797 VA Computrace

Hardware Manual

8.797.8001EN

Metrohm

Metrohm AG
CH-9101 Herisau
Switzerland
Phone +41 71 353 85 85
Fax +41 71 353 89 01
info@metrohm.com
www.metrohm.com

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08.2009 zst

Teachware
Metrohm AG
CH-9101 Herisau
teachware@metrohm.com

Although all the information given in this documentation has been checked with great care, errors cannot be entirely excluded. Should you notice any mistakes please send us your comments using the address given above.

Documentation in additional languages can be found on *http://products.metrohm.com* under **Literature/Technical documentation**.

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1 Introduction

1.1 Instrument description

797 VA Computrace is a PC controlled system for voltammetry, which consists of the following parts:

1.797.0010 **VA Computrace Stand** with accessories

6.2151.020 **Connecting Cable**

6.6053.030 **797 VA Computrace Software** (current version)

For a detailed description of the PC software «797 VA Computrace Software» see the **797 Software Manual**.

This **797 Hardware Manual** describes the installation and maintenance of the 797 VA Computrace Stand and its accessories. The central element of this Stand is the Multi-Mode Electrode (MME), which combines the dropping mercury electrode (DME/SMDE) and the stationary hanging mercury drop electrode (HMDE) in a single construction. The rotating disk electrode (RDE) can also be used in the stand.

The 797 VA Computrace Stand is controlled with the PC-Software «797 VA Computrace Software», parameters necessary for the VA measurement are sent from the PC to the VA Computrace via USB connection. The data acquisition at the 797 VA Computrace Stand is started and controlled by the PC-Software «797 VA Computrace Software», which receives and stores the measurement data. At the end of the determination, the recorded data are sent back to the PC where they are evaluated and saved in a determination file.

Operation of the 797 VA Computrace Stand follows the potentiostatic 3-electrode principle in which the voltage of the working electrode is controlled by means of a virtually currentless reference electrode to the preset desired value and the current flows across a separate auxiliary electrode.

1.2 Parts and controls

In this section you will find the numbers and designations of the parts and controls of the 797 VA Computrace Stand. The numbering applies throughout the instructions for use, i.e. bold numbers in the text (e.g. ***7*** *) refer to the parts and controls illustrated here.*

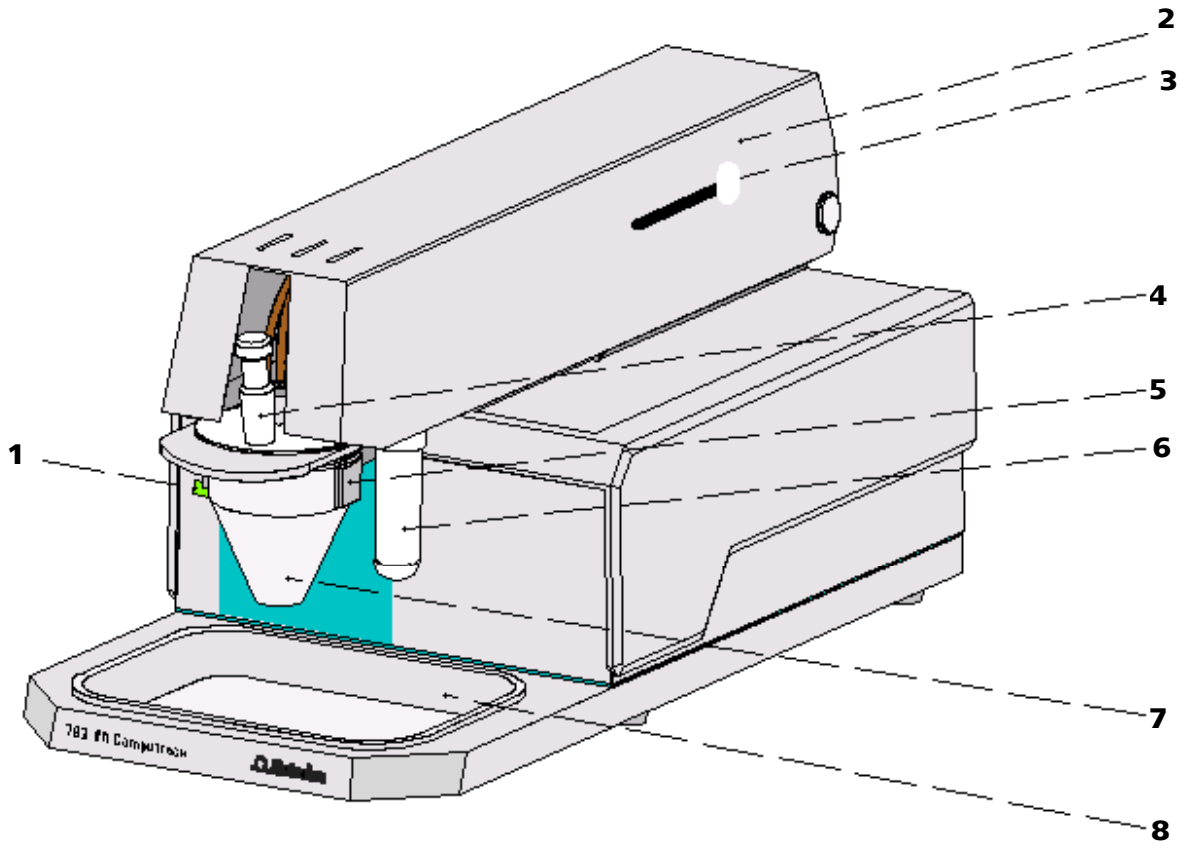


Fig. 1: Front of the 797 VA Computrace Stand

1 Mains pilot lamp
lit up when instrument switched on

2 Cover of measuring head arm
hinged

3 Release slide
to release fixture of the lifted measuring head arm

4 Stopper (6.2709.080)
to close the pipetting opening

5 Holder for measuring vessel

6 Gas wash bottle (6.2405.030)
for inert gas supply (filling with dist. water, see *section 2.2.5*)

7 Measuring vessel
when measuring head arm is fully raised, the measuring vessel can be pulled forward out of the holder **5**

8 Drip pan (6.2711.040)

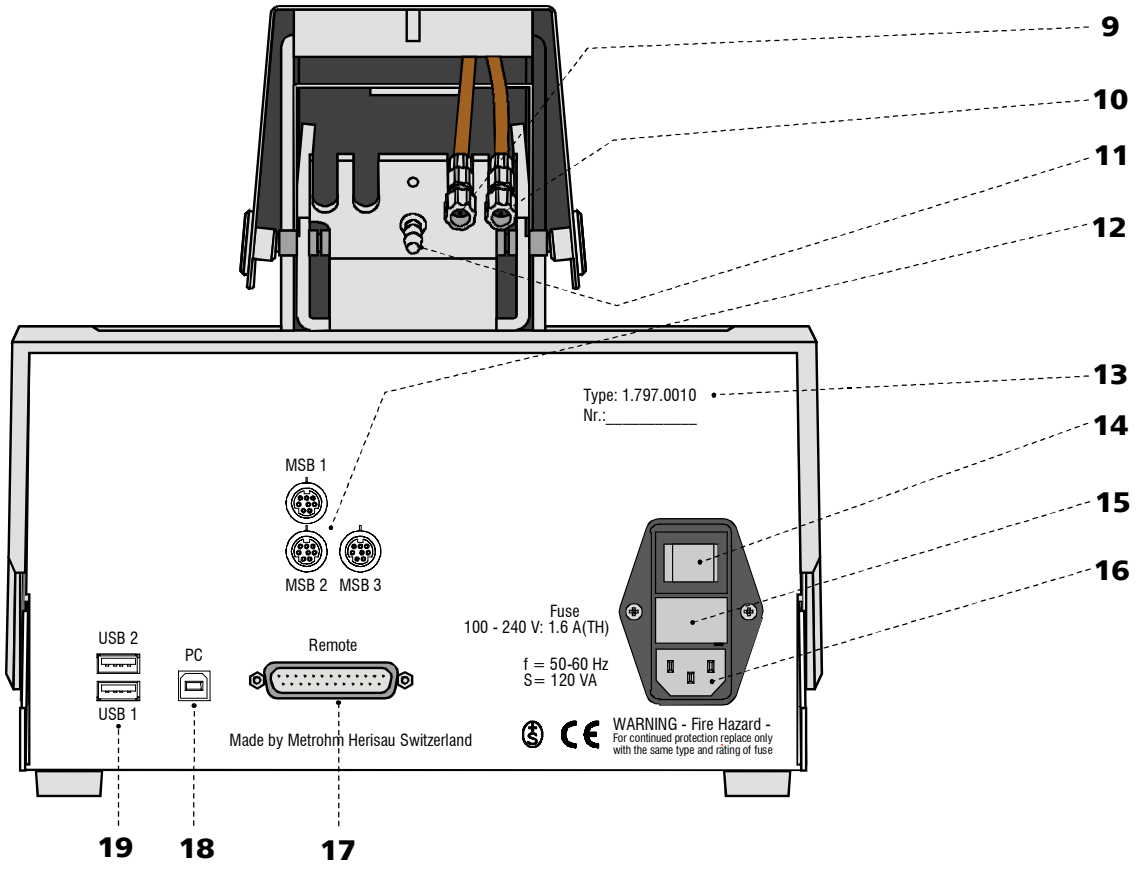


Fig. 2: Rear of the 797 VA Computrace Stand

9 Connection for inert gas lead-off

10 Connection for optional waste solution lead-off

11 Connection for inert gas supply
required pressure:
p = 1 ± 0.2 bar

12 MSB1 – MSB3
(**M**etrohm **S**erial **B**us)
Connections for Dosing devices

13 Serial number

14 Mains switch (on/off)
on/off switching of instrument (the pilot lamp **1** is lit up when the instrument is on)

15 Fuse cover
Changing the fuses, see *section 3.2*

16 Mains connection plug
mains connection, see *section 2.1.1*

17 Remote
Connection for Sample Changer and Rinsing Equipment

18 PC
Connection socket for connection cable 6.2151.020 to PC, see *section 2.2.3*

19 USB1 and USB2
Connections for peripherals like printer, ..., see *section 2.12*

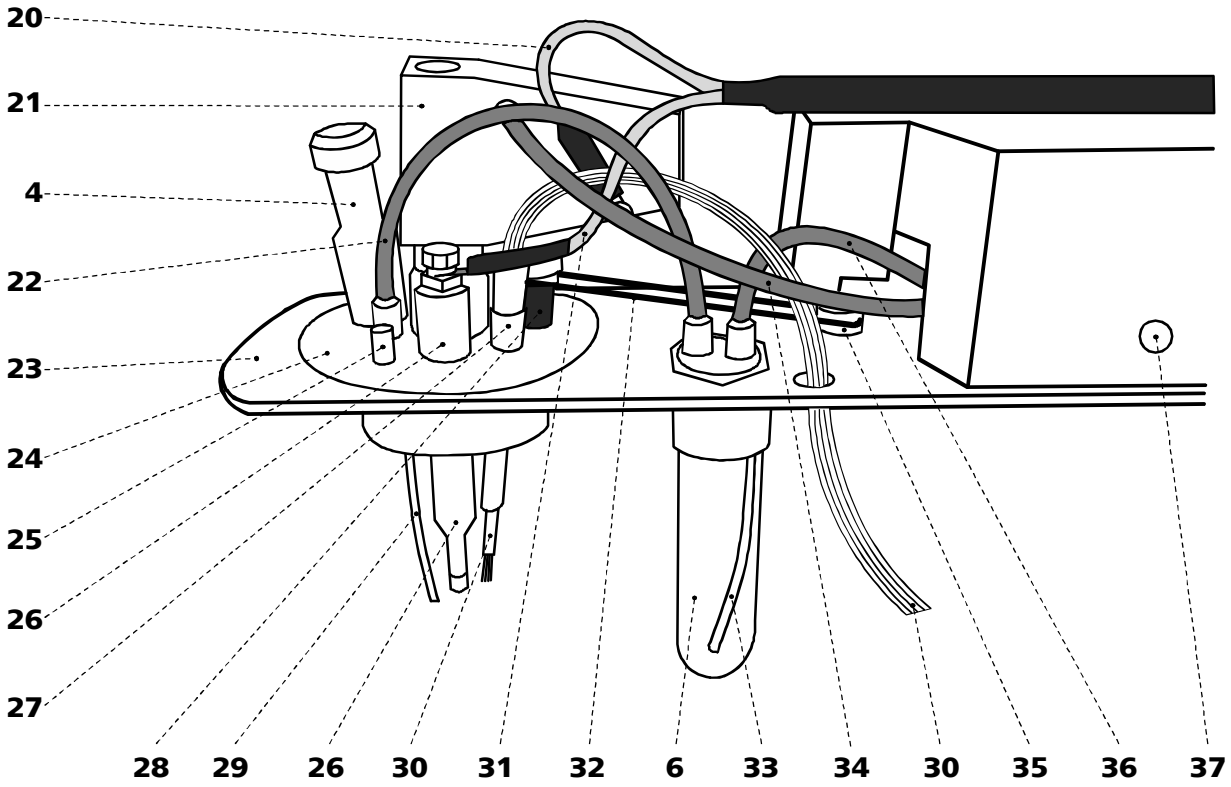


Fig. 3: Right side view of the 797 VA Computrace Stand (fully equipped)

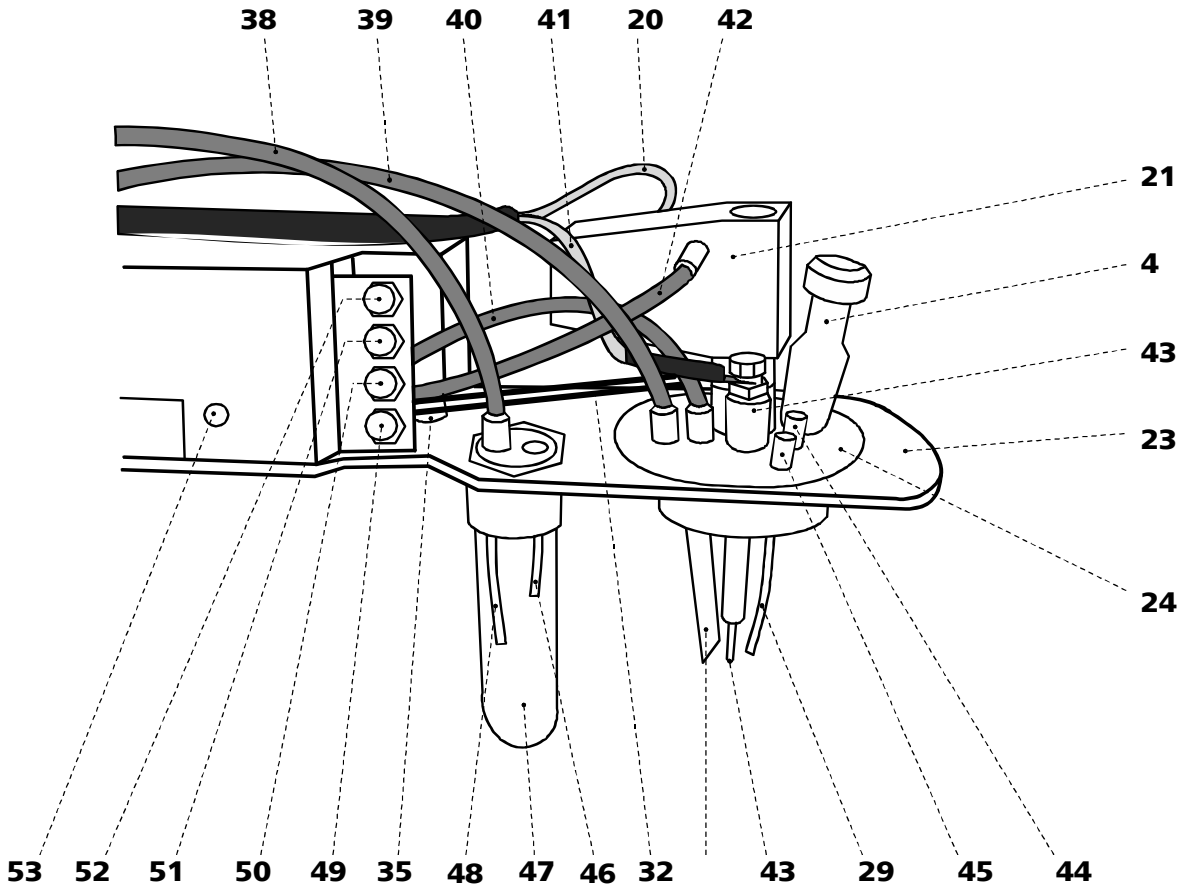


Fig. 4: Left side view of the 797 VA Computrace Stand (fully equipped)

4 Stopper (6.2709.080)
to close the pipetting opening

6 Gas wash bottle (6.2405.030)
for inert gas supply
(must be filled halfway with dist. H_2O, see *section 2.2.5*)

20 Electrode cable "WE"
connection for working electrode (MME or RDE)

21 Multi-Mode Electrode (MME) (6.1246.020)
details, see *section 2.3*

22 FEP tubing (6.1805.180)
for inert gas supply to measuring vessel (attached)

23 Measuring head arm
carrier plate with permanently attached measuring head, raisable

24 Measuring head
measuring vessel upper half made of PTFE; with openings for electrodes, stirrer, gas and liquid supply lines

25 Dummy stopper (6.1446.040)

26 Reference electrode
comprising 6.0728.020 Ag/AgCl Reference system and 6.1245.010 Electrolyte vessel (details, see *section2.5*)

27 Nipple (6.2730.030)
for mounting the 4-way microtip **30** or a dummy stopper

28 Stirrer (6.1204.200)

29 PTFE tube (6.1819.000)
(attached)

30 4-way microtip (6.1824.000)
for delivery of solutions; with 4 lengths of PTFE tubing with connecting nipples for Dosing devices

31 Electrode cable "RE"
connection for reference electrode **26**

32 Drive belt (6.1244.020)
connection between drive wheel **35** and stirrer **28**

33 PTFE tube (6.1819.000)
for inert gas delivery to gas wash bottle **6** (attached)

34 FEP tubing (6.1805.180)
for inert gas supply to MME **21**

35 Drive wheel of drive motor

36 FEP tubing (6.1805.040)
for inert gas delivery to gas wash bottle **6** attached.

37 Slotted screw for controlling the inert gas flow
Note: The factory setting of ca. 20 L/h should not be changed without good reason!

38 FEP tubing (6.1805.020)
for inert gas lead-off (attached)

39 FEP tubing (6.1805.090)
for inert gas lead-off (attached)

40 FEP tubing (6.1805.180)
for inert gas supply to tapping mechanism (attached)

41 Electrode cable "AE"
connection for auxiliary electrode **43**

42 FEP tubing (6.1805.180)
for inert gas supply to MME **21**

43 Auxiliary electrode
for details see *section 2.6*

44 Dummy stopper (6.1446.040)

45 Dummy stopper (6.1446.040)

46 **PTFE tube (6.1819.010)**
for optional supply of the waste solution to gas wash bottle **47** (attached)

47 **Gas wash bottle (6.2405.030)**
for separating mercury from the waste solution (attached)

48 **PTFE tube (6.1819.010)**
for optional siphoning off the waste solution from gas wash bottle **47** (attached)

49 **Dummy cell connection "WE-D"**
differential mode simulation (peak/wave)

50 **Dummy cell connection "WE-L"**
linear mode simulation (RC element)

51 **Dummy cell connection "RE"**

52 **Dummy cell connection "AE"**

53 **Slotted screw for controlling the tapping power in the DME or SMDE case**
Note: The factory setting should not be changed without good reason!

1.3 Information about the Instructions for Use

Please read through these Instructions for Use carefully before you put the 797 VA Computrace Stand into operation. The Instructions for Use contain information and warnings to which the user must pay attention in order to assure safe operation of the instrument.

1.3.1 Organization

This 8.797.8001EN Hardware Manual for the 797 VA Computrace Stand provides a comprehensive overview of the installation, operation, and technical specifications of these instruments. The Instructions for Use are divided into the following 4 sections:

Section 1 **Introduction**
General instrument description
Numbers and designations of the parts and controls
Safety instructions

Section 2 **Installation**
Installation of 797 VA Computrace Stand
Installation of working, reference and auxiliary electrodes
Attachment of 700 and 800 Dosinos
Attachment of 685 and 805 Dosimats
Attachment of the 863 Compact Autosampler
Attachment of the 838 Advanced Sample Processor

Section 3 **Safety**
Electrical safety
Safety considerations in the handling of mercury

Section 4 **Appendix**
Scope of delivery, options, validation, warranty, certification, index

To find the required information on the instrument please use either the **Table of contents** or the **Index** at the back.

1.3.2 Notation and pictograms

The following notations and pictograms (symbols) are used in these Instructions for Use:

Mode	Parameter or entry value
15	**Part or control**
	**Hazard** This symbol draws attention to a possible danger to life or of injury if the associated directions are not followed correctly.
	**Warning** This symbol draws attention to possible damage to instruments or instrument parts if the associated directions are not followed correctly.
	**Caution** This symbol marks important information. First read the associated directions before you continue.
	**Comment** This symbol marks additional information and tips.

1.4 Support documentation

1.4.1 Application-Bulletins

The «Application Bulletins» is a collection of analytical methods, application examples and literature references. Of Metrohm's approximately 200 Application Bulletins, ca. 60 refer to Polarography and Voltammetry. All these Application Bulletins are available on request free of charge from your Metrohm supplier.

The examples listed here substantiate the versatility of the polarographic and voltammetric methods for a range of applications including both inorganic and organic substances. At any time you will find an updated list of the Application Bulletins with the option for download in the Internet under « www.metrohm.com ».

Most of the methods required to run the applications described in the Application Bulletins are installed when the 797 VA Computrace software is installed.

No.	Title
36	Polarographic analysis – Half-wave potentials of inorganic substances
50	Polarographic determination of lead in petrochemical products
57	Polarographic determination of nicotine
60	Polarographic determination of fructose
70	Polarographic nitrate determination in water samples, soil and plant extracts, vegetable juices, meat and sausage products, fertilizers, liquid manure etc.
73	Polarographic analysis – Half-wave potentials of organic substances
74	Polarographic and stripping voltammetric analysis methods for thallium, antimony, bismuth and iron (copper, vanadium)
76	Polarographic determination of nitrilotriacetic acid (NTA) and ethylenediaminetetraacetic acid (EDTA)
96	Stripping voltammetric analysis of mercury
97	Voltammetric determination of tocopherols (vitamin E) in edible oils and fats
98	Determination of ascorbic acid (vitamin C) and its compounds
105	Determination of permissible lead and cadmium levels in crockery and glassware
110	Polarographic determination of free cyanide
113	Determination of lead, cadmium and copper in foodstuffs, waste water and sewage sludge by anodic stripping voltammetry after digestion
114	Polarographic determination of five metal ions (copper, cobalt, nickel, zinc and iron) in a single operation
116	Polarographic determination of chromium in small quantities
117	Determination of selenium by stripping voltammetry
123	Voltammetric determination of iron and manganese in water samples
126	Polarographic determination of quinine
127	Polarographic determination of nitrite in water samples, meat and sausages
131	Voltammetric determination of aluminum
132	Polarographic determination of molybdenum in strongly ferruginous substances and ferrous metals
136	Polarographic determination of styrene in polystyrenes and copolymers
141	Analysis of edible fats and oils

No.	Title
146	Direct polarographic determination of trace amounts of molybdenum in water
147	Simultaneous trace determination of seven metal ions (Zn, Cd, Pb, Cu, Ni, Co, Fe) in «electronic grade» materials with the aid of stripping voltammetry
176	Simultaneous determination of lead and tin by anodic stripping voltammetry
179	Polarographic determination of maleic and fumaric acid alone or in mixtures
186	Determination of aluminum in water samples by adsorptive stripping voltammetry
190	Polarographic determination of 4-carboxybenzaldehyde in terephthalic acid
191	Polarographic determination of cystine and cysteine simultaneously
192	Determination of thiourea in the lower ppm and ppb range by polarography and stripping voltammetry
196	Polarographic determination of formaldehyde
199	Polarographic determination of sulphide and sulphite
207	Stripping voltammetric analysis of silver
213	Polarographic determination of nicotinamide
215	Polarographic determination of folic acid (vitamin B_9, vitamin B_C)
218	Polarographic determination of thiamine (vitamin B_1)
219	Polarographic determination of riboflavin (vitamin B_2)
220	Voltammetric determination of platinum and rhodium in the ultratrace range
221	Standard methods in water analysis – use of Metrohm instruments
224	Polarographic determination of pyridoxine (vitamin B_6)
226	Determination of arsenic by anodic stripping voltammetry at the rotating gold electrode
231	Voltammetric determination of zinc, cadmium, lead, copper, thallium, nickel and cobalt in water samples according to DIN 38406 E 16
241	Determination of cadmium and lead at the «Ultra Trace» graphite electrode by anodic stripping voltammetry
242	Determination of tungsten at the «Ultra Trace» graphite electrode by anodic stripping voltammetry
243	Determination of chromium at the «Ultra Trace» graphite electrode by cathodic stripping voltammetry
250	Polarographic determination of diazepam in body fluids and pharmaceutical preparations
251	Polarographic determination of cinchocaine (dibucaine) in pharmaceutical preparations
254	Determination of zinc, cadmium, lead and copper by anodic stripping voltammetry using carbon electrodes
266	Voltammetric determination of titanium and uranium
276	Validation of Metrohm VA instruments using Standard Operating Procedures

1.4.2 Application Notes

The «Application Notes» present application information in concentrated form. In the field of voltammetry, there are at present approximately 120 Application Notes (in English), which can be viewed in the Internet under « www.metrohm.com » and cop-

ied from there. All these Application Notes are printed in the **8.757.2003 VA Applications Collection** supplied with the instrument. All methods required to run the applications described in the Application Notes are installed when the 797 VA Computrace software is installed.

1.4.3 Monographs

The «Metrohm Monographs» listed below impart theoretical fundamentals and general information on measurement techniques and sample preparation of polarography and voltammetry. All these monographs are available on request free of charge from your Metrohm supplier.

Title
First aid for polarography and voltammetry (8.693.1071)
Sample preparation techniques in voltammetric trace analysis
Inorganic Adsorptive Stripping Analysis
Organic Stripping Analysis
Stripping Voltammetry
Electrode Reaction Kinetics determined by Cyclic Voltammetry
The Application of VA Techniques to the Galvanic/Plating Industry
Practical voltammetry (8.757.5003)
Introduction to Polarography and Voltammetry (8.027.5003)
Voltammetric analysis methods in electroplating (8.108.5002EN)

1.4.4 Reprints

The following reprints reporting on practical applications are available on request free of charge from your Metrohm supplier.

Title
Investigations of oxidative UV photolysis: I. Sample preparation for the voltammetric determination of Zn, Cd, Pb, Cu, Ni and Co in waters
Investigations of oxidative UV photolysis: II. Sample preparation for the voltammetric determination of mercury in water samples
Determination of Zn, Cd, Pb, and Cu in soils and sewage sludges by microprocessor-controlled voltammetry in comparison with AAS
Voltammetric instrument for training and trace analysis

2 Installation

This section offers a full description of the 797 VA Computrace Stand and provides detailed information on the various electrodes and the stirrer. Reliable operation of the instrument is assured only if you follow the instructions in this section exactly.

2.1 Setting up the instrument

2.1.1 Packaging

The 797 VA Computrace Stand is supplied together with the separately packed accessories in special packages designed to ensure excellent protection. These contain shock-absorbing foam linings. The instrument itself is packed in an evacuated polyethylene bag. As only these special packaging guarantees indemnified transport of the instrument, it is essential you store it in a safe place.

2.1.2 Check

After recipt, immediately check whether the shipment is complete and has arrived without damage (compare with delivery note and list of accessories in sections 4.2). In the case of transport damage, see instructions in section 4.5.1 "Warranty".

2.1.3 Location

Place the 797 VA Computrace on a laboratory bench in a position suitable for operation and which is free from vibrations, protected against corrosive atmospheres and contamination by chemicals. The drip pan 8 (6.2711.040) has to be placed at the front side of the 797 VA Computrace Stand to catch drops (see Fig. 1).

2.2 Installation of the 797 VA Computrace Stand

*If the 797 VA Computrace Stand is connected to the power supply, the instrument may not be opened or parts removed, as there is a danger of contact with live components. Before you open the 797 VA Computrace Stand to change components or for maintenance or repair work, always switch off the instrument by setting the mains switch **14** to the OFF position and then disconnect the mains cable from the mains connection plug **16** of the 797 VA Computrace Stand.*

2.2.1 Mains cable and mains connection

The instrument is supplied with one of three mains cables:

- 6.2122.020 with plug SEV 12 (Switzerland, …)
- 6.2122.040 with plug CEE(7), VII (Germany, …)
- 6.2133.070 with plug NEMA 5-15 (USA, …)

which are three-cored and fitted with a plug with a grounding pin. If a different plug has to be fitted, the yellow/green lead (IEC standard) must be connected to protective earth (protection class 1).

Any break in the grounding inside or outside the instrument can make it a hazard!

Plug the mains cable into mains connection plug **16** of the 797 VA Computrace Stand (see *Fig. 2*).

2.2.2 Switching the instrument on/off

The 797 VA Computrace Stand is switched on and off using mains switch **14**. When the instrument is switched on, the pilot lamp **1** lights up.

2.2.3 Connection to the PC

The 797 VA Computrace Stand is connected to the PC via USB Cable 6.2151.020. Proceed as follows:

The 797 VA Computrace Stand must not be connected until the Software is installed.

1 Software installation

- Switch on PC and start operating system (Windows™ 2000, XP Professional or Vista Professional)) without connection of the 797 VA Computrace via USB cable.
- Insert installation CD into CD drive.
- If the autorun option for the CD drive is disabled, select **<Start>** and **Run**. Browse for the **Setup.exe** file on the installation CD and click on **<OK>**.
- Click on "**797**" and follow the instructions given in the setup program. The software package will be installed in the desired directory (the default directory is **Program Files/Metrohm/797 VA Computrace**).

2 Connection of the 797 VA Computrace

- Connect 797 VA Computrace to the PC using the **6.2151.020 USB cable** and switch on the 797 VA Computrace. The PC detects a new USB device and starts the setup wizard. Insert installation CD into CD drive and follow the wizard instructions always selecting the recommended default options.
- Start the 797 VA Computrace Software.

The setup wizard is started three times when installing the instrument driver. All three installation steps must be conducted to ensure proper operation.

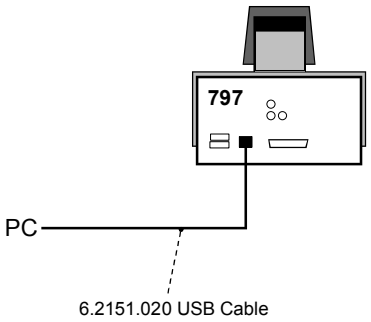


Fig. 5: Connection to PC

In case your computer does not start if the 797 VA Computrace stand is switched on, it might is due to an older version of the BIOS. These BIOS versions are not able to handle USB Hubs in a correct way.

In that case, start the computer first, and switch on 797 VA Computrace stand as soon as Windows booting is finished.

2.2.4 Equipping the measuring head

The fixtures inserted in the openings and connections of the measuring head **24** in the 797 VA Computrace Stand depend on the working electrode selected (MME or RDE) (see *Fig. 6*). The fully equipped measuring head for operation with a Multi-Mode Electrode is illustrated in *section 1.2 (Fig. 3* und *Fig. 4*), that for operation with a rotating disk electrode in *section 2.4* (*Fig. 12*).

When equipping the measuring head for the first time, the best procedure is as follows:

1 Preparations

- Prepare Multi-Mode Electrode MME **21** (details, see *section 2.3*) or rotating disk electrode RDE (details, see *section 2.4)* for operation.
- Prepare reference electrode **26** (details, see *section 2.5.2*) for operation.
- Tilt back cover **2** of measuring head arm.

2 Insert dummy stoppers

- Screw dummy stopper **45** (6.1446.040) into opening **55**.
- Screw dummy stopper **44** (6.1446.040) into opening **56**.

3 Insertion of 4-way microtip (option)

For automatic solution addition with Dosinos or Dosimats, the 6.1824.000 4-way microtip has to be installed. Proceed as follows:

- Remove stopper from nipple **27** and insert 4-way microtip **30** into nipple as far as it will go.
- Tighten nipple using a 6.2739.010 Wrench until the 4-way microtip can no longer move.
- Pull the 4 lengths of PTFE tubing of the 4-way microtip in succession from above through the opening **68** (connection of Dosinos or Dosimats see section *2.8*).

4 Install stirrer or RDE

in operation with MME:

- Insert stirrer (6.1204.200) in opening **63** as far as it will go.
- Stretch drive belt **32** (6.1244.020) between drive wheel **35** and drive shaft of the stirrer.

in operation with RDE:

- Screw electrode tip **98** (6.1204.XXX) to drive shaft **99** (6.1204.210) (see also *section 2.4*).
- Insert RDE in opening **63** as far as it will go.
- Stretch drive belt **32** (6.1244.020) between drive wheel **35** and drive shaft **99** of the RDE.
- Attach electrode cable **20** (WE) to the RDE: push cable lug under the screw and then tighten screw firmly.

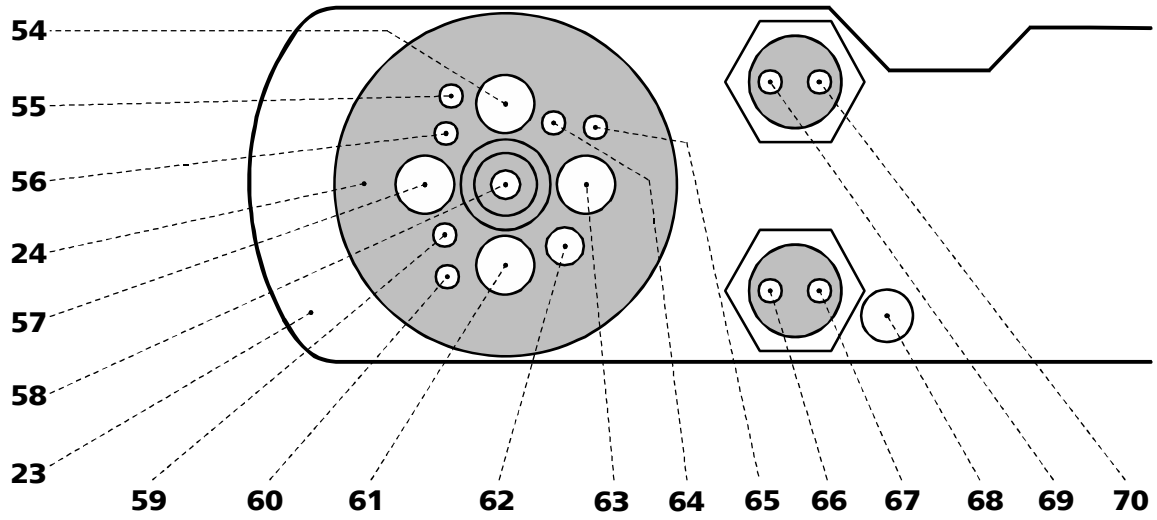


Fig. 6: Measuring head arm

23 Measuring head arm

24 Measuring head

54 Opening
for auxiliary electrode **43** (6.0343.000 Pt - auxiliary electr. or optional GC electr. comprising 6.1241.020 Electrode holder and 6.1247.000 GC tip)

55 Threaded opening
for dummy stopper **45** (6.1446.040)

56 Threaded opening
for dummy stopper **44** (6.1446.040)

57 Pipetting opening
for the manual addition of solutions, closed with stopper **4** (6.2709.080)

58 Opening
in operation with MME:
for Multi-Mode Electrode **21** (6.1246.020)
in operation with RDE:
for 6.2709.040 Stopper

59 Threaded opening
for FEP tubing **22** (6.1805.180, already permanently attached); inert gas supply to measuring vessel **7**

60 Threaded opening
for dummy stopper **25** (6.1446.040)

61 Opening
for reference electrode **26** (Ag/AgCl reference system and 6.1245.010 Electrolyte vessel)

62 Threaded opening
for nipple **27** (6.2730.030) with dummy stopper or 4-way microtip **30** (6.1824.000)

63 Opening
in operation with MME:
for stirrer **28** (6.1204.200)
in operation with RDE:
for rotating disk electrode, comprising drive shaft **99** (6.1204.210) and electrode tip **98** (6.1204.XXX)

64 Threaded opening
for FEP tubing **40** ((6.1805.180, already permanently attached); inert gas supply for tapping mechanism

65 Threaded opening
for FEP tubing **39** (6.1805.090, already perm. attached); inert gas lead-off

66 Threaded opening
for FEP tubing **22** (6.1805.180, already permanently attached); inert gas supply from gas wash bottle **6** to measuring vessel **7**

67 Threaded opening
for FEP tubing **36** (6.1805.040, already permanently attached); inert gas supply to gas wash bottle **6**

68 Opening
for feed-through of tubing connections of 4-way microtip **30** (6.1824.000)

69 Threaded opening
for FEP tubing (6.1805.180); optional waste solution lead-off

70 Threaded opening
for FEP tubing **38** (6.1805.090, already permanently attached); optional waste solution supply from gas wash bottle to waste

5 Install reference electrode

- Insert reference electrode **26** in opening **61**.
- Attach electrode cable **31 (RE)** to reference electrode: push cable lug under the screw and then tighten screw firmly.
- Turn reference electrode so that the electrode cable points to the rear and not to the side (in the latter position it may become kinked and damaged when cover **2** is closed).

6 Install auxiliary electrode

- Insert auxiliary electrode **43** (6.0343.000 Pt auxiliary electrode or GC auxiliary electrode, see *section 2.6*) in opening **54**.
- Attach electrode cable **41** (AE) to auxiliary electrode: push cable lug under the screw and then tighten screw firmly.
- Turn auxiliary electrode **39** so that the electrode cable **37** points to the rear and not to the side (in the latter position it may become kinked and damaged when cover **2** is closed).

7 Install MME or dummy stopper

in operation with MME:

- Carefully insert Multi-Mode Electrode **21** (6.1246.020) in opening **58** (the underside of the capillary must not touch the measuring head during insertion) and push in as far as it will go.
- Screw FEP tubing **34** (6.1805.180) for inert gas supply into connection **71** of the MME.
- Screw FEP tubing **42** (6.1805.180) for inert gas supply into connection **72** of the MME.
- Attach electrode cable **20** (WE) to screw connection **88** of the MME: push cable lug under the screw and then tighten screw firmly.

in operation with RDE:

- Insert stopper **97** (6.2709.040, option) into opening **58** as far as it will go so that the two blind holes point to the rear of the stand.
- Screw FEP tubing **34** (6.1805.180) into upper hole of stopper **97**.
- Screw FEP tubing **42** (6.1805.180) into lower hole of stopper **97**.

8 Install measuring vessel

- Tilt back measuring head arm **23**.
- Slide measuring vessel **7** into holder **5** from the front and fill with analyte solution or dist. H_2O (storage solution) until the tips of the MME or RDE and the reference electrode are immersed in the liquid.
- Lower measuring head arm **23** and cover **2**.

2.2.5 Inert gas connection

Nitrogen (N_2) is generally used as the inert gas to de-aerate the analyte solution and for operation of the MME. The nitrogen must be of sufficient purity.

$w(N_2) \geq 0.99996$ (= 99.996%)
for general polarography/voltammetry

$w(N_2) \geq 0.99999$ (= 99.999% = "5 × 9")
for analyses in organic solvents; for determinations involving very high current amplification (e.g. in the determination of very low concentrations without preceding enrichment)

For electroplating bath applications, using CVS or CPVS, no inert gas connection is required.

The scheme for de-aeration of the analyte solution and the inert gas connections at the 797 VA Computrace Stand needed for operation of the MME is shown in *Fig. 7*. The inert gas connections are established as follows:

1 Fill gas wash bottle

- Unscrew gas wash bottle **6** from measuring head arm **23**.
- Fill gas wash bottle half full with dist. H_2O (for long-term measurements with supporting electrolytes such as Acetic acid / Acetate buffer or Ammonia / Ammonium chloride buffer, fill with supporting electrolyte; for measurements in organic solvents fill with the used solvent).
- Screw gas wash bottle back on measuring head arm.

2 Connect inert gas supply

- Attach one end of 6.1801.080 PVC tubing to connection **11** of the 797 VA Computrace Stand.
- Attach the other end of the 6.1801.080 PVC tubing to connection of the inert gas bottle.
- Set inert gas pressure at gas bottle using the reducing valve to $p = 1 \pm 0.2$ bar.
- Open gas supply line at gas bottle.

3 Connect inert gas lead-off (option)

- Attach a length of suitable tubing (e.g. Metrohm 6.1805.030, length 150 cm) to connection **9** for inert gas lead-off.
- Route the other end of the lead-off tubing to a fume cupboard.

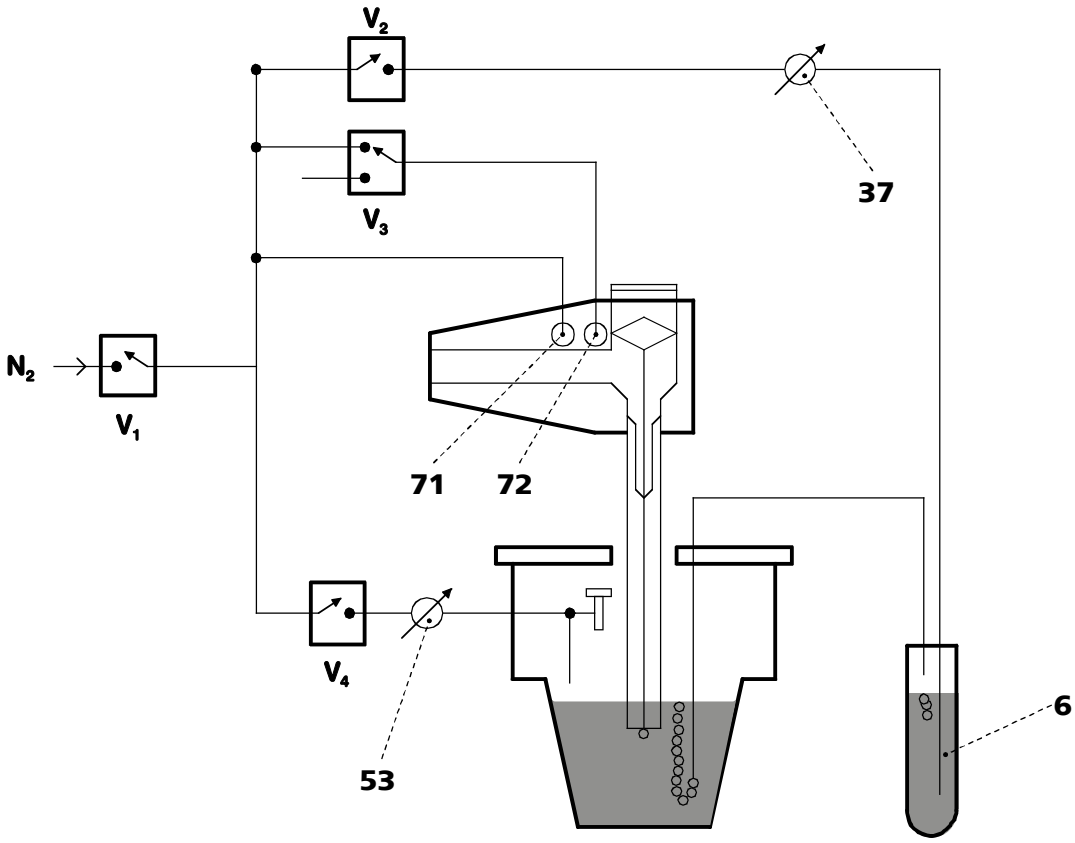


Fig. 7: Scheme showing the inert gas connections at the 797 VA Computrace Stand

6 **Gas wash bottle (6.2405.030)**
for inert gas supply (must be filled only halfway with dist. H_2O or supporting electrolyte, see also *Fig. 3*)

37 **Slotted screw for controlling the inert gas flow for de-aeration** (see also *Fig. 3*)

Note: The factory setting of ca. 20 L/h should not be changed without good reason!

53 **Slotted screw for controlling the tapping power in the DME case** (see also *Fig. 4*)

Note: The factory setting should not be changed without good reason!

71 **Connection for inert gas supply of the MME**
for raising and lowering the sealing needle in the MME (see also *section 2.3.1* and *Fig. 8*)

72 **Connection for inert gas supply of the MME**
for pressurizing the mercury (see also *section 2.3.1* and *Fig. 8*)

V_1, V_2, V_3, V_4 **Valves**

2.3 Multi-Mode Electrode (MME)

The Multi-Mode Electrode combines the most important polarographic and voltammetric mercury electrodes in a single construction:

- **HMDE** **Hanging mercury drop electrode**
  Mercury is forced through a glass capillary until a drop forms at the capillary tip and the entire voltage sweep performed on this single stationary drop; in general with preceding enrichment (stripping voltammetry).
- **DME** **Dropping mercury electrode**
  The classical electrode, the mercury drops fall from the glass capillary at a controlled rate.
- **SMDE** **Static mercury drop electrode**
  The latest electrode, it combines the features of the DME and the HMDE: during the measurement, the drop surface is constant and stationary (as with the HMDE); however, for the complete voltage sweep several drops are needed (renewal as with the DME).

2.3.1 Construction and operating characteristics of the MME

The construction of the 6.1246.020 Multi-Mode Electrode is shown in *Fig. 8*. The mercury in the reservoir **81** flows through the glass capillary **87** forming a drop at its end. The mercury flow is controlled by the sealing needle **75** which can be raised or lowered pneumatically. The different types of electrodes (HMDE, DME, SMDE) are implemented by timed opening or closing of the mercury flow using this sealing needle.

The operating characteristics of the MME are illustrated by *Fig. 7* and *Fig. 8*. After valve **V1** (inert gas supply) is opened, the mercury in the reservoir **81** is pressurized. In the standby mode, a back pressure is built up in the interior of the slotted screw **74** which causes the built-in spring to press the sealing needle **75** onto the capillary opening of the glass capillary **87** thus preventing the outflow of mercury. Switching the valve **V3** allows the inert gas to escape thus releasing the back pressure. The inert gas pressure in the mercury reservoir **81** presses the sealing needle **74** fixed to the PTFE membrane of the slotted screw **75** upwards and the mercury can now flow out. The tapping mechanism of the DME and SMDE is triggered by brief opening and closing of valve **V4**.

The mercury drops formed at the end of the capillary are very small and stable and thus afford a very good signal/noise ratio. The mercury hermetically sealed in the reservoir comes into contact only with inert gas and other inert materials and suffices for around 200'000 drops.

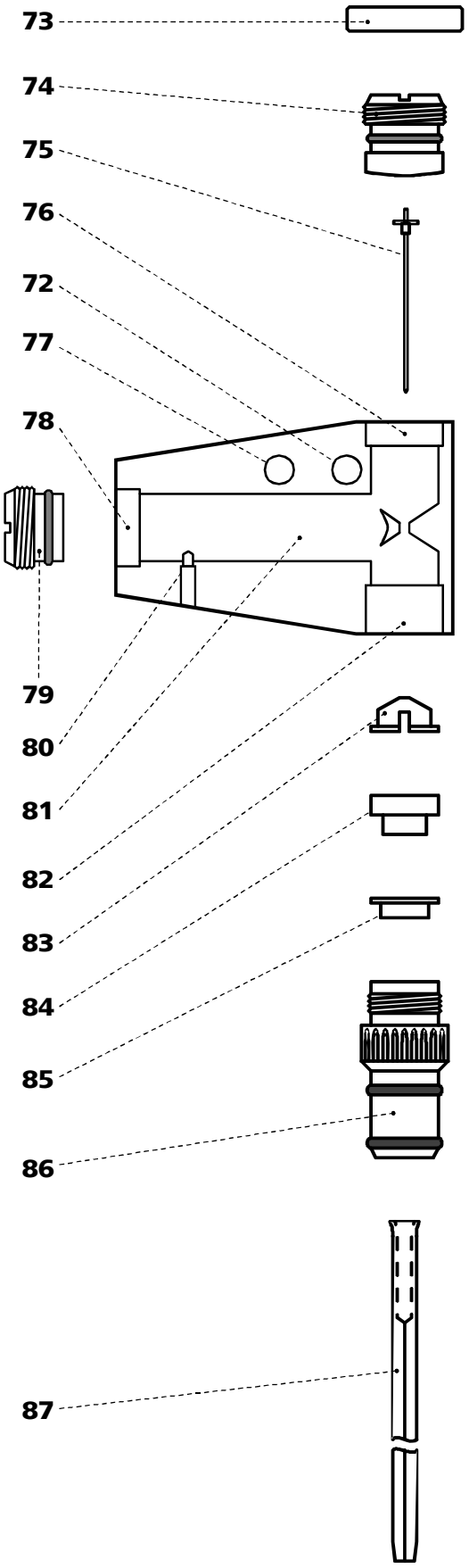
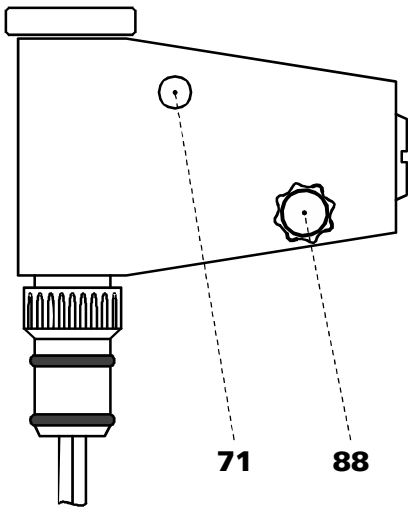


Fig. 8: Multi-Mode-Electrode



71 **Connection for inert gas supply**

72 **Connection for inert gas supply**
(for all MME operating modes)

73 **Locking ring (4.420.2920)**
for slotted screw **74**

74 **Slotted screw (6.1247.040)**
with PTFE membrane and built-in spring

75 **Sealing needle (6.1247.020)**

76 **Screw thread** for slotted screw **74**

77 **Unused connection**

78 **Screw thread** for slotted screw **79**

79 **Slotted screw (4.420.2960)**
for replenishing the mercury with capillary fitted

80 **Electrical contact pin for mercury**

81 **Mercury reservoir**

82 **Screw thread** for retaining nut **86**

83 **Insert ring (4.420.3011)**

84 **Sealing ring (4.420.2800)**
made of silicone rubber

85 **Locking ring (4.420.2870)**

86 **Retaining nut (4.420.2850)**

87 **Glass capillary (6.1226.030 or 6.1226.050)**

88 **Screw connection**
electrical contact for "WE" electrode cable

2.3.2 Filling the MME with mercury

When handling mercury, it is necessary to take special precautionary measures. These are described in detail in section 3.4.

*All actions involving the electrode and mercury vessels must be performed in or over the drip pan **91** supplied (see Fig. 9 - Fig. 11).*

The Hg reservoir **81** of the Multi-Mode Electrode **21** is filled with mercury of the highest degree of purity (mass fraction $w \geq 0.99999$) as follows:

1 Prepare Multi-Mode Electrode

- Unscrew locking ring **73** from slotted screw **74** (this gray PVC ring is needed only to remove the slotted screws **74** or **79**, see *section 2.3.7* and *section 2.3.9*).
- Turn slotted screw **74** in or out of the screw thread **76** using a suitable coin until the contact surface of the black O-ring at the Plexiglas wall (thin, black stripe) is just visible below the metal thread **76**.
- Remove the plastic cap used as a transport safeguard from the retaining nut **86**.
- Undo retaining nut **86** fully and remove from screw thread **82**.
- Place Multi-Mode Electrode **21** with the capillary opening facing upwards in the electrode holder **92** (see *Fig. 9*).

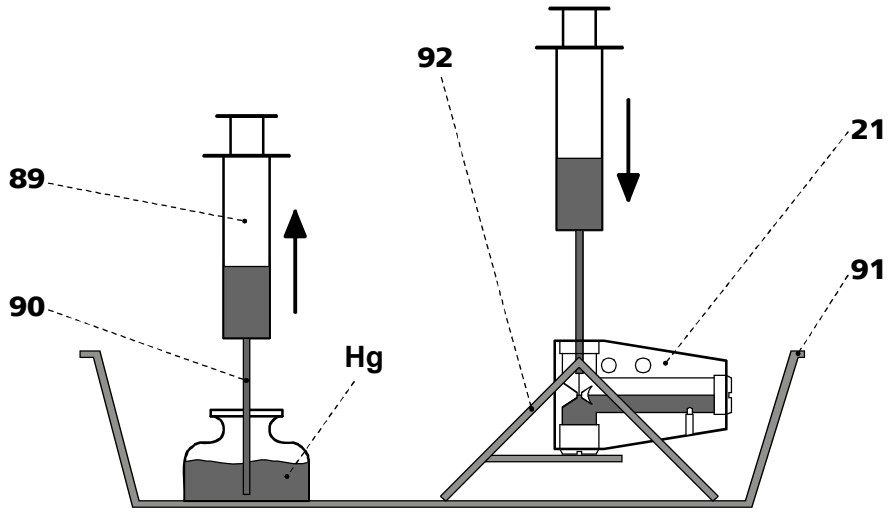


Fig. 9: Adding the mercury

21 Multi-Mode Electrode (6.1246.0020)

89 Syringe (6.2816.020)

90 Needle (6.2816.030)

91 Drip pan (6.2711.030)

92 Electrode holder (6.2615.030)

2 Draw up mercury

- Attach needle **90** to syringe **89**.
- Draw up 6 mL ultra pure mercury slowly and carefully using syringe.

3 Add mercury to MME

- Lower syringe needle **90** into the top opening of the MME **21** between sealing ring **84** and sealing needle **75**.
- Expel mercury slowly and carefully from the syringe to allow it to flow into the Hg reservoir **81**.

*The Hg reservoir **81** must never be filled more than $^2/_3$ full with mercury.*

2.3.3 Mounting the capillary

The glass capillaries **87** for the Multi-Mode Electrode **21** are supplied separately in a protective plastic package. After they have been unpacked, avoid any contact whatsoever with the sensitive capillary tip. The capillary is mounted in the MME filled with mercury (as described in *section 2.3.2*) as follows:

1 Insert retaining nut

- Screw retaining nut **86** into screw thread **82** until a slight resistance is noticeable (on no account screw in retaining nut fully!).

2 Insert capillary

- Cut open plastic package containing the glass capillary **87** on the side of the large capillary opening using scissors (do not tear open), leave capillary in the package.
- Insert glass capillary directly from its protective plastic package through the retaining nut **86** into the sealing ring **84** and push in as far as it will go.

3 Tighten retaining nut

- Firmly tighten retaining nut **86** by hand (do not use a tool). The glass capillary should then be centered in the opening of the retaining nut.
- If this is not the case, undo retaining nut by one full turn and then retighten by hand. When tightening, move glass capillary in a circle so that it is centered in the feed-through of the retaining nut.

2.3.4 Filling capillary without vacuum

The glass capillary **87** can normally be filled with mercury by the method described here without vacuum. However, if difficulties regarding stability or reproducibility arise with a capillary filled in this manner, try to fill the capillaries by the alternative method with vacuum (*section 2.3.5*). To fill the mounted glass capillary (*section 2.3.3*) with Hg without vacuum, proceed as follows:

1 Install Multi-Mode Electrode in 797 VA Computrace Stand

- With the measuring head arm **23** tilted back, slide the empty measuring vessel **7** into the holder **5** of the 797 VA Computrace Stand and then lower the measuring head arm.
- Carefully insert Multi-Mode Electrode **21** in opening **58** of the measuring head **24** (during insertion, the tip of the capillary **87** must not touch the measuring head) and push in carefully as far as it will go. Avoid water drops touch the tip of the capillary.

2 Connect Multi-Mode Electrode

- Screw FEP tubing **34** for the inert gas supply into connection **71** of the Multi-Mode Electrode **21**.
- Screw FEP tubing **42** for the inert gas supply into connection **72** of the Multi-Mode Electrode.
- Attach electrode cable **20** (WE) to screw connection **88** of the Multi-Mode Electrode: push cable lug under the screw and then tighten screw firmly.

3 Fill capillary with mercury

- Switch on 797 VA Computrace Stand with mains switch **14** (the 797 VA Computrace Stand must first be installed properly as described in *section 2.2*).
- Start the VA Computrace program and click on  or **MAIN WINDOW / Utility / Computrace control** to open the **COMPUTRACE CONTROL** window. Then switch on the inert gas supply to the 797 VA Computrace Stand by clicking on **DME**. This pressurizes the Multi-Mode Electrode **21** and the mercury begins to flow slowly out of the capillary.
- Gently tap the MME with your finger (to remove any air bubbles) and allow the mercury to flow out of the capillary into the empty measuring vessel for approx. 2 min.
- Fill measuring vessel **7** with 10 mL ultra pure water and add 1 drop KCl solution (in pure water, mercury drops from the capillary only with difficulty).
- Allow mercury to flow out of the capillary for ca. 2 min while checking the drop formation: The drop time should be ca. 3 s.

4 Adjusting the sealing needle 75

- Turn slotted screw **74** using a suitable coin slowly in a clockwise direction until the mercury flow stops.
- Open slotted screw slightly in an anticlockwise direction until the mercury flow restarts.
- Gently tap the MME with your finger and turn the slotted screw very slowly clockwise until the mercury flow just stops. (The tapping action is used to knock off the mercury drops so that it is easier to see whether mercury continues to flow).
- Finally, turn slotted screw a quarter of a turn clockwise.

5 Checking the MME for leaks

- Switch on the dropping mercury electrode by selecting **DME** in the **COM-**

PUTRACE CONTROL window and clicking on New drop. The mercury drops freely out of the capillary.

- Select **HMDE** and click on New drop. A single mercury drop is formed. Knock this off by gently tapping the MME **21** with your finger and check that the mercury flow has really stopped. Repeat this operation several times.
- If mercury continues to flow, turn slotted screw **74** still further in a clockwise direction and repeat check.
- If it is not possible to stop the mercury flow, both the glass capillary **87** and the sealing needle **75** have to be replaced (see *section 2.3.9*).

2.3.5 Filling the capillary using vacuum

Filling of the glass capillary **87** with vacuum is advisable in all cases where difficulties have been found with the method without vacuum described in *section 2.3.4* Filling with vacuum is especially recommended when no ultra pure Hg is available.

To fill the mounted glass capillary (*section 2.3.3*) with Hg with vacuum, proceed as follows:

1 Set up filling station

- All actions involving the electrode and the mercury vessels must be performed in or over the drip pan **91** supplied (see *Fig. 10*).
- The MME **21** is placed in the electrode holder **92** for filling.

2 Connection for vacuum pump

- For filling the capillary **87**, the filling tubing **93** is required. At one end it is fitted with a filling cone **94** for mounting on the capillary, and at the other end with the tubing coupling **96** for attachment to the line for the vacuum pump.
- To avoid possible mercury losses, two gas wash bottles **95** are attached to the filling tubing

3 Vacuum pump

- To draw up mercury a suitable vacuum pump is required (e.g. water jet pump). The partial vacuum Δp should be around 25 mbar.
- A vacuum release tap must be installed at the vacuum pump or in the line between the gas wash bottle and the pump for slowly releasing the vacuum.

4 Mount filling tubing

- Mount filling tubing **93** with filling cone **94** on glass capillary **87**.
- Connect filling tubing with tubing coupling **96** to the two gas wash bottles **95** and the vacuum pump (see *Fig. 10*).

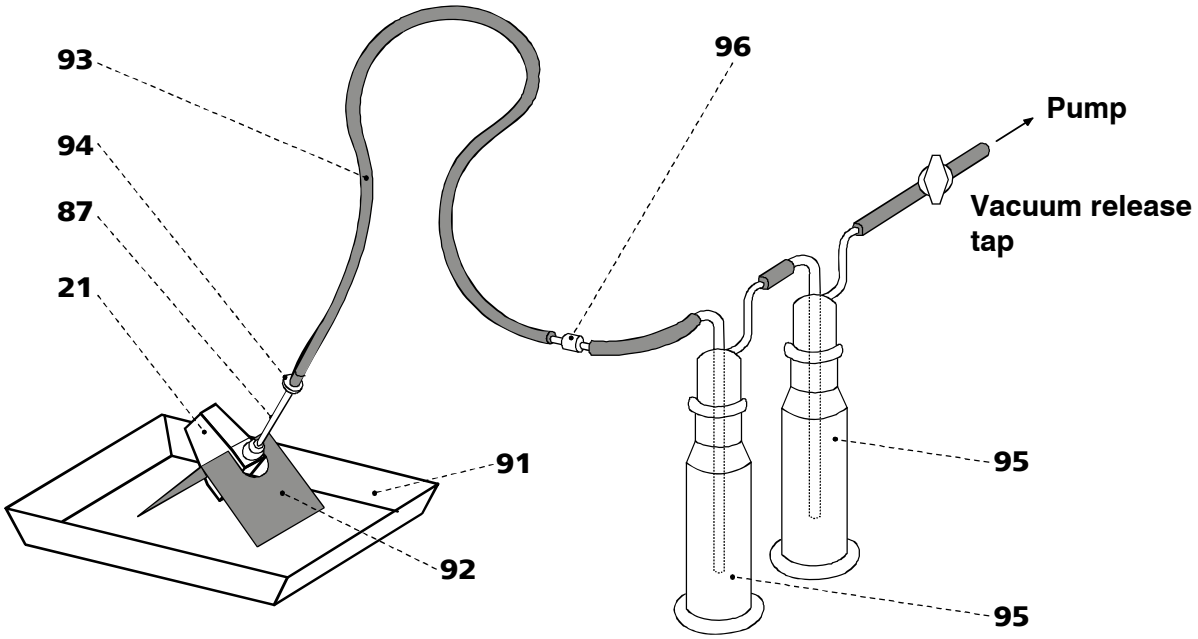


Fig. 10: Setting up the filling station

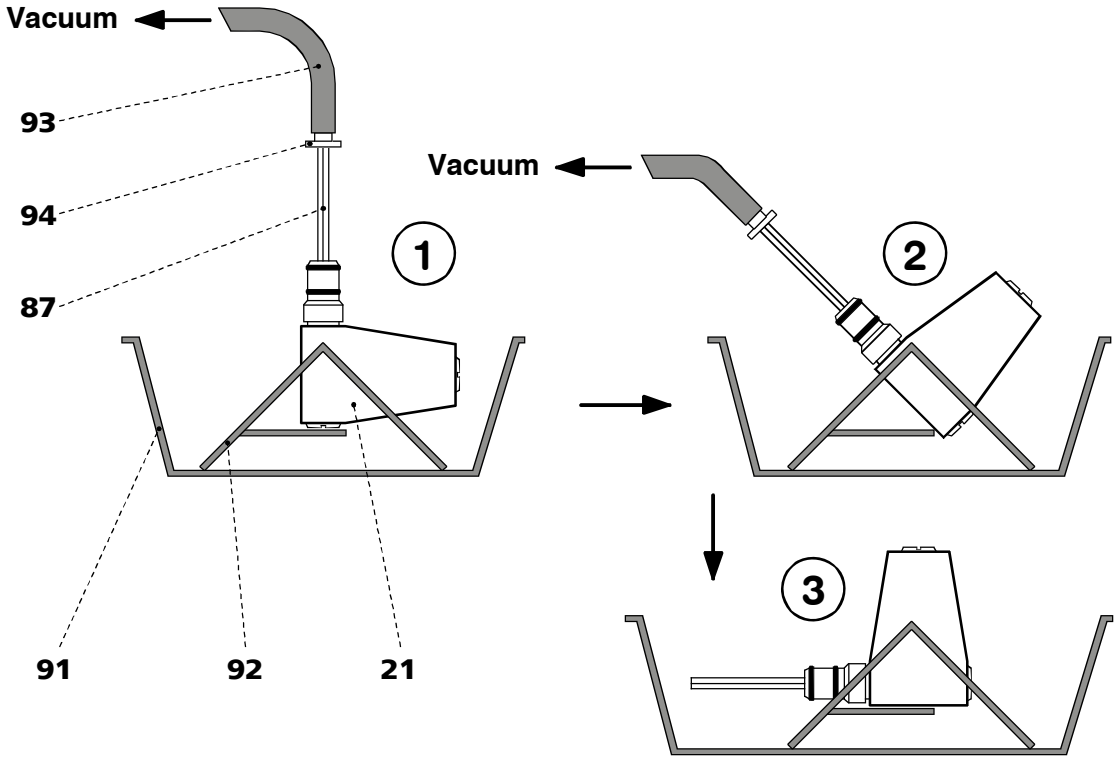


Fig. 11: Filling the capillary

21 Multi-Mode Electrode (6.1246.0020)

87 Glass capillary (6.1226.030)

91 Drip pan (6.2711.030)

92 Electrode holder (6.2615.030)

93 Filling tubing (6.1817.000)

94 **Filling cone (4.420.2860)**
(part of the filling tubing **93**)

95 **Gas wash bottle**

96 **Tubing coupling (6.1809.000)**
(part of the filling tubing **93**)

5 Evacuating in vertical position

- Place Multi-Mode Electrode **21** vertically in the electrode holder **92** (see *Fig. 11-1*).
- Evacuate for ca. 2 min in this position.

6 Evacuating in inclined position

- Carefully tilt Multi-Mode Electrode **21** in the electrode holder **92** to an inclined position and continue evacuating (see *Fig. 11-2*).

7 Release vacuum

- As soon as mercury issues from the tip of the glass capillary **87** into the filling tubing **93**, carefully release the vacuum by opening the vacuum release tap.

*The filling tubing **93** must not be disconnected from the glass capillary **87** when under vacuum, otherwise the mercury which has issued from the capillary would be sprayed onto the tubing wall and can no longer be disposed of in drop form!*

- Tap the glass capillary **87** gently by hand so that any mercury drops at its tip are knocked into the filling tubing **93**.
- Disconnect filling tubing **94** with filling cone from glass capillary.
- Place Multi-Mode Electrode **21** in a horizontal position in the electrode holder **92** (see *Fig. 11-3*).

From now on, the MME must be left in this position until it is installed in the stand!

8 Install Multi-Mode Electrode in 797 VA Computrace Stand

- With measuring head arm **23** tilted back, push empty measuring vessel **7** into the holder **5** of the 797 VA Computrace Stand and then lower measuring head arm **23**.
- Carefully insert Multi-Mode Electrode **21** in opening **58** of the measuring head **24** (during insertion, the tip of the capillary **87** must not touch the measuring head) and push in as far as it will go.

9 Connect Multi-Mode Electrode

- Screw FEP tubing **34** for the inert gas supply into connection **71** of the Multi-Mode Electrode **21**.
- Screw FEP tubing **42** for the inert gas supply into connection **72** of the Multi-Mode Electrode.
- Attach electrode cable **20** (WE) to screw connection **88** of the Multi-Mode Electrode push cable lug under the screw and then tighten screw firmly.

10 Pressurize the MME

- Switch on 797 VA Computrace Stand with mains switch **14** (the 797 VA Computrace Stand must first be installed properly as described in *section 2.2*).
- Start the VA Computrace program and click on  or **MAIN WINDOW / Utility / Computrace control** to open the **COMPUTRACE CONTROL** window. Then switch on the inert gas supply to the 797 VA Computrace Stand by clicking on **DME**. This pressurizes the Multi-Mode Electrode **21** and the mercury begins to flow slowly out of the capillary.
- Gently tap the MME with your finger (to remove any air bubbles) and allow mercury to flow out of the capillary into the empty measuring vessel for approx. 2 min.
- Fill measuring vessel **7** with 10 mL ultra pure water and add 1 drop KCl solution (in pure water, mercury drops from the capillary only with difficulty).
- Allow mercury to flow out of the capillary for ca. 2 min while checking the drop formation: The drop time should be ca. 3 s.

11 Adjusting the sealing needle 75

- Turn slotted screw **74** using a suitable coin slowly in a clockwise direction until the mercury flow stops.
- Open slotted screw slightly in an anticlockwise direction until the mercury flow restarts.
- Gently tap the MME with your finger and turn the slotted screw very slowly clockwise until the mercury flow just stops. (The tapping action is used to knock off the mercury drop so that it is easier to see whether mercury continues to flow).
- Finally, turn slotted screw a quarter of a turn clockwise.

12 Checking the MME for leaks

- Switch on the dropping mercury electrode by selecting **DME** in the **COMPUTRACE CONTROL** window and clicking on 

. The mercury drops freely out of the capillary.
- Select **HMDE** and click on 

. A single mercury drop is formed. Knock this off by gently tapping the MME **21** with your finger and check that the mercury flow has really stopped. Repeat this operation several times.
- If mercury continues to flow, turn slotted screw **74** still further in a clockwise direction and repeat check.
- If it is not possible to stop the mercury flow, both the glass capillary **87** and the sealing needle **75** have to be replaced (see *section 2.3.9*).

2.3.6 Storing the MME

On completion of the measurements, the MME is stored in the 797 VA Computrace Stand so that the tip of the glass capillary **87** is immersed in pure water (or in the solvent used). This prevents blockage of the capillary by crystallized salts.

An electrode treated in this manner can be taken out of the 797 VA Computrace Stand after a few hours and stored in air for a lengthy period without suffering any damage. Always store the MME so that the glass capillary is horizontal (see *Fig. 11-3*).

2.3.7 Replenishing the mercury (without changing capillary)

The Multi-Mode Electrode **21** can also be refilled with mercury without having to remove the glass capillary **87**.

1 Dismantle Multi-Mode Electrode

- Unscrew FEP tubing **34** and **42** from the MME. Disconnect electrode cable **20** from the MME.
- Take Multi-Mode Electrode **21** out of the measuring head **24** and tap the MME gently to knock off any mercury drops on the glass capillary into the measuring vessel.
- Place Multi-Mode Electrode horizontally in the electrode holder **92** (see *Fig. 11-3*). The slotted screw **79** is now at the top.

2 Replenish mercury

- Unscrew slotted screw **79** using a suitable coin. If the slotted screw can not be loosened by hand, screw on locking ring **73** and pull out of the MME.
- Draw up mercury using the syringe **89** with attached needle **90** and expel into the Hg reservoir **81**.

The Hg reservoir must never be filled more than $^{2}/_{3}$ full with mercury.

- Reinsert slotted screw into screw thread **78** and screw flush to surface using a suitable coin (this action may expel a few drops of mercury from glass capillary).

*Do not turn so tightly that the cemented-in steel threaded ring **78** becomes loose and hence jeopardizes the tightness and safety of the MME!*

2.3.8 Changing capillary

The capillary has a limited life time due to mechanical wearout of and chemical contamination of the capillary tip. This results in irreproducible drop fall in DME mode, fall-off of the drop in stripping voltammetry using HMDE or increased noise or high background currents. If the MME is stored for a longer period of time, it is possible that the capillary is blocked by mercury salts. In such cases, exchange the capillary.

We also recommend exchanging the sealing needle regularly. After a longer period of use the surface can be covered with mercury oxides and/or glass particles from the capillary. Both produce high noise during the measurement. Damaged sealing needles

can also lead to leakage of the MME, i.e. the mercury flow cannot be stopped any more.

Proceed as follows:

1 Remove Multi-Mode Electrode from 797 VA Computrace Stand

- Unscrew FEP tubing **34** and **42** from the MME, disconnect electrode cable **20** from MME.
- Take Multi-Mode Electrode **21** out of measuring head **24** while gently tapping the MME to knock off any mercury drops on the glass capillary into the measuring vessel.
- Place Multi-Mode Electrode in a horizontal position in the electrode holder **92** (see *Fig. 11-3*).

2 Unscrew slotted screw 74

- Using a suitable coin, unscrew slotted screw **74** out of screw thread **76** until the contact surface of the black O-ring at the Plexiglas wall (thin, black stripe) is just visible below the metal thread.

3 Replace sealing needle 75

If problems with leaks arise owing to a worn, deformed or damaged sealing needle, it must be replaced. Three spare needles are supplied separately in a protective plastic package. After unpacking a needle, please avoid any contact whatsoever with the needle tip. The spare needle **75** is installed as follows:

- Carefully pull old sealing needle out of PTFE membrane of the slotted screw **74**.
- Carefully insert new sealing needle without tilting into the hole in the PTFE membrane of the slotted screw.

NOTE: Do not touch the needle with bare fingers but use the plastic package

4 Dismantle old capillary

- Position Multi-Mode Electrode vertically in the electrode holder (see *Fig. 11-1*).
- Undo retaining nut **86** completely by turning anticlockwise and lift up until the lower part of the glass capillary **87** with the wide opening is visible.
- Gently tap the glass capillary to knock off any residual mercury in the wide opening into the MME.
- Press the retaining nut downward with one hand and with your other hand take glass capillary completely out of the mount.

5 Dispose of old capillary

- Connect filling tubing **93** with the tubing coupling **96** to the two gas wash bottles **95** and the vacuum pump (see *Fig. 10*).
- Insert glass capillary **87** (capillary end) in the filling cone **94** of the filling tubing.
- Remove mercury from capillary with the vacuum pump.

6 Replenish mercury if necessary

Proceed as described in *section 2.3.2*.

7 Mount new capillary

Proceed as described in *section 2.3.3*.

8 Fill capillary

Proceed as described in *section 2.3.4* or *section 2.3.5*.

2.3.9 Cleaning the MME

If the mercury in the Multi-Mode Electrode is contaminated and this leads to disturbances, the MME must be cleaned and refilled with ultra pure mercury. Proceed as follows:

1 Remove Multi-Mode Electrode from 797 VA Computrace Stand

- Unscrew FEP tubing **34** and **42** from the MME, disconnect electrode cable **20** from MME.
- Take Multi-Mode Electrode **21** out of measuring head **24** while gently tapping the MME to knock off any mercury drops on the glass capillary into the measuring vessel.

2 Remove old mercury

- Place Multi-Mode Electrode **21** in a horizontal position in the electrode holder **92** (see *Fig. 11-3*). The slotted screw **79** is now at the top.
- Unscrew slotted screw using a suitable coin.
- Carefully turn MME and empty mercury through the threaded opening **78** into a waste container placed in the drip pan **91**. While doing so, gently tap the glass capillary **87** and the MME to ensure that all mercury flows out of the MME.

3 Dismantle MME

- Unscrew retaining nut **86**.
- Take glass capillary **87** out of opening **82**, the sealing ring **84** and the locking ring **85** are removed at the same time. Remove these two parts from the glass capillary.
- Remove insert ring **83** from the MME.
- Unscrew slotted screw **74** with a suitable coin in an anticlockwise direction from screw thread **76**.
- Screw locking ring **73** onto slotted screw and pull out of the MME.

4 Dispose of old capillary

- Connect filling tubing **93** with the tubing coupling **96** to the two gas wash bottles **95** and the vacuum pump (see *Fig. 10*).
- Insert glass capillary **87** (capillary end) in the filling cone **94** of the filling tubing.
- Remove mercury from the capillary with the vacuum pump.

5 Clean MME

- Clean inner compartments of the MME, contact pin **80** and the screw threads **76**, **78** and **82** with a lint-free cloth.
- If required, rinse all inner compartments of the MME and the unscrewed individual parts with dist. water and then dry with N_2.

Do not use any organic solvents.

If you used water to clean the MME, make sure that the inside of the electrode has dried entirely. Residual moistness can cause problems during subsequent measurements.

6 Replace sealing needle 75 if needed

If problems with leaks arise owing to a worn, deformed or damaged sealing needle this must be replaced. Three spare needles are supplied separately in a protective plastic package. After unpacking a needle, please avoid any contact whatsoever with the needle tip. The spare needle **75** is installed as follows:

- Carefully pull old sealing needle out of PTFE membrane of the slotted screw **74**.
- Carefully insert new sealing needle without tilting into the hole in the PTFE membrane of the slotted screw.

*When the sealing needle **75** is changed, it is always necessary to change the glass capillary **87**!*

7 Replace sealing ring 84 if needed

- If the sealing ring **84** is contaminated or damaged in any way, it must be replaced for the subsequent assembly of the MME. Two new sealing rings are enclosed in the package with the 6.1226.030 (normal) resp. 6.1226.050 (silanised) glass capillaries.

8 Reassemble MME

- Screw slotted screw **79** using a suitable coin flush into screw thread **78**.

*Do not turn so tightly that the cemented-in steel threaded ring **78** becomes loose and hence jeopardizes the tightness and safety of the MME!*

- Using a suitable coin, screw slotted screw **74** into the screw thread **80** until the contact surface of the black O-ring at the Plexiglas wall (thin, black stripe) is just visible below the metal thread.
- Place Multi-Mode Electrode **21** with the opening **82** facing upwards in the electrode holder **92** (see *Fig. 11-1*).
- Insert ring **83** in opening **86**.
- Push sealing ring **84** onto locking ring **85** and insert both in the opening **82**.
- Screw retaining nut **86** by hand into screw thread **82** until a slight resistance is felt.

9 Add mercury

Proceed as described in *section 2.3.2*.

10 Mount new capillary

Proceed as described in *section 2.3.3*.

11 Fill capillary

Proceed as described in *section 2.3.4* or *section 2.3.5*.

2.4 Rotating disk electrode (RDE)

The rotating disk electrode (RDE) can be used in place of the MME in the 797 VA Computrace Stand with different electrode tips as a working electrode. Version 2.797.0030 is delivered solely with a rotating plating electrode. For operation of the rotating disk electrode (RDE) the following accessories are required (see also *section 4.3*):

- **6.1204.210 Driving axle for rotating disk electrode (RDE) with titanium axle**
- **6.1204.220 Driving axle for rotating disk electrode (RDE) with titanium axle and mercury contact**
- **6.1204.XXX Electrode tip for rotating electrode**
  - 6.1204.110 GC (Glassy Carbon)
  - 6.1204.120 Pt unpolished, 2 mm disk diameter
  - 6.1204.130 Ag
  - 6.1204.140 Au for Hg determination
  - 6.1204.150 Au for As determination
  - 6.1204.160 Pt polished, 2 mm disk diameter for CVS
  - 6.1204.170 Pt polished, 3 mm disk diameter for CVS
  - 6.1204.180 Ultra Trace Graphite
  - 6.1204.190 Pt polished, 1 mm disk diameter for CVS
- **6.2709.040 Stopper for closing the MME opening**
- **6.2802.000 Polishing kit for 6.1204.XXX Electrode tips (Pt, Ag, Au, GC)**
- **6.2827.000 Trimming tool for 6.1204.180 Electrode tip (Ultra Trace Graphite)**

It is recommended to use RDE tips (except Pt) only together with a glassy carbon auxiliary electrode!

2.4.1 Construction and startup of the RDE

The rotating disk electrode RDE comprises the two parts drive shaft **99** (6.1204.210) and electrode tip **98** (6.1204.2x0), which must be screwed together.

The procedure for installing the RDE in the measuring head arm of the 797 VA Computrace Stand is described in detail in *section 2.2.4.* The fully equipped measuring head arm with the RDE is illustrated in *Fig. 12*.

2.4.2 Regeneration of RDE

The RDE is a solid electrode with a stationary surface. This becomes contaminated with the products of the electrode redox processes with increasing use
For regeneration please observe the information on the leaflet enclosed with the RDE.

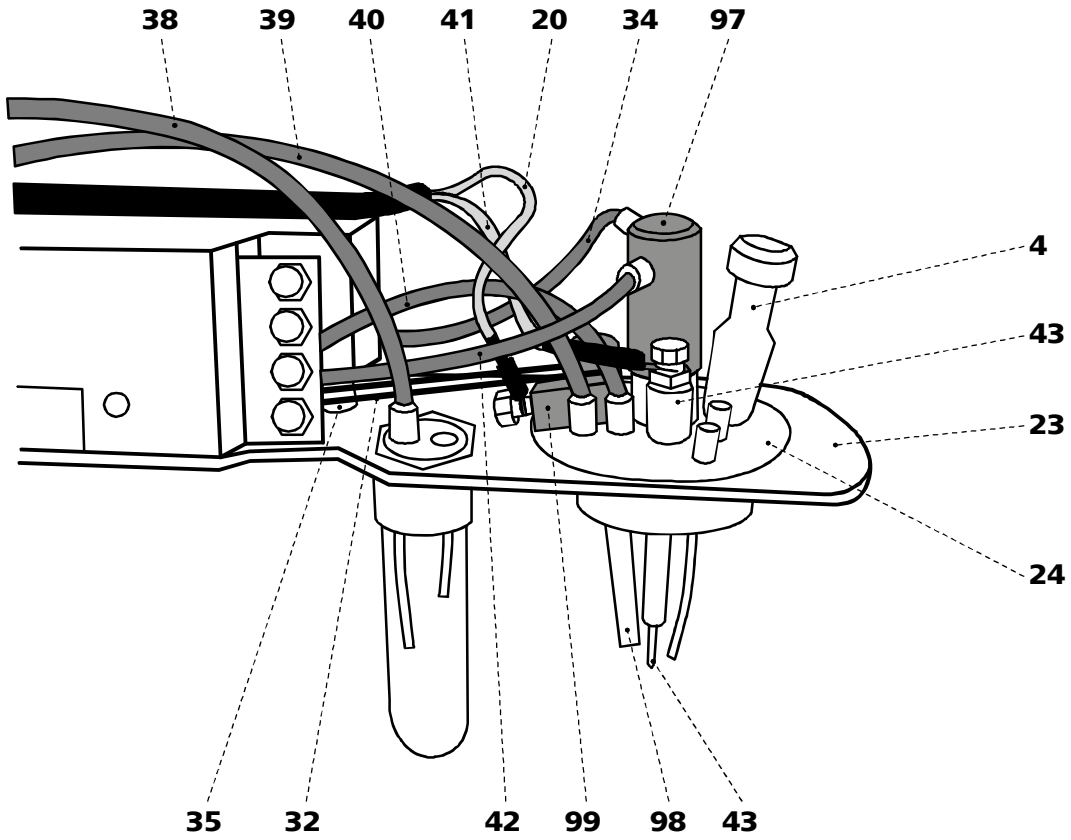


Fig. 12: Measuring head arm with rotating disk electrode (RDE)

4 Stopper (6.2709.080)
to close the pipetting opening

20 Electrode cable "WE"
connection for working electrode (RDE)

23 Measuring head arm
carrier plate with permanently attached measuring head, raisable

24 Measuring head
measuring vessel upper half made of PTFE; with openings for electrodes, stirrer, gas and liquid supply lines

32 Drive belt (6.1244.020)
connection between drive wheel **35** und and drive shaft **99**

34 FEP tubing (6.1805.180)

35 Drive wheel of drive motor

39 FEP tubing (6.1805.090)
for inert gas lead-off

40 FEP tubing (6.1805.180)
for inert gas supply to tapping mechanism (attached)

41 Electrode cable "AE"
connection for auxiliary electrode **43**

42 FEP tubing (6.1805.180)

43 Auxiliary electrode
details, see *section 2.6*

97 Stopper (6.2709.040)
for closing the MME opening and to accommodate the two lengths of FEP tubing **34** and **42**

98 Electrode tip (6.1204.XXX) for RDE

99 Drive shaft (6.1204.210) for RDE

2.5 Reference electrode

2.5.1 Construction

The complete reference electrode (RE) **26** comprises two parts:

- **6.0728.0X0 Ag/AgCl-reference system (100)**
  with ceramic diaphragm type D, diameter = 1 mm
  6.0728.030 Reference system: LL-Ag/AgCl/*c*(KCl) =3 mol/L;
  6.0728.020 Reference system: Ag/AgCl/*c*(KCl) = 3 mol/L; supplied in a holder filled with *c*(KCl) = 3 mol/L as standard
  6.0728.010 Reference system: Ag/AgCl supplied dry (option)
- **6.1245.010 Electrolyte vessel (101)**
  with ceramic diaphragm type D, diameter=3 mm; holds a second electrolyte solution (bridge electrolyte) and thus forms with the 6.0728.020 Reference system a complete reference electrode in the so-called double junction construction.

The construction of the reference electrode and the designations of the individual parts are shown in *Fig. 13*.

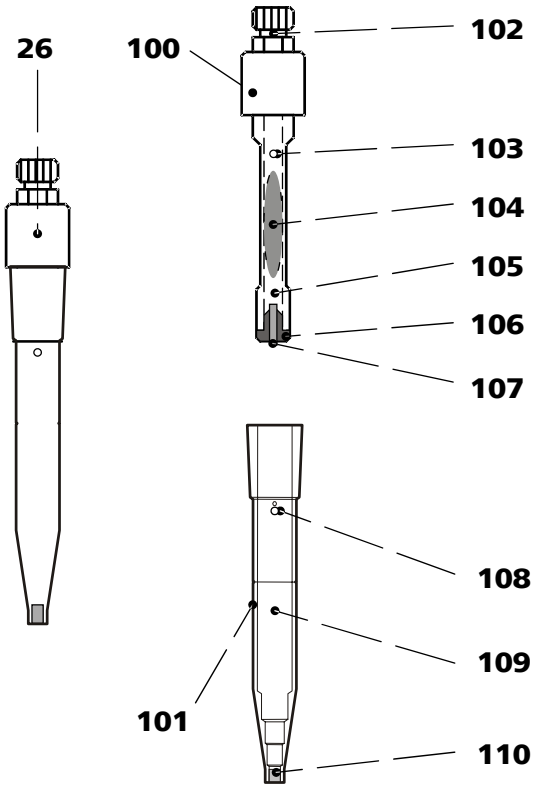


Fig. 13: Construction of the reference electrode

26	**Reference electrode**
100	**Reference system (6.0728.0X0)**
101	**Electrolyte vessel (6.1245.010)**
102	**Electrical connection for cable "RE"**
103	**Vent opening**
104	**Ag/AgCl filling**
105	**Electrolyte compartment with internal electrolyte**
106	**Diaphragm support made of PCTFE**
107	**Diaphragm**
108	**Vent opening**
109	**Electrolyte compartment with bridge electrolyte**
110	**Diaphragm**

2.5.2 Startup procedure

The reference electrode **26** is supplied in modular form as the reference system **100** and the electrolyte vessel **101** and has first to be filled and assembled as follows:

1 Add internal electrolyte

Filling of the reference system is necessary only when the optional 6.0728.010 Reference system supplied dry is used, if the internal electrolyte solution has to be renewed / filled up or if gas bubbles interrupt the electrical connection.

- Hold reference system **100** so that diaphragm **107** faces upwards.
- Unscrew diaphragm support **106**.
- Fill electrolyte compartment **105** completely with the desired internal electrolyte. Expel any air bubbles by tapping shaft gently.
- Screw diaphragm support **106** back on, the electrolyte solution thus displaced is expelled through the vent opening **103**.

2 Add bridge electrolyte

- Fill internal compartment **109** of the electrolyte vessel **101** with a suitable bridge electrolyte whose composition depends on the analyses to be performed (aqueous or non-aqueous solution, composition of the supporting electrolyte, etc.).
- For the determination of organic additives in electroplating bath solutions with CVS and CPVS use electrolyte c(KNO3) = 1 mol/L (Metrohm order no. 6.2310.010).

*If you use the same solution for the bridge electrolyte and the internal electrolyte (single-junction operation), the inner diaphragm **107** can be omitted to reduce the electrical resistance: Unscrew diaphragm support **106** with diaphragm **107** from the reference system **100**.*

3 Screw reference electrode together

- Insert the filled reference system **100** in the vessel **101** filled with bridge electrolyte and screw tight. The electrolyte solution thus displaced is expelled through the vent opening **108**. Metrohm recommends waiting now until the diaphragm is soaked with bridge electrolyte (ca. 20 min).

4 Install reference electrode in 797 VA Computrace Stand and connect

- Insert reference electrode **26** in opening **61** of the measuring head **24** (see *Fig. 6*).
- Attach electrode cable **31** (RE) to reference electrode:
  push cable lug under the screw and then tighten screw firmly.
- Turn reference electrode so that the electrode cable points to the rear and not to the side (in the latter position it may become kinked and damaged when cover **2** is closed).

2.6 Auxiliary electrode

2.6.1 Construction

The following electrodes can be used as the auxiliary electrode **43**:

- **6.0343.000** **Pt auxiliary electrode**
  supplied as standard
- **6.1241.020** **Electrode holder** and
  6.1247.000 **Glassy carbon tip**
  together form the glassy carbon auxiliary electrode
  available as an option

The construction of the two auxiliary electrodes and the designations of the individual parts are shown in *Fig. 14*.

2.6.2 Startup procedure

The 6.0343.000 Pt auxiliary electrode supplied as standard can be inserted directly in the 797 VA Computrace Stand (→ **2**), whereas the GC auxiliary electrode available as an option must first be assembled (→ **1**):

1 Assembly of the GC auxiliary electrode

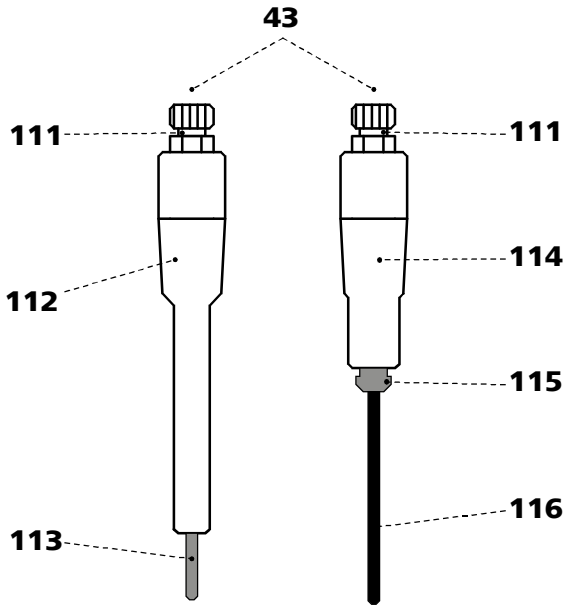
- Insert glassy carbon tip **116** through the locking ring **115** into the electrode holder **114** as far as it will go.

Glassy carbon is a brittle, easily breakable material and must therefore be inserted carefully into the electrode holder and handled gently.

*If the GC tip breaks, the part remaining in the holder can be removed by pulling out the locking ring **115**.*

2 Install auxiliary electrode in 797 VA Computrace Stand and connect

- Insert auxiliary electrode **43** in opening **54** of the measuring head **24** (see *Fig. 6*).
- Attach electrode cable **41** (AE) to auxiliary electrode **39**:
  Push cable plug under the screw and tighten screw firmly.
- Turn auxiliary electrode **39** so that the electrode cable **37** points to the rear and not to the side (in the latter position it may become kinked and damaged when cover **2** is closed).



43	**Auxiliary electrode**
111	**Electrical connection for cable "AE"**
112	**Pt Auxiliary electrode** (6.0343.000)
113	**Pt tip** (permanently attached)
114	**Electrode holder (6.1241.020)**
115	**Locking ring**
116	**Glassy carbon tip (6.1247.000)**

Fig. 14: Construction of the auxiliary electrode

2.7 Stirrer

The startup procedure for the stirrer is as follows:

1 Insert stirrer

- Insert complete stirrer in opening **63** of the measuring head **24** as far as it will go (see *Fig. 6*).

2 Connect stirrer

- Stretch drive belt **32** between drive wheel **35** and drive shaft of the stirrer **28** (see *Fig. 3*).

2.8 Connection of Dosing devices

For the automatic addition of standard and auxiliary solutions, up to three Dosing devices (possible: 700/800 Dosino or 685/805 Dosimat) can be attached via the MSB sockets **MSB1 - MSB3 (12)** to the 797 VA Computrace Stand.

*For the connection of four additional Dosing devices, a 846 Dosing Interface can be used (from software version 1.2). The 846 Dosing Interface (ordering details see Section 4.3.1) can be connected to a USB Connection **19** of the 797 VA Computrace or to a USB Connection of the PC. For the controlling of the Dosing devices, see the Software Manual 8.797.8033.*

Following Dosing devices can be operated with the 797 Computrace:

800 Dosino with Dosing unit 807

700 Dosino with Dosing unit 807

805 Dosimat with Exchange unit 806

685 Dosimat with Exchange unit 806
(for the connection, cable 6.2134.030 is needed)

Dosing- and Exchange Units have burette volumes from 1 mL – 50 mL. The choice between Exchange unit and Dosing unit depends on the volume of liquid the Dosimat/Dosino should dispense. A burette volume of 5 mL (Exchange unit) or 2 mL (Dosing unit) is recommended for additions in the µL range (standard additions solutions), a burette volume of 10 mL or higher is recommended for additions in the mL range (auxiliary solutions).

Ordering descriptions of all Dosing devices, Dosing- and Exchange units and cables can be found in *section 4.3.*

This section describes the connection procedure; further details on Dosing devices and the different Dosing- and Exchange units can be found in the respective *Instructions for Use*.

2.8.1 Electrical connection

Connect all Dosing devices to an MSB-connection **12** of the 797 VA Computrace Stand and switch the 797 VA Computrace Stand on at the main switch **14**. MSB-Connections can be extended with the cable 6.2151.010. The connection must not be longer than 15 m.

For hardware-settings of the Dosing units see 797 Software Manual and the respective *Instructions for Use*.

2.8.2 Tubing connection

For the addition of volumes < 2 mL of standard or auxiliary solutions into the measuring vessel of the 797 VA Computrace Stand, the 4-way microtip **30** (6.1824.000) can be used. It is fitted with 4 lengths of PTFE tubing with connection nipples for direct attachment to the Dosinos or Dosimats. To ready the Dosing devices for automatic dispensing, proceed as follows:

700 Dosino and 800 Dosino

1 Mount Dosing unit on Dosino

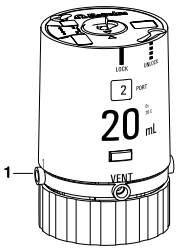
- Procedure, see *Instructions for Use 700*, *section 2.2*, and *Instructions for Use 800*, *section 3.1 respectively*.

2 Insert 4-way microtip in 797 VA Computrace Stand (see *section 2.2.4*)

- Remove stopper from nipple **27** and insert 4-way microtip **30** into nipple as far as it will go (see *Fig. 3* and *Fig. 6*).
- Tighten nipple manually, so that the 4-way microtip can no longer move.
- Pull the 4 lengths of PTFE tubing of the 4-way microtip **26** in succession from above through the opening **64**.

3 Connect PTFE-Tubing to Dosing unit

- Screw connection nipple of the PTFE tubing of the 4-way microtip **30** on **1** (Port 1) of the Dosing unit 807.

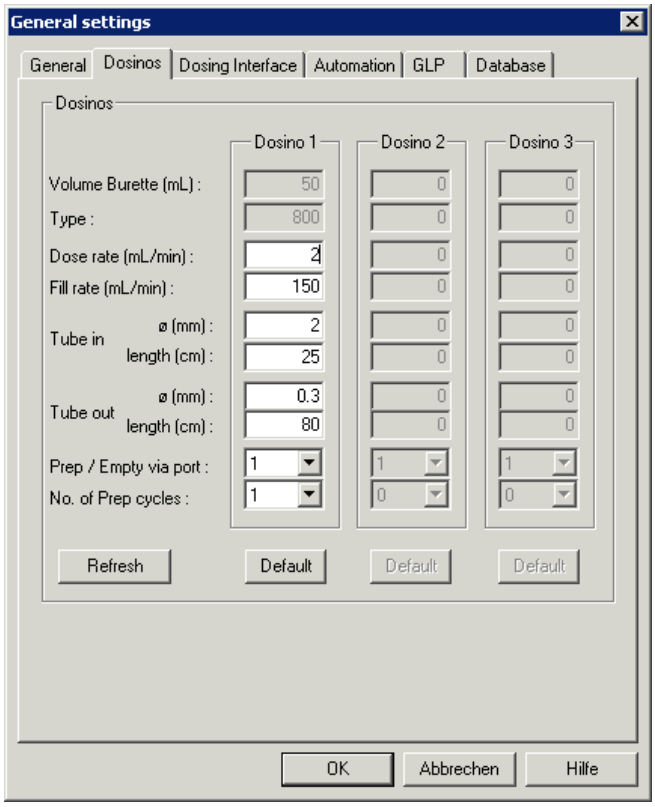


4 Close unused PTFE tubing

- Screw a 6.1808.000 Coupling (accessory of 797 VA Computrace Stand) on each unused PTFE tubing of the 4-way microtip **30**.
- Screw a 6.1446.040 Dummy stopper (accessory of 797 VA Computrace Stand) on each 6.1808.000 Coupling.

5 Initialize Dosino(s)

- Switch on the 797 VA Computrace Stand using the mains switch **14**.
- Switch on the PC and start the 797 VA Computrace program.
- Open the **Dosinos** tab (if the Dosino is connected to the 846 Dosing Interface: the **Dosing Interface** tab) of the window **General settings** and enter the following configuration:



- **Note**: The maximum allowed dose rate is 2 mL/min if the 4-way microtip is used to dose the solution in the measuring vessel.
- Click **<OK>**.
- Click on  or **MAIN WINDOW / Utility / Dosino control** to open the **DOSINO CONTROL** window.
- The connected Dosino and the mounted Dosing unit are automatically identified.
- Click the Prep ON button to empty and refill the Dosing unit installed on the Dosino.
- Check if there are air bubbles left in the glass cylinder of the Dosing unit. If this is the case, repeat the flushing procedure by clicking the Prep ON button.
- Close the **DOSINO CONTROL** window.
- **Note**: If you choose Port 3 for menu item **Prep / Empty via port**, you must install an FEP Tubing Connection 6.1805.XXX from Port 3 to a waste container.

685 Dosimat and 805 Dosimat

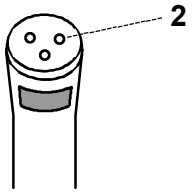
1 Mount Exchange unit on Dosimat

- Procedure, see *Instructions for Use 685*, *section 2.1*; and *Instructions for Use 805*, *section 3.1 respectively*.

2 Insert 4-way microtip in 797 VA Computrace Stand (see *section 2.2.4*)

- Remove stopper from nipple **27** and insert 4-way microtip **30** into nipple as far as it will go (see *Fig. 3* and *Fig. 6*).
- Tighten nipple manually, so that the 4-way microtip can no longer move.
- Pull the 4 lengths of PTFE tubing of the 4-way microtip **26** in succession from above through the opening **64**.

3 Connect PTFE tubing to Exchange unit



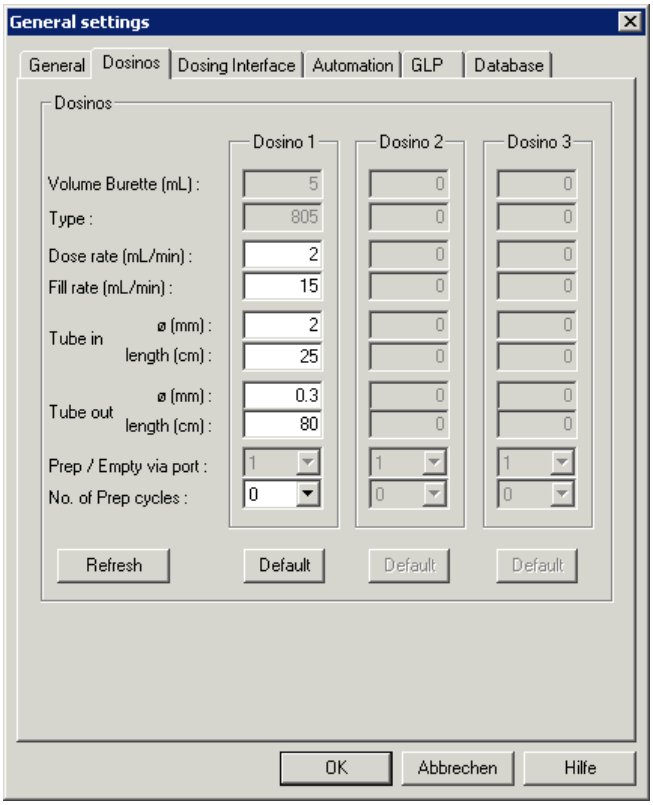
- Unscrew the attached 6.1805.020 FEP Tubing (*L* = 40 cm) from connection **2** (connection for burette tip) of the flat stopcock on the Exchange unit mounted on the Dosimat.
- Screw connection nipple of the PTFE tubing of the 4-way microtip **30** onto connection **2** of the flat stopcock on the Exchange unit mounted on the Dosimat.

4 Close unused PTFE tubing

- Screw a 6.1808.000 Coupling (accessory of 797 VA Computrace Stand) on each unused PTFE tubing of the 4-way microtip **30**.
- Screw a 6.1446.040 Dummy stopper (accessory of 797 VA Computrace Stand) on each 6.1808.000 Coupling.

5 Initialize Dosimat(s)

- Switch on the 797 VA Computrace Stand using the mains switch **14**.
- Switch on the PC and start the 797 VA Computrace program.
- Open the **Dosinos** tab (if the Dosino is connected to the 846 Dosing Interface: the **Dosing Interface** tab) of the window **General settings** and enter the following configuration:



- **Note**: The maximum allowed dose rate is 2 mL/min if the 4-way microtip is

used to dose the solution in the measuring vessel.

- Click **<OK>**.
- Click on  or **MAIN WINDOW / Utility / Dosino control** to open the **DOSINO CONTROL** window.
- The connected Dosimat and the mounted Exchange Unit are automatically identified.
- Click the Prep ON button to empty and refill the Exchange unit installed on the Dosimat.
- Check if there are air bubbles left in the glass cylinder of the Exchange unit. If this is the case, repeat the flushing procedure by clicking the Prep ON button.
- Close the **DOSINO CONTROL** window.

2.8.3 Change Dosing-/Exchange unit

Dosing unit 807

The Dosing unit mounted on the Dosino can be changed only in the exchange position which is reached after filling. Please proceed as follows:

1 Fill Dosing unit

At the start of the VA Computrace program, the Dosing unit is automatically filled. So this step is only necessary if the Dosino has already been used during the running program session.

- Click on  or **MAIN WINDOW / Utility / Dosino control** to open the **DOSINO CONTROL** window.
- Click the Fill button of the corresponding Dosino to fill the Dosing unit installed on the Dosino.

2 Change Dosing unit

- Unscrew connection nipple of the PTFE tubing of the 4-way microtip **30** from connection **1** and take off old Dosing unit.
- Mount new Dosing unit on Dosino, the new Dosing unit is automatically identified.
- Screw connection nipple of the PTFE tubing of the 4-way microtip **30** on **1** (Port 1) of the Dosing unit.

3 Initialize Dosino(s)

- Click on  or **MAIN WINDOW / Utility / Dosino control** to open the **DOSINO CONTROL** window.
- Click the Prep ON button of the corresponding Dosino to empty and refill the Dosing unit installed on the Dosino.
- Check if there are air bubbles left in the glass cylinder of the Dosing unit. If this is the case, repeat the flushing procedure by clicking the Prep ON button.
- Close the **DOSINO CONTROL** window.

Exchange unit 806

The Exchange unit 806 mounted on the Dosimat can be changed only in the exchange position which is reached after filling. Please proceed as follows:

1 Fill Exchange unit

At the start of the VA Computrace program, the exchange unit is automatically filled. So this step is only necessary if the Dosimat has already been used during the running program session.

- Click on  or **MAIN WINDOW / Utility / Dosino control** to open the **DOSINO CONTROL** window.
- Click the 

button of the corresponding Dosimat to fill the Exchange unit installed on the Dosimat.

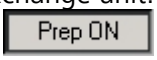
2 Change Exchange unit

- Unscrew connection nipple of the PTFE tubing of the 4-way microtip **30** from connection **2** and take off old Exchange unit.
- Mount new Exchange unit on Dosimat, the new Exchange unit is automatically identified.
- Screw connection nipple of the PTFE tubing of the 4-way microtip **30** onto connection **2** of the flat stopcock on the Exchange unit.

3 Initialize Dosimat(s)

- Click on  or **MAIN WINDOW / Utility / Dosino control** to open the **DOSINO CONTROL** window.
- Click the 

button of the corresponding Dosimat to empty and refill the Exchange unit installed on the Dosimat.
- Check if there are air bubbles left in the glass cylinder of the Exchange unit.

  If this is the case, repeat the flushing procedure by clicking the 

button.
- Close the **DOSINO CONTROL** window.

2.9 Connection of 863 Compact Autosampler

With the 863 Compact Autosampler connected to the 797 VA Computrace Stand, max. 18 samples can be transferred to the measuring vessel at the 797 VA Computrace Stand. It can only be used for the automated voltammetric trace analysis. After each measurement, the measuring vessel is rinsed by means of a 843 Pump Station. For operation of this sample changer and the automatic addition of addition solutions and auxiliary solutions by means of Dosing devices, the following instruments and accessory parts are needed (see also *section 4.3*):

Quant.	Order no.	Instrument/Accessory
1	2.863.0020	863 Compact Autosampler for VA-Applications
1	2.843.0140	843 Pump Station Membrane Version for VA-Applications
	or	
1	2.731.0010	731 Relay Box with
2	2.772.0110	772 Pump Units

For automatically addition of addition- and auxiliary solutions up to **three** Dosing devices can be used (four additional with a 846 Dosing Interface, see also *section 2.8*). Following instruments/accessories are needed per Dosing device (see also *section 4.3*):

Quant.	Order no.	Instrument/Accessory
1	2.800.0010	800 Dosino
1	6.3032.120	Dosing unit 2 mL (for addition solutions)
1	6.3032.210	Dosing unit 10 mL (for auxiliary solutions)
	or	
1	2.700.0010	700 Dosino
1	6.3032.120	Dosing unit 2 mL (for addition solutions)
1	6.3032.210	Dosing unit 10 mL (for auxiliary solutions)
	or	
1	2.805.0010	805 Dosimat
1	6.3026.150	Exchange unit 5 mL (for addition solutions)
1	6.3026.210	Exchange unit 10 mL (for auxiliary solutions)
	or	
1	2.685.0010	685 Dosimat
1	6.3026.153	Exchange unit 5 mL (for addition solutions)
1	6.3026.213	Exchange unit 10 mL (for auxiliary solutions)
1	6.2134.030	Cable 797–685

This section describes the procedure for the connection of 863 Compact Autosampler and 843 Pump Station. For the connection of Dosing devices, see *section 2.8*.

For the addition of Volumes > 2 mL it is recommended to use 6.1805.xxx tubings instead of the 4-way-microtip 6.1824.000.

2.9.1 Electrical connection

*Before any instruments are attached to the 797 VA Computrace Stand, the 797 VA Computrace Stand must be **switched off** using the mains switch **14**.*

The 863 Compact Autosampler is connected to the socket "Remote 2" of the 843 Pump Station with the cable 6.1241.230 (Autosampler accessory). The socket "Remote 1" of the 843 Pump Station is connected to the socket "Remote" **15** of the 797 VA Computrace Stand with the cable 6.2141.280 (Pump Station accessory) (see *Fig. 15*).

For connection of Dosing devices see *section 2.8*.

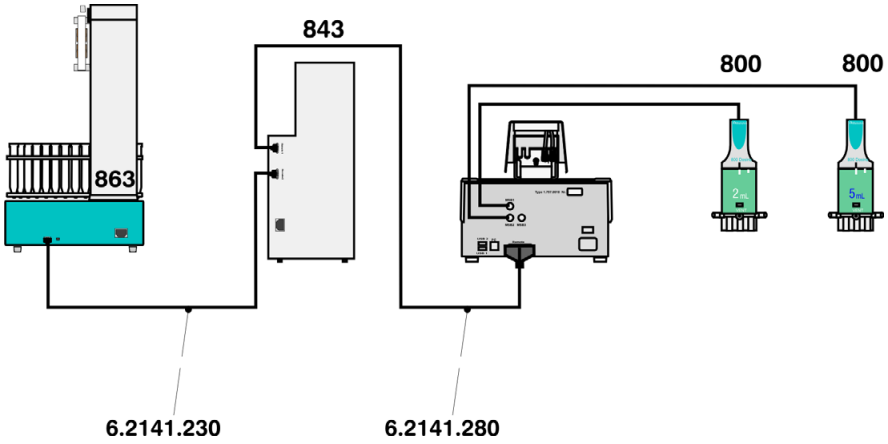


Fig. 15: Electrical connection of the 863 Compact Autosampler

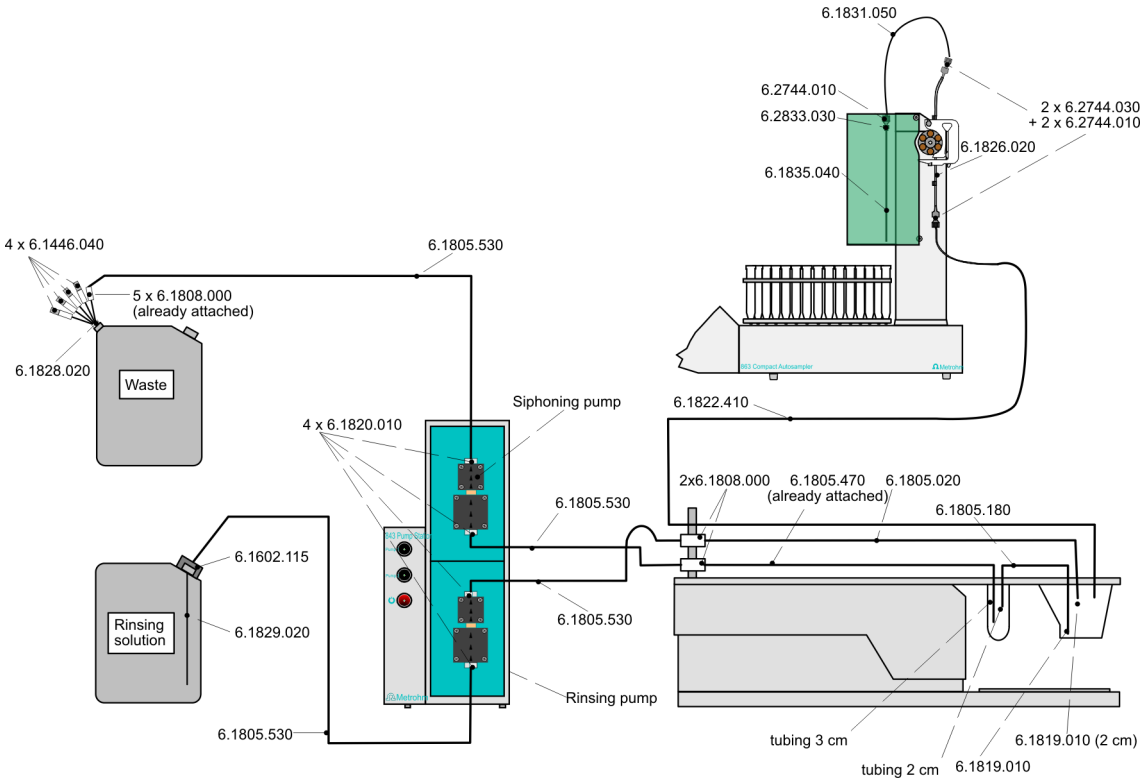


Fig. 16: Tubing connections for operation of the 863 Compact Autosampler

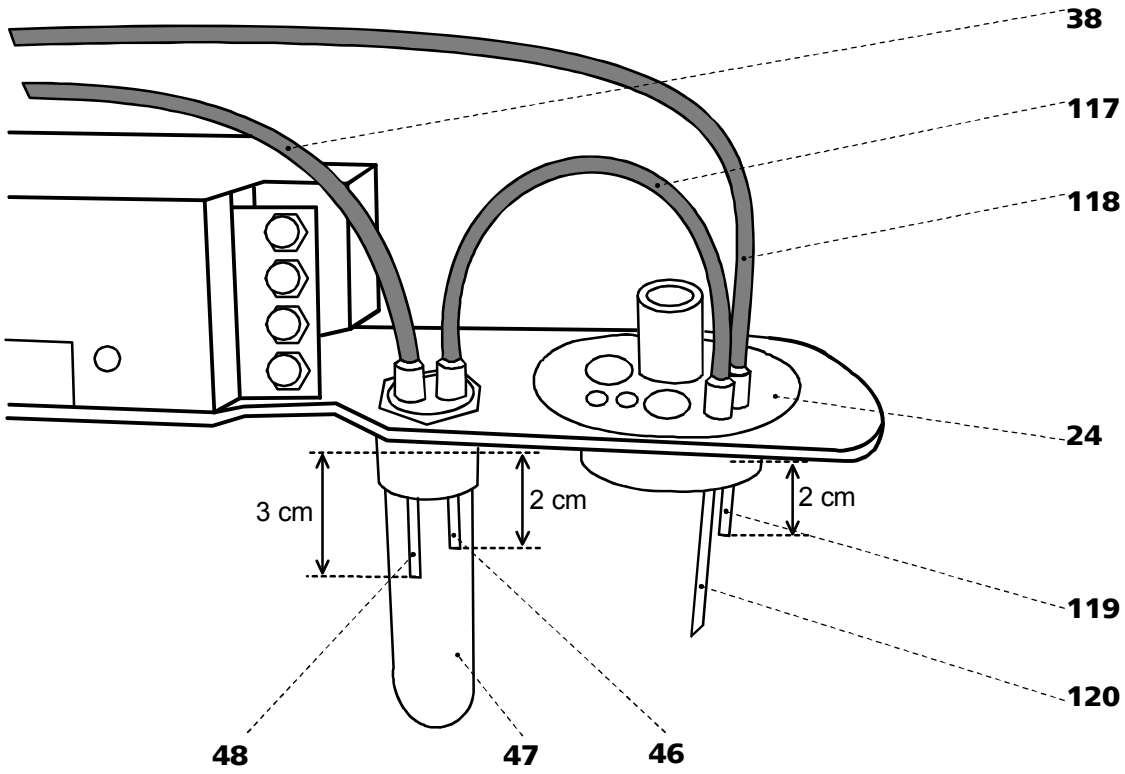


Fig. 17: Installation of accessories for rinsing and siphoning off

24 Measuring head

38 FEP tubing (6.1805.100)
for waste solution lead-off (attached)

46 PTFE tube (6.1819.010)
for supply of the waste solution to gas wash bottle **47**

47 Gas wash bottle (6.2405.030)
for separating mercury from the waste solution (attached)

48 PTFE tube (6.1819.010)
for siphoning off the waste solution from gas wash bottle **47** (attached)

117 FEP tubing (6.1805.180)
for transferring the waste solution to gas wash bottle **47**

118 FEP tubing (6.1805.020)
for supply of the rinsing solution

119 PTFE tube (6.1819.010)
for introduction of the rinsing solution to the measuring vessel

120 PTFE tube (6.1819.010)
for siphoning-off the waste solution

2.9.2 Tubing connections

For operation of the 797 VA Computrace Stand with 863 Compact Autosampler 843 Pump Station, the accessories and tubing connections must be installed according to *Fig.* 16. Proceed as follows:

1 Install accessories at 797 VA Computrace Stand

- Instead of the 6.1415.210 measuring vessel, install the 6.1456.210 measuring vessel at the 797 VA Computrace Stand.
- Cut PTFE tube **119** (6.1819.010) to a length of **max. 20 mm** and insert from above in opening **56** of the measuring head **24**.
- Cut the bottom end of PTFE tube **120** (6.1819.010) diagonally and insert from above in opening **55** of the measuring head **24**. To ensure that the solution (particularly the mercury) is siphoned off as completely as possible, the end of the tube must be located in the deepest part of the 6.1456.210 measuring vessel (left rear when viewed from front).
- Screw FEP tubing **117** (6.1805.180) into threaded openings **55** and **69**.
- Screw FEP tubing **118** (6.1805.020) into threaded opening **56** of the measuring head **24**. Screw a 6.1808.000 tubing coupling to the other end of FEP tubing **118** (tighten strongly, to prevent leakage of possibly corrosive liquid!) and insert the coupling in a slot of the tubing holder at the rear of the 797 VA Computrace Stand.

2 Connect 863 Compact Autosampler

- Install accessories at 863 Compact Autosampler (see *Instructions for Use 863*).
- Adjust 6.1835.030 Pipetting needle at the 863 Compact Autosampler to ensure that the lower end of the needle is positioned max. 0.5 mm above the bottom of the sample vessel (see *Fig. 18*). This is essential to guarantee a complete transfer of the sample from the sample vessel into the measuring vessel of the 797 VA Computrace Stand.
- Insert 6.1822.410 transfer tubing connected to 6.1826.020 pump tubing from above into opening **60** of the measuring head **24** at the 797 VA Computrace Stand (see *Fig. 6*) and fix it by screwing the nipple.

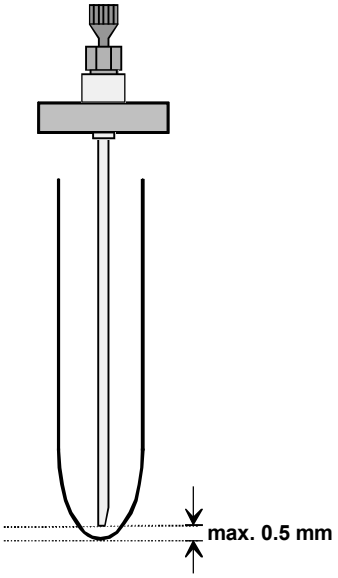


Fig. 18: Adjusting the pipetting needle

3 Connect 843 Pump Station

- On both membrane pumps, replace the two 6.1446.040 threaded stoppers by two 6.1820.010 screw connectors.
- Attach one end of a 6.1805.530 FEP tubing to the top screw connector of the siphoning pump (upper membrane pump). Attach the other end of the 6.1805.530 FEP tubing to one of the 6.1808.000 connection bushings of the waste container.
- Attach one end of a 6.1805.530 FEP tubing to the lower screw connector of the siphoning pump (upper membrane pump). Attach the other end of the 6.1805.530 FEP tubing to the 6.1808.000 connection bushing attached at the FEP tubing **38** of the 797 VA Computrace Stand (see *Fig.* 16 and *Fig. 17*).
- Attach one end of a 6.1805.530 FEP tubing to the top screw connector of the rinsing pump (lower membrane pump). Attach the other end of the 6.1805.530 FEP tubing to the 6.1808.000 connection bushing attached at the FEP tubing **118** of the 797 VA Computrace Stand (see *Fig. 16* and *Fig. 17*).
- Attach one end of a 6.1805.530 FEP tubing to the lower screw connector of the rinsing pump (lower membrane pump). Attach the other end of the 6.1805.530 FEP tubing to the 6.1602.115 bottle neck attachment of the storage container (see *Fig.* 16 and *Fig. 17*).

5 Connect waste container

- Remove the cap nut of the small opening at the rear side of the waste container.
- Insert the 6.1828.020 "Tubing connection to the container" (with five M6 couplings 6.1808.000) into the smaller opening of the waste container and reattach the cap nut.
- Attach all tubings who are to lead to the waste container to a M6 coupling of the 6.1828.020 "Tubing connection to the container".
- Close not used M6 couplings of the 6.1828.020 "Tubing connection to the container" with a 6.1446.040 M6 thread stopper.
- Slightly open the cap of the larger opening. If the waste container is closed airtight, pressure builds which reduces pumping capacity.

6 Connect storage container

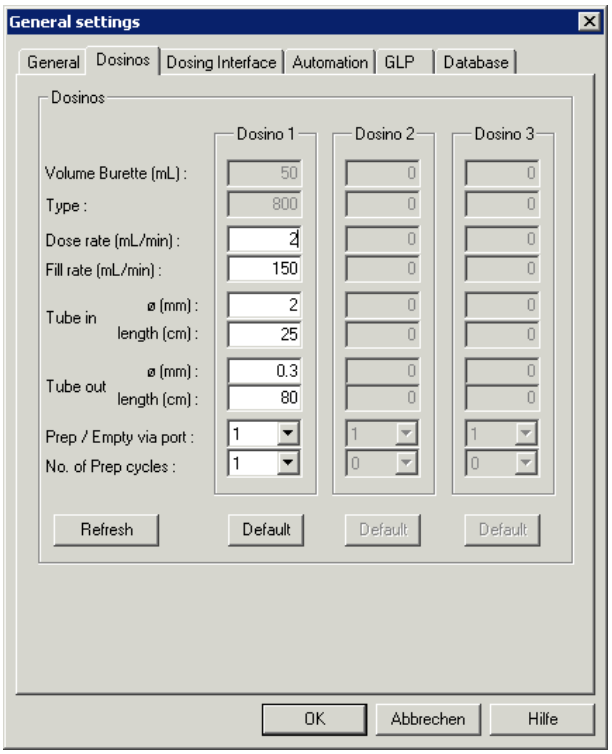
- Unscrew red filling connection from second 6.1621.000 container.
- Using a funnel, add max. 10 L rinsing solution (normally ultra pure water acidified with 100 µL conc. HCl/L) to the storage container.
- Screw 6.1618.050 threaded adapter to the container.
- Screw 6.1602.115 bottle neck attachment onto 6.1618.050 threaded adapter.
- Remove screw nipple from 6.1829.020 FEP tube and insert it from above into the smallest opening of the 6.1602.115 bottle neck attachment.
- Screw a 6.1805.530 FEP tubing into this opening of the 6.1602.115 bottle neck attachment.
- Attach the other end of the 6.1805.530 FEP tubing at the **lower** end of the pump tubing of the rinsing pump (see *Fig.* 16).

2.9.3 Software settings

Before putting the 797 VA Computrace Stand with the 863 Compact Autosampler into operation, the following settings have to be made in the "**797 VA Computrace Software**" software program:

1 Set dosing parameters

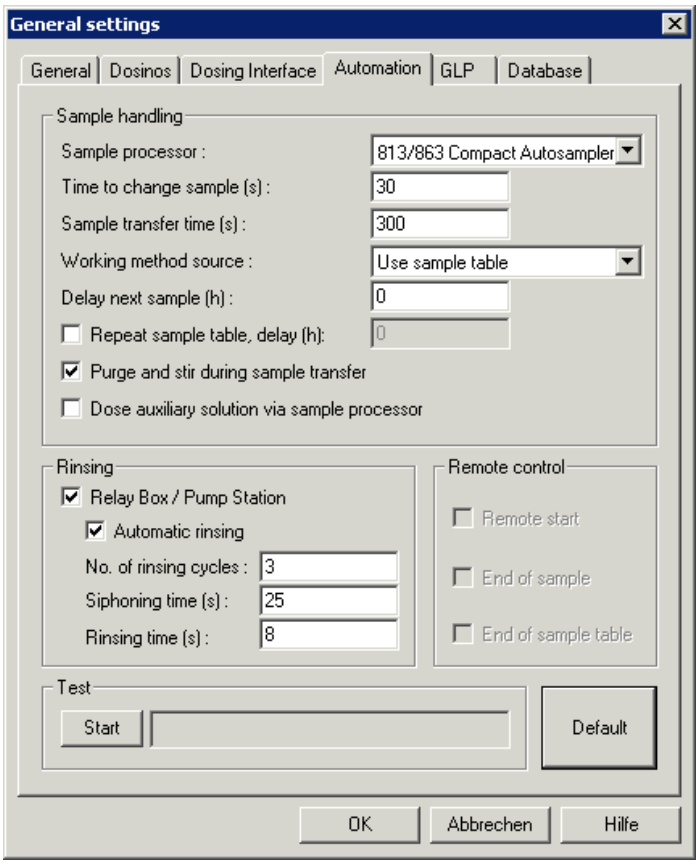
- Click on **797 VA COMPUTRACE / Settings / General settings** and select the **Dosinos** tab (if the Dosino is connected to the 846 Dosing Interface: the **Dosing Interface** tab) of the window **General settings** and enter the following configuration:
- Click on Refresh to display the currently connected Dosing devices.
- Set parameters of used Dosing devices.



- Define the addition or predose solutions for the desired method in the **DOSINOS** window (procedure see *Software Manual, section 5.2*).
- Fill the Dosing- or Exchange units of the Dosinos/Dosimats with the desired solutions and make sure that there are no gas bubbles in the glass cylinders using the Prep ON button in the **DOSINO CONTROL** window (see *section 7.2*, *Software Manual*).
- **Note**: If you choose Port 3 for menu item **Prep / Empty via port**, you must install an FEP Tubing Connection 6.1805.XXX from Port 3 to a waste container.

2 Set automation parameters

- Select the **Automation** tab.
- Select „813/863 Compact Autosampler“ for the field Sample processor in the **Sample handling**-part of the **Automation** tab.
- Check the checkbox **Relay box**.
- Normally, the default settings can be used for samples with 10 mL volume:



3 Test automation parameters

- Fill two sample vessels with water and place them in position 1 and 2 on the sample rack of the 863 Compact Autosampler.
- Click on **797 VA COMPUTRACE / Settings / General settings** and select the **Automation** tab.
- Click on Start, check the automation parameters and modify them if needed.

2.9.4 Operation of the 863 Compact Autosampler

After installation of the instruments according to *sections 2.9.1...2.9.3* sample series using the 863 Compact Autosampler can be started. Proceed always in the following sequence:

1 Switch on instruments

- Switch on PC.
- Switch on 797 VA Computrace Stand.
- Switch on 863 Compact Autosampler and 843 Pump Station.

- Start 797 VA Computrace Software (see *Software Manual*, *section 2.2*)

2 Load Autosampler method

- Load **Method 2** of the 863 Compact Autosampler (see *Instructions for Use* 863, *section 3.4*)

3 Load and modify VA method

- Click on  or **797 VA COMPUTRACE / Mode / Determination**.
- Click on  or **797 VA COMPUTRACE / Window / Working method specification** to open the **WORKING METHOD SPECIFICATIONS** window.
- Load the desired method in the **WORKING METHOD SPECIFICATIONS** window.
- If desired, modify the loaded method (details see *Software Manual*).

4 Load and modify sample table

- If you want to work with a sample table, set „Use sample table" in the field **Working method source** on the **Automation** tab of the **General settings** windows. With „Repeat current method", every measurement is done with the same method, the sample table is not activated.
- Click on  or **797 VA COMPUTRACE / Window / Sample table** to open the window **SAMPLE TABLE**.
- Load the desired sample table or change the currently loaded sample table (details see *Software Manual*).

5 Place samples on 863 Compact Autosampler

- Transfer the desired sample amount (5...10 mL) into the sample vessels and place them at the odd positions on the sample rack of the 863 Compact Autosampler.
- For each sample vessel, place a vessel filled with rinsing solution at the following even position (volume rinsing solution = volume sample solution).

6 Start determination

- Click on  or **MAIN WINDOW / Window / Monitor** to open the **MONITOR** window.
- Start the measurement by clicking the  icon in the **MAIN WINDOW** or the  button in the **MONITORING** window.
- Press the "START" button on the keypad of the 863 Compact Autosampler.
- Follow the instructions in the appearing message windows.

2.10 Connection of 838 Advanced Sample Processor

The 838 Advanced Sample Processor can be connected to the 797 VA Computrace. It is particularly used for electroplating bath analysis. For operation of this sample changer and the automatic addition of standard addition and auxiliary solutions by means of Dosing devices (see Section 2.8), the following instruments and accessory parts are needed (see also section 4.3):

Order no.	Instrument/Accessory	Complete system	Suppressor determination with DT / RC	Brightener determination with MLAT	Brightener determination with LAT
2.797.0030	797 VA Computrace for CVS	1	1	1	1
2.838.0310	838 Advanced VA Sample Processor	1	1	1	1
2.800.0010	800 Dosino	3	2	3	1
6.3032.120	807 Dosing Unit 2 mL	3	1	2	1
6.3032.250	807 Dosing Unit 50 mL	1	1	1	-
2.843.0040	843 Pump Station	1	1	1	1
6.1608.050	Bottle 100 mL	2	1	2	1
6.1608.070	Bottle 2 L	1	1	1	-
6.2055.100	Bottle holder	1	-	1	1
6.1618.020	Thread adapter	2	-	2	1
6.1805.020	52 cm tubing FEP	1	1	1	-
6.1805.120	100 cm tubing FEP	1	1	1	-
6.1805.530	200 cm tubing FEP	3	2	3	1
6.1819.010	PTFE tubing	1	1	1	-
6.2160.010	Adapter cable	2	2	2	2
6.5323.010	Rinsing equipment VA	1	1	1	1

2.10.1 General composition

Instruments for a complete system

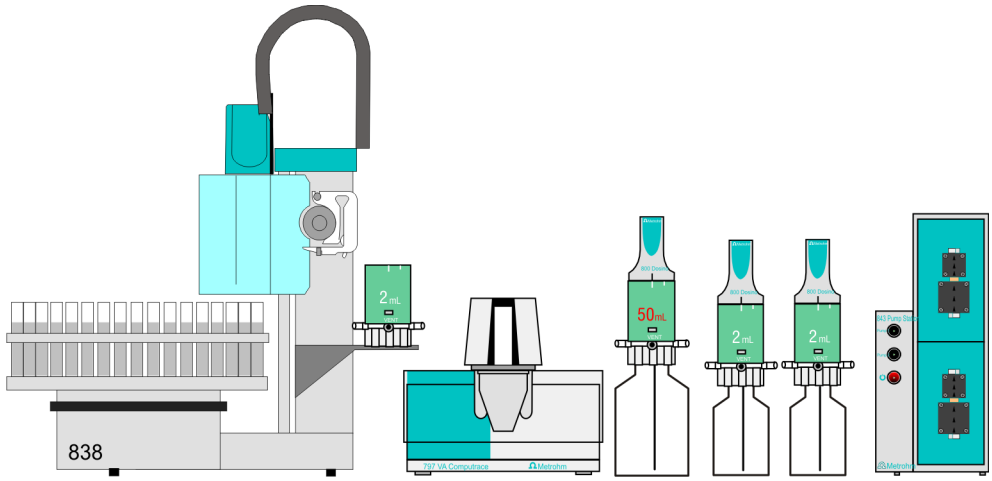


Fig. 19: Complete system for automation with the 838 Advanced Sample Processor

Brightener/Suppressor analysis of electroplating baths can be fully automated with a 797 VA Computrace, an 838 Advanced Sample Processor, three 800 Dosinos, four 807 Dosing Units (one 50 mL, three 2 mL), and one 843 Pump Station.
If (and which of) the 4 Dosing Units and 3 Dosinos are needed depends on the type of determination (see section 2.10.3 System description for Suppressor determination; 2.10.4 System description for Brightener determination with MLAT; 2.10.5 System description for Brightener determination with LAT).

Tubing connections for the rinsing equipment

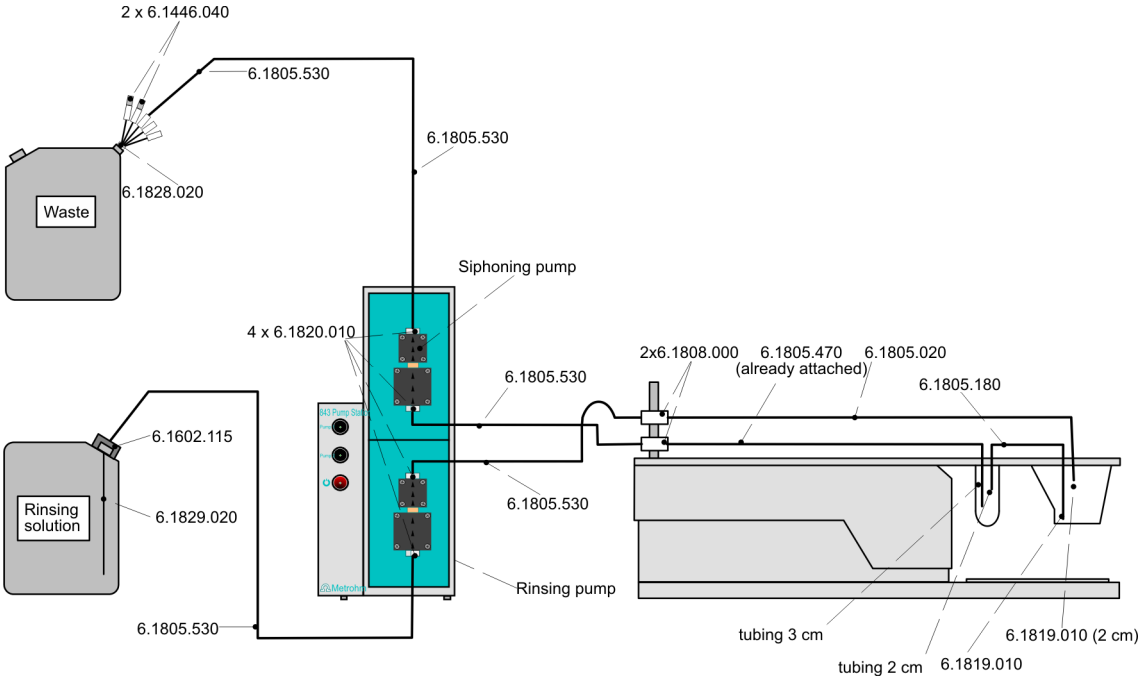
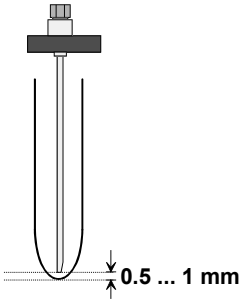


Fig. 20: Tubing connections for the rinsing equipment with the 838 Advanced Sample Processor

Pipetting needle adjustment

Adjust 6.1835.040 or 6.1835.050 pipetting needle at the 838 Advanced Sample Processor to ensure that the lower end of the needle is positioned max. 0.5 mm above the bottom of the sample vessel. This is essential to guarantee a complete transfer of the sample from the sample vessel into the measuring vessel of the 797 VA Computrace Stand. Follow the *Instructions for Use 838* for the definition of the "work position".



2.10.2 System description for a combined system for Brightener and Suppressor

Electrical connection

*Before any instruments are attached to the 797 VA Computrace Stand, the 797 VA Computrace Stand must be **switched off** using the mains switch **14**.*

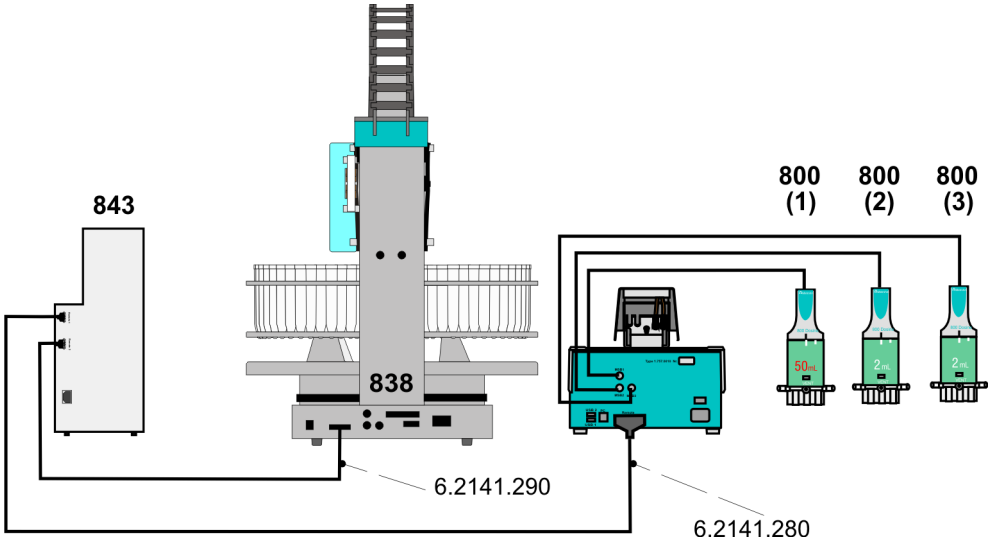


Fig. 21: Electrical connection for a combined system with the 838 Advanced Sample Processor

A 50 mL Dosing Unit filled with VMS is connected to Dosino 1. A 2 mL Dosing Unit filled with Brightener standard solution is connected to Dosino 2. For Brightener determination, a 2 mL Dosing Unit filled with Suppressor concentrate is connected to Dosino 3. For Suppressor determination (with "dilution titration technique"), a 2 mL Dosing Unit is connected to Dosino 3 to suck Suppressor standard solution or sample from the 838 rack.

Tubing connections

Below, the tubing connections for Suppressor determination with 11 mL sample vessels and Brightener determination with 50 mL sample vessels (and MLAT) are described.

System description for Suppressor determination:

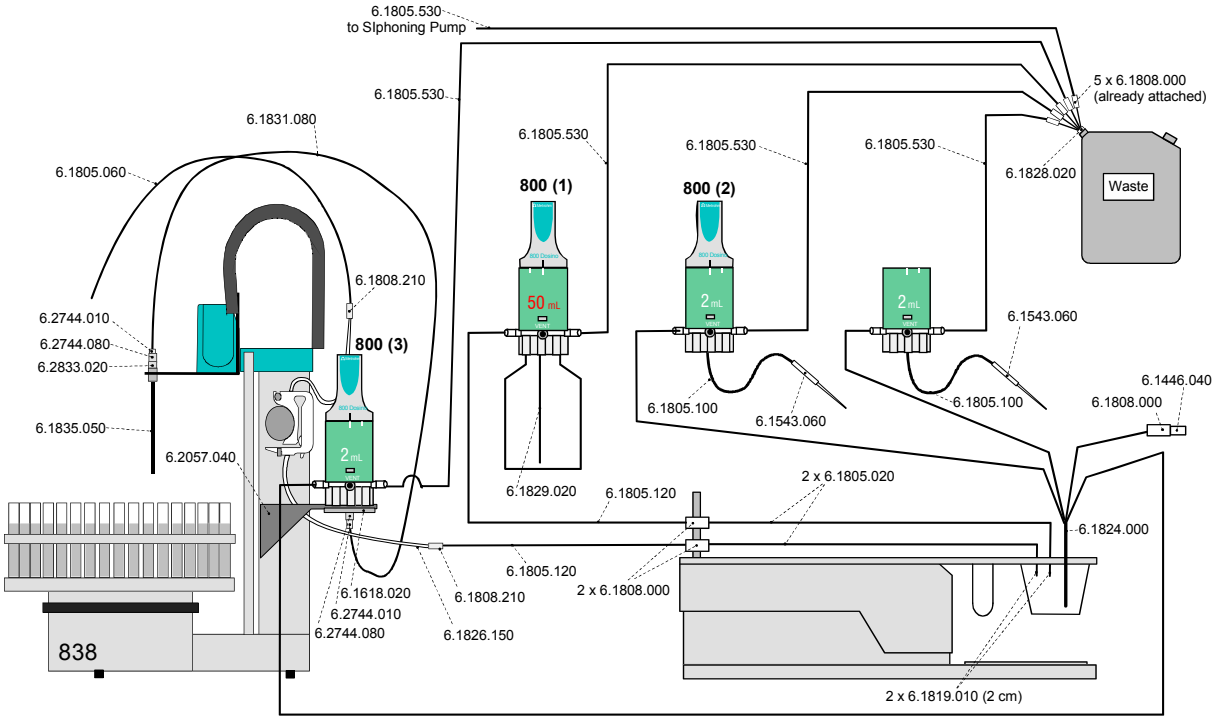


Fig. 22: Tubing connections for Suppressor determination with the 838 Advanced Sample Processor (and DT) with a combined system

System description for Brightener determination:

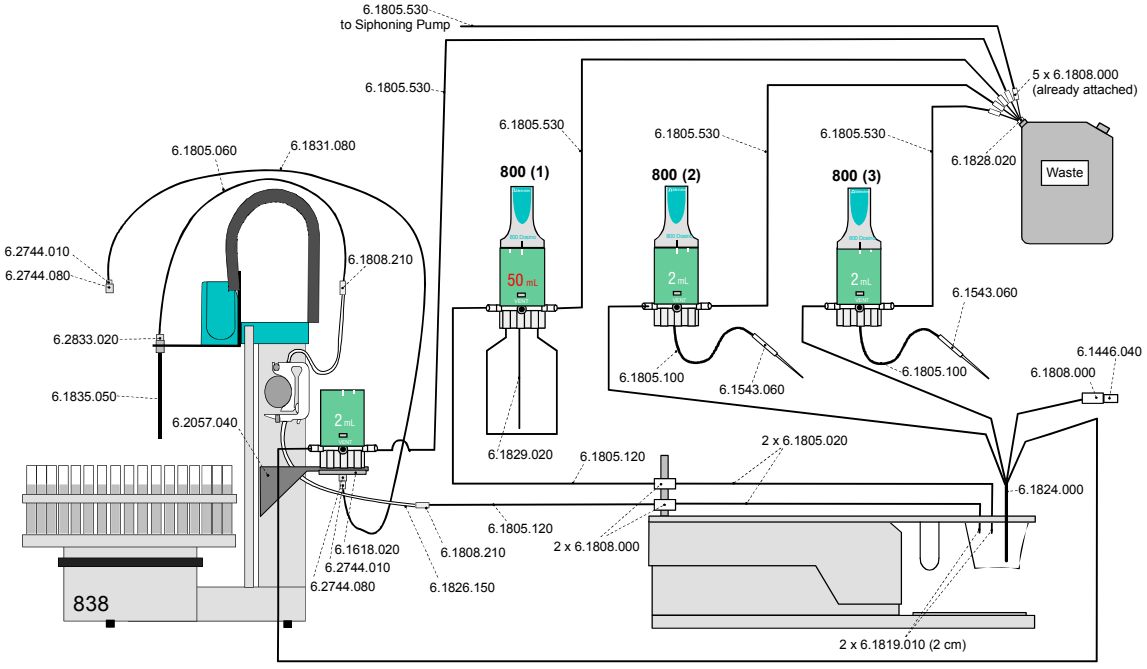


Fig. 23: Tubing connections for Brightener determination with the 838 Advanced Sample Processor with a combined system

For the modification from a Suppressor system to a Brightener system, following procedure is recommended:

1 Permute Dosino 3

- Remove Dosino 3 from the 2 mL Dosing Unit attached to the 838 Advanced Sample Processor.
- Attach Dosino 3 to the 2 mL Dosing Unit with Suppressor concentrate.

2 Unscrew 6.1831.080 PEEK capillary from needle clamp

- Unscrew 6.2744.010 PEEK pressure screw from the 6.2744.080 M6 coupling at the robotic arm of the 838 Advanced Sample Processor.
- Unscrew 6.2744.080 M6 coupling from the 6.2833.020 needle clamp.

3 Attach 6.1805.060 FEP tubing to the needle clamp

- Attach pre-assembled 6.1805.060 FEP tubing to the 6.2833.020 needle clamp.

Tubing connections at the measuring head of the 797

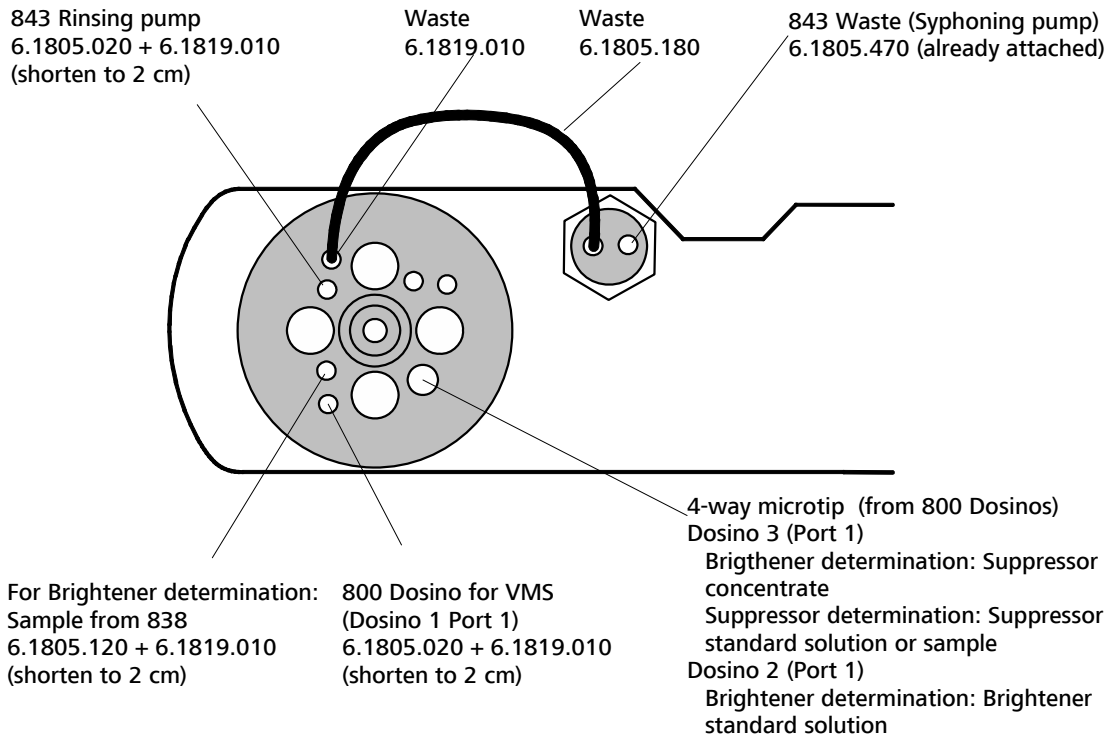


Fig. 24: Measuring head for a combined system with the 838 Advanced Sample Processor

For software settings and measurement procedures: see Software Manual 797 section 8.6, and the Online-Help of the <797 VA Computrace Software>.

2.10.3 System description for Suppressor determination

Electrical connection

*Before any instruments are attached to the 797 VA Computrace Stand, the 797 VA Computrace Stand must be **switched off** using the mains switch **14**.*

A composition with two Dosinos connected to the 797 is recommended for the Suppressor determination with the DT (dilution titration technique) or RC (response curve technique):

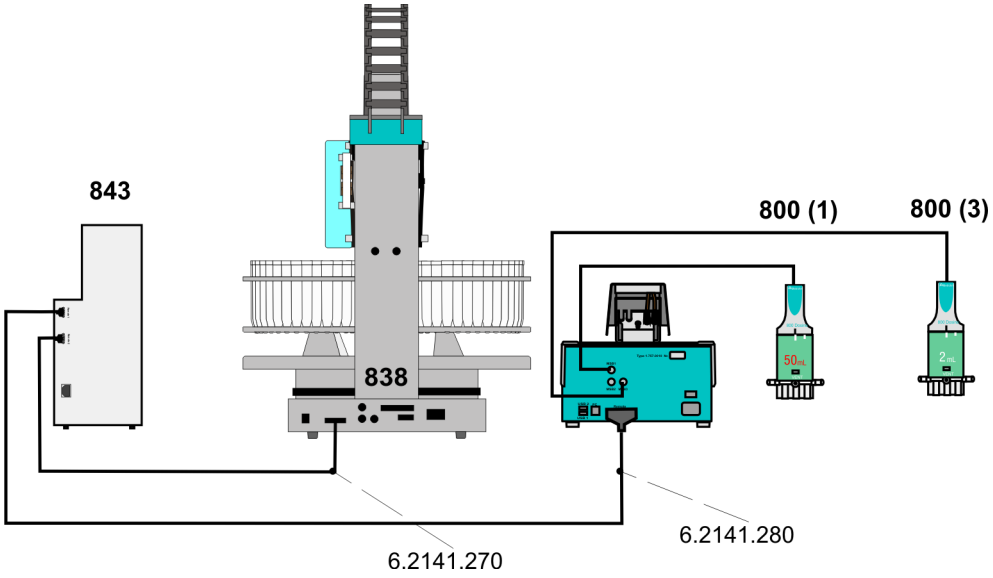


Fig. 25: Electrical connection for Suppressor determination with the 838 Advanced Sample Processor

A 50 mL Dosing Unit filled with "VMS" (with "dilution titration technique") or "Electrolyte" (with "response curve technique") is connected to Dosino 1.

A 2 mL Dosing Unit is connected to Dosino 3. With the "dilution titration technique", it is used to suck in Suppressor standard solution or sample from the sample vessels on the 838 rack. With the "response curve technique" it is used to dose Suppressor standard solution from the dosing unit to the measuring cell to record the "response curve" (see *Software Manual section 8.6*, or in the *Online Help section Suppressor analysis with 838 Advanced Sample Processor and DT* or *Suppressor analysis with 838 Advanced Sample Processor and RC*).

Tubing connections for suppressor determination with DT

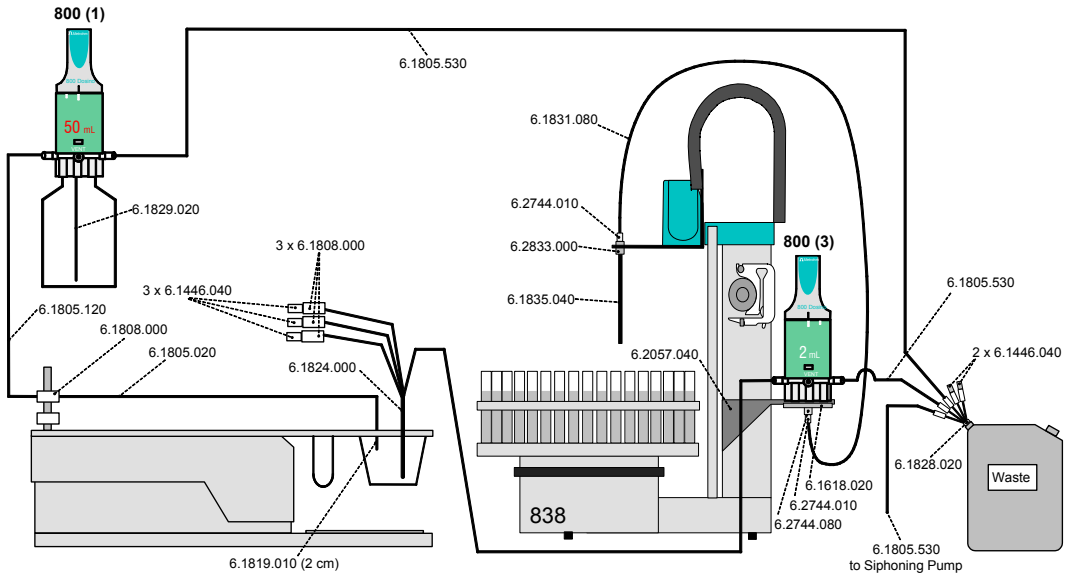


Fig. 26: Tubing connections for Suppressor determination (with DT) with the 838 Advanced Sample Processor

Tubing connections for suppressor determination with RC

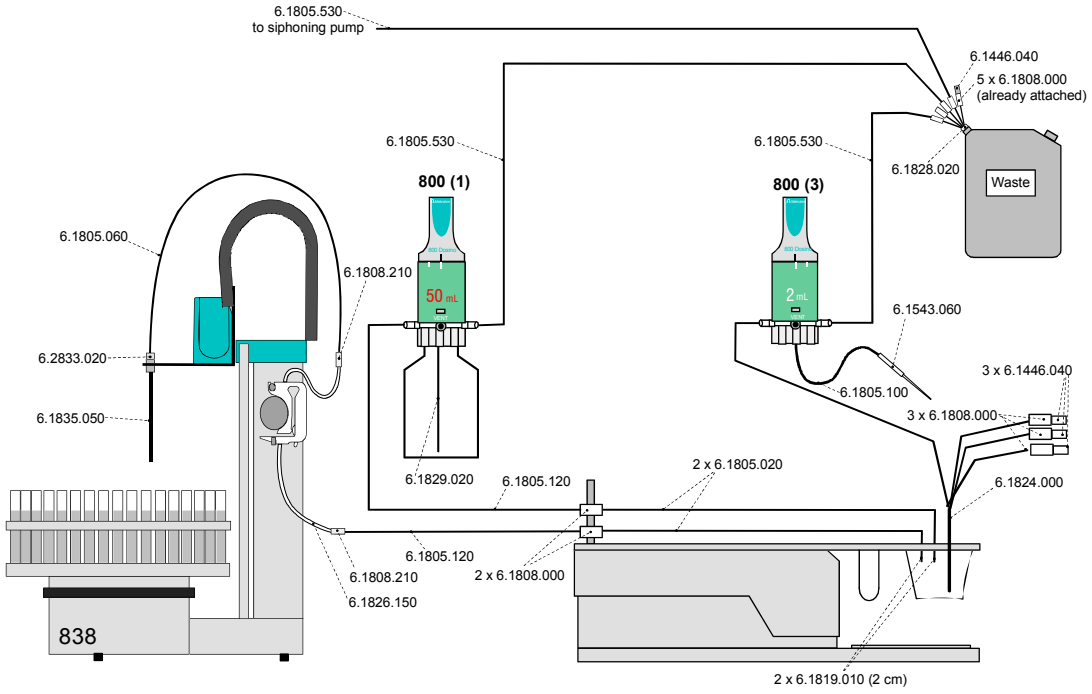


Fig. 27: Tubing connections for Suppressor determination (with RC) with the 838 Advanced Sample Processor

Tubing connections at the measuring head of the 797

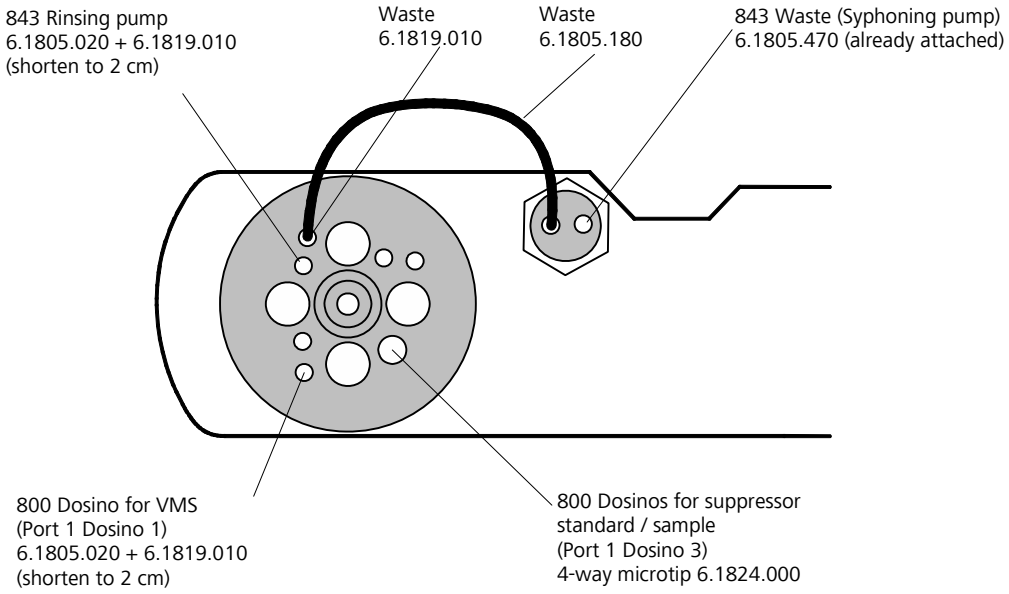


Fig. 28: Measuring head for Suppressor determination with the 838 Advanced Sample Processor

For software settings and measurement procedures: see Software Manual 797 section 8.6, and Online-Help of the <797 VA Computrace Software> section Suppressor analysis with 838 Advanced Sample Processor and DT or Suppressor analysis with 838 Advanced Sample Processor and RC.

2.10.4 System description for Brightener determination with MLAT

Electrical connection

*Before any instruments are attached to the 797 VA Computrace Stand, the 797 VA Computrace Stand must be **switched off** using the mains switch **14**.*

A composition with three to the 797 connected Dosinos is recommended for the Brightener determination with the Calibration technique MLAT:

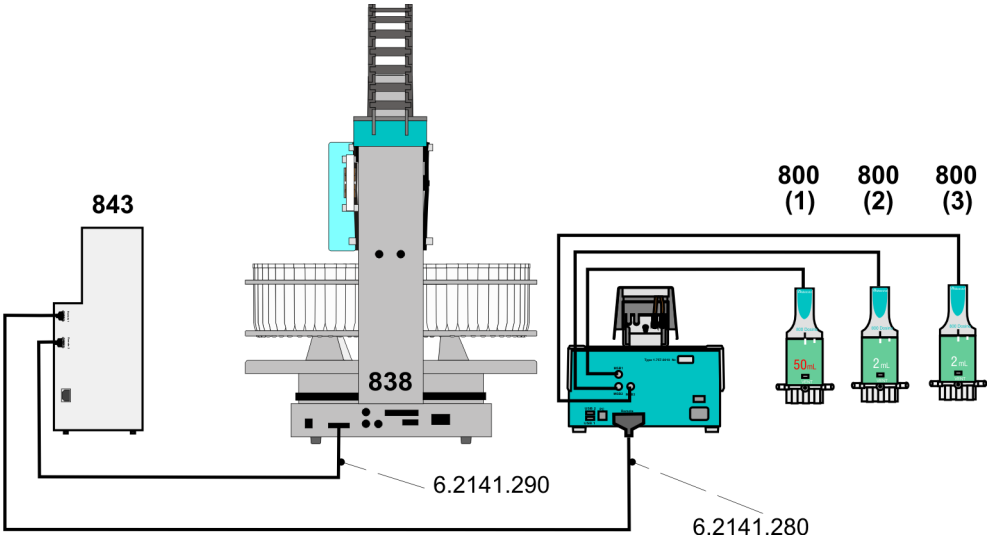


Fig. 29: Electrical connection for Brightener determination with the 838 Advanced Sample Processor and MLAT

A 50 mL Dosing Unit filled with VMS is connected to Dosino 1. A 2 mL Dosing Unit filled with Brightener standard solution is connected to Dosino 2. A 2 mL Dosing Unit filled with Suppressor concentrate is connected to Dosino 3.

Tubing connections

The choice of the tubing connections depends on the sample volume. Following 2 options are described:

- Sample volume <10 mL in 11 mL sample vessels
- Sample volume >10 mL in 50 mL sample vessels

Use thicker tubes for larger sample volumes.

Sample volume > 10 mL

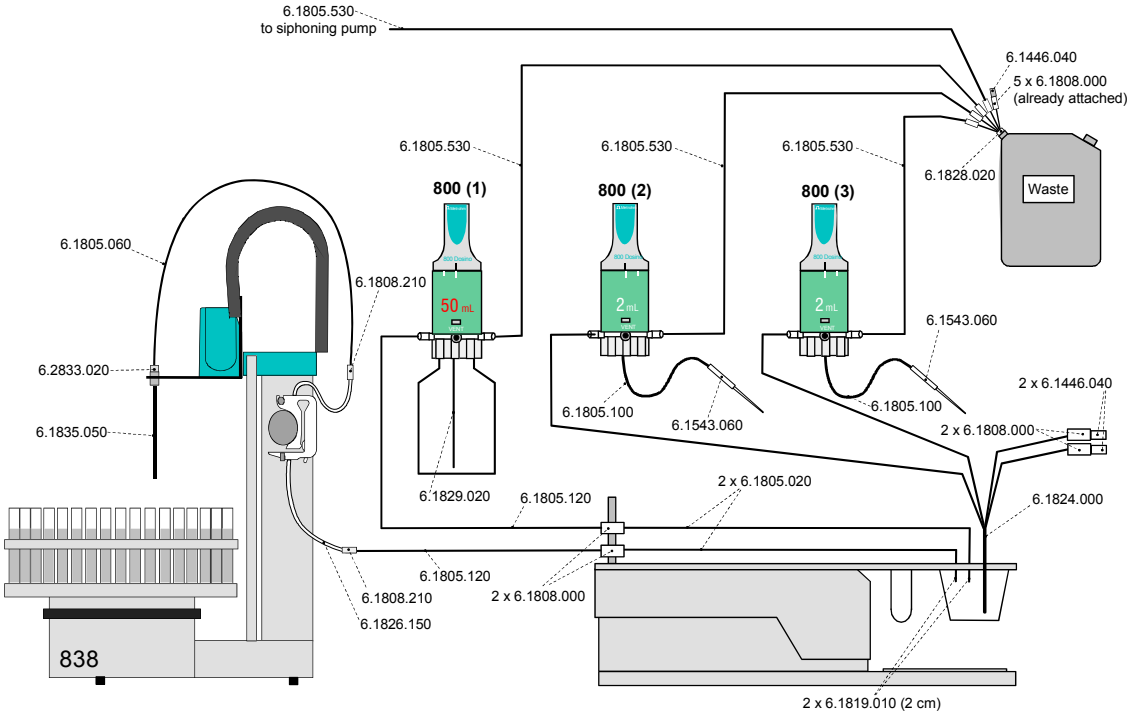


Fig. 30: Tubing connections for Brightener determination for samples>10mL with the 838 Advanced Sample Processor and MLAT

Sample volume < 10 mL

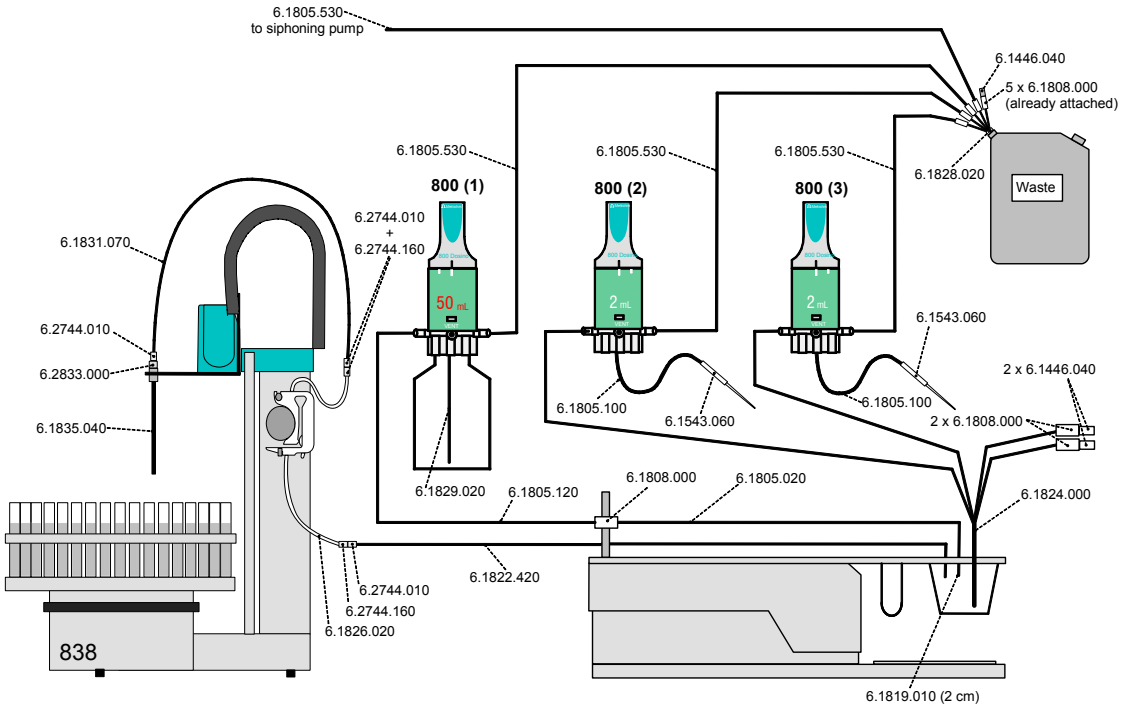


Fig. 31: Tubing connections for Brightener determination for samples<10mL with the 838 Advanced Sample Processor and MLAT

Tubing connections at the measuring head of the 797

sample volume >10 mL

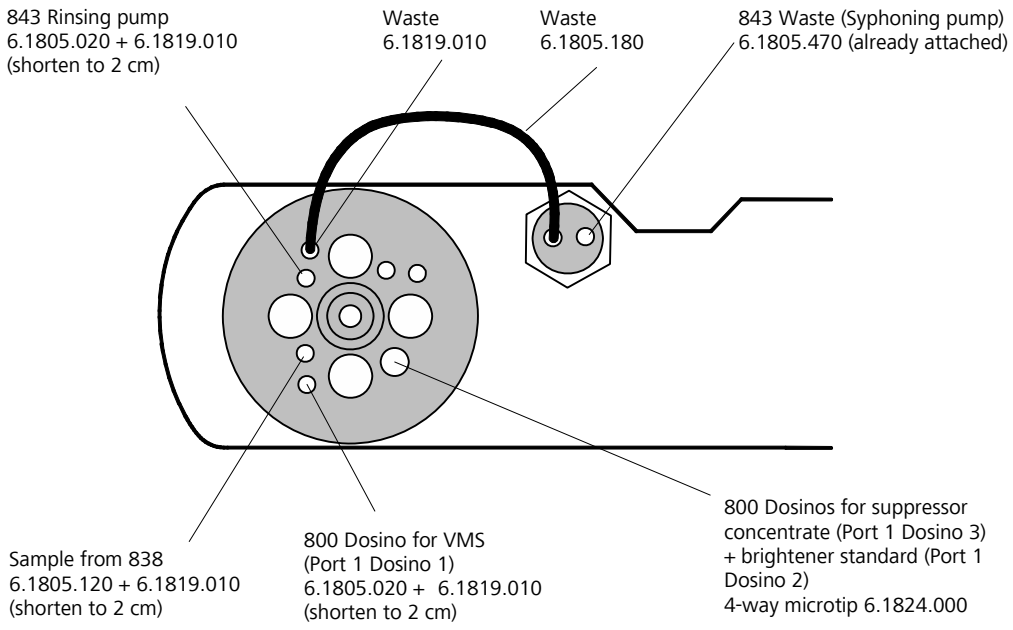


Fig. 32: Measuring head for Brightener determination for samples>10mL with the 838 Advanced Sample Processor and MLAT

sample volume <10 mL

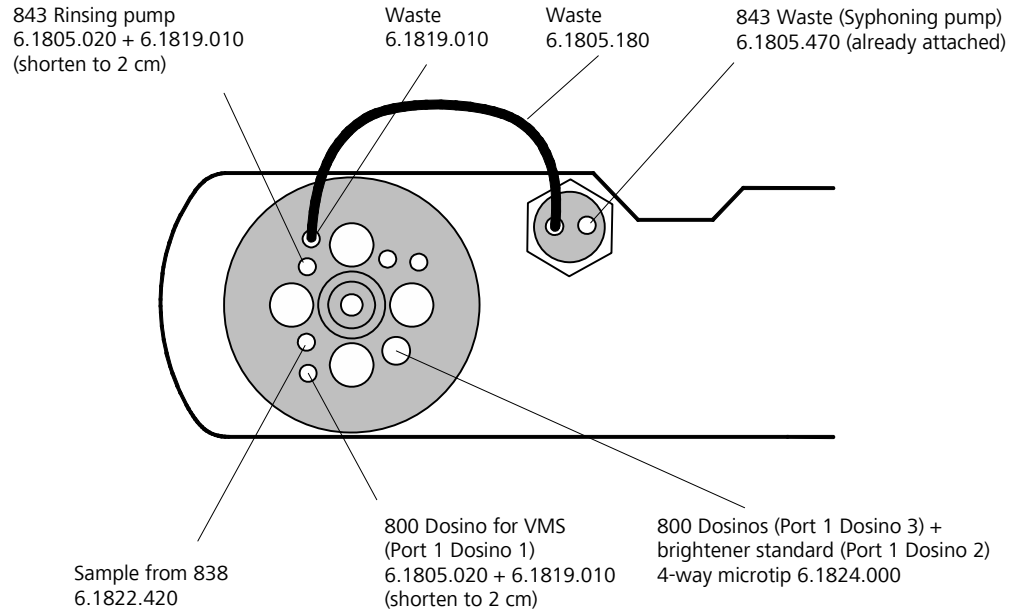


Fig. 33: Measuring head for Brightener determination for samples>10mL with the 838 Advanced Sample Processor and MLAT

For software settings and measurement procedures: see *Software Manual 797 section 8.6*, and *Online-Help* of the <797 VA Computrace Software> *section Brightener Analysis with the 838 Advanced Sample Processor and MLAT*.

2.10.5 System description for Brightener determination with LAT

Electrical connection

*Before any instruments are attached to the 797 VA Computrace Stand, the 797 VA Computrace Stand must be **switched off** using the mains switch **14**.*

A composition with one Dosino connected to the 797 is recommended for the Brightener determination with the Calibration technique LAT:

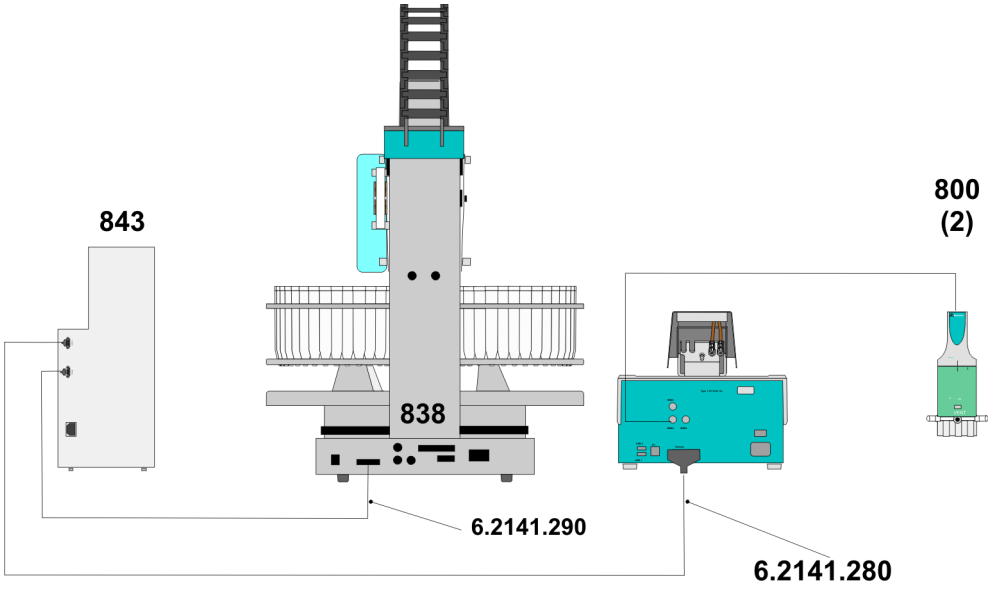


Fig. 34: Electrical connection for Brightener determination with the 838 Advanced Sample Processor and LAT

A 2 mL Dosing Unit filled with VMS is connected to Dosino 2.

Tubing connections

It is recommended to work with sample volumes >10 mL for Brightener determination with LAT. The tubing connection should be as follows:

Brightener sample volume > 10 mL

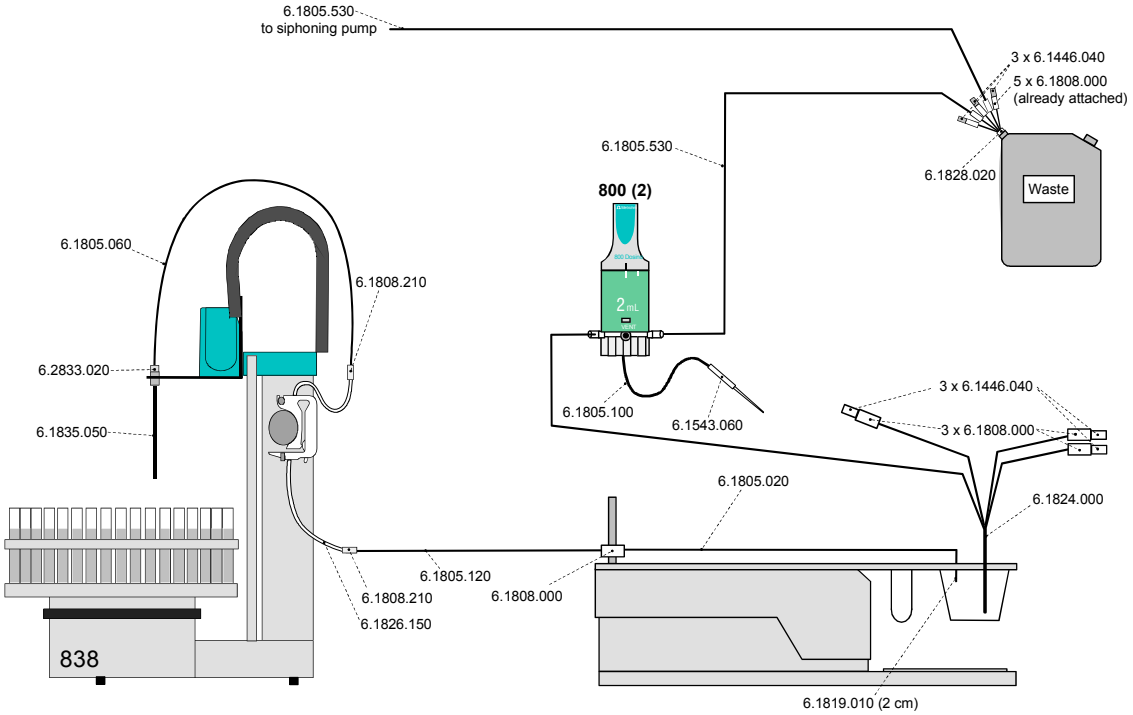


Fig. 35: Tubing connections for Brightener determination with the 838 Advanced Sample Processor and LAT

Tubing connections at the measuring head of the 797

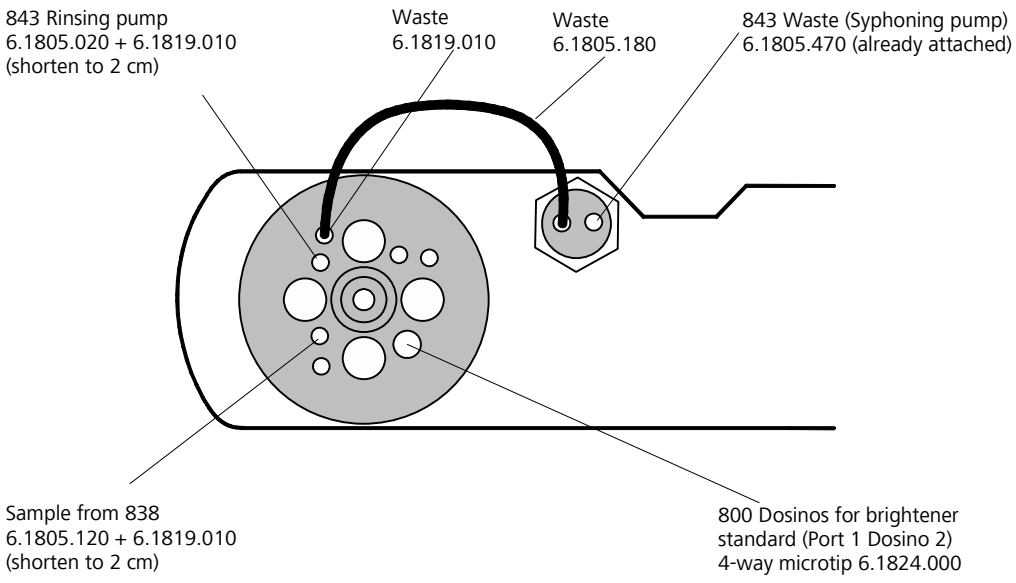


Fig. 36: Tubing connections for Brightener determination with the 838 Advanced Sample Processor and LAT

For software settings and measurement procedures: see *Software Manual 797 section 8.6*, and *Online-Help* of the <797 VA Computrace Software> *section Brightener Analysis with the 838 Advanced Sample Processor and LAT*.

2.11 Control lines

Control lines for 863 Compact Autosampler, 766 Sample Processor, 838 Advanced Sample Processor and 731 Relay Box are listed in the table below:

797 VA Computrace	863 Compact Autosampler	838 Advanced Sample Processor	731 Relay Box
Pin 3 (End of sample)		Pin 10 (Input 3)	
Pin 4 (End of sample table)		Pin 24 (Input 6)	
Pin 5 (Start)		Pin 12 (Input 7)	
Pin 6 (Set Control line)	Pin 22 (Input 2)	Pin 22 (Input 2)	
Pin 7 (Siphoning)			Pin 7 (Output 9)
Pin 8 (Rinsing)			Pin 8 (Output 10)
Pin 17 (Scan Control line)		Pin 5 (Output 0)	

2.12 Connection of peripherals

The USB Connections (**19**) **USB1** and **USB2** on the backside of the 797 VA Computrace Stand serve as USB-distributor of the connected PC. Any USB-instrument (e.g. printer or 846 Dosing Interface) can be operated with these connections.

For connection and installation of a particular instrument read the respective "Instructions for Use" of the instrument and operating system.

2.13 Communication diagrams for automation

In this chapter, sequence diagrams are used to describe the communication between the devices for automation with a 838 Advanced Sample Processor.

The communication sequence depends on the selected Calibration technique in the window **WORKING METHOD SPECIFICATION**.

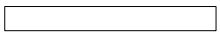
The 797 VA Computrace acts as master.

The TTL's used in the diagram match with the following connections:

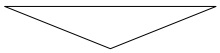
TTL	797 VA Computrace	838 Advanced Sample Processor	731 Relay Box
1	Pin 3 (End of sample)	Pin 10 (Input 3)	
2	Pin 4 (End of sample table)	Pin 24 (Input 6)	
3	Pin 5 (Start)	Pin 12 (Input 7)	
4	Pin 6 (Set Control line)	Pin 22 (Input 2)	
5	Pin 7 (Siphoning)		Pin 7 (Output 9)
6	Pin 8 (Rinsing)		Pin 8 (Output 10)
7	Pin 17 (Scan Control line)	Pin 5 (Output 0)	

Legend to the communication diagrams (Section *2.13.1 - 2.13.6*):

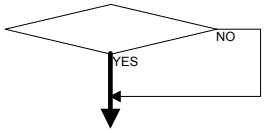
Signal wird von einem Gerät an ein anderes gesendet



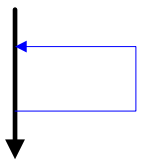
Sequenz-Block (der im Diagramm nicht detailliert beschrieben wird)



Warten eines Gerätes auf ein eintreffendes Signal



Alternativer Sequenz-Ablauf



Ein- oder mehrmalige Wiederholung des Sequenz-Teils zwischen Pfeilanfang und -ende

2.13.1 Communication diagram VA

Standard addition / Sample with calibration curve / Record calibration curve

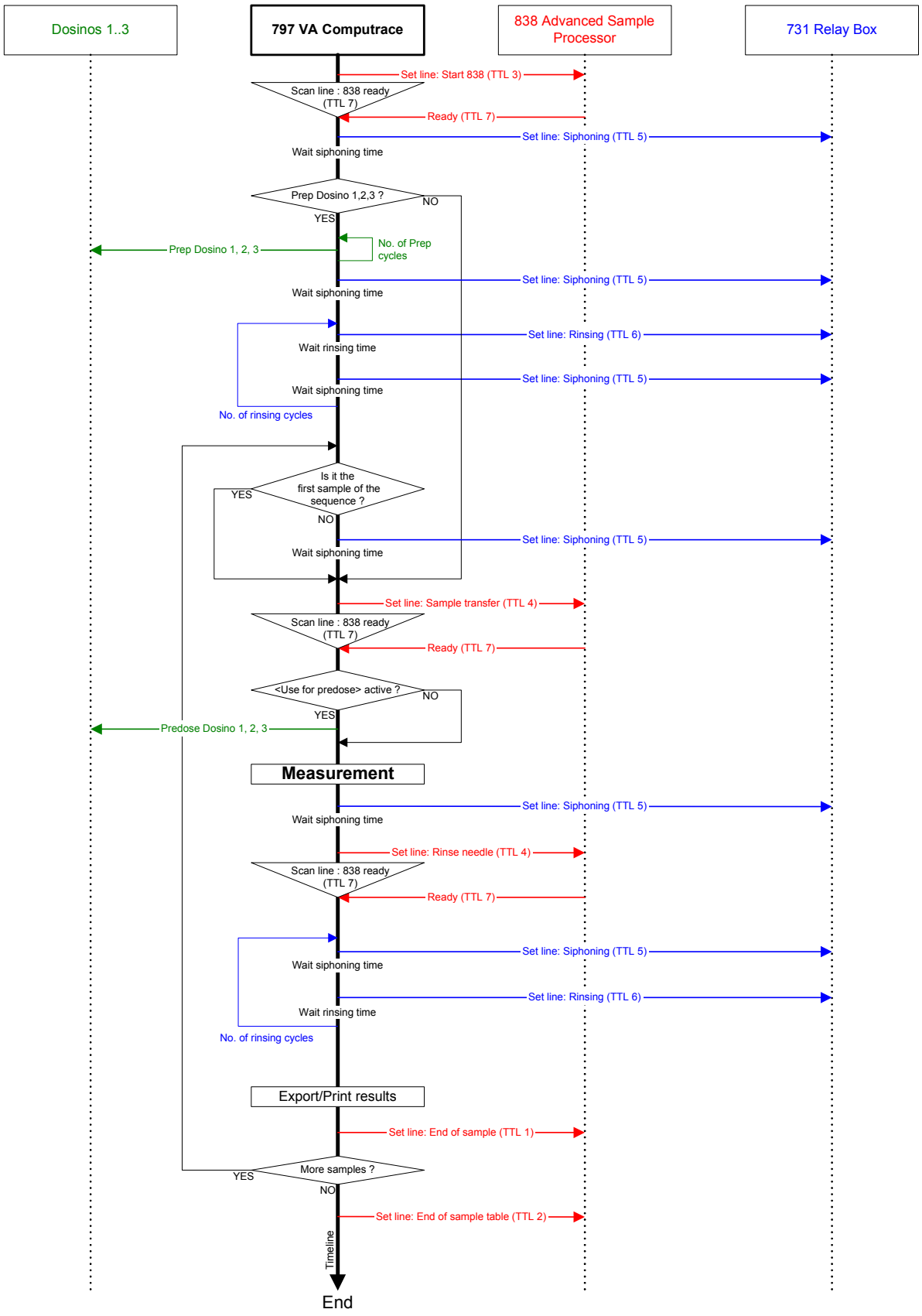


Fig. 37: Communication diagram for VA

2.13.2 Communication diagram LAT

LAT Standard addition for brighteners / LAT Record intercept value

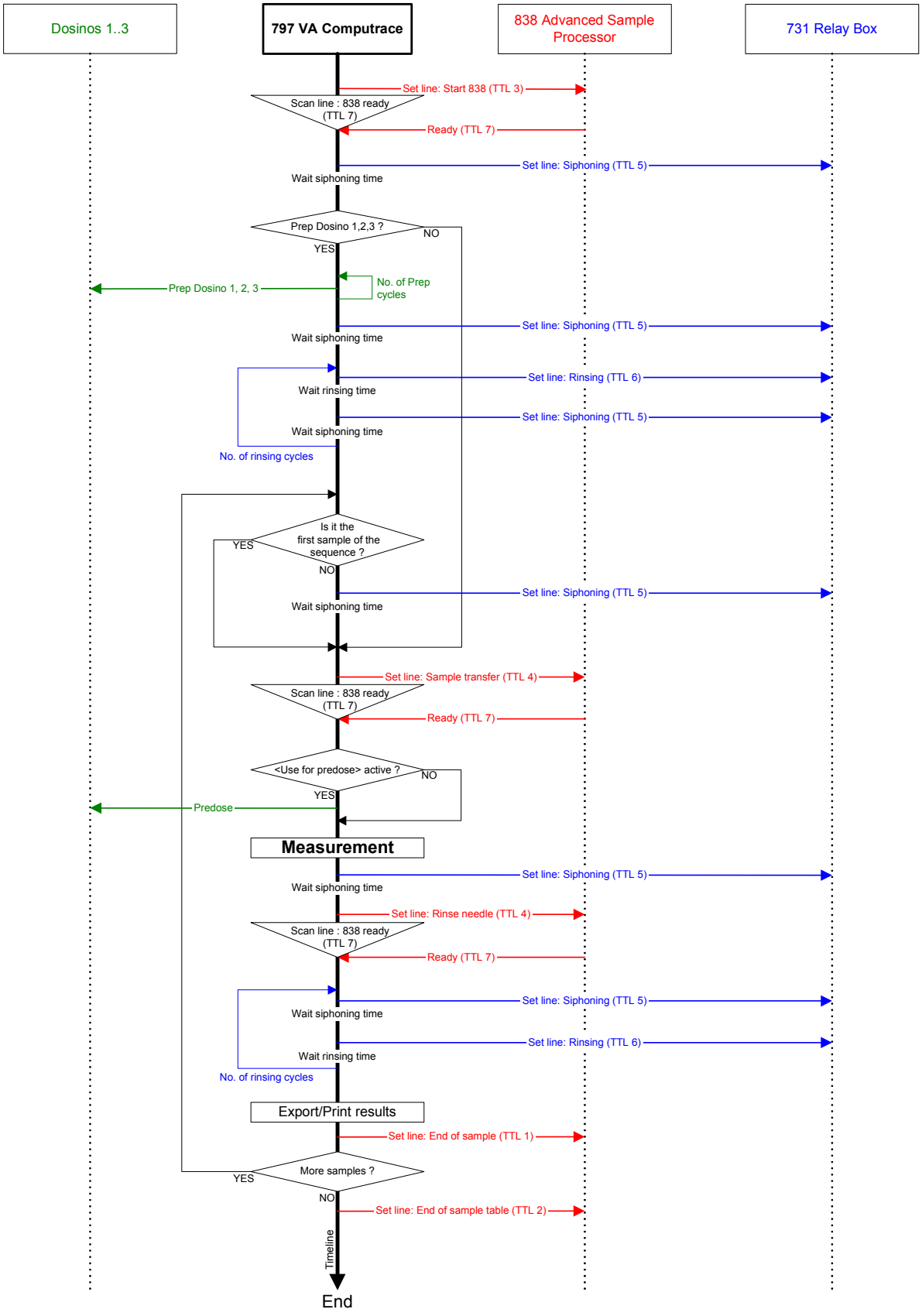


Fig. 38: Communication diagram for LAT

2.13.3 Communication diagram MLAT

MLAT Standard addition for brighteners

Fig. 39: Communication diagram for MLAT

2.13.4 Communication diagram DT

DT Suppressors with calibration curve / DT Record calibration curve

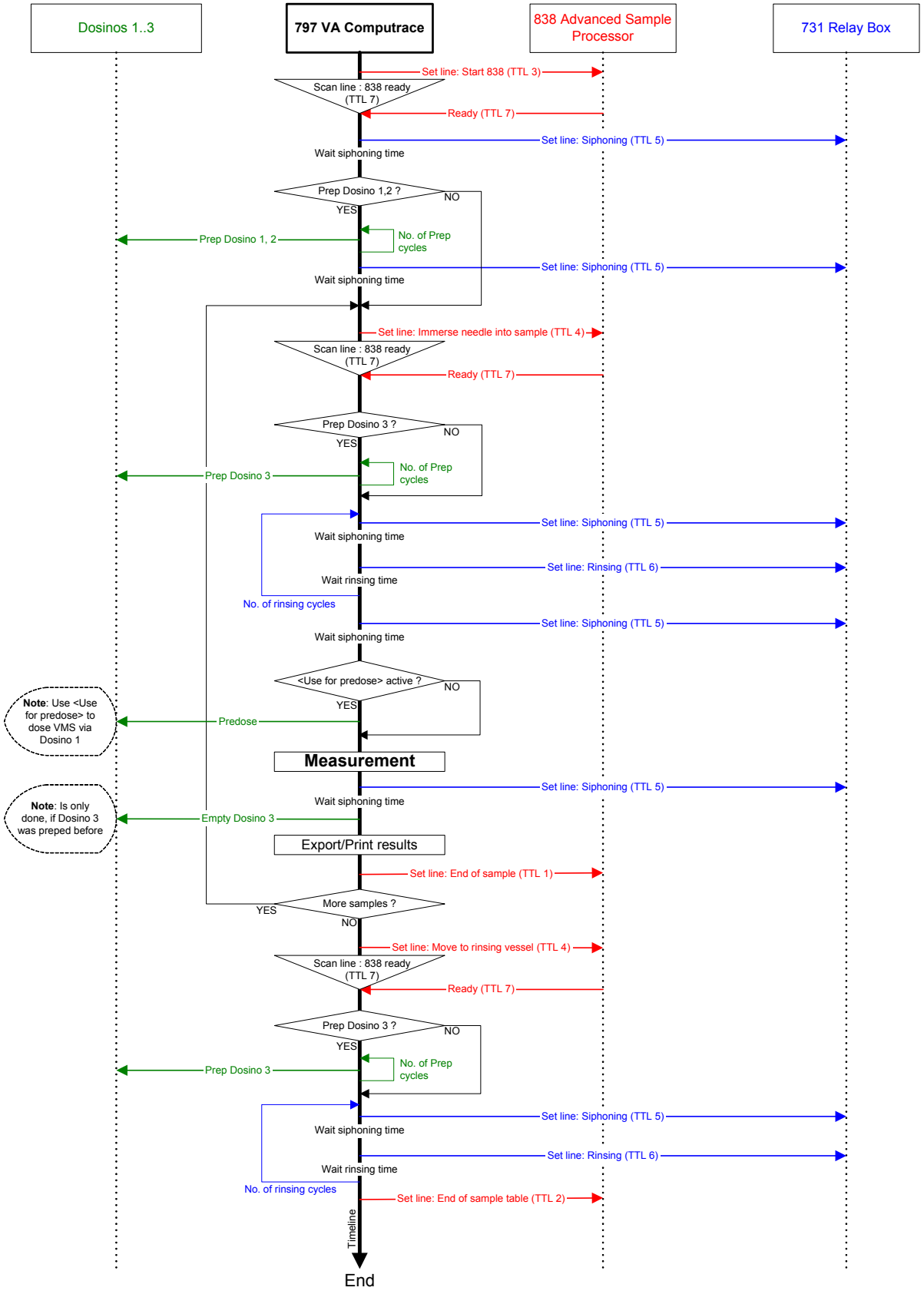


Fig. 40: Communication diagram for DT

2.13.5 Communication diagram "RC Record response curve"

RC Record response curve

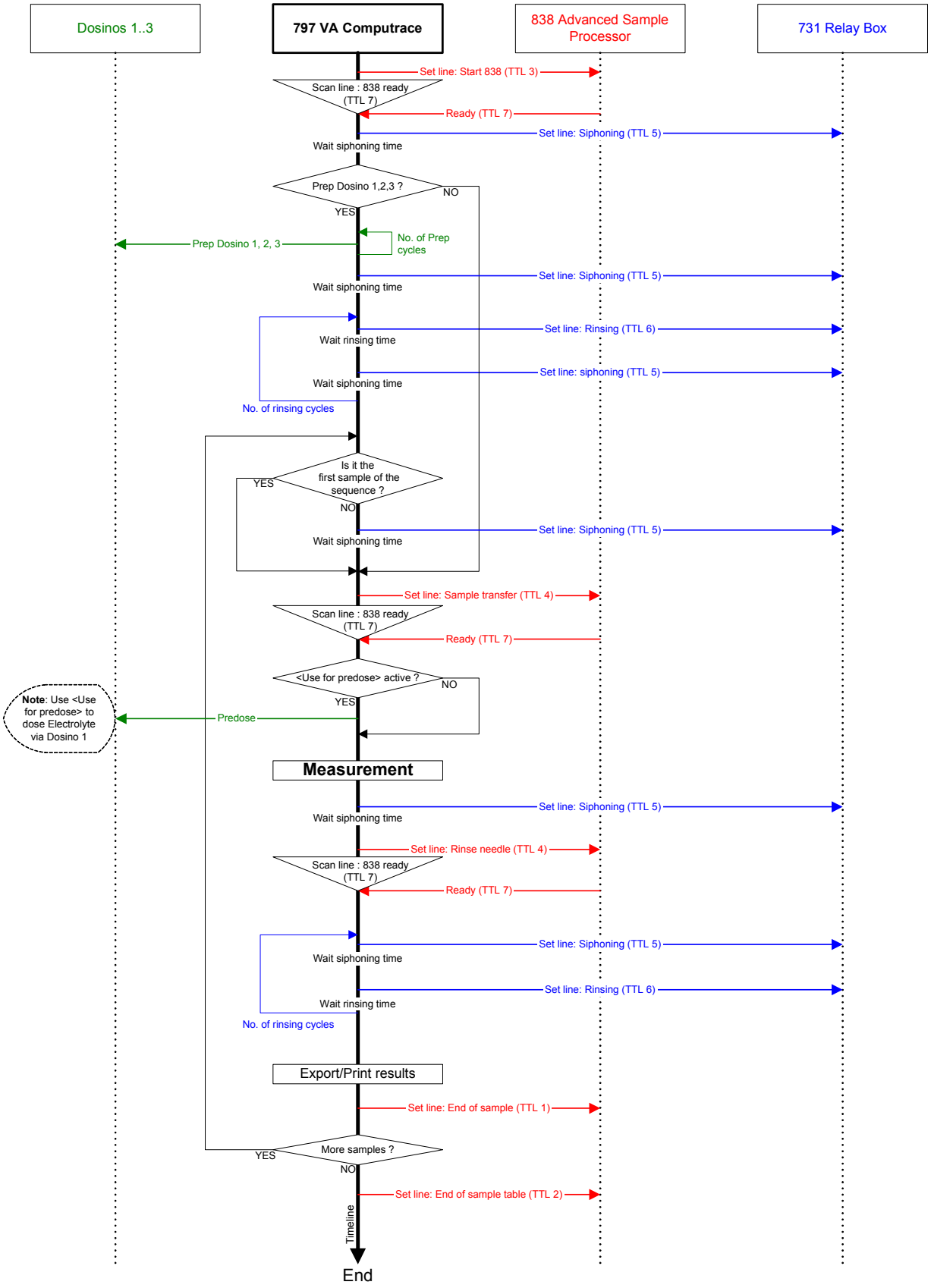


Fig. 41: Communication diagram for "RC Record response curve"

2.13.6 Communication diagram "RC Sample with response curve"

RC Sample with response curve

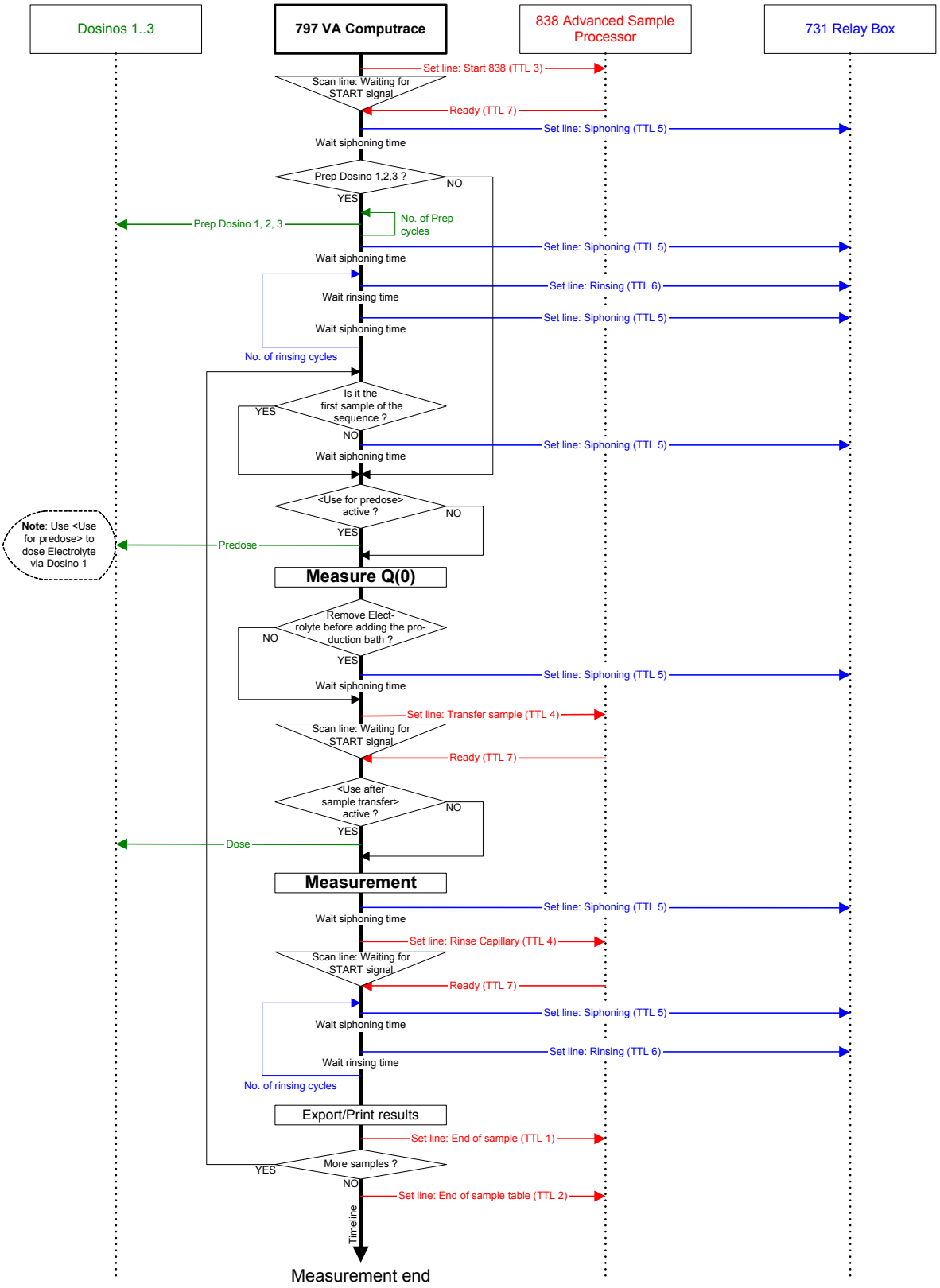


Fig. 42: Communication diagram for "RC Sample with response curve"

3 Safety

3.1 Electrical safety

While electrical safety in the handling of the 797 VA Computrace Stand is assured in the context of the specifications IEC 61010-1 (protection class 1), the following points should be noted:

- **Mains connection**

*Setting **mains connection** must be effected in accordance with the instructions in section 2.2.1.*

- **Opening the instrument**

*When the 797 VA Computrace Stand is connected to the power supply, the instrument may not be opened nor parts of them be removed, otherwise there is a danger of coming into contact with components which are live. Before you open the 797 VA Computrace Stand to change components or for maintenance or repair work, always switch on the instrument by setting the mains switch to the ON position and then disconnect the mains cable from the mains connection plug **16** of the 797 VA Computrace Stand!*

- **Protection against static charges**

Electronic components are sensitive to static charging and can be destroyed by discharges. Before you touch any of the components inside the 797 VA Computrace Stand, you should earth yourself and any tools you are using by touching an earthed object (e.g. metal housing of the instrument or a radiator) to eliminate any static charges that exist.

3.2 Change fuses

The fuses of the 797 VA Computrace are placed between the mains switch **14** and the mains connection plug **16** under the Fuse cover. To change them, proceed as follows:

1 Disconnect mains cable

Disconnect mains cable from mains connection plug **16** of the 797 VA Computrace.

2 Remove fuse cover

Using a screwdriver, lever out fuse cover **15** forwards until it opens.

3 Check and change fuses if necessary

Carefully take the fuses installed for the desired mains voltage out of the fuse holder and check its specifications:

100…240 V 1.6 AHT Metrohm-Nr. U.600.0018

Change fuses if necessary and reinsert in fuse holder.

4 Install fuse holder

Reinsert fuse holders in the instrument (the arrows printed on the holders must point in the same direction as the arrows on the inside of fuse cover **15**).

5 Install fuse cover

Push in fuse cover **15** firmly until it clicks into place.

6 Connect mains cable

Plug mains cable into mains connection plug **16**.

3.3 Cabinet temperature

The cabinet of the 797 VA Computrace stand locally heats up to 45°C or more.

3.4 Safety considerations concerning mercury

3.4.1 Properties of mercury

The most important properties of mercury (Hg) are listed in the Table below. This compilation allows the following summary:

- Mercury is a **heavy metal** with a very high density and is **liquid** at room temperature.
- Mercury is mobile at room temperature and tends to **form drops** because of its high surface tension. The surface tension is around 6 times greater than that of water; Hg is thus not wetted by water.
- Mercury has a relatively **high electrical conductivity** (at room temperature it is only some 60 times lower than that of silver).
- Mercury has a relatively **high vapor pressure** compared with other metals. Mercury vapor is some seven times heavier than air (so that it sinks rapidly and specifically to the floor).
- The **odor threshold is very high** relative to the threshold limit value (TLV).
- Air saturated with Hg vapor (which naturally does not occur in practice) contains approximately 250 times the amount of Hg specified by the TLV at room temperature.

Properties of mercury

Property	Value			Ref.
Density ρ (liquid mercury)	13.5451	g/cm^3	(at Θ = 0 °C)	[1]
Density ρ (mercury vapor)	8.959	g/dm^3	(at Θ = 0 °C)	[2]
Melting point Θ_F	−38.86	°C	(at p_{air} = 1.01325 bar)	[3]
Melting enthalpy ΔH_F	2.295	kJ/mol	(at p_{air} = 1.01325 bar)	[3]
Boiling point Θ_V	356.73	°C	(at p_{air} = 1.01325 bar)	[3]
Boiling enthalpy ΔH_F	59.1	kJ/mol	(at p_{air} = 1.01325 bar)	[3]
Vapor pressure p	0.0253 0.17 0.391 0.81 1.69	Pa Pa Pa Pa Pa	(at Θ = 0 °C) (at Θ = 20 °C) (at Θ = 30 °C) (at Θ = 40 °C) (at Θ = 50 °C)	[2, 4]
Mass concentration ρ in air (after reaching equilibrium)	2.0 13.6 29.6 62.7 126	mg/m^3 mg/m^3 mg/m^3 mg/m^3 mg/m^3	(at Θ = 0 °C) (at Θ = 20 °C) (at Θ = 30 °C) (at Θ = 40 °C) (at Θ = 50 °C)	[2, 4]
Evaporation rate	85	µg/h · cm^2	(at Θ = 25 °C)	[2]
Surface tension σ	$4.67 \cdot 10^{-3}$	N/cm	(at Θ = 20 °C)	[5]
Electrical conductivity κ	$1.044 \cdot 10^4$	S/cm	(at Θ = 20 °C)	[6]
Odor threshold	13	mg/m^3		[2]
Threshold limit value (TLV) for air for mercury for organic mercury compounds (calculated as Hg)	 0.1 0.01	 mg/m^3 mg/m^3		 [4, 7] [2, 4, 7]

3.4.2 Toxicity of mercury and its compounds

Mercury and its compounds are toxic since they react with enzymes containing sulfur and decompose them with the formation of HgS. The toxicity depends on the chemical and physical state of the mercury [4, 8 – 10]:

- **Metallic liquid mercury** is readily resorbed by the skin and finds its way through glandular passages into lower skin regions where it is oxidized and carried on as a salt.
- The low-solubility **mercury (I) compounds** and metallic mercury in the form of a coherent liquid have low toxicity when taken up orally (but not through the skin!).
- **Mercury (II) compounds** are more readily soluble and therefore much more toxic: LD100 (the 100% lethal dose) for oral take-up is approx. 0.2…1 g.
- **Mercury vapor** is highly toxic: vapor with an Hg concentration exceeding the TLV of 0.1 mg/m^3 air causes chronic poisoning after prolonged breathing for 5 to 8 hours per day.

Despite the large number of laboratories involved in polarographic/voltammetric work, sensible and proper handling (see *section 3.4.3* has ensured that not one single case of mercury poisoning has been reported to date. The real Hg concentrations measured in the laboratory atmosphere are consistently far below the TLV (threshold limit value).

3.4.3 Handling of mercury

Several safety rules, described in detail in what follows, must be observed in the handling of mercury owing to its toxicity (see *section 3.4.2*):

- **Working in a fume cupboard**
  The handling of mercury should, if possible, always be carried out in a fume cupboard (hood). It must be ensured that no metal drops or spilling drop on the floor or the lab bench and that no evaporation of the metal occurs.
- **Working over plastic trays**
  Movements with vessels containing mercury must be carried out in, or at least above, rigid seamless trays made from plastic or enameled metal. The supplied 6.2711.030 Drip pan made of polystyrene is eminently suitable for this.
- **Collecting mercury from the measuring vessel**
  If work is performed with the MME, at the end of the determination the analysis solution contains mercury, which must be collected for later disposal. This can be done by collecting the analysis solutions in a large vessel and then decanting, by filtering the analysis solutions or by siphoning off the mercury using vacuum.
- **Trapping of mercury drops**
  Single mercury drops in this drip pan or any other spilt mercury can be bound in a simple manner by amalgamation:
  - with silver (Ag):
    Metrohm drop catcher Type 6.2406.000 which is included in the standard outfit of the 797 VA Computrace Stand
  - with tin (Sn):
    e.g. the thin tin foil supplied by Merck, Darmstadt/FRG

with special laboratory aids:
e.g. Mercurisorb-Roth™ from Roth, Karlsruhe/FRG; e.g. Mercury Sponge™ and Resisorb™ from Baker, Phillipsburg, N.J./USA

- **Empty reservoir of mercury trap regularly**
  The storage container of the 6.2406.000 mercury trap should be emptied regularly and rinsed thoroughly several times. If the mercury trap is needed outside the fume cupboard, a minimum safety distance of 50 cm between the head and the mercury trap must be observed.
- **Never leave mercury in open vessels**
  Mercury must never be left exposed to the air. The upper layer of water or supporting electrolyte in no way suppresses nor reduces Hg evaporation [11, 12].
- **Store mercury container in fume cupboard**
  The tightly closed mercury container as well as all parts that come into contact with mercury must be stored in a fume cupboard, which is always switched on.
- **Use gas wash bottles when siphoning off mercury under vacuum**
  If mercury is siphoned off under vacuum using a water jet pump, one or two gas wash bottles must always be connected between the vacuum pump and the suction tube to ensure trapping of the siphoned-off mercury.
- **Ventilate laboratory areas well**
  Rooms where work with mercury is being carried out should be thoroughly aired from time to time.
- **Dispose of mercury properly**
  Mercury can be cleaned by distillation [13 – 16], but the apparatus is extensive and the time needed considerable. For this reason, waste mercury is normally collected in a closed container and then sent for disposal to the responsible authorities in accordance with the national legal requirements

3.4.4 References dealing with mercury

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4 Appendix

4.1 Technical data

Subject to changes!
The listed technical data apply to an ambient temperature of 25°C.

Brief characterization

PC-controlled system for voltammetry, set chemical workplace with potentiostat and measuring amplifier.

With Multi-Mode Electrode or rotating disk electrode (RDE).

Tilt-back measuring arm, integrated drip pan.

Current measurement techniques

DC	Direct Current
NP	Normal Pulse
DP	Differential Pulse
SqW	Square Wave (10 ... 2000 Hz)
AC1	Phase-sensitive Alternating Current 1st harmonic (1 … 250 Hz)
AC2	Phase-sensitive Alternating Current 2nd harmonic (1 … 250 Hz)
PSA	Potentiometric Stripping Analysis (chronopotentiometry) with chemical oxidation/reduction
CCPSA	PSA with Constant Current oxidation/reduction
CV	Cyclic Voltammetry (digital ramp)
CVS	Cyclic Voltammetric Stripping
CPVS	Cyclic Pulse Voltammetric Stripping (Chronoamperometry)

Potentiostat

Output voltage (AE)	± 12 V
Output current (AE)	± 80 mA
Sweep voltage range	± 5 V
Voltage resolution	150 µV
Input impedance(RE)	$R \geq 1 \cdot 10^{10}\ \Omega$
Input Bias Current (RE)	± 5 pA
Noise	typ. 200 pA
Sweep rate	with voltage step 10 mV

CV,CVS:	0 … 36.7 V/s	SQW, DC:	0 … 20 V/s
DP, NP:	0 … 0.5 V/s	AC1, AC2:	0 … 22 mV/s

Pulse amplitudes	AC1, AC2:	1 mV … 1 V
	DP, NP:	–1 … 1 V
	SQW:	0.15 mV … 1 V

Current measurement

Current ranges	10 nA … 10 mA in 7 ranges
Current resolution	0.2 % of the current range
Minimum current I_{min}	30 fA
Maximum current I_{max}	80 mA
Integration times	0.1 … 20 ms

Multi-Mode Electrode MME (working electrode WE)

Designation	6.1246.020
Electrode types	DME (dropping mercury electrode) HMDE (hanging mercury drop electrode) SMDE (static mercury drop electrode)
Drop surface	0.15 … 0.60 mm^2 (DME, HMDE and SMDE)
Glass capillary	Standard capillary for polarography and stripping voltammetry in alkaline solutions: 6.1226.030 (set of 10) internal diameter = 0.05 mm Silanized capillary for stripping voltammetry in acidic solutions: 6.1226.050 (set of 10) internal diameter = 0.05 mm
Mercury reservoir	6 mL ≅ 81.2 g; sufficient for ca. 200'000 Hg drops
Mercury quality	ultra pure mercury, min. 99.999%
Auxiliary power	inert gas (generally nitrogen N_2"5.0", min 99.999%); *p* = 1 ± 0.2 bar

Rotating disk electrode RDE (working electrode WE)

Construction	6.1204.210	Drive shaft + screw-on
	6.1204.XXX	Electrode tips
Electrode tips	6.1204.110	glassy carbon (GC)
	6.1204.120	platinum (Pt) unpolished
	6.1204.130	silver (Ag)
	6.1204.140	gold (Au) for Hg determination
	6.1204.150	gold (Au) for As determination
	6.1204.160	platinum (Pt) polished, for CVS
	6.1204.170	platinum (Pt) polished, for CVS
	6.1204.180	Ultra trace graphite (UT)
	6.1204.190	Pt electrode tip (1 mm) for CVS, shaft made of glass
Disk diameter	2.0 ± 0.1 mm (6.1204.150 / 6.1204.170 disk diameter 3 ± 0.1 mm) (6.1204.190 disk diameter 1 ± 0.02 mm)	
Radial eccentricity	≤ 0.2 mm	

Regeneration	with 6.2802.000 Polishing kit or with 6.2802.020 Trimming tool (only for 6.1204.180)
Rotational speed	200, 400, 600, ... , 3000 min^{-1}
Speed constancy	± 2 %

Reference electrode(RE)

Construction	double-junction; 6.0728.0X0 Ag/AgCl Ref. system + 6.1245.010 Electrolyte vessel to be filled by user
Reference system	6.0728.030 LL-Ag/AgCl(KCl) Reference system 6.0728.020 Ag/AgCl/c(KCl) = 3 mol/L 6.0728.010 Ag/AgCl/dry (Option); can be filled with any electrolyte.
Diaphragm	ceramic diaphragm; diameter = 3 mm

Auxiliary electrode(AE)

Pt auxiliary electrode	6.0343.000 Platinum electrode
GC auxiliary electrode (option)	6.1241.020 Electrode holder + 6.1247.000 Glassy carbon tip

Stirrer

Construction	6.1204.200
Material	PET
Rotational speed	200, 400, 600, ... , 3000 min^{-1}
Speed constancy	± 2 %

Measuring vessels

6.1415.210	standard measuring vessel made of lead-free borosilicate glass 3.3; working volume = 10 ... 90 mL
6.1415.250	measuring vessel made of lead-free borosilicate glass 3.3; working volume = 50 … 150 mL
6.1415.150	measuring vessel made of lead-free borosilicate glass 3.3 (option); working volume = 5 ... 70 mL
6.1418.220	measuring vessel made of lead-free borosilicate glass 3.3 with thermostat jacket (option); working volume = 12 ... 70 mL
6.1418.250	measuring vessel made of lead-free borosilicate glass 3.3 with thermostat jacket (option); working volume = 50 ... 150 mL
6.1450.210	measuring vessel made of PFA (option) working volume = 10 ... 90 mL
6.1456.210	measuring vessel made of lead-free borosilicate glass 3.3 for sample changer operation (option); working volume = 10 ... 90 mL
6.1457.210	measuring vessel made of lead-free borosilicate glass 3.3 with thermostat jacket for sample changer operation (option); working volume = 10 ... 90 mL

Dummy Cell

Use	Checking of the 797 VA Computrace	
	Determination of the signal-to-noise ratio	
Connections	AE	auxiliary electrode
	RE	reference electrode
	WE-L	working electrode linear mode (RC element)
	WE-D	working electrode differential mode (peak/wave)

Inert gas (in general nitrogen N_2)

Use	Operation of MME de-aeration of sample solution (Not needed for electroplating bath analysis)
Purity	min. 5.0 (99.999 %)
Required pressure	$p = 1 \pm 0.2$ bar (this gas pressure results in a gas flow rate of ca. 20 L/h)

Dosing devices (Option)

Type	800 Dosino (2.800.0010) + 807 Dosing unit (6.3032.XXX), 700 Dosino (2.700.0020) + 807 Dosing unit (6.3032.XXX), 685 Dosimat (2.685.0010) + 806 Exchange unit (6.3026.XXX) + Cable (6.2134.030) 805 Dosimat (2.805.0010) + 806 Exchange unit (6.3026.XXX) connect via MSB 1…3 (or to a 846 Dosing Interface)
Number	1...3 (with a 846 Dosing Interface, 4 additional can be connected)
Plug	Mini-DIN
Manual operation	Dispensing, filling, adjustment of feed and filling rate

MSB connections (MSB = Metrohm Serial Bus)

Dosing devices	Connection of max. 3 Dosing devices (MSB1 to MSB3) to 797 VA Computrace. With a 846 Dosing Interface, four additional Dosing devices can be connected.

USB connections

USB Standard	USB1.1
Connection computer	With cable 6.2151.020
USB ports	2 USB downstream Ports (type A sockets), each 500 mA, for the connection of peripherals as printer,…

Remote connections

Remote Interface	D-Sub, 25 pin remote interface to control sample changer and rinsing equipment.

Cable	6.2141.170 (option, for the 863 Compact Autosampler) 6.2141.180 (option, for 838 Advanced Sample Processor)
Sample changer	863 Compact Autosampler (2.863.0020, option) or 838 Advanced Sample Processor (2.838.0310, option)
Rinsing equipment	843 Pump Station or 731 Relay Box (2.731.0010, option) with two 772 Pump units (2 x 2.772.0110, option) or two 823 Membrane Pump Units (2 x 2.823.0010, option), Adapter cable (6.2160.010) and *Rinsing equipment* (6.5323.010, Option).

Mains connection

Voltage	100...240 V
Frequency	50...60 Hz
Power consumption	120 W
Fuse	2 × 1.6 ATH (to be replaced by Metrohm Service only using the same type). Additional electronic overload protection.

Safety specifications

Construction/testing	According to EN/IEC/UL 61010-1, CSA-C22.2 No. 61010-1 protection class 1
Safety directions	The Instructions for Use include information and warnings, which must be heeded by the user to assure safe operation of the instrument.

Electromagnetic compatibility (EMC)

Emitted interference	Standards complied with: - EN/IEC 61326-1 - EN 55022 / CISPR 22 - EN/IEC 61000-3-2 - EN/IEC 61000-3-3
Immunity to interference	Standards complied with: - EN/IEC 61326-1 - EN/IEC 61000-4-2 - EN/IEC 61000-4-3 - EN/IEC 61000-4-4 - EN/IEC 61000-4-5 - EN/IEC 61000-4-6 - EN/IEC 61000-4-11

Ambient temperature

Nominal operating range	0…+45 °C

Storage, transport	–40…+70 °C

Housing

Material of cover	Polyurethane rigid foam (PUR) with fire protection for fire class UL94VO, FCH-free
Material of base	Steel, enameled
Material of measuring head arm	Steel, enameled

Dimensions

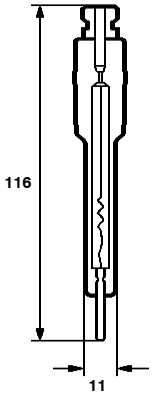
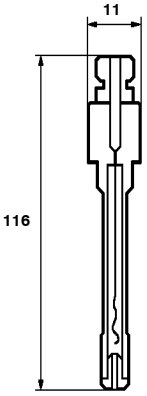
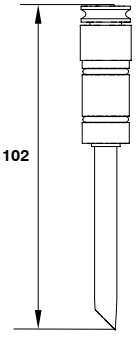
Width	259 mm
Height	240mm (544/620 mm with cover raised)
Depth	530 mm
Weight	9.7 kg (excl. accessories)

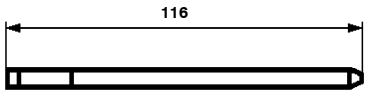
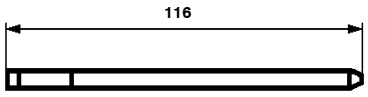
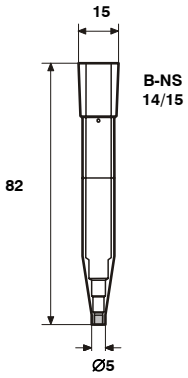
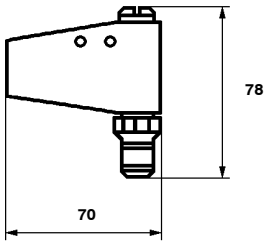
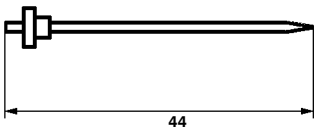
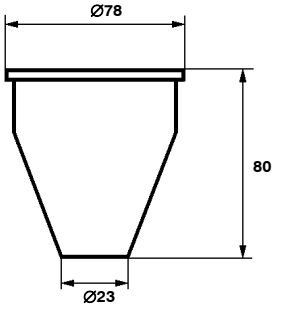
4.2 Scope of delivery

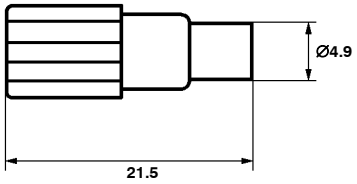
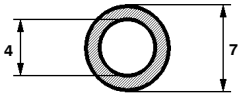
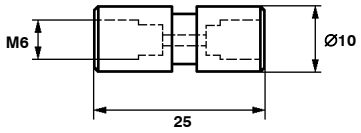
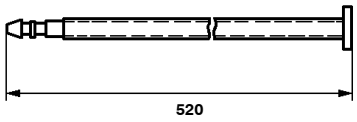
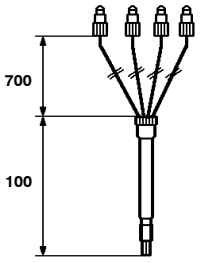
Subject to changes!
All dimensions are given in mm.

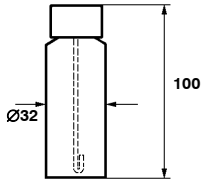
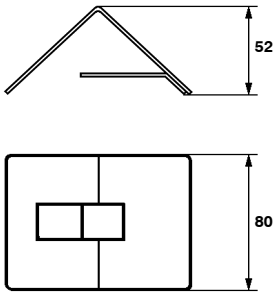
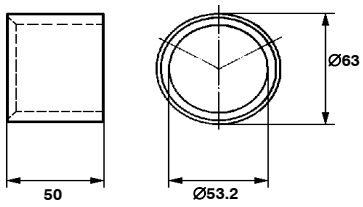
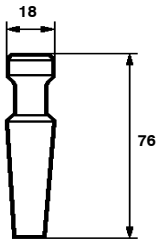
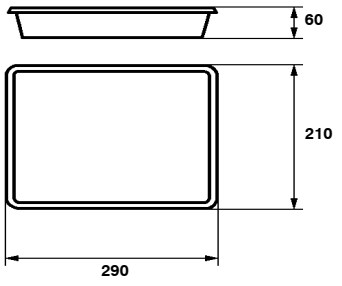
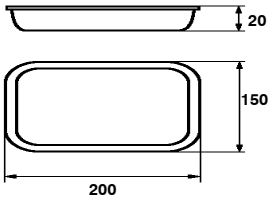
4.2.1 VA Computrace 2.797.0010

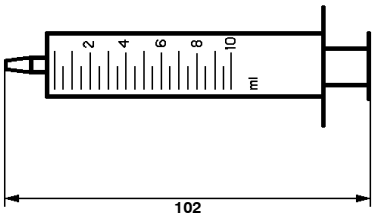
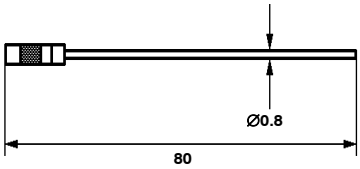
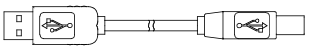
The 2.797.0010 VA Computrace System includes the following accessories:

Quant.	*Order No.*	*Description*
1	1.797.0010	**797 VA Computrace Stand** Instrument without accessories
1	6.0343.000	**Pt Auxiliary electrode** 
1	6.0728.020	**Ag/AgCl reference system** with ceramic diaphragm Ag/AgCl/*c*(KCl) = 3 mol/L Together with the 6.1245.010 Electrolyte vessel forms a complete reference electrode (double-junction construction, assembly, see *section 2.5.2*). The Ag/AgCl reference system is supplied with a screwed-on holder filled with *c*(KCl) = 3 mol/L. 
1	6.1204.200	**Stirrer** 

Quant.	*Order No.*	*Description*
1	6.1226.030	**Glass capillaries** for 6.1246.020 Multi-Mode Electrode Set of 10 incl. two 4.420.2800 sealing rings 
1	6.1226.050	**Glass capillaries (silanized)** for 6.1246.020 Multi-mode electrode Set of 10 incl. two 4.420.2800 sealing rings 
1	6.1244.020	**Drive belt** made of EPDM (ethylene propylene rubber), set of 3 Connection motor – drive shaft (6.1246.010 or 6.1204.210)
1	6.1245.010	**Electrolyte vessel** with ceramic diaphragm Together with the 6.0728.020 Ag/AgCl reference system forms a complete reference electrode (double-junction construction, assembly, see *section 2.5.2)* 
1	6.1246.020	**Multi-Mode Electrode** incl. 2 O-rings NBR (nitril rubber) Together with the 6.1226.030 glass capillary forms a complete working electrode. 
1	6.1247.020	**Sealing needle** for 6.1246.020 Multi-Mode Electrode Set of 3 
1	6.1415.210	**Measuring vessel** borosilicate glass Volume: 10 ... 90 mL 

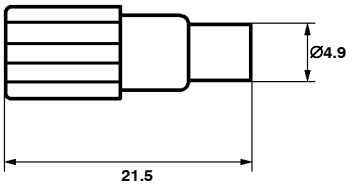
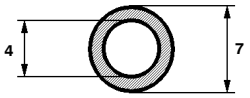
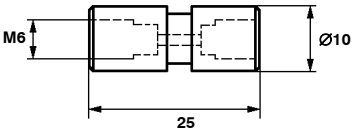
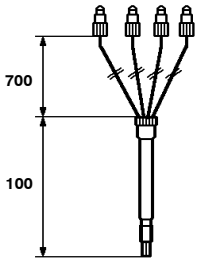
Quant.	Order No.	Description
7	6.1446.040	**Dummy stopper** made of PVDF, with M6 thread For closing the unused openings in the measuring vessel upper half 
1	6.1801.080	**PVC tubing** for supply of the inert gas Length *L* = 4 m 
4	6.1808.000	**Tubing coupling** made of ETFE, with 2 M6 threads For the connection of 2 lengths of tubing with thread M6 (e.g. 6.1805.XXX) 
1	6.1817.000	**Filling tubing**, made of PVC incl. 4.420.2860 Filling cone and 6.1809.000 Tubing coupling For filling the MME with mercury. 
1	6.1824.000	**4-way microtip** made of PTFE With 4 lengths of PTFE tubing with connection nipples with thread M6 for the attachment of 4 Dosing devices. 
1	6.2122.0X0	**Mains cable** to customer's specifications: Cable socket — Cable plug Type IEC 320/C 13 — Type SEV 12 (CH…) 6.2122.020 Type IEC 320/C 13 — Type CEE (7), VII (D…) 6.2122.040 Type CEE (22), V — Type NEMA 5-15 (USA…) 6.2122.070
1	6.2301.100	**Lead standard solution** $\beta(Pb^{2+})$ = 1.000 ± 0.003 g/L plastic bottle, volume *V* = 50 mL To perform the test methods.
1	6.2308.020	**KCl electrolyte solution** *c*(KCl) = 3 mol/L plastic bottle, volume *V* = 250 mL For filling the Ag/AgCl-reference-system 6.0728.020 and the electrolyte vessel 6.1245.010 for voltammetric trace analysis.

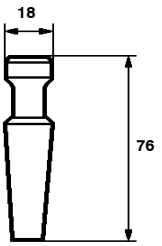
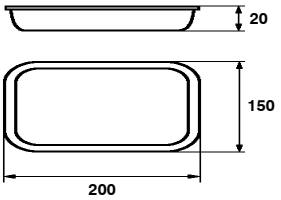
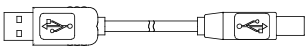
Quant.	Order No.	Description
1	6.2406.000	**Mercury drop catcher** silver wire in plastic bottle For the destruction of mercury drops by amalgamation 
1	6.2615.030	**Electrode holder** For filling and storing the 6.1246.020 Multi-Mode Electrode 
1	6.2703.000	**Stand ring made of PVC** To hold the 6.1415.210 measuring vessel outside the 797 VA Computrace Stand 
1	6.2709.080	**Stopper** For closing the pipetting aperture of the 797 VA Computrace Stand 
1	6.2711.030	**Drip pan** made of PS (polystyrene) For filling the Multi-Mode Electrode with mercury 
1	6.2711.040	**Drip pan** made of PS (polystyrene) To be inserted in the 797 VA Computrace Stand 
1	6.2739.000	**Spanner** for screwing down plastic nipples 

Quant.	*Order No.*	*Description*
1	6.2816.020	**Syringe** made of PP, with Luer connection Volume *V* = 10 mL For filling the MME 
1	6.2816.030	**Needle** for 6.2816.020 syringe 
1	6.2151.020	**USB Cable 797 – PC** For connection of the 797 VA Computrace Stand to the PC via USB USB A – USB B (1.8 m) 
1	6.6053.030	**PC Software-CD «797 VA Computrace Software»**
1	8.797.8001EN	**Hardware Manual (English)** Instructions for Use for 797 VA Computrace Stand
1	8.797.8027	**Registration card (German/English)** for PC program «797 VA Computrace»
1	8.757.2003	**"VA Application Notes" (English)**
1	8.757.5003	**Metrohm Monograph "Practical voltammetry" (English)**
1	8.027.5003	**Metrohm Monograph "Introduction to Polarography and Voltammetry" (English)**
1	8.797.8033	**Software Manual (English)** Instructions for Use for PC program «797 VA Computrace»
1	8.110.8213	**Software Manual (English)** **Metrodata Autodatabase**

4.2.2 VA Computrace 2.797.0020

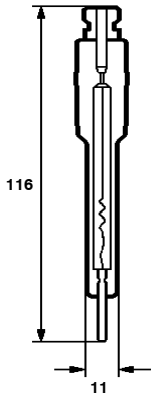
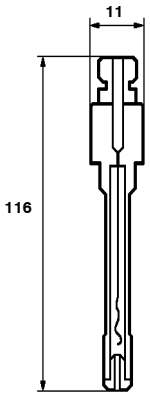
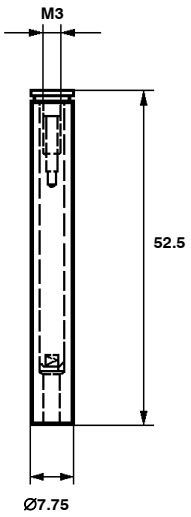
The 2.797.0020 VA Computrace System includes the following accessories:

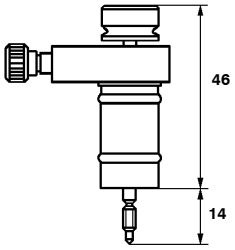
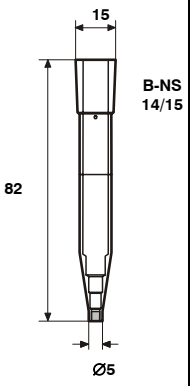
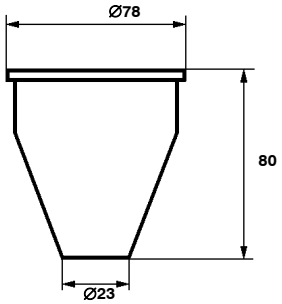
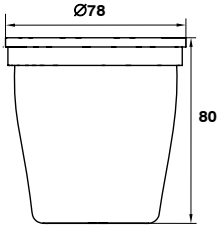
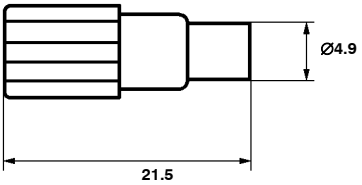
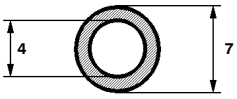
Quant.	*Order No.*	*Description*
1	1.797.0010	**797 VA Computrace Stand** Instrument without accessories
7	6.1446.040	**Dummy stopper** made of PVDF, with M6 thread For closing the unused openings in the measuring vessel upper half 
1	6.1801.080	**PVC tubing** for supply of the inert gas Length *L* = 4 m 
4	6.1808.000	**Tubing coupling** made of ETFE, with 2 M6 threads For the connection of 2 lengths of tubing with thread M6 (e.g. 6.1805.XXX) 
1	6.1824.000	**4-way microtip** made of PTFE With 4 lengths of PTFE tubing with connection nipples with thread M6 for the attachment of 4 Dosing Devices. 
1	6.2122.0X0	**Mains cable** to customer's specifications: Cable socket — Cable plug Type IEC 320/C 13 — Type SEV 12 (CH…) ..... 6.2122.020 Type IEC 320/C 13 — Type CEE (7), VII (D…) ..... 6.2122.040 Type CEE (22), V — Type NEMA 5-15 (USA…) 6.2122.070
1	6.2301.100	**Lead standard solution** $\beta(Pb^{2+})$ = 1.000 ± 0.003 g/L plastic bottle, volume *V* = 50 mL To perform the test methods.
1	6.2308.020	**KCl electrolyte solution** *c*(KCl) = 3 mol/L plastic bottle, volume *V* = 250 mL For filling the Ag/AgCl-reference-system 6.0728.020 and the electrolyte vessel 6.1245.010 for voltammetric trace analysis.

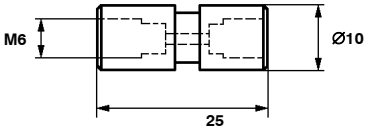
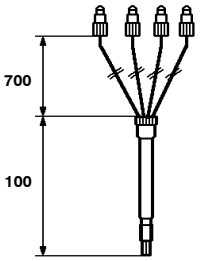
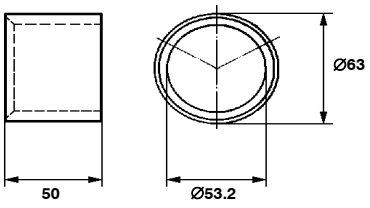
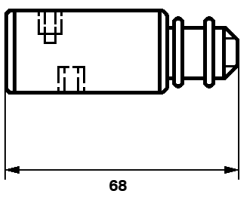
Quant.	Order No.	Description
1	6.2709.080	**Stopper** For closing the pipetting aperture of the 797 VA Computrace Stand 
1	6.2711.040	**Drip pan** made of PS (polystyrene) To be inserted in the 797 VA Computrace Stand 
1	6.2739.000	**Spanner** for screwing down plastic nipples 
1	6.2151.020	**USB Cable 797 – PC** For connection of the 797 VA Computrace Stand to the PC via USB USB A – USB B (1.8 m) 
1	6.6053.030	**PC Software-CD «797 VA Computrace Software»**
1	8.797.8001EN	**Hardware Manual (English)** Instructions for Use for 797 VA Computrace Stand
1	8.797.8027	**Registration card (German/English)** for PC program «797 VA Computrace»
1	8.757.2003	**"VA Application Notes" (English)**
1	8.757.5003	**Metrohm Monograph "Practical voltammetry" (English)**
1	8.027.5003	**Metrohm Monograph "Introduction to Polarography and Voltammetry“ (English)**
1	8.797.8033	**Software Manual (English)** Instructions for Use for PC program «797 VA Computrace»
1	8.110.8213	**Software Manual (English)** **Metrodata Autodatabase**

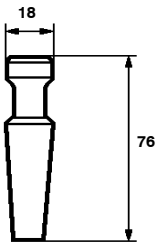
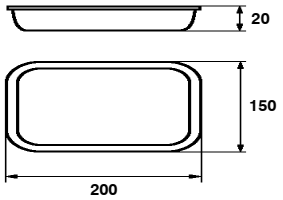
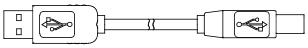
4.2.3 VA Computrace 2.797.0030

The 2.797.0030 VA Computrace System includes the following accessories:

Quant.	*Order No.*	*Description*
1	1.797.0010	**797 VA Computrace Stand** Instrument without accessories
1	6.0343.000	**Pt Auxiliary electrode** 
1	6.0728.030	**LL-Ag/AgCl rerference electrode for CVS** Internal system with electrolyte KCl = 3 mol/L 
1	6.1204.190	**Platinum electrode tip** Metal electrode tip made of platinum (Pt), electrode disk diameter 1 mm ±0.02 mm, polished surface, shaft made of glass, thread adapter M3 

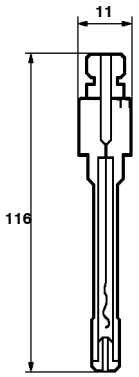
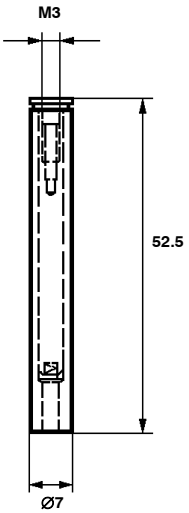
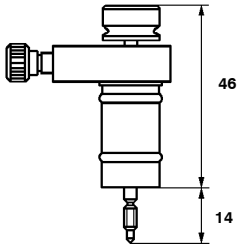
Quant.	Order No.	Description
1	6.1204.210	**Driving axle for rotating disk electrode (RDE)** for VA Stands 
1	6.1244.020	**Drive belt** made of EPDM (ethylene propylene rubber), set of 3 Connection motor – drive shaft (6.1246.010 or 6.1204.210)
1	6.1245.010	**Electrolyte vessel** with ceramic diaphragm Together with the 6.0728.020 Ag/AgCl reference system forms a complete reference electrode (double-junction construction, assembly, see *section 2.5.2)* 
1	6.1415.210	**Measuring vessel** borosilicate glass 3.3 Volume: 10 ... 90 mL 
1	6.1415.250	**Measuring vessel** borosilicate glass 3.3 Volume: 50 ... 150 mL 
7	6.1446.040	**Dummy stopper** made of PVDF, with M6 thread For closing the unused openings in the measuring vessel upper half 
1	6.1801.080	**PVC tubing** for supply of the inert gas Length *L* = 4 m 

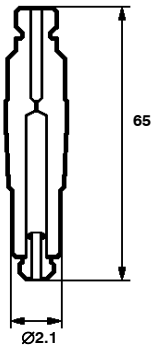
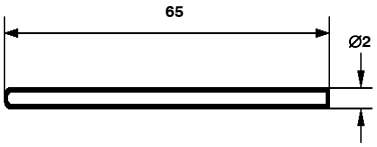
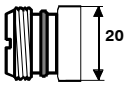
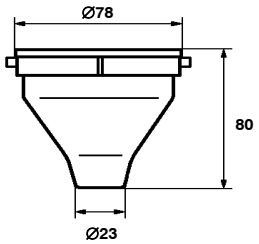
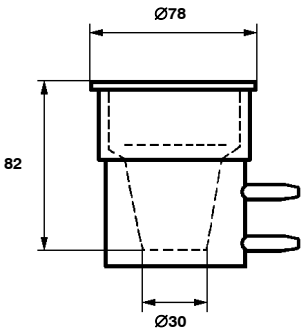
Quant.	Order No.	Description
4	6.1808.000	**Tubing coupling** made of ETFE, with 2 M6 threads For the connection of 2 lengths of tubing with thread M6 (e.g. 6.1805.XXX) 
1	6.1824.000	**4-way microtip** made of PTFE With 4 lengths of PTFE tubing with connection nipples with thread M6 for the attachment of 4 Dosing devices. 
1	6.2122.0X0	**Mains cable** to customer's specifications: Cable socket — Cable plug Type IEC 320/C 13 — Type SEV 12 (CH…).....6.2122.020 Type IEC 320/C 13 — Type CEE (7), VII (D…).....6.2122.040 Type CEE (22), V — Type NEMA 5-15 (USA…).....6.2122.070
1	6.2308.020	**KCl electrolyte solution** *c*(KCl) = 3 mol/L plastic bottle, volume *V* = 250 mL For filling the Ag/AgCl-reference-system 6.0728.020 and the electrolyte vessel 6.1245.010 for voltammetric trace analysis.
1	6.2310.000	**Potassium nitrate electrolyte solution** KNO_3 sat. Plastic-bottles, Volume *V* = 250 mL For filling of electrolyte vessels 6.1245.010 in the electroplating bath analysis.
1	6.2703.000	**Stand ring made of PVC** To hold the 6.1415.210 measuring vessel outside the 797 VA Computrace Stand 
1	6.2709.040	**Stopper** made of PVC, incl. 2 E.301.0004 O-rings of NBR (nitril rubber) For closing the MME opening when the RDE is used; with two dummy holes (thread M6) for holding the two MME gas lines not used in operation with the RDE. 

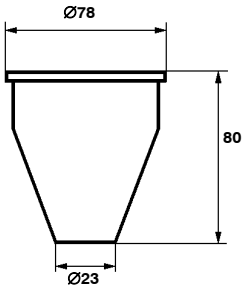
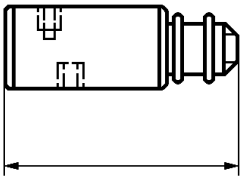
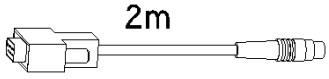
Quant.	*Order No.*	*Description*
1	6.2709.080	**Stopper** For closing the pipetting aperture of the 797 VA Computrace Stand 
1	6.2711.040	**Drip pan** made of PS (polystyrene) To be inserted in the 797 VA Computrace Stand 
1	6.2739.000	**Spanner** for screwing down plastic nipples 
1	6.2802.000	**Polishing kit** for mechanical regeneration of the active surface of 6.1204.XXX electrode tips comprising: 1× 2 g α-Al_2O_3 (0.3 µm) 1× polishing cloth
1	6.2151.020	**USB Cable 797 – PC** For connection of the 797 VA Computrace Stand to the PC via USB USB A – USB B (1.8 m) 
1	6.6053.030	**PC Software-CD «797 VA Computrace Software»**
1	8.797.8001EN	**Hardware Manual (English)** Instructions for Use for 797 VA Computrace Stand
1	8.797.8027	**Registration card (German/English)** for PC program «797 VA Computrace»
1	8.757.2003	**"VA Application Notes" (English)**
1	8.027.5003	**Metrohm Monograph "Introduction to Polarography and Voltammetry“ (English)**
1	8.797.8033	**Software Manual (English)** Instructions for Use for PC program «797 VA Computrace»
1	8.110.8213	**Software Manual (English)** **Metrodata Autodatabase**

4.3 Options

4.3.1 General options

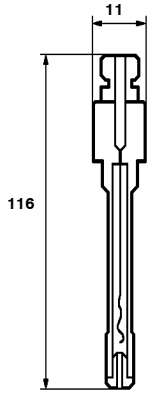
Order No.	*Description*
6.0728.010	**Reference system** **6.0728.010** **Ag/AgCl Reference Electrode** Internal system without electrolyte **6.0728.020** **Ag/AgCl Reference Electrode** Internal system with electrolyte KCl = 3 mol/L **6.0728.030** **LL Ag/AgCl reference electrode for CVS** Internal system with electrolyte KCl = 3 mol/L **6.0728.040** **LL Ag/AgCl (gel) reference electrode for CVS** Internal system with electrolyte KCl = 3 mol/L (gel) 
6.1204.XXX	**Electrode tip** Together with the 6.1204.210 Drive shaft forms the rotating disc electrode (RDE). The following electrode tips are available: *Order No.* *Disk material* *Shaft material* **6.1204.110** **Glassy Carbon (GC)** PEEK **6.1204.120** **Pt unpolished** PEEK **6.1204.130** **Ag** PEEK **6.1204.140** **Au** PEEK **6.1204.150** **Au** PEEK **6.1204.160** **Pt polished (for CVS)** PEEK **6.1204.170** **Pt polished (for CVS)** PEEK **6.1204.180** **Ultra Trace Graphite (UT)** PEEK **6.1204.190** **Pt electrode tip CVS** PEEK Disk diameter: 2.0 ± 0.1 mm 3.0 ± 0.1 mm for 6.1204.150 / 6.1204.170 1.0 ± 0.02 mm for 6.1204.190 Concentricity error: ≤ 0.2 mm 
6.1204.210	**Driving axle for rotating disk electrode (RDE)** for VA Stands 

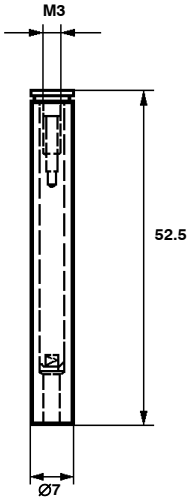
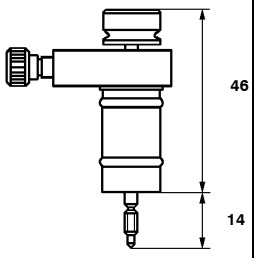
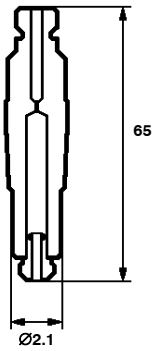
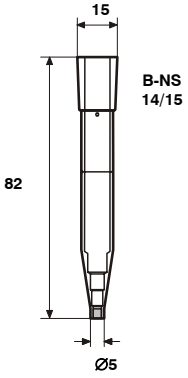
Order No.	*Description*
6.1204.220	**Driving axle for rotating disk electrode (RDE) with titanium axle and mercury contact** for VA Stands 
6.1241.020	**Electrode holder** to take the 6.1247.000 glassy carbon rod Together with the 6.1247.000 glassy carbon rod forms the GC auxiliary electrode. 
6.1247.000	**Glassy carbon tip** Together with the 6.1241.020 electrode holder forms the GC auxiliary electrode. 
6.1247.040	**Slotted screw** Slotted screw with PTFE membrane. 
6.1415.150	**Measuring vessel** borosilicate glass, incl. 6.2036.000 holding ring Volume: 5 ... 70 mL 
6.1418.220	**Measuring vessel** borosilicate glass, with thermostatic jacket; incl. 6.2036.000 holding ring Volume: 12 ... 70 mL 

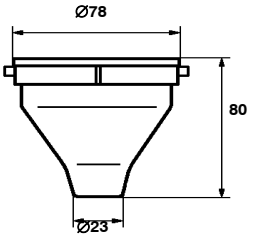
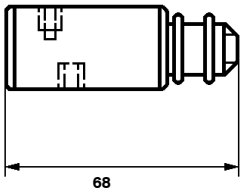
Order No.	*Description*
6.1450.210	**Measuring vessel** Made of PFA (polyfluoralkyloxy-copolymer), incl. 6.2036.000 holding ring Volume: 10 ... 90 mL 
6.2709.040	**Stopper** made of PVC, incl. 2 E.301.0004 O-rings of NBR (nitril rubber) For closing the MME opening when the RDE is used; with two dummy holes (thread M6) for holding the two MME gas lines not used in operation with the RDE. 
6.2802.000	**Polishing kit** for mechanical regeneration of the active surface of 6.1204.XXX electrode tips comprising: 1 × 2 g α-Al_2O_3 (0.3 µm) 1 × polishing cloth
6.2802.020	**Polishing kit** exclusively to clean the 6.1204.180 Ultra Trace graphite electrode tips
2.685.0010	**685 Dosimat** Dosing device to 797 VA Computrace Stand.
6.2134.030	**Connection cable for 685 Dosimat** 9 p./f – Mini-DIN/m Connection cable 685 Dosimat – 797 VA Computrace Stand. 
2.805.0010	**805 Dosimat** Dosing device to 797 VA Computrace Stand.
6.3026.XXX	**Exchange unit 806** Burette unit for Metrohm Dosimats with glass cylinder and integrated data chip. **6.3026.110** burette volume *V* = 1 mL **6.3026.150** burette volume *V* = 5 mL **6.3026.210** burette volume *V* = 10 mL **6.3026.220** burette volume *V* = 20 mL **6.3026.250** burette volume *V* = 50 mL
2.700.0010	**700 Dosino** Dosing device to 797 VA Computrace Stand.
2.800.0010	**800 Dosino** Dosing device to 797 VA Computrace Stand.
2.846.0010	**846 Dosing Interface** Device for the connection of four additional Dosing devices.

Order No.	Description
6.3032.XXX	**Dosing unit 807** Burette unit for Metrohm 700 and 800 Dosino, with glass cylinder, four dosing ports (In- and Outlets) and integrated data chip; transparent housing. **6.3032.120** burette volume *V* = 2 mL **6.3032.150** burette volume *V* = 5 mL **6.3032.210** burette volume *V* = 10 mL **6.3032.220** burette volume *V* = 20 mL **6.3032.250** burette volume *V* = 50 mL
6.5323.010	**Rinsing equipment for 797 VA Computrace** incl. the following accessories: 1 × 6.1446.040 Dummy stopper M6 1 × 6.1456.210 Measuring vessel for sample changer operation 2 × 6.1602.105 Siphon GL45 2 × 6.1618.050 Thread adapter 40 mm/GL45 2 × 6.1621.000 PE container, *V* = 10 L 1 × 6.1805.020 FEP tubing, *L* = 52 cm 1 × 6.1805.100 FEP tubing, *L* = 40 cm 1 × 6.1805.180 FEP tubing, *L* = 16 cm 4 × 6.1805.530 FEP tubing, *L* = 200 cm 1 × 6.1808.000 Coupling bush, with 2 threads M6 2 × 6.1819.010 PTFE tube, *L* = 86 mm 1 × 6.1819.020 FEP tube, *L* = 250 cm 4 × 6.1820.020 Screw connector 1 × 6.1828.020 Tubing connection to container 1 × 6.1829.020 FEP aspiration tubing, *L* = 500 cm

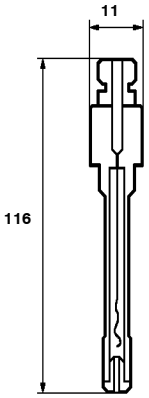
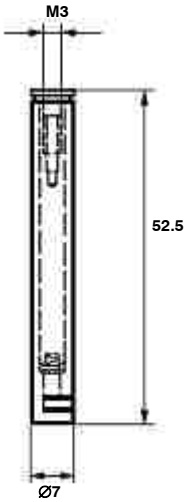
4.3.2 6.5327.000 MVA-Hg: Equipment for Hg-determination

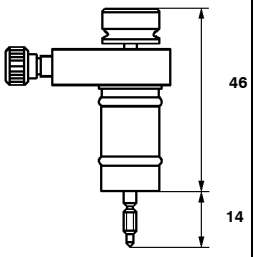
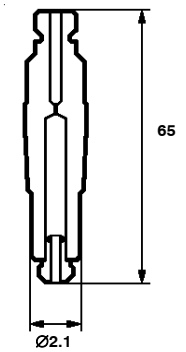
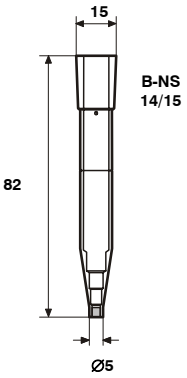
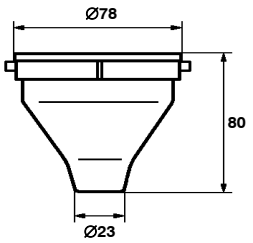
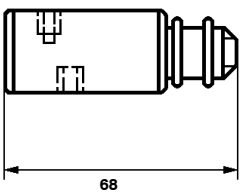
Quant.	Order No.	Description
1	6.0728.020	**Ag/AgCl reference system** with ceramic diaphragm Ag/AgCl/*c*(KCl) = 3 mol/L Together with the 6.1245.010 Electrolyte vessel forms a complete reference electrode (double-junction construction, assembly, see *section 2.5.2*). The Ag/AgCl reference system is supplied with a screwed-on holder filled with *c*(KCl) = 3 mol/L. 

Quant.	Order No.	Description
1	6.1204.140	**Au - Electrode tip** Forms the rotating disc electrode (RDE). together with the 6.1204.210 Drive shaft. Shaft material: PEEK Disk diameter: 2.0 ± 0.1 mm Concentricity error: ≤ 0.2 mm 
1	6.1204.210	**Driving axle for rotating disk electrode (RDE)** for VA Stands 
1	6.1241.020	**Electrode holder** to take the 6.1247.000 glassy carbon rod Together with the 6.1247.000 glassy carbon rod forms the GC auxiliary electrode. 
1	6.1245.010	**Electrolyte vessel** with ceramic diaphragm Together with the 6.0728.020 Ag/AgCl reference system forms a complete reference electrode (double-junction construction, assembly, see *section 2.5.2)* 
1	6.1247.000	**Glassy carbon tip** Together with the 6.1241.020 electrode holder forms the GC auxiliary electrode. 

Quant.	Order No.	Description
1	6.1415.150	**Measuring vessel** borosilicate glass, incl. 6.2036.000 holding ring Volume: 5 ... 70 mL 
1	6.2709.040	**Stopper** made of PVC, incl. 2 E.301.0004 O-rings of NBR (nitril rubber) For closing the MME opening when the RDE is used; with two dummy holes (thread M6) for holding the two MME gas lines not used in operation with the RDE. 
1	6.2802.000	**Polishing kit** for mechanical regeneration of the active surface of 6.1204.XXX electrode tips comprising: 1 × 2 g α-Al_2O_3 (0.3 µm) 1 × polishing cloth

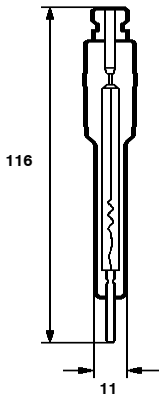
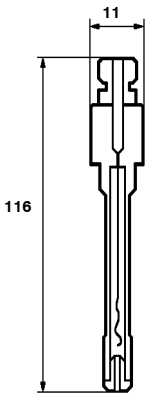
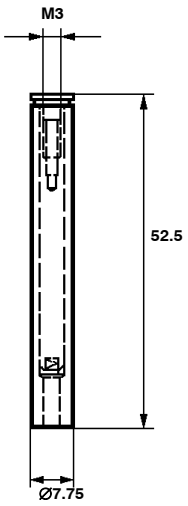
4.3.3 6.5327.010 MVA-As: Equipment for As-determination

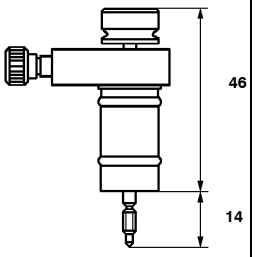
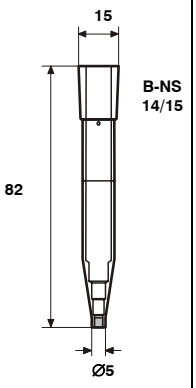
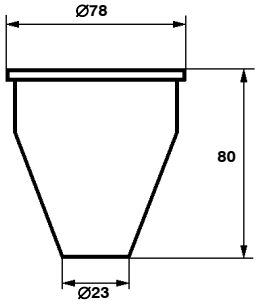
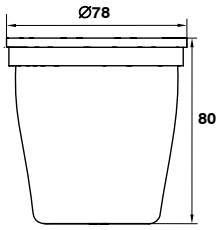
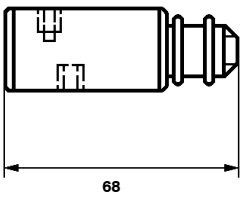
Quant.	Order No.	Description
1	6.0728.020	**Ag/AgCl reference system** with ceramic diaphragm Ag/AgCl/*c*(KCl) = 3 mol/L Together with the 6.1245.010 Electrolyte vessel forms a complete reference electrode (double-junction construction, assembly, see *section 2.5.2*). The Ag/AgCl reference system is supplied with a screwed-on holder filled with *c*(KCl) = 3 mol/L. 
1	6.1204.150	**Au - Electrode tip** Forms the rotating disc electrode (RDE). together with the 6.1204.210 Drive shaft. Shaft material: PEEK Disk diameter: 3.0 ± 0.1 mm Concentricity error: ≤ 0.2 mm Surface sidewise. 

Quant.	Order No.	Description
1	6.1204.210	**Driving axle for rotating disk electrode (RDE)** for VA Stands 
1	6.1241.020	**Electrode holder** to take the 6.1247.000 glassy carbon rod Together with the 6.1247.000 glassy carbon rod forms the GC auxiliary electrode. 
1	6.1245.010	**Electrolyte vessel** with ceramic diaphragm Together with the 6.0728.020 Ag/AgCl reference system forms a complete reference electrode (double-junction construction, assembly, see *section 2.5.2)* 
1	6.1247.000	**Glassy carbon tip** Together with the 6.1241.020 electrode holder forms the GC auxiliary electrode. 
1	6.1415.150	**Measuring vessel** borosilicate glass, incl. 6.2036.000 holding ring Volume: 5 ... 70 mL 
1	6.2709.040	**Stopper** made of PVC, incl. 2 E.301.0004 O-rings of NBR (nitril rubber) For closing the MME opening when the RDE is used; with two dummy holes (thread M6) for holding the two MME gas lines not used in operation with the RDE. 

Quant.	Order No.	Description
1	6.2802.000	**Polishing kit** for mechanical regeneration of the active surface of 6.1204.XXX electrode tips comprising: 1 × 2 g α-Al_2O_3 (0.3 µm) 1 × polishing cloth

4.3.4 6.5327.020 MVA-CVS: Equipment for CVS/CPVS

Quant.	Order No.	Description
1	6.0343.000	**Pt Auxiliary electrode** 
1	6.0728.030	**LL-Ag/AgCl Reference electrode for CVS** Internal system with electrolyte KCl = 3 mol/L 
1	6.1204.190	**Platinum electrode tip** Metal electrode tip made of platinum (Pt), electrode disk diameter 1 mm ±0.02 mm, polished surface, shaft made of glass, thread adapter M3 

Quant.	Order No.	Description
1	6.1204.210	**Driving axle for rotating disk electrode (RDE)** for VA Stands 
1	6.1245.010	**Electrolyte vessel** with ceramic diaphragm Together with the 6.0728.020 Ag/AgCl reference system forms a complete reference electrode (double-junction construction, assembly, see *section 2.5.2)* 
1	6.1415.210	**Measuring vessel** borosilicate glass Volume: 10 ... 90 mL 
1	6.1415.250	**Measuring vessel** borosilicate glass Volume: 50 ... 150 mL 
1	6.2310.010	**Potassium nitrate electrolyte solution** KNO_3 sat. Plastic-bottles, Volume *V* = 250 mL For filling of electrolyte vessels 6.1245.010 in the electroplating bath analysis.
1	6.2709.040	**Stopper** made of PVC, incl. 2 E.301.0004 O-rings of NBR (nitril rubber) For closing the MME opening when the RDE is used; with two dummy holes (thread M6) for holding the two MME gas lines not used in operation with the RDE. 

Quant.	Order No.	Description
1	6.2802.000	**Polishing kit** for mechanical regeneration of the active surface of 6.1204.XXX electrode tips comprising: 1× 2 g α-Al_2O_3 (0.3 µm) 1× polishing cloth

4.3.5 Accessories for the automated addition of auxiliary solutions

It is recommended to use a 800 Dosino for the automated addition of auxiliary solutions (standards, electrolytes, etc.):

Quant.	Order No.	Description
1..3	2.800.0010	**800 Dosino** Dosing device to 797 VA Computrace Stand.

If a 846 Dosing Interface is used, four additional dosing devices can be connected.

Dosing Unit and accessories depend on the volume of liquid to be dosed and the desired dosing speed.

µL range:

Quant.	Order No.	Description
1	6.3032.120	**2mL Dosing unit 807** 2mL Burette unit for Metrohm 700 and 800 Dosino, with glass cylinder, four dosing ports (In- and Outlets) and integrated data chip; transparent housing.
1	6.1608.050	**Glass bottle 100 mL**
1	6.2055.100	**Bottle holder**

mL range up to max. 2 mL:

Quant.	Order No.	Description
1	6.3032.150	**5mL Dosing unit 807** 5mL Burette unit for Metrohm 700 and 800 Dosino, with glass cylinder, four dosing ports (In- and Outlets) and integrated data chip; transparent housing.
1	6.1608.050	**Glass bottle 250 mL**
1	6.2055.100	**Bottle holder**

higher mL range:

Quant.	*Order No.*	*Description*
1	6.3032.250	**50mL Dosing unit 807** 50mL Burette unit for Metrohm 700 and 800 Dosino, with glass cylinder, four dosing ports (In- and Outlets) and integrated data chip; transparent housing.
1	6.1608.070	**Glass bottle 2 L**
1..2	6.1618.020	**Thread adapter S40**
1	6.1805.020	**FEP tubing** L = 52 cm
1	6.1805.120	**FEP tubing** L = 100 cm
1	6.1819.010	**PTFE tube** L = 86 mm

4.3.6 Automation for trace analysis

It is recommended to use the 863 Compact Autosampler for automated trace analysis. For automated addition of auxiliary solutions, see *section 4.3.5*.

Option 863 Compact Autosampler:

Quant.	*Order No.*	*Description*
1	2.863.0020	**863 Compact Autosampler for VA applications** Sample changer for up to 18 sample vessels
1	2.843.0040	**843 VA Membrane Pump Station (standard)**
1	2.731.0010	**731 Relay Box (with 772, alternative to 843)** Control unit for the two 772 Pump Units
2	2.772.0110	**772 Pump Unit (with 731, alternative to 843)** Peristaltic pump
2	6.2160.010	**Adapter cable** Connection cable for 772 Pump Units to the 731 Relay Box

Quant.	Order No.	Description
1	6.5323.010	**Rinsing equipment for 797 VA Computrace** incl. the following accessories: 1 × 6.1446.040 Dummy stopper M6 1 × 6.1456.210 Measuring vessel for sample changer operation 2 × 6.1602.105 Siphon GL45 2 × 6.1618.050 Thread adapter 40 mm/GL45 2 × 6.1621.000 PE container, *V* = 10 L 1 × 6.1805.020 FEP tubing, *L* = 52 cm 1 × 6.1805.100 FEP tubing, *L* = 40 cm 1 × 6.1805.180 FEP tubing, *L* = 16 cm 4 × 6.1805.530 FEP tubing, *L* = 200 cm 1 × 6.1808.000 Coupling bush, with 2 threads M6 2 × 6.1819.010 PTFE tube, *L* = 86 mm 1 × 6.1819.020 FEP tube, *L* = 250 cm 4 × 6.1820.020 Screw connector 1 × 6.1828.020 Tubing connection to container 1 × 6.1829.020 FEP aspiration tubing, *L* = 500 cm
1	6.2141.230	**Remote cable Compact Sample Changer/Compact Autosampler - Titrino plus/Pump Station (standard)**
1	6.2141.180	**Connecting cable 797–863–731 (alternative)** Cable 797 VA Computrace - 838 Advanced VA Sample Processor - 731 Relay Box
1	6.9921.221	**Adapter cable 863 - 6.2141.180 (alternative)**

4.3.7 Automation for electroplating bath analysis

It is recommended to use the 838 Advanced Sample Processor for automated electroplating bath analysis. For automated addition of auxiliary solutions, see *section 4.3.5*.

Option 838 Advanced Sample Processor:

Quant.	Order No.	Description
1	2.838.0310	**838 Advanced Sample Processor for VA** Instrument with accessories
1	2.843.0040	**843 VA Membrane Pump Station (standard)**
1	2.731.0010	**731 Relay Box (with 772, alternative to 843)** Control unit for the two 772 Pump Units
2	2.823.0010	**823 Membrane Pump Units (with 731, alternative to 843)** Pumps to rinse the measuring vessel at the 797
3	6.1805.530	**FEP tubing** L = 200 cm
1	6.1819.010	**PTFE tube** L = 86 mm

Quant.	*Order No.*	*Description*
1	**6.2141.290**	**Connection cable 843 Pump Station - 838 Advanced Sample Processor (standard)**
1	**6.2141.180**	**Cable 797-838-731 (alternative)** Connection cable for 731 Relay Box and 838 Advanced Sample Processor to the 797 VA Computrace
2	**6.2160.010**	**Adapter cable (alternative)** Connection cable for 823 Membrane Pump Units to the 731 Relay Box
1	**6.5323.010**	**Rinsing equipment for 797 VA Computrace** incl. the following accessories: 1 × 6.1446.040 Dummy stopper M6 1 × 6.1456.210 Measuring vessel for sample changer operation 2 × 6.1602.105 Siphon GL45 2 × 6.1618.050 Thread adapter 40 mm/GL45 2 × 6.1621.000 PE container, *V* = 10 L 1 × 6.1805.020 FEP tubing, *L* = 52 cm 1 × 6.1805.100 FEP tubing, *L* = 40 cm 1 × 6.1805.180 FEP tubing, *L* = 16 cm 4 × 6.1805.530 FEP tubing, *L* = 200 cm 1 × 6.1808.000 Coupling bush, with 2 threads M6 2 × 6.1819.010 PTFE tube, *L* = 86 mm 1 × 6.1819.020 FEP tube, *L* = 250 cm 4 × 6.1820.020 Screw connector 1 × 6.1828.020 Tubing connection to container 1 × 6.1829.020 FEP aspiration tubing, *L* = 500 cm

4.4 Validation / GLP

GLP (**G**ood **L**aboratory **P**ractice) requires, among other things, that the precision and correctness of analytical instruments is checked at regular intervals by using SOPs (**S**tandard **O**perating **P**rocedures, **SOP**).

In the 797 VA Computrace **Software**, a **GLP Wizard** is integrated. If this function is activated, the GLP Wizard monitors your system, reminds you of due verifications, leads you through verifications and creates your GLP-report.

An example of such a standard operating procedure is available from Metrohm under the title **«Application Bulletin No. 276 – Validation of Metrohm VA instruments using Standard Operating Procedures(SOP)»**. This SOP can be adapted for your VA system and used for its validation.

The 797 VA Computrace Stand must be included as a part of the whole voltammetry system, whose most important components include control- and evaluation software, PC, possible Sample changer and Dosing devices, in the all-embracing validation of the whole system.

Please contact your local Metrohm agency in order to receive support in validating your 797 VA Computrace Stand. It can also provide you with validation documentation which will help you to carry out your installation qualification (IQ) and operational qualification (OQ).

Further information about QA, GLP and validation can also be found in the brochure «**Quality management with Metrohm**» which is also obtainable from your local Metrohm agency.

Checking the electronic and mechanical assemblies of Metrohm instruments can and should be undertaken within the framework of regular servicing by Metrohm technicians. All Metrohm instruments are equipped with start-up check routines, which check that the relevant assemblies are functioning perfectly when the instrument is switched on. If no error message appears it can be assumed that the instrument is functioning properly.

The 797 VA Computrace Stand also contains a built-in diagnosis program which allows the service technicians to check the functioning of particular assemblies should faults or malfunctions occur and to localize them.

4.5 Warranty and certificates

4.5.1 Warranty

The warranty on our products is limited to defects that are traceable to material, construction or manufacturing error, which occur within 12 months from the day of delivery. In this case, the defects will be rectified in our workshops free of charge. Transport costs are to be paid by the customer.

For day and night operation, the warranty is limited to 6 months.

Glass breakage in the case of electrodes or other parts is not covered by the warranty. Checks, which are not a result of material or manufacturing faults, are also charged during the warranty period. For parts of outside manufacture insofar as these constitute an appreciable part of our instrument, the warranty stipulations of the manufacturer in question apply.

With the regard to the guarantee of accuracy, the technical specifications in the instruction manual are authoritative.

Concerning defects in material, construction or design as well as the absence of guaranteed features, the orderer has no rights or claims except those mentioned above.

If damage of the packaging is evident on receipt of a consignment or if the goods show signs of transport damage after unpacking, the carrier must be informed immediately and a written damage report demanded. lack of an official damage report releases Metrohm from any liability to pay compensation.

If any instruments and parts have to be returned, the original packaging should be used if at all possible. This applies above all to instruments, electrodes, burette cylinders and PTFE pistons. Before embedment in wood shavings or similar material, the parts must be packed in a dust-proof package (for instruments, use of a plastic bag is imperative). If open assemblies are enclosed in the scope of delivery that are sensitive to electromagnetic voltages (e.g. data interfaces etc.) these must be returned in the associated original protective packaging (e.g. conductive protective bag). (Exception: assemblies with built-in voltage source belong in a non-conductive protective packaging). For damage that arises as a result of non-compliance with these instructions, no warranty responsibility whatsoever will be accepted by Metrohm.

4.5.2 Declaration of Conformity

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

Metrohm
Ion analysis
CH-9101 Herisau, Switzerland
Tel. +41 71 353 85 85
Fax +41 71 353 89 01
www.metrohm.com

Name of commodity	**797 VA Computrace**
Name of manufacturer	Metrohm Ltd., Herisau, Switzerland

Description PC-controlled system for polarographic and voltammetric trace analysis of organic and inorganic substances.

This instrument has been built and has undergone final type testing according to the standards:

Electromagnetic compatibility: Emission
EN/IEC 61326, EN 55022 / CISPR 22

Electromagnetic compatibility: Immunity
EN/IEC 61326, EN/IEC 61000-4-2, EN/IEC 61000-4-3, EN/IEC 61000-4-4, EN/IEC 61000-4-5, EN/IEC 61000-4-6, EN/IEC 61000-4-8, EN/IEC 61000-4-11, EN/IEC 61000-4-14, Namur

Safety specifications
EN/IEC/UL 61010-1, EN/IEC 61010-2-081, CSA-C22.2 No. 61010-1

It has also been certified by ElectroSuisse, which is member of the International Certification Body (CB/IEC).

CE *The instrument meets the requirements of the CE mark as contained in the EU directives 89/336/EEC and 73/23/EEC and fulfils the following specifications:*

EN 61326 Electrical equipment for measurement, control and laboratory use – EMC requirements

EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use

Metrohm Ltd. is holder of the SQS-certificate of the quality system ISO 9001 for quality assurance in design/development, production, installation and servicing.

The system software, stored in Read Only Memories (ROMs) has been validated in connection with standard operating procedures in respect to functionality and performance.

The technical specifications are documented in the instruction manual.

Herisau, June 20, 2007

D. Strohm Vice President Head of R&D	Ch. Buchmann Vice President Head of Production Responsible for Quality Assurance

4.5.3 Quality Management Principles

Metrohm Ltd., CH-9101 Herisau, Switzerland

Metrohm
Ion analysis
CH-9101 Herisau/Switzerland
E-Mail info@metrohm.com
Internet www.metrohm.com

Metrohm Ltd. holds the ISO 9001 Certificate, registration number 10872-02, issued by SQS (Swiss Association for Quality and Management Systems). Internal and external audits are carried out periodically to assure that the standards defined by Metrohm's QM Manual are maintained.

The steps involved in the design, manufacture and servicing of instruments are fully documented and the resulting reports are archived for ten years. The development of software for PCs and instruments is also duly documented and the documents and source codes are archived. Both remain the possession of Metrohm. A non-disclosure agreement may be asked to be provided by those requiring access to them.

The implementation of the ISO 9001 quality system is described in Metrohm's QM Manual, which comprises detailed instructions on the following fields of activity:

Instrument development

The organisation of the instrument design, its planning and the intermediate controls are fully documented and traceable. Laboratory testing accompanies all phases of instrument development.

Software development

Software development occurs in terms of the software life cycle. Tests are performed to detect programming errors and to assess the program's functionality in a laboratory environment.

Components

All components used in the Metrohm instruments have to satisfy the quality standards that are defined and implemented for our products. Suppliers of components are audited by Metrohm as the need arises.

Manufacture

The measures put into practice in the production of our instruments guarantee a constant quality standard. Production planning and manufacturing procedures, maintenance of production means and testing of components, intermediate and finished products are prescribed.

Customer support and service

Customer support involves all phases of instrument acquisition and use by the customer, i.e. consulting to define the adequate equipment for the analytical problem at hand, delivery of the equipment, user manuals, training, after-sales service and processing of customer complaints. The Metrohm service organisation is equipped to support customers in implementing standards such as GLP, GMP, ISO 900X, in performing Operational Qualification and Performance Verification of the system components or in carrying out the System Validation for the quantitative determination of a substance in a given matrix.

4.6 Index