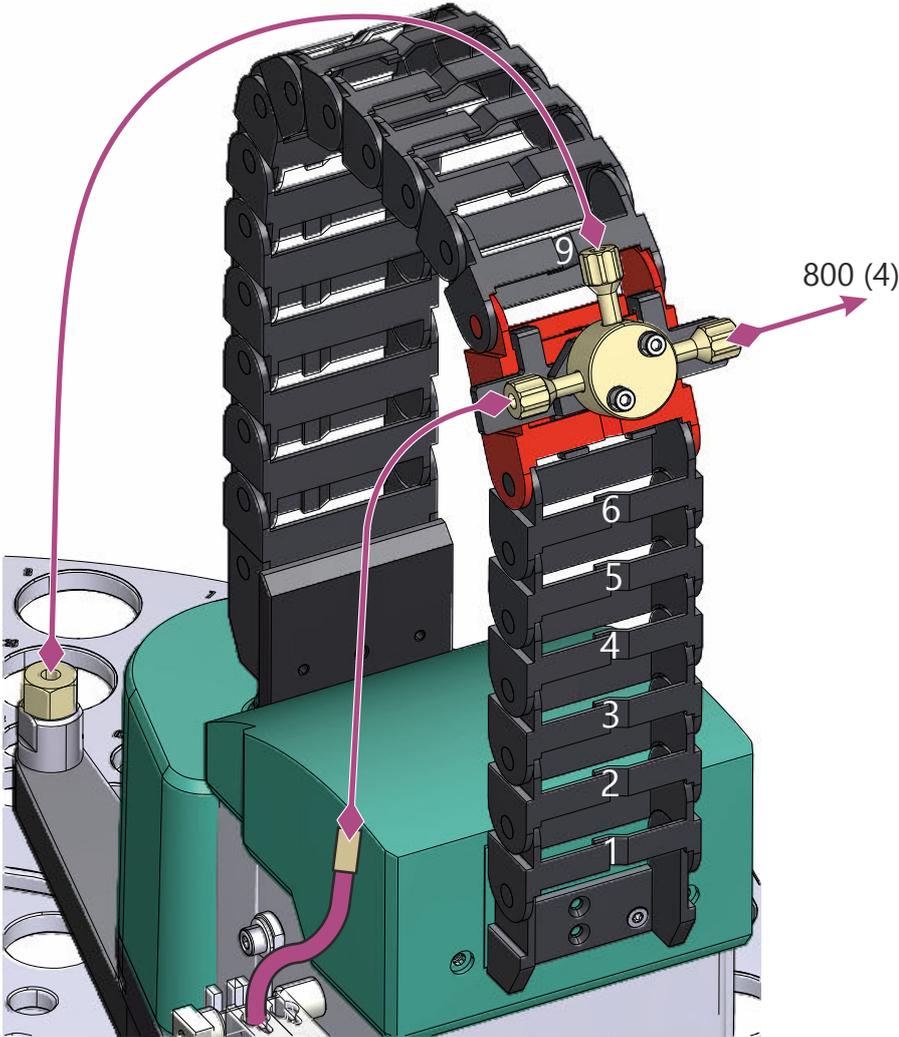


Figure 42 Automated operation – Tubing setup – 858 Professional Sample Processor details – Guide chain

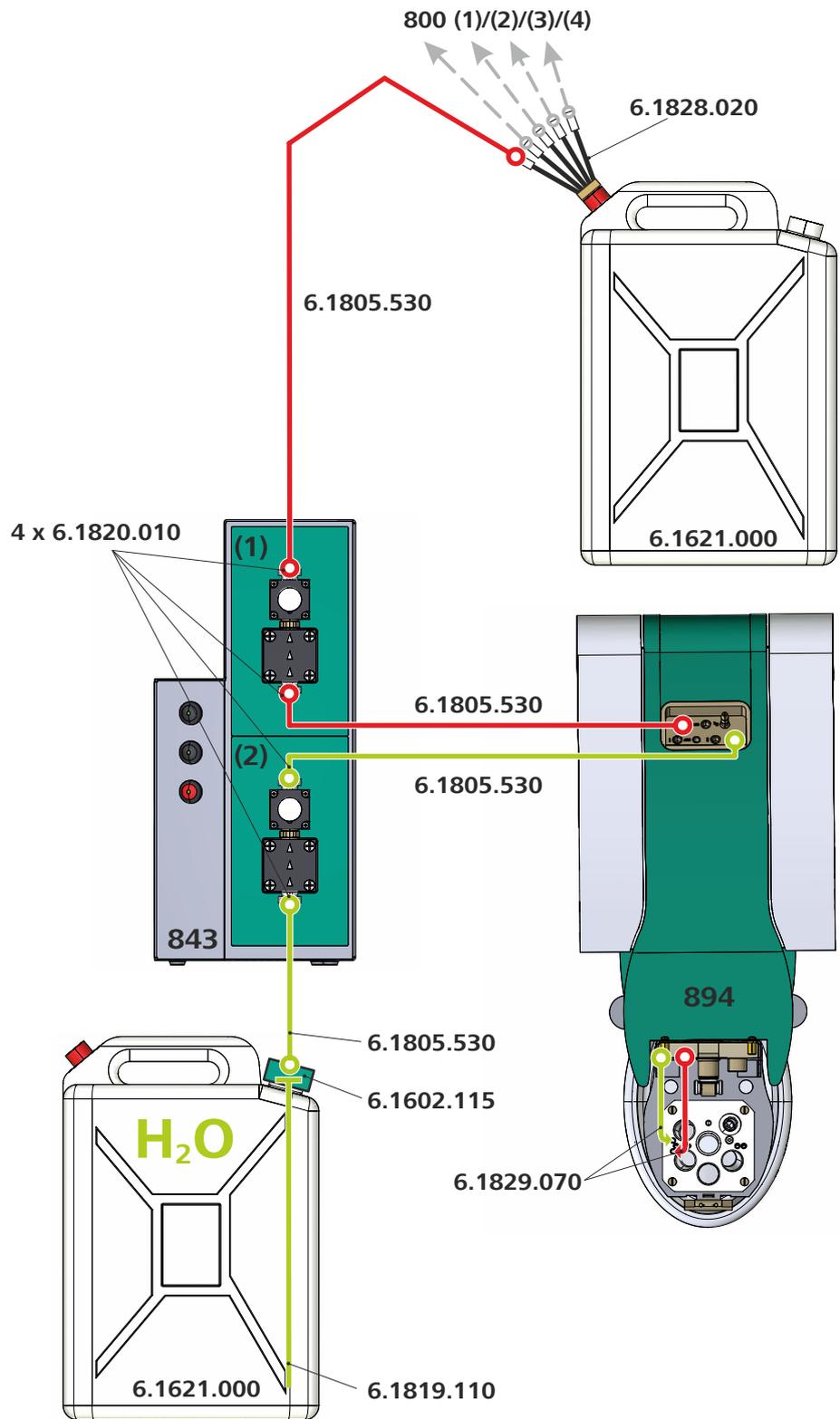


Figure 43 Automated operation – Tubing setup – Adding rinsing solution and pumping out the waste solution

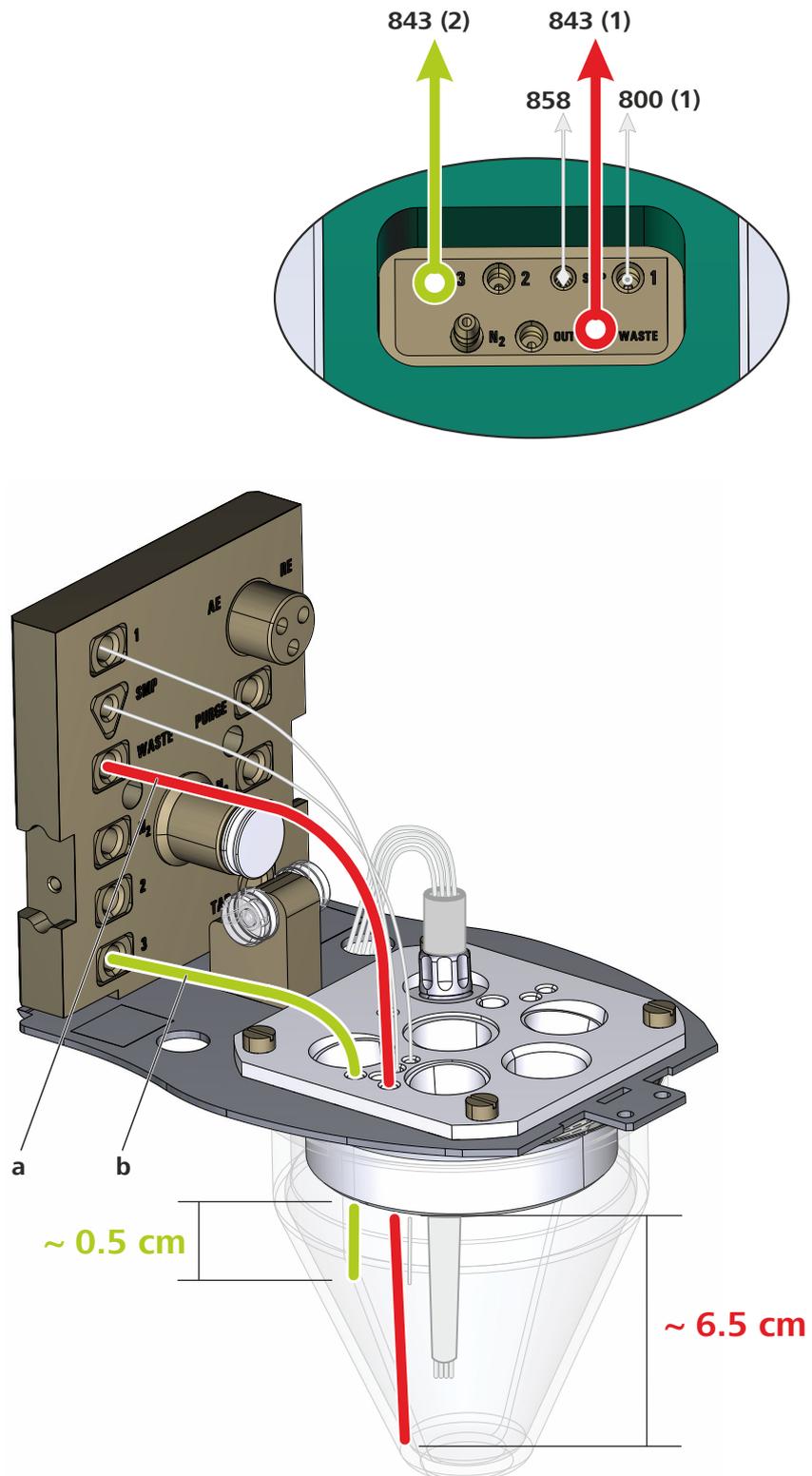


Figure 44 Automated operation – Tubing configuration – Rinsing and waste solutions – Details 894 Professional CVS

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.

6 Operation and maintenance

6.1 Care



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.

The instrument requires appropriate care. Excess contamination of the instrument 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 instrument has been designed so that aggressive media are largely prevented from entering the instrument. However, if liquids should get into the instrument, unplug the power plug immediately to avoid serious damage to the instrument 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.



6.2 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.

6.3 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.

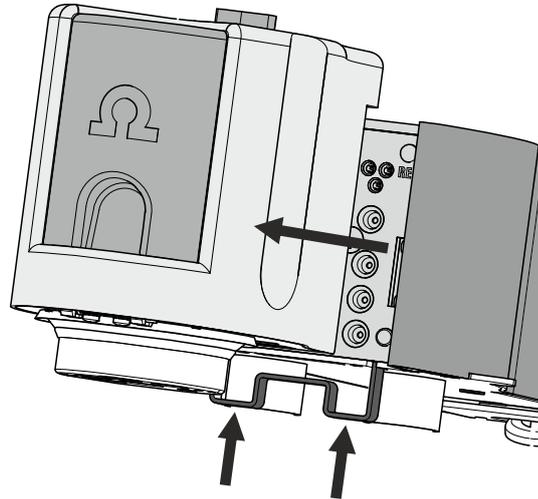


Figure 45 Removing the measuring head

- 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.

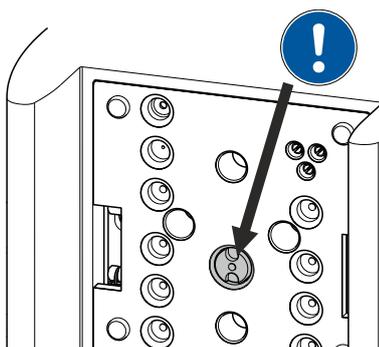


Figure 46 Do not touch the drive disk

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.

6.4 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 three 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 \pm 0.33 mA.
- At $+2.0$ V, the current should be $+1.67$ mA \pm 0.33 mA.

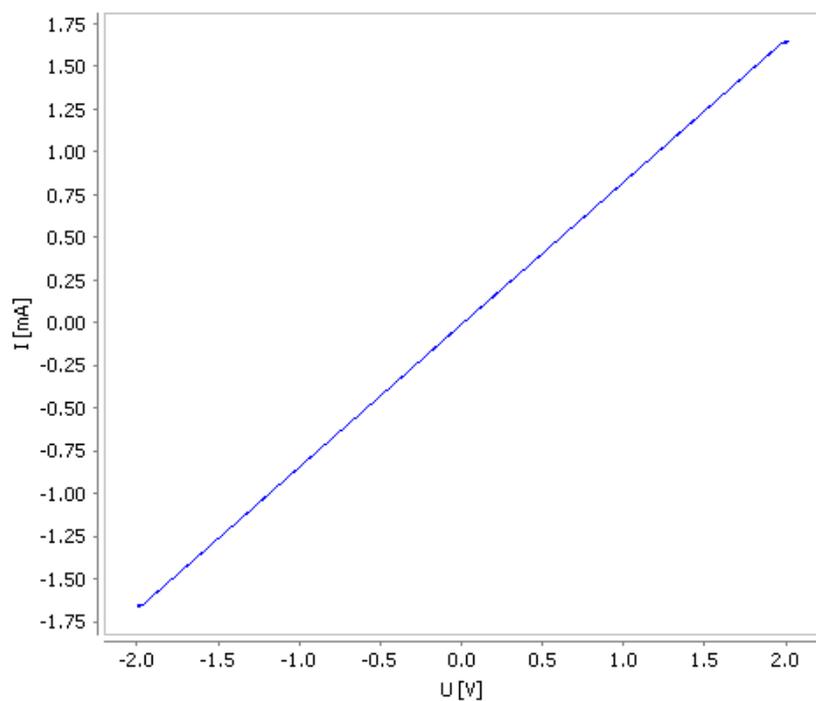


Figure 47 Dummy cell test – Ideal curve progression

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



6.5 Replacing electrode cables

It may be the case that one or more of the three 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:

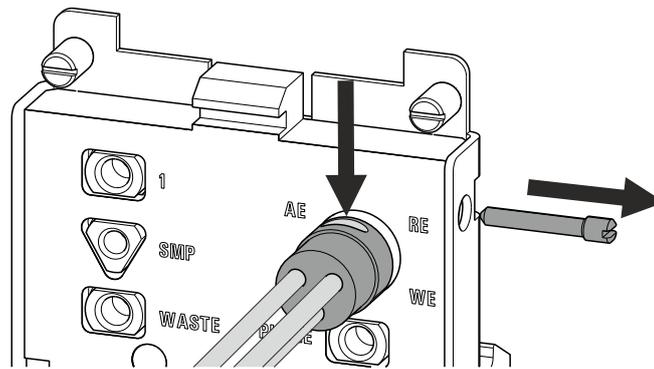


Figure 48 Replacing electrode cables

- 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 9, page 18 and Figure 10, page 18).
- 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 three 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.

6.6 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:

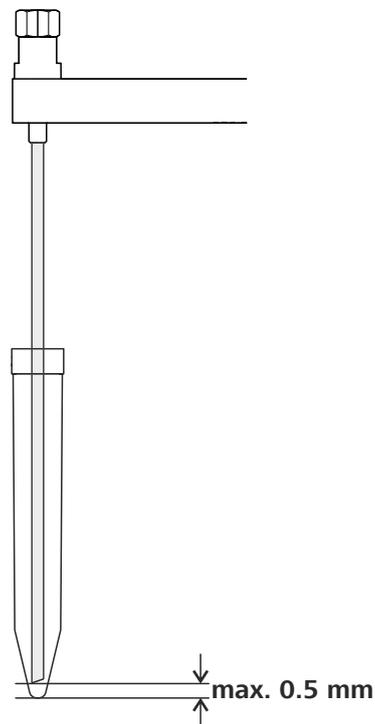


Figure 49 Adjusting the sample needle in the Sample Processor



6.7 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 48*). The automatic adjustment is active starting with this activation time. The certified reference values of the built-in calibrator are valid for two years. For this period, we guarantee that the adjustment is undertaken correctly and that the automatic calibration is accurate. Just before two years have elapsed, a prompt appears in the **viva** computer software stating that the calibrator should be replaced in order to ensure correct adjustment of the measuring input.

We therefore recommend having the calibrator replaced every two years. We can thus guarantee correct automatic self-adjustment of the 894 Professional CVS over the entire service life of the instrument. In addition, you are well prepared for your audits. Please contact your local 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.

6.8 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.



6.9 Quality management and qualification with Metrohm

Quality management

Metrohm offers you comprehensive support in implementing quality management measures for instruments and software.

Qualification

Please contact your local Metrohm representative for support in qualification of instruments and software. The **Installation Qualification** (IQ) and **Operational Qualification** (OQ) are offered by Metrohm representatives as a service. They are carried out by trained employees using standardized qualification documents and in accordance with the currently applicable requirements of the regulated industry.

7 Troubleshooting

7.1 894 Professional CVS

Problem	Cause	Remedy
An electrode cable has broken.	<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 .
Conditioning takes a long time.	<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"> ▪ Immerse the electrode tip in $c(\text{NaOH}) = 0.5$ mol/L for approx. 10 min and then thoroughly rinse with distilled water. ▪ Replace the electrode tip if necessary.
	<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.
Solution is leaking between the measuring instrument and the measuring head.	<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.
The electrode test fails.	<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.



Problem	Cause	Remedy
	<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.
The electrode tip of the working electrode and/or the auxiliary electrode shows copper deposits.	<i>An incorrect potential has been applied because the reference electrode is defective.</i>	<ul style="list-style-type: none"> ▪ 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.
	<i>An incorrect potential was applied because the reference electrode is not connected.</i>	<ul style="list-style-type: none"> ▪ 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.
	<i>An incorrect potential was applied because the measuring vessel contains too little measuring solution.</i>	<ul style="list-style-type: none"> ▪ 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.	<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).
The measurement curves are noisy.	<i>Contact problem at the driving axle (6.1204.510 or 6.1204.520).</i>	<ul style="list-style-type: none"> ▪ Remove the abrasion residue from the driving axle. ▪ Replace the driving axle.
The measuring signal for Cu VMS fluctuates.	<i>The ambient and/or solution temperature is not constant.</i>	Keep the ambient and solution temperature stable during measurements (± 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.
The measuring vessel overflows.	<i>Incorrect pump times have been defined in viva.</i>	Adjust the pump times.
	<i>The volumes defined in the dosing commands in viva are too large.</i>	Reduce the volumes.
The peak is no longer recognized.	<i>The reference potential has shifted.</i>	Perform the maintenance procedure for the reference electrode in accordance with the electrode leaflet.
The signal does not decrease in spite of suppressor addition.	<i>No chloride is contained in the Cu VMS.</i>	Check the preparation of the Cu VMS and modify it if required.

7.2 Peripheral devices

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



Problem	Cause	Remedy
The dosing unit is recognized either not at all or incorrectly.	<i>The dosing drive was not attached correctly.</i>	<ul style="list-style-type: none"> ▪ 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 Metrohm Service if necessary.
The membrane pumps of the 843 Pump Station do not operate at full pump capacity.	<i>The cables are not or not correctly connected.</i>	Connect the cables as described in .
	<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.
The pump time of the peristaltic pump increases.	<i>The pump tubing of the peristaltic pump has aged or is defective.</i>	Replace the pump tubing.
The sample is not completely transferred from the Sample Processor to the measuring vessel via the peristaltic pump.	<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 as described in .
	<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.

8 Appendix

8.1 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 14)	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

8.2 "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.



9 Technical specifications

9.1 Operating modes

<i>Potentiostat</i>	yes
<i>Galvanostat</i>	yes
<i>Temperature measurement</i>	yes (Pt1000)

9.2 Potentiostat

Maximum output voltage (AE)

<i>(maximum potential applied)</i>	± 25 V
------------------------------------	------------

Maximum output current (AE)

<i>(maximum current applied)</i>	± 224 mA
----------------------------------	--------------

Sweep potential range

± 5.0 V

Current measuring ranges

+200 pA - +224 mA
(Not all ranges are available in all measuring modes.)

Bandwidth

> 800 kHz

Rise time / fall time

300 ns

Noise

5 pA typical

9.3 Galvanostat

Potential measuring ranges +5 mV - +5 V

9.4 Temperature measurement

Measuring range (Pt1000) 0 - +100 °C

Accuracy (Pt1000) ±0.5 °C

9.5 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

9.6 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)



9.7 Resolution

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

9.8 Calibrator

<i>Reference voltage</i>	2.5 V
<i>R17.8</i>	17.8 Ω
<i>R178</i>	178 Ω
<i>R1.9k</i>	1900 Ω
<i>R18k</i>	18000 Ω
<i>R180k</i>	180000 Ω
<i>R1.8M</i>	1800000 Ω
<i>R18M</i>	18000000 Ω
<i>Validity of the certification</i>	Two years after activation

9.9 Stirrer

<i>Stirring rate</i>	200 - 3,000 min^{-1}
<i>Stability</i>	$\pm 2\%$

9.10 Hardware

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

9.11 Power connection

<i>Supply voltage</i>	100 - 240 V
<i>Frequency</i>	50 - 60 Hz
<i>Power consumption</i>	45 W

9.12 Ambient temperature

<i>Nominal function range</i>	0 - +45 °C (at a maximum of 85% relative humidity)
<i>Automatic interior temperature monitoring</i>	> 70 °C
<i>Storage</i>	-40 - +70 °C
<i>Transport</i>	-40 - +70 °C

9.13 Reference conditions

<i>Ambient temperature</i>	+25 °C (±3 °C)
<i>Relative humidity</i>	≤ 60%
<i>Operating temperature status</i>	Instrument in operation at least 30 min



9.14 Housing data

Dimensions without accessories

<i>Width</i>	188 mm
<i>Height</i>	294 mm
<i>Depth</i>	406 mm
<i>Weight</i>	7,400 g

Dimensions with measuring head and drip pan

<i>Width</i>	188 mm
<i>Height</i>	322 mm
<i>Depth</i>	452 mm

Material of housing

<i>Cover</i>	PP with flame retardation for fire class UL94 V-0
<i>Base</i>	Steel sheet, coated

10 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.

Tubing
 Install 33
 Tubing connection
 Automated system 58
 Semiautomated system 52
 Tubing diameter
 Measuring head arm 79

Tubing length
 Measuring head arm 79
 Tubing setup 33
 843 Pump Station 37
 Rinsing canister 37
 Waste canister 38

W
 Waste canister
 Tubing setup 38
 Working electrode
 Connect 24
 Insert 22
 Prepare 22