Eco KF Titrator

Manual

8.1027.8001EN / v7 / 2025-07-07

Metrohm

Metrohm AG
Ionenstrasse
CH-9100 Herisau
Switzerland
+41 71 353 85 85
info@metrohm.com
www.metrohm.com

Eco KF Titrator

Firmware version 57.1027.0012 or higher

Manual

8.1027.8001EN / v7 /
2025-07-07

Technical Communication
Metrohm AG
CH-9100 Herisau

This documentation is an original document.

This documentation has been prepared with great care. However, errors can never be entirely ruled out. Please send comments regarding possible errors to the address above.

Disclaimer

Deficiencies arising from circumstances that are not the responsibility of Metrohm, such as improper storage or improper use, etc., are expressly excluded from the warranty. Unauthorized modifications to the product (e.g., conversions or attachments) exclude any liability on the part of the manufacturer for resulting damage and its consequences. Instructions and notes in the Metrohm product documentation must be strictly followed. Otherwise, Metrohm's liability is excluded.

Table of contents

1 Overview

1.1 Product description

The Eco KF Titrator is an instrument with built-in stirrer used for volumetric water content determination.

Conditioning is automatically carried out before and after the actual titration. Reagent dosing is controlled in such a way that a predefined endpoint is reached as quickly and precisely as possible. The volume steps and the rate of the reagent dosing are controlled using the difference between the current measured value and the predefined endpoint. This means that titration is slower and that smaller volumes are added in the control range. The titration termination at the endpoint takes place either drift-controlled or after a waiting time. The volume dosed until the endpoint is used for calculating the water content of the sample. *(see figure 1, page 1)*

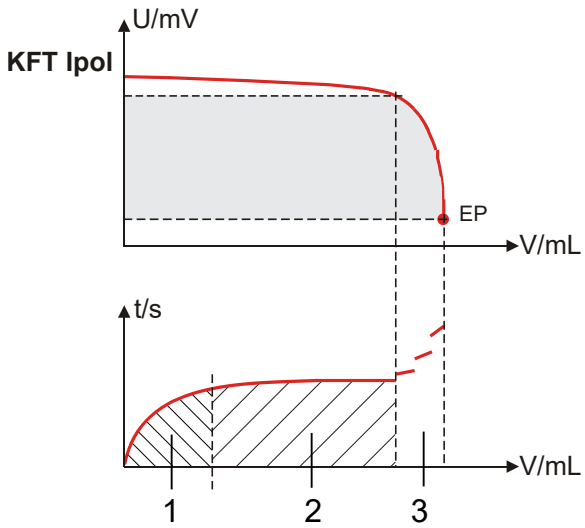


Figure 1 Reagent dosing for KFT

1	**Initial dosing**	**2**	**Continuous dosing**
3	**Control range**		

1.2 Product versions

The product is available in the following versions:

Table 1 Product versions

Art. no.	Designation	Version feature
2.1027.0010	Eco KF Titrator	
2.1027.0100	Eco KF Titrator assembly	with Solvent Pump

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

Figure 2 Type label (example)

1	**(01) = External article number**
2	**(21) = Serial number**
3	**(240) = Metrohm article number**

1.3 Displaying the accessories

Up-to-date information on the scope of delivery and on optional accessories can be found on the Metrohm website.

1 Searching for a product on the website

- Go to *https://www.metrohm.com*.
- Click on 🔍.
- Enter the article number of the product into the search field and press **[Enter]**.
  - Obtain the article number from the list *(see "Product versions", chapter 1.2, page 2)*.
- In the result list, click on the desired product.

Detailed information regarding the product is displayed.

2 **Displaying the accessories**

- Scroll down (accessories subject to availability):
  - Included parts
  - Optional parts

3 **Downloading the accessories list (included and optional parts)**

- Click on ⬇ to download the accessories list as a PDF.

ℹ Metrohm recommends keeping the downloaded PDF for reference purposes.

1.4 Further information

Additional information on the product is available on the following pages:

- Metrohm website *https://www.metrohm.com* – Documents as PDF, overview of product family, information on applications, and details of accessories.

1.5 About the documentation

Possible depictions in the documentation:

Depiction	Meaning
*(5-**12**)*	Cross-reference to figure legend (Figure number - ***Element in the figure***)
1	Instruction step
Method	Parameters, menu items, tabs, and dialogs
File ▶ New	Menu path
[Continue]	Button or key
ℹ	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 Safety

2.1 Intended use

The Eco KF Titrator is designed for usage as a titrator in analytical laboratories. Its main area of use is volumetric Karl Fischer titration. This instrument is suitable for processing chemicals and flammable samples.

The Eco KF Titrator is equipped with the following functional units:

- Built-in magnetic stirrer
- Exchangeable cylinder unit

Method templates are available which are already configured except for a few parameters. The methods can be modified and saved under a new name or exported to a connected USB flash drive. This function makes it possible to copy methods quickly and easily from one instrument to another.

Titration modes

The following titration modes are supported:

- **KFT**
  Volumetric water content determination according to Karl Fischer.

Measuring modes

The following measuring modes are supported:

- **Ipol**
  Voltametric measurement with selectable polarization current

2.2 Responsibility of the operator

The operator must ensure that basic regulations on occupational safety and accident prevention in chemical laboratories are observed. The operator has the following responsibilities:

- Instruct personnel in the safe handling of the product.
- Train personnel in the use of the product according to the user documentation (e.g. install, operate, clean, eliminate faults).
- Train staff on basic occupational safety and accident prevention regulations.
- Provide personal protective equipment (e.g. protective glasses, gloves).
- Provide suitable tools and equipment to carry out the work safely.

The product may be used only when it is in perfect condition. The following measures are required to ensure the safe operation of the product:

- Check the condition of the product before use.
- Remedy defects and malfunctions immediately.
- Maintain and clean the product regularly.

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:

- Label the product according to regulations if it is used for substances that have a potential for chemical hazards and are generally subject to the Hazardous Substances Ordinance.
- Wear personal protective equipment (e.g. protective glasses, gloves).
- Use exhaust equipment when working with vaporizing hazardous substances.
- Dispose of hazardous substances in accordance with regulations.
- Clean and disinfect contaminated surfaces.
- Only use detergents that do not cause any unwanted side reactions with the materials to be cleaned.
- Dispose of chemically contaminated materials (e.g. cleaning material) in accordance with regulations.
- Proceed as follows in case of a return shipment to Metrohm AG or a regional Metrohm representative:
  - Decontaminate the product or product component.
  - Remove the labeling for hazardous substances.
  - Create a declaration of decontamination and enclose it with the product.

2.4.3 Danger from highly flammable substances

Using highly flammable substances or gases may cause fires or explosions. To avoid danger from highly flammable substances, observe the following:

- Avoid ignition sources.
- Use protective grounding.
- Use exhaust equipment.

2.4.4 Danger from leaking liquids

Leaking liquids may cause injuries and may damage the product. To avoid danger from leaking liquids, observe the following:

- Check the product and its accessories for leakages and loose connections.
- Replace leaking components and connecting elements without delay.
- Tighten loose connecting elements.
- Do not loosen tubing connections under pressure.
- Do not remove aspiration tubing under pressure.
- Carefully pull the tubing ends out of the vessels.
- Carefully allow liquids from the tubing to drain into suitable vessels.
- Insert the tubing tips completely into the vessels.

- Remove and dispose of escaping liquids in accordance with regulations.
- If you suspect that liquid has penetrated the instrument, disconnect the instrument from the energy supply. Then have the instrument checked by a regional Metrohm service representative.

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 KF Titrator – Overview

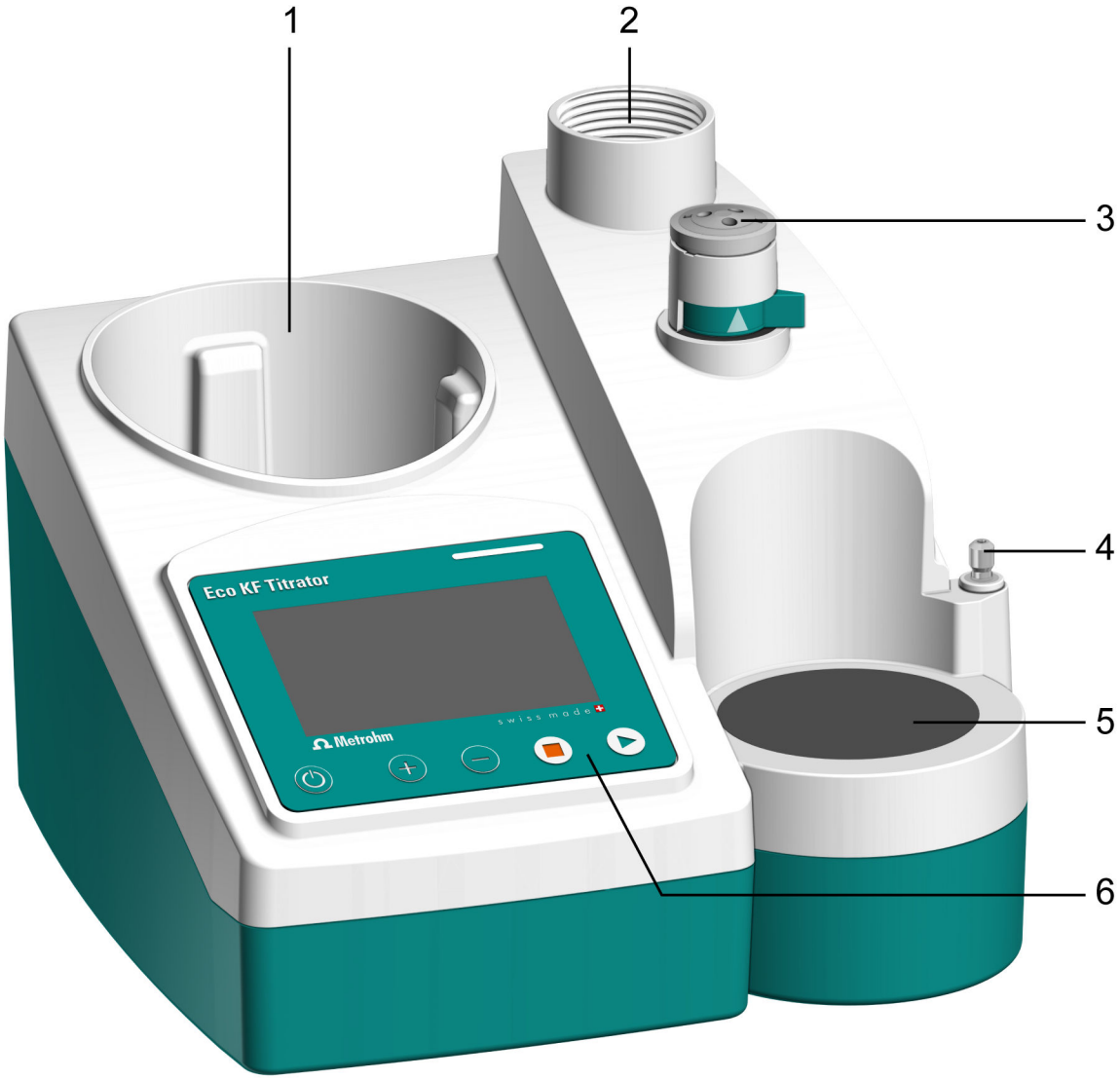


Figure 3 Eco KF Titrator – Front

1	**Bottle holder**	**2**	**Connector for cylinder unit**
3	**Flat stopcock**	**4**	**Stand attachment**
5	**Magnetic stirrer**	**6**	**Indicators/Controls**

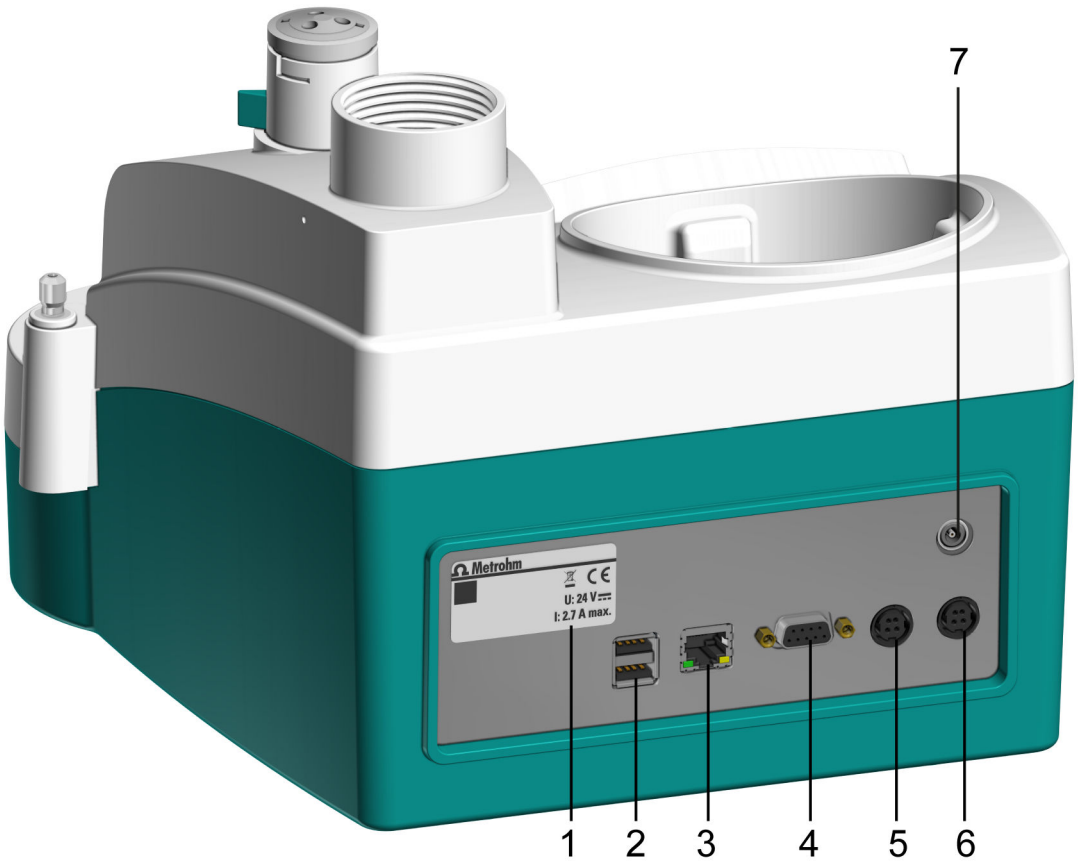


Figure 4 Eco KF Titrator – Rear

1	**Type label**	**2**	**USB (USB 1 and USB 2)** Connect USB flash drive, printer, balance, etc.
3	**Ethernet (RJ-45)** Remote control via local network	**4**	**Remote** Connect remote control
5	**Power OUT** Connect external device	**6**	**Power IN** Connecting the power supply unit
7	**Pol** Connect a polarizable electrode		

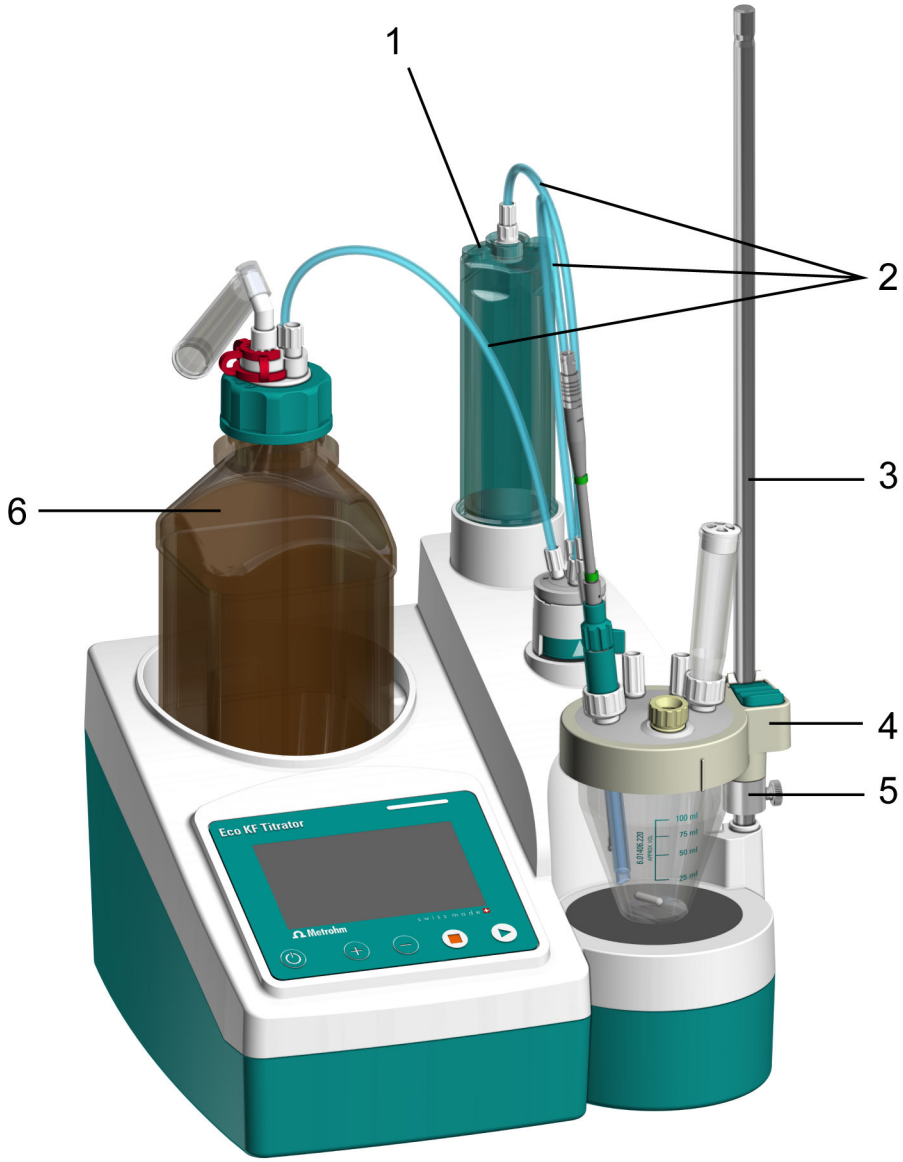


Figure 5 Eco KF Titrator – Accessories

1	**Cylinder unit**	**2**	**Tubing connections**
3	**Support rod**	**4**	**Titration cell**
5	**Clamping ring**	**6**	**Bottle unit**

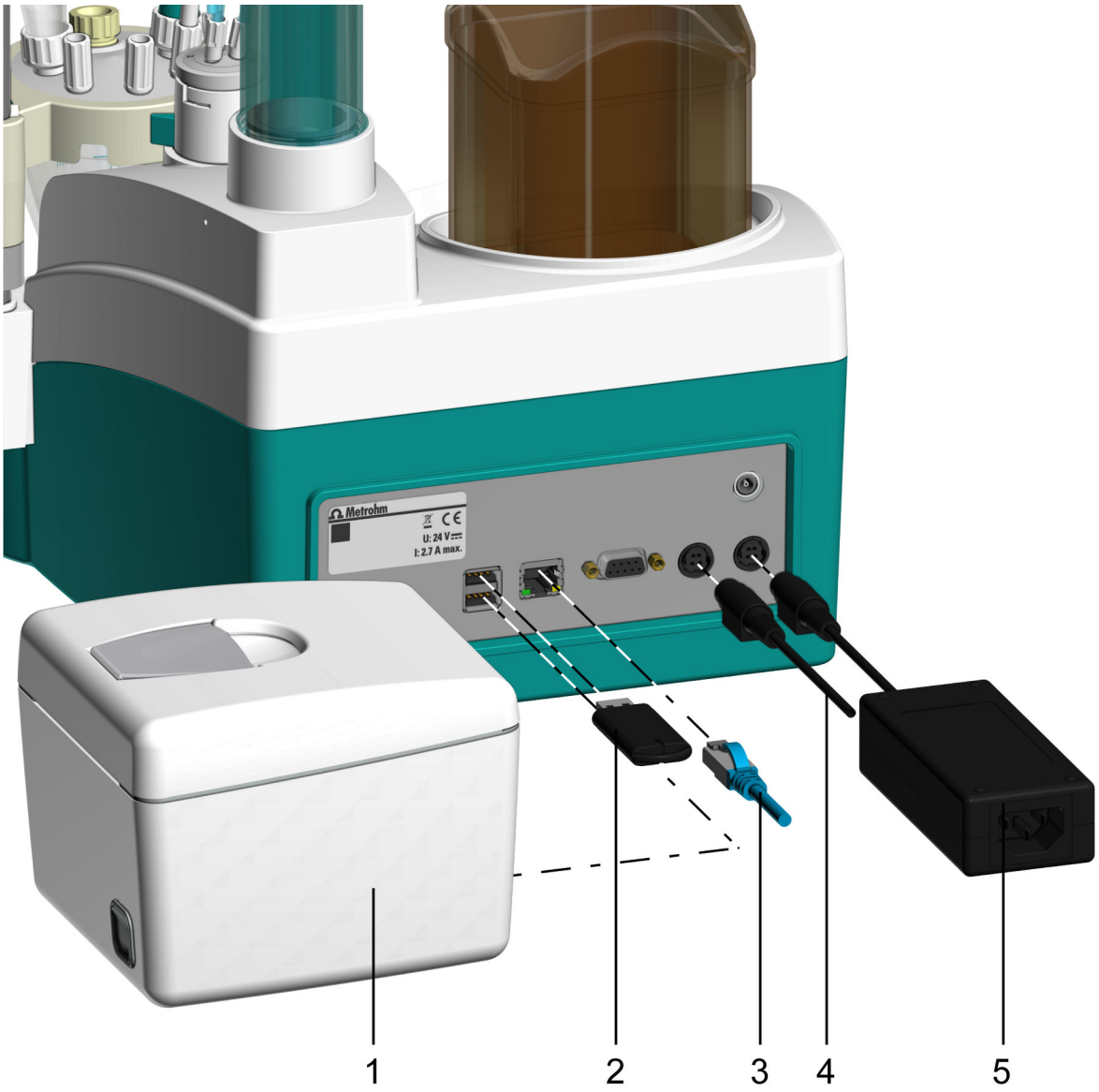


Figure 6 Eco KF Titrator – Peripherals

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

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 Cylinder unit and dosing drive

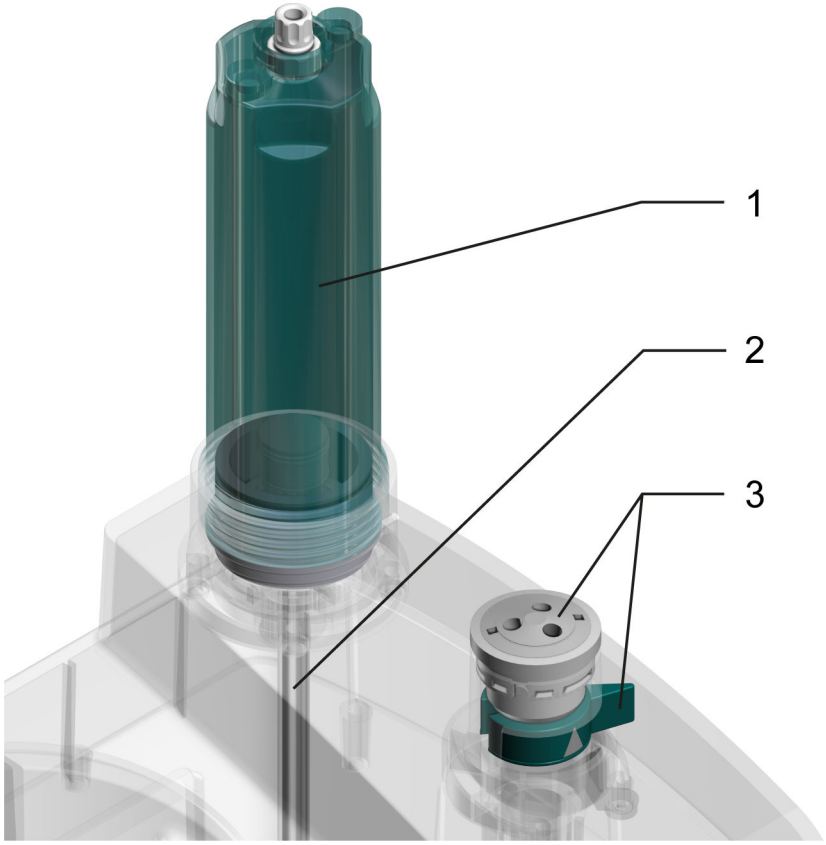


Figure 7 Cylinder unit and dosing drive – Overview

1	**Cylinder unit**	**2**	**Push rod (dosing drive)**
3	**Flat stopcock**		

The dosing drive and connected cylinder unit can be used to accurately dose liquid volumes.

The dosing drive is permanently installed in the housing of the device and moves the push rod to raise and lower the cylinder in the cylinder unit and is responsible for accurate dosing of the solution.

The flat stopcock switches between filling and emptying the cylinder unit.

Once the cylinder unit is put into place, the dosing drive and the flat stopcock assume responsibility for the following functions:

- **Raising and lowering the piston:**
  Solution is aspirated while the piston is being lowered. The cylinder fills up.
  Solution is dosed while the piston is being raised. The cylinder empties.
- **Rotate the flat stopcock:**
  The position of the flat stopcock determines which connectors the solution flows through.

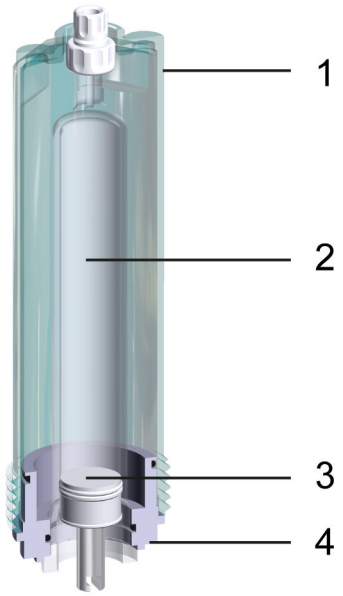


Figure 8 Cylinder unit – Overview

1	**Light protection**	**2**	**Cylinder**
3	**Piston with sealing lips and piston rod**	**4**	**Mounting ring**

3.2.3 Flat stopcock

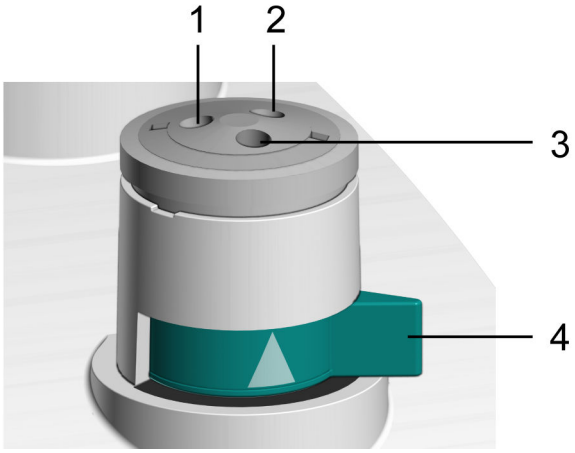


Figure 9 Flat stopcock – Overview

1	**Connector for the tubing connection to the bottle**	**2**	**Connector for the tubing connection to the tubing tip**
3	**Connector for the tubing connection to the cylinder unit**	**4**	**Switching lever**

3.2.4 Bottle unit

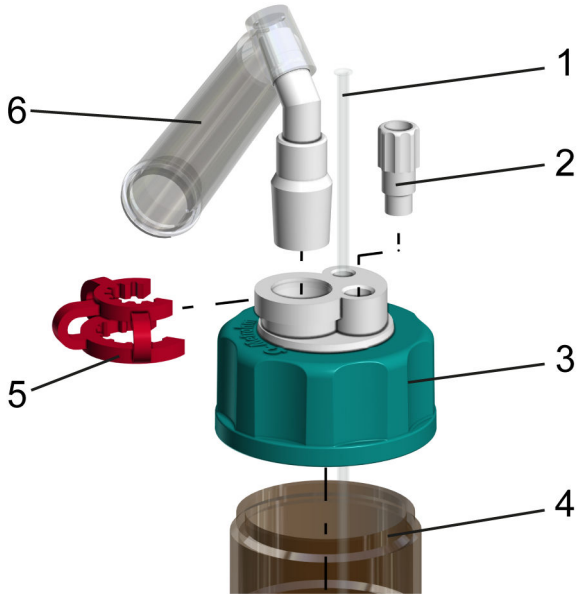


Figure 10 Bottle unit – Overview

1	**Cannula**	**2**	**Threaded stopper**
3	**Bottle cap**	**4**	**Amber glass bottle with GL 45 thread**
5	**Clip for SGJ 14/15**	**6**	**Adsorber tube**

3.2.5 Volumetric Karl Fischer titration cell

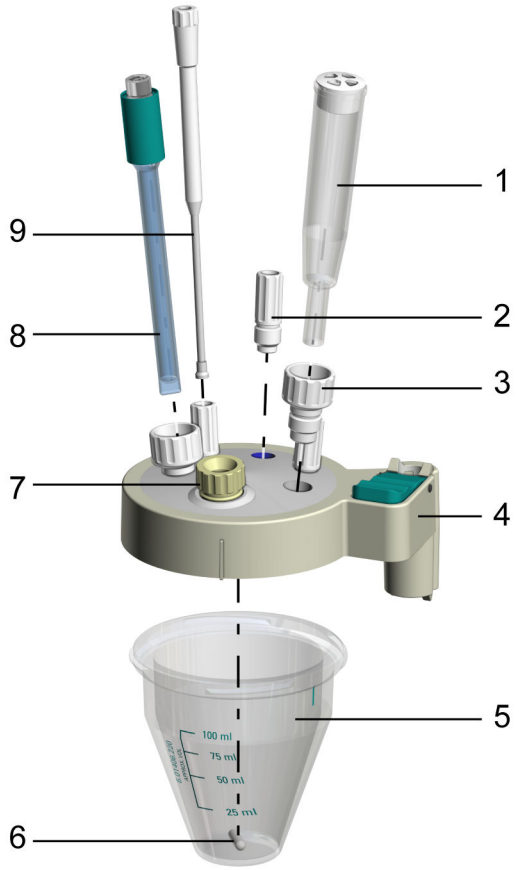


Figure 11 Titration cell – Overview

1	**Adsorber tube**	**2**	**M10 screw nipple** (6.02709.010)
3	**M12 screw nipple** (6.02709.030)	**4**	**KF titration vessel lid**
5	**Titration vessel**	**6**	**Stirring bar**
7	**Septum stopper**	**8**	**Electrode**
9	**Tubing tip**		

The volumetric Karl Fischer titration cell (KF titration cell) is a closed vessel for water content determination according to Karl Fischer and is fastened to the support rod of the magnetic stirrer.

The volumetric KF titration cell consists of a titration vessel and a titration vessel lid.

Seepage of moisture into the KF titration cell is prevented with seals and with the adsorber tube, which is filled with molecular sieve.

3.3 Indicators and controls

Indicators – Status display and status indicator

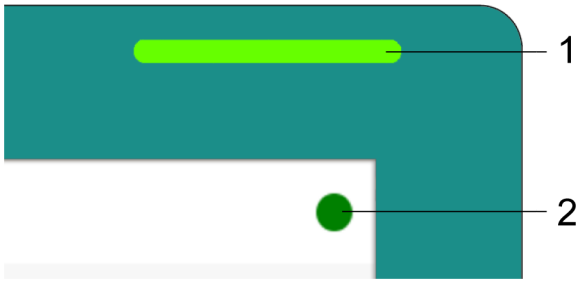


Figure 12 Indicators

1	**Status display**	**2**	**Status indicator**

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

Controls – Control bar

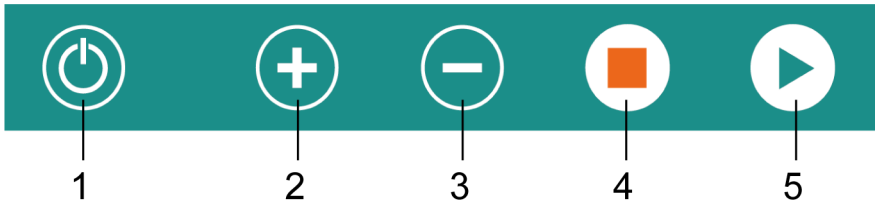


Figure 13 Control bar keys

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

Signal	Flashing pattern	Meaning
	LED flashes green (fast)	Malfunction or error

The status indicator uses colors and symbols 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
		Conditioning OK
		Conditioning not OK

3.5 Remote interface

Pin assignment of the remote interface

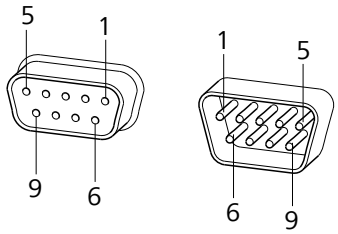


Figure 14 Pin assignment of remote socket and remote plug

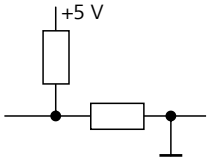
The above figure of the pin assignment applies to all Metrohm instruments with 9-pin D-Sub remote connector.

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

Pin no.	Assignment	Function
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

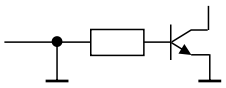


approx. 5 kΩ Pull-up

t_p > 100 ms

active = low, inactive = high

Outputs



Open Collector

t_p > 200 ms

active = low, inactive = high

I_C = 20 mA, V_{CEO} = 40 V

+5 V: maximum load = 20 mA

Status diagrams of the remote interface

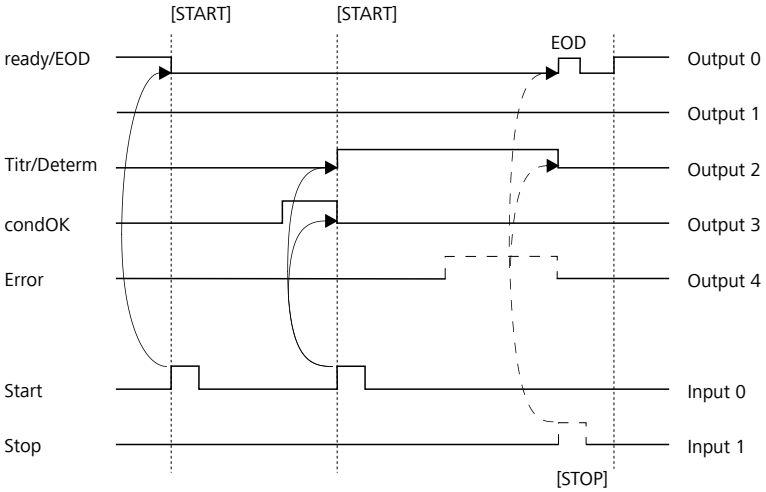


Figure 15 Remote status diagram

EOD = End of Determination

3.6 Remote control

The instrument can be remotely controlled via an Ethernet/RS-232 connection. An RJ-45 plug with Local Area Network (LAN) is required for this. Connect the Ethernet cable to the Ethernet connector on the rear of the instrument *(see "Eco KF Titrator – Overview", chapter 3.1, page 10)*.

The connection can be established only if the instrument and the computer are part of the same local network (LAN) and communicate via port 8005. The IP address of the instrument is defined under: **System ► Ethernet settings**

Transfer protocol

The data communication is synchronous. On each command there is an acknowledgement by the instrument.

A command must be sent to the instrument with the control characters **CR LF** as terminator. The responses of the instrument will also be transferred with **CR LF** as terminator.

The instrument does not send spontaneous messages.

Commands and variables

Command	Function	Comment
$G	Start/Continue	Corresponds to the **[START]** or **[Continue]** key.
$S	Stop	Corresponds to the **[STOP]** key.
$H	Hold	Hold the method run.
$D	Scan instrument status	Acknowledgements: *Ready;0*, *Busy;0* or *Hold;0* or *Cond;0*(0 = no message). If a message on the instrument requires the interaction of the user, then the acknowledgement of the status scan displays the corresponding message number. The message can be acknowledged with **[OK]** or **[Cancel]**, see below.

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

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

Acknowledgement of the instrument	Comment
OK	Command executed
E1	Method not found
E2	Invalid variable
E3	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 5.02999999999999E+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 ($1 \le k \le 5$) calculated in a determination can be statistically evaluated. A statistical series can contain a maximum of 20 determinations ($1 \le n \le 20$).

The following convention applies to the subsequent formulas:

$1 \le n \le 20$ and $1 \le k \le 5$.

Mean value:	$\bar{x}_k = \frac{1}{n} \cdot \sum_{i=1}^{n} R_{k,i}$
Absolute standard deviation:	$Sabs_k = +\sqrt{\frac{\sum_{i=1}^{n} \left(R_{k,i} - \bar{x}_k\right)^2}{n-1}}$

Relative standard deviation (in %):

$$S\,rel_k = 100 \cdot \frac{S\,abs_k}{\bar{x}_k}$$

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.

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^2 / 18 AWG
  - Coupling: IEC 60320, type C13, 10 A
  - Power plug: 6.2122.XX0 (according to customer requirement), min. 10 A

1

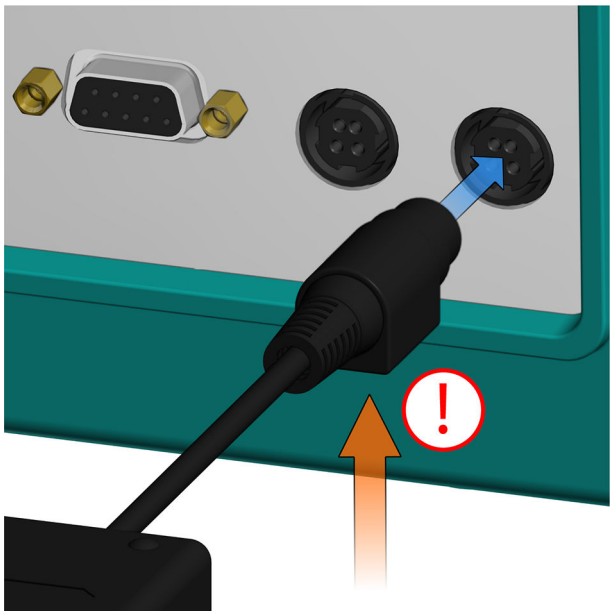


Figure 16 Rear of the instrument – Connecting the power cord

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 device on and off", chapter 6.1, page 37)*

5.3 Initial assembly of the cylinder unit

The initial assembly of the cylinder unit is carried out with an **installation wizard**.

Scan the QR code for additional accessories.

If the instrument has already been set up, then the cylinder unit is disassembled and assembled with the **Manual control** ▶ **Exchange cylinder unit** function.

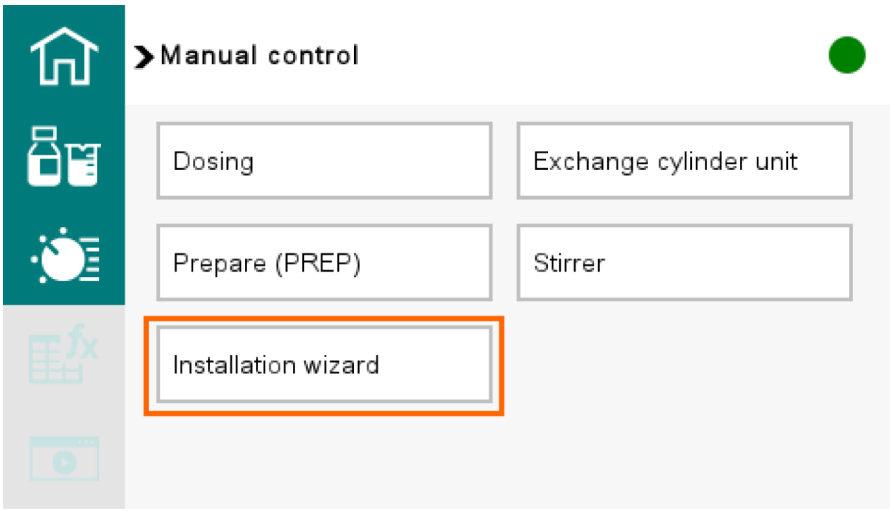
Executing the installation wizard

Prerequisite:

- The instrument is switched on. The push rod is in the lowest position.

1 The installation wizard starts automatically if the instrument is switched on for the first time.

The installation wizard can also be opened manually via **Manual control** ▶ **Installation wizard**.



2 Mount the cylinder unit according to the instructions on the screen.

After having executed a step, move to the next step with .

The cylinder unit has been mounted.

3 Scan the provided QR code to watch the installation video for installing the remaining accessories.

Further accessories can also be assembled without the installation wizard.

5.4 Mounting the support rod

Mounting the support rod

1. Screw the support rod onto the stand attachment.
2. Push the clamping ring over the support rod with the indent facing upward as far as it will go.

   The clamping ring is used as the lower stop for the titration vessel lid.

5.5 Replacing the adsorber material

Replacing the adsorber material of various vessels

Figure 17 Adsorber tube for the volumetric KF titration cell

1 Lid	**2 Housing**

Replacing the adsorber material of the adsorber tube

1 Removing the lid

- Remove the lid by pulling it out of the housing.

2 Removing the adsorber material

- Remove the entire content.
- This step is not necessary if the housing is empty.

The molecular sieve can be regenerated 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

- Place a cotton plug loosely at the base of the housing. Do not pack the cotton too tightly as sufficient gas flow has to be possible.
- Fill the housing with molecular sieve to approx. 1 cm under the housing edge.
- Place a small cotton plug on the molecular sieve. Do not pack the cotton too tightly as sufficient gas flow has to be possible.

4 Sealing the housing with the lid

- Seal the housing with the lid.

Make sure that the sealing surface between the housing and the lid is clean and dry and that there are no residuals of filling material!

At average humidity, we recommend replacing 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 should possibly 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.

5.6 Mounting the volumetric Karl Fischer titration cell

Preparing the volumetric KF titration cell

1 Place a suitable stirring bar inside the KF titration vessel.

2 Screw the KF titration vessel and the KF titration vessel lid together.

When doing so, ensure that the color marking on the KF titration vessel aligns with the raised marking on the KF titration vessel lid.

The scale of the volumetric KF titration cell can thus be read from the front.

3 Insert the 3 screw nipples in the M10 openings of the KF titration vessel lid.

4 Insert the 2 screw nipples in the M12 openings of the KF titration vessel lid.

Equipping the volumetric KF titration cell

Prerequisite:

- The volumetric KF titration cell is assembled.
- The adsorber tube with lid is filled with fresh molecular sieve. *(see "Replacing the adsorber material", chapter 5.5, page 29)*

1 Insert the tubing tip of the cylinder unit in the M10 screw nipple in the middle and screw it tight.

The antidiffusion valve of the tubing tip should be located just above the stirring bar, but should not impede it.

2 Insert the electrode in the M12 screw nipple on the left and then tighten the screw nipple until it seals.

3 Insert the adsorber tube in the M12 screw nipple on the right and then tighten the screw nipple until it seals.

4 Introduce the septum stopper (with septum inserted) into the front opening of the titration vessel lid.

Mounting the volumetric KF titration cell on the Eco KF Titrator

Prerequisite:

- The support rod with the clamping ring is mounted on the product. The clamping ring is used as the lower stop for the KF titration vessel lid. Thus, the clamping ring ensures that the KF titration cell is always positioned at the same height and exactly in the center on the magnetic stirrer.
- The volumetric KF titration cell is fully equipped.

1 Press the green locking lever on the KF titration vessel lid.

2 Push the KF titration cell over the support rod.

3 Push the KF titration cell down so that it is positioned approx. 1 mm above the magnetic stirrer and position it in the center of the magnetic stirrer.

To fix in place, release the green locking lever.

4 Push the clamping ring under the KF titration vessel lid. Rotate the clamping ring in such a way that the wedge on the KF titration vessel lid fits in the indent in the clamping ring.

5 Fix the clamping ring in place at the desired position with the knurled screw.

The position of the KF titration cell is now fixed by the clamping ring.

5.7 Mounting the bottle unit

Preparing the bottle cap

Required accessories:

- Bottle cap (6.1602.105)
- Cannula (6.1819.020)
- Threaded stopper (6.1446.080)
- Adsorber tube (6.1619.010)
- Ground-joint clip SGJ 14/15 (6.2023.020)
- Cotton
- Suitable sorbent
  - Molecular sieve for water-sensitive samples.
  - Soda lime for CO_2-sensitive samples.

1 Insert the cannula into the bottle cap.

2 Screw the threaded stopper into the bottle cap.

3 Fill the adsorber tube with a suitable sorbent.

If no special sorbent is required, then the adsorber tube can be filled with cotton and used as a dust filter.

4 Place the filled adsorber tube on the bottle cap.

5 Secure the adsorber tube in place with the ground-joint clip for SGJ 14/15.

The bottle cap is prepared.

Mounting the bottle unit

Prerequisite:

- The bottle cap is prepared.

Required accessories:

- Amber glass bottle (6.1608.023)

1 Set the bottle in the bottle holder.

2 Screw the prepared bottle cap onto the bottle and tighten it by hand.

The bottle unit is mounted

5.8 Mounting the tubing connections

The tubing connections connect the flat stopcock with the bottle unit, the cylinder unit, and the tubing tip.

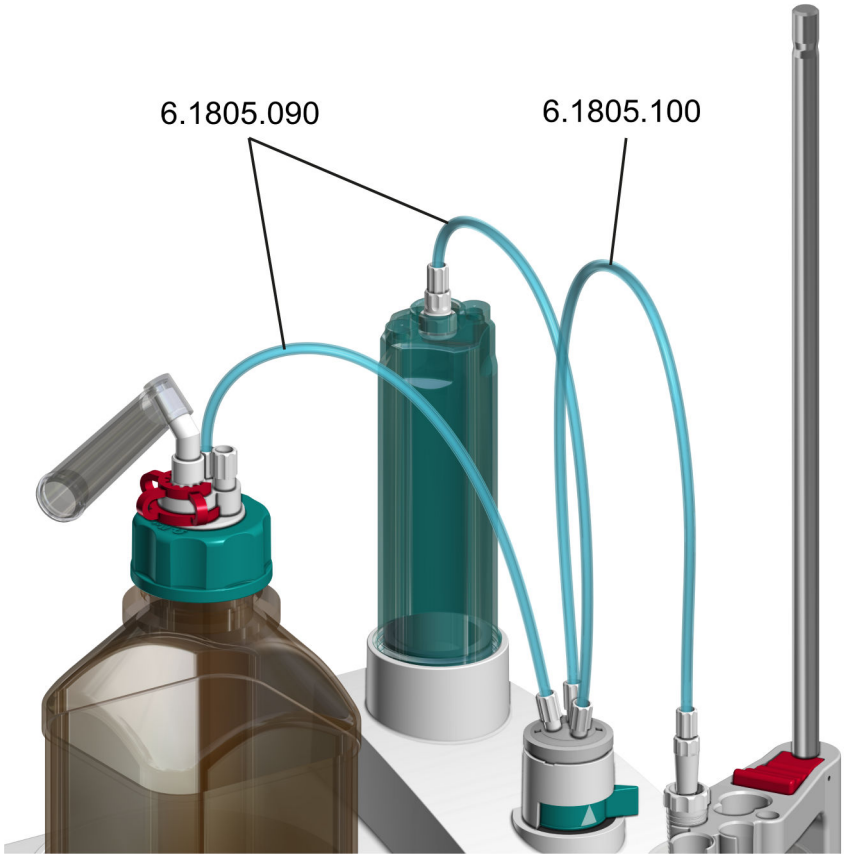


Figure 18 Tubing connections

Mounting the tubing connections and tubing tip

NOTICE

Deformation of the screw nipple of the tubing connections.

The tubing connections are unusable and must be replaced, otherwise liquids may leak out.

Measures to be avoided:

- Carefully screw in and tighten all tubing connections.
- Use no other investigative tools or other tools.

Prerequisite:

- The cylinder unit, electrode holder and bottle unit are mounted.

Required accessories:

- 2x FEP tubing 31 cm (6.1805.090)
- 1x FEP tubing 40 cm (6.1805.100)
- Optional:
  - Stopper (6.02709.010)

1 Screw the 6.1805.090 tubing securely to the cylinder unit and to the flat stopcock.

2 Screw the 6.1805.090 tubing securely to the bottle unit and to the flat stopcock.

3 Screw the 6.1805.100 tubing to the flat stopcock.

4 Screw the 6.1805.100 tubing to the tubing tip in the titration cell.

If the instrument is operated without a Solvent Pump, then seal the M10 screw nipples on the titration cell tightly with the 6.02709.010 stopper.

6 Operation and control

6.1 Switching the device on and off

Switching on the device

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.
- **PREP warning** appears and indicates that the cylinder unit needs to be prepared *(see "Preparing (PREP)", chapter 6.3.3, page 51)*.

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

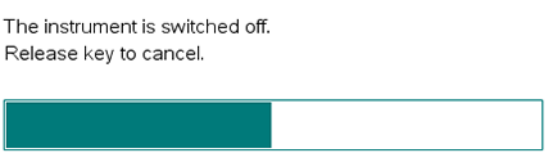
Switching off the device

Prerequisite:

- The device 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.



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

The device is switched off.

Instant Up

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

Activating and deactivating Instant Up

Prerequisite:

- The device is switched on.

1 Activating Instant Up

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

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

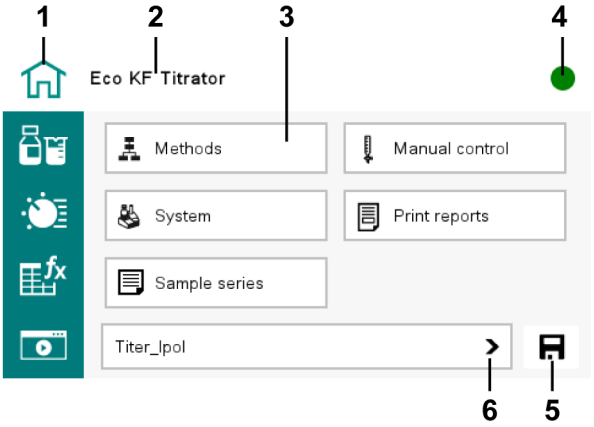


Figure 19 Start page with access to the functions

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.

If necessary, click the button so that the piston moves to the basic position, the status display lights up and the status indicator is green.

The following work areas can be selected:

Eco KF Titrator 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

Parameters

Access to the parameters, grouped into the following categories:

- Conditioning
- Start conditions
- Control parameters
- Titration parameters
- Stop conditions
- Calculation
- Statistics
- Reports

Results

Access to the calculated results and the statistics.

Live status

Access to the graphic display of the ongoing determination.

Menu path

In the menu path, clicking one of the elements of the menu path can be used to call up the respective menu.

Buttons, input fields, keyboards and help texts

The menu provides the following possible inputs and information:

- **Buttons**
  The respective menu is called up by clicking the button.
- **On/off switch**
  The corresponding function is activated or deactivated by clicking on **[ON]** or **[OFF]**.
- **Input fields**
  The respective keyboard is called up by clicking the button of the input field.
- **Keyboards**
  Input of text, numbers or characters. An appropriate keyboard is called up, depending on the type of input.

Help texts

Help texts (in English) are available for the input fields. The respective help text is called up by long pressing (for at least 3 seconds) on an input field. Default values and possible inputs are displayed.

Status indicator

The status indicator on the touch screen uses colors and symbols to display the operating status of the instrument.

Icon

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

- Save
- Delete
- Export
- etc.

Method selection bar

The list of saved methods opens by clicking on the method selection bar.

The list can be searched with the scroll bar and the requested method can be loaded by clicking on it.

Brightness of the display

The brightness of the display can be adjusted on the start page in the **System** ► **Diagnosis** ► **Display test** menu.

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

Brightness

Input range	**1** to **10**
Default value = 7	

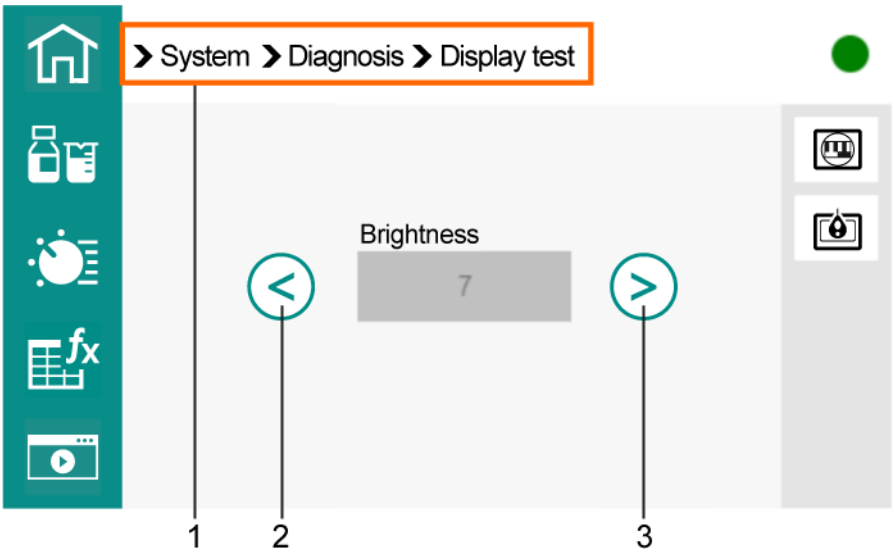


Figure 20 Display – Controls

1	**Menu path**	**2**	**Reducing brightness**
3	**Increasing brightness**		

Keyboards

Different keyboard types are available.

Figure 21 Keyboard (example: lower-case characters)

1	**Input field**	**2**	**Deleting the entry**
3	**Backspace**	**4**	**Canceling the entry (closing the window)**
5	**Applying the entry**	**6**	**Forwards in the input field**
7	**Backwards in the input field**	**8**	**Space**
9	**Switching the keyboard**		

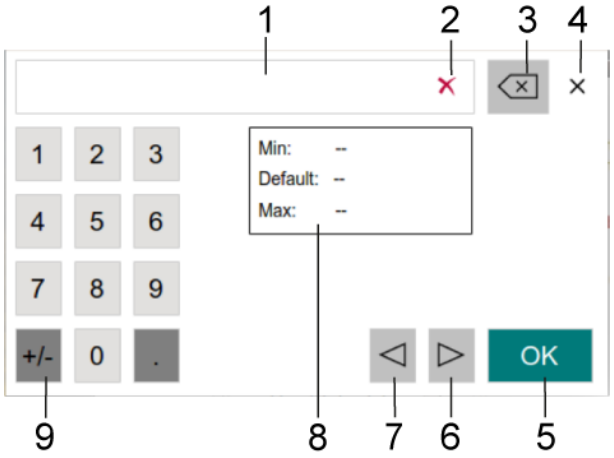


Figure 22 Keyboard (example: numbers)

1	**Input field**	**2**	**Deleting the entry**
3	**Backspace**	**4**	**Canceling the entry (closing the window)**
5	**Applying the entry**	**6**	**Forwards in the input field**
7	**Backwards in the input field**	**8**	**Information on the input range**
9	**Algebraic sign change**		

6.2.1 Formula editor

Figure 23 Formula editor

1	**Input field**	**2**	**Deleting the entry**
3	**Backspace**	**4**	**Canceling the entry (closing the window)**
5	**Applying the entry**	**6**	**Forwards in the input field**
7	**Backwards in the input field**		

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	Volume of the endpoint EP1
CI#	Sample identification (# = 1–2)
R#	Result (# = 1–5)
FCT	Factor
DIV	Divisor
CV0#	Common variable (# = 1–5)
SMN#	Mean value of the result R# (# = 1–5)
TITER	Titer of selected solution
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, then only **R#** is entered. In order to define the R# to be used, the corresponding number needs to be added manually after "R#". Example: R**5**

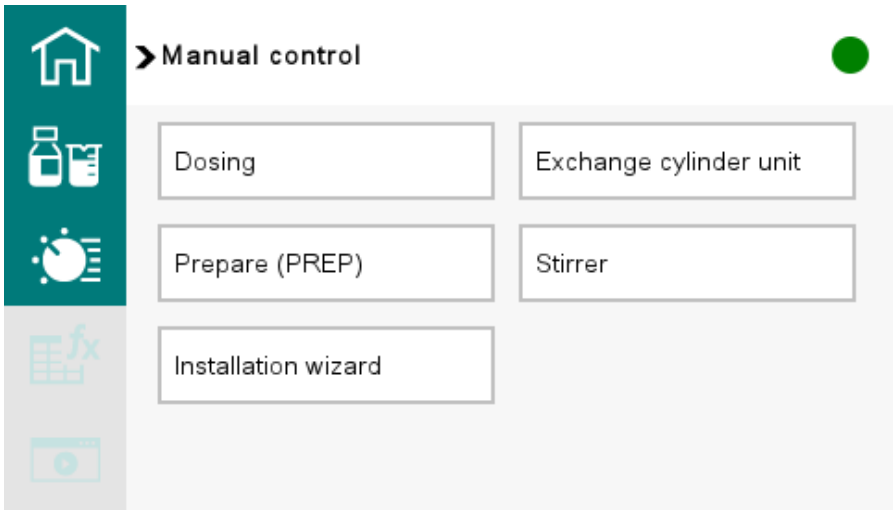
Variables

Clicking on **[Var]** displays a list with additional variables. These variables can either be entered directly into the formula or can be selected from this list and applied with **[OK]**.

Variable	Description
MIM	Initial measured value, i.e. measured value prior to the processing of the start conditions
MSM	Start measured value, i.e. measured value after the processing of the start conditions
MCV	End volume, i.e. total dosed volume at the end of the titration
EM#	Measured value of endpoint EP# (# = 1–9)
ED#	Time at endpoint EP# (# = 1–9)
MSV	Start volume
DD	Duration of the entire determination

6.3 Manual control

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



- Dosing – Dose a specified volume or dose continuously.
- Exchange the cylinder unit – Empty and safely replace the cylinder unit.
- Prepare – Rinses and fills the cylinder unit and the tubings.
- Stirrer – Switch the stirrer on and off and set the stirring rate.
- Installation wizard – Initial installation of the cylinder unit.

6.3.1 Manual control – Dosing

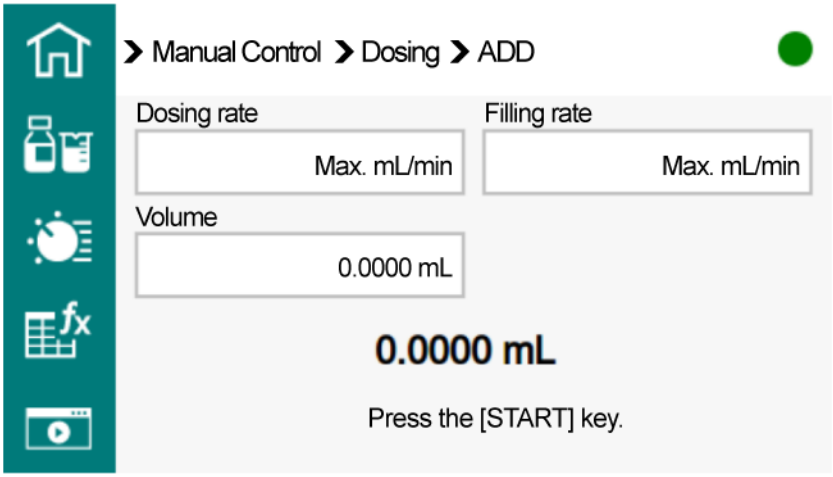
The following manual dosing functions are available with the Eco KF Titrator:

- **Dosing a fixed volume (ADD)** – Dosing a specified volume.
- **Continuous dosing (DOS)** – Dosing as long as the ▶ key is being pressed.

Dosing a specified volume (ADD)

1 Selecting the dosing function

- Manual control ▶ Dosing ▶ ADD



2 Configuring the dosing function

- The dosing and filling rates should be decreased for viscous and highly volatile liquids.
- The maximum dosing rate and maximum filling rate depend on the cylinder volume.
- In manual control, the instrument doses in steps of 1/20,000 of the cylinder volume. The entered dosing volume is rounded accordingly.

- Enter the dosing rate.
- Enter the filling rate (filling the cylinder).
- Enter the required dosing volume.

3 Starting the dosing

Press the ▶ key.

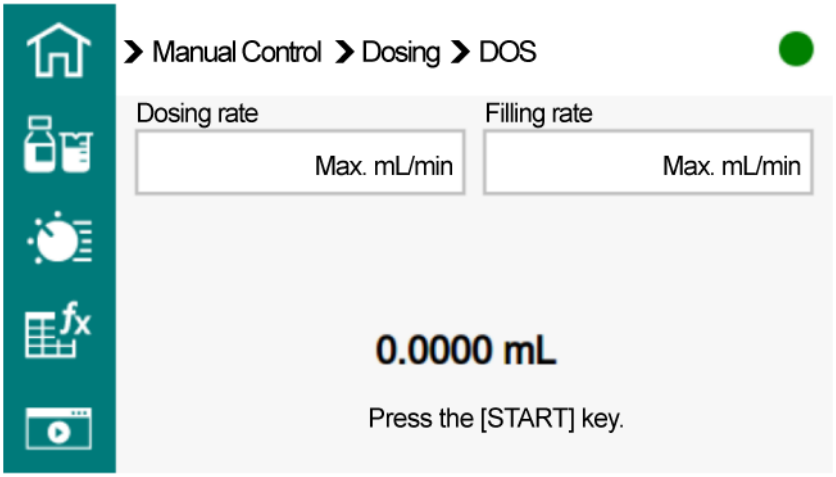
The dosed volume is shown on the screen.

- As soon as the cylinder is empty, the cylinder will be refilled automatically.

Dosing continuously (DOS)

1 Selecting the dosing function

- **Manual control ▶ Dosing ▶ DOS**



2 Configuring the dosing function

- The dosing and filling rates should be decreased for viscous and highly volatile liquids.
- The maximum dosing rate and maximum filling rate depend on the cylinder volume.

- Enter the dosing rate.
- Enter the filling rate (filling the cylinder).

3 Starting the dosing

- Press the ▶ key for as long as dosing should take place.
- Pausing the dosing: Release the ▶ key.
- Continuing the dosing: Press the ▶ key again for as long as dosing should take place.

The dosed volume is shown on the touch screen.

4 Use the ■ button to stop the process and fill the cylinder.

6.3.2 Exchanging the cylinder unit

In the **Exchange cylinder unit** function, the drive moves the push rod into the exchange position.

NOTICE

Material damage caused by incorrect handling of the cylinder unit

The cylinder unit is blocked or damaged in some other way and must be replaced.

- Follow strictly the instructions for assembly, disassembly, and maintenance of the cylinder unit.
- Use only the tools specified.

NOTICE

Material damage from aggressive chemical hazardous substances

If the product comes into contact with aggressive chemical substances, this can lead to malfunctions or the product may be damaged and must be replaced.

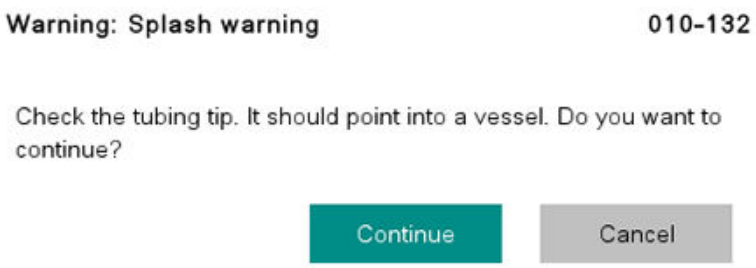
- Clean up spilled liquids and solids immediately.
- Use protective grounding when working with highly flammable chemical substances and gases.
- If you suspect that chemical substances have penetrated the product, disconnect the product from the energy supply immediately. Then notify the regional Metrohm service representative.

Emptying and removing the cylinder unit

1 On the **Start page**, open the **Manual control** menu.

Click **[Exchange cylinder unit]**.

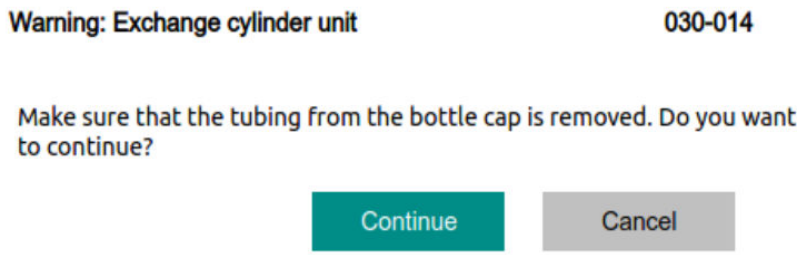
A splash warning appears:



2
- Make sure that the tubing tip points into a vessel.
- **[Continue]**

The piston rises and the cylinder empties as much as possible. The message **Exchanging cylinder unit...** appears.

Once the push rod has reached the top position, the following warning appears:

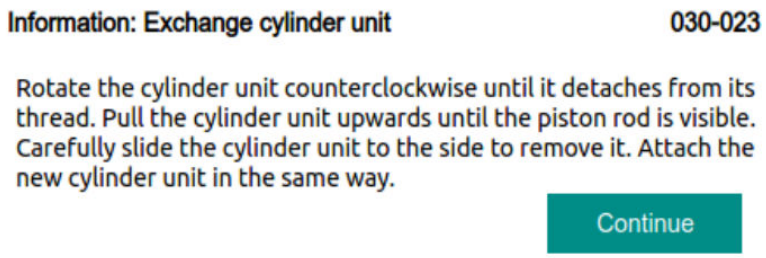


3
- Make sure that the tubing from the bottle cap is removed.
- **[Continue]**

The message **Exchanging cylinder unit...** appears and the piston is lowered down to the height at which the cylinder unit can be disassembled.

4
- Remove the tubing from the cylinder unit.
- **[Continue]**

The following message is displayed:



5 **Dismantling the cylinder unit**

- Rotate the cylinder unit counterclockwise until it detaches from its thread.
- Pull the cylinder unit vertically upwards until the piston rod is visible.
- Carefully slide the cylinder unit to the side to remove it.

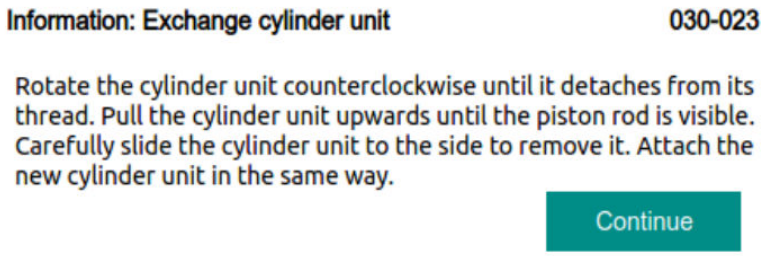
The disassembled cylinder unit can be cleaned and reused or replaced with a new cylinder unit.

Mounting the cylinder unit

Prerequisite:

- The instrument is switched on.

- The **[Exchange cylinder unit]** process was executed up to the point when the cylinder unit can be removed from the instrument.
- The instrument is carrying out the **[Exchange cylinder unit]** procedure and the push rod of the dosing drive is at the height at which the cylinder unit can be mounted. The following message is displayed:



- The maintenance has been carried out professionally or a new cylinder unit is ready for assembly.
  The cylinder unit is prepared:

1 Connect the cylinder unit to the push rod and carefully align the piston rod into the hook profile of the push rod while doing so.

2 Grasp the cylinder unit at the light protection and press it **carefully and straight** down (the piston is pressed into the cylinder) until the mounting ring rests on the housing.

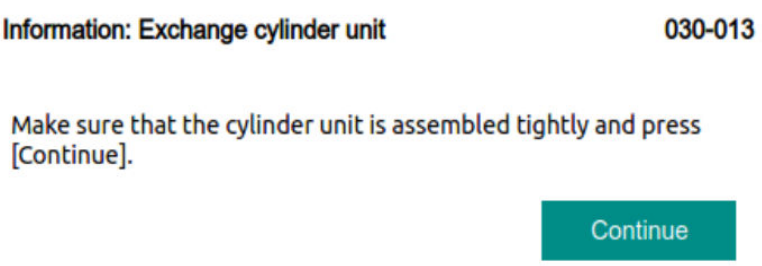
Make sure that the sealing lips and the piston in the cylinder are not damaged.

3 Screw the cylinder unit securely into the thread of the housing and tighten it.

4 **[Continue]**

The push rod moves the piston into the basic position.

5



Make sure that the cylinder unit has been mounted correctly.

[Continue]

6 **[Continue]**

Make sure in the **System** ▶ **Settings** menu that the value of the cylinder volume matches the volume of the mounted cylinder unit.

The cylinder unit is ready and the **Prepare (PREP)** command can be executed.

6.3.3 Preparing (PREP)

The **PREP** function is used to rinse the cylinder unit and tubings and fill them free of air bubbles.

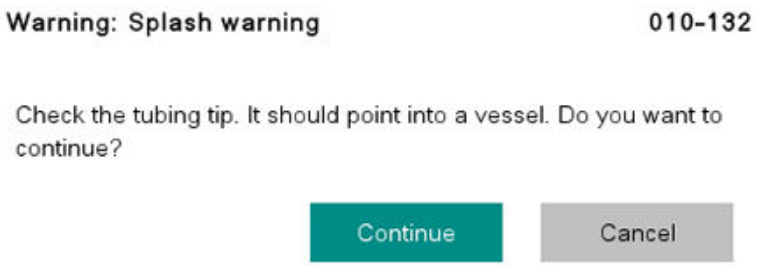
Metrohm recommends executing the function (PREP) before the first determination.

Preparing (PREP)

1 On the **Start page**, click on **[Manual control]**.

2 Click on **[Prepare (PREP)]**.

A splash warning appears:



3 Make sure that the tubing tip points into a vessel.

[Continue]

The piston rises and sinks and the cylinder empties and fills in 2 cycles.

The cylinder unit is prepared and can be used.

6.3.4 Operating the magnetic stirrer

Switching the stirrer on and off

Prerequisite:

- The instrument is switched on.

1 Add a stirring bar to the sample vessel.

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

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

The controls for the magnetic stirrer appear:

4 **Switching on the stirrer**

Click on ▶. This icon is visible only when the stirrer is switched off.

The stirrer begins stirring with the most recently set stirring rate.

5 **Switching off the stirrer**

Click on ■. This icon is visible only when the stirrer is switched on.

The stirrer stops.

Setting the stirring rate

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

The stirring rate should be high enough to form a small vortex. Select the appropriate stirring rate, otherwise incorrect measured values may result.

Table 6 Consequences of incorrect stirring rate

The stirring rate is too high	Air bubbles are stirred into the measuring solution.
The stirring rate is too low	The solution is not mixed well at the electrode.

Prerequisite:

- The magnetic stirrer controls are opened: **Start page** ▶ **Manual control** ▶ **Stirrer**
- The stirrer is switched on.

1 **Reducing the stirring rate in steps**

Click < repeatedly until the desired stirring rate has been reached.

With each click, the stirring rate is reduced by one step. The current stirring rate is displayed.

2 Increasing the stirring rate in steps

Click (>) repeatedly until the desired stirring rate has been reached.

With each click, the stirring rate is increased by one step. The current stirring rate is displayed.

6.4 Methods

Definition

A **method** determines how determinations are carried out. The titration mode, measured quantity and further 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

The **method selection bar** on the start page shows the method that has been loaded. If needed, another method can be loaded in the method selection bar. Determinations can be executed with the method that has been loaded.

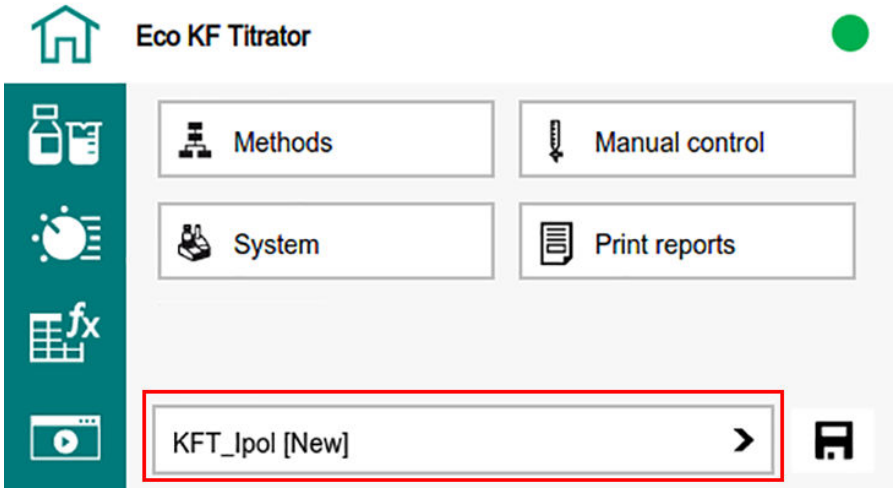


Figure 24 Method selection bar

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

Method list

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

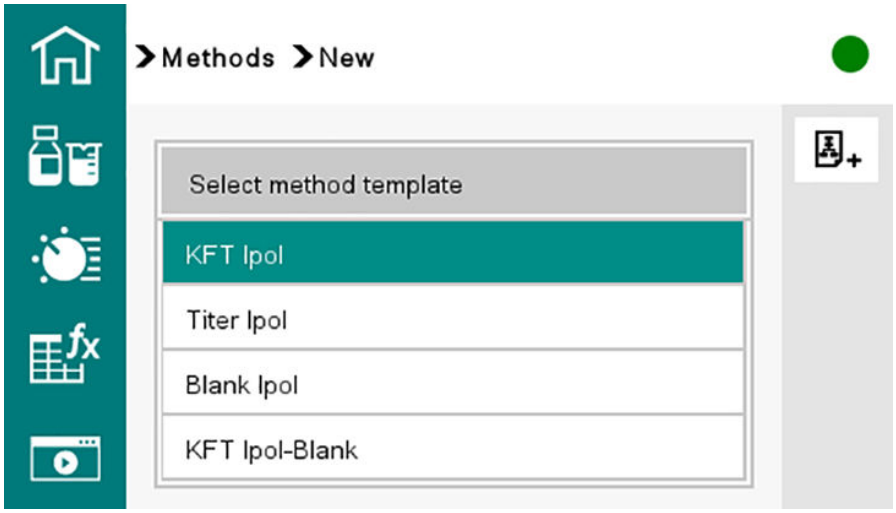


Figure 25 Method list (example)

A scroll bar appears if the list is longer.

Titration mode

Each method is based on the same titration mode. The corresponding calculation is specified in each case.

The following titration modes are available:

- **KFT Ipol** – Method for the content determination of water in the sample.
- **Titer Ipol** – Method for titer determination.

- **Blank Ipol** – Method for blank value determination. The mean value of the blank value is automatically saved as common variable.
- **KFT Ipol-Blank** – Method for content determination of water in the sample minus the blank value. The blank value is automatically taken into account if the blank Ipol method was previously carried out.

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** – Print out the method or save it to a USB flash drive.
- **Import method** – Add a method from a USB flash drive to the method list.

Loading the method

1 Open the method selection bar on the **Start page**:

Click 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.

3 Change the method parameters if necessary.

The method is available for determinations.

Changing the method parameters

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.

4 Continue with one of the following steps:

- Carry out determinations with the modified method.
- Go to the **Start page** and save the method for later use.

Saving the method

If the method parameters are modified, then they can be saved as your own method. A maximum of 120 methods can be saved. 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.

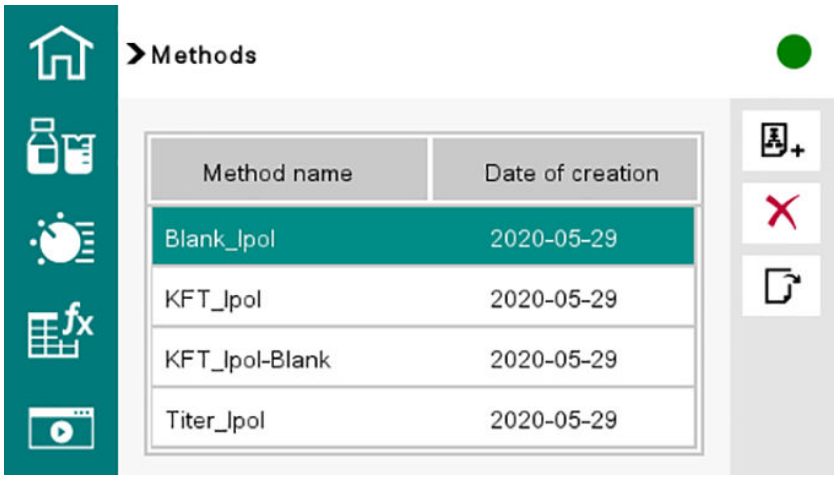
3 Enter the desired name with the keyboard. Finish with **[OK]**.

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

Creating a new method

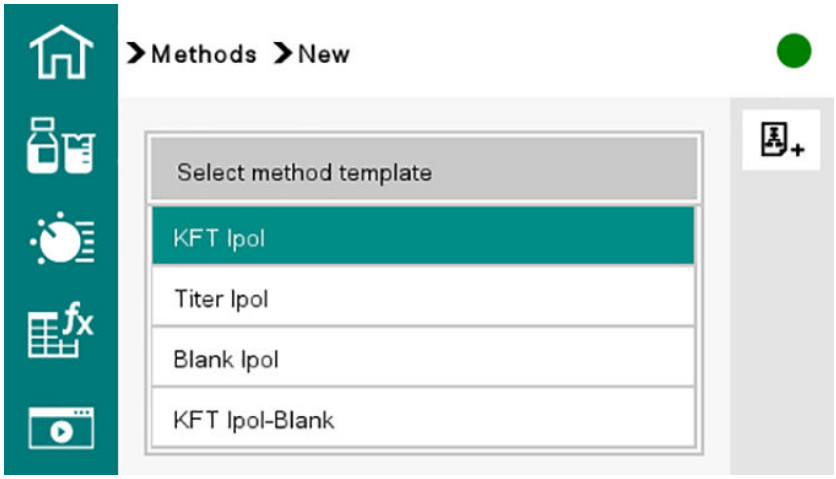
1 On the **Start page**, click on the **[Methods]** button.

The method list opens.



2 Create a new method:

A selection of titration modes appears.



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

- Select the desired titration mode by clicking on it. Example: KFT Ipol
- Click on .

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

4 Set the method parameters.

5 Continue with one of the following steps:

- Carry out determinations with the new method.
- Save the method for later use.

Deleting a method

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

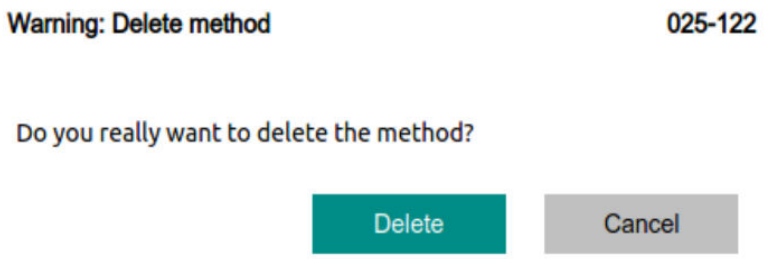
The method list appears.

2 Select the method that you want to delete by clicking on it.

The selected method is highlighted in green.

3 Delete the highlighted method:

The warning **Delete method** appears.



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 Select the method that you want to export by clicking on it.

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.

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?**.

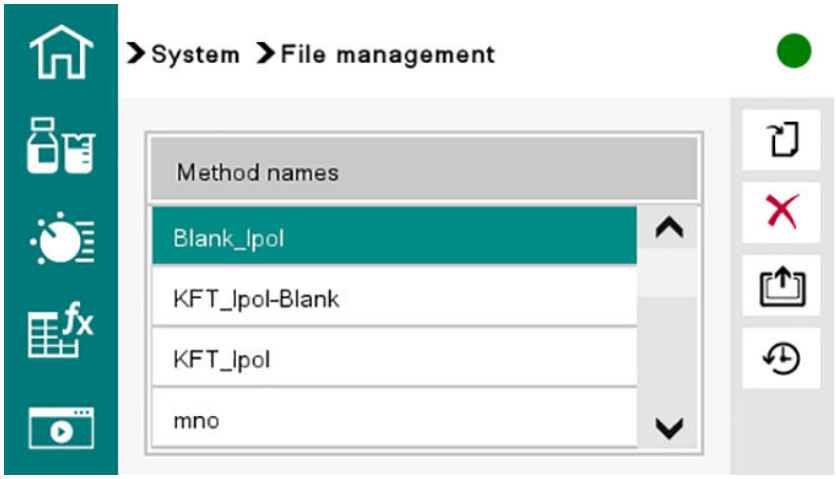
- **[Yes]**: The method on the USB flash drive will be overwritten.
- **[No]**: The method will not be exported.

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 Select the method that you want to import by clicking on it.

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 series

Metrohm recommends operating the Eco instrument together with the 885 Oven Sample Changer. Activation of the sample series is necessary for this application.

Use the 6.2141.390 remote cable (sold separately) to connect the instruments.

The following options are available for creating and managing sample data:

- **Enabling the sample table**
- **Creating new samples**
- **Editing samples**
- **Deleting individual samples** – Delete samples from the sample table.
- **Resetting the sample table** – All samples are reset to not executed.
- **Creating a new sample table** – Delete all samples from the sample table.

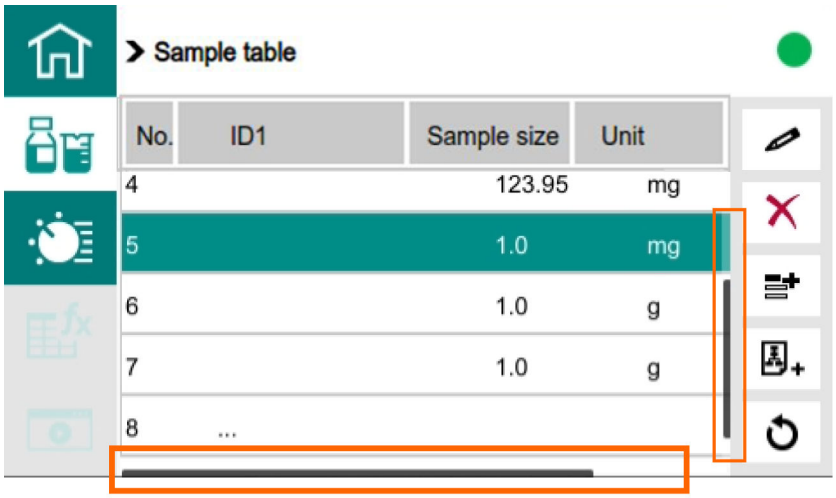
Enabling the sample table

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

2 Click on **[ON]**.

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:

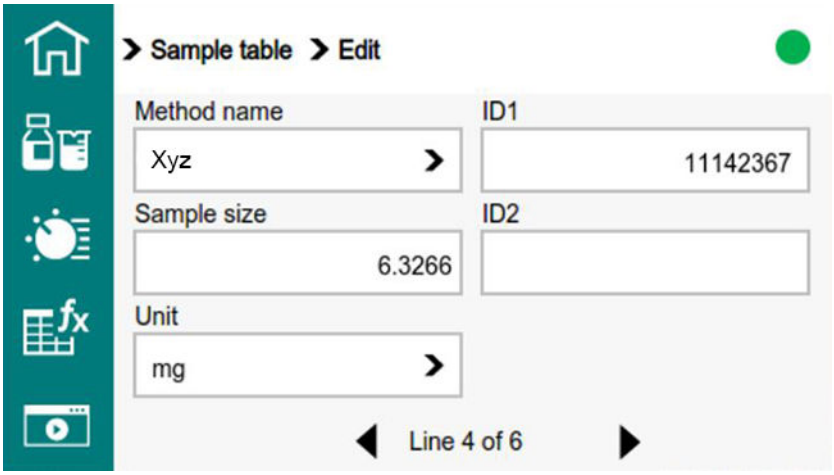
- The sample table is activated.

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

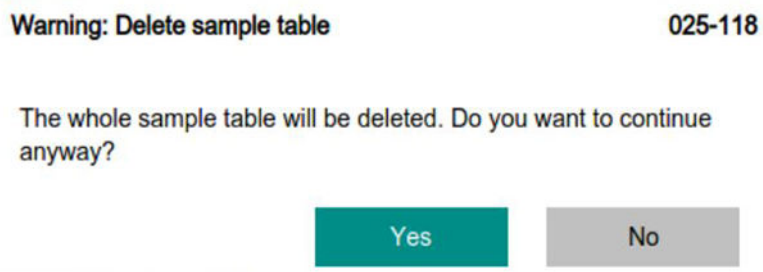
Prerequisite:

- 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.



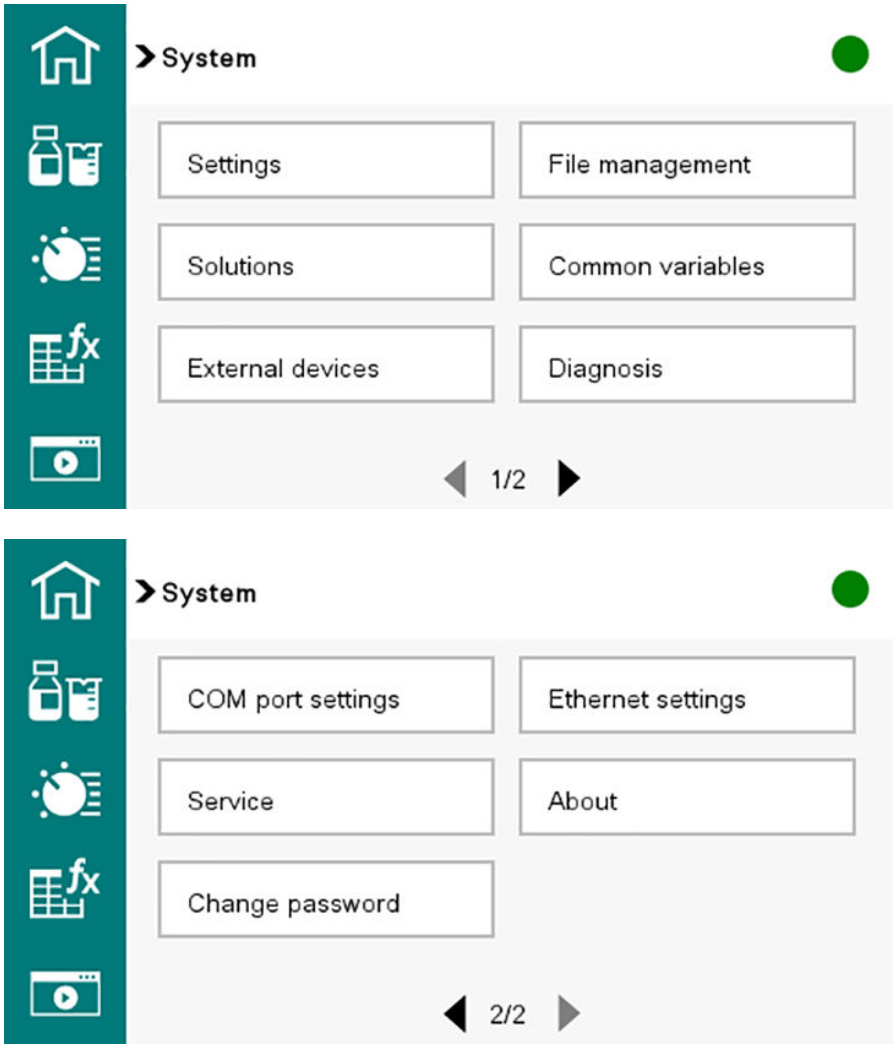
3 Confirm deleting: **[Yes]**

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

6.6 System – Configuration

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

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



- Settings – Basic instrument settings.
- Solutions
- Common variables
- External devices (peripherals)
- Diagnosis
- File management
- Ethernet settings
- Service
- About

- Change password
- COM port settings

6.6.1 System – Settings

System ▶ Settings

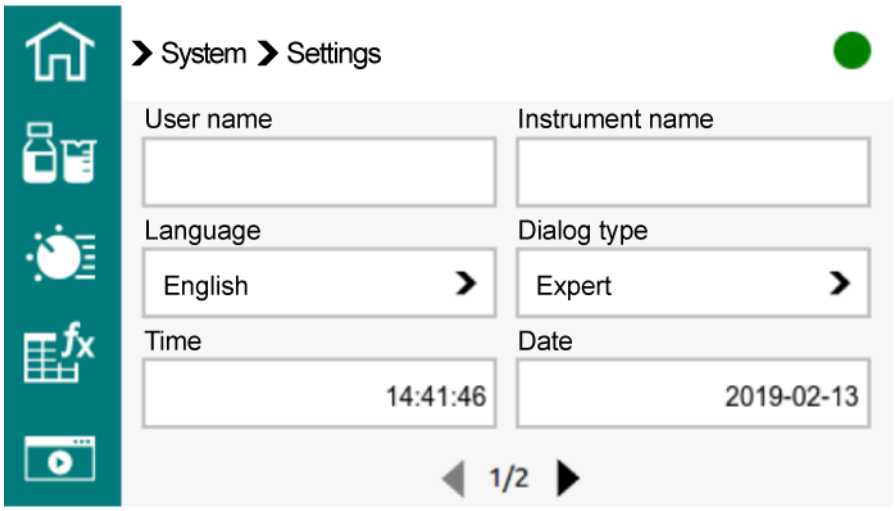


Figure 26 System – Settings page 1

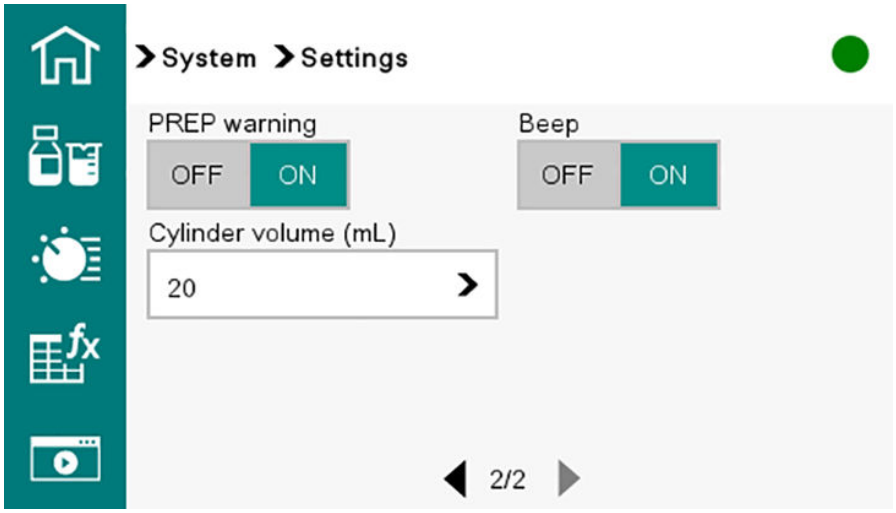


Figure 27 System – Settings page 2

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 be printed only if a designation has been defined.

Input: max. 10 characters

Default value: empty

Language

Set the dialog language.

Dialog type

The user dialog can be limited for routine operations. The resetting of the dialog will take effect as soon as you exit the start page.

- Dialog type **Expert** (default value)
  In the dialog type **Expert**, all the user settings are available.
- Dialog type **Routine**
  In the dialog type **Routine**, 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. Methods can be loaded, however, on the start page.

The **Routine** setting will only take effect once the **[System]** menu has been exited.

To switch back to expert mode, open the **[System]** menu and enter the password:

- **METROHM9100**

Then activate the **Expert** dialog type.

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

PREP warning

If the **PREP warning** is activated, then the recommendation to execute the **Prepare (PREP)** function will appear:

- After the device is switched on.
- Each time a cylinder unit is attached.

All tubing and the cylinder are rinsed with this function.

Switch: 

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

Default value: **ON**

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 conditioned without interruption for 10 seconds.

Switch: 

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

Default value: **ON**

Cylinder volume (mL)

Volume of the cylinder in mL.

Selection:

- **5**
- **10**
- **20**
- **50**

Default value: **20**

6.6.1.1 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]**.

6.6.1.2 Setting the dialog type

The user rights can be restricted with the **Dialog type** input field:

- Dialog type **Expert** (default value)
  In the dialog type **Expert**, all the user settings are available.
- Dialog type **Routine**
  In the dialog type **Routine**, 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. Methods can be loaded, however, on the start page.

If the instrument is switched off, the dialog type that was set remains activated.

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.

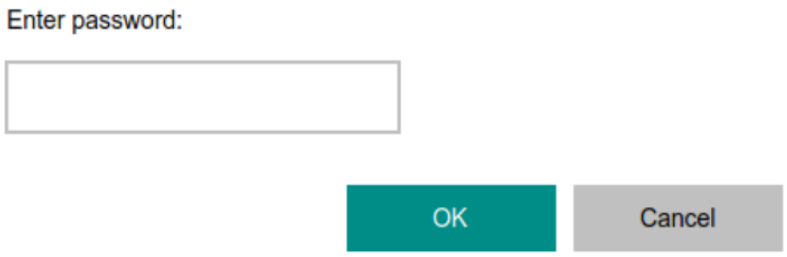
4 Exit the **System** menu.

The instrument is now in **Routine** mode. 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:



2 Click in the input field.

A keyboard appears.

3 Enter the password:

- **METROHM9100**

Confirm with **[OK]**.

The password can be changed under **System** ▶ **Change password** *(see "Changing the password", chapter 6.6.9, page 81)*.

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

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

If you exit the **System** menu at this point, the instrument will return to Routine mode.

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.

6.6.2 Managing solutions

System ► Solutions

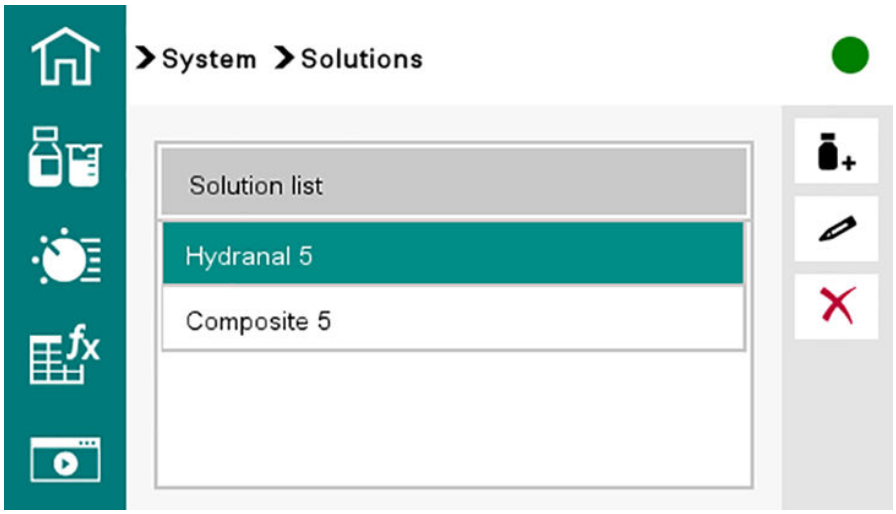


Figure 28 Solution list (example)

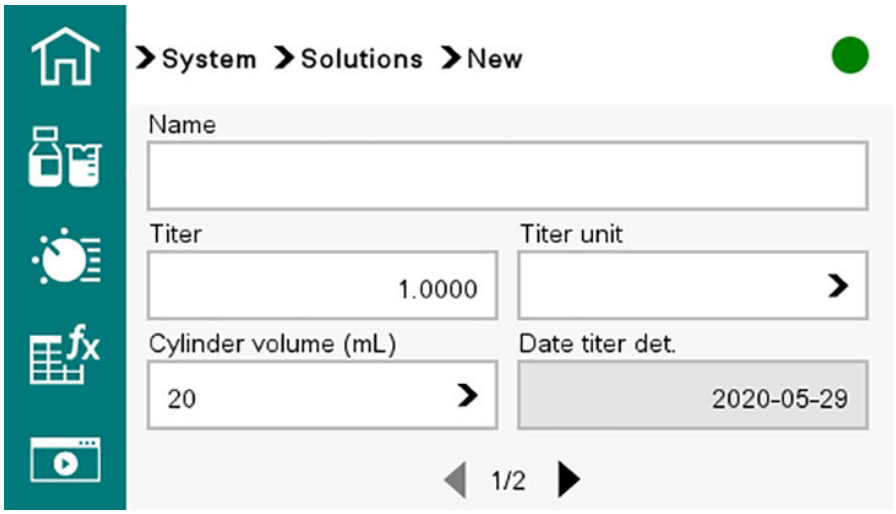
Table 7 Managing the solution list

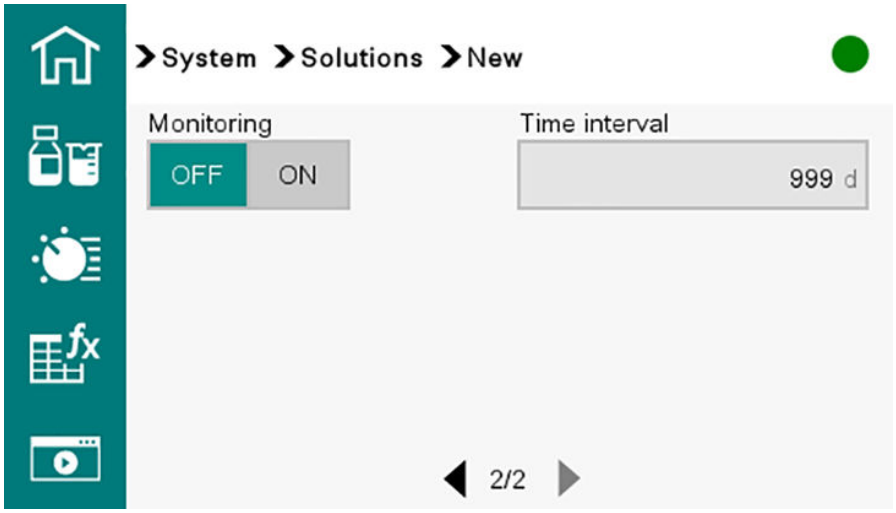
	Add a new solution to the list. Solution data see below.
	Edit the data of the selected solution. Solution data see below.
	Delete the selected solution from the list.

A maximum of 20 solutions can be saved.

Solution data

The solution data for **New** ( ) and **Edit** ( ) are the same, therefore only pictures for **System ► Solutions ► New** are shown:





Name

The designation of the solution is used for unique identification.

Input: max. 24 characters

Default value: empty

Titer

Titer of the solution.

Input range	**–999,999,999** to **9,999,999,999**
Default value	**1.000**

Titer unit

Unit of the titer.

Selection:

- **µmol/mL**
- **mmol/L**
- **mol/L**
- **g/L**
- **mg/L**
- **mg/mL**
- **µg/L**
- **ppm**
- **%**
- **mEq/L**
- **empty**
- **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.

Default value: **empty**

Cylinder volume (mL)

Volume of the cylinder in mL.

Selection:

- **5**
- **10**
- **20**
- **50**

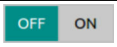
Default value: **20**

Date titer det.

Date of the last titer determination.

Monitoring

Activate and deactivate titer monitoring.

Switch: 

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

Default value: **OFF**

Time interval

This parameter is visible only when **Monitoring = On**.

When you start a method, you will be notified if this time interval (in days) has already elapsed. You can then select whether or not you would still like to start the method.

Input range	**1** to **999 d**
Default value	**999 d**

6.6.3 Managing common variables

System ▶ Common variables

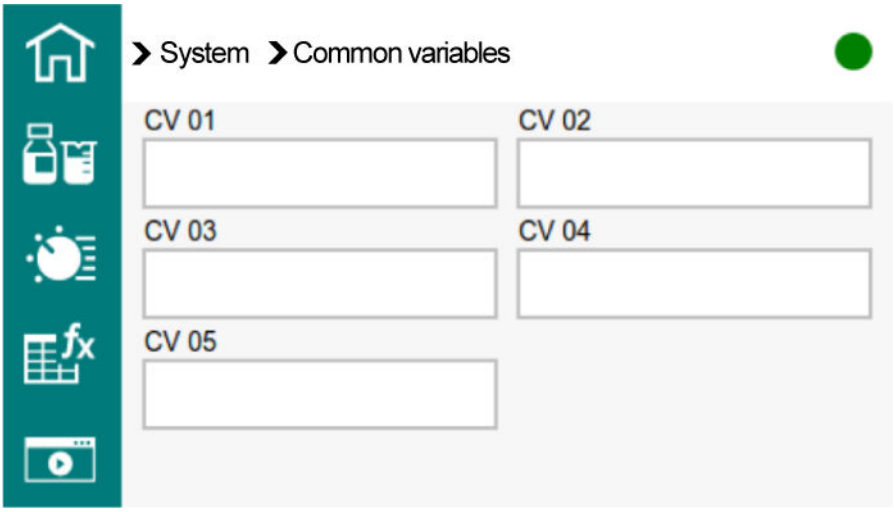


Figure 29 Common variables

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.
- Determination of the content of a standard solution, 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).

6.6.4 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**

USB flash drive	The report is saved as a TXT file on the USB flash drive in the folder **pc_lims_report**.
Ethernet/ RS-232	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.

6.6.5 System – File management

System ▶ File management

This dialog offers the following functions:

- Importing a method from a USB flash drive to the instrument.
- Deleting the method on the USB flash drive.
- Writing a system backup to a USB flash drive. The backup contains all the data and settings of the instrument.
- Restoring the system of the instrument with an existing backup.
  We recommend to create 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:

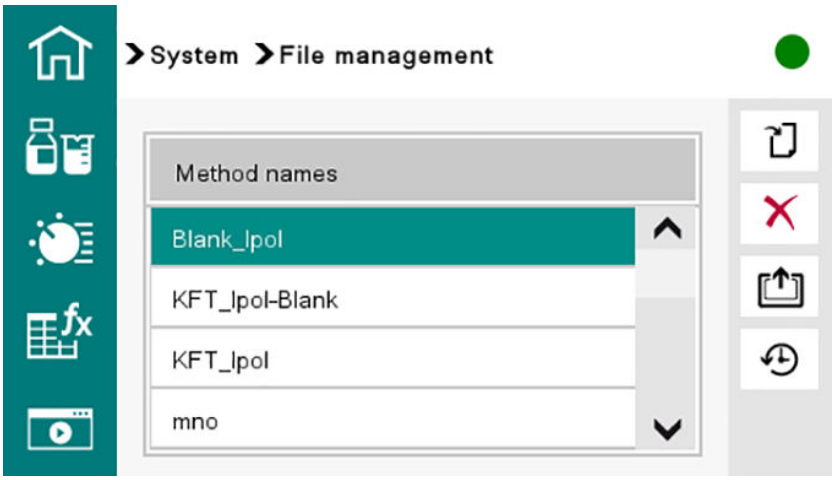
Backup	All of the files of the backup are stored in this folder. The folder is created as soon as a backup is created for the first time. The file names of the backups are structured as follows: *SF_YYYY-MM-DD_hhmmss.ods*
Files	Exported methods are stored in this folder. The folder is created as soon as a method is exported for the first time. Only methods located in this folder can be imported.
pc_lims_report	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 Select the method that you want to import by clicking on it.

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?**.

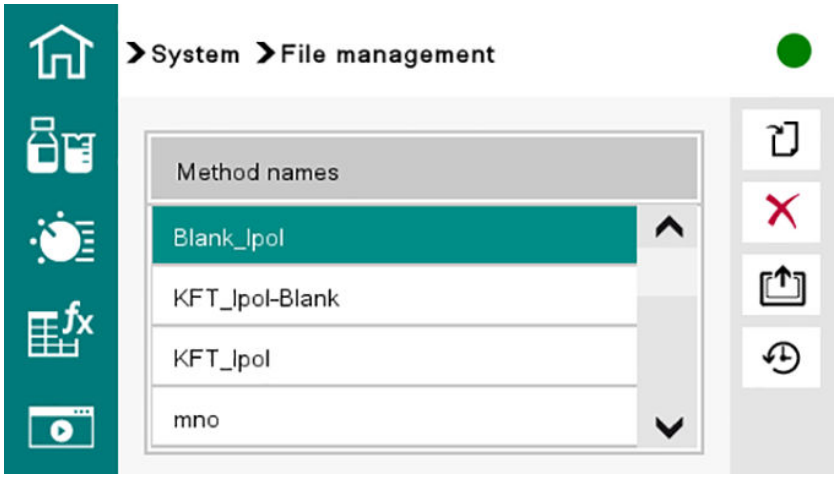
- **[Yes]**: The method on the instrument will be overwritten.
- **[No]**: The method will not be imported.

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 Select the method that you want to delete by clicking on it.

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]**.

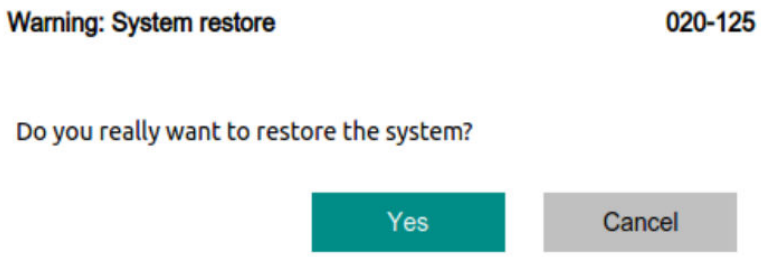
3 Restore the system:

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 warning **System restore** appears.



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.

6.6.6 Instrument diagnosis

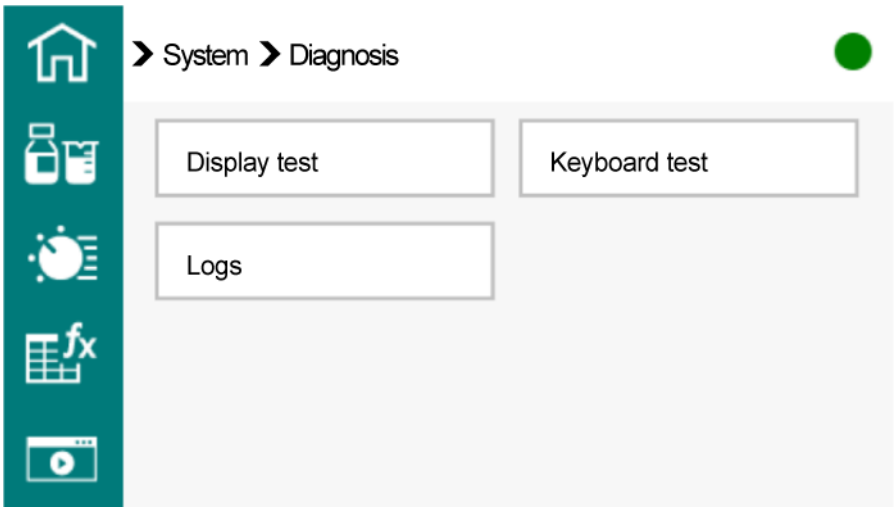


Figure 30 System menu – Diagnosis

Display test

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

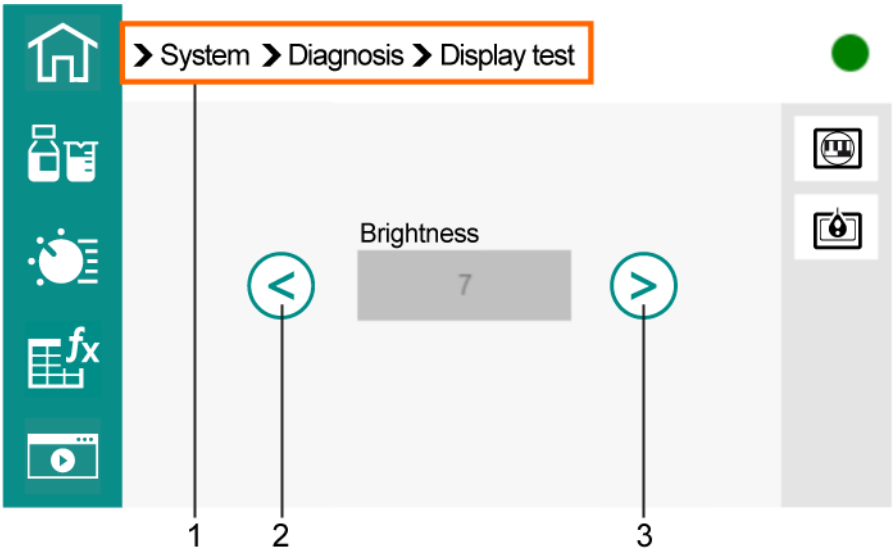


Figure 31 Display – Controls

1	**Menu path**	**2**	**Reduce brightness**
3	**Increase 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 five keys of the control bar one after the other:

- The instrument confirms each successful press of a key with a tick: ✓

Logs

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

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

6.6.7 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**

6.6.8 Service – Brief description

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

6.6.9 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.

Make a note of the password and store it in a safe place.
If you lose the password, the system must be reset to factory settings with a system initialization. The default password is:

- **METROHM9100**

The system can then be restored with a backup.

6.6.10 COM port settings

System ▶ **COM port settings**

When using a balance with serial interface, adjust the corresponding settings. The parameters set for the RS-232 interface on the balance must match those on the instrument.

Use the 6.2148.050 USB/RS-232 Converter. This converter provides the serial connector.

Baud rate

Transfer rate in characters per second.

Selection:

- **1200**
- **2400**
- **4800**
- **9600**
- **19200**
- **38400**
- **57600**
- **115200**

Default value: **9600**

Data bits

Number of data bits.

Selection:

- **7**
- **8**

Default value: **8**

Stop bits

Number of stop bits.

Selection:

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

Default value: **1**

Parity

Type of parity testing.

Selection:

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

Default value: **None**

Handshake

Type of the data transfer protocol.

Selection:

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

Default value: **Hardware**

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

6.6.11 Displaying system data

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

- Program version
- Instrument
- Main board
- Measuring interface

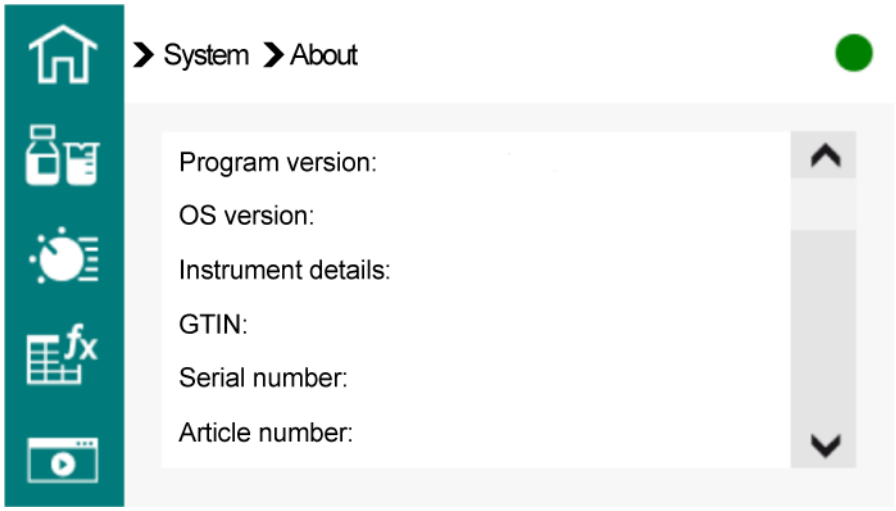


Figure 32 System data

6.7 Carrying out the determination

1 Loading the method

- Load the desired method.

2 Starting conditioning

Prerequisite:

- The titration cell is filled with reagent.
- Press the ▶ key.
- Conditioning starts. **Conditioning not OK** is displayed until the endpoint is reached. The working medium is titrated to the end. This is indicated by **Conditioning OK**. The status is kept stable.

3 Adding sample

- Press the ▶ button as soon as **Conditioning OK** is displayed.
- Conditioning is stopped. The prompt to add the sample will be displayed for 8 s. Add the sample during this time.

Then the request for the sample size appears.

4 Entering the sample size

- Enter the sample size.

5 Starting the titration

- Press the ▶ key.

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

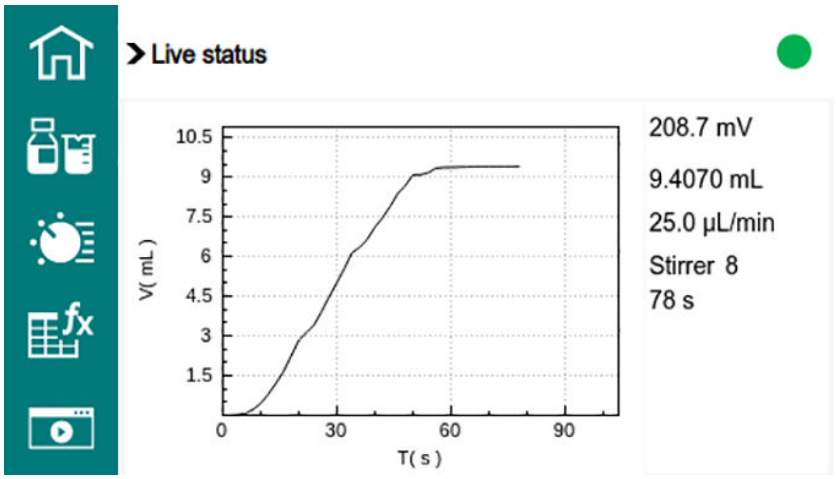


Figure 33 Live status

The axes are scaled automatically.

Pauses the determination.

Continues the determination.

This button appears as soon as the determination is paused.

6 Making live modifications (if necessary)

- Edit the sample data of the running determination
- Edit 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 the sample data

- Edit the sample data.

3 Opening 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:

6.8 Results

shows the **Results** work area.

After a titration has been completed, the **Results** work area opens automatically.

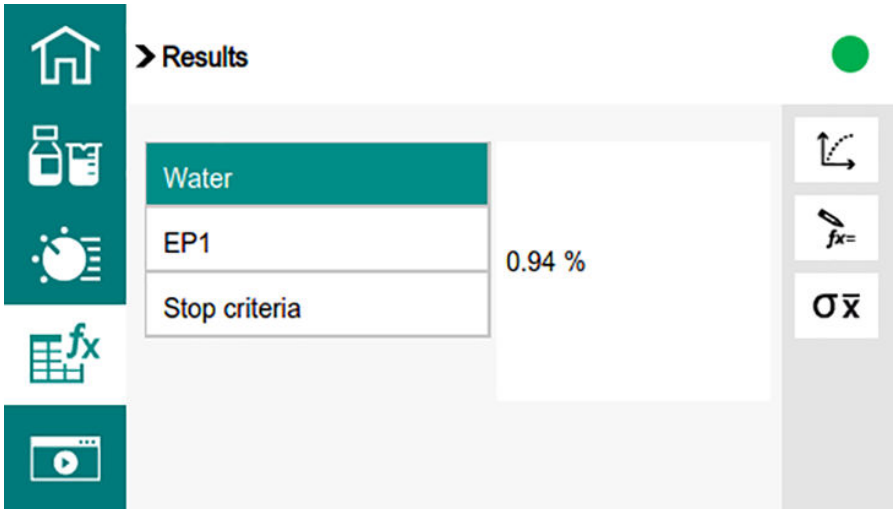


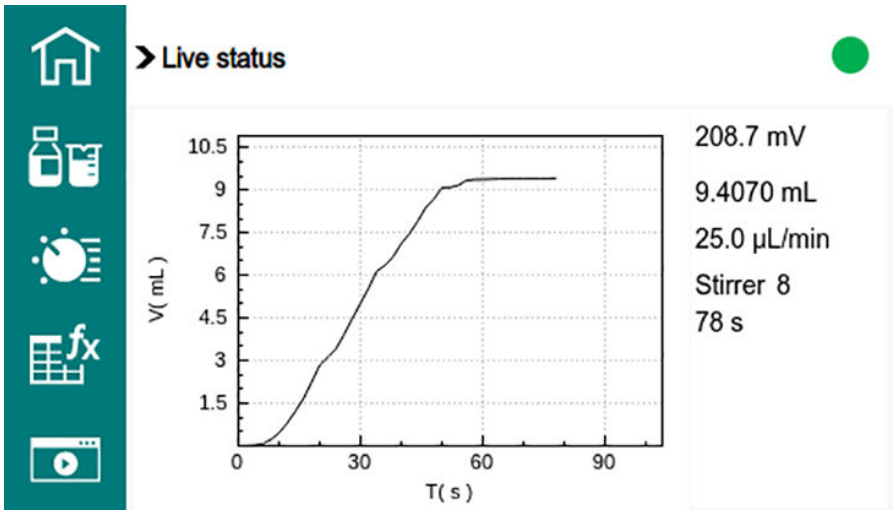
Figure 34 Results overview

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

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

Curve

By clicking on the key, the curve of the current determination is displayed.



Recalculating

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

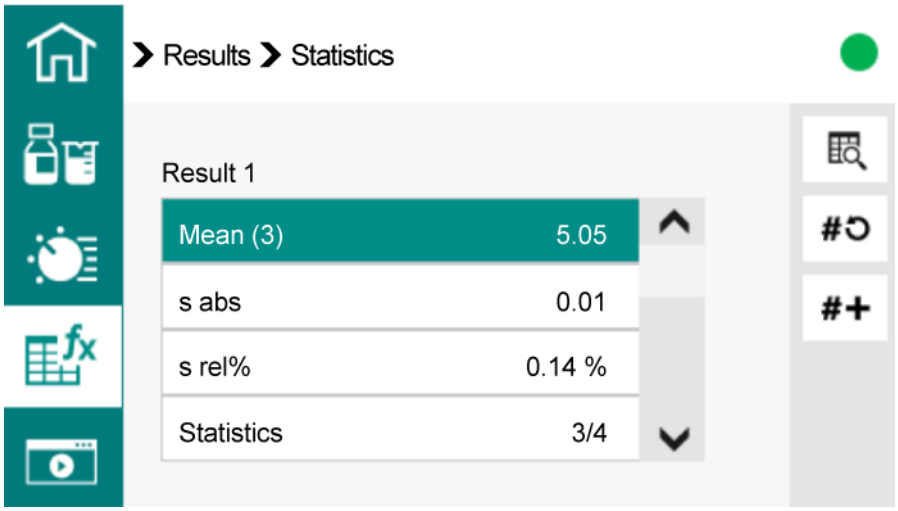
Recalculation cannot be undone.

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.

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



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 4 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 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.
#+	**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.

6.9 Printing reports

The following reports can be printed out:

Results — Result report with determination properties, sample data, calculated results, etc.

Parameter — Report with all method parameters of the loaded method.

System — System report with system settings, solution list, external devices, etc.

Preparing to print

1 On the start page, open **System** ▶ **External devices**.

Click on the **Printer** button.

The printer list opens:

- With **Custom printer**, you can print out on a Q3X printer.
- With **PDF**, you can save a PDF file on the USB flash drive. If no USB flash drive is connected, an error message will appear.

2 Select the desired printer.

If the command **Print reports** is executed, then the reports will be printed out on the Custom printer or saved in PDF form on the connected USB flash drive.

Printing reports

1 On the **Start page**, click on the **Print reports** button.

A list with the following options opens:

- Results
- Parameter
- System

2 Select the desired report.

The report data is recorded and printed.

6.10 Parameters

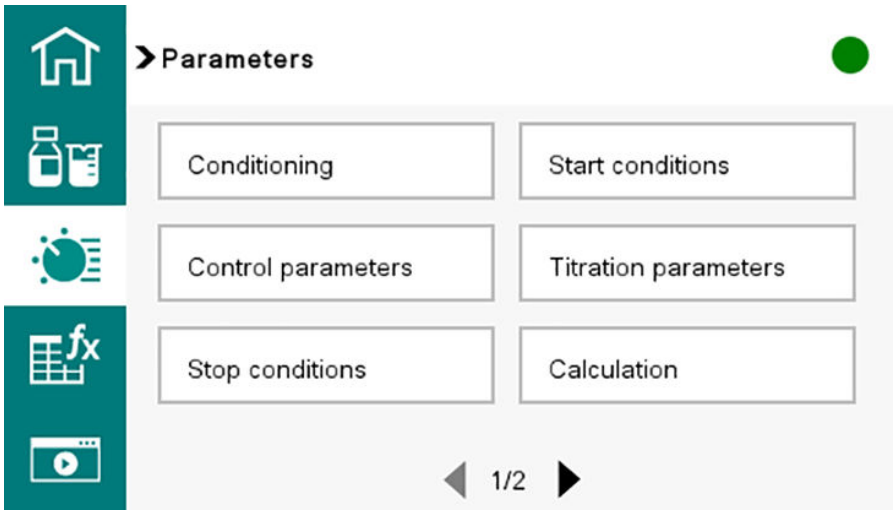


Figure 35 Parameters – Menu page 1

Figure 36 Parameters – Menu page 2

6.10.1 Karl Fischer titration volumetric

6.10.1.1 Conditioning

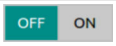
Parameters ▶ Conditioning

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

Conditioning

If this parameter is activated, the first time the titration 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: 

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

Default value: **ON**

Start drift

Conditioning OK will be displayed as soon as the value falls below this volume drift and the titration can be started.

Input range	**1** to **999 µL/min**
Default value	**20 µL/min**

Drift correction

The endpoint volume can be corrected for drift. This involves multiplying the volume drift by the drift correction time and then subtracting the resulting value from the endpoint volume. 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: **off**

auto

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

manual

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

off

No drift correction takes place.

Drift value

This parameter is visible only when **Drift correction = manual**.

Input range	**0.0** to **99.9 µL/min**
Default value	**0.0 µL/min**

Cond. stop volume

Maximum permissible volume that can be dosed during conditioning. Conditioning is stopped when the specified volume is dosed. If conditioning is continued by pressing **[START]** once again, then the titrant volume that has already been dosed will not be taken into account; i.e. the dosing starts again at zero. The stop volume should be adjusted to the size of the titration cell in order to prevent any overflow.

Input range	**0.00000** to **9,999.99 mL**
Default value	**20.0000 mL**
Selection: **off**	

Cond. stop time

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

Input range	**0** to **999,999 s**
Default value	**off**
Selection: **off**	

6.10.1.2 Start conditions

Parameters ▶ Start conditions

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

Request sample ID

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

Selection:

- **ID1**
- **ID2**
- **ID1&ID2**
- **Off**

Default value: **Off**

Start volume

Volume that is dosed prior to the start of the titration.

Input range	**0.00000** to **9,999.99 mL**
Default value	**0.00000 mL**

Dosing rate

Rate at which the start volume is dosed.

Input range	**0.01** to **166.00 mL/min**
Default value	**Max. mL/min**

Additional selection: **Max.** = maximum dosing rate.

Default value: **Max.**

The maximum dosing rate depends on the cylinder volume (see table).

If volatile solvents/solutions or solutions with a high viscosity are used, the dosing rate must be reduced accordingly so that the cylinder unit is not overloaded.

Table 8 Maximum dosing rate / filling rate

Cylinder volume	maximum dosing rate / filling rate
5 mL	15.00 mL/min
10 mL	30.00 mL/min
20 mL	60.00 mL/min
50 mL	150.00 mL/min

Independent of the cylinder volume, values ranging from 0.01 to 166.00 mL/min can always be entered. When the function is carried out, the rate will be reduced automatically if necessary to the highest possible value.

Pause

Waiting time, e.g. for the stabilization of the measured value after the start, for dissolving solid substances or a reaction time after the dosing of a start volume.

Input range	**0** to **999,999 s**
Default value	**0 s**

Request sample size

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

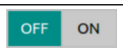
Switch: OFF ON

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

Default value: **OFF**

Request sample unit

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

Switch: 

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

Default value: **OFF**

Hold at request

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

Switch: 

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

Default value: **ON**

6.10.1.3 Titration parameters

Parameters ▶ Titration parameters

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

Solution

Selection of the solution from the solution list. We always recommend selecting the solution. This ensures that the correct data (titer, concentration, etc.) is always used for the calculation. Solutions are defined under **System ▶ Solutions**.

Selection:

- **Selection of configured solutions**
- **not defined**

Default value: **not defined**

I(pol)

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

Selection:

- **1**
- **20**
- **50**
- **100**

Default value: **50 µA**

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 when the determination is started.

Switch: OFF ON

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

Default value: **OFF**

With very dry media, the electrode test may indicate a short circuit even though the electrode is fine.

Add a few drops of water, then the electrode test will function properly again.

Stirrer

If this parameter is activated, then the stirrer is switched on at the start of the determination.

Switch: OFF ON

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

Default value: **ON**

Stirring rate

Setting the stirring rate. It can be adjusted in steps from 1 to +15.
The default setting **8** corresponds to 1,000 rpm. The formula for calculating the rotational speed is specified in Stirring rate Required link is broken! Target id: NOTFOUND_ID_2faa6a0cb78ebd080a9dd5690f9ef2dc-d1f2b3a7cdfe40ea0a0002020fe12663-en-US. The optimum stirring rate can be tested in the manual control.

Input range	**1** to **15**
Default value	**8**

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 6.10.1.5, page 100)* is fulfilled during this time. Entering an extraction time is recommended, for example, for samples that release and dissolve water slowly or if a Karl Fischer oven is used.

Input range	**0** to **999,999 s**
Default value	**0 s**

6.10.1.4 Control parameters

Parameters ▶ Control parameters

The control parameters for the endpoint are defined under **[Control parameters]**.

Endpoint at

Measured value for the endpoint.

Input range	**–2,000** to **2,000 mV**
Default value	**250 mV**
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 titrations with 2-component reagents, for example.

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.

Table 9 Default values of the predefined titration rates for KFT

	Titration rate		
	slow	optimal	fast
Control range	300 mV	100 mV	30.0 mV
Max. rate	1.00 mL/min	max.	max.
Min. increment	min. (= cylinder volume/10,000)	min. (= cylinder volume/10,000)	5.00 µL

Control range

This parameter is visible only when **Titration rate = user**. This parameter defines the control range before the specified endpoint. Individual volume steps are dosed in the control range; the dosing is finely controlled. The closer the endpoint, the slower the dosing until the volume increment defined under **Min. increment** has been reached. The larger the control range, the slower the titration. Outside of the control range, dosing is carried out continuously; the dosing rate is defined under **Max. rate**.

Input range	**0.1** to **1,250.0 mV**
Default value	**100.0 mV**
Selection: **off**	

Max. rate

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

Input range	**0.01** to **166.00 mL/min**
Default value	**max.**
Selection: **max.**	

The maximum dosing rate depends on the cylinder volume (see table).

If volatile solvents/solutions or solutions with a high viscosity are used, the dosing rate must be reduced accordingly so that the cylinder unit is not overloaded.

Table 10 Maximum dosing rate / filling rate

Cylinder volume	maximum dosing rate / filling rate
5 mL	15.00 mL/min
10 mL	30.00 mL/min

Cylinder volume	maximum dosing rate / filling rate
20 mL	60.00 mL/min
50 mL	150.00 mL/min

Independent of the cylinder volume, values ranging from 0.01 to 166.00 mL/min can always be entered. When the function is carried out, the rate will be reduced automatically if necessary to the highest possible value.

Min. increment

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

Minimum volume increment that is dosed at the 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 increment, the slower the titration.

Input range	**0.01** to **99.90 µL**
Default value	**min.**
Selection: **min.**	

Stop criterion

The titration is canceled when 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 6.10.1.5, page 100)* always lead to a stop, even if the stop criterion has not been reached.

Selection:

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

Default value: **Drift**

Drift

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

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 value is below both the endpoint and the sum of the drift at the start of the titration and the relative stop drift.

off

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

Stop drift

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

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

Input range	**1** to **999 µL/min**
Default value	**20 µL/min**

Delay time

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

If the value falls below the endpoint, the specified time is allowed to elapse after the last dosing and the titration is then stopped.

Input range	**0** to **999 s**
Default value	**10 s**

Relative stop drift

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

The titration is canceled if the value is below both the endpoint and the sum of the drift at the start of the titration and the relative stop drift.

Input range	**1** to **999 µL/min**
Default value	**10 µL/min**

6.10.1.5 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 volume

The titration is canceled if the specified volume has been dosed since the start of the titration. Adjust the volume to the size of the titration vessel to prevent it from overflowing. Metrohm recommends using the volume of the cylinder as the stop volume, as refilling during the titration is not advisable.

Input range	**0.00000** to **9,999.99 mL**
Default value	**100.000 mL**
Selection: **off**	

Stop time

The titration is canceled if the specified time has elapsed following the expiration of the start conditions.

Input range	**0** to **999,999 s**
Default value	**off**
Selection: **off**	

Filling rate

Rate at which the cylinder is filled after the titration. The maximum filling rate depends on the cylinder volume.

Input range	**0.01** to **150.00 mL/min**
Default value	**max.**
Selection: **max.**	

The maximum filling rate depends on the cylinder volume (see table). If volatile solvents/solutions or solutions with a high viscosity are used, then the filling rate must be reduced accordingly so that the cylinder unit is not overloaded.

Table 11 Maximum dosing rate / filling rate

Cylinder volume	maximum dosing rate / filling rate
5 mL	15.00 mL/min
10 mL	30.00 mL/min
20 mL	60.00 mL/min
50 mL	150.00 mL/min

6.10.1.6 Calculation – Blank Ipol methods

Parameters ▶ Calculation

Calculation formula

EP1*FCT

The calculated result is saved for each measuring mode separately as variable **Blank value (CV01)**.

Factor (FCT)

If a larger amount of solvent is used for determining the blank value than will be used afterwards for the sample, the endpoint volume has to be converted accordingly with this factor.

Input range	**–999,999,999** to **9,999,999,999**
Default value	**1.0**

Decimal places

Number of decimal places used to display the result.

Input range	**0** to **5**
Default value	**2**

Result unit

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

Selection:

- **mL**

6.10.1.7 Calculation – Titer Ipol methods

Parameters ▶ Calculation

Calculation formula

(C00*FCT)/EP1

The mean value of the calculated result (value and unit) is saved as titer of the solution used.

Depending on what you use to determine the titer of the reagent and which unit the sample size has, the **Factor (FCT)** parameter has to be adjusted.

Table 12 Conversion table

Used standard	Sample size in …	Factor (FCT)
10 mg/g water standard	g	Water content in mg/g (see certificate)
Water	g	1,000
Water	µL	Density of water in g/mL
Sodium tartrate dihydrate	g	156.6
Sodium tartrate dihydrate	mg	0.1566

Factor (FCT)

Conversion factor, see table above.

Input range	**–999,999,999** to **9,999,999,999**
Default value	**1.0**

Decimal places

Number of decimal places used to display the result.

Input range	**0** to **5**
Default value	**4**

Result unit

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

Selection:

- **%**
- **ppm**
- **mg/mL**
- **g**
- **mg**
- **mL**
- **mg/piece**
- **User-defined**

Default value: **mg/mL**

User-defined

A user-defined unit can be created. This will be added to the selection list. As soon as a new unit is defined, the previous entry will be overwritten. An empty entry can be generated this way as well.

6.10.1.8 Calculation – KFT Ipol method

Parameters ► Calculation

Calculation formula for KFT Ipol

EP1*TITER*FCT/(C00*DIV)

Depending on which unit the sample size and the result have, the **Factor (FCT)** and **Divisor (DIV)** parameters have to be adjusted. The conversion table is displayed if the input field is clicked for a prolonged period of time.

Table 13 Conversion table

Result unit	Sample size in …	Factor (FCT)	Divisor (DIV)
%	g	0.1	1
%	mg	100	1
%	mL	0.1	Density of the sample in g/mL
ppm	g	1,000	1
ppm	mL	1,000	Density of the sample in g/mL
mg/mL	g	Density of the sample in g/mL	1
mg/mL	mL	1	1
mg/piece	Pieces	1	1

Factor (FCT)

Conversion factor, see table above.

Input range	**–999,999,999** to **9,999,999,999**
Default value	**0.1**

Divisor (DIV)

Conversion factor, see table above.

Input range	**–999,999,999** to **9,999,999,999**
Default value	**1.0**

Titer

Titer of the solution used. If a solution is selected in **Titration parameters**, the value and unit from the solution data in **System** ▶ **Solutions** is read out and displayed here. If the titer is manually changed here, the solution data is updated.

Input range	**0.00000001** to **9,999,999,999**
Default value	**1.000**

Decimal places

Number of decimal places used to display the result.

Input range	**0** to **5**
Default value	**2**

Result unit

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

Selection:

- **%**
- **ppm**
- **mg/mL**
- **g**
- **mg**
- **mL**
- **mg/piece**
- **User-defined**

Default value: **%**

User-defined

A user-defined unit can be created. This will be added to the selection list. As soon as a new unit is defined, the previous entry will be overwritten. An empty entry can be generated this way as well.

6.10.1.9 Calculation – KFT Ipol-Blank method

Parameters ▶ Calculation

Calculation formula for KFT Ipol–Blank

(EP1–CV01)*TITER*FCT/(C00*DIV)

Depending on which unit the sample size and the result have, the **Factor (FCT)** and **Divisor (DIV)** parameters have to be adjusted. Once the calculation formula has been selected, press the **[OK]** button. A table with the conversion factors is displayed:

Table 14 Conversion table

Result unit	Sample size in …	Factor (FCT)	Divisor (DIV)
%	g	0.1	1
%	mg	100	1
%	mL	0.1	Density of the sample in g/mL
ppm	g	1,000	1
ppm	mL	1,000	Density of the sample in g/mL
mg/mL	g	Density of the sample in g/mL	1
mg/mL	mL	1	1
mg/piece	Pieces	1	1

Factor (FCT)

Conversion factor, see table above.

Input range	**–999,999,999** to **9,999,999,999**
Default value	**0.1**

Divisor (DIV)

Conversion factor, see table above.

Input range	**–999,999,999** to **9,999,999,999**
Default value	**1.0**

Titer

Titer of the solution used. If a solution is selected in **Titration parameters**, the value and unit from the solution data in **System ► Solutions** is read out and displayed here. If the titer is manually changed here, the solution data is updated.

Input range	**0.00000001** to **9,999,999,999**
Default value	**1.000**

Blank value (CV01)

This parameter is visible only in the **KFT Ipol-Blank** method.

This value is calculated with the blank value determination (method **Blank Ipol**) and entered here. The value can also be modified manually.

Input range	**–999,999,999** to **9,999,999,999 mL**
Default value	**0.0 mL**

Decimal places

Number of decimal places used to display the result.

Input range	**0** to **5**
Default value	**2**

Result unit

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

Selection:

- **%**
- **ppm**
- **mg/mL**
- **g**
- **mg**
- **mL**
- **mg/piece**
- **User-defined**

Default value: **%**

User-defined

A user-defined unit can be created. This will be added to the selection list. As soon as a new unit is defined, the previous entry will be overwritten. An empty entry can be generated this way as well.

6.10.2 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	**2** to **20**
Default value	**3**

6.10.3 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 Performing maintenance on the cylinder unit

In the **Manual control** ▶ **Exchange cylinder unit** function, the drive moves the push rod into the exchange position.

NOTICE

Material damage caused by incorrect handling of the cylinder unit

The cylinder unit is blocked or damaged in some other way and must be replaced.

- Follow strictly the instructions for assembly, disassembly, and maintenance of the cylinder unit.
- Use only the tools specified.

NOTICE

Material damage from aggressive chemical hazardous substances

If the product comes into contact with aggressive chemical substances, this can lead to malfunctions or the product may be damaged and must be replaced.

- Clean up spilled liquids and solids immediately.
- Use protective grounding when working with highly flammable chemical substances and gases.
- If you suspect that chemical substances have penetrated the product, disconnect the product from the energy supply immediately. Then notify the regional Metrohm service representative.

Disassembling the cylinder unit

Prerequisite:

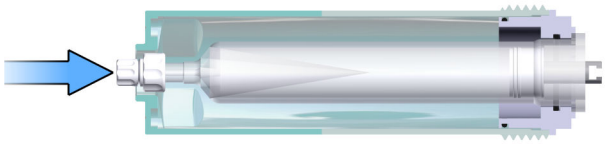
- The cylinder unit has been disassembled: *(see "Emptying and removing the cylinder unit", page 48)*

Required accessories:

- 6.1546.040 piston tool

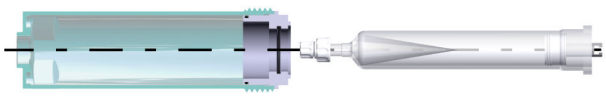
It is normally not necessary to remove the mounting ring out of the light protection or the screw nipple on the cylinder for cleaning. The parts can be cleaned while still in their pre-mounted state.

1



Push the cylinder out of the light protection from above.

2



Remove the cylinder from the light protection. Empty the remaining liquid from the cylinder.

3

Carefully lift the piston out of the cylinder. Use the 6.1546.040 piston tool to accomplish this.

The individual parts can now be cleaned and checked.

Cleaning the disassembled cylinder unit

Prerequisite:

- The cylinder unit has been taken apart.

Required accessories:

- Deionized water
- Dishwashing detergent

1 Clean the single parts of the cylinder unit with deionized water.

2 In the event of severe contamination, place the single parts in warm water with a little dishwashing detergent and then rinse off with deionized water.

3 Check the single parts of the cylinder unit (cylinder, piston, sealing lips, and piston rod) for the following defects:

- Are rough areas or scratches visible on the cylinder?
- Are scratches visible on the piston surface?
- Is any unevenness visible on the sealing lips of the piston?

If any of these defects is visible, replace the entire cylinder unit.

Assembling the cylinder unit

Prerequisite:

- The cylinder unit has been taken apart.
- The single parts of the cylinder unit have been cleaned and checked.
- The single parts of the cylinder unit show no defects.

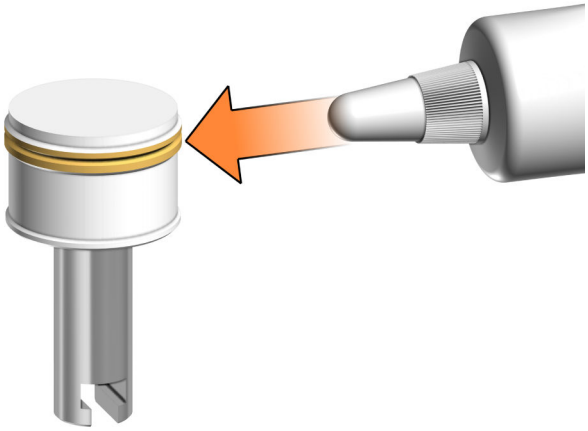
Required accessories:

- 6.2803.010 paraffin grease

- Lint-free cloth

1 **Greasing the piston**

- Grease the piston.



- Using your finger, carefully apply a trace of paraffin grease (6.2803.010) to the exterior of the sealing lips (orange marking) of the piston.
- Wipe off excess grease with the lint-free cloth.

The tip of the piston (area above the sealing lips) must be **free of grease**.

2 Carefully slide the piston far enough into the cylinder that the piston rod still protrudes out of it by approximately 6 mm.

3 Push the cylinder far enough into the light protection so that its flange is securely up against the mounting ring (gray plastic ring).

The cylinder unit can now be mounted: *(see "Mounting the cylinder unit", page 49)*

7.2 Cleaning the product surface

Regularly clean the product to prevent malfunctions and to ensure a long service life.

- Remove spilled chemicals immediately.
- Protect plug connections against contamination.

WARNING

Chemical hazardous substances

Contact with aggressive chemical substances may cause poisoning or chemical burns.

- Wear personal protective equipment (e.g. protective glasses, gloves).
- Use exhaust equipment when working with vaporizing hazardous substances.
- Clean contaminated surfaces.
- Only use detergents that do not cause any unwanted side reactions with the materials to be cleaned.
- Dispose of chemically contaminated materials (e.g. cleaning material) in accordance with regulations.

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 18)

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.

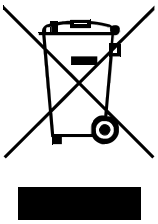
The **Factory reset** warning appears: All information (including saved methods, determination results, etc.) is deleted. Do you want to continue?

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

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

Power consumption	max. 65 W	
Outlet		
Nominal voltage	24 V DC	
Power output	max. 45 W	

USB connector

Nominal voltage	5 V	
Current at the power supply unit	500 mA	max. output current per channel

Protection

Internal fuse	1.5 A	cannot be replaced by the user

10.3 Measurements and weight

Measurements

Width	286 mm	
Height		
without cylinder unit	220 mm	
with cylinder unit	358 mm	
with support rod	508 mm	
Depth	286 mm	

Weight	3.6 kg	without accessories and power supply unit

10.4 Housing

Materials

Cover	PP	20% filled with talc
Back panel	1.4301	stainless steel
Base	PP	20% filled with talc
Front foils	PET	EBA 180, anti-glare

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. FFTP	shielded
Cable length	max. 10 m	

USB

Type	2.0	
Socket	Type A	
Cable type	shielded	
Cable length	max. 5 m	

Measuring inputs

Pol

Socket	type F	Measuring input for polarizable electrodes

10.6 Display specifications

Display

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

Status display	LED	green

10.7 Operation specifications

Touch screen

Type	resistive

Resistance to chemicals	Ethanol
	Methanol
	Water

Keys	5 keys

10.8 Measurement specifications

Polarizer

Ipol DC

Polarization current	1, 20, 50, 100 µA	can be selected
Measuring range	0–3,500 mV	
Measuring resolution	0.1 mV	

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%

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

10.10 Liquid handling specifications

Cylinder unit

Cylinder volume	5, 10, 20, 50 mL	

Dosing drive

Dosing resolution	20,000	steps per cylinder volume
Dosing accuracy	according to ISO/DIN 8655-3	

Tubing

Tubing nipple outer thread	M6
Inner diameter	2 mm

Material	FEP	fluorinated ethylene propylene