

899 Coulometer



Manual – Short Instructions

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Manual – Short Instructions

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Documentation in additional languages can be found on
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Table of contents

| | | |
|----------|---|-----------|
| 1 | About these short instructions | 1 |
| 2 | Introduction | 2 |
| 2.1 | Instrument description | 2 |
| 2.1.1 | Connectors | 2 |
| 2.1.2 | Intended use | 3 |
| 2.2 | About the documentation | 3 |
| 2.2.1 | Symbols and conventions | 3 |
| 2.3 | Safety instructions | 4 |
| 2.3.1 | General notes on safety | 4 |
| 2.3.2 | Electrical safety | 4 |
| 2.3.3 | Tubing and capillary connections | 5 |
| 2.3.4 | Flammable solvents and chemicals | 6 |
| 2.3.5 | Recycling and disposal | 6 |
| 3 | Overview of the instrument | 7 |
| 3.1 | Front | 7 |
| 3.2 | Rear | 8 |
| 4 | Installation | 9 |
| 4.1 | Setting up the instrument | 9 |
| 4.1.1 | Packaging | 9 |
| 4.1.2 | Checks | 9 |
| 4.1.3 | Location | 9 |
| 4.2 | Setting up the titration cell for coulometry | 10 |
| 4.2.1 | Inserting the titration cell | 10 |
| 4.2.2 | Preparing the titration cell | 10 |
| 4.2.3 | Mounting the addition and aspiration tube (utilization with Ti Stand) | 14 |
| 4.2.4 | Using the titration cell with a Karl Fischer oven | 15 |
| 4.2.5 | Using the titration cell with a sample changer | 15 |
| 4.3 | Connecting the coulometer to the power supply | 15 |
| 4.3.1 | Connecting the power supply unit | 15 |
| 4.3.2 | Connecting the Power Box | 16 |
| 4.4 | Connecting sensors | 18 |
| 4.4.1 | Connecting a generator electrode | 18 |
| 4.4.2 | Connecting an indicator electrode | 19 |
| 4.4.3 | Connecting a temperature sensor | 21 |
| 4.5 | Connecting an additional stirrer | 22 |
| 4.6 | Connecting a balance | 23 |



| | | |
|----------|---|-----------|
| 4.7 | Connecting a keyboard, printer and other USB devices | 25 |
| 4.8 | Connecting a sample changer to the remote connector | 28 |
| 5 | Operation | 29 |
| 5.1 | Switching the instrument on and off | 29 |
| 5.2 | Fundamentals of operation | 30 |
| 5.2.1 | The keypad | 30 |
| 5.2.2 | Structure of the dialog windows | 30 |
| 5.2.3 | Navigating in the dialog | 31 |
| 5.2.4 | Entering text and numbers | 31 |
| 5.2.5 | Selecting from a selection list | 32 |
| 5.3 | Formula editor | 33 |
| 5.4 | Methods | 34 |
| 5.4.1 | Method templates | 34 |
| 5.4.2 | Loading a method template | 34 |
| 5.4.3 | Saving a method | 35 |
| 5.4.4 | Exporting a method | 36 |
| 5.5 | Control | 37 |
| 5.6 | Sample data | 38 |
| 5.6.1 | Entering sample data in the main dialog | 38 |
| 5.6.2 | Requesting sample data at the start of the determination | 39 |
| 5.7 | Sample table | 40 |
| 5.7.1 | General | 40 |
| 5.7.2 | Editing the sample data | 42 |
| 5.7.3 | Sending the sample size from a balance | 43 |
| 5.8 | Carrying out a determination | 44 |
| 5.9 | Live modifications | 47 |
| 5.9.1 | Editing the sample data of the running determination | 47 |
| 5.9.2 | Editing the sample table while a determination is running | 48 |
| 5.9.3 | Editing the live parameters | 49 |
| 5.10 | Results | 50 |
| 5.11 | Statistics | 51 |
| 5.12 | Printing a report manually | 53 |
| 5.13 | Manual control | 54 |
| 5.13.1 | Stirring | 54 |
| | Index | 56 |



1 About these short instructions

The present short instructions contain important chapters from the more detailed manual. In addition to an introduction, safety instructions and an overview of the instruments, you will also find information about the installation and operation of the 899 Coulometer in addition to information regarding the warranty. You will find the detailed manual as a PDF file at <http://products.metrohm.com> under **Literature/Technical documentation**.



2 Introduction

2.1 Instrument description

The 899 Coulometer is a titrator used for coulometric water content determination according to Karl Fischer. There are method templates available which are already configured except for a few parameters. The methods can be modified and stored under a new name. The methods can be exported to a connected USB flash drive. This function makes it possible for you to copy methods quickly and easily from one instrument to another.

The 899 Coulometer has an integrated magnetic stirrer that is visible on the top side of the housing. The titration cell (coulometry) can easily be attached to the magnetic stirrer. Thanks to its compact construction, you can use the instrument in a small space as a stand-alone titrator. Furthermore, the remote interface permits you to connect a sample changer with oven module and to perform automated determinations.

As an alternative to the power supply with the power supply unit provided, the 899 Coulometer can also be operated by means of an accumulator (a so-called Power Box). The Power Box is available as optional equipment. It is particularly appropriate for use in environments where the power supply is either unstable or absent.

2.1.1 Connectors

The instrument is equipped with the following connectors:

- **Electrical connection**
For connecting to the power supply with the aid of the power supply unit provided or for connecting to the 6.2164.500 Power Box.
- **MSB connector (Metrohm Serial Bus)**
For connecting an additional stirrer.
- **USB (OTG) connector**
The 6.2151.100 adapter can be used to connect, for example, a printer, a USB flash drive or a USB keyboard.
- **Sensor connectors**
Three connectors for the following sensor types:
 - Double Pt electrode
 - Generator electrode
 - Temperature sensor (Pt1000)
- **Grounding socket**
For grounding the coulometer.

- **Remote connector**

For connecting instruments with a remote interface (e.g. *885 Compact Oven SC*).

2.1.2 Intended use

The 899 Coulometer is designed for usage as a titrator in analytical laboratories. Its application field is coulometric water content determination according to Karl Fischer.

The present instrument is suitable for processing chemicals and flammable samples. Usage of the 899 Coulometer therefore requires the user to have basic knowledge and experience in handling toxic and caustic substances. Knowledge with respect to the application of the fire prevention measures prescribed for laboratories is also mandatory.

2.2 About the documentation




CAUTION

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

2.2.1 Symbols and conventions

The following symbols and formatting may appear in this documentation:

| | |
|---|---|
| (5-12) | Cross-reference to figure legend The first number refers to the figure number, the second to the instrument part in the figure. |
| 1 | Instruction step Carry out these steps in the sequence shown. |
| Method | Dialog text, parameter in the software |
| File ▶ New | Menu or menu item |
| [Next] | Button or key |
|  | WARNING This symbol draws attention to a possible life-threatening hazard or risk of injury. |

**WARNING**

This symbol draws attention to a possible hazard due to electrical current.

**WARNING**

This symbol draws attention to a possible hazard due to heat or hot instrument parts.

**WARNING**

This symbol draws attention to a possible biological hazard.

**CAUTION**

This symbol draws attention to possible damage to instruments or instrument parts.

**NOTE**

This symbol highlights additional information and tips.

2.3 Safety instructions

2.3.1 General notes on safety

**WARNING**

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

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

2.3.2 Electrical safety

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

**WARNING**

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

**WARNING**

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

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

Mains voltage**WARNING**

An incorrect mains voltage can damage the instrument.

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

Protection against electrostatic charges**WARNING**

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

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

2.3.3 Tubing and capillary connections**CAUTION**

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

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



2.3.4 Flammable solvents and chemicals

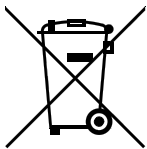


WARNING

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

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

2.3.5 Recycling and disposal



This product is covered by European Directive 2002/96/EC, WEEE – Waste from Electrical and Electronic Equipment.

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

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

3 Overview of the instrument

3.1 Front

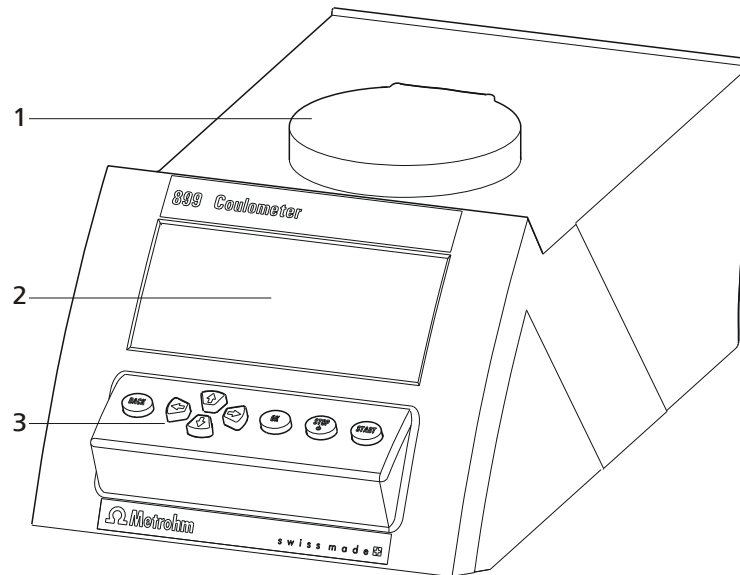


Figure 1 Front 899 Coulometer

1 Magnetic stirrer
For attaching the titration vessel holder.

2 Display

3 Keypad



3.2 Rear

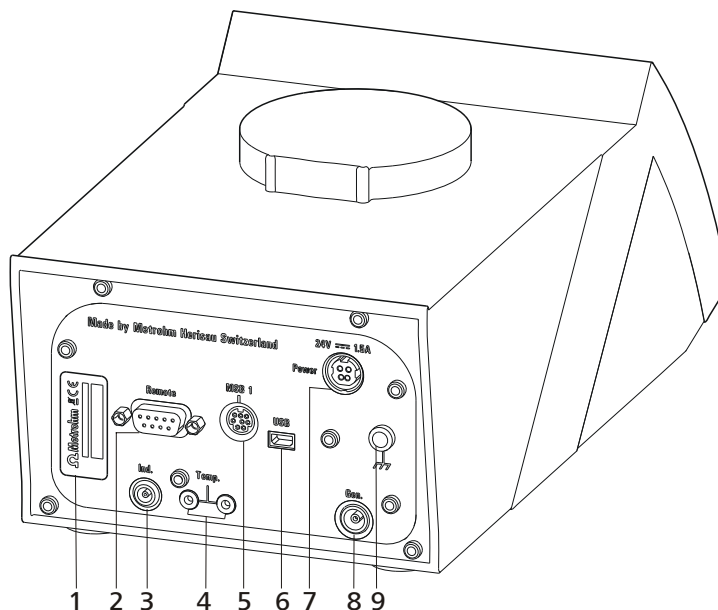


Figure 2 Rear 899 Coulometer

1 Type plate

Contains the serial number.

3 Electrode connector (Ind.)

For connecting a metal electrode (double Pt wire electrode). Socket F.

5 MSB connector (MSB 1)

Metrohm Serial Bus. For connecting an external stirrer. Mini DIN, 8-pin.

7 Mains connection socket (Power)

For connecting the external power supply unit or a Power Box (6.2164.500).

9 Grounding socket

For grounding the Coulometer. Socket B, 4 mm.

2 Remote connector

For connecting instruments with a remote interface. D-Sub, 9-pin.

4 Temperature sensor connector (Temp.)

For connecting a temperature sensor of the type Pt1000. Two B sockets, 2 mm.

6 USB (OTG) connector

For connecting printers, USB flash drives, USB hubs, etc.

8 Electrode connector (Gen.)

For connecting a generator electrode.

4 Installation

4.1 Setting up the instrument

4.1.1 Packaging

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

4.1.2 Checks

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

4.1.3 Location

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

Place the instrument in a location of the laboratory which is suitable for operation, free of vibrations, protected from corrosive atmosphere, and contamination by chemicals.

The instrument should be protected against excessive temperature fluctuations and direct sunlight.



4.2 Setting up the titration cell for coulometry

4.2.1 Inserting the titration cell

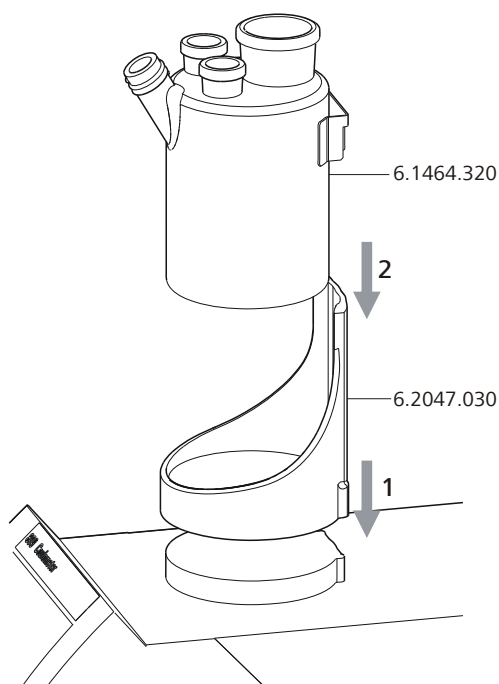


Figure 3 Inserting the titration cell (coulometry)

Set up the titration cell on the magnetic stirrer as follows:

- 1 Attach the 6.2047.030 titration vessel holder to the magnetic stirrer.
- 2 Insert the 6.1464.320 titration cell into the titration vessel holder.

4.2.2 Preparing the titration cell

Filling the adsorber tube

Before setting up the titration cell, the 6.1403.030 adsorber tube has to be filled with 6.2811.000 molecular sieve. Proceed as follows:

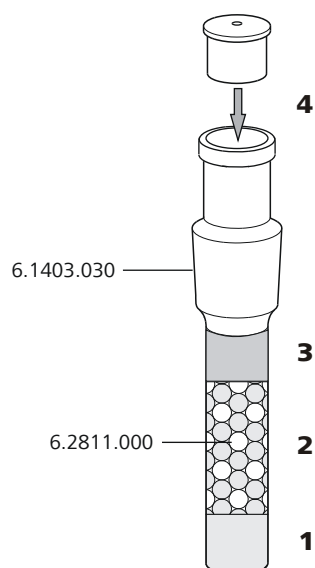


Figure 4 Filling the adsorber tube

- 1** Insert a small cotton plug into the bottom of the adsorber tube. Do not pack the cotton too tightly.
- 2** Fill the molecular sieve up to $\frac{3}{4}$ of the height.
- 3** Place a small cotton plug on the molecular sieve. Do not pack the cotton too tightly.
- 4** Seal the adsorber tube with the appropriate cover.



NOTE

Note that the molecular sieve must be replaced at regular intervals. Each time you refill the adsorber tube with molecular sieve, you can, for example, write the date directly on the adsorber tube.



Equipping the titration cell

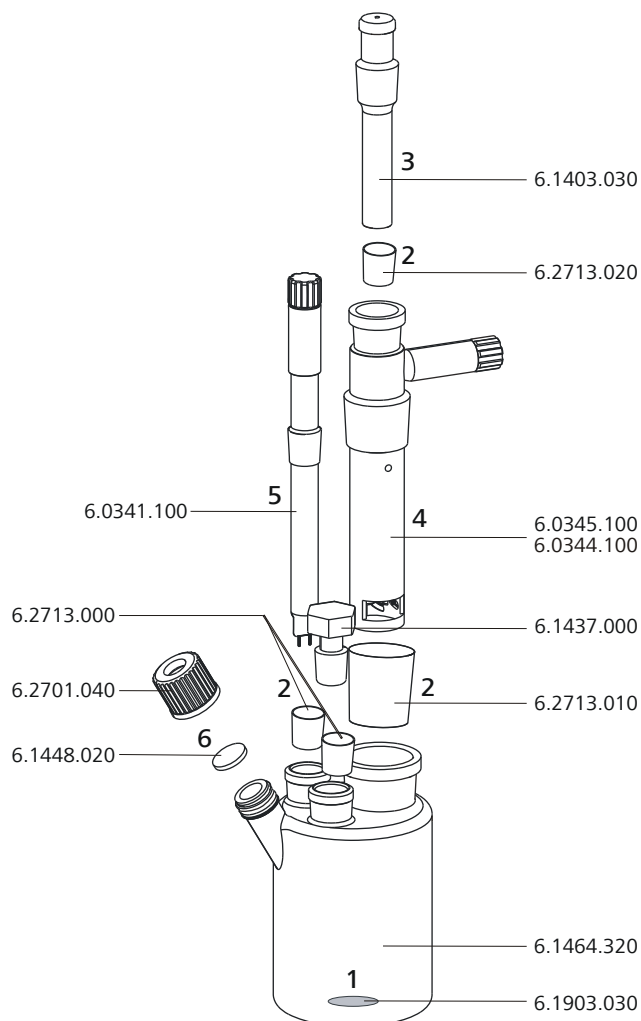


Figure 5 Equipping the titration cell (coulometry)

Equip the titration cell as follows:

- 1** Place the 6.1903.030 stirring bar in the titration cell.
- 2** Cut the 6.2713.0x0 ground-joint sleeves to the correct length and attach them to the ground joints of the inserts (electrodes, adsorber tube, etc.).

Make sure that the edges of the ground-joint sleeves are cut to size cleanly and that there are no fringes. The ground-joint sleeves must not protrude at the lower edge of the ground-joint opening.
- 3** Insert the 6.1403.030 adsorber tube into the generator electrode.

- 4 Insert the 6.0345.100 generator electrode without diaphragm or the 6.0344.100 generator electrode with diaphragm together with the adsorber tube into the large ground-joint opening at the rear.
- 5 Insert the 6.0341.100 indicator electrode into the left ground-joint opening.
- 6 Place the 6.1448.020 septum on the front opening of the titration cell and screw it shut with the 6.2701.040 screw cap.
Tighten the screw cap only enough so that it seals. The septum is not permitted to bend.

Filling the titration cell (generator electrode with diaphragm)

Proceed as follows when using a generator electrode with a diaphragm:

- 1 Fill approximately 5 mL of catholyte into the generator electrode.
- 2 Fill approximately 100 mL of anolyte into the titration cell with the aid of the 6.2738.000 funnel. The level of the anolyte should be roughly 1 - 2 mm above the level of the catholyte.
- 3 Close the remaining ground-joint opening on the right with the 6.1437.000 ground-joint stopper (with ground-joint sleeve attached).

Filling the titration cell (generator electrode without diaphragm)

Proceed as follows when using a generator electrode without a diaphragm:

- 1 Fill approximately 100 mL of reagent into the titration cell with the aid of the 6.2738.000 funnel.
- 2 Close the remaining ground-joint opening on the right with the 6.1437.000 ground-joint stopper (with ground-joint sleeve attached).



4.2.3 Mounting the addition and aspiration tube (utilization with Ti Stand)

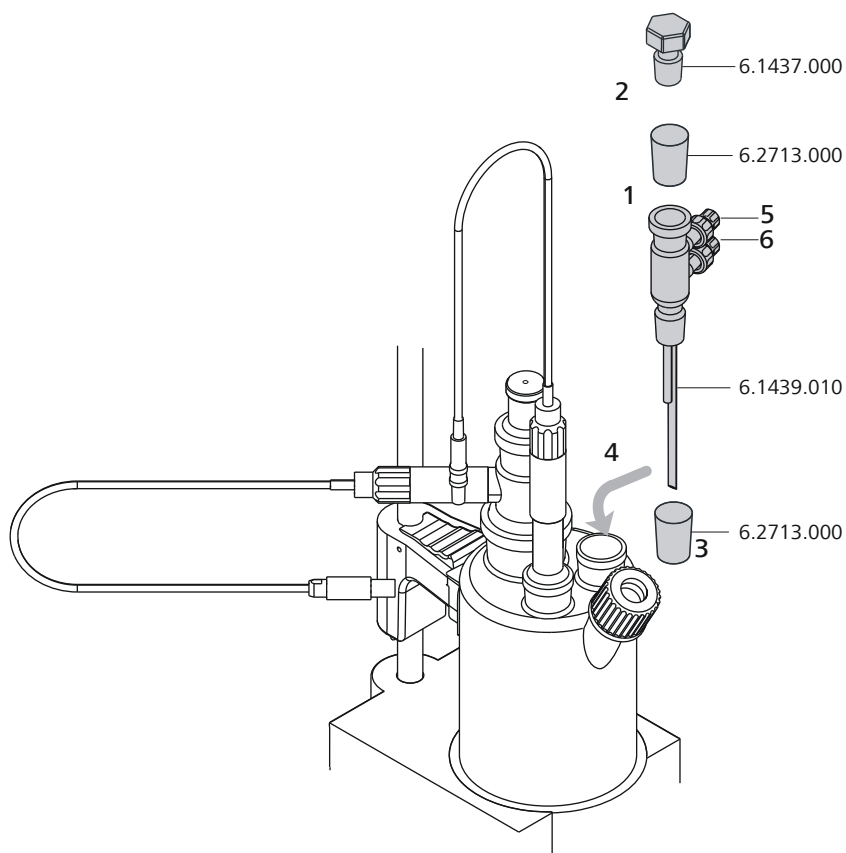


Figure 6 Mounting the addition and aspiration tube

Insert the addition and aspiration tube as follows into the titration cell:

- 1** Attach the 6.2713.000 ground-joint sleeve that has been cut to size to the ground joint of the 6.1437.000 stopper.
- 2** Insert the stopper into the 6.1439.010 addition and aspiration tube.
- 3** Attach the 6.2713.000 ground-joint sleeve that has been cut to size to the ground joint of the addition and aspiration tube.
- 4** Insert this assembly into the ground-joint opening.
- 5** Connect the tubing for the reagent addition at the upper connector of the addition and aspiration tube (5).

- 6** Connect the tubing for the aspiration of the titration cell at the lower connector of the addition and aspiration tube (6).

Details regarding how to connect the addition tubing and the aspiration tubing can be found in the manual for the *803 Ti Stand*.

4.2.4 Using the titration cell with a Karl Fischer oven

When samples release their water only slowly or only at higher temperatures, the oven method is used. The sample is heated in a KF oven (e.g. *860 KF Thermoprep*) and the water that is released is transferred to the titration cell with a carrier gas. You will find recommended parameter settings for determinations with a Karl Fischer oven in the appendix of the more detailed manual.

A detailed description of how to set up the titration cell with the KF oven can be found in the respective manual.

4.2.5 Using the titration cell with a sample changer

If a large number of samples have to be processed, the determination of the water content can be automated with the aid of a sample changer with oven module (e.g. *885 Compact Oven SC*). You will find recommended parameter settings for determinations with a Karl Fischer oven in the appendix of the more detailed manual.

A detailed description of how to set up the titration cell with the sample changer can be found in the respective manual.

4.3 Connecting the coulometer to the power supply

You can supply the 899 Coulometer with electricity in two different ways:

- Connect the coulometer directly to the power supply with the aid of the power supply unit provided.
- Connect the coulometer to the 6.2164.500 Power Box if no stable power supply is available.

4.3.1 Connecting the power supply unit

The 899 Coulometer has an external power supply unit for a 24 V power supply (DC). This is connected to the power socket of the coulometer.



WARNING

An incorrect supply voltage can damage the instrument.

Operate the instrument only with the supply voltage specified for it. Use the supplied power supply unit exclusively.

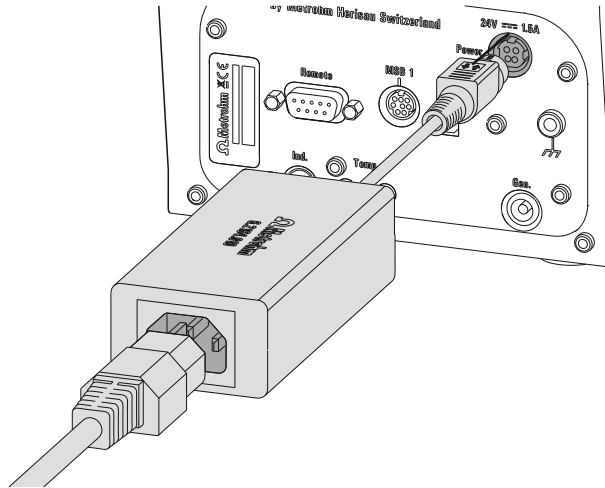


Figure 7 Connecting the power supply unit

Proceed as follows:

- 1 Connect the plug of the external power supply unit with the power socket (2-7) of the coulometer.



NOTE

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

- 2 Connect the power supply cable with the external power supply unit of the coulometer and with the power supply.



CAUTION

Switch off the 899 Coulometer correctly by pressing the red **[STOP]** key before you interrupt the electricity supply. If this is not done, then there is a danger of data loss.

4.3.2 Connecting the Power Box

As an alternative to the power from the power supply, it is possible to provide the 899 Coulometer with electricity through the 6.2164.500 Power Box. This means that you can also use the instrument in environments in which no stable power supply is available. Details regarding the Power Box can be found in the respective manual.

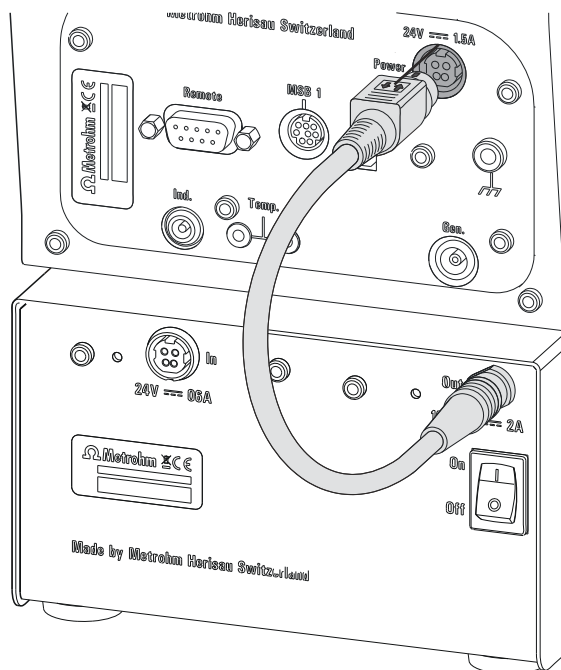


Figure 8 Connecting the Power Box

Proceed as follows:

- 1 Connect the plug of the Power Box with the power socket (2-7) of the coulometer.



NOTE

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



CAUTION

Switch off the 899 Coulometer correctly by pressing the red **[STOP]** key before you interrupt the connection with the Power Box. If this is not done, then there is a danger of data loss.



4.4 Connecting sensors

The measuring interface contains the following measuring inputs:

- **Gen.** for a generator electrode
- **Ind.** for a double Pt electrode
- **Temp.** for a temperature sensor of the Pt1000 type



CAUTION

Under all circumstances, avoid mixing up the electrode cable from the indicator electrode with the one from the generator electrode. Mark the screw heads of the cables accordingly.

4.4.1 Connecting a generator electrode

Screwing the electrode cable to the generator electrode

- 1 Unscrew the cover of the generator electrode.

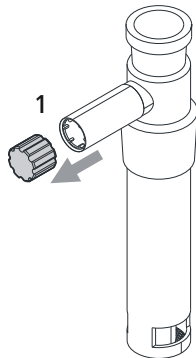


Figure 9 Unscrewing the cover from the generator electrode

- 2 Tighten the 6.2104.120 electrode cable to the generator electrode.

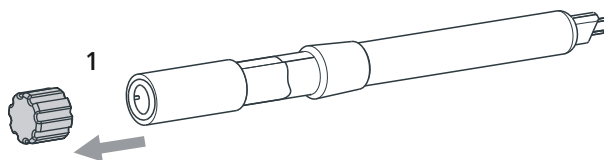


Figure 12 Unscrewing the cover from the indicator electrode

- 2 Tighten the 6.2104.020 electrode cable to the indicator electrode.

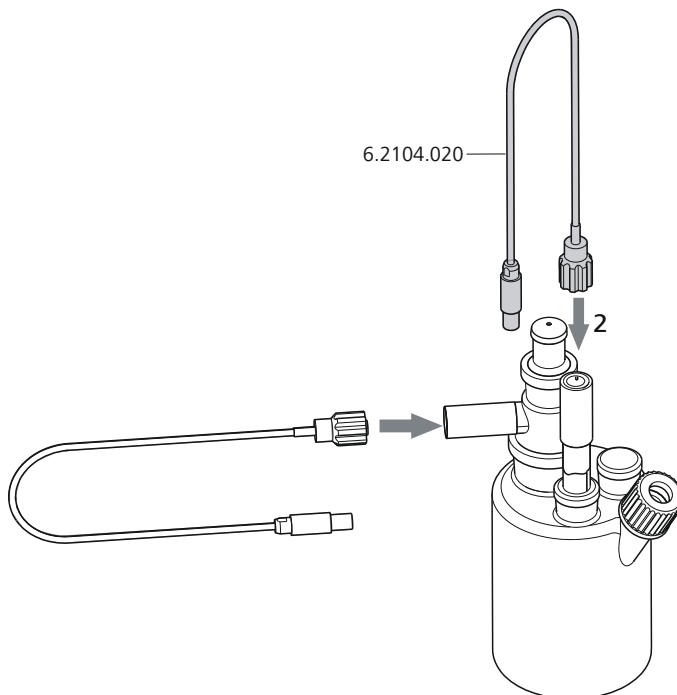


Figure 13 Screwing the electrode cable to the indicator electrode

Connecting the electrode cable to the coulometer

- 1 Plug the electrode plug into the **Ind.** socket of the coulometer.

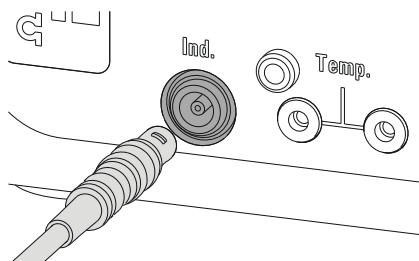


Figure 14 Connecting an indicator electrode

**NOTE**

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

4.4.3 Connecting a temperature sensor

A temperature sensor of the Pt1000 type can be connected to the **Temp.** connector.

Connect the temperature sensor as follows:

- 1 Insert the plugs of the temperature sensor into the **Temp.** sockets of the coulometer.

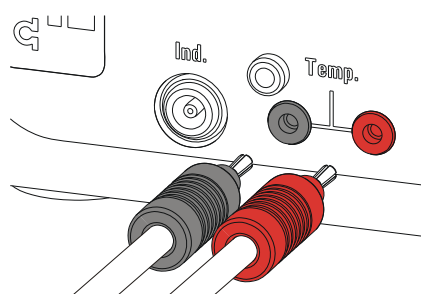


Figure 15 Connecting a temperature sensor

**NOTE**

Always insert the red plug into the red socket. This is the only way that shielding against electrical interference can be ensured.



4.5 Connecting an additional stirrer

Instead of the built-in magnetic stirrer, you can use the magnetic stirrers *801 Stirrer* or *803 Ti Stand*.

Proceed as follows:

- 1 Switch off the coulometer.
- 2 Connect the connection cable of the magnetic stirrer to MSB 1 on the rear of the coulometer.

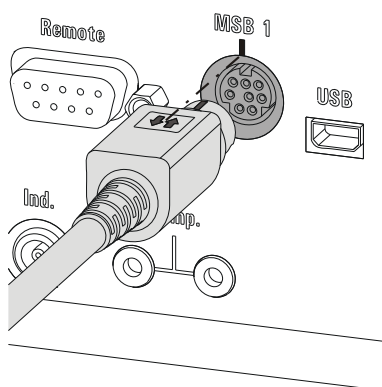


Figure 16 Connecting a stirrer



NOTE

Make sure that the flat side of the plug matches the marking on the socket.

- 3 Switch on the coulometer.

4.6 Connecting a balance

As a rule, balances are equipped with a serial RS-232 interface. To connect a balance, you require a 6.2148.030 RS-232/USB Box.

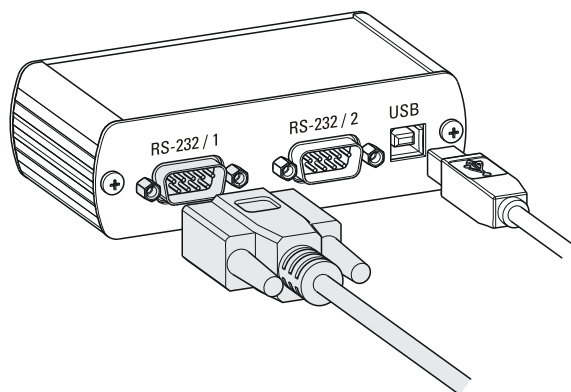


Figure 17 Connecting the balance via RS-232/USB Box

Proceed as follows:

- 1 Connect the RS-232/USB Box with a 6.2151.020 connecting cable (USB A - USB B) on the USB (OTG) connector of the coulometer.
You can connect the RS-232/USB Box to the coulometer either via a USB hub or using a 6.2151.100 USB MINI (OTG) - USB A adapter (see Chapter 4.7, page 25).
- 2 Connect the 9-pin plug of the respective balance connecting cable to the **RS-232/1** connector. Consult the following list or contact the balance manufacturer in order to find the correct balance connecting cable.



NOTE

The parameters for the RS-232 interfaces on the 899 Coulometer must match those on the balance. Check the detailed manual for the 899 Coulometer in addition to the manual for the balance.

The following table offers an overview of the balances that you can use together with the 899 Coulometer and of which cable you will need for connection to the RS-232 interface:



| Balance | Cable |
|--|--|
| AND ER, FR, FX with RS-232 interface (OP-03) | 6.2125.020 + 6.2125.010 |
| Mettler AB, AG, PR (LC-RS9) | In the scope of delivery for the balance |
| Mettler AM, PM, PE with interface option 016 or Mettler AJ, PJ with interface option 018 | 6.2146.020 + 6.2125.010 Also from Mettler: ME 47473 adapter and either ME 42500 hand switch or ME 46278 foot switch |
| Mettler AT | 6.2146.020 + 6.2125.010 Also from Mettler: ME 42500 hand switch or ME 46278 foot switch |
| Mettler AX, MX, UMX, PG, AB-S, PB-S, XP, XS | 6.2134.120 |
| Mettler AE with interface option 011 or 012 | 6.2125.020 + 6.2125.010 Also from Mettler: ME 42500 hand switch or ME 46278 foot switch |
| Ohaus Voyager, Explorer, Analytical Plus | Cable AS017-09 from Ohaus |
| Precisa balances with RS-232-C interface | 6.2125.080 + 6.2125.010 |
| Sartorius MP8, MC, LA, Genius, Cubis | 6.2134.060 |
| Shimadzu BX, BW | 6.2125.080 + 6.2125.010 |

4.7 Connecting a keyboard, printer and other USB devices

The 899 Coulometer has a USB (OTG) connector. Use the 6.2151.100 USB MINI (OTG) - USB A adapter supplied for connecting USB devices.

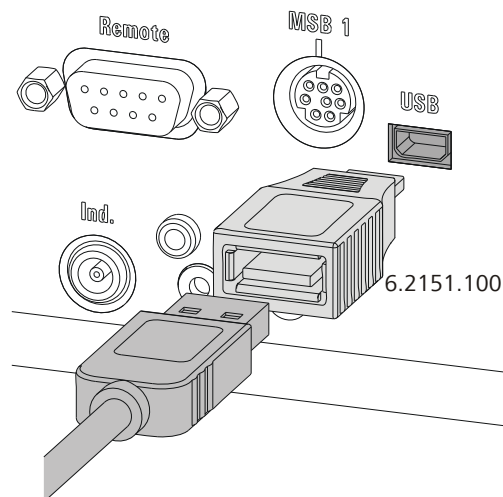


Figure 18 Connecting USB devices



CAUTION

Switch the instrument off before connecting or disconnecting a USB device or a USB flash drive.

The 899 Coulometer can recognize the USB device only immediately after switching on.



NOTE

Many USB devices need a so-called USB hub in order to work correctly. A USB hub is a distributor to which several USB devices can be connected. USB hubs are available in specialty stores in a number of different models.

The 6.2147.000 numerical USB keypad can, in addition to its function as keyboard, also be used as a USB hub. It has two USB connectors. You cannot however use these two USB connectors to connect any PC keyboards, barcode readers or additional keypads with numerical keypads. These devices are recognized as input devices (like the numerical USB keypad) and they cannot be switched in series.



The following list provides you with an overview of the various USB devices and how you can connect them to the Coulometer.

| USB device | Connection options |
|--|---|
| USB flash drives (for the backup or storing of methods) | <ul style="list-style-type: none"> ■ With 6.2151.100 adapter USB MINI (OTG) - USB A ■ With USB hub ■ With 6.2147.000 numerical USB keypad |
| 6.2147.000 numerical USB keypad (for comfortable numerical input and for navigating in the dialog) | <ul style="list-style-type: none"> ■ With 6.2151.100 adapter USB MINI (OTG) - USB A ■ With USB hub |
| 6.2148.030 RS-232/USB Box (for connecting a balance, a PC or to the RS-232 remote control) | <ul style="list-style-type: none"> ■ With 6.2151.100 adapter USB MINI (OTG) - USB A ■ With USB hub ■ With 6.2147.000 numerical USB keypad |
| USB hub (with or without an own power supply) | <ul style="list-style-type: none"> ■ With 6.2151.100 adapter USB MINI (OTG) - USB A |
| "Custom Neo's" printer with 6.2151.120 cable | <ul style="list-style-type: none"> ■ Directly on the USB (OTG) connector of the 899 Coulometer |
| "Custom Neo's" printer with 6.2151.020 cable | <ul style="list-style-type: none"> ■ With 6.2151.100 adapter USB MINI (OTG) - USB A ■ With USB hub ■ With 6.2147.000 numerical USB keypad |
| USB printer with 6.2151.020 connecting cable | <p>Depending on the model of the printer:</p> <ul style="list-style-type: none"> ■ With 6.2151.100 adapter USB MINI (OTG) - USB A <p>or</p> <ul style="list-style-type: none"> ■ With USB hub ■ With 6.2147.000 numerical USB keypad |
| PC mouse with USB cable (for navigating in the dialog) | <ul style="list-style-type: none"> ■ With USB hub ■ With 6.2147.000 numerical USB keypad |

| USB device | Connection options |
|---|--|
| PC keyboard with USB cable (for the comfortable input of letters and numbers) | <ul style="list-style-type: none"> With USB hub |
| Barcode reader with USB cable | <ul style="list-style-type: none"> With USB hub |
| Keypad with numerical keypad with USB cable | <ul style="list-style-type: none"> With USB hub |

If you wish to connect **several different instruments that do not have their own power supply**, then it is possible you will need to use a USB hub that does have its own power supply (*self powered*). The USB (OTG) connector of the 899 Coulometer is not designed for supplying power to several devices with elevated electricity requirements.

Also observe the instructions in the Appendix of the more detailed manual.

Examples:

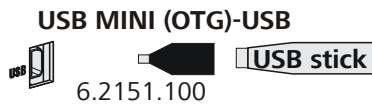


Figure 19 Connecting the USB flash drive

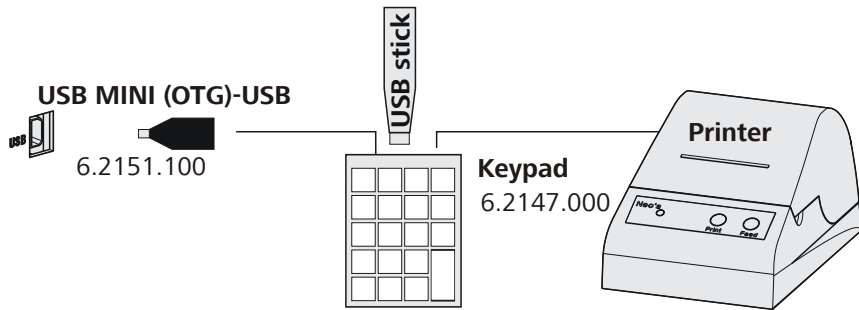


Figure 20 Connecting the 6.2147.000 USB keyboard with USB flash drive and printer

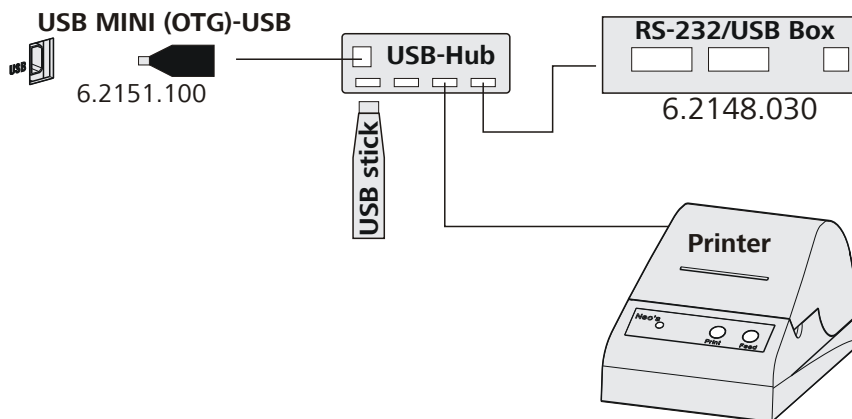


Figure 21 Connecting the USB hub with USB flash drive, printer and 6.2148.030 RS-232/USB Box

4.8 Connecting a sample changer to the remote connector

The 899 Coulometer can be connected to a sample changer with oven module with the aid of the 6.2141.390 remote cable. This makes it possible to integrate the Coulometer in an automation system.

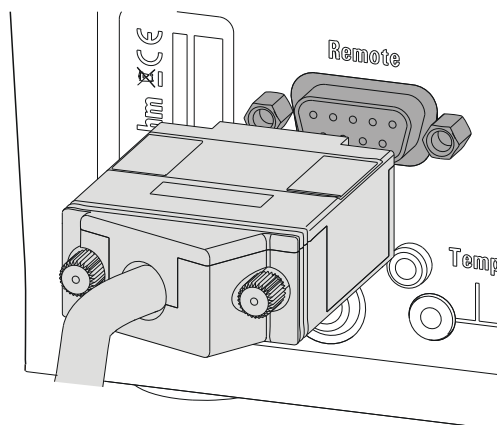


Figure 22 Connecting a remote cable

Details regarding the use of the sample changer (e.g. 885 Compact Oven SC) can be found in the respective manual.

5 Operation

5.1 Switching the instrument on and off

Switching on the instrument

Proceed as follows:



- 1 ▪ Press the red **[STOP]** key.
The instrument is initialized and a system test performed. This process takes some time.

The main dialog is displayed:

| Menu | ready |
|-------------|-------|
| Method | KFC |
| ID1 | |
| ID2 | |
| Sample size | 1.0 |
| Unit | g |

Switching off the instrument

The instrument is switched off with the **[STOP]** key. The fact that the key needs to be pressed down for an extended time prevents accidental switch off.

Proceed as follows:

- 1 ▪ Keep the red **[STOP]** key pressed down for at least 3 s.
A progress bar is displayed. If the key is released during this time, then the instrument will not be switched off.

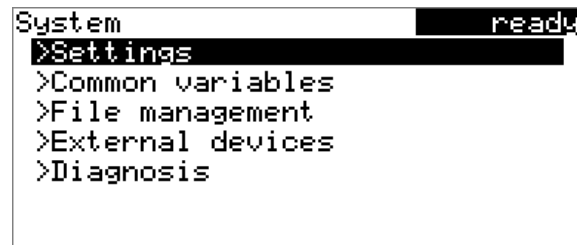
Some dialogs have a so-called function bar on the bottom line. The functions contained therein can be selected with the arrow keys [←] or [→] and executed with [OK].



5.2.3 Navigating in the dialog

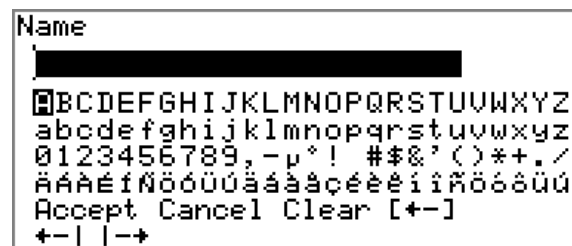
The selection bar is displayed in inverted style. Use the arrow keys [↑] and [↓] to move the selection bar upward or downward one line at a time. If a dialog text is marked with ">", then additional settings are available in a subordinate dialog. Use [OK] to access this dialog.

Example: System settings



Use the [BACK] key to return to the next higher level.

5.2.4 Entering text and numbers



In the editing dialog for text input or numerical input, select the individual characters with the arrow keys. Use [OK] to apply the character in the input field. The following functions are available:

| Editing function | Description |
|------------------|---|
| Accept | The modification is applied and the editing dialog is exited. |
| Cancel | The editing dialog is exited without applying the modification. |



| Editing function | Description |
|------------------|---|
| Clear | The content of the input field is deleted completely. |
| [←] | The character left of the cursor is deleted (back-space). |
| ← | Text editor only The cursor within the input field is shifted to the left by one character each time that [OK] is pressed. |
| → | Text editor only The cursor within the input field is shifted to the right by one character each time that [OK] is pressed. |
| [BACK] | The modification is applied and the editing dialog is exited. |

The **[BACK]** key has the same function as **Accept**.

A commercially available USB keyboard can be connected to make it easier to enter text and numbers. The key assignment on the PC keyboard is described in the Appendix of the more detailed manual.

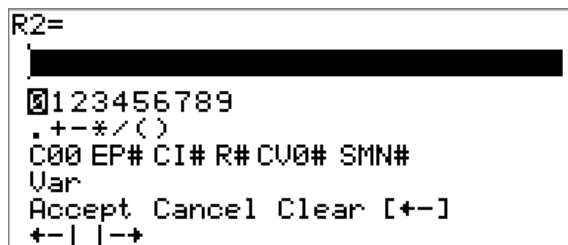
5.2.5 Selecting from a selection list



In a selection list, select the individual entries with the arrow keys [↑] and [↓]. Accept the selection with **[OK]** or **[BACK]**.

5.3 Formula editor

The formulas for the calculations are entered with the formula editor. The formula editor is equipped with an automatic syntax check. This is triggered as soon as a formula is applied. The generally valid rules of priority apply for the calculation operations.



| Variable | Description |
|----------|---|
| C00 | Sample size |
| EP# | Water quantity at the endpoint EP# (# = 1...9) |
| CI# | Sample identification (# = 1...2) |
| R# | Result (# = 1...5) |
| CV0# | Common variable (# = 1...5) |
| SMN# | Mean value of result R# (# = 1...5) |
| Var | List of additional variables (see "Variables", page 33) |

"#" stands for a sequential number that you must enter manually. Example: if you apply the variable **EP#** in the formula, only **EP** is entered. You will still need to enter the number yourself.

The meanings of the editing functions are explained in *chapter 5.2.4, page 31*.

Variables

Pressing **Var** displays a list with additional variables. You can enter these variables either directly into the formula or also by selecting them from the list and applying them with **[OK]**.

| Variable | Description |
|----------|--|
| MCQ | End quantity, i.e. total amount of removed water at the end of the titration (in µg) |
| MCD | Duration of the entire titration |
| MDC | Drift for drift correction |



| Variable | Description |
|----------|---|
| DDC | Time for drift correction |
| MIM | Initial measured value, i.e. measured value prior to the processing of the start conditions |
| MIT | Initial temperature, i.e. temperature prior to the processing of the start conditions |
| MCM | End measured value |
| MCT | End temperature |
| DD | Duration of the entire determination |

5.4 Methods

5.4.1 Method templates

The 899 Coulometer contains method templates which are already configured except for a few parameters.

The following method templates can be selected:

| | |
|------------------|---|
| KFC | Coulometric Karl Fischer titration. The blank value is not taken into account for the calculation. |
| KFC-Blank | Coulometric Karl Fischer titration minus the blank value. |
| Blank | Coulometric blank value determination. |

The method templates differ only in their calculation formulas.

5.4.2 Loading a method template

Proceed as follows to load a method template:

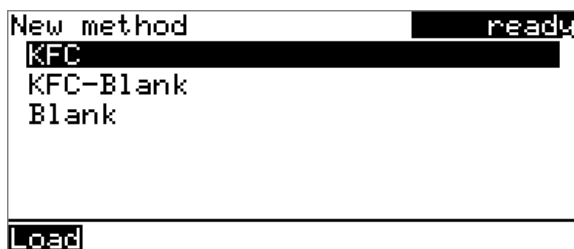
1 Opening method templates

- In the main dialog, select **Method** and press **[OK]**.

The method table with the stored methods opens:

2 In the function bar, select **New** and press **[OK]**.

The list with method templates opens:



3 Loading the method template

- Select the desired method template and press **[OK]**.

The method is now loaded and is displayed in the main dialog under **Method**.

5.4.3 Saving a method

If you modify method parameters, then you can save these as your own method. A maximum of 100 methods can be saved.

To save a method, proceed as follows:

1 Opening the method table

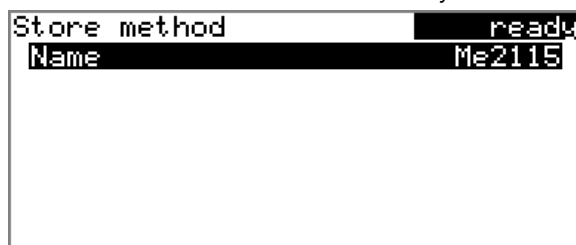
- In the main dialog, select **Method** and press **[OK]**.

The method table opens:



2 Modifying/applying the method name

- In the function bar, select **Store** and press **[OK]**.
The name of the method template is suggested as the method name (e.g. **KFC-Blank**). If the method has already been saved once, then the method name already used will be displayed:



Applying the name:



- Press **[BACK]**.

The method will be saved and the method table is displayed.

Entering a new name:

- Press **[OK]**.
The text editor opens.
- Enter a method name (max. 12 characters) and apply with **Accept** or **[BACK]**.
- Press **[BACK]**.

The method will be saved and the method table is displayed.

5.4.4 Exporting a method

The methods can be exported to a connected USB flash drive.



NOTE

This function is possible only if a USB flash drive is connected as an external storage medium.

To export a method, proceed as follows:

1 Opening the method table

- In the main dialog, select **Method** and press **[OK]**.

The method table with the stored methods opens:



2 Selecting the method

- Select the desired method.

3 Exporting the method

- In the function bar, select **Export** and press **[OK]**.

The method is being exported. The directory structure on the USB flash drive is described in the more detailed manual.

5.5 Control

Menu ► Control

In the dialog **Control**, the settings for the execution of a single determination or of one sample series are defined.

Sample table

If this parameter is activated, the sample data for a sample series can be entered in a table (see Chapter 5.7, page 40).

| | |
|---------------|-----------------|
| Selection | on off |
| Default value | off |

Autostart

If this parameter is activated, a new determination is started automatically at the end of a determination. This continues until the number specified has been reached (see **Number of autostarts**).

| | |
|---------------|-----------------|
| Selection | on off |
| Default value | off |



NOTE

If you are working with a sample changer with oven module (e.g. 885 *Compact Oven SC*), then the **Autostart** parameter must be set to **off**, because the sample changer starts the titration.

Number of autostarts

This parameter is visible only when **Autostart = on**.

Number of automatic starts.

| | |
|---------------|---------------|
| Input range | 1 - 50 |
| Selection | table |
| Default value | table |

table

The number of automatic starts corresponds to the number of samples in the sample table.



5.6 Sample data

You can enter the sample data (identification, sample size, etc.) in a variety of ways:

- Directly in the main dialog.
- Using the sample table. This is particularly useful with sample series. The sample table is a table in which the sample data for up to 99 samples can be entered (*see Chapter 5.7, page 40*).
- Automatic request immediately after the start of the determination (*see Chapter 5.6.2, page 39*).

You can also send the sample size and the unit from a connected balance in any case. With some balances, the sample identification and method can be also sent. You will find precise information concerning this in the Appendix of the more detailed manual.

5.6.1 Entering sample data in the main dialog

For a sample, you can enter the sample data directly in the main dialog, even while the determination is running (*see Chapter 5.9, page 47*).

| | |
|-------------|-------|
| >Menu | ready |
| Method | KFC |
| ID1 | |
| ID2 | |
| Sample size | 1.0 |
| Unit | g |

ID1

Sample identification. The sample identification can be used in calculations as the variable **CI1**.

| | |
|---------------|---------------------------|
| Entry | max. 10 characters |
| Default value | empty |

ID2

Sample identification. The sample identification can be used in calculations as the variable **CI2**.

| | |
|---------------|---------------------------|
| Entry | max. 10 characters |
| Default value | empty |

Sample size

Sample size. The value of the sample size can be used in calculations as the variable **C00**.

| | |
|---------------|------------------------|
| Input range | -999999999 - 999999999 |
| Default value | 1.0 |

Unit

Unit of the sample size.

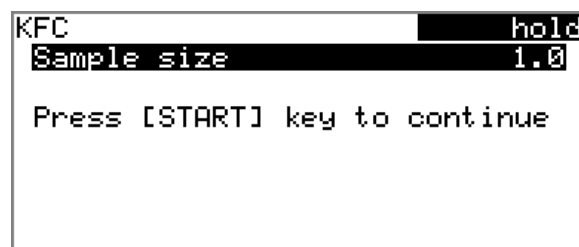
| | |
|---------------|---|
| Selection | g mg µg mL µL pieces User-defined |
| Default value | g |

User-defined

A user-defined unit can be created. This will be added to the selection list. The previous entry will be overwritten as soon as the new unit has been defined.

5.6.2 Requesting sample data at the start of the determination

The sample data can be requested immediately after the start of the determination in order to ensure that the sample data entry is not forgotten. This automatic request is indispensable when you reweigh your samples.



The corresponding parameters must be activated under **Start conditions** for this purpose. If the parameter **Hold at request** is activated, then the run will be paused and must be continued with **[START]** after the input of the sample data. If **Hold at request** is deactivated, then the titration will be started in the background. This dialog will be displayed until the entering of the sample data is confirmed with **[START]**, even if the titration is already completed. This ensures that the sample data is available for calculations.


```

Menu                                ready
>Manual control
>Results
>Parameters
>Sample table
>System
>Control
>Print reports

```

The sample table contains numbered lines. The identification (**ID1**) and the sample size of each sample are displayed.

```

Sample table                        ready
1 #8805923    1.0 g
2 #8805824    1.0 g
3 #8805926    1.0 g
4 #8805927    1.0 g
5 ...
Edit Delete Insert New Store +

```

Edit

Edit the data of the selected line, see following chapter.

Delete

Delete the selected line from the sample table.

Insert

Insert a new line above the line selected.

New

Delete the sample table completely. This function is visible only if the instrument is in **ready** status.

Store

Save the sample table. The sample table is saved in the internal device memory.



NOTE

You can save only one sample table. When you save a sample table, any previously saved sample table will be overwritten automatically.

Load

Load the sample table from the internal device memory.



5.7.2 Editing the sample data

| Sample data | | ready |
|-------------------|--|----------|
| Method | | Me4155 |
| ID1 | | #8805923 |
| ID2 | | |
| Sample size | | 1.0 |
| Unit | | g |
| +- Line 1 of 4 -+ | | |

You will see at the very bottom the line number of the selected line and the line number of the last line containing data. In this example, the first line is opened and the sample table contains four lines.

One can scroll between the individual data sets with the keys [←] and [→].

Inserting a new line

If you find yourself on the last line (i.e. **Line 4 of 4** in the above example), you can add a new line to the sample table by pressing [→] again. The sample data of the previous sample will be applied thereby.

Method

Method used for processing the sample.

| | |
|---------------|--|
| Selection | Selection of stored methods empty |
| Default value | empty |

empty

The currently loaded method is used.

ID1

Sample identification. The sample identification can be used in calculations as the variable **CI1**.

| | |
|---------------|---------------------------|
| Entry | max. 10 characters |
| Default value | empty |

ID2

Sample identification. The sample identification can be used in calculations as the variable **CI2**.

| | |
|---------------|---------------------------|
| Entry | max. 10 characters |
| Default value | empty |

Sample size

Sample size. The value of the sample size can be used in calculations as the variable **C00**.

| | |
|---------------|--------------------------------|
| Input range | -999999999 - 9999999999 |
| Default value | 1.0 |

Unit

Unit of the sample size.

| | |
|---------------|---|
| Selection | g mg µg mL µL pieces User-defined |
| Default value | g |

User-defined

A user-defined unit can be created. This will be added to the selection list. The previous entry will be overwritten as soon as the new unit has been defined.

5.7.3 Sending the sample size from a balance

| | |
|--------------------------------|-------|
| Sample table | ready |
| 1 #8805923 | 1.0 g |
| 2 #8805824 | 1.0 g |
| 3 #8805926 | 1.0 g |
| 4 #8805927 | 1.0 g |
| 5 ... | |
| Edit Delete Insert New Store + | |

If the sample size is sent directly from the balance, then it will always be entered in a new line at the end of the sample table. It does not matter which line is selected or whether the sample table is even opened. In the above example, the sample size is entered in line 5.



NOTE

If you would like to enter the sample size in a particular line, then you must open the corresponding editing dialog (i.e. the **Sample data** dialog is displayed).

If the editing dialog for the sample size is opened, then the sent value will be ignored.



5.8 Carrying out a determination

The sample size can be entered in the following ways when a determination is carried out:

- Enter manually on the instrument.
- Send automatically from a connected balance. For this purpose, check the manual for the balance.

Proceed as follows to carry out a determination:

1 Loading the method

- See Chapter "Methods", Page 34.

2 Starting conditioning

- Press **[START]**.

Conditioning starts. **Conditioning not OK** is displayed until the endpoint is reached. The working medium is titrated to the endpoint. This is indicated by **Conditioning OK**. The status is kept stable.

```

KFC                                cond.ok
Conditioning OK
++Drift          1.7 µg/min
Stirrer
  
```

The stirring rate can be modified with the **Stirrer** function. The following dialog is opened by pressing **[OK]**:

```

Stirrer                                cond.ok
Stirrer  on  Rate  8
Off Stir- Stir+
  
```

The stirring rate can be reduced with **Stir-** and increased with **Stir+**. **Off** switches the stirrer off. **On** is now displayed instead. This can be used to switch the stirrer back on. This dialog is exited with **[BACK]**.

3 Adding sample

- If **Conditioning OK** is displayed, press **[START]**.
Conditioning is stopped. The request for adding the sample will be displayed for 8 s.
The sample must be added during this time.

```

KFC                               busy
Add sample                          6 s

Stirrer
  
```

- Add the sample.

Afterward, the request for the sample size appears:

```

KFC                               hold
Sample size                          1.0
Press [START] key to continue
  
```

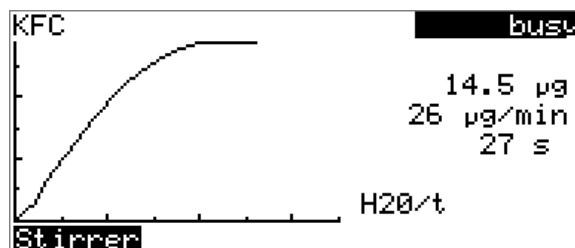
4 Entering the sample size

- Press **[OK]**.
The editing dialog opens.
- Enter the sample size and apply with **Accept** or **[BACK]**.

5 Starting the titration

- Press **[START]**.

The titration starts and the curve is displayed:



The axes are scaled automatically.

The stirring rate can be modified during titration with the **Stirrer** function. The following dialog is opened by pressing **[OK]**:



```

Stirrer                                busy
-----
Stirrer    on    Rate 8
-----
Off Stir- Stir+

```

The stirring rate can be reduced with **Stir-** and increased with **Stir+**. **Off** switches the stirrer off. **On** is now displayed instead. This can be used to switch the stirrer back on. This dialog is exited with **[BACK]**.

After the completion of the titration, the results dialog is displayed:

```

Results                                cond. busy
-----
Water                                0.993 mg/g
Drift (automatic)                    2.5 µg/min
Drift corr. time                      146.9 s
EP1                                  1829.1 µg
Regular stop
-----
Curve Recalculate Statistics

```

Conditioning is restarted automatically in the background. You can see the current status of the conditioning in the status display at the upper right in the dialog window (**cond.busy** or **cond.ok**).

6 Returning to the conditioning dialog

- Press **[BACK]**.
The main dialog with the sample data of the previously ended titration is displayed.
- Select **Menu** and press **[OK]**.
- Select the menu item **Live dialog** and press **[OK]**.

```

Menu                                cond. busy
-----
>Results
>Live dialog
>Parameters
>Print reports

```

The current status of the conditioning is displayed (see instruction step 2).

If you wish to start the next titration, repeat the actions starting with instruction step 3.

Canceling a determination manually

A determination can be canceled at any time with the **[STOP]** key.

5.9 Live modifications

5.9.1 Editing the sample data of the running determination

The sample data can be entered or modified in the main dialog while a determination is running. In calculations always the sample data entered at the end of the titration in the main dialog is used.

Proceed as follows to edit the sample data:

1 Displaying the main dialog

- Press **[BACK]**.

The main dialog is displayed. The determination continues to run in the background.

2 Editing the sample data

- Edit the sample data and apply with **Accept** or **[BACK]**.

3 Displaying the live dialog

- Press **[BACK]**.

or

- Select **Menu** and press **[OK]**.

```
Menu                               busy
>Results
>Live dialog
>Parameters
```

- Select the menu item **Live dialog** and press **[OK]**.

The live dialog is displayed once again.



NOTE

If the determination is finished while an editing dialog is opened (e.g. of the sample size), then this will be closed automatically and the results dialog will be displayed. The value entered must be entered once more and the determination must be recalculated.

Make sure that the editing dialogs are closed before the determination is finished.

5 Displaying the live dialog

- Select the menu item **Live dialog** in the main menu and press **[OK]**.

or

- Press **[BACK]** in the main dialog.

The live dialog is displayed once again.

Editing the sample data of the running determination

When you use the sample table, the editing of the sample data of the running determination proceeds as described in *chapter 5.9.1, page 47*. In addition, you have the option of editing these in the sample table. The first line always contains the sample data of the running determination. Simply select for this purpose the **Sample table**(see "Editing the sample table", page 48) menu item in the main menu.

5.9.3 Editing the live parameters

Certain method parameters can be edited while a determination is being carried out. The only parameters that can be modified are those that can be selected. Nevertheless, all of the parameters are visible. The modified parameters are taken into account at once. If, for example, you increase the parameter **Extraction time** while the extraction time is still running, then the new value will be taken into account at once. If however you change this parameter after the extraction time has already expired, then the changed value will not be taken into account until the next determination.

Proceed as follows to edit the parameters:

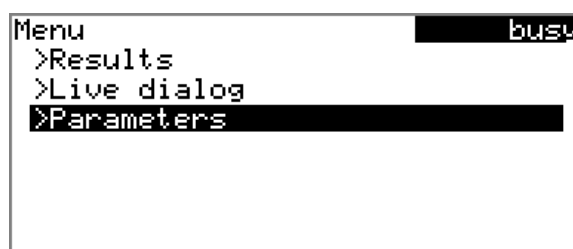
1 Displaying the main dialog

- Press **[BACK]**.

The main dialog is displayed. The determination continues to run in the background.

2 Opening the main menu

- Select **Menu** and press **[OK]**.





3 Editing the method parameters

- Select the menu item **Parameters** and press **[OK]**.
- Change the desired parameters accordingly.

4 Displaying the live dialog

- Select the menu item **Live dialog** in the main menu and press **[OK]**.

or

- Press **[BACK]** in the main dialog.

The live dialog is displayed once again.

5.10 Results

Menu ► Results

After the completion of the titration, the results dialog is displayed:

| | |
|------------------------------|------------|
| Results | cond. busu |
| Water | 0.993 mg/g |
| Drift (automatic) | 2.5 µg/min |
| Drift corr. time | 146.9 s |
| EP1 | 1829.1 µg |
| Regular stop | |
| Curve Recalculate Statistics | |

The calculated result and details concerning the drift and the endpoint are shown in the overview.

Curve

Display the curve of the current determination.

Recalculate

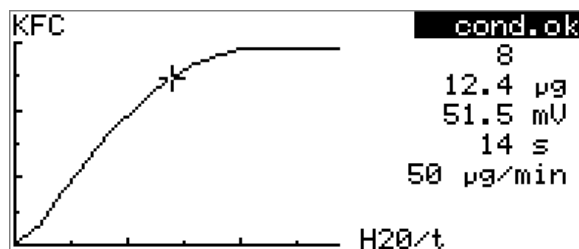
Recalculate the current determination. The procedure will be executed immediately.

Statistics

Display the statistical overview of a determination series (*see Chapter 5.11, page 51*).

Displaying the curve

The curve of the current determination can be displayed with the **Curve** function.



The arrow keys [←] and [→] can be used to move to the individual measuring points. A cross hair is used to show the current position on the curve. The data (water quantity, measured value, time, etc.) for the respective measuring point is indicated on the right-hand side.

Recalculating



NOTE

Recalculation cannot be undone.

All of the results are recalculated with the **Recalculate** function. This is necessary if, for example, the calculation or the sample size has been modified.

5.11 Statistics

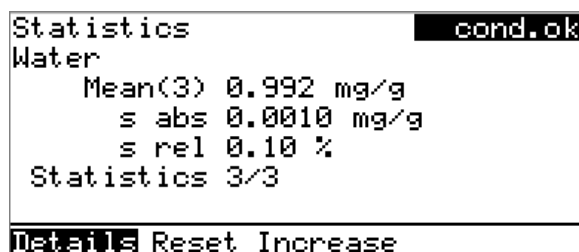
Menu ► Results ► Statistics

The statistical overview of a determination series can be displayed in the **Results** dialog with the **Statistics** function.



NOTE

This function is visible only if statistics has been activated.



The mean value (**Mean**), the absolute and the relative standard deviation (**s abs** and **s rel**) are displayed in the overview. For the mean value, the number of individual results from which it has been calculated is displayed in parentheses. In this example, it is 3. The **Statistics** line shows how many determinations have already been carried out and how many deter-

5.12 Printing a report manually

Menu ► Print reports

Proceed as follows to print a report manually:

1 Opening the main menu

- In the main dialog, select **Menu** and press **[OK]**.

```
Menu ready
>Manual control
>Results
>Parameters
>System
>Control
>Print reports
```

2 Opening the print dialog

- Select the menu item **Print reports** and press **[OK]**.

The dialog window with the available reports opens:

```
Print reports ready
Results
Curve
Measuring point list
Parameters
System
Calculations/Statistics
PC/LIMS ↓
```

3 Selecting the report

- Select the desired report and press **[OK]**.

The report is printed out.

The following reports can be printed out manually:

| | |
|-----------------------------|--|
| Results | Result report with determination properties, sample data, calculated results, etc. |
| Curve | Curve report. The width of the curve is defined in the system settings. |
| Measuring point list | Measuring point list report. |
| Parameters | Report with all method parameters of the loaded method. |

2 Setting the stirring rate

| | |
|----------------|--------|
| Manual control | ready |
| Stirrer off | Rate 8 |
| On Stir- Stir+ | |

- In the function bar, select **Stir-** or **Stir+**.
 The stirring rate will be increased or decreased by one step each time the **[OK]** key is pressed.
 The algebraic sign changes the direction in which the stirring is done. When viewing the stirrer from above, this means:
 - "+": counterclockwise rotation
 - "-": clockwise rotation

3 Switching on the stirrer

- In the function bar, select **On** and press **[OK]**.

The stirrer is started and stirs at the rate which has been set. **Off** is now displayed in the function bar.

4 Switching off the stirrer

- In the function bar, select **Off** and confirm with **[OK]**.

The stirrer is stopped.



Index

A

| | |
|------------------------------|----|
| Adapter | |
| Connect | 25 |
| Addition and aspiration tube | |
| Mount | 14 |
| Adsorber tube | |
| Fill | 10 |

B

| | |
|---------|----|
| Balance | 43 |
| Connect | 23 |

C

| | |
|--------------|----|
| Control | 37 |
| Autostart | 37 |
| Sample table | 37 |
| Coulometer | |
| Set up | 9 |
| Curve | 50 |

D

| | |
|---------------|----|
| Determination | |
| Cancel | 46 |
| Carry out | 44 |
| Result | 50 |

E

| | |
|--------------------------|----|
| Electrical connection | |
| Power Box | 16 |
| Power supply unit | 15 |
| Electrode | |
| Connect | 18 |
| Electrode connector | |
| Double Pt wire electrode | 8 |
| Generator electrode | 8 |
| Indicator electrode | 8 |
| Electrostatic charge | 5 |

F

| | |
|-------------------------|----|
| Formula editor | 33 |
| Front of the instrument | 7 |

G

| | |
|---------------------|----|
| Generator electrode | |
| Fill | 13 |

I

| | |
|------------|----|
| Instrument | |
| Set up | 9 |
| Switch off | 29 |

| | |
|-----------|----|
| Switch on | 29 |
|-----------|----|

K

| | |
|-------------------|----|
| Karl Fischer oven | |
| Use | 15 |
| Keyboard | |
| Connect | 25 |

L

| | |
|--------------------|----|
| Live modifications | 47 |
| Live parameters | 49 |

M

| | |
|------------------|----|
| Mains connection | 8 |
| Mains voltage | 5 |
| Manual control | |
| Stirring | 54 |
| Method | |
| Export | 36 |
| Save | 35 |
| Method template | |
| Load | 34 |
| Molecular sieve | |
| Replace | 11 |
| MSB | |
| Connector | 8 |

N

| | |
|-----------------|----|
| Navigate | 31 |
| Numerical input | 31 |

O

| | |
|-------------|----|
| Operation | |
| General | 30 |
| Oven module | 15 |

P

| | |
|-------------|----|
| Parameters | |
| Modify live | 49 |
| Print | 53 |
| Printer | |
| Connect | 25 |

R

| | |
|------------------------|----|
| Rear of the instrument | 8 |
| Recalculate | 50 |
| Remote | |
| Connector | 8 |

| | |
|------------------|----|
| Remote connector | |
| Sample changer | 28 |
| Report | |
| Print manually | 53 |
| Result | 50 |
| Recalculate | 51 |

S

| | |
|---------------------|----|
| Safety instructions | 4 |
| Sample changer | |
| Connect | 28 |
| With oven module | 15 |
| Sample data | |
| Enter | 38 |
| Modify live | 47 |
| Sample size | |
| Send from a balance | 43 |
| Sample table | 40 |
| Insert line | 42 |
| Load | 41 |
| Modify live | 48 |
| Save | 41 |
| Sensor | |
| Connect | 18 |
| Sensor connector | |
| Pt1000 | 8 |
| Temperature sensor | 8 |
| Service | 4 |
| Statistics | 51 |
| Stirrer | |
| Connect | 22 |
| Switch off | 29 |
| Switch on | 29 |

T

| | |
|--------------------|----|
| Temperature sensor | |
| Connect | 18 |
| Text input | 31 |
| Titration cell | |
| Equip | 12 |
| Fill | 13 |
| Insert | 10 |

U

| | |
|------------|----|
| USB (OTG) | |
| Connector | 8 |
| USB device | |
| Adapter | 25 |
| Connect | 25 |