

# Eco Coulometer



Manual

8.1028.8001EN / v6 / 2025-12-12





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# Eco Coulometer

Firmware version 57.1028.0005 or higher

**Manual**

8.1028.8001EN / v6 /  
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Technical Communication  
Metrohm AG  
CH-9100 Herisau

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# 1 Overview

## 1.1 Product description

The Eco Coulometer is a titrator used for coulometric water content determination according to Karl Fischer.

## 1.2 Product versions

The product is available in the following versions:

Table 1 Product versions

Article number	Designation	Version feature
2.1028.0010	Eco Coulometer	with generator electrode with diaphragm
2.1028.0110	Eco Coulometer	with generator electrode without diaphragm

The article number and serial number for identification the product can be found on the type label:

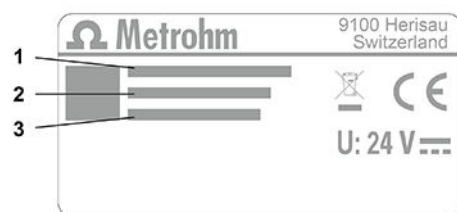


Figure 1 Type label (example)

**1** (01) = External article number




**2** (21) = Serial number

**3** (240) = Metrohm article number



## 1.5 About the documentation

Possible depictions in the documentation:

Depiction	Meaning
<i>(5-12)</i>	Cross-reference to figure legend (Figure number - <b><i>Element in the figure</i></b> )
<b>1</b>	Instruction step
<b>Method</b>	Parameters, menu items, tabs, and dialogs
<b>File ▶ New</b>	Menu path
<b>[Continue]</b>	Button or key
	Supplementary information to the descriptive text
	Note In graphics, orange arrows or frames indicate the reference to the descriptive text. The relevant elements may also be colored orange.
	Movement In graphics, blue arrows indicate the movement direction. The elements to be moved may also be colored blue.



## 2.3 Requirements for operating personnel

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

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

## 2.4 Safety instructions

### 2.4.1 Danger from electrical potential

Contact with electrical potential can cause serious injuries or death. To avoid danger from electrical potential, observe the following:

- Operate the product only if it is in perfect condition. The housing must also be intact.
- Only use the product with the covers fitted. If covers are damaged or missing, disconnect the product from the energy supply and contact the regional Metrohm service representative.
- Protect live components (e.g. power supply unit, power cord, connection sockets) against moisture.
- Always have maintenance work and repairs on electrical components carried out by a regional Metrohm service representative.
- Disconnect the product from the energy supply immediately if at least one of the following cases occurs:
  - The housing is damaged or open.
  - Live parts are damaged.
  - Moisture penetrates.

### 2.4.2 Danger from biological and chemical hazardous substances

Contact with biological hazardous substances may cause poisoning from toxins or infections from microorganisms. Contact with aggressive chemical substances may cause poisoning or chemical burns. To avoid danger from biological or chemical hazardous substances, observe the following:



### 2.4.5 Danger during transport of the product

Chemical or biological substances may be spilled during the transport of the product. Parts of the product may fall down or may be damaged. There is a risk of injury from chemical or biological substances and pieces of broken glass. To ensure safe transport, observe the following:

- Remove loose parts (e.g. sample racks, sample vessels, bottles) before transport.
- Remove liquids.
- Lift and transport the product with both hands on the base plate.
- Lift and transport heavy products only according to instructions.

## 2.5 Design of warning messages

The present documentation uses warning messages as follows.

### Structure

1. Severity of the danger (signal word)
2. Type and source of danger
3. Consequences of disregarding the danger
4. Measures for averting the danger

### Hazard levels

Signal color and signal word designate the hazard level.

#### **DANGER**

Indicates an immediate danger. It will result in serious injuries or death if not avoided.

#### **WARNING**

Indicates a potential danger. Failure to avoid the danger may result in death or serious injury.

#### **CAUTION**

Indicates a potential danger. If not avoided, it may result in light or minor injuries.

#### **NOTICE**

Indicates a potentially damaging situation. If not avoided, the product or something in the surrounding area could be damaged.














## 2.6 Meaning of warning signs

Warning signs on the product or in the documentation indicate potential dangers or draw attention to certain behaviors in order to avoid accidents or damage.

Depending on the application purpose, the operating company attaches additional warning signs to the product. The corresponding instructions of the operator must be followed.

Table 2 Warning signs according to ISO 7010 (examples)

Warning signs / meaning	Warning signs / meaning
 General warning sign	 Warning of hot surface
 Warning of sharp object (cut/puncture)	 Warning of hand injuries (crushing)
 Warning of electrical voltage	 Warning of corrosive substances
 Warning of optical radiation	 Warning of a laser beam
 Warning of flammable materials	 Warning of biological hazard
 Warning of toxic materials	



### 3 Functional description

#### 3.1 Eco Coulometer – Overview

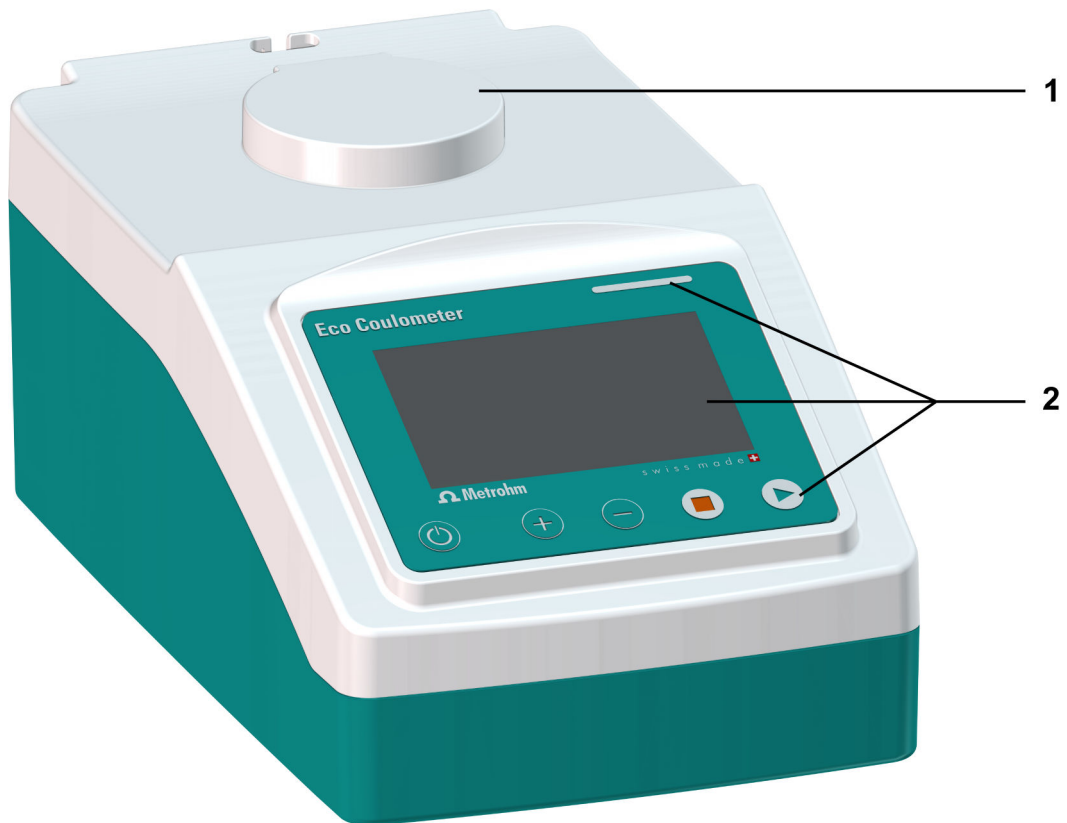


Figure 2 Eco Coulometer – Front

**1** Magnetic stirrer

**2** Indicators/Controls

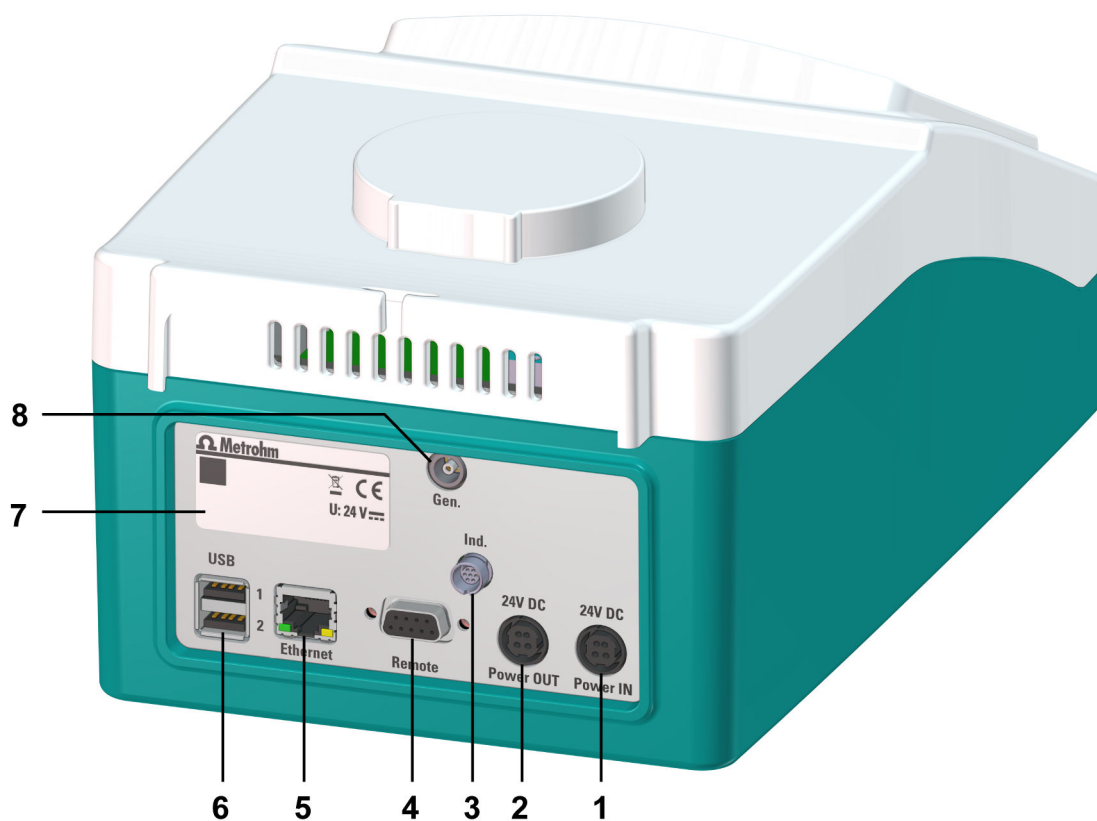


Figure 3 Eco Coulometer – Rear

<p><b>1 Power IN</b> Connecting the power supply unit</p>	<p><b>2 Power OUT</b> Connect external device</p>
<p><b>3 Ind.</b> Connect indicator electrode (6.02104.040)</p>	<p><b>4 Remote</b> Connect remote control</p>
<p><b>5 Ethernet (RJ-45)</b> Remote control via local network</p>	<p><b>6 USB (USB 1 and USB 2)</b> Connect USB flash drive, printer, balance, etc.</p>
<p><b>7 Type label</b></p>	<p><b>8 Gen.</b> Connect generator electrode (6.2104.120)</p>

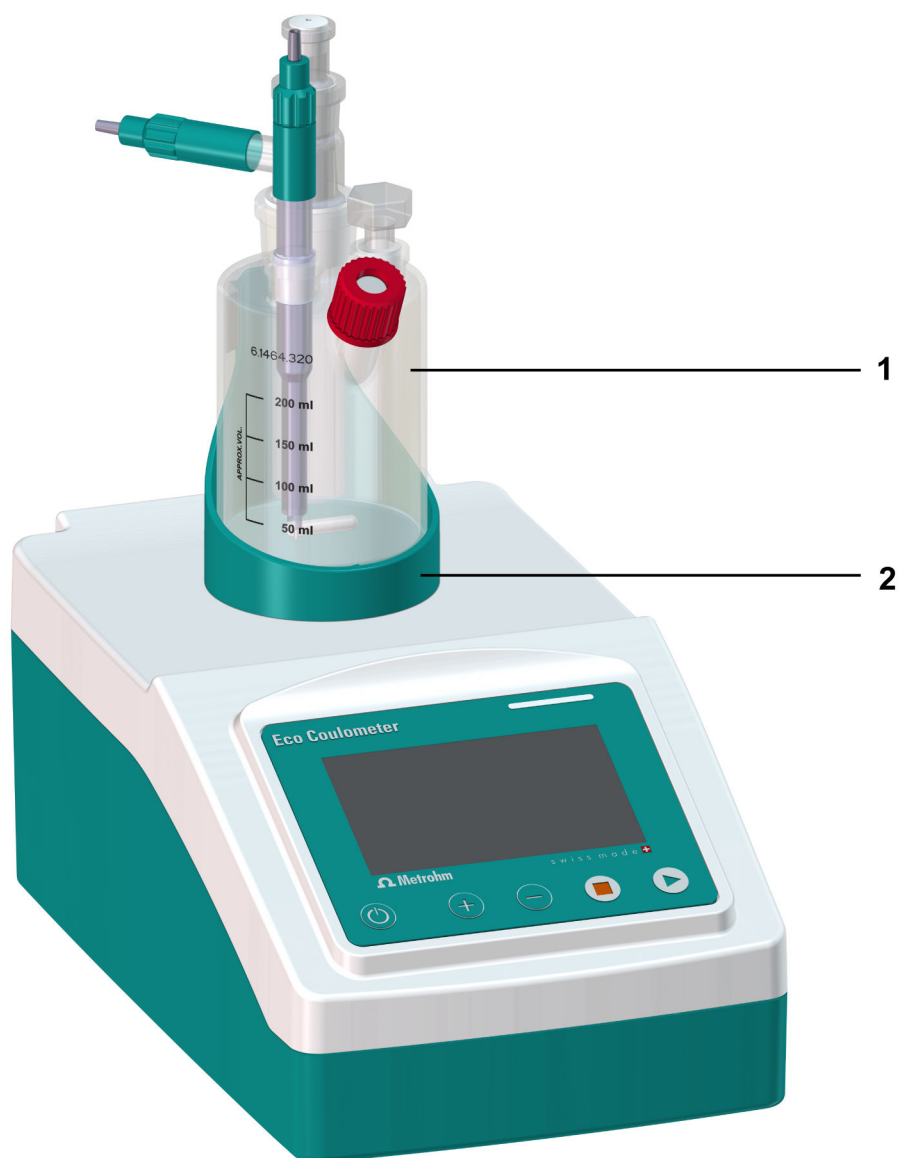


Figure 4 Eco Coulometer – Accessories

**1** Titration cell

**2** Titration vessel holder

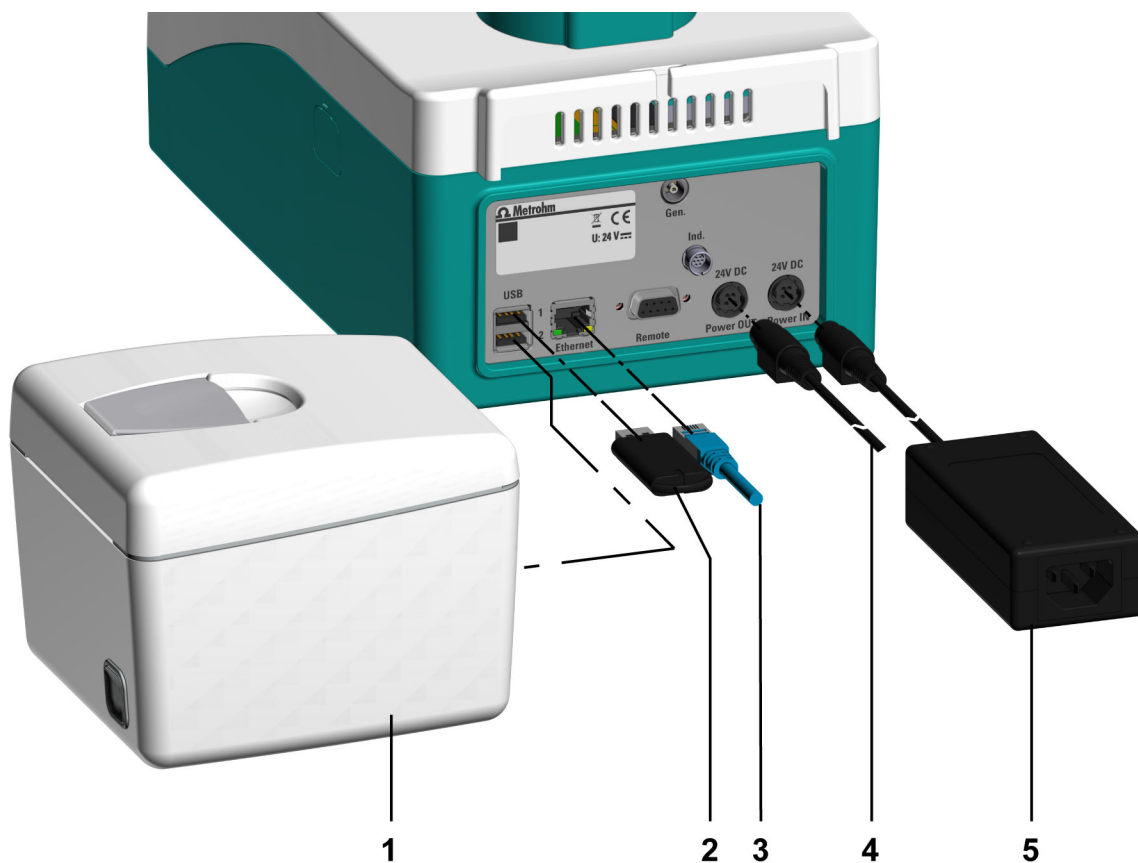


Figure 5 Eco Coulometer – Peripherals

<b>1</b>	<b>Printer Q3X (optional)</b>	<b>2</b>	<b>USB flash drive</b>
<b>3</b>	<b>Ethernet cable (optional)</b>	<b>4</b>	<b>Solvent Pump (optional)</b>
<b>5</b>	<b>Power supply unit</b>		

## 3.2 Function of the components

### 3.2.1 Magnetic stirrer

The magnetic stirrer ensures that the sample is well mixed in the reagent. The stirring rate can be adjusted depending on the amount and viscosity of the sample.

### 3.2.2 Coulometric Karl Fischer titration cell

The coulometric Karl Fischer titration cell is a closed vessel for water content determination according to Karl Fischer.

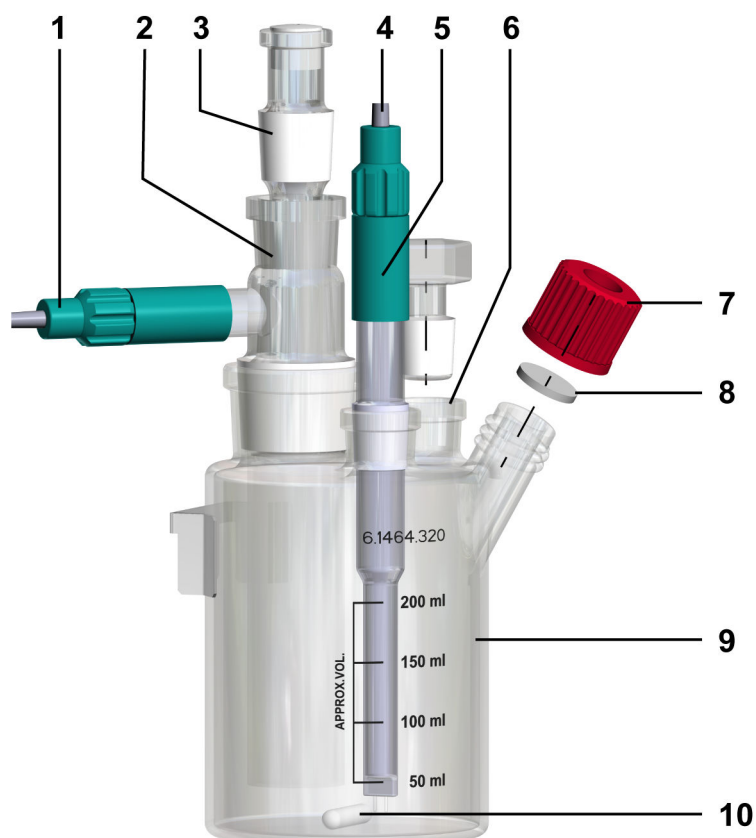


Figure 6 Coulometric Karl Fischer titration cell (equipped) – Overview

<b>1</b> Electrode cable / 1 m / H (6.2104.120)	<b>2</b> Generator electrode, with diaphragm (6.0344.100) / without diaphragm (6.0345.100) With PTFE sleeve SGJ 29 (6.2713.010)
<b>3</b> KF adsorber tube for coulometer cell (6.1403.030) With PTFE sleeve SGJ 19 (6.2713.020)	<b>4</b> Electrode cable plug-in head G (pole) / plug P, 0.55 m (6.02104.040) With blue coding



### 3.3 Indicators and controls

#### Indicators – Status display and status indicator

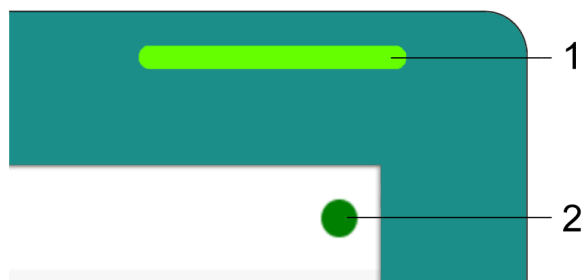


Figure 7 Indicators

**1 Status display**

**2 Status indicator**

The status indicator is only displayed if the touch screen is switched on.

#### Controls – Control bar

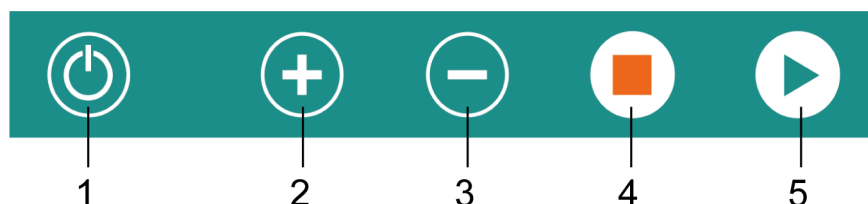


Figure 8 Control bar keys

**1 On/Off**

**2 Increase stirring rate**

**3 Reduce stirring rate**




**4 Stop**

**5 Start**

### 3.4 Signals

The status display uses flashing patterns to display the operating status of the instrument.





Table 3 Status display

Signal	Flashing pattern	Meaning
	LED lights up green	Ready for operation
	LED flashes green (slowly)	In operation / Waiting
	LED flashes green (fast)	Malfunction or error



The status indicator uses colors to display the operating status of the instrument.

Table 4 Status indicator

Signal	Color	Meaning
	Green	Ready for operation
	Orange	In operation
	Yellow	Waiting
	Red	Malfunction or error

### 3.5 Remote interface

#### Pin assignment of the remote interface

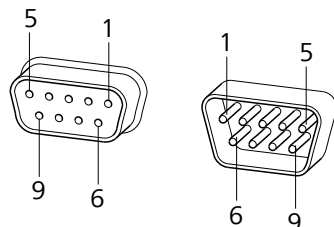


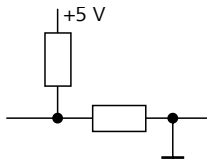
Figure 9 Pin assignment of remote socket and remote plug

The above figure of the pin assignment applies to all Metrohm instruments with 9-pin D-Sub remote connector.

Table 5 Inputs and outputs of the remote interface

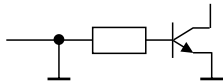
Pin no.	Assignment	Function
1	Output 0	Ready/EOD
2	Output 1	Activate/Dosimat
3	Output 2	Titration/Determination
4	Output 3	Cond. OK
5	Output 4	Error
6	0 volt (GND)	
7	+5 volt	
8	Input 0	Start
9	Input 1	Stop

**Inputs**



approx. 5 kΩ Pull-up  
 $t_p > 100 \text{ ms}$   
 active = low, inactive = high

**Outputs**



Open Collector  
 $t_p > 200 \text{ ms}$   
 active = low, inactive = high  
 $I_C = 20 \text{ mA}$ ,  $V_{CEO} = 40 \text{ V}$   
 +5 V: maximum load = 20 mA

**Status diagrams of the remote interface**

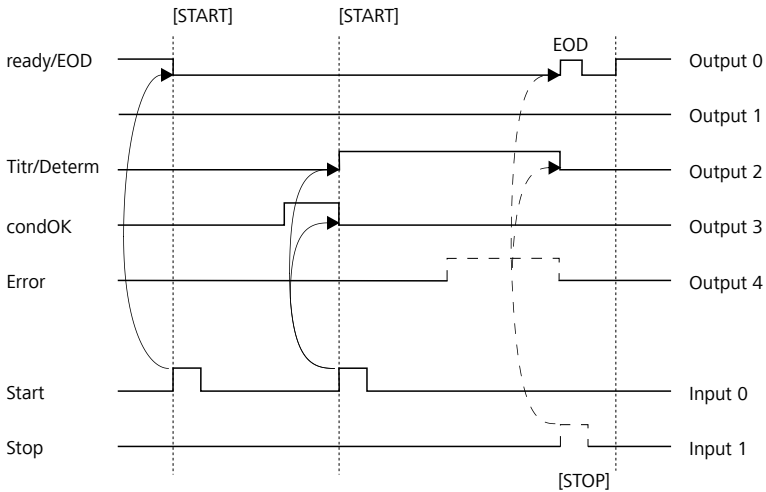


Figure 10 Remote status diagram

EOD = End of Determination



Command	Function	Comment
<b>\$A</b>	Confirm message	Confirm the message on the instrument with <b>[OK]</b> .  A mandatory status scan providing the message number must take place immediately before confirming the message, see above.
<b>\$A(OK), \$A(CANCEL)</b>	Confirm message	Confirm the message with <b>[OK]</b> or <b>[CANCEL]</b> .
<b>\$A(DELETE), \$A(CANCEL)</b>	Confirm message	Confirm the message with <b>[DELETE]</b> or <b>[CANCEL]</b> .
<b>\$A(YES), \$A(CANCEL)</b>	Confirm message	Confirm the message with <b>[YES]</b> or <b>[CANCEL]</b> .
<b>\$A(RECONNECT)</b>	Confirm message	Confirm the message with <b>[RECONNECT]</b> .
<b>\$L(<i>method name</i>)</b>	Load method	The method name must be known and unique.
<b>\$Q(<i>variable</i>)</b>	Request variable value	Examples for variables: <i>EP1</i> , <i>R1</i> , <i>C00</i> .  Complete list of the variables: see chapter <i>Formula editor</i> .

The values of the variables are only available after the end of a determination (in the status 'ready').

Acknowledgement of the instrument	Comment
<b>OK</b>	Command executed
<b>E1</b>	Method not found
<b>E2</b>	Invalid variable
<b>E3</b>	Invalid command

## 3.7 Arithmetic algorithms

### Numerical format

The device software calculates in accordance with the widespread standard IEEE 754 (IEEE Standard for Binary Floating-Point Arithmetic for Microprocessor Systems). The numbers are used in calculations in "double precision" (64 bit). Decimal numbers are converted into binary numbers in the computer and used in this form for calculations. The output on the display and in reports once again contains decimal numbers; the binary numbers are thus converted back into decimal numbers. In order to check the internal calculations performed by the computer yourself in accordance with IEEE 754, the numbers are reproduced in the calculation report in complete accuracy. A minimal difference may arise between an originally entered decimal number and the internal computer representation in complete accuracy in the range of the rear decimal places. This difference results from the fact that an exact binary equivalent does not exist for every decimal number. If, for example, you enter the sample size 50.3 mg, then this will be depicted in the calculation report in "double precision" with 5.029999999999999E+01.

### Rounding-off process

Measured values and results are rounded to the defined number of decimal places (commercial rounding, in accordance with the US Pharmacopeia USP). If the digit at the first dropped decimal place is **1, 2, 3 or 4**, then it will be rounded down. If this digit is **5, 6, 7, 8 or 9**, then it will be rounded up. Negative digits will be rounded in accordance with their amount (away from zero).

### Statistics

The arithmetic mean value and the absolute and relative standard deviations of results are calculated:

A maximum of five results ( $1 \leq k \leq 5$ ) calculated in a determination can be statistically evaluated. A statistical series can contain a maximum of 20 determinations ( $1 \leq n \leq 20$ ).

The following convention applies to the subsequent formulas:

$$1 \leq n \leq 20 \text{ and } 1 \leq k \leq 5.$$

---

Mean value:

$$\bar{x}_k = \frac{1}{n} \cdot \sum_{i=1}^n R_{k,i}$$

---

Absolute standard deviation:

$$S_{abs_k} = + \sqrt{\frac{\sum_{i=1}^n (R_{k,i} - \bar{x}_k)^2}{n-1}}$$


---

Relative standard deviation (in %):

$$Srel_k = 100 \cdot \frac{Sabs_k}{\bar{x}_k}$$

### Explanations

The individual values are incorporated in the statistics with full accuracy.

15 significant places are yielded when the 64 bit numerical format is applied for the floating-point number in decimal presentation.

The accuracy can be controlled by the selection of the prefix of the unit (milli, micro) and the number of decimal places.

### Example

The result displayed, **1234.56789158763 mg/L**, has 15 significant places. It should be rounded off to 3 decimal places according to the above rounding-off process:

- **1234.568 mg/L.**

If the same result is expressed in **g/L (1.23456789158,763 g/L)**, and is also rounded off to 3 decimal places, then this will yield:

- **1.235 g/L.**

This means you obtain the lowest losses of accuracy with rounding if you select the application and the numerical format in such a way that the numbers displayed have as many places **before** the decimal point as possible.

A complete recalculation of the statistics using a pocket calculator or a computer calculation program may exhibit deviations. This can be explained by the different binary numerical formats used by these computers.

**i** The above losses of accuracy by rounding off in the range of significant places are only theoretically relevant. They are generally several orders of magnitude less than measurement technique uncertainties (balance errors, dosing errors, measuring errors).



## **4 Delivery and transport**

### **4.1 Delivery**

Inspect the delivery immediately upon receipt:

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

### **4.2 Packaging**

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

## 5 Installation

### 5.1 Setup location

The product is only suitable for operation indoors and may not be used in explosive environments.

The following requirements apply to the setup location:

- The room is well-ventilated and protected against both direct sunlight and excessive temperature fluctuations.
- The setup space is stable and free of vibrations. The setup space must be suitable for the dimensions and weight of the components (see technical specifications).
- All cables and connectors are accessible during operation. The cables are safely installed (no tripping hazards).
- The workplace is ergonomically designed and ensures trouble-free operation of the product.

### 5.2 Connecting the power cord



#### **WARNING**

##### **Health hazards from electrical potential.**


Severe injuries with possibly fatal consequences.

- Operate the product only if it is in perfect condition. The housing must also be intact.
- Only use the product with the covers fitted.
- Protect live components (e.g. power supply unit, power cord, connection sockets) against moisture.
- Always have maintenance work and repairs on electrical components carried out by a regional Metrohm service representative.

#### **Connecting the power cord**

##### **Required accessories:**

- Power supply unit (6.2164.010)

 Use only this power supply unit. Other products are not permitted.

- Power cord:
  - Length: max. 2 m
  - Number of conductors: 3, with protective ground
  - Conductor cross-section: 3 × min. 1.0 mm<sup>2</sup> / 18 AWG
  - Coupling: IEC 60320, type C13, 10 A
  - Power plug: 6.2122.XX0 (according to customer requirement), min. 10 A

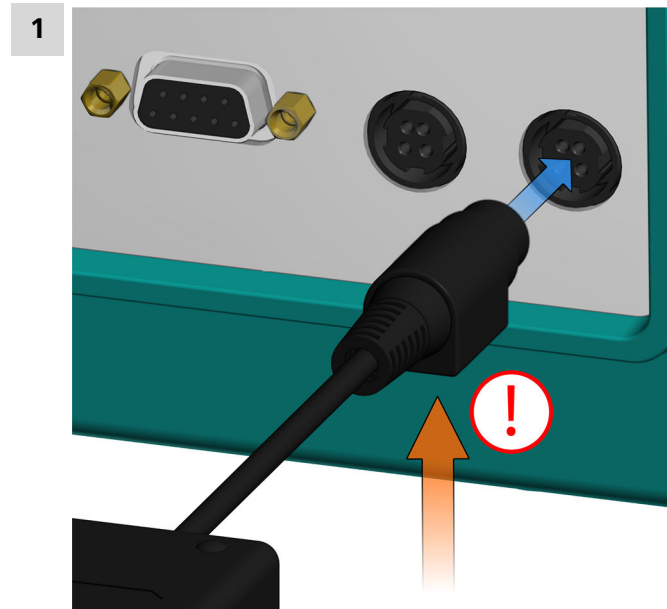


Figure 11 Rear of the instrument – Connecting the power cord  
Connect the power supply unit to the **Power IN** connector.  
Note the alignment (see figure).

2 Connect the power cord to the power supply unit.

3 Connect the cable to the energy supply.

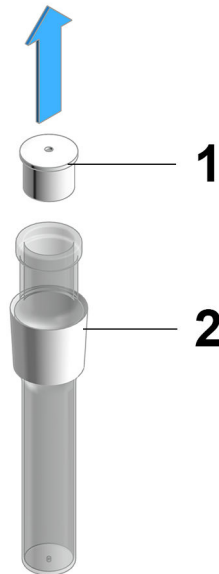
The instrument can now be switched on and off: (see "Switching the instrument on and off", chapter 6.1, page 31)

## 5.3 Filling the adsorber tube

### Required accessories:

- Cotton for adsorber tube (6.02801.000)
- Molecular sieve (6.2811.000 / 6.2811.010)

#### 1 Removing the lid



- Remove the lid (1) by pulling it out of the housing (2).

#### 2 Filling the housing with adsorber material

- Insert cotton wool loosely into the bottom of the housing. Do not pack the cotton too tightly as sufficient gas flow must be possible.
- Use a molecular sieve to fill the housing to approx. 1 cm under the housing edge.
- Place cotton wool on the molecular sieve. Do not pack the cotton too tightly as sufficient gas flow must be possible.

### 3 Sealing the housing with the lid



- Seal the housing with the lid.
- i** Check whether the sealing surface between the housing and the lid is clean and dry and that no residual filling material whatsoever is present!

## 5.4 Equipping the titration cell

### Preparing the titration cell

#### Prerequisite:

- The adsorber tube is filled.
- 1** Place the stirring bar in the titration cell.
  - 2** Cut the 6.2713.0x0 sleeves to the correct length and attach them to the ground joints of the inserts (electrodes, adsorber tube, ground-joint stopper).
- i** Ensure that the edges of the sleeves are cut to size cleanly and that there are no fringes left over. The sleeves must not protrude at the lower edge of the ground-joint opening.

- 3 Insert the generator electrode (6.0345.100 without diaphragm or 6.0344.100 with diaphragm) with the attached sleeve into the large ground-joint opening at the rear.
- 4 Insert the filled adsorber tube with attached sleeve into the generator electrode.
- 5 Insert the indicator electrode with the attached sleeve into the left ground-joint opening.
  - i** The two Pt wires of the indicator electrode should run as parallel as possible to one another. Check the Pt wires before inserting the electrode.
- 6 Place the septum on the front opening of the titration cell and screw it shut with the screw cap .
  - i** Tighten the screw cap only enough so that it seals. The septum must not bend.

## 5.5 Filling the titration cell

### Using a generator electrode with diaphragm

#### Prerequisite:

- The Karl Fischer titration cell is completely equipped with a generator electrode with diaphragm.

#### Required accessories:

- Funnel (6.2738.000)
- Ground-joint stopper (6.1437.000) with attached PTFE sleeve SGJ 14 (6.2713.000)

- 1 Remove the adsorber tube from the generator electrode.
- 2 Fill approximately 5 mL of catholyte into the generator electrode.
- 3 Insert the funnel into the right ground-joint opening and use it to fill approx. 100 mL of anolyte into the Karl Fischer titration cell.  
The level of the anolyte should be roughly 1 to 2 mm above the level of the catholyte.
- 4 Remove the funnel.



- 5 Reinsert the adsorber tube into the generator electrode.
- 6 Insert the ground-joint stopper with attached PTFE sleeve SGJ 14 into the right ground-joint opening.

### Using a generator electrode without diaphragm

#### Prerequisite:

- The Karl Fischer titration cell is completely equipped with a generator electrode without diaphragm.

#### Required accessories:

- Funnel (6.2738.000)
- Ground-joint stopper (6.1437.000) with attached PTFE sleeve SGJ 14 (6.2713.000)

- 1 Use a funnel to fill approximately 100 mL of reagent into the Karl Fischer titration cell.
- 2 Insert the ground-joint stopper with attached PTFE sleeve SGJ 14 into the right ground-joint opening .

## 5.6 Mounting the titration cell

#### Prerequisite:

- The titration cell is filled.

- 1 Attach the titration vessel holder (4-2) to the magnetic stirrer.
- 2 Insert the filled titration cell into the titration vessel holder.

## 5.7 Mounting the Solvent Pump (optional)

### Prerequisite:

- The titration cell is filled and assembled.

### Required accessories:

- Solvent Pump (2.1029.0010)
- KF addition and aspiration tube (6.1439.010)
- PTFE sleeve SGJ 14 (6.2713.000)

- 1** Remove the ground-joint stopper together with the PTFE sleeve SGJ 14 from the opening in the titration cell.
- 2** Insert the ground-joint stopper with attached PTFE sleeve SGJ 14 at the top into the addition and aspiration tube.
- 3** Cut a sleeve to size and attach to the ground surface of the addition and aspiration tube.
- 4** Insert everything into the right ground-joint opening of the titration cell.
- 5** Connect the tubing for the reagent addition at the upper connector of the addition and aspiration tube.
- 6** Connect the tubing for the aspiration of the titration cell at the lower connector of the addition and aspiration tube.

### See also

*[Reagent replacement \(chapter 7.2, page 98\)](#)*

## 5.8 Assembling the electrodes

### CAUTION


#### Risk of cuts from sharp edges

Cut injuries due to damaged glass parts and pieces of broken glass.

- Handle glass parts (e.g. electrodes, bottles) with care.
- Only use undamaged glass parts.
- Dispose of damaged glass parts immediately.

#### Assembling the indicator electrode

- 1 Unscrew the protective cap from the indicator electrode . Keep the protective cap.
- 2 Screw the electrode cable to the indicator electrode and then connect the electrode cable to the **Ind. (3-3)** connector.

 A new indicator electrode may require a certain warm-up time for surface formation. During this time, unexpectedly long titration times and excessively high measuring results can occur. This phenomenon will, however, disappear after a short time of use. To accelerate the setting of a new indicator electrode, the Eco Coulometer can be conditioned (e.g. over night).

#### Assembling the generator electrode

- 1 Unscrew the protective cap from the generator electrode . Keep the protective cap.
- 2 Screw the electrode cable to the generator electrode and then connect the electrode cable to the **Gen. (3-8)** connector.


## 6 Operation and control

### 6.1 Switching the instrument on and off

#### Switching on the instrument

##### Prerequisite:

- The power cord is connected.
- The instrument is switched off.

**1** Press the  key.

The instrument is initialized and a system test is performed.

 If enabled in **System** ► **Settings**, then the following can occur after switching on:

- A **beep** sounds.



The instrument is switched on and the **Start page** is displayed.

#### Switching off the instrument

##### Prerequisite:


- The instrument is switched on.

**1** **Key combination**

- Press and hold down the  key.
- Also press the  key and hold down both keys until the progress bar is full.

The instrument is switched off.  
Release key to cancel.



 If the keys are released during this time, then the instrument will remain switched on. This is to prevent accidental switch-off.

The instrument is switched off.



## Instant Up

The **Instant Up** function locks the indicators and controls, but ensures that the instrument is immediately available again at the touch of a button.

### Activating and deactivating Instant Up

#### Prerequisite:


- The instrument is switched on.

#### 1 Activating Instant Up

- Press and hold down the  key until the progress bar is full.

Instant up is activated.  
Release key to cancel.



-  If the key is released during this time, then the indicators and controls will remain active.

**Instant Up** is activated. Indicators and controls are inactive.

#### 2 Deactivating Instant Up

- To deactivate **Instant Up**, press the  key.  
The indicators and controls are available again.

## 6.2 User interface

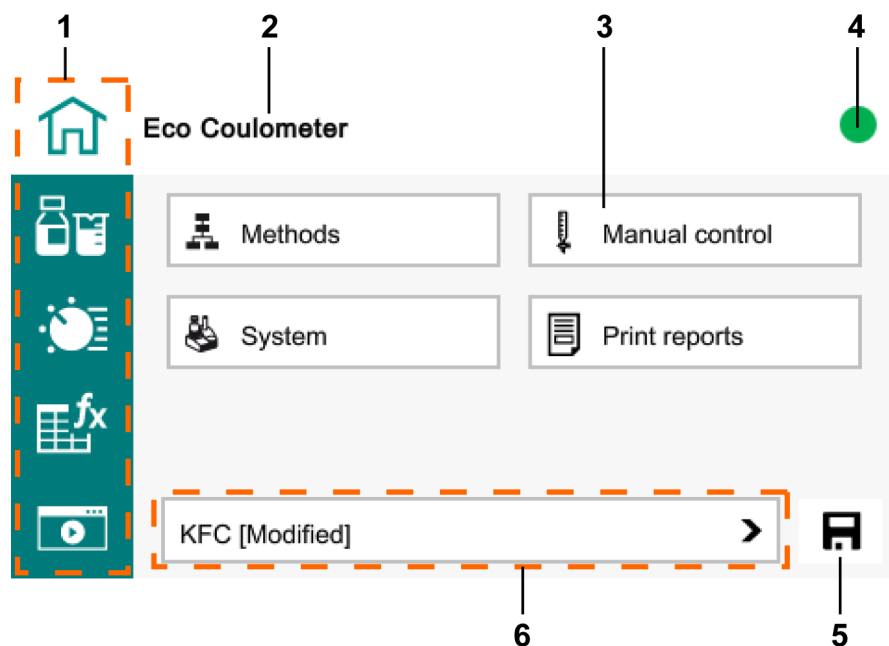


Figure 12 Start page

1	Work areas	2	Menu path
3	Button	4	Status indicator
5	Icon	6	Method selection bar

### Work areas

Once the instrument is ready for operation, the work areas can be selected. Work areas that cannot be selected are grayed out.

The following work areas can be selected:



#### Eco Coulometer start page

The start page with access to the functions:

- Methods
- Manual control
- System
- Print reports



#### Sample data

Access to the sample data: sample size, unit, ID1 and ID2



### Icon

The following functions can be called up with the different icons - depending on the context:

- Save
- Delete
- Export
- etc.

### Method selection bar


The method selection bar (12-6) on the start page shows the method that has been loaded.

Display in the method selection bar	Meaning
Method name	The method is saved in the method list.
Method name [New]	The method has just been created. It has not been saved.
Method name [Modified]	The method has been modified. The modifications have not been saved.

A new or modified method is available for determinations until it is changed or until another method is loaded. The method can be saved in the method list for use at a later point in time.

### Brightness of the display

Setting the brightness of the display: (see "Instrument diagnosis", chapter 6.7.5, page 67)

 The most recently set brightness is used when the instrument is switched on.

### Keyboards

Different keyboard types are available.



Figure 13 Keyboard (example: lower-case characters)

<b>1</b>	<b>Input field</b>	<b>2</b>	<b>Delete the entry</b>
<b>3</b>	<b>Backspace</b>	<b>4</b>	<b>Cancel the entry (close the window)</b>
<b>5</b>	<b>Apply the entry</b>	<b>6</b>	<b>Forwards in the input field</b>
<b>7</b>	<b>Backwards in the input field</b>	<b>8</b>	<b>Space</b>
<b>9</b>	<b>Switch keyboard</b>		

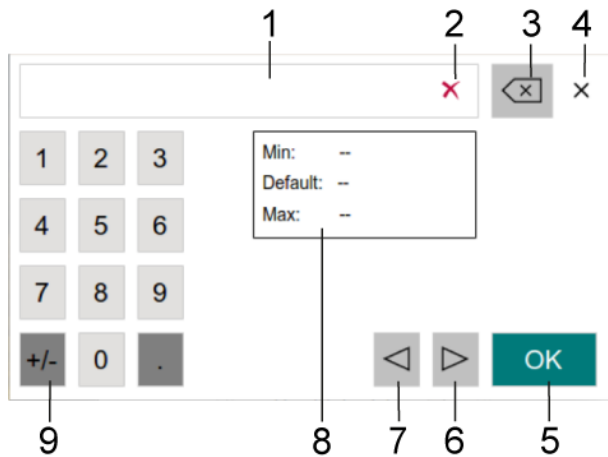


Figure 14 Keyboard (example: numbers)

<b>1</b>	<b>Input field</b>	<b>2</b>	<b>Delete the entry</b>
<b>3</b>	<b>Backspace</b>	<b>4</b>	<b>Cancel the entry (close the window)</b>
<b>5</b>	<b>Apply the entry</b>	<b>6</b>	<b>Forwards in the input field</b>
<b>7</b>	<b>Backwards in the input field</b>	<b>8</b>	<b>Specifications</b>
<b>9</b>	<b>Algebraic sign change</b>		

### 6.2.1 Formula editor



Figure 15 Formula editor

<b>1</b>	<b>Input field</b>	<b>2</b>	<b>Delete the entry</b>
<b>3</b>	<b>Backspace</b>	<b>4</b>	<b>Cancel the entry (close the window)</b>
<b>5</b>	<b>Apply the entry</b>	<b>6</b>	<b>Forwards in the input field</b>
<b>7</b>	<b>Backwards in the input field</b>		

The formula editor allows for the entry of formulas. 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
EP1	Water quantity at the endpoint in µg
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

"#" stands for a sequential number that must be entered manually. Example: If the variable **R#** is applied in the formula, only **R#** is entered. In order to define the result to be used, the corresponding number has to be added manually after "R#". Example: **R5**

### Variables

Clicking on **[Var]** displays a list with additional variables. These variables can be selected from this list and applied with **[OK]**.

Variable	Description
MCQ	End quantity, i.e. total amount of titrated water at the end of the titration (in µg)
MCD	Duration of the entire titration
MDC	Drift for drift correction
DDC	Time for drift correction
MIM	Initial measured value, i.e. measured value prior to the processing of the start conditions
MCM	End measured value
MCT	End temperature
DD	Duration of the entire determination

## 6.3 Manual control

The **[Manual control]** button on the start page provides the following functions:

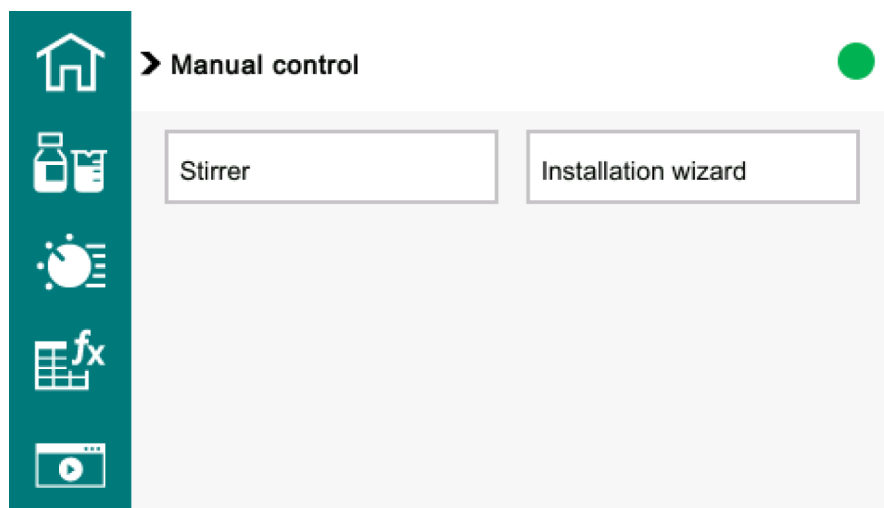


Figure 16 Manual control

- Stirrer – Switch the stirrer on and off and set the stirring rate
- Installation wizard – Start the installation wizard.

### 6.3.1 Operating the magnetic stirrer

#### Switching the stirrer on and off

##### Prerequisite:

- The instrument is switched on.
- The titration cell is assembled.
- Or:  
The titration vessel holder is empty.

#### 1 Only with empty titration vessel holder

Place a suitable vessel on the titration vessel holder and insert a stirring bar into it.

2 On the **start page**, click on the **[Manual control]** button.

3 Click on the **[Stirrer]** button.


The controls for the magnetic stirrer are displayed.

#### 4 Switching on the stirrer

Click on the  button (visible only if the stirrer is switched off).

The stirrer begins stirring with the set stirring rate.

#### 5 Switching off the stirrer

Click on the  button (visible only if the stirrer is switched on).

The stirrer stops.

#### Stirring rate

#### Setting the stirring rate

The stirring rate can be adjusted in 15 steps. The default value is 8.




##### Prerequisite:

- The stirrer is switched on.


- The magnetic stirrer controls are displayed: **Start page** ► **Manual control** ► **Stirrer**

### 1 Reducing the stirring rate in steps

Click on the  button to reduce the stirring rate until the desired stirring rate has been reached.

The current stirring rate is displayed.

### 2 Increasing the stirring rate in steps

Click on the  button to increase the stirring rate until the desired stirring rate has been reached.

The current stirring rate is displayed.

## 6.4 Methods

### Definition

A **Method** determines how determinations are carried out. Parameters are defined in a method.

Methods are saved under a freely selectable method name. A method name consists of a maximum of 12 characters.

### Method selection bar

If needed, another method can be loaded in the method selection bar . Determinations can be executed with the method that has been loaded.

### Method list

The **[Methods]** button on the start page shows a list of all the saved methods. Methods can be created, exported and deleted here.

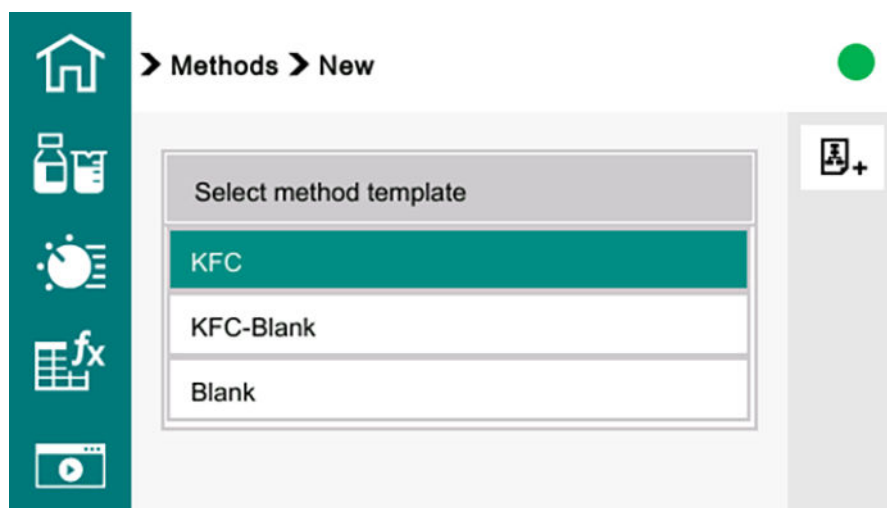


Figure 17 Method list (example)

A scroll bar appears if the list is longer.

### Method templates

All the method templates are already configured except for a few parameters.

- **KFC** – Coulometric Karl Fischer titration.
- **KFC-Blank** – Coulometric Karl Fischer titration minus the blank value.
- **Blank** – Coulometric blank value determination.

## 6.4.1 Using and managing methods

Methods are used as follows:

- **Load method** – Allows for the execution of determinations with the method that has been loaded. Allows for changes of the method that has been loaded.
- **Change method parameters** – Changes the parameters of the method that has been loaded.
- **Store method** – The method that has been loaded can be added to the method list.

The following options are available to create and manage methods:

- **Create new method**
- **Delete method** – Remove the method from the method list.
- **Export method** – Save the method to a USB flash drive.
- **Import method** – Add a method from a USB flash drive to the method list.

### Loading the method

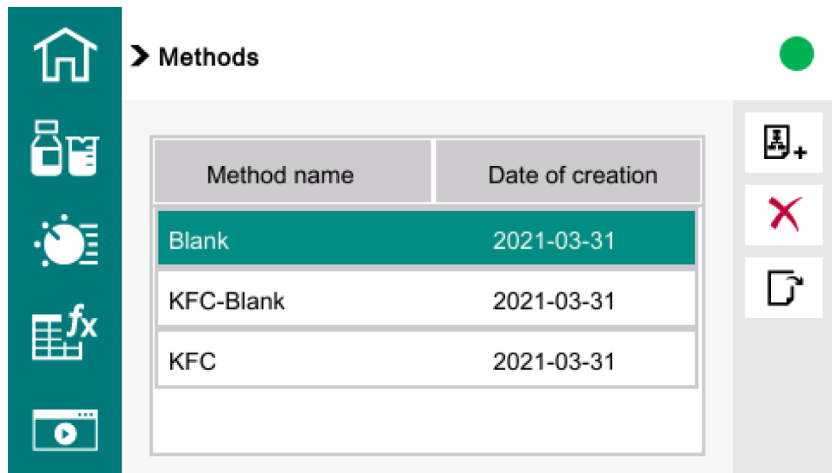
**Prerequisite:**



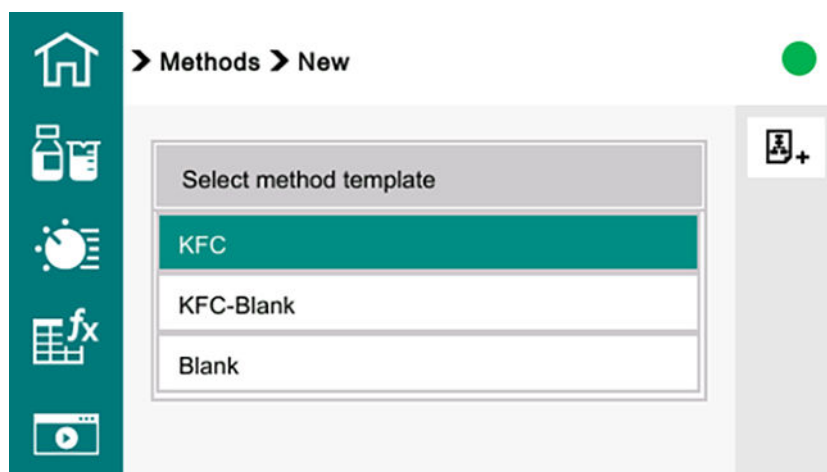
- The **Start page** is displayed.
- 1 Open the method selection bar by clicking on **>**.  
A list with the saved methods appears. The list can be searched with the scroll bar.
  - 2 Select the desired method.  
The desired method appears in the method selection bar and is loaded.  
The method is available for determinations.

### Creating a new method

- 1 On the **Start page**, click on the **[Methods]** button.  
The method list opens.



- 2 Create a new method: +  
A selection of method templates appears.



**i** If modifications on the method that was loaded before have not been saved, the following warning appears:

**Store method: The modifications of the current method have not been saved. Do you want to load the method anyway?**

- **[Yes]** – a new method is created. The changes on the method that is currently loaded are discarded.
- **[Cancel]** – creation of the new method is canceled.

**3** Click on the desired method template.

**4** Click on .

The new method appears in the method selection bar. The method is marked with **[New]**. Example: KFC [New]

**5** **Change the method parameters** or **save the method** as required.

### Changing the method parameters

#### Prerequisite:


- The method to be changed is loaded.

**1** Load the method that you want to change in the method selection bar on the **Start page**.

**2** Open the **Parameters** work area: 

**3** Set the parameters if necessary.


The method is available for determinations.

 Metrohm recommends saving the method after changing parameters.

### Saving a method

#### Prerequisite:

- The method that you want to save is loaded in the **Method selection bar**.
- The method is marked [New] or [Modified].

**1** Save the method: 


An input field for the name appears.

**2** Click on the input field.

A keyboard appears.

**3** Enter the desired name with the keyboard. Finish with **[OK]**.

The name that was entered appears in the method selection bar. The method is now saved in the method list.

 A maximum of 120 methods can be saved.

### Deleting a method

**1** On the **Start page**, click on the **[Methods]** button.

The method list appears.

**2** Click on the method that you want to delete.

The selected method is highlighted in green.

**3** Delete the highlighted method: 

The warning **Delete method** appears.

**Warning: Delete method**

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Do you really want to delete the method?

Delete

Cancel

**4** Confirm deleting: **[Delete]**

The deleted method is no longer available in the method list.

**Exporting a method****1** Connect the USB flash drive to the instrument.**2** On the **Start page**, click on the **[Methods]** button.

The method list appears.

**3** Click on the method that you want to export.

The selected method is highlighted in green.

**4** Export the marked method: 

The message **Exporting method to USB flash drive...** appears.

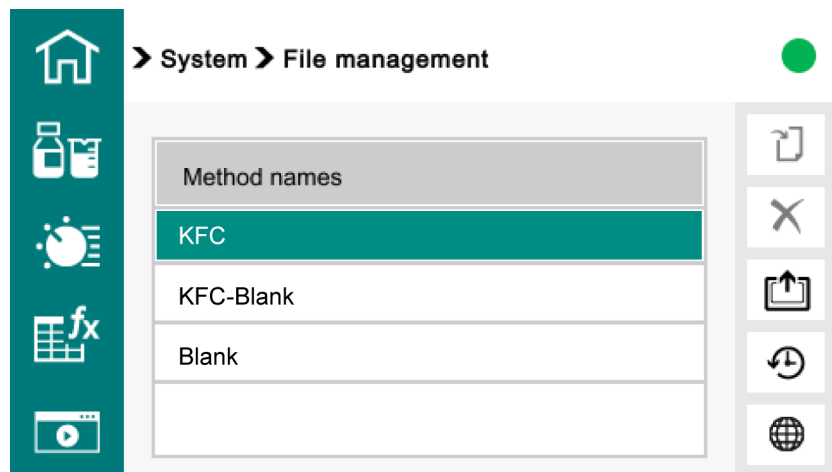
Once the message has disappeared, the method is saved to the USB flash drive that is connected.

**i** If a method with the same name already exists on the USB flash drive, then the following warning appears: **Store method: Method name already exists. Do you want to overwrite the name?**

- **[Yes]:** The method on the USB flash drive will be overwritten.
- **[No]:** The method will not be exported.

**Importing a method****1** Connect the USB flash drive to the instrument.**2** On the **Start page**, click on the **[System]** button. Move to page 2 and click on **[File management]**.

A list with the methods saved on the USB flash drive appears.




- 3 Click on the method that you want to import.

The selected method is highlighted in green.

- 4 Import the highlighted method: 

The message **Importing method from USB flash drive...** appears.

Once the message has disappeared, the method is saved to the instrument.

 If a method with the same name already exists on the instrument, then the following warning appears: **Store method: Method name already exists. Do you want to overwrite the name?**

- **[Yes]:** The method on the instrument will be overwritten.
- **[No]:** The method will not be imported.

## 6.5 Sample data

### Definition

A **sample** is the substance to be analyzed. With the **sample data**, the samples can be identified.

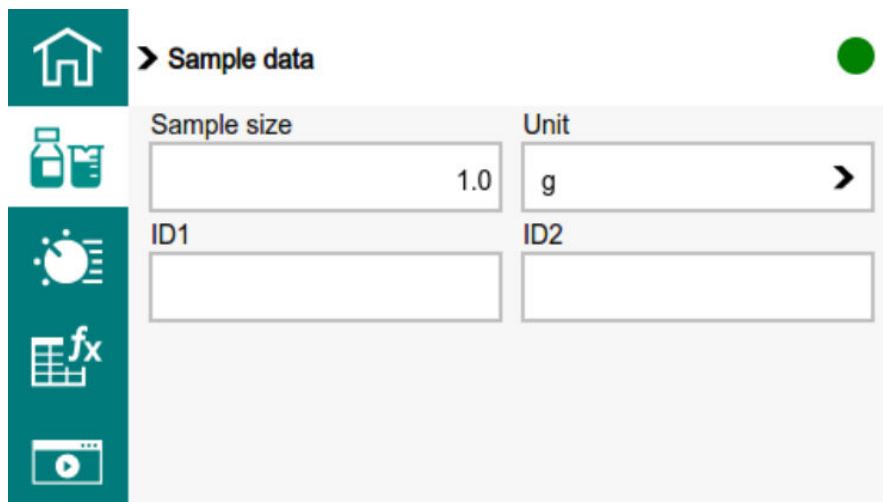
### Input options

There are 2 options for entering sample data:

- Directly in the **Sample data** work area.
- Automatic request immediately after the start of the determination.

### Entering the sample data in the Sample data work area

Click on the  button to display the **Sample data** work area:



Sample size	Unit
1.0	g
ID1	ID2

Figure 18 Sample data

The data for the sample can be entered in the **Sample data** work area, even if the determination is ongoing.

#### ID1

The sample identification **ID1** can be used in calculations as the variable **CI1**.

---

Input: max. 10 characters


Default value: empty

---

#### ID2

The sample identification **ID2** can be used in calculations as the variable **CI2**.



- 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  or until the sample data is transferred from the balance, even if the titration is already completed. This ensures that the sample data is available for calculations.

## 6.6 Samples

### Sample addition

This chapter contains a few notes concerning sample addition. An exhaustive discussion of this topic is not possible here. Further notes can be found in the literature from the reagent manufacturers and in the following **Metrohm Application Bulletins**:

Bulletin no.	Title
No. 137	Coulometric water content determination according to Karl Fischer

### Values for the sample sizes

The sample weight should be small in order to be able to titrate as many samples as possible in the same electrolyte solution and thus to keep the titration time short. Ensure that the sample contains at least 50 µg of H<sub>2</sub>O. The following table helps you determine the appropriate sample size.

Table 6 Recommended sample sizes

Water content of the sample	Sample size	Resulting water content
10,000 ppm = 1%	10–100 mg	100–1,000 µg
1,000 ppm = 0.1%	100 mg–1 g	100–1,000 µg
100 ppm = 0.01%	1 g	100 µg
10 ppm = 0.001%	5 g	50 µg

### Working with liquid samples

Add **liquid samples** with a syringe.

The samples can be injected two different ways:

- Use a syringe with a long needle and immerse it in the reagent during the injection.
- Use a syringe with a short needle and aspirate the last drop back into the needle.

Weigh the syringe before and after the sample addition to determine the sample amount injected. The difference in weight corresponds to the sample amount.

Use glass syringes for the **determinations of traces and validations**. Metrohm recommends obtaining these from a specialized syringe manufacturer.

Cool **highly volatile samples and samples of low viscosity** before sampling. Doing so avoids losses while working. The syringe must, however, not be cooled directly, as condensation could be formed. For the same reason, no air may be aspirated into a syringe into which a cooled sample has been aspirated beforehand.

**Samples of high viscosity** can be thinned by heating. Heat the syringe as well. The same target can be reached by diluting with a suitable solvent. In this case, the water content of the solvent has to be determined and subtracted as a Blank.

If samples contain only **traces of water**, pre-dry the syringe well. If possible, rinse the syringe with the sample solution by filling in and discarding solution several times.

#### **Working with solid samples**

If possible, extract or dissolve solid samples in a suitable solvent. Inject the resulting solution, at which time a blank value correction for the solvent must be carried out.

If no suitable solvent can be found for a solid sample, or if the sample reacts with the Karl Fischer reagent, then use a Karl Fischer oven.

### **6.6.1 Working with water standards**

#### **Certified water standards**

Commercially available, certified water standards with water content of about 1.00 mg/g and/or 0.10 mg/g should be used for validating the instrument as a whole, integrated system.

**i** The 1.0 mg/g water standard is easier to handle and is therefore preferred.

Table 7 Recommended weighing ranges

<b>1.0 mg/g water standard</b>	<b>0.2–2.0 g</b>
0.1 mg/g water standard	0.5–5.0 g

#### **Practical recommendations**

For validation, it is essential to work very accurately. In order to minimize any measurement inaccuracies that could occur, the sample preparation and the sample processing should proceed in accordance with a defined scheme:

- 1** Put on gloves (always for Karl Fischer titration).

2 Use a clean syringe.

**i** If you are working with the 0.1 mg/g water standard, then a glass syringe must be used. If you are working with the 1.0 mg/g water standard, then a plastic syringe or a glass syringe can be used.

3 Take a new ampoule of water standard and shake it briefly.

4 With a folded paper towel held between thumb and index finger, break open the ampoule at the marking.

5 Draw approx. 1 mL of the water standard into the syringe.

6 Dispose of the used water standard in a waste bottle.

7 Draw the rest of the water standard into the syringe, aspirating as little air as possible.

8 Push out any air bubbles that may be present in the syringe.

9 Wipe off the needle with a lint-free paper towel.

10 Place the syringe on the balance and press **[TARA]**.

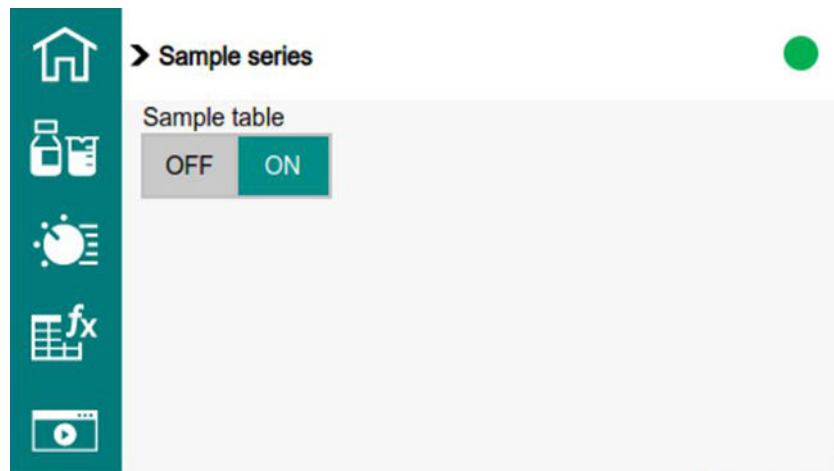
11 As soon as the drift on the Eco Coulometer is stable, take the syringe in your hand, press **[START]** and inject the water standard through the septum according to (*see table 7, page 50*).

There are 2 possibilities:

- Version 1:  
Inject the water standard without immersing the needle in the reagent liquid. If a little drop remains on the end of the needle, it must be aspirated back before pulling the needle out of the titration cell.  
The water standard should not be sprayed from the syringe onto the electrode nor onto the wall of the titration cell.
- Version 2:  
Inject the water standard directly under the surface of the reagent liquid.  
Ensure that no liquid is aspirated when you withdraw the syringe from the reagent liquid.

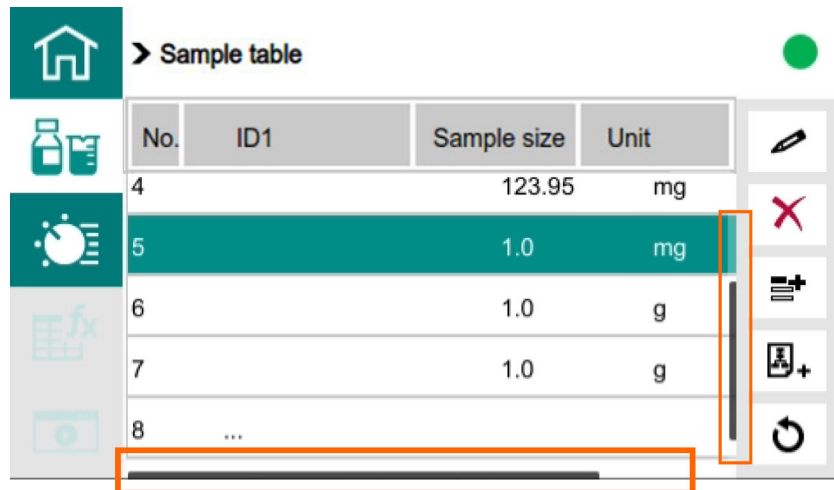
12 Place the syringe back on the balance.





The sample table is now enabled.

The **sample table** is displayed under the **Sample data** work area:



 The sample table can be scrolled horizontally and vertically.


### Creating new samples

#### Prerequisite:

- The sample table is activated.

**1** Open the **Sample data** work area: 

The **sample table** is displayed.

**2** Insert a new sample: 

The message **Inserting a new sample...** appears.



The new sample is inserted in the **sample table** as soon as the message disappears.


### Editing samples

**Prerequisite:**

- The sample table is activated.

1 Go to the **Sample data** work area: 

2 Click on the sample that you want to edit.  
The selected sample is highlighted in green.

3 Edit the sample: 

4 Make the desired changes.


### Deleting individual samples

**Prerequisite:**

- The sample table is activated.

1 Go to the **Sample data** work area: 

2 Click on the sample that you want to delete.  
The selected sample is highlighted in green.

3 Delete the sample: 

The message **Do you really want to delete the selected line?** appears.

**4** Confirm deleting: **[Delete]**

The sample is no longer available in the **sample table**.

### Resetting the sample table

**Prerequisite:**

- The sample table is activated.

**1** Go to the **Sample data** work area: 

**2** Reset **sample table**: 

The **sample table** is reset. All samples can be measured again.

### Creating a new sample table

**Prerequisite:**

- The sample table is activated.

**1** Go to the **Sample data** work area: 

**2** Create a new sample table:  +

The message **The whole sample table will be deleted. Do you want to continue anyway?** appears.

**Warning: Delete sample table**

025-118

The whole sample table will be deleted. Do you want to continue anyway?

Yes

No

**3** Confirm deleting: **[Yes]**

The existing **sample table** is now deleted and the samples can be created once again.

## 6.7 System – Configuration

The system configuration of the Eco Coulometer defines the basic, method-independent configuration of the instrument.

The following submenus can be found under the **[System]** button on the **Start page**:

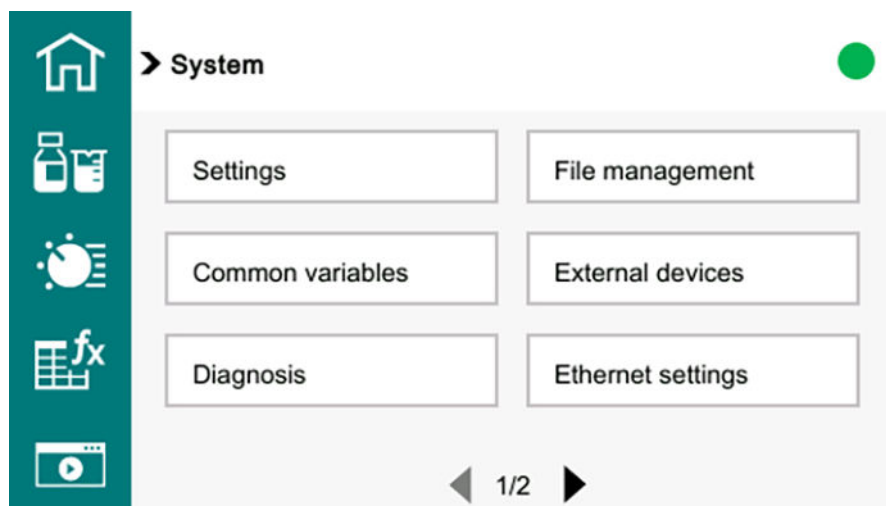


Figure 19 System menu page 1

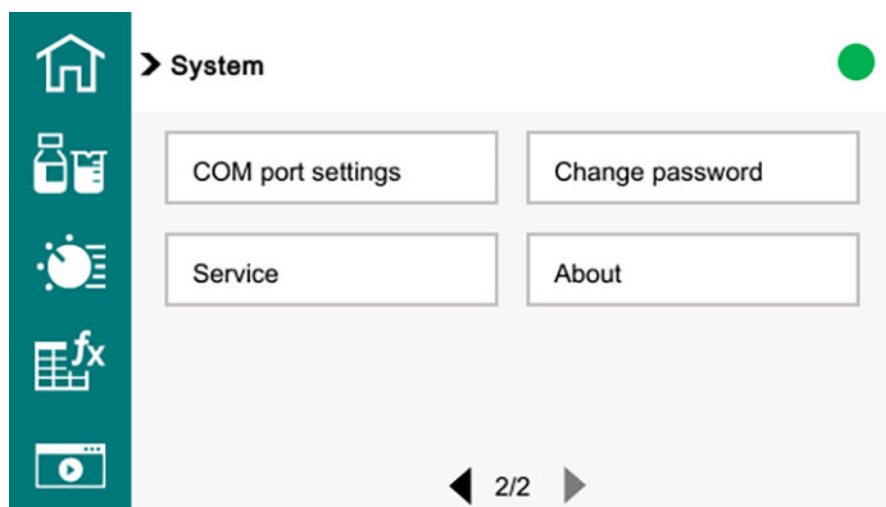


Figure 20 System menu page 2

### 6.7.1 System – Settings

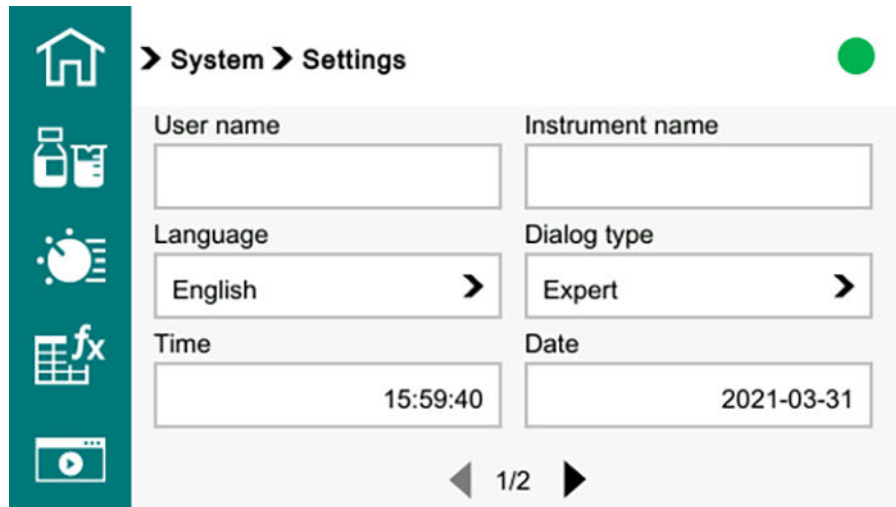


Figure 21 System – Settings page 1

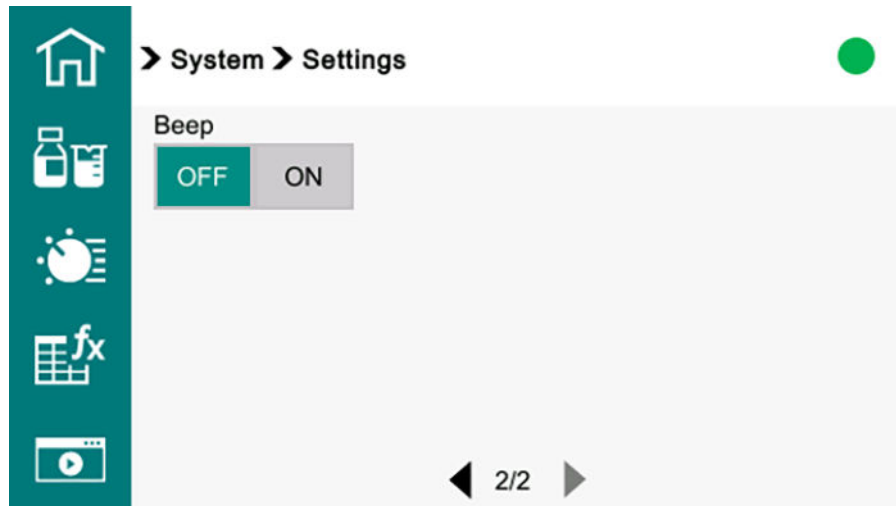


Figure 22 System – Settings page 2

#### User name

A user name can be entered for the report. This parameter will be printed only if a user has been defined.

---

Input: max. 12 characters

Default value: empty

---

#### Instrument name

An instrument name can be entered for the report. This parameter will only be printed if an instrument name has been defined.




---

Input: max. 10 characters

Default value: empty

---

**Language**

Set the dialog language.

**Dialog type**

The user rights can be restricted by changing the dialog type (*see "Setting the dialog type", chapter 6.7.1.2, page 59*).

---

Selection:

- **Expert**
- **Routine**

Default value: **Expert**

---

**Time**

Current time. Only numbers that make sense can be entered.

---

Format: hh:mm:ss

---

**Date**

Current date. Only numbers that make sense can be entered.

---

Format: YYYY:MM:DD

---

**Beep**

If **Beep** is activated, a short acoustic signal sounds in the following cases:

- At the press of a key.
- At the end of the determination.
- If the system remains in the status **Conditioning OK** without interruption for 10 seconds.

---

Switch:  OFF  ON

- **OFF**
- **ON**


Default value: **ON**

---

**6.7.1.1 Setting the language, date and time**

**Setting the language**

**Prerequisite:**

- The instrument is switched on.
- 1 On the **Start page**, open the **System ► Settings** menu.
  - 2 Click on ► for **Language** to expand the list.  
The list of available languages is displayed.
  - 3 Select the desired language from the list.  
 If the desired language is not available, import the language:  
The user interface is now displayed in the selected language.

### Setting the date and time

#### Prerequisite:

- The instrument is switched on.
- 1 On the **Start page**, open the **System ► Settings** menu.
  - 2 Click in the **Date** input field.
  - 3 Enter the current date. Format: YYYY-MM-DD.
  - 4 Confirm the entry with **[OK]**.
  - 5 Click in the **Time** input field.
  - 6 Enter the current time. Format: hh:mm:ss.
  - 7 Confirm the entry with **[OK]**.

#### 6.7.1.2 Setting the dialog type

- In the **Expert** dialog type, all the user settings are available.
- In the **Routine** dialog type, the availability of the settings is restricted.  
The **[System]** and **[Methods]** menus as well as the **Parameters** work area can only be opened with a password.  
Saved methods can be selected on the start page in the method selection bar.

### Setting the Routine dialog type

- 1 On the **Start page** open the **System ► Settings** menu and go to page 2/2.



2 Click on ➤ for **Dialog type** to expand the list.

3 Select the **Routine** dialog type.

**i** If the instrument is switched off at this point, then the **Expert** dialog type will remain active.

4 Exit the **System** menu.

The instrument is now in the **Routine** dialog type. The availability of the settings is restricted.

### Setting the Expert dialog type

1 On the **Start page**, click on the **[System]** button.

The **Enter password** prompt appears:

Enter password:



2 Click in the input field.

A keyboard appears.

- 3
  - Enter the password:  
Default value: **METROHM9100**
  - Confirm with **[OK]**.

**i** The password can be changed under **System ▶ Change password** (see *"Changing the password"*, chapter 6.7.8, page 69).

4 Confirm the entry with **[OK]**.

The **System** menu opens. The menu is now ready for use.

**i** If the instrument is switched off at this point, then the **Routine** dialog type will remain active.

5 Open the **Settings** menu.

6 Click on > for **Dialog type** to expand the list.

7 Select the **Expert** dialog type.

All the user settings are available again.

## 6.7.2 Managing common variables

Figure 23 Common variables

The instrument offers the possibility of saving **5 method-independent variables**, so-called **common variables**. These variables remain saved in the instrument and can be used in future calculations. Common variables are useful, e.g. for the following applications:

- Determination of a blank value which will be taken into account during the content determination of the sample.

The common variables have the designations **CV01–CV05** that cannot be changed. The value for every variable is displayed. No unit can be assigned to the common variables.

### Editing common variables

The common variables can be modified as follows:

- Manually in this dialog.
- Automatic assignment from the determination run. A calculation result must be configured accordingly for this purpose (see below).


### Assigning a result automatically to a common variable

#### 1 Loading the method

- Load the method that contains the result to be used in the **method selection bar** on the **Start page**.



### 2 Opening the editing dialog of the result


- Open the **Parameters** work area.
- Click on the **[Calculation]** button.
- Click on the result whose value is to be assigned to a common variable.
- Edit the highlighted result: 

### 3 Adjusting the result properties

- Enable the **Save as CV** switch:  OFF  ON

The assignment of the result to a common variable occurs automatically according to the following schematic diagram:

- Result **R1** ⇒ Common variable **CV01**
- Result **R2** ⇒ Common variable **CV02**
- etc.

 If the parameter **Statistics** is set to **[ON]**, then the mean value of the results will be assigned to the respective common variable.

## 6.7.3 Managing external devices

### System ► External devices

#### PC/LIMS report

Specification of the storage location for the PC/LIMS report. The PC/LIMS report is a machine-readable report with all of the important data for a determination. It can be saved as follows:

- as a TXT file on a USB flash drive.
- to a LIMS via the Ethernet interface and an RS-232 instrument server.

Selection:

- **USB flash drive**
- **Ethernet/RS-232**

Default value: **USB flash drive**

---

<b>USB flash drive</b>	The report is saved as a TXT file on the USB flash drive in the folder <b>pc_lims_report</b> .
<b>Ethernet/RS-232</b>	The report is sent via an RS-232 instrument server. The interface parameters are set on the RS-232 instrument server (see Application Bulletin AB-435).

## Printer

If a printer is connected, then the printer type needs to be defined here in order for the reports to be printed out correctly.

The printers that have the designation **ESC-POS** are so-called POS printers (point-of-sale printers), i.e. they print on continuous paper.

---

Selection:

- **PDF** (Save on USB flash drive)
  - **Custom (ESC-POS)**
  - **PostScript**
- Default value: **Custom (ESC-POS)**

Commercially available A4 printers that communicate via PostScript can be connected directly via USB.

---

## Keyboard layout

Layout of the on-screen keyboard.

---

Selection:

- **English US**
- 

## Balance

---

Selection:

- **Sartorius**
- **Mettler**

For balances with RS-232 interface: Use the 6.2148.050 USB/RS-232 Converter.

Configure the serial interface: [System ► COM port settings](#)

The parameters set for the RS-232 interface on the balance must match those on the instrument.

---

### 6.7.4 System – File management

#### [System ► File management](#)

This dialog offers the following functions:

- Importing a method from a USB flash drive to the instrument.
- Delete the method on the USB flash drive.
- Write a system backup to a USB flash drive.
- Restore the system of the instrument with an existing backup.



**!** The backup contains all the data and settings of the instrument. However, the password for the **Expert** dialog type is **not** included in the backup.  
When restoring to another instrument, the default value of the password applies.

**i** Metrohm recommends creating a backup of the current system status before restoring the system.

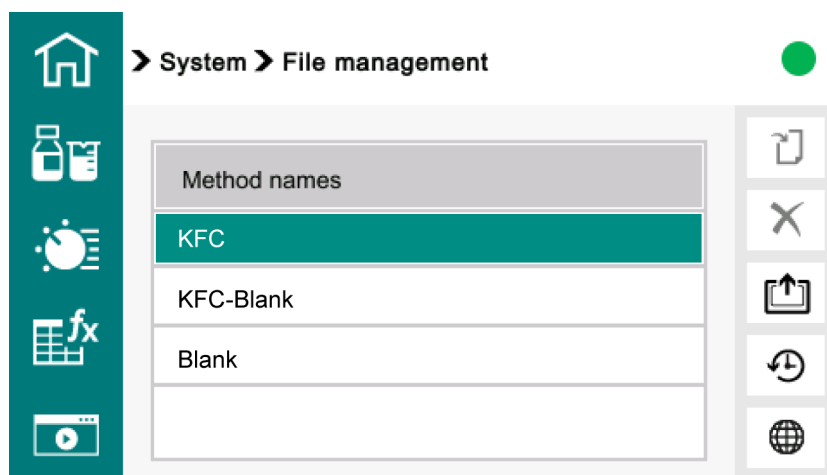
### Folder structure on the USB flash drive

A folder with the instrument number will be created on the USB flash drive. The structure within this folder appears as follows:

<b>Backup</b>	All of the files of the backup are stored in this folder. The folder is created as soon as a backup is created for the first time.  The file names of the backups are structured as follows: <i>SF_YYYY-MM-DD_hhmmss.ods</i>
<b>Files</b>	Exported methods are stored in this folder. The folder is created as soon as a method is exported for the first time.  Only methods located in this folder can be imported.
<b>pc_lims_report</b>	PC/LIMS reports are stored in this folder as TXT files. The folder is created as soon as a PC/LIMS report is printed for the first time.

### Importing a method

- 1** Connect the USB flash drive to the instrument.
- 2** On the **Start page**, click on the **[System]** button. Move to page 2 and click on **[File management]**.  
A list with the methods saved on the USB flash drive appears.




- 3 Click on the method that you want to import.  
The selected method is highlighted in green.

- 4 Import the highlighted method: 

The message **Importing method from USB flash drive...** appears.

Once the message has disappeared, the method is saved to the instrument.

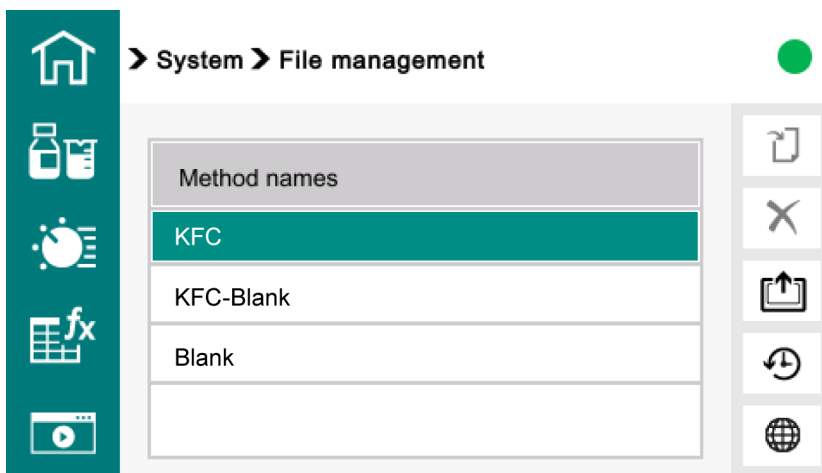
 If a method with the same name already exists on the instrument, then the following warning appears: **Store method: Method name already exists. Do you want to overwrite the name?**

- **[Yes]:** The method on the instrument will be overwritten.
- **[No]:** The method will not be imported.


### Deleting the method on the USB flash drive

- 1 Connect the USB flash drive to the instrument.
- 2 On the **Start page**, click on the **[System]** button. Move to page 2 and click on **[File management]**.


A list with the methods saved on the USB flash drive appears.



**3** Click on the method that you want to delete.  
The selected method is highlighted in green.


**4** Delete the highlighted method:   
The message **Method deleted successfully from USB flash drive.** confirms the deletion process.

### Creating a backup

- 1** Connect the USB flash drive to the instrument.
- 2** On the **Start page**, click on the **[System]** button. Move to page 2 and click on **[File management]**.
- 3** Start the backup:   
The message **Backing up data and settings to USB flash drive...** appears.  
Once the message has disappeared, the backup is saved to the USB flash drive.

### System restore

- 1** Connect the USB flash drive to the instrument.
- 2** On the **Start page**, click on the **[System]** button. Move to page 2 and click on **[File management]**.

**3** Restore the system: 

A list with the backups saved on the USB flash drive appears.

The file names of the backups are structured as follows: *SF\_YYYY-MM-DD\_hhmmss.ods*

**4** Click on the desired backup.

The **System restore** warning appears.

**Warning: System restore**

020-125

Do you really want to restore the system?



**5** Confirm the system restore: **[Yes]**

The following message appears before the instrument is restarted:  
**System files are restored. Press [Continue] to restart the instrument.**

**6** Restart the instrument: **[Continue]**

The instrument restarts. The system is restored.

**6.7.5 Instrument diagnosis**

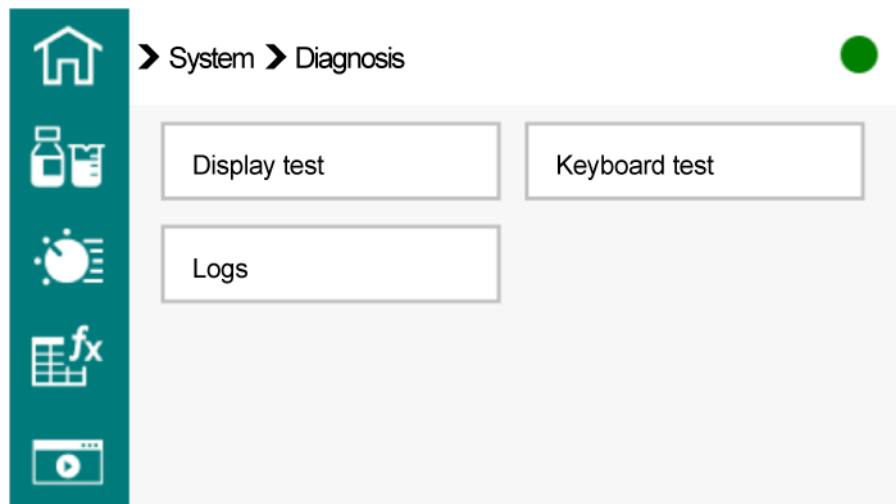


Figure 24 System menu – Diagnosis

### Display test

The **[Display test]** button offers settings for brightness, various test images and a calibration program for the screen:

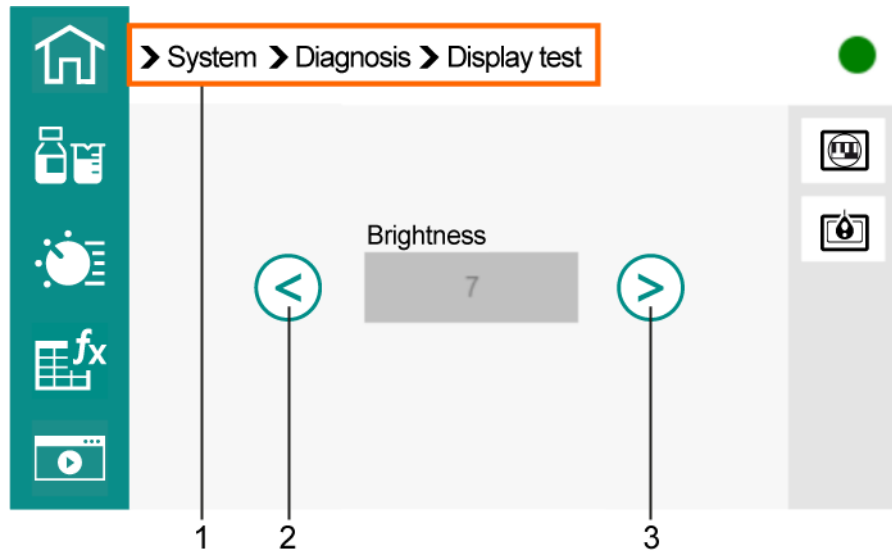




Figure 25 Display – Controls

- |                                |                              |
|--------------------------------|------------------------------|
| <b>1</b> Menu path             | <b>2</b> Reducing brightness |
| <b>3</b> Increasing brightness |                              |

**Brightness** The current brightness is displayed.






 Shows a number of test images for checking image quality.

 Starts the calibration program.


- Look at the screen in such a way that your line of sight is vertical to the screen.
- A crosshair appears in succession at various places on the screen. Each time, click in the center of the crosshair.


Once the calibration has been completed, the instrument is restarted automatically.

### Keyboard test

- Start the test: **[Keyboard test]**
- Press the 5 keys of the control bar one after the other:
  -     
- The instrument confirms each successful press of a key with a check mark: ✓

### Logs

- Show error log: **[Logs]**
- Save error log to a USB flash drive: 

 If the instrument displays an error, then the error log is deleted again after the second start.

## 6.7.6 Ethernet settings

### System ► Ethernet settings

Example of usage: Reports can be sent to a LIMS directly via an RS-232/Ethernet Box.

### Mode

This network configuration can be done manually or automatically.

Selection:

---

- **Static**  
The network configuration is done manually. The input fields **IP address**, **Subnet mask** and **Gateway** are used for this.
  - **DHCP**  
The network configuration is assigned automatically via a server.  
Default value: **DHCP**
- 


## 6.7.7 Service – Brief description

The **[Service]** button leads to a protected area to which only regional Metrohm service representatives have access.

## 6.7.8 Changing the password

With the password for the **Expert** dialog type, you can control access to the **System** and **Methods** menus as well as to the **Parameters** work area.

Changing the password for the **Expert** dialog type:

- 1 On the **Start page**, open the **System ► Change password** menu.
- 2 Enter the current password and then the new password twice.
- 3 Perform the change:   
The password is changed.



---

Selection:

- **1**
- **2**

Default value: **1**

---

## Parity

Type of parity testing.

---

Selection:

- **Even**
- **None**
- **Odd**

Default value: **None**

---

## Handshake

Type of data transfer protocol.


---

Selection:

- **Hardware**
- **Software**
- **none**

Default value: **Hardware**

---

 If communication problems occur, set the parameter **Handshake** to **Software**, and make another attempt.

### 6.7.10 Displaying system data

The **System** ► **About** menu path shows detailed information on:

- Program version
- Instrument
- Main board
- Measuring interface

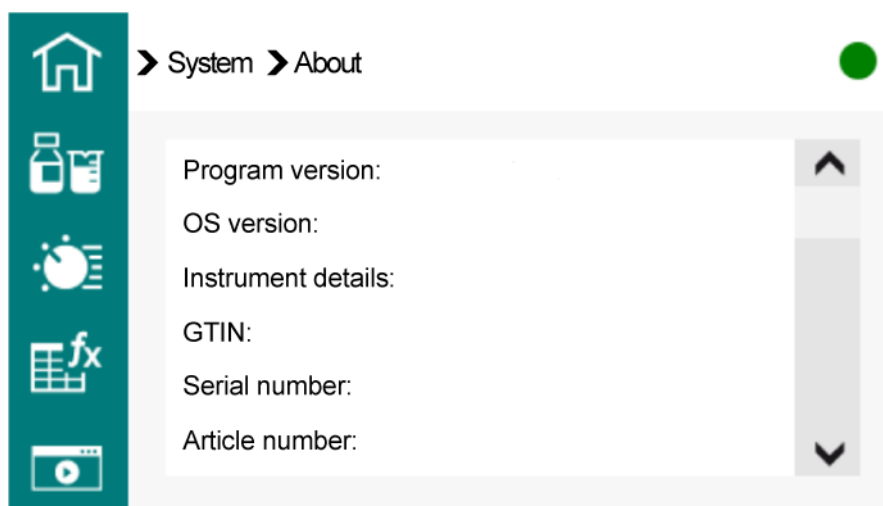



Figure 26 System data

## 6.8 Carrying out the determination


### 1 Loading the method

- Load the desired method.

### 2 Starting conditioning

- Press the  key.
- Conditioning starts. **Cond. not OK** is displayed until the endpoint criteria are reached. This is indicated by **Cond. OK**. The status is kept stable.

### 3 Adding the sample


- Press the  button as soon as **Cond. OK** is displayed.
- Conditioning is stopped. The prompt to add the sample is displayed for the defined sample addition time. Add the sample during this time.

Then the request for the sample size appears.

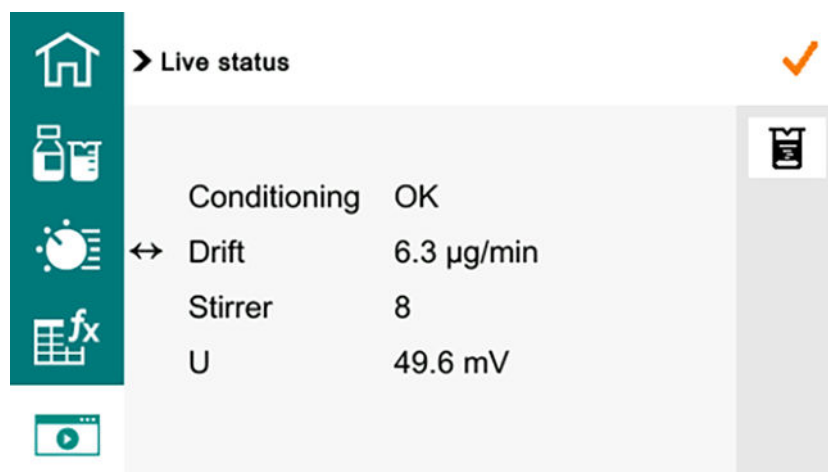
### 4 Entering the sample size

- Enter the sample size.
- Submit the sample weight directly from the balance.

### 5 Starting the titration

- Press the  button if the sample size is entered manually.


The titration is started. The on-screen display changes to the **Live status** work area:



## 6 Making live modifications (if necessary)

- Edit the sample data of the running determination.
- Editing the method parameters of the running determination.
- Modify the stirring rate.

## 7 Canceling the determination manually (if necessary)

- A determination can be canceled at any time with the  key.
- The determination data is saved up to the point of cancellation.

Once the determination has been completed successfully, the on-screen display changes to the **Results** work area.

## Editing the sample data of the running determination

The sample data can be entered or modified in the **Samples** work area while a determination is running. The sample data entered at the end of the titration in the **Samples** work area is always used in calculations.

### 1 Opening the Samples work area

- Click on .

The **Samples** work area appears. The determination continues to run in the background.


### 2 Editing sample data

- Edit the sample data.

### 3 Open the Live status work area

- Click on .

The **Live status** work area appears again.

 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.

## Editing the method parameters of the running determination

### 1 Opening the Parameters work area

- Click on .

The **Parameters** work area appears. The determination continues to run in the background.

### 2 Editing the method parameters

- Edit the method parameters.

The modified parameters are taken into account at once. However, if for instance the start conditions are modified after the start volume has been dosed, then these modifications will not be taken into account until the next determination.



### 3 Opening the Live status work area

- Click on .

The **Live status** work area appears again.

## Modifying the stirring rate while a determination is running

1 The stirring rate of the magnetic stirrer can be changed with the control bar while a determination is carried out.

- Increase the stirring rate in steps: 
- Reduce the stirring rate in steps: 

## 6.9 Results

 shows the **Results** work area.

After a titration has been completed, this work area opens automatically.

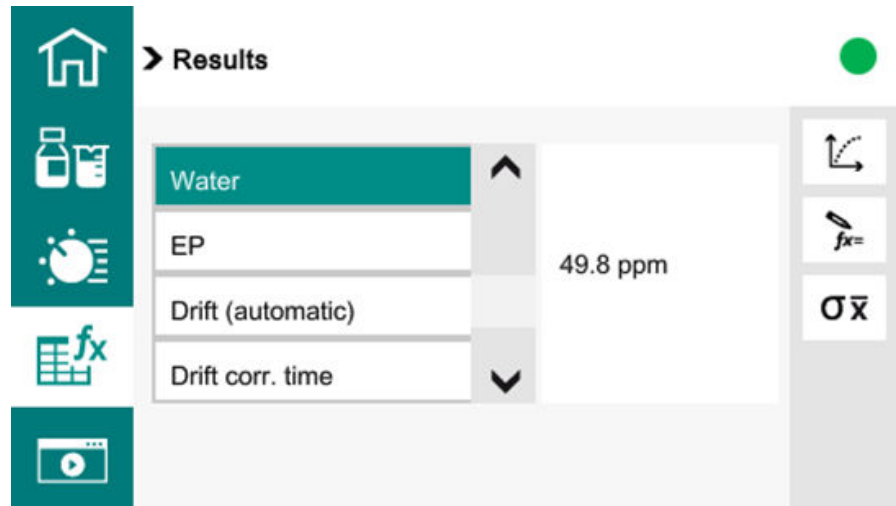



Figure 27 Results

The result overview shows the calculated results and the stop criterion:

- Click on the desired result row or stop criterion row.

### Curve

Clicking on the  button displays the curve of the current determination.

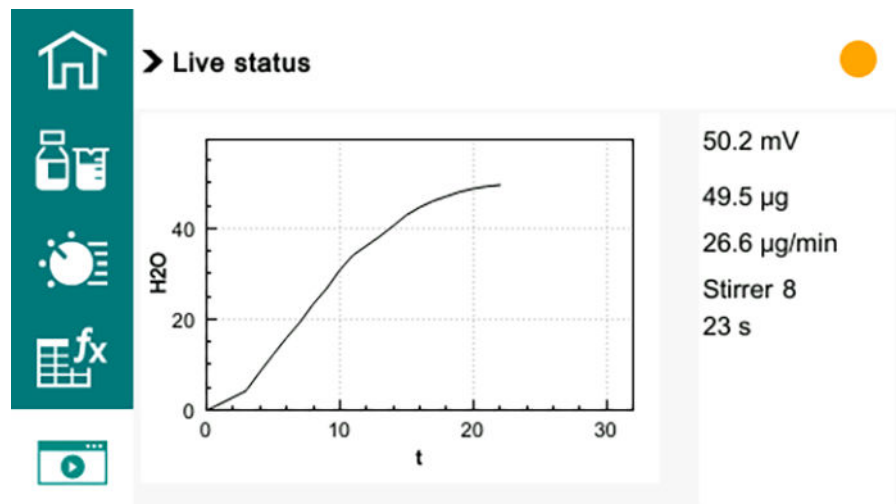


Figure 28 Live status

### Recalculating

By clicking on the  $fx=$  key, the current determination is recalculated. The procedure will be executed immediately.

**i** Recalculation cannot be undone.

All the results of the determination that was carried out last are recalculated with the **Recalc** function. This is necessary if, for example, the calculation, the titer or the sample size has been modified.

### Statistics

By clicking on the  $\sigma\bar{x}$  key, the statistical overview of a determination series is displayed.

**i** This function is visible only if the **Statistics** parameter is set to **[ON]**.

The screenshot shows a software interface with a teal sidebar on the left containing icons for home, a bottle and beaker, a gauge, a calculator with 'fx', and a play button. The main area is titled 'Results > Statistics' and contains a table for 'Result 1'. The table has four rows: 'Mean(3)' with a value of 97.7 ppm, 's abs' with 0.9 ppm, 's rel%' with 0.94 %, and 'Statistics' with 3/3. To the right of the table are three buttons: a magnifying glass, a refresh symbol '#↺', and a plus sign '#+'. A green circle is visible in the top right corner of the interface.

Result 1	
Mean(3)	97.7 ppm
s abs	0.9 ppm
s rel%	0.94 %
Statistics	3/3

Figure 29 Results – Statistics

The mean value **Mean**, the absolute standard deviation **s abs** and the relative standard deviation **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 row shows how many determinations have already been carried out and how many determinations are to be carried out in total. 3 out of 3 determinations were carried out in this example.

**Details**

Shows further data of the determination series.

The result and the sample size of each determination are shown.

A determination can be removed from or added to the statistics in the column **On/Off**. That row is then marked with ✓. All the results from the highlighted determination are removed from the statistics. The statistics are automatically recalculated.

**Reset**

Deletes all statistics data.

The statistics data is deleted automatically in the following cases:

- Once all the determinations of the determination series have been carried out and a new determination is started.
- Once a new method is being loaded.
- Once a method is saved again.

**Increase**

Adds an additional sample to a determination series, e.g. because a determination was faulty and had to be removed from the statistics. The second number in the **Statistics** line will be increased automatically by one.

## 6.10 Printing reports

The following reports can be printed out:

- **Result**  
Result report with determination properties, sample data, calculated results, etc.
- **Curve**  
Curve report.
- **Measuring point list**  
Measuring point list report and additionally a CSV file with the corresponding measuring point list.
- **Parameters**  
Report with all method parameters of the loaded method.
- **System**  
System report with system settings, solution list, external devices, etc.



## 6.11 Parameters

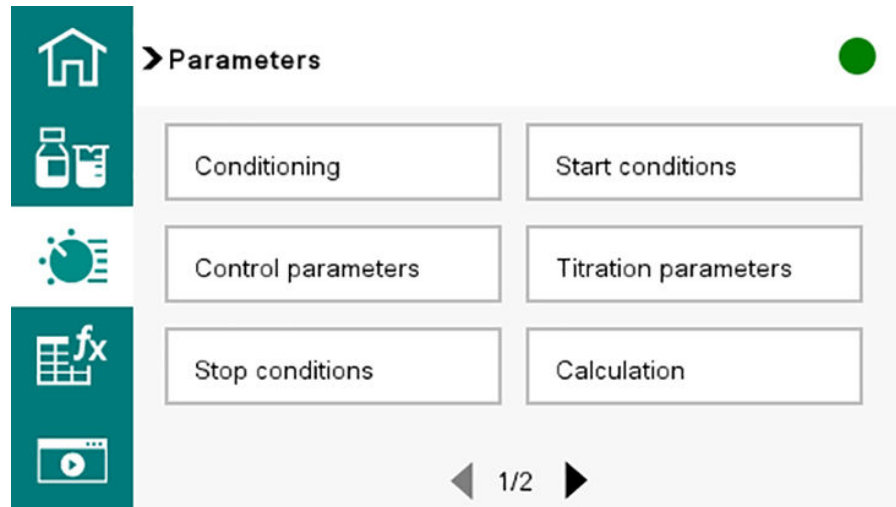


Figure 30 Parameters – Menu page 1



Figure 31 Parameters – Menu page 2

### 6.11.1 Karl Fischer titration coulometric

#### 6.11.1.1 Conditioning

##### Parameters ► Conditioning

The conditions required for conditioning are defined under **[Conditioning]**.

#### Conditioning

If this parameter is activated, the first time the method is started the working medium will be titrated to the endpoint with the specified control parameters. The status is kept stable. The actual method run does not



begin until **[START]** is pressed once more. Conditioning will be carried out again automatically after the titration.

---

Selection:

- **on**
- **off**

Default value: **on**

---

### Start drift

If the value is below the endpoint and the current drift is smaller than this value for a certain time (so-called stabilizing time), then **Conditioning OK** is displayed and the titration can be started. The stabilizing time is defined under **Conditioning ► Stabilizing time**.

---

Input range	<b>1 to 999 µg/min</b>
Default value	<b>20 µg/min</b>

---

### Drift correction

The endpoint amount can be corrected for drift. To accomplish this, the drift is multiplied by the drift correction time at the start of the titration and this value is subsequently subtracted from the endpoint amount. The drift correction time is the time interval between the end of the conditioning process and the end of the determination.

---

Selection:

- **auto**
- **manual**
- **off**

Default value: **auto**

---

#### **auto**

The value of the current amount drift is automatically applied at the start of the titration.

#### **manual**

If the amount drift is known throughout a longer time period, this can be entered manually.

#### **off**

No drift correction takes place.

### Drift value

This parameter can only be edited when **Drift correction = manual**.

---

Input range	<b>0.0 to 99.9 µg/min</b>
Default value	<b>0.0 µg/min</b>

---


## Automatic start

If this parameter is activated and the measured voltage changes suddenly, then the determination is automatically started. This setting will be ignored as long as the working medium has not been conditioned.

Selection:

- **on**
- **off**

Default value: **off**

 If the automatic start function is used, then we recommend to reduce the start drift and define a stabilizing time.  
Recommendation: start drift  $\leq 10 \mu\text{g}/\text{min}$  / stabilizing time  $\geq 30 \text{ s}$

## Threshold value

This parameter can only be edited if **Automatic start = on**.

If the change in voltage is higher than this value, then the determination will automatically be started.

Input range	<b>0 to 999 mV</b>
Default value	<b>50 mV</b>

## Stabilizing time

Waiting time, during which the current drift has to be smaller than the start drift defined until **Conditioning OK** is displayed. The start drift is defined under **Conditioning ► Start drift**.

Input range	<b>0 to 999,999 s</b>
Default value	<b>0 s</b>

## Cond. stop time

Maximum permissible time during which conditioning may take place. Conditioning is stopped if the specified time has elapsed.

Input range	<b>1 to 999,999 s</b>
Default value	<b>off</b>
Selection:	<b>off</b>

## Measured value display

If this parameter is activated, then the currently measured value is displayed during the conditioning.

---

 Selection:

- **on**
- **off**

 Default value: **off**


---

### Sample addition time

The sample addition time is a waiting time between the end of the conditioning and the start of the titration which is waited for before adding sample into the titration cell.

---

Input range	<b>0 to 20</b>
Default value	<b>8</b>

---

### 6.11.1.2 Start conditions

#### Parameters ► Start conditions

The parameters that are carried out before the start of titration are defined under **[Start conditions]**.

### Pause

Waiting time, e.g. for the stabilization of the measured value after the start.

---

Input range	<b>0 to 999,999 s</b>
Default value	<b>0 s</b>

---

### Request sample ID

Selection of the sample identification that is queried at the determination start.

---

 Selection:

- **ID1**
- **ID2**
- **ID1&ID2**
- **off**

 Default value: **off**


---

### Request sample size

If this parameter is activated, then the *value* for the sample size will be requested at the start of the determination.

---

 Selection:

- **on**
- **off**

 Default value: **on**


---

**Request sample unit**

If this parameter is activated, then the *unit* for the sample size will be requested at the start of the determination.

---

Selection:

- **on**
- **off**

Default value: **off**

---

**Pause at request**

If this parameter is activated, then the run will be paused during the request. If the parameter is switched off, then the titration will be started in the background.

---

Selection:

- **on**
- **off**

Default value: **off**

---

**6.11.1.3 Control parameters**

**Parameters ► Control parameters**

The control parameters for the endpoint are defined under **[Control parameters]**. The voltage of the indicator electrode lies in the range **endpoint +5 mV** and **endpoint -2 mV**.

**Endpoint at**

Measured value for the endpoint.

---

Input range	<b>-1,250.0 to 1,250 mV</b>
-------------	-----------------------------

Default value	<b>50.0 mV</b>
---------------	----------------

Selection: **off**

---

**Titration rate**

3 predefined sets of parameters can be selected for the titration rate.

---

Selection:

- **slow**
- **optimal**
- **fast**
- **user**

Default value: **Optimal**

---

**slow**



For samples with a low water content or samples which release their moisture only slowly.

**optimal**

For all standard titrations. The parameters have been optimized for the most frequent applications.

**fast**

For uncritical samples with high water content.

**user**

The individual titration parameters can be modified. The settings of the individual titration rates are listed below.

**Control range**

This parameter can be edited only when **Titration rate = user**. This parameter defines the control range before the specified endpoint. Within the control range, the iodine is generated step by step. The generation is finely controlled. The closer the endpoint, the slower the iodine is generated until the rate defined under **Min. rate** is reached. The larger the control range, the slower the titration. Outside of the control range, iodine is generated with the **Max. rate**.

---

Input range	<b>0.1 to 1,250.0 mV</b>
Default value	<b>70.0 mV</b>
Selection:	<b>off</b>

---

**off**

The generation of iodine is finely controlled during the entire titration.

**Max. rate**

This parameter can be edited only when **Titration rate = user**.

Rate at which iodine is generated outside the control range.

---

Input range	<b>1.5 to 2,241.0 µg/min</b>
Default value	<b>max.</b>
Selection:	<b>max.</b>

---

**Min. rate**

This parameter is visible only when **Titration rate = user**.

Rate at which iodine is generated at the very beginning of the titration and in the control range at the end of the titration. This parameter has a vital influence on the titration rate and thus also on the accuracy. The smaller the selected minimum rate, the slower the titration.

Input range	<b>0.3 to 999.9 µg/min</b>
Default value	<b>15.0 µg/min</b>

Table 8 Default values of the predefined titration rates for KFC

	Titration rate		
	slow	optimal	fast
Control range	120.0 mV	70.0 mV	30.0 mV
Max. rate	1000.0 µg/min	max.	max.
Min. rate	0.3 µg/min	15.0 µg/min	30.0 µg/min

### Stop criterion

The titration is canceled if the endpoint has been reached and this stop criterion has been fulfilled. If no stop criterion has been selected then the titration will not be canceled. The [\(see "Stop conditions", chapter 6.11.1.6, page 90\)](#) always lead to a stop, even if the stop criterion has not been reached.

Selection:

- **Drift**
- **Time**
- **Rel. drift**
- **off**

Default value: **Rel. drift**

#### Drift

The titration is canceled if the stop drift has been reached.

#### Time

The titration is canceled if the value has been below the endpoint during a certain time period (**delay time**).

#### Rel. drift

The titration is canceled if the sum of the drift at the start of the titration plus the relative stop drift has been reached.

#### off

The titration will not be canceled until the stop conditions are fulfilled.

### Stop drift

This parameter can be edited only when **Stop criterion = drift**.

The titration is canceled if the value falls below both the endpoint and the stop drift.



Input range	<b>1 to 999 <math>\mu\text{g}/\text{min}</math></b>
Default value	<b>5 <math>\mu\text{g}/\text{min}</math></b>

### Delay time

This parameter can be edited only when **Stop criterion = time**.

The titration is canceled if the endpoint has been reached and the defined delay time has passed.

Input range	<b>0 to 999 s</b>
Default value	<b>10 s</b>

### Relative stop drift

This parameter can be edited only when **Stop criterion = rel. drift**.

The titration is canceled upon reaching the endpoint and the sum of the drift at the start of the titration and the relative stop drift.

Input range	<b>1 to 999 <math>\mu\text{g}/\text{min}</math></b>
Default value	<b>5 <math>\mu\text{g}/\text{min}</math></b>

#### 6.11.1.4 Control parameters and polarization current

The standard control parameters are optimally set for most determinations and should not be altered.

Should you nevertheless need to change the control parameters for special reagents and/or samples, then the following parameters are dependent on one another:

- The polarization current at the indicator electrode (*see "Titration parameters", chapter 6.11.1.5, page 87*)
- The endpoint (*see "Control parameters", chapter 6.11.1.3, page 83*)
- The control range (*see "Control parameters", chapter 6.11.1.3, page 83*)

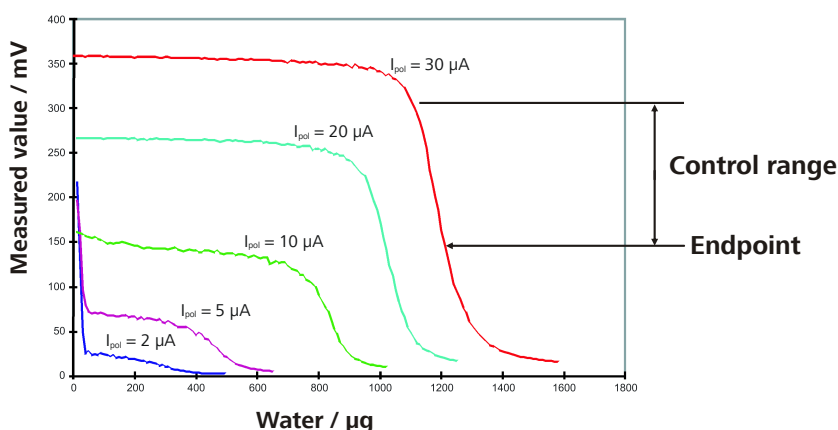


Figure 32 Control parameters and polarization current

The chart shows Karl Fischer titration curves at different polarization currents. It is clear to see that the position of the endpoint varies with the polarization current. The curves have different slopes, i.e. the dynamics must also be adapted. Polarization currents < 10 µA are not suitable for this application.

Table 9 Optimum control parameters at different polarization currents

I(pol) (polarization current)	10 µA	20 µA	30 µA
Endpoint at	50 mV	100 mV	150 mV
Control range	70 mV	100 mV	120 mV
Max. rate	Default value	Default value	Default value
Min. rate	Default value	Default value	Default value
Stop drift	Default value	Default value	Default value

**i** The indicator electrode is activated after a certain operating time in the same reagent, i.e. the titration curve becomes steeper. If the titration curve is too steep, then slowly fluctuating drift values will occur during conditioning. This can be solved by setting the endpoint lower, but endpoints that have been set too low could prolong the titration.

### 6.11.1.5 Titration parameters

#### Parameters ► Titration parameters

Under **[Titration parameters]**, the parameters influencing the run of the entire titration are defined.

#### Extraction time

Minimum duration of the titration. The titration will not be canceled during the extraction time, even if the endpoint has already been reached. The titration is, however, canceled if a (see "Stop conditions", chapter 6.11.1.6, page 90) is fulfilled during this time. Entering an extraction time is recommended, for example, for samples that release water slowly and dissolve slowly or if a Karl Fischer oven is used.

Input range	<b>0 to 999,999 s</b>
Default value	<b>0 s</b>

#### Generator electr.

Type of generator electrode.



Input range	<b>1 to 15</b>
Default value	<b>8</b>

### I(pol)

The polarization current is the current that is applied to a polarizable electrode during voltametric measurement.

Selection:

- **5  $\mu$ A**
- **10  $\mu$ A**
- **20  $\mu$ A**
- **30  $\mu$ A**

Default value: **10  $\mu$ A**

**i** The parameter **I(pol)** is connected with the parameters **Control range** and **Endpoint at** (see "*Control parameters and polarization current*", chapter 6.11.1.4, page 86).

### Electrode test

In the case of polarizable electrodes, an electrode test can be carried out. A check is made that the electrode is properly connected and that no short circuit is present. The electrode test is carried out if the determination is started.

Selection:

- **on**
- **off**

Default value: **off**

**i** With very dry media, the electrode test may indicate a short circuit even though the electrode is fine.  
Add a few drops of water standard or sample, then the electrode test will function properly again.

### Time interval MP

Time interval for entering a measuring point in the measuring point list. The measuring point list is limited to 1000 measuring points.

Input range	<b>0.1 to 999,999.0 s</b>
Default value	<b>2.0 s</b>

### Temperature

Temperature entered manually.

Input range	<b>-20.0 to 150.0 °C</b>
Default value	<b>25.0 °C</b>



**6.11.1.6 Stop conditions**

**Parameters ► Stop conditions**

The conditions for canceling the titration are defined under **[Stop conditions]**, if this does not occur automatically. This could be the case if the endpoint set is not reached or if the stop criterion is not fulfilled.

**Stop time**

The titration is canceled as soon as the specified time has elapsed following the termination of the start conditions.

---

Input range	<b>1 to 999,999 s</b>
Default value	<b>off</b>
Selection:	<b>off</b>

---

**6.11.1.7 Calculation**

**Parameters ► Calculation**

A maximum of five calculations can be defined in one method. A series of variables (raw data from the determination, previously calculated results) is available for the calculations. Definition can be made for each calculation as to whether the result is to be saved as a common variable.

The method templates **KFC**, **KFC-Blank** and **Blank** each contains one calculation. Each of these calculations already bears an appropriate result name. The name can be customized if necessary.

**Edit**

Edit the data of the selected calculation.

**Delete**

Delete the selected calculation.

**Editing calculations**

**Calculation formula Method KFC "R1"**

EP1/C00
---------

**Calculation formula Method Blank "R1"**

EP1
-----

**Calculation formula Method KFC-Blank "R1"**

(EP1-CV01)/C00
----------------



### Result name

The result name is the text that will be shown in the result view and in the report.

---

Input range            **1 to 12 characters**

---

### R2-R5

Shows the calculation formula. A special editor is opened for the definition (*see "Formula editor", chapter 6.2.1, page 37*)

---

Input range            **1 to 30 characters**

---

### Decimal places

Number of decimal places used to display the result.

---

Input range            **0 to 5**

---

### Result unit

The result unit is displayed and saved along with the result.

---

Selection:

- %
  - mg
  - mg/piece
  - mg/g
  - ppm
  - µg
  - User-defined
- 

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. An empty entry can be generated this way as well.

### Save as CV

The calculated result can be saved as a method-independent variable, called a common variable. The result is then also available in other methods for calculations. If Statistics has been activated, then the current mean value of the determination series will be saved.

---

Selection:

- **on**
  - **off**
-

### 6.11.1.8 Statistics

#### Parameters ► Statistics

The statistics calculation of a multiple determination is activated under **[Statistics]** and the number of determinations for the series is defined.

#### Statistics

If this function is activated, then statistics calculations will be carried out for all of the defined results.

---

Selection:

- **on**
- **off**

Default value: **off**

---

#### Number of determinations

The number of determinations that are carried out for the statistics calculations.

If an additional determination needs to be added to the determination series, e.g. because one determination was incorrect, then this can be accomplished in the statistical overview.

---

Input range	<b>2 to 20</b>
Default value	<b>3</b>

---

### 6.11.1.9 Reports

#### Parameters ► Reports

The reports that will be printed out automatically after a determination are defined under **[Reports]**.

#### Results

The result report contains the calculated results, endpoints, sample data, etc.

---

Selection:

- **on**
- **off**

Default value: **off**

---

#### Curve

Curve report.

---

Selection:

- **on**
- **off**

Default value: **off**

---

### Calculations/statistics

Output of the calculation formulas for the individual results. Results are specified with full accuracy. This makes checking with an external program possible. If Statistics has been activated, then the following data will be printed out as well:

- Result and sample size of the individual determinations
- Mean value as well as absolute and relative standard deviation

---

Selection:

- **on**
- **off**

Default value: **off**

---

### Measuring point list

Output of the measuring point list. The measuring point list is also saved as a CSV file.

---

Selection:

- **on**
- **off**

Default value: **off**

---

### Parameters

All of the parameters of the current method are printed out in the parameter report.

---

Selection:

- **on**
- **off**

Default value: **off**

---

### PC/LIMS

The PC/LIMS report is a machine-readable report with all of the important data for a determination. The PC/LIMS report can be saved as a TXT file on a USB storage device or sent to a LIMS via an RS-232 interface. The output location is defined in the system settings.

The file name of the TXT file is constructed as follows: *PC\_LIMS\_Report-ID1-YYYYMMDD-hhmmss.txt*.



---

Selection:

- **on**
- **off**

Default value: **off**

---




## 7 Maintenance

Perform maintenance work on the product at regular intervals to prevent functional disruptions and to ensure a long service life.

- Metrohm recommends having the products maintained by the regional Metrohm service representative as part of an annual service. Shorter maintenance intervals may be necessary if you frequently work with caustic and corrosive chemicals.
- Only perform maintenance work that is described in this instruction. Contact your regional Metrohm service representative for further maintenance work and repairs. The regional Metrohm service representative offers every form of technical advice for maintenance and service of all Metrohm products.
- Only use spare parts that meet the technical requirements of the manufacturer. Original spare parts always meet these requirements.

### 7.1 Replacing the adsorber material

 At average humidity, replace the adsorber material approx. every 6 weeks.

An increase in drift indicates that the leak-tightness of the KF titration cell should be inspected and that the molecular sieve may need to be replaced.

**Hint:**

Write the date on the adsorption cartridge when you replace the molecular sieve. With this, you always know when it was last filled or replaced.

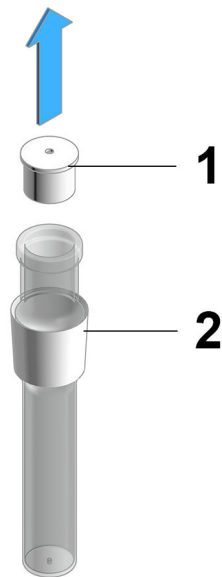
**Required accessories:**

- Cotton for adsorber tube (6.02801.000)



- Molecular sieve (6.2811.000 / 6.2811.010)

### 1 Removing the lid



- Remove the lid (1) by pulling it out of the housing (2).

### 2 Removing the adsorber material



- Remove the entire content.

**i** To regenerate the molecular sieve at 300 °C in the drying oven, see <https://www.metrohm.com/en/support-und-service/faq-kft/>

**3 Filling the housing with adsorber material**

- Tear off a piece of the 6.02801.000 cotton and form it into cotton wool (do not pack the cotton too tightly). Insert the cotton wool loosely into the bottom of the housing.
- Use a molecular sieve to fill the housing to approx. 1 cm under the housing edge.
- Tear off a piece of the 6.02801.000 cotton and form it into cotton wool (do not pack the cotton too tightly). Place the cotton wool on the molecular sieve.

**4 Sealing the housing with the lid**

- Check whether the housing is clean and dry and has no residual cotton or adsorber material.
- Seal the housing with the lid:



The adsorber tube can be reinserted and used again.



**WARNING****Health hazards from electrical potential.**

Severe injuries with possibly fatal consequences.

- Operate the product only if it is in perfect condition. The housing must also be intact.
- Only use the product with the covers fitted.
- Protect live components (e.g. power supply unit, power cord, connection sockets) against moisture.
- Always have maintenance work and repairs on electrical components carried out by a regional Metrohm service representative.

**Prerequisite:**

- The product is switched off and disconnected from the energy supply.

**Required accessories:**

- Cleaning cloth (soft, lint-free)
- Water or ethanol

**1** Clean the surface with a damp cloth. Remove persistent contamination with ethanol.

**2** Wipe the surface with a dry cloth.

**3** Clean the connectors with a dry cloth.

## 8 Troubleshooting

Messages on malfunctions and errors are displayed in the control software or in the embedded software (e.g. on the display of an instrument) and contain the following information:

- Descriptions of causes of malfunctions (e.g. jammed drive)
- Descriptions of problems with the control (e.g. missing or invalid parameter)
- Information on how to solve the problem

System components with status display elements also indicate malfunctions and errors with a red flashing LED.


Troubleshooting on the product is often only possible with the control software or the embedded software (e.g. initializing, moving to a defined position).


### See also

*Signals (chapter 3.4, page 15)*

### 8.1 Resetting the system

In very rare instances, a faulty file system (e.g. because of a program crash) may lead to an impairment of program functioning. The internal file system must be initialized in such cases.

 If the system is reset, all user data (methods, solutions, etc.) will be deleted. The instrument will be reset to factory settings. The password for the **Expert** dialog type is then: **METROHM9100**

 Metrohm recommends creating a backup of the system at regular intervals in order to avoid data losses.

The program version does not change when resetting the system.

#### Resetting the system

##### Prerequisite:

- The instrument is switched off.

##### 1 Resetting the system

- Switch on the instrument.
- Wait until the following text is displayed in the bottom line of the screen: **Initialization, please wait...**

- Press the 3 keys    simultaneously and hold them down for approx. 4 s.

The **Factory reset** warning appears: All information (including saved methods, determination results, etc.) is deleted. Do you want to continue?

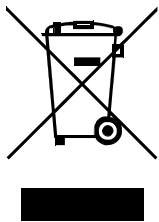
## 2 Confirming the reset

Confirm the warning with **[Continue]**.

The device deletes the user data and restarts.



# 9 Disposal



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



## 10 Technical specifications

### 10.1 Ambient conditions

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

### 10.2 Energy supply

#### External power supply unit

##### *Inlet*

Nominal voltage range	100–240 V AC	±10%
Frequency range	50–60 Hz	
Current	max. 1.5 A	

##### *Outlet*

Nominal voltage	24 V DC	
Current	max. 2.7 A	
Power output	65 W	

#### Instrument

##### *Inlet*

Nominal voltage	24 V DC	
-----------------	---------	--

## Technical specifications



Power consumption	max. 65 W	
<i>Outlet</i>		
Nominal voltage	24 V DC	
Power output	max. 20 W	
<b>USB connector</b>		
<i>Nominal voltage</i>	5 V	
<i>Output current</i>	500 mA	max. output current per channel
<b>Protection</b>		
<i>Internal fuse</i>	1.5 A	cannot be replaced by the user

## 10.3 Measurements and weight

### Measurements

<i>Width</i>	178 mm
<i>Height</i>	
without titration cell	138 mm
<i>Depth</i>	311 mm

<b>Weight</b>	2.8 kg	without accessories and power supply unit
---------------	--------	---

## 10.4 Housing

### Materials

<i>Cover</i>	PPTV20	20% filled with talc
<i>Back panel</i>	1.4301	stainless steel
<i>Base</i>	PPTV20	20% filled with talc
	1.4301	
<i>Front foils</i>	PET	poly(ethylene terephthalate), mat

IP degree of protection IP 21

## 10.5 Connectors specifications

### Power IN

Socket Round plug 4-pin

### Power OUT

Socket Round plug 4-pin

### Remote

Socket D-Sub 9-pin

### Ethernet

Type CAT 6

Socket RJ-45

Cable type min. FTP shielded

Cable length max. 10 m *sold separately*

### USB

Type 2.0

Socket Type A

Cable type shielded

Cable length max. 5 m *sold separately*

### Measuring inputs

*Ind.*

Socket Type P Measuring input for polarizable electrodes

### Contacts

*Gen.*

Generator connector Type H



## 10.6 Display specifications

### Display

<i>Type</i>	LCD	VGA color display
<i>Size</i>	approx. 4.3"	diagonal
<i>Resolution</i>	480 × 272	pixels

### Status display

LED	green
-----	-------

## 10.7 Operation specifications

### Touch screen

<i>Type</i>	resistive
-------------	-----------

### Resistance to chemicals

Ethanol
Methanol
Water

### Keys

5 keys
--------

## 10.8 Measurement specifications

### Polarizer

#### *Ipol AC*

Polarization current	5, 10, 20, 30 $\mu$ A	can be selected
Measuring range	0–2,400 mV	
Measuring resolution	0.1 mV	
Frequency	10 Hz	



**Generator connector**

*Generator electrode*

Current auto, variable 100, 200, 400 mA

**Reference conditions**

*Instrument status*

min. 30 minutes in operation

*Adjusting interval*

annual

**Measuring accuracy**

applies to all measuring ranges without sensor error, under reference conditions, measuring interval 100 ms, ambient temperature +25 °C (± 3 °C), relative humidity ≤ 60%

**Measured value memory**

*Memory size*

non-volatile memory

120 methods

**10.9 Stirrer specifications**

**Version**

magnetic

**Rotational speed range**

+1 to +15

120–1,800 rpm

**Rotational speed change per step**

115–125 rpm

**Maximum rotational speed**

1,700–1,900 rpm

**Lengths of stirring bar**

The stirrer is designed for stirring bars in the following lengths:

- 8 mm
- 12 mm
- 16 mm
- 25 mm
- 30 mm