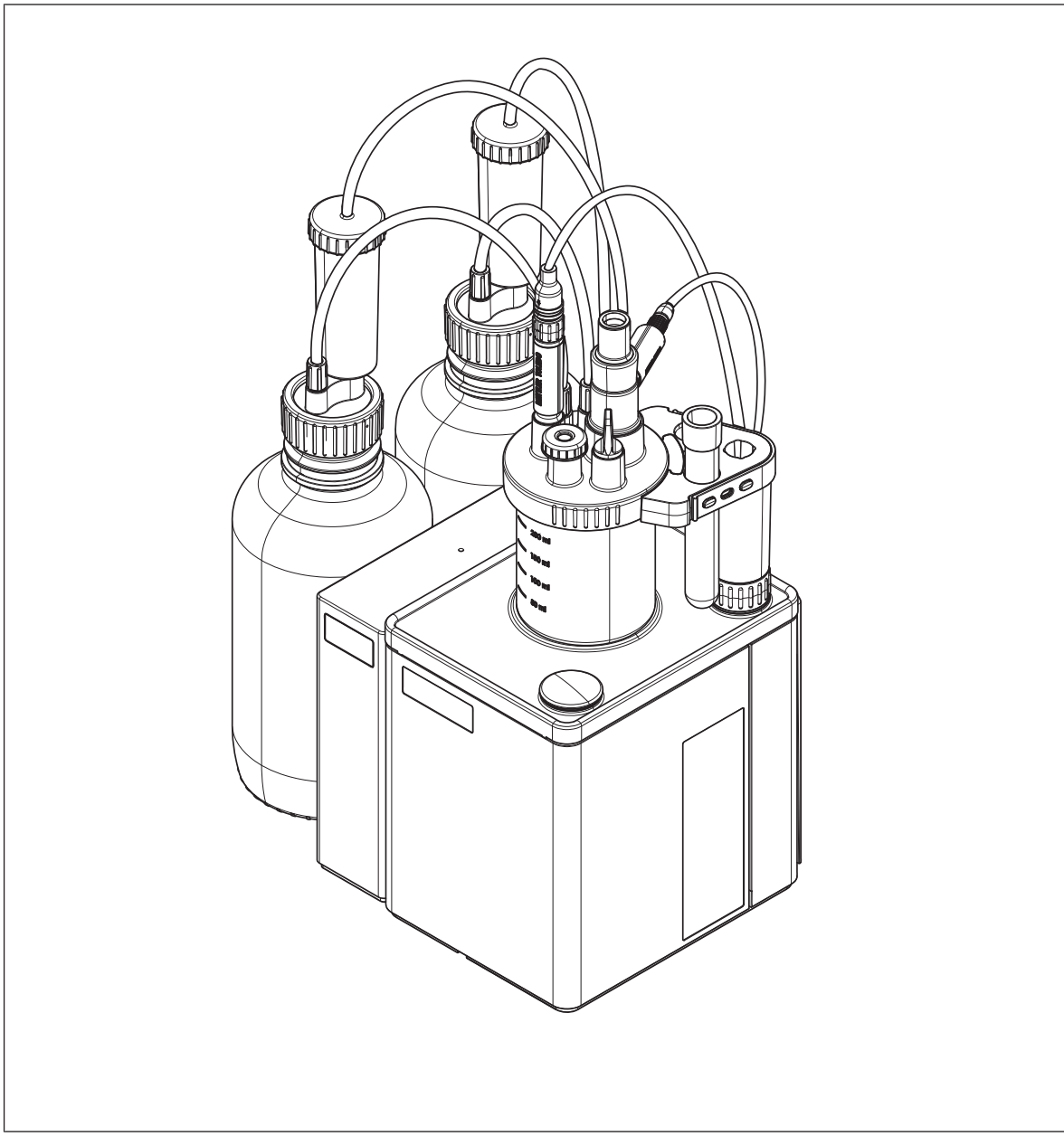
Reference Manual

# Advanced Titrator

## EVA C1/EVA C3



METTLER TOLEDO

# Table of Contents

# 1 Introduction

Thank you for choosing a METTLER TOLEDO EVA titrator. The EVA coulometric Karl Fischer titrators are instruments for coulometric Karl Fischer titrations.

Information is provided for the following titrators:

- EVA C1
- EVA C3

This document applies to software version 2.0.0 or higher.

The screenshots show the user interface of an EVA C3 titrator without connection to the LabX computer software.

The software license is subject to the End User License Agreement EULA. See the following link for the license text:

▸ www.mt.com/EULA

## 1.1 Further documents and information

For application notes and METTLER TOLEDO methods, see the following link:

▸ www.mt.com/analytical-application-library

For third party licenses and open source attribution files, see the following link:

▸ www.mt.com/licenses

If you have any additional questions, contact your authorized METTLER TOLEDO service representative or dealer.

▸ www.mt.com/contact

## 1.2 Explanation of conventions and symbols

Refers to an external document.

**Elements of instructions**

Instructions always contain action steps and can contain prerequisites, intermediate results, and results. If an instruction contains more than one action step, the action steps are numbered.

- Prerequisites that must be fulfilled before the individual action steps can be executed.

1 Action step 1

   ➡ Intermediate result

2 Action step 2

➡ Result

## 1.3 Compliance information

The instrument complies with the directives and standards listed on the Declaration of Conformity.

▸ https://www.mt.com/doc

National approval documents, e.g., the FCC Supplier Declaration of Conformity, are available online and/or included in the packaging.

▸ www.mt.com/ComplianceSearch

Contact METTLER TOLEDO for questions about the country-specific compliance of your instrument.

▸ www.mt.com/contact

**European Union**

This product may contain SVHC candidate substances according to Article 33 of the EU regulation no. 1907/2006 (REACH). SVHC candidate substances are listed on the Declaration of Conformity (DoC).

▸ https://www.mt.com/doc

### United States of America

This equipment has been tested and found to comply with the limits for a **Class B** digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### Trademarks

| Trademark | Trademark owner |
|---|---|
| IPP Everywhere™ | IEEE Industry Standards and Technology Organization (ISTO) |
| AirPrint | Apple Inc. |

# 2 Safety information

Two documents named "User Manual" and "Reference Manual" are available for this instrument.

- The User Manual is printed and delivered with the instrument.
- The electronic Reference Manual contains a full description of the instrument and its use.
- Keep both documents for future reference.
- Include both documents if you transfer the instrument to other parties.

Only use the instrument according to the User Manual and the Reference Manual. If you do not use the instrument according to these documents or if the instrument is modified, the safety of the instrument may be impaired and Mettler-Toledo GmbH assumes no liability.

User Manual and Reference Manual are available online. See [Download manuals ▸ Page 23].

## 2.1 Definitions of signal words and warning symbols

Safety notes contain important information on safety issues. Ignoring the safety notes may lead to personal injury, damage to the instrument, malfunctions and false results. Safety notes are marked with the following signal words and warning symbols:

### Signal words

**WARNING** A hazardous situation with medium risk, possibly resulting in death or severe injury if not avoided.

**NOTICE** A hazardous situation with low risk, resulting in damage to the instrument, other material damage, malfunctions and erroneous results, or loss of data.

### Warning symbols

General hazard

Notice

## 2.2 Product-specific safety notes

### Intended use

This instrument is designed to be used in laboratories by trained staff. The titrator is intended for the processing of reagents and solvents for coulometric Karl Fischer titrations. All processed reagents and solvents must be compatible with the materials they come into contact with.

Any other type of use and operation beyond the limits of use stated by Mettler-Toledo GmbH without consent from Mettler-Toledo GmbH is considered as not intended.

### Responsibilities of the instrument owner

The instrument owner is the person holding the legal title to the instrument and who uses the instrument or authorizes any person to use it, or the person who is deemed by law to be the operator of the instrument. The instrument owner is responsible for the safety of all users of the instrument and third parties.

Mettler-Toledo GmbH assumes that the instrument owner trains users to safely use the instrument in their workplace and deal with potential hazards. Mettler-Toledo GmbH assumes that the instrument owner provides the necessary protective gear.

## ⚠ WARNING

**Death or serious injury due to electric shock**

Contact with parts that carry a live current can lead to death or injury.

1 Only use the METTLER TOLEDO power cable and AC/DC adapter designed for your instrument.
2 Connect the power cable to a grounded power outlet.
3 Keep all electrical cables and connections away from liquids and moisture.
4 Check the cables and the power plug for damage and replace them if damaged.

## NOTICE

**Damage to the instrument or malfunction due to the use of unsuitable parts**

– Only use parts from METTLER TOLEDO that are intended to be used with your instrument.

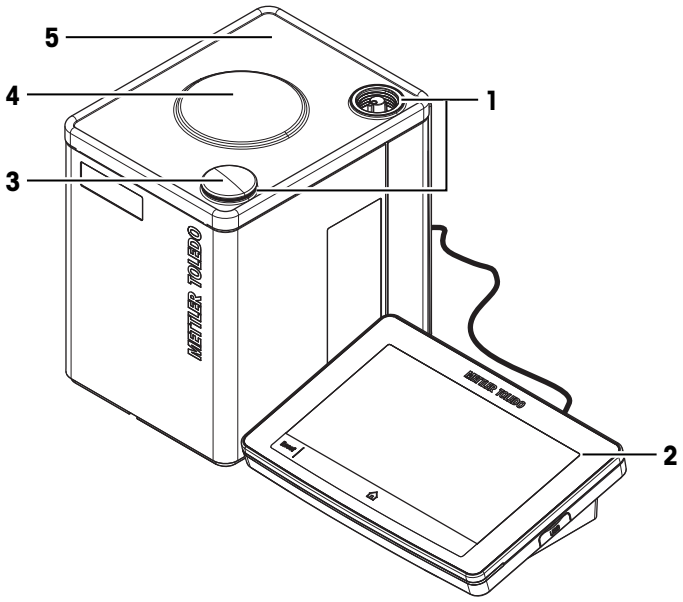
**See also**

Technical data ▸ Page 89

# 3 Design and function

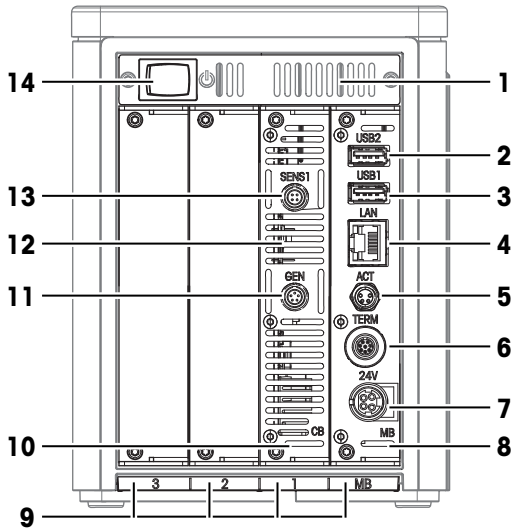
## 3.1 Titrator overview

### 3.1.1 Front view




| No. | Name | Function |
|---|---|---|
| **1** | Mounting positions | Mounting positions for titration arm |
| **2** | Terminal | Controls the titrator and can be used to enter information |
| **3** | Mounting position cover | Cover for unused mounting position |
| **4** | Internal magnetic stirrer | To stir contents of the Karl Fischer cell |
| **5** | Titrator cover | Protects the surface of the titrator |

### 3.1.2 Rear panel



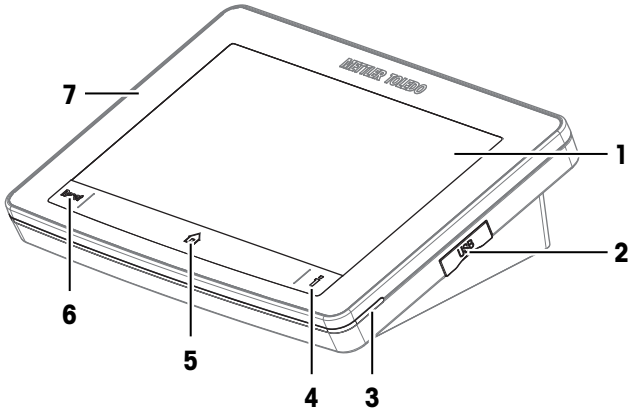

| No. | Name | Function |
|---|---|---|
| **1** | Vents | Air outlet for cooling the titrator |

| No. | Name | Function |
|---|---|---|
| **2** | **USB2** | USB-A socket to connect USB devices, for example, printers or barcode readers |
| **3** | **USB1** | USB-A socket to connect USB devices, for example, printers or barcode readers |
| **4** | **LAN** | RJ45 socket to connect to a network |
| **5** | **ACT** | 4-pin M8 socket to connect actor bus devices, for example, a solvent pump |
| **6** | **TERM** | 8-pin M9 socket to connect the terminal |
| **7** | **24V** | 4-pin power mini-DIN socket to connect the AC/DC adapter |
| **8** | Main board (**MB**) | Main board installed in board slot **MB** |
| **9** | Board slots **1**, **2**, **3**, and **MB** | Slots for holding boards |
| **10** | Coulometer board (**CB**) | Coulometer board installed in board slot 1 |
| **11** | **GEN** | 5-pin socket to connect generator electrode |
| **12** | Vents | Air outlet for cooling the titrator |
| **13** | **SENS1** | 4-pin socket to connect digital sensors |
| **14** | Power button | Push button to start up the titrator |

**See also**

Technical data ▸ Page 89

### 3.1.3 Terminal




| No. | Name | Function |
|---|---|---|
| **1** | Touchscreen | Displays information and is used to enter information |
| **2** | **USB** | USB-C connection for data transfer |
| **3** | Status light | Provides information about the status of the titrator |
| **4** | Information button | Displays a QR code to access the Reference Manual |
| **5** | Home button | Opens the home screen |
| **6** | **Reset** button | Interrupts or ends all tasks that are currently running |
| **7** | Terminal cover | Protects the surface of the terminal |

**See also**

Technical data ▸ Page 89

### 3.1.4 Status light

The status light provides information about the status of the titrator.

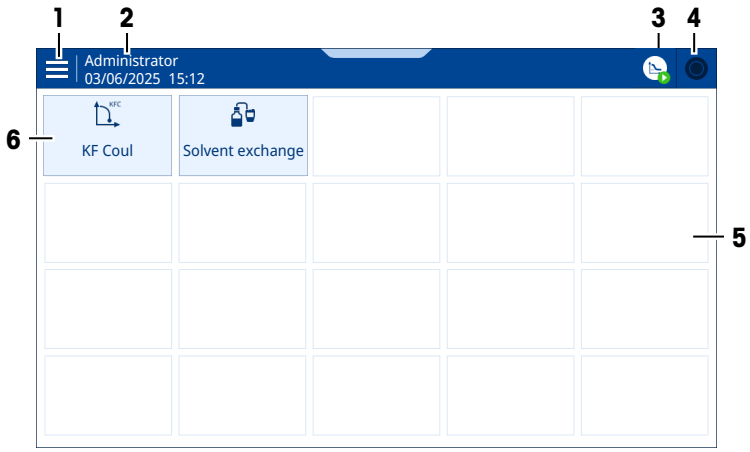
| Status light | Titrator status |
|---|---|
| Steady, green light | The titrator is ready for operation. |
| Blinking, green light | Two states are possible:<br>• The titrator is performing a task that requires no user interaction.<br>• The Karl Fischer cell is ready for a titration. The titrator is performing the **KF Conditioning** action to maintain this state. |
| Steady, yellow light | The titrator is waiting for the user to perform an action. |
| Blinking, yellow light | The Karl Fischer cell is not ready for a titration. The titrator is performing the **KF Conditioning** action to prepare the Karl Fischer cell for titration. |
| Steady, red light | The titrator has an error. |

**See also**

Measurement principle ▸ Page 16

## 3.2 Home screen and menu structure

### 3.2.1 Home screen




| No. | Name | Function |
|---|---|---|
| **1** | Menu | Opens the menu tree |
| **2** | User name | Shows, which user is logged in (only displayed if user management is activated) |
| **3** | Workplace button | • Icon shows that a task or an action is running<br>• Icon shows the state of the task or the action<br>• Opens the window of the task or of the action |
| **4** | Task area button | • Icon shows if a task is running<br>• Icon shows the state of the task<br>• Opens the task area |
| **5** | Shortcut area | Shows user-defined shortcuts |
| **6** | Shortcut button | • Tapping the button starts a task or an action<br>• Tapping and holding the button opens an editor to configure the task or the action |

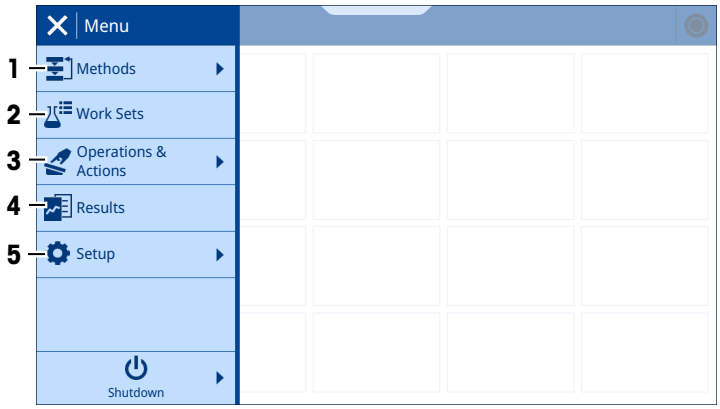
**Explanation of the task area icon**

| Icon | Description |
|---|---|
|  | The task area is empty. |
|  | A task such as an analysis or an operation is running. |
|  | A task such as an analysis is interrupted or is blocked. |

**Explanation of the workplace area icon**

| Icon | Description |
|---|---|
|  | The **KF Conditioning** action is running in the background. |
|  | A task such as an analysis or an operation is running. |
|  | This icon stands for one of the following states:<br>• An analysis is running but the Karl Fischer cell is not ready for the titration to start.<br>• User interaction is needed for the analysis to continue. |

## 3.2.2 First level menus




| No. | Name | Function |
|---|---|---|
| 1 | **Methods** | Access the following functions:<br>• Create, edit or delete a method.<br>• Configure method-specific settings with the method editor.<br>Examples of method-specific settings:<br>• Method name<br>• Results that are calculated and displayed during the analysis<br>• Control focus |
| 2 | **Work Sets** | Access the following functions:<br>• Create, edit or delete a work set.<br>• Configure settings for the analysis of a set of samples.<br>Examples of sample-specific settings:<br>• Method used to analyze the samples<br>• Number of samples |

| No. | Name | Function |
|---|---|---|
| 3 | **Operations & Actions** | Configure and start operations and actions.<br>Examples:<br>• Exchange the solvent.<br>• **KF Conditioning**: a dry state of the Karl Fischer cell is established and maintained. |
| 4 | **Results** | View and manage analysis results. |
| 5 | **Setup** | Configure settings that apply to the entire instrument and not to a specific method, action or operation.<br>Examples:<br>• Date and time<br>• Standards<br>• Sensors |

### 3.2.3 Menu structure

**Submenus of Methods**

| |
|---|
| **KF Coulometric** |
| **KF Coul External Extraction** (EVA C3 only) |
| **KF Coul Blank** (EVA C3 only) |
| **KF Coul Scan** (EVA C3 only) |

**Submenus of Work Sets**

This menu has no submenus.

**Submenus of Operations & Actions**

| |
|---|
| **KF Conditioning** |
| **Solvent Exchange** |
| **Stirrer** |
| **Sample Changer** (EVA C3 only) |

**Submenus of results Results**

This menu has no submenus.

**Submenus of Setup**

| | |
|---|---|
| **Chemicals** | **Reagents** |
| | **Standards** |
| **Values & Tables** (EVA C3 only) | **Blank Values** (EVA C3 only) |

| | |
|---|---|
| **Hardware** | **KF Cells** |
| | **Generator Electrodes** |
| | **Sensors** |
| | **Pumps** |
| | **Stirrers** |
| | **Sample Changers** (EVA C3 only) |
| **Peripherals** | **Print & Export** |
| | **Balance** |
| | **SmartReader** |
| | **Barcode Reader** |
| | **USB Serial Devices** |
| **System Settings** | **Task & Resources Behavior** |
| | **Instrument** |
| | **Personal** |
| | **User Management** (only displayed if activated) |
| | **Network** |
| | **LabX** |
| | **Shortcuts** |
| **Maintenance & Service** | **MT-Service** |
| | **Update Software** |
| | **Import/Export** |
| | **Reset to Factory Settings** |
| | **Instrument Software History** |
| | **Hardware Software Summary** |

## 3.3 Overview of functions

### 3.3.1 Type definition

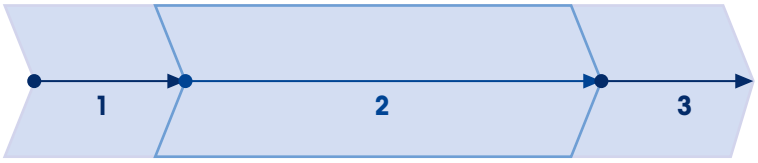
The hardware is the same for both titrator types but both titrator types have different functionality. The following table shows a summary of the functionality:

| Functionality | | EVA C1 | EVA C3 |
|---|---|---|---|
| Sample types | • Liquid samples<br>• Solid samples that are soluble in the solvent | • | • |
| | Solid samples that are not soluble in the solvent<br>• External extraction and blank values to correct results | – | • |
| Reduced contact with chemicals | • Automatic exchange of solvent<br>• Operation of the terminal outside a fume hood | • | • |
| Automation | Automated sampling with an InMotion KF sample changer | – | • |
| Data transfer | • Direct transfer of sample weights from balance<br>• Reading in SmartChemical data with a barcode reader | • | • |
| Data management | Secure data handling with LabX laboratory software | • | • |
| Data storage | Storage devices for reports and data exports:<br>• Network share<br>• USB flash drive | • | • |
| Printer types | • Ethernet printers for the paper sizes A4 or Letter<br>• METTLER TOLEDO thermal printers<br>• METTLER TOLEDO dot matrix printers | • | • |
| User Management | User-specific access rights and user authorization | • | • |

### 3.3.2 Customization of analyses

#### Water-content determination

The Karl Fischer titrator is used to determine the water content of samples. Such a determination can be divided into sample preparation, analysis, and sample disposal.

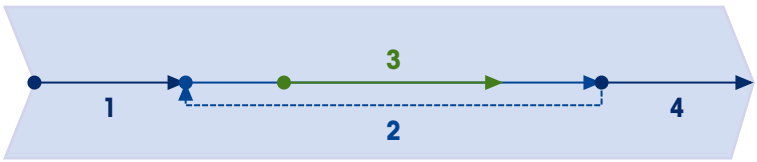



| No. | Name | Function |
|---|---|---|
| **1** | Sample preparation | Performed by users without interaction with the titrator |
| **2** | Analysis | The titrator executes a series of steps that might or might not require the interaction of users.<br>• An analysis can include one sample or several samples.<br>• At the end of the analysis, results are available. |
| **3** | Sample disposal | Performed by users without interaction with the titrator |

#### Analysis

To perform an analysis, the titrator needs resources such as a sensor and a method. Through the configuration of the method and the resources, users can customize analyses according to their needs.

The method defines the sequence of steps that a titrator performs during an analysis. These steps are grouped according to their function and position in the analysis.




| No. | Name | Function |
|---|---|---|
| **1** | Initial sequence | The titrator performs the initial steps one time at the beginning of the analysis.<br>Examples:<br>• The titrator displays a user-defined message.<br>• The titrator determines a drift value. |
| **2** | Sample sequence | The steps in the sample sequence define what happens during the sample analysis. The sample analysis is a phase within the entire analysis.<br>• The sample analysis always includes the addition of a sample and the measurement of physical quantities.<br>• If more than one sample is analyzed, the titrator repeats the sample analysis for each sample.<br>• The titrator calculates the results for the sample at the end of the sample sequence. |
| **3** | Measurement | During the measurement, the titrator measures physical quantities that it needs to calculate results. |
| **4** | Final sequence | The titrator performs the steps in the final sequence one time after it has analyzed the last sample.<br>Examples:<br>• The titrator calculates a mean value for all samples.<br>• The titrator creates a report with all the results from the analysis. |

**See also**


- Measurement technology ▸ Page 16
- Configuration of analysis settings ▸ Page 50
- Methods ▸ Page 50


## 3.4 Measurement technology

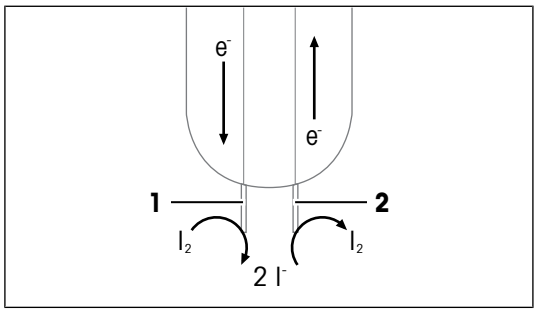
### 3.4.1 Measurement principle

Karl Fischer titrations are used for the quantitative water-content determination in liquids, solids, and gases. The water-content determination is based on the chemical reaction of iodine with water in the presence of an alcohol, a base, and sulfur dioxide.

Water present in the Karl Fischer cell reacts with iodine that is added to the Karl Fischer cell. This reaction leads to changes in the iodine concentration. The iodine concentration can be used as an indicator for the presence of water.

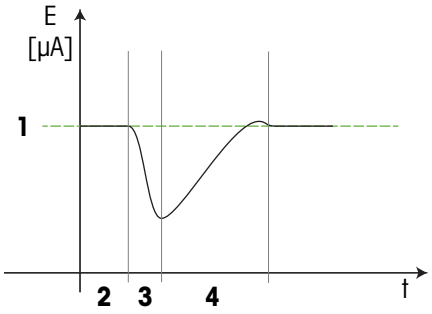
The titrator uses an amperometric measurement to track the iodine concentration. For this amperometric measurement, the titrator maintains a constant polarization potential between the two pins of a polarized sensor.

- Cathode, negatively charged pin (1): iodine molecules are reduced to iodide ions.
- Anode, positively charged pin (2): iodide ions are oxidized to iodine molecules.
- The reactions at the cathode and the anode result in a current. The titrator measures the intensity of this current.




The current intensity varies with the iodine concentration. As a consequence, changes in the current intensity can be used to control the iodine addition. The iodine concentration and the current intensity have an almost linear relation.

The following diagram shows the course of the current intensity in the different phases of the water-content determination.




| No. | Name | Description |
|---|---|---|
| **1** | Set current intensity | Current intensity at which the titrator terminates the titration. |
| **2** | Conditioning | • The titrator maintains the Karl Fischer cell in a state where the current intensity is equal to the set current intensity.<br>• To maintain the current intensity, the titrator adds small amounts of iodine to remove water that enters the Karl Fischer cell. |
| **3** | Sample addition | • With the sample, water is added to the Karl Fischer cell.<br>• The water removes iodine from the solution and this results in a lower current intensity. |
| **4** | Titration | • The titrator adds iodine. The iodine reacts with the water.<br>• As the water is consumed, the iodine concentration increases and the current intensity increases.<br>• The titrator terminates the titration when the measured current intensity has reached the set current intensity. |

**See also**

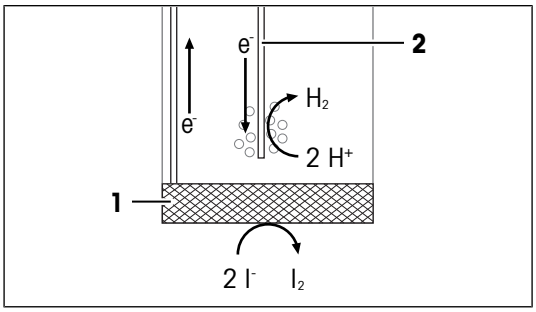

- Configure the sample analysis ▸ Page 55
- Configure iodine generation ▸ Page 59
- Configure the drift for correction ▸ Page 62
- Control algorithm ▸ Page 52


### 3.4.2 Coulometric Karl Fischer titration

In coulometric Karl Fischer titrations, the generator electrode generates the iodine for the Karl Fischer reaction.

### Reactions at the generator electrode

- Anode (2): iodide ions are oxidized to iodine molecules.
- Cathode (1): positive hydrogen ions are reduced to hydrogen molecules.
- The titrator controls the current that passes through the generator electrode and calculates the charge that passes through the anode. This charge is equivalent to the amount of iodine that is generated at the anode.



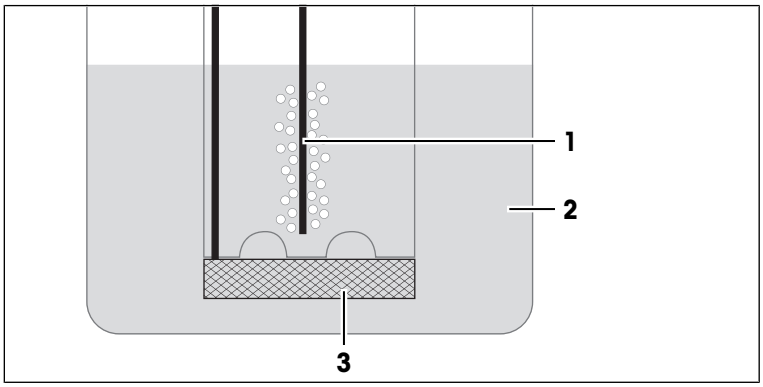

The titrator calculates the water content of the sample based on the amount of iodine that is generated at the anode.

Easily reducible samples can react at the cathode. Such reactions can produce water and result in an overestimation of the water content.

Two types of generator electrodes are available:

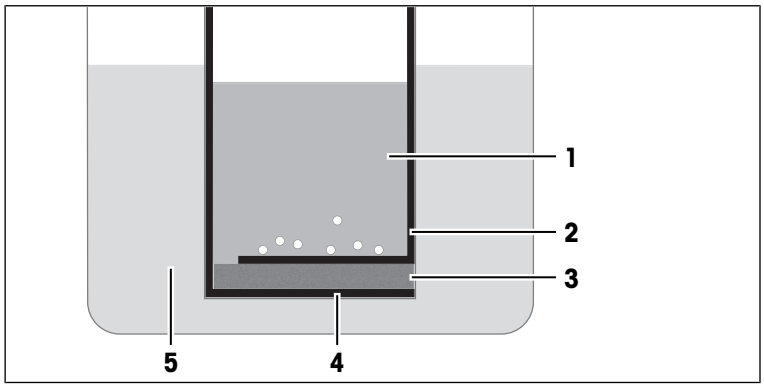
- Generator electrode without diaphragm
- Generator electrode with diaphragm

### Generator electrode without diaphragm




| No. | Name | Function |
|---|---|---|
| **1** | Cathode | • Positive hydrogen ions are reduced to hydrogen molecules.<br>• The molecular hydrogen forms bubbles around the cathode and escapes into the air above the solution. |
| **2** | Anolyte | • Contains iodide ions and other chemicals that facilitate the removal of water through the reaction with iodine molecules.<br>• Dissolves the sample. |
| **3** | Anode | Iodide ions are oxidized to iodine molecules. |

**Generator electrode with diaphragm**




| No. | Name | Function |
|---|---|---|
| **1** | Catholyte | Contains chemicals that facilitate the reduction at the cathode. |
| **2** | Cathode | • Positive hydrogen ions are reduced to hydrogen molecules.<br>• The molecular hydrogen forms bubbles around the cathode and escapes into the air above the solution. |
| **3** | Diaphragm | Separates the chemicals reacting at the anode from the chemicals reacting at the cathode. The diaphragm is permeable for ions. |
| **4** | Anode | Iodide ions are oxidized to iodine molecules. |
| **5** | Anolyte | • Contains iodide ions and other chemicals that facilitate the removal of water through the reaction with iodine molecules.<br>• Dissolves the sample. |

The catholyte contains traces of water. For accurate results, it is important that no catholyte flows into the anolyte compartment that contains the sample. To prevent catholyte from flowing into the anolyte compartment, the anolyte level must be at the same level or up to 5 mm higher than the catholyte level.

**Comparison**

| Characteristic | Without diaphragm | With diaphragm |
|---|---|---|
| Cleaning | Easy | More difficult |
| Solvent exchange | Automatic exchange of anolyte | • Automatic exchange of anolyte<br>• Manual exchange of catholyte |
| Accuracy for samples with low amounts of water | Lower | Higher |
| Accuracy for titrations with low currents at the generator electrode | Lower | Higher |
| Easily reducible samples react at the cathode | Possible | Not possible |

**See also**

Influence of atmospheric humidity ▸ Page 19

## 3.4.3 Influence of atmospheric humidity

Atmospheric humidity is a relevant source of error in Karl Fischer titrations. Atmospheric humidity impacts the results on different levels.

**Karl Fischer cell and cell drift**

The cell drift has three components:

- Physical drift: water from the ambient air that enters the Karl Fischer cell.
- Chemical drift: water that is released in side reactions.

- Water that is added with the sample.

The titrator determines a drift value during conditioning. This drift value is a measure of the physical drift and the chemical drift.

Measures to minimize the physical drift:

- Tighten all connections of the Karl Fischer cell.
- Remove moisture from air that enters the Karl Fischer cell.
- Remove moisture from air that enters any bottle connected to the Karl Fischer cell.
- Position the titrator in a space with low atmospheric humidity.

Measures to minimize the effect of physical drift and chemical drift on the calculated water content:

- Only start a sample analysis if the drift value is stable and lower than a given threshold.
  - High drift values have a larger influence on the final result than low drift values.
  - The influence of physical drift and chemical drift is larger for samples with very low amounts of water.
  - The influence of physical drift and chemical drift increases with the titration duration.
- Use the drift value to correct results.

**Water content of the sample**

Two types of samples are susceptible to the influence of atmospheric humidity.

- Hygroscopic samples that take up water from the air.
- Samples that easily lose water and can dry out.

In both cases, the water content of the sample might differ from the water content of the original substance.

Recommended measures for hygroscopic samples:

- Sample the substances very quickly with a dry syringe or a dry spatula.
- Store samples in tightly sealed glass bottles with small openings.
- For liquid samples, rinse the bottle two or three times with the substance you want to analyze before you add the sample.

Recommended measures for samples that easily lose water:

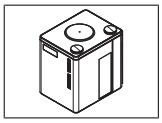
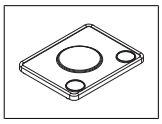
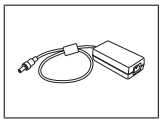
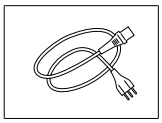
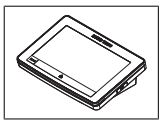
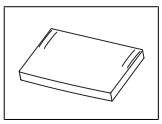
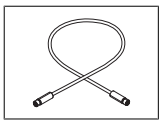
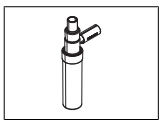
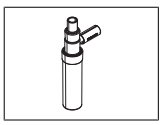
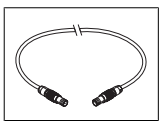
- Store samples in tightly sealed glass bottles with small openings.

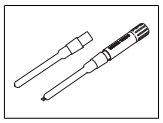
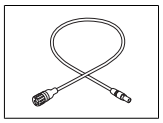
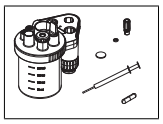
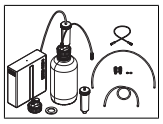
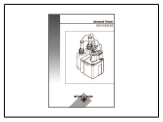
**See also**


- Configure the drift for correction ▸ Page 62
- Raw results and calculation of water content ▸ Page 56
- View the changes in cell drift over time ▸ Page 74
- Configure the sample analysis ▸ Page 55

# 4 Installation

## 4.1 Scope of delivery

| Part | | Order number | EVA C1 X<br>EVA C3 X | EVA C1 D<br>EVA C3 D | EVA C1 Base<br>EVA C3 Base |
|---|---|---|---|---|---|
|  | EVA titrator | – | • | • | • |
|  | Titrator cover | 30869313 | • | • | • |
|  | Extern. Power Supply 120W (SP)<br>AC/DC adapter | 30298362 | • | • | • |
|  | Power cable (country specific) | – | • | • | • |
|  | Terminal PSGT | – | • | • | • |
|  | Terminal cover | 30125377 | • | • | • |
|  | Terminal cable 68 cm | 30003971 | • | • | • |
|  | Generator electrode without diaphragm | 31028003 | • | – | – |
|  | Generator electrode with diaphragm | 31028002 | – | • | – |
|  | Generator electrode cable 70 cm | 30927803 | • | • | • |

| Part | | Order number | EVA C1 X<br>EVA C3 X | EVA C1 D<br>EVA C3 D | EVA C1 Base<br>EVA C3 Base |
|---|---|---|---|---|---|
|  | Sensor dSens M143<br>• Sensor dSens M143<br>• Protective sleeve<br>• Protection cap<br>• Quality certificate<br>• User Manual | 30573200 | • | • | • |
|  | Cable dSens dVP4-T 70 cm | 30635146 | • | • | • |
|  | Titration kit KFC<br>• Adapter plate KFC GL80<br>• Adapter plate seal KF GL80<br>• Vessel KFC clear GL80<br>• Titration arm GL80<br>• Titration arm strap<br>• Sample injection adapter NS14<br>• Septum set KF (5 pcs)<br>• Stopper NS14<br>• Stopper set M9 (2 pcs)<br>• Molecular sieve 250 g<br>• Syringe 1 mL (2 pcs)<br>• Injection needle 0.8 x 80 mm (2 pcs)<br>• Magnetic stirrer bar | 30988520 | • | • | • |
|  | Solvent pump dPump KF<br>• dPump KF<br>• Cable ACT M8/F, M8/M, 20 cm<br>• Glass bottle clear 1 L<br>• Drying tube NS14 (2 pcs)<br>• Bottle adapter M9 GL45 (2 pcs)<br>• Flat seal GL45 (2 pcs)<br>• Solvent tube (2 pcs)<br>• Air tube 100 cm (2 pcs) | 30869285 | • | • | – |
|  | User Manual | – | • | • | • |
|  | Declaration of conformity | – | • | • | • |
|  | Test report | – | • | • | • |

**See also**

Accessories, spare parts and consumables ▸ Page 93

## 4.2 Download manuals

1 Go to the website www.mt.com/library.
2 Select the **Technical Documentation** tab.
3 Find the product type on the housing of the titrator and enter it into the search field.
4 Start the search.
5 Select the manual from the result list.
6 Select the link.
➡ The manual is either opened or downloaded depending on the browser settings.
7 Check which software version is installed on your titrator.

www.mt.com/contact

## 4.3 Unpack the titrator

1 Remove the titrator from the protective packaging.
2 Store the protective packaging for later transport over long distances.
3 Check that you have received all parts listed in the scope of delivery.
4 Inspect the parts visually for flaws or damage.
5 If parts are missing or damaged, report it to your authorized METTLER TOLEDO service representative or dealer.

www.mt.com/contact

**See also**

Scope of delivery ▸ Page 21

## 4.4 Position the titrator

The titrator has been developed for indoor operation in a well-ventilated area.

The following site requirements apply:

- Ambient conditions within the limits specified in the technical data
- No powerful vibrations
- No direct sunlight
- No corrosive gas atmosphere
- No explosive atmosphere
- No powerful electric or magnetic fields

**See also**

Technical data ▸ Page 89

## 4.5 Connect, adjust and disconnect the terminal

Read the User Manual of the terminal for more information about the terminal. See [Download manuals ▸ Page 23].

### 4.5.1 Connect the terminal

Titrators and terminals are designed as paired equipment. If multiple titrators and terminals are available, the matched pair of terminal and titrator must be connected.

**Procedure**

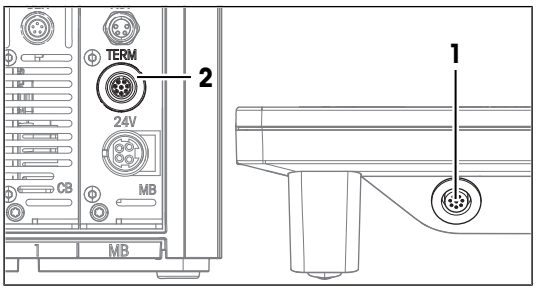
- The titrator is disconnected from the power supply.

1 Rotate one of the terminal-cable plugs until the arrow is on the upper side.

2 Insert the plug into the **INST** socket (1) on the terminal and tighten the knurled nut.

3 Rotate the other terminal-cable plug until the arrow is on the upper side.

4 Insert the plug into the **TERM** socket (2) on the titrator and tighten the knurled nut.




## 4.5.2 Adjust the angle of the terminal

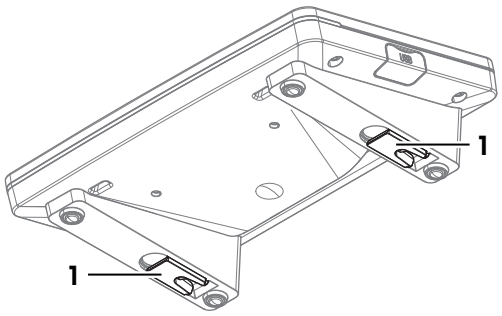
The angle of the terminal has two positions.

**Preparations**

- No task or action is running.

**Procedure**

– To increase the angle of the terminal, fold out the two feet (1).




## 4.5.3 Disconnect the terminal

- The titrator is disconnected from the power supply.

1 Remove the terminal cable from the socket on the back of the terminal.

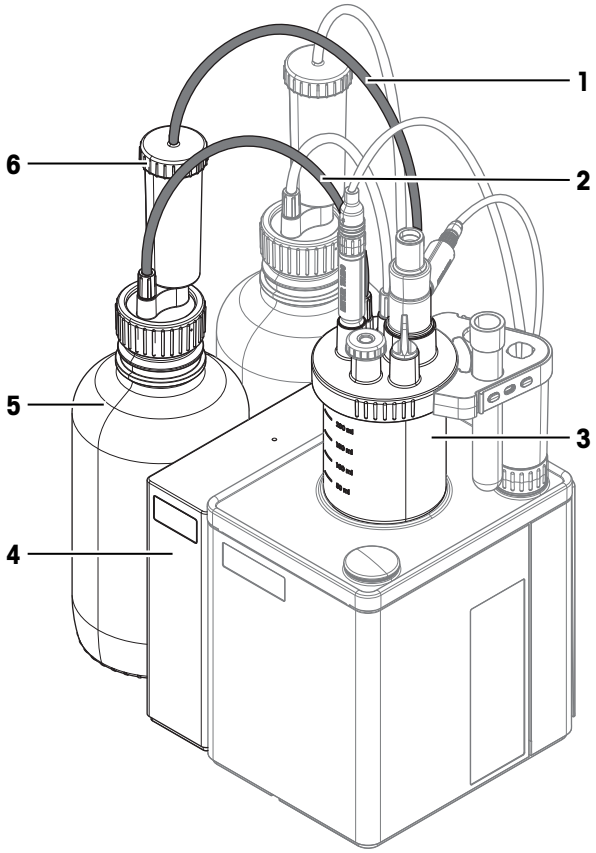
2 Remove the terminal cable from the **TERM** socket on the rear panel of the titrator.

## 4.6 Install a system with automated solvent exchange

### 4.6.1 Use cases and material

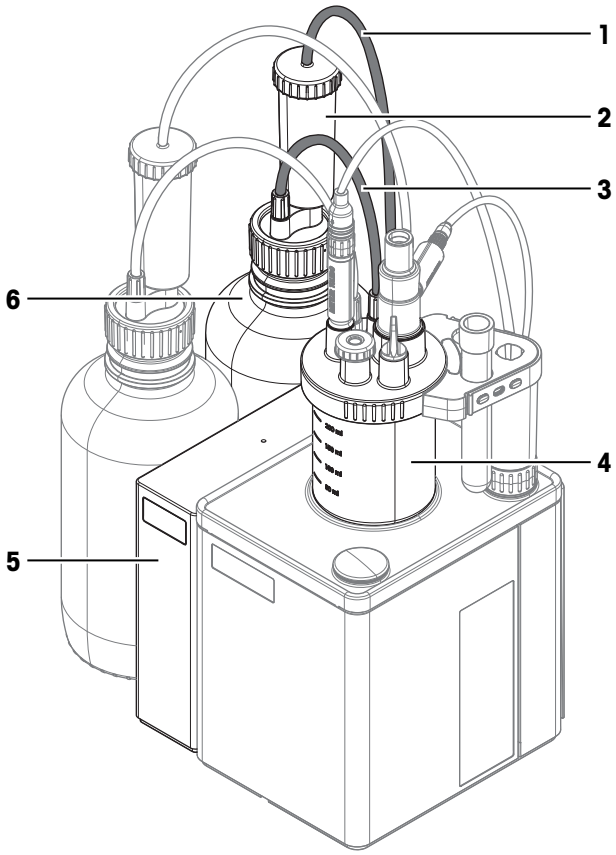
### 4.6.2 Overview of the setup

**Solvent flow**




| No. | Name | Function |
|---|---|---|
| **1** | Air tube | Connects the solvent bottle to the solvent pump. |
| **2** | Solvent tube | Connects the solvent bottle to the Karl Fischer cell. |
| **3** | Karl Fischer cell | Assembled reaction vessel for the Karl Fischer titration. |
| **4** | Solvent pump | Pumps air into the solvent bottle. Overpressure builds up in the solvent bottle and pushes solvent into the Karl Fischer cell. |
| **5** | Solvent bottle | Contains the solvent. |
| **6** | Drying tube | Removes moisture from the air that is pumped into the solvent bottle. |

**Waste flow**




| No. | Name | Function |
|---|---|---|
| **1** | Air tube | Connects the waste bottle to the solvent pump. |
| **2** | Drying tube | Removes moisture from the air that enters the waste bottle. |
| **3** | Waste tube | Connects the waste bottle to the Karl Fischer cell. |
| **4** | Karl Fischer cell | Assembled reaction vessel for the Karl Fischer titration. |
| **5** | Solvent pump | Aspirates air out of the waste bottle. Underpressure is created in the waste bottle and aspirates used solvent out of the Karl Fischer cell. |
| **6** | Waste bottle | Contains the waste. |

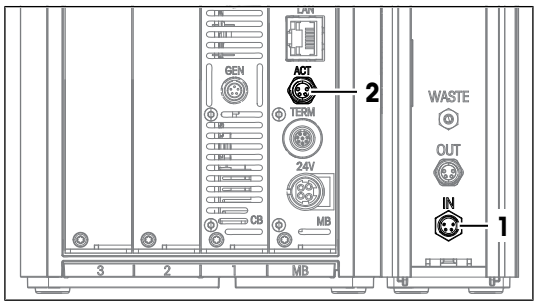
### 4.6.3 Overview of the actions

1 Install the solvent pump. See [Install the solvent pump dPump KF ▸ Page 27].
2 Prepare the drying tubes. See [Prepare drying tubes ▸ Page 27].
3 Install the titration arm. See [Install the titration arm ▸ Page 27].
4 Assemble the Karl Fischer cell. See [Assemble the Karl Fischer cell ▸ Page 28].
5 Install the waste bottle and solvent bottle. See [Install the waste bottle and the solvent bottle ▸ Page 29].
6 Install the sample injection adapter and NS14 stopper. See [Install sample injection adapter and NS14 stopper ▸ Page 32].
7 Install the sensor. See [Install the sensor ▸ Page 32].
8 Assemble the generator electrode. See [Assemble the generator electrode ▸ Page 32].
9 Install the generator electrode. See [Install the generator electrode ▸ Page 33].
10 Connect the power supply. See [Connect the power supply ▸ Page 37].

### 4.6.4 Install the solvent pump dPump KF

- The titrator is disconnected from the power supply.
- The length of the ACT cable does not exceed 2.4 m.

1 Rotate the female plug of the ACT cable until the arrow is on the upper side.
2 Insert the plug into the **IN** socket (1) on the pump.
3 Tighten the knurled nut to secure the connection.
4 Position the pump on the left side of the titrator.
5 Push the pump against the titrator.
   ➡ The internal magnets pull the pump into place.
6 Rotate the male plug of the ACT cable until the arrow is on the upper side.
7 Insert the plug into the **ACT** socket (2) on the titrator.
8 Tighten the knurled nut to secure the connection.

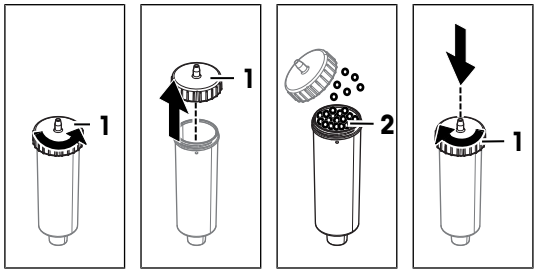



### 4.6.5 Prepare drying tubes

A drying tube can be used to remove moisture from the inside of a container. To remove moisture, the drying tube needs to be filled with desiccant.

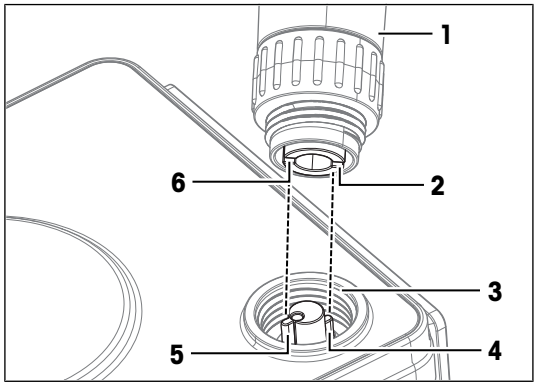
#### Fill the drying tube

1 Unscrew the lid (1) counterclockwise and lift the lid off the drying tube.
2 Fill the drying tube with desiccant (2).
3 Screw the lid (1) clockwise onto the drying tube and tighten it.

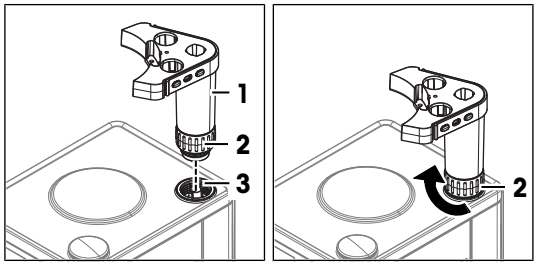



### 4.6.6 Install the titration arm

1 Pull the mounting position cover out of the rear mounting position (3).
2 Position the column (1) over the mounting position (3).
3 Align the long tab (5) with the long slot (6) and the short tab (4) with the short slot (2).




4 Gently lower the column (1) until the connector (2) slides down into the mounting position (3).
5 Tighten the connector (2) clockwise.



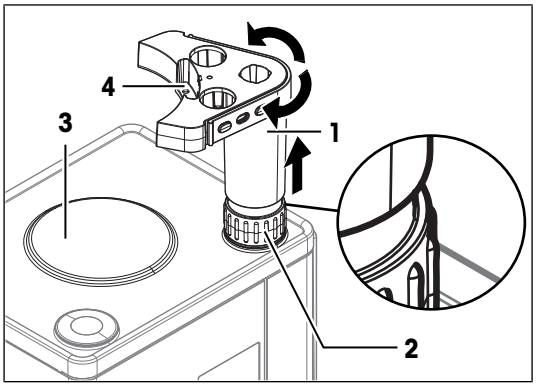
**Swivel the titration arm**

If the mounting slot for the Karl Fischer cell is not aligned with the internal magnetic stirrer, swivel the titration arm.

1 Gently pull the column (1) upward until there is a gap of a few millimeters between the connector (2) and column (1).

2 Swivel the titration arm clockwise or counterclockwise to align the mounting slot (4) for the Karl Fischer cell with the internal magnetic stirrer (3).

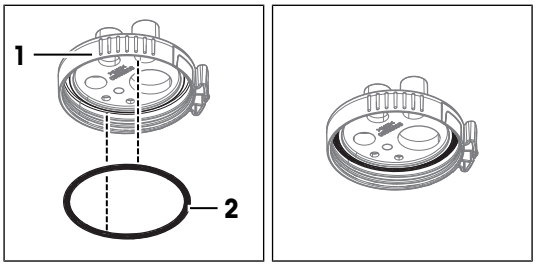
➡ When the titration arm is properly aligned, the column (1) retracts down to the connector (2).




## 4.6.7 Assemble the Karl Fischer cell

- The titration arm is installed on the titrator.

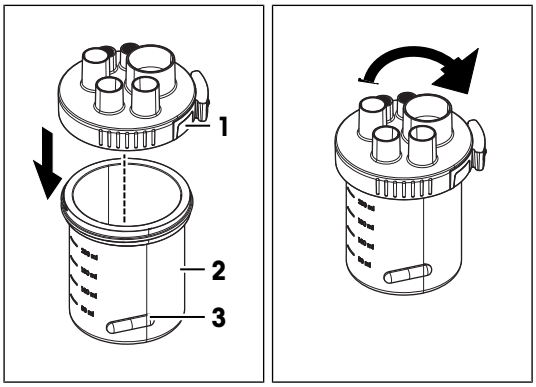
1 Attach the adapter plate seal (2) to the bottom of the adapter plate (1).




2 Place the appropriate stir bar (3) into the vessel (2).

3 Place the adapter plate (1) on the vessel (2).

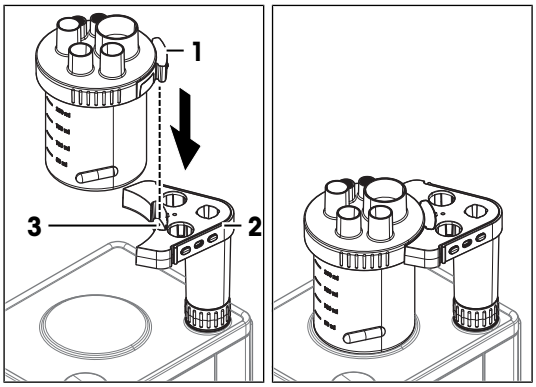
4 Turn the adapter plate clockwise and tighten it.




5 Stabilize the titration arm (2) with one hand.

6 Align the mounting tab (1) with the mounting slot (3) on the titration arm.

7 Push the mounting tab down completely into the mounting slot.



## 4.6.8 Install the waste bottle and the solvent bottle

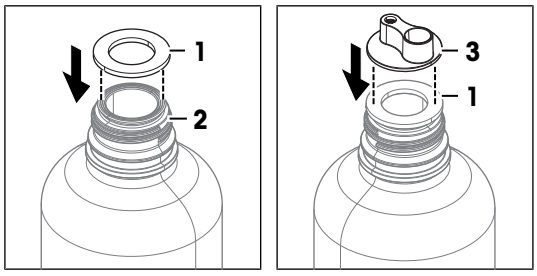
**Overview of the actions**

1 Install bottle adapters and drying tubes on the solvent bottle and on the waste bottle. See [Install bottle adapters and drying tubes ▸ Page 29].
2 Assemble the waste tube and the solvent tube. See [Assemble the waste tube and the solvent tube ▸ Page 29].
3 Connect the waste bottle. See [Connect the waste bottle ▸ Page 30].
4 Connect the solvent bottle. See [Connect the solvent bottle ▸ Page 30].

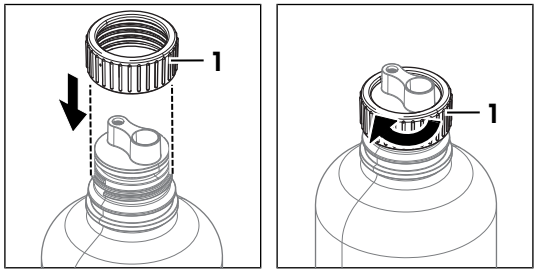
### 4.6.8.1 Install bottle adapters and drying tubes

- The drying tube is prepared.

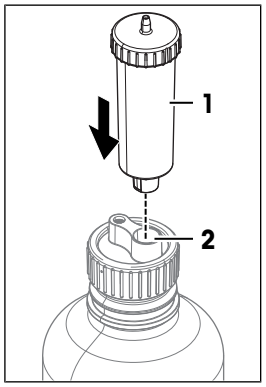
1 Place the flat seal (1) on the bottle (2).
2 Place the insert (3) on the flat seal (1).




3 Slide the threaded ring (1) over the insert and the flat seal.
4 Screw the threaded ring (1) clockwise onto the bottle and tighten it.




5 Insert the drying tube (1) into the mounting position (2).




### 4.6.8.2 Assemble the waste tube and the solvent tube

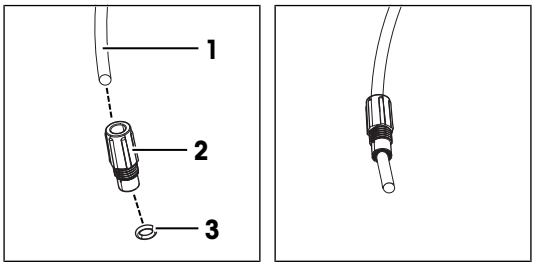
The solvent tube and the waste tube are identical tubes and are assembled in the same way.

**Material**

- 2 solvent tubes
- 4 M9 connectors
- 4 O-rings

**Procedure**

1 Slide one of the M9 connectors (2) over one end of a solvent tube (1).
2 Push one of the O-rings (3) over the end of the solvent tube.
3 Repeat the steps with the other end of the solvent tube.



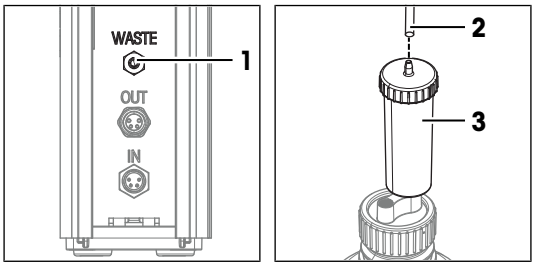

### 4.6.8.3 Connect the waste bottle

**Material**

- Air tube
- Waste tube: one of the assembled solvent tubes
- Assembled waste bottle

**Connect the waste bottle to the solvent pump**

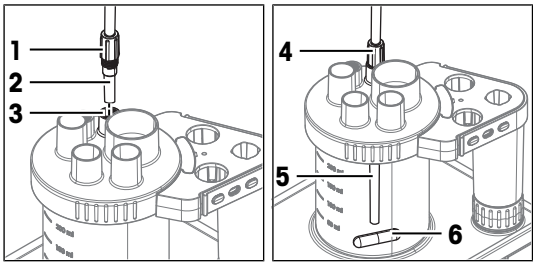
1 Push one end of the air tube over the **WASTE** fitting (1) on the pump.
2 Position the waste bottle behind the pump.
3 Make sure that there is no risk of knocking over the waste bottle.
4 Push the free end of the air tube (2) over the fitting on the drying tube (3).




**Connect the waste tube to the Karl Fischer cell**

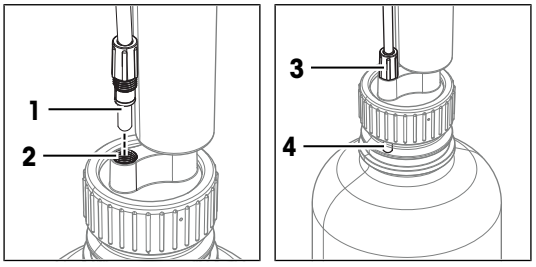
- The Karl Fischer cell is prepared.

1 Insert one end of the waste tube (2) into the M9 mounting position (3).
2 Screw the M9 connector (1) clockwise into the M9 mounting position (3) without tightening it.
3 Slide the tube tip (5) down to the bottom of the Karl Fischer cell, without interfering with the stir bar (6).
4 Tighten the M9 connector (4) clockwise.




**Connect the waste tube to the waste bottle**

1 Insert the free end of the waste tube (1) into the tube mounting position (2).
2 Screw the M9 connector (3) clockwise into the tube mounting position (2) without tightening it.
3 Slide the waste tube (4) down into the waste bottle until the end of the tube is visible just below the bottle adapter.
4 Tighten the M9 connector (3) clockwise.




### 4.6.8.4 Connect the solvent bottle

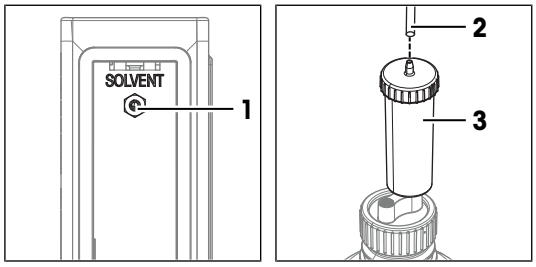
To avoid overflow, the liquid level in the solvent bottle must always be lower than the Karl Fischer cell adapter plate.

**Material**

- Air tube
- Solvent tube: one of the assembled solvent tubes
- Assembled solvent bottle

**Connect the solvent bottle to the solvent pump**

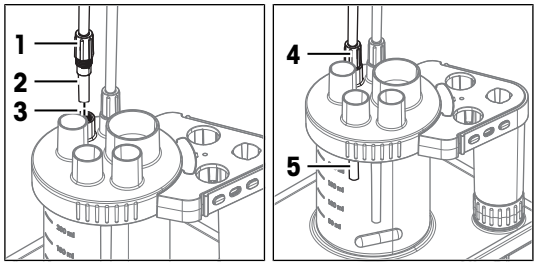
1 Push one end of the air tube over the **SOLVENT** fitting (1) on the pump.
2 Position the solvent bottle next to the pump.
3 Make sure that there is no risk of knocking over the solvent bottle.
4 Push the free end of the air tube (2) over the fitting on the drying tube (3).




**Connect the solvent tube to the Karl Fischer cell**

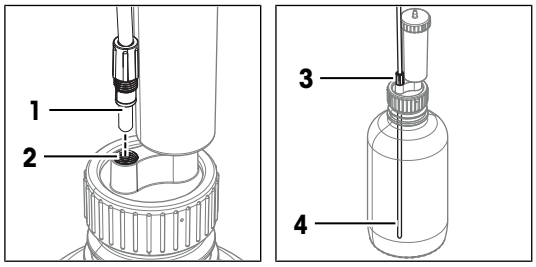
- The Karl Fischer cell is prepared.

1 Insert one end of the solvent tube (2) into the M9 mounting position (3).
2 Screw the M9 connector (1) clockwise into the M9 mounting position (3) without tightening it.
3 Slide the solvent tube down into the Karl Fischer cell until the tube tip (5) is visible under the adapter plate.
4 Tighten the M9 connector (4) clockwise.



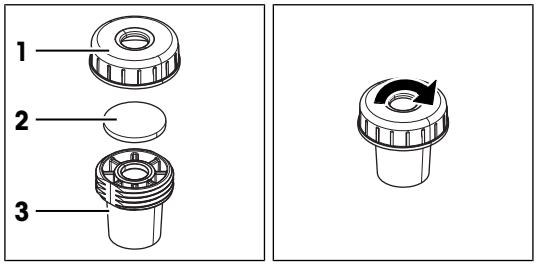

**Connect the solvent tube to the solvent bottle**

1 Insert the free end of the solvent tube (1) into the tube mounting position (2).
2 Screw the M9 connector (3) clockwise into the tube mounting position (2) without tightening it.
3 Slide the solvent tube (4) down until it touches the bottom of the solvent bottle.
4 Tighten the M9 connector (3) clockwise.




## 4.6.9 Assemble the sample injection adapter

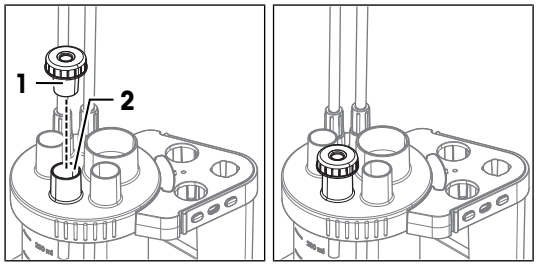
1 Place a septum (2) in the center of the bottom of the sample injection adapter (3).
2 Place the top of the sample injection adapter (1) on the bottom (3).
3 Screw the top clockwise on the bottom and tighten it.



### 4.6.10 Install sample injection adapter and NS14 stopper

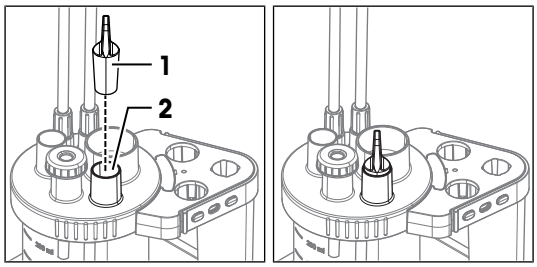
1 Insert the sample injection adapter (1) into the mounting position (2).

2 To tighten the connection, gently push the sample injection adapter down.




3 Insert the NS14 stopper (1) into the mounting position (2).

4 To tighten the connection, gently push the NS14 stopper down.




### 4.6.11 Install the sensor

- The titrator is disconnected from the power supply.
- The sensor is assembled.

1 Align the red dot on the sensor cable plug the with the red dot above the **SENS1** socket on the rear panel of the titrator.

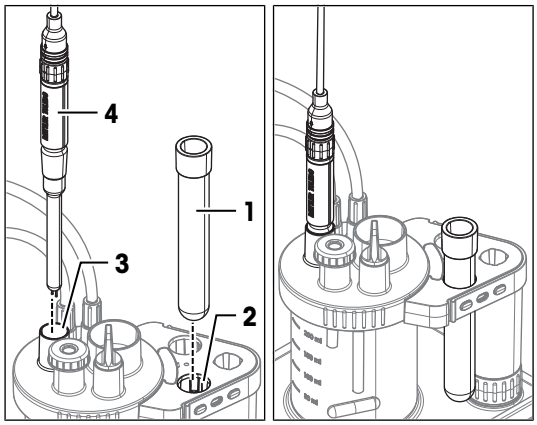
2 Insert the plug into the socket.

3 Remove the sensor (4) from the protective sleeve (1).

4 Insert the sensor (4) into the mounting position (3).

5 To tighten the connection, gently push the sensor down.

6 Insert the protective sleeve (1) into the holder (2).



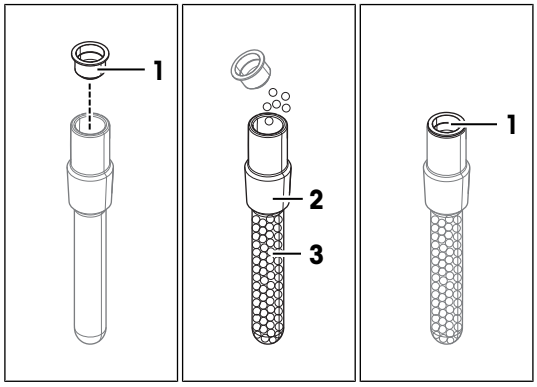

### 4.6.12 Assemble the generator electrode

**Material**

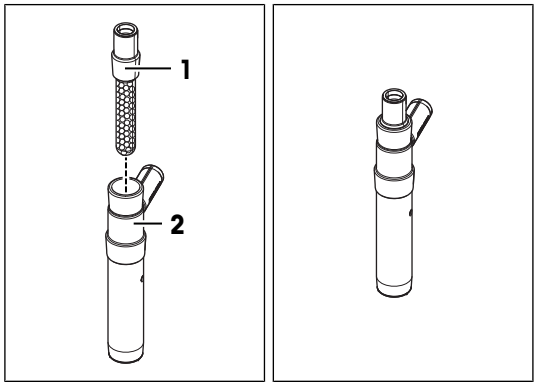
- Desiccant

**Procedure**

1 Remove the cap (1) from the drying tube.
2 Fill the drying tube with desiccant (3) up to the ground glass joint (2).
3 Replace the cap (1) on the drying tube.
4 Apply a thin film of silicon grease to the ground glass joint (2).




5 Insert the drying tube (1) into the shaft (2).



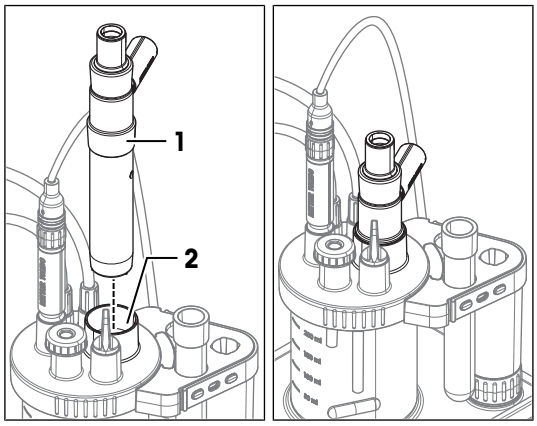

## 4.6.13 Install the generator electrode

**Preparations**

- The titrator is disconnected from the power supply.
- The generator electrode is assembled.

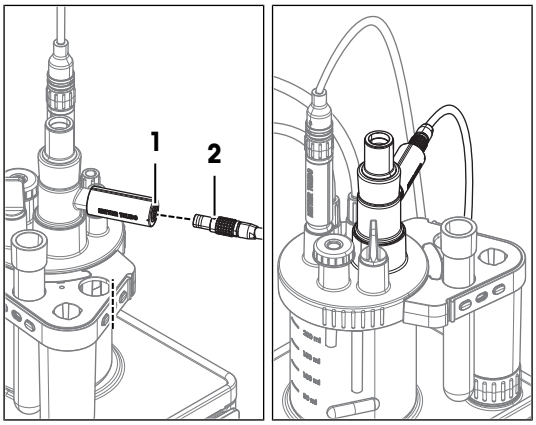
**Procedure**

1 Remove the generator electrode from the holder and store the holder.
2 Insert the generator electrode (1) into the mounting position (2).
3 To tighten the connection, gently push the generator electrode down.



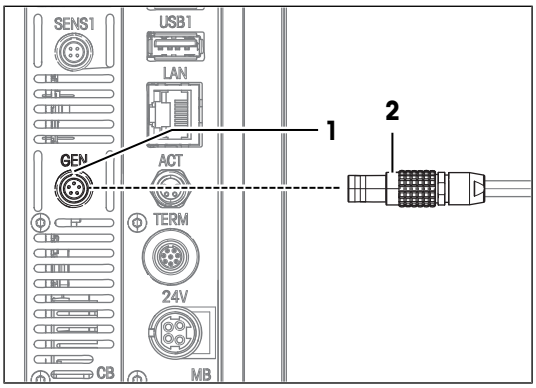
4 Align the red dot (2) on the generator electrode cable plug with the red dot (1) on the generator electrode socket.

5 Insert the plug into the generator electrode socket.




6 Align the red dot (2) on the generator electrode cable plug with the red dot (1) above the **GEN** socket on the rear panel of the titrator.

7 Insert the plug into the socket.




## 4.7 Connect an InMotion KF sample changer (EVA C3 only)

Read the User Manual of the sample changer for information on installing the sample changer. See [Download manuals ▸ Page 23].

### 4.7.1 Connect the sample changer to the titrator

**Preparations**

- The sample changer is installed.
- The sample changer is shut down.
- The titrator is shut down.
- The titrator is disconnected from the power supply.

**Procedure**

1 Insert the USB-B plug of the cable supplied with the sample changer into the **INSTRUMENT** socket on the sample changer.

2 Insert the USB-A plug into the **USB1** or **USB2** socket on the rear panel of the titrator.

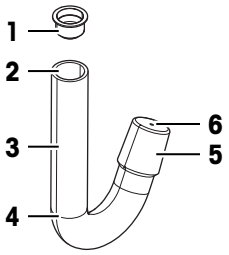
### 4.7.2 Connect the KF head to the Karl Fischer cell

**Preparations**

- The sample changer is installed.
- The sample changer is shut down.
- The Karl Fischer cell is installed as described in the installation of a system with automated solvent exchange.

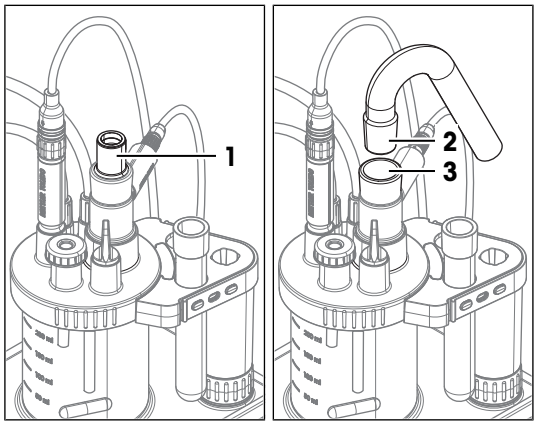
### Prepare the curved drying tube

1 Remove the cap (1) from the opening (2).
2 Make sure that the air vent in the cap is not clogged.
3 Make sure that the air vent at the bottom (4) of the desiccant chamber is not clogged.
4 Make sure that the air vent (6) is not clogged.
5 Fill the desiccant chamber (3) with molecular sieve.
6 Insert the cap (1) into the opening (2).
7 Apply a thin film of silicon grease to the ground glass joint (5).



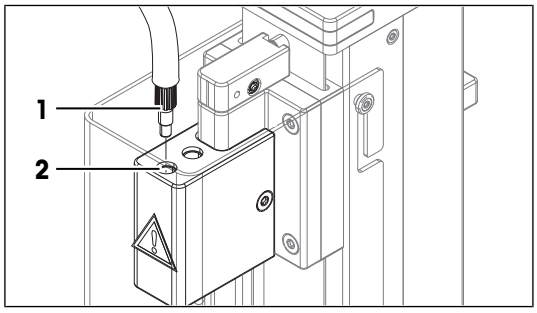

### Install the curved drying tube

1 Lift the straight drying tube (1) out of the generator electrode.
2 Insert the ground glass joint (2) into the mounting position (3).



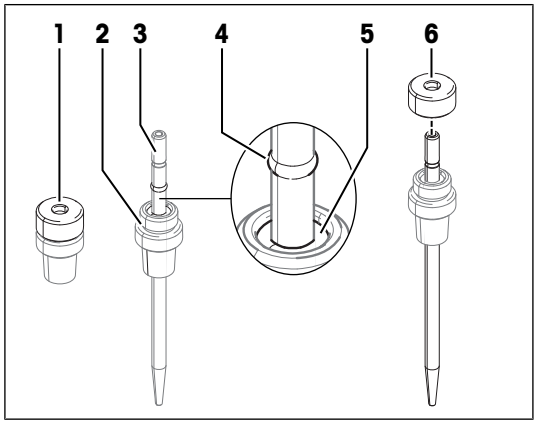

### Connect the transfer tube to the KF head

– Screw the M8 connector (1) of the transfer tube into the gas outlet (2) of the KF head.



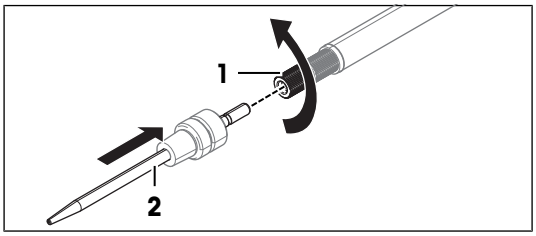

### Assemble the inlet tube

1 Unscrew and remove the top (1) of the inlet-tube adapter.
2 Insert the inlet tube (3) from above into the inlet-tube adapter (2).
3 Push the inlet tube down until its bulge (4) sits on the O-ring (5).
4 Slide the top (6) of the inlet-tube adapter over the inlet tube.
5 Screw the two parts of the inlet-tube adapter together.

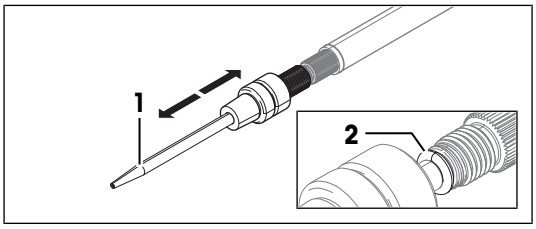


### Connect the transfer tube to the inlet tube

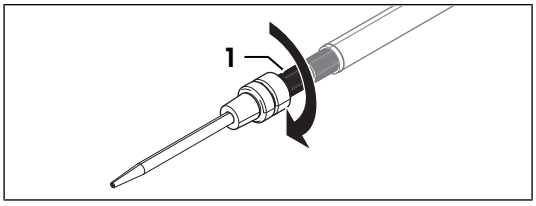
1 Turn the front part (1) of the coupling counterclockwise for two complete turns.
2 Insert the inlet tube (2) all the way into the coupling.




3 Move the inlet tube (1) back and forth by about 1 mm until the resistance decreases.
   ➡ The O-ring (2) sits in the groove of the inlet tube and moves with the inlet tube.

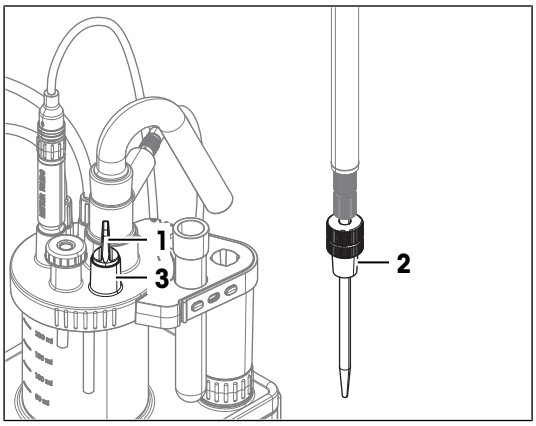



4 Tighten the front part (1) of the coupling clockwise.




### Connect the transfer tube to the Karl Fischer cell

1 Remove the NS14 stopper (1).
2 Insert the inlet-tube adapter (2) into the NS14 mounting position (3).




**See also**

Install a system with automated solvent exchange ▸ Page 25

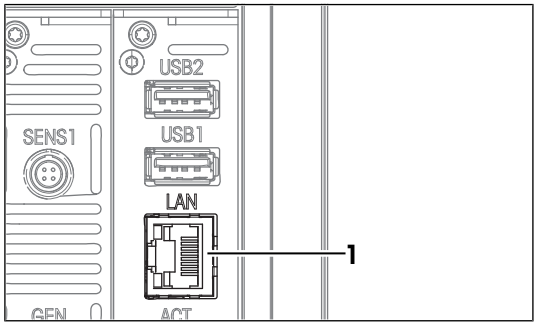
## 4.8 Connect a network cable

**Preparations**

- The titrator is disconnected from the power supply.

**Procedure**

– Connect an RJ45 network cable to the **LAN** socket on the rear panel.




**See also**


Configure a network connection ▸ Page 48

Titrator ▸ Page 89


## 4.9 Connect and disconnect the power supply

**NOTICE**

**Damage to the main instrument and accessories**

– Connect the power supply to the titrator after the terminal and all accessories are installed.

### 4.9.1 Connect the power supply

The AC/DC adapter is suitable for all supply line voltages ranging from 100...240 V AC and 50–60 Hz.

**⚠ WARNING**

**Death or serious injury due to electric shock**

Contact with parts that carry a live current can lead to death or injury.

1 Only use the METTLER TOLEDO power cable and AC/DC adapter designed for your instrument.
2 Connect the power cable to a grounded power outlet.
3 Keep all electrical cables and connections away from liquids and moisture.
4 Check the cables and the power plug for damage and replace them if damaged.

**NOTICE**

**Damage to the AC/DC adapter due to overheating**

An AC/DC adapter that does not have adequate air circulation around it, cannot cool sufficiently and overheats.

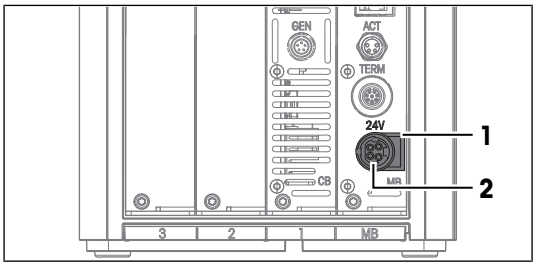
– Do not cover the AC/DC adapter.

1 Install the cables in such a way that they cannot be damaged or interfere with operation.
2 Position the AC/DC adapter so that the socket for the power cable is easily accessible.
3 Insert the plug of the power cable into the socket of the AC/DC adapter.

4 Rotate the plug of the AC/DC adapter until it is aligned with the marking (1) on the rear panel

5 Insert the plug into the **24V** socket (2).

6 Insert the plug of the power cable into a grounded power outlet that is easily accessible.




### 4.9.2 Disconnect the power supply

- The titrator is shut down.

1 Pull the plug of the power cable out of the power outlet.

2 Pull the AC adapter cable connector out of the **24V** socket at the back of the titrator.

# 5 Instrument configuration

## 5.1 Configure user management

User management is divided into the following parts:

- User groups: each user group has a set of permissions that determines which functions its members can access. User accounts assigned to a user group inherit the permissions of the user group.
- User accounts: include settings that are specific for each user.
- User authentication: verifies the identity of users before they can access the instrument.

You can choose between three basic forms of user management:

- Use the instrument without user accounts.
- Use the instrument with user accounts but without user authentication. In this case, users select an account from a list to access the instrument.
- Use the instrument with user accounts and user authentication. In this case, users log in with a password to access the instrument.

The following table provides an overview of the functions available for each option.

| Function | No user account | User accounts | User accounts and user authentication |
|---|---|---|---|
| The instrument records which user performs an action. | No | Yes | Yes |
| Users can customize some aspects of the user interface. | No | Yes | Yes |
| Users can create user-specific shortcuts. | No | Yes | Yes |
| You can control a user's access rights with user groups. | No | Yes | Yes |
| You can temporarily block a user's access to the instrument. | No | Yes | Yes |
| Users have to log in with a password. | No | No | Yes |
| The instrument logs out users that are inactive for given period of time. | No | No | Yes |

**See also**


- Configure the type of user management ▸ Page 39
- Configure user groups and access rights ▸ Page 40
- Configure user accounts ▸ Page 44
- Configure user authentication ▸ Page 45
- Export and import user management data ▸ Page 47


### 5.1.1 Configure the type of user management

The following table shows the available types of user management and the parameter settings for the different types:

| Functions | User management |
|---|---|
| No user management:<br>• No user accounts<br>• No user authentication | **None** |

| Functions | User management |
|---|---|
| Basic user management:<br>• Up to 30 user accounts<br>• Three predefined user groups with fixed settings<br>• A user can only belong to one user group<br>• Optional user authentication | **Basic** |
| Flexible user management<br>• Up to 30 user accounts<br>• Up to ten user-defined user groups<br>• A user can belong to more than one user group<br>• Optional user authentication | **Flexible** |

**Preparations**

**NOTICE**

**Data loss due to changed type of user management**

When you change the type of user management, the instrument replaces the current configuration with the default values of the new type of user management. The instrument also deletes all shortcuts.

– Back up the user management data.

- No task or action is running.

**Procedure**

1 Go to ☰ > ⚙ **Setup** > ⚙ **System Settings** > 🖥 **Instrument**.
   ➡ The **Instrument** window opens.
2 Select the ⚙ **General Settings** tab.
3 For **User management**, select the required type of user management.
4 Tap 💾 **Save**.
5 Confirm the message.
   ➡ The instrument restarts and you are logged in as the default user **Administrator**.

**See also**


- Configure user groups and access rights ▸ Page 40
- Configure user accounts ▸ Page 44
- Configure user authentication ▸ Page 45
- Export and import user management data ▸ Page 47


## 5.1.2 Configure user groups and access rights

User groups make it easier to manage which functions each user can access. Instead of configuring permissions for each user, you configure the permissions for a user group. User accounts that you assign to a user group inherit the permissions of the user group.

Three user groups are predefined on the instrument:

- **Administrator**
- **Lab manager**
- **Operator**

The following table shows the permissions that are assigned to the predefined user groups.

| Permission | Operator | Lab manager | Administrator |
|---|---|---|---|
| **Execute analysis** | • | • | • |

| Permission | Operator | Lab manager | Administrator |
|---|---|---|---|
| **Execute operations** | • | • | • |
| **Edit methods** | – | • | • |
| **Edit resources** | – | • | • |
| **Edit shared shortcuts** | – | • | • |
| **Delete shared shortcuts** | – | • | • |
| **Edit personal shortcuts** | – | • | • |
| **Edit personal settings** | – | • | • |
| **Edit instrument** | – | – | • |

#### 5.1.2.1 Create and edit user groups

The following table shows which user groups you can edit and delete depending on the type of user management.

| User group | Basic user management | Flexible user management |
|---|---|---|
| **Administrator** | • Read only<br>• Cannot be deleted | • Read only<br>• Cannot be deleted |
| **Lab manager** | • Read only<br>• Cannot be deleted | • Can be edited<br>• Can be deleted |
| **Operator** | • Read only<br>• Cannot be deleted | • Can be edited<br>• Can be deleted |
| User-defined user groups | Not available | Up to ten user groups in addition to the predefined **Administrator** group |

**Unique identifier and description**

Each user group has a unique identifier that is defined in the **Name** parameter. This identifier is read only after you have created the user group.

You can enter a description into the **Description** parameter.

**Access rights**

All users can access the following functions:

- Add or remove plug-and-play resources
- Add or remove plug-and-play USB serial devices
- View the settings for the following entities:
  - Methods
  - Work sets
  - Resources
  - Peripheral devices
  - Shortcuts for methods
  - Shortcuts for work sets
- View results
- View the task list

To provide access to other functions, you need to assign permissions to the user group. The following table shows which access rights are associated with each available permission.

| Permission | Description |
|---|---|
| **Execute analysis** | • Start, stop, pause, interrupt and resume a method.<br>• Start, stop, pause, interrupt and resume a work set.<br>• Skip samples during an analysis.<br>• Complete a method with an open number of samples.<br>• Start a method from a shortcut.<br>• Start a work set from a shortcut.<br>• Add entries to the sample list of an analysis.<br>• Remove entries from the sample list of an analysis.<br>• Change the order of the entries in the sample list of an analysis.<br>• Edit sample data.<br>• Edit task properties.<br>• Change the order of the entries in the task list. |
| **Execute operations** | • View, edit and execute entries in **Operations & Actions**.<br>• Start operations and actions from shortcuts. |
| **Edit methods** | • Create, edit and delete methods.<br>• Create, edit and delete work set. |
| **Edit resources** | • Create, edit and delete entries in **Chemicals**<br>• Create, edit and delete entries in **Values & Tables**<br>• Create, edit and delete entries in **Hardware** |
| **Edit shared shortcuts** | • Create shared shortcuts.<br>• Edit settings for shared shortcuts, such as name and position. |
| **Delete shared shortcuts** | Delete shared shortcuts. |
| **Edit personal shortcuts** | • Create personal shortcuts.<br>• Edit settings for personal shortcuts, such as name and position.<br>• Delete personal shortcuts. |
| **Edit personal settings** | • View and edit personal settings.<br>• Change password. |

| Permission | Description |
|---|---|
| **Edit instrument** | **Peripherals**<br>• Edit settings for devices listed in this submenu.<br>**System Settings**:<br>• Edit user management data.<br>• Edit the behavior of resources and tasks.<br>• Edit instrument settings such as date and time, temperature unit, and instrument identification.<br>• Edit network settings.<br>• Register the instrument with LabX cloud and decommission the instrument.<br>**Maintenance & Service**<br>• View entries in this menu.<br>• Import and export user management data.<br>• Import and export methods.<br>• Backup and restore the instrument configuration.<br>• Restore the factory settings.<br>• Update software.<br>• Organize preventive maintenance.<br>• View the service history.<br>• View the instrument software history.<br>• View and export the hardware and software summary. |

**Preparations**

- User management is activated.

**Procedure**

1 Go to ☰ > ⚙ **Setup** > ⚙ **System Settings** > 👤 **User Management**.
2 In the 👤 **Groups** tab, tap + **New**.
3 For **Name**, enter the unique identifier.
4 Activate the permissions as required.
5 Tap ✓ **Create**.

**See also**


- Assign user accounts to user groups ▸ Page 43
- Configure the type of user management ▸ Page 39


### 5.1.2.2 Assign user accounts to user groups

1 Go to ☰ > ⚙ **Setup** > ⚙ **System Settings** > 👤 **User Management**.
2 In the 👤 **Users** tab, select the user account.
3 For **Group**, activate the checkbox of the required group.
4 Tap 💾 **Save**.

**See also**


- Configure the type of user management ▸ Page 39


### 5.1.2.3 Delete user groups

You can only delete a user group if at least one of the following conditions is met.

- No user account is assigned to the user group.
- User accounts that are assigned to the user group are assigned to at least one other user group.

You cannot delete the predefined **Administrator** user group.

**Procedure**

1 Go to ☰ > ⚙ **Setup** > ⚙ **System Settings** > 👤 **User Management**.
2 In the 👤 **Groups** tab, select the group.
3 To delete the user account, tap 🗑 **Delete**.

**See also**


- Assign user accounts to user groups ▸ Page 43
- Configure the type of user management ▸ Page 39


### 5.1.3 Configure user accounts

You can create up to 30 user accounts. Only one user can be logged in at a time.

A user account with the user name **Administrator** is predefined on the instrument. You cannot edit or delete this user account.

**See also**


- Create user accounts ▸ Page 44
- Edit user accounts ▸ Page 45
- Deactivate or delete user accounts ▸ Page 45
- Reset password or enforce password change ▸ Page 46
- Assign user accounts to user groups ▸ Page 43


#### 5.1.3.1 Create user accounts

Each user account needs a unique identifier, the **User name**. This identifier is used for the following functions:

- User name to log in
- Identify which user has performed an action

The identifier has the following characteristics:

- Length: 1…20 characters
- Case sensitive
- Read only after the user account is created

In addition to the identifier, you can enter the user's given name in **Full name**.

The **Group** parameter assigns the user account to one of the user groups. The user group defines the user's access rights.

Other parameters are only displayed if user authentication is activated.

**Preparations**

- User management is activated.
- User groups are defined.

**Procedure**

1 Go to ☰ > ⚙ **Setup** > ⚙ **System Settings** > 👤 **User Management**.
2 In the 👤 **Users** tab, tap + **New**.
3 For **User name**, enter the identifier.
4 For **Full name**, enter the user's given name.
5 For **Group**, activate the checkbox of the user group.
6 Tap 💾 **Save**.
7 Tap ← **Back**.
8 Tap ✓ **Create**.

**See also**


- Configure user groups and access rights ▸ Page 40
- Deactivate or delete user accounts ▸ Page 45
- Configure user authentication ▸ Page 45
- Reset password or enforce password change ▸ Page 46


### 5.1.3.2 Edit user accounts

You can only edit user accounts of users that are not logged in.

**Procedure**

1 Go to ☰ > ⚙ **Setup** > ⚙ **System Settings** > 👤 **User Management**.
2 In the 👤 **Users** tab, select the user account.
3 Change the parameters as needed.
4 Tap 💾 **Save**.

**See also**


- Configure user accounts ▸ Page 44


### 5.1.3.3 Deactivate or delete user accounts

You have the following options to remove user access to the instrument:

- Deactivate the user account
- Delete the user account

The following table shows a comparison of the options.

| Function | Deactivated user account | Deleted user account |
|---|---|---|
| Log in to the instrument | Not possible | Not possible |
| Restore user account and user specific settings | Possible | Not possible |
| Use unique identifier for another user account | Not possible | Possible |

You can only deactivate or delete user accounts of users that are not logged in.

**Procedure**

1 Go to ☰ > ⚙ **Setup** > ⚙ **System Settings** > 👤 **User Management**.
2 In the 👤 **Users** tab, select the user account from the list.
3 To deactivate the user account, activate **Deactivate user**.
4 To delete the user account, tap 🗑 **Delete**.
5 Tap 💾 **Save**.

**See also**


- Configure user accounts ▸ Page 44


## 5.1.4 Configure user authentication

The following functions are available if user authentication is activated:

- Users have to identify themselves with a password when they log in.
- You can reset passwords.
- You can force users to change their password.
- You can prevent users from accessing the instrument.

**See also**

Configure the type of user management ▸ Page 39

### 5.1.4.1 Activate user authentication

You can configure the following functions when you activate user authentication.

**User name in the login window**

The following table shows the options for the login window and the parameter settings for the different options:

| Action of the system | Show users on login screen |
|---|---|
| Users have to enter their user name in the login window. | Deactivated |
| Users can select their user name from a list in the login window. | Activated |

**Password**

The password can have up to 32 characters. The initial password for all users is "123456". Users are asked to change this password when they log in for the first time.

You can define a minimal password length in **Min. password length**. If you increase the minimal password length, users with shorter passwords have to change their password when they log in.

**Configure automatic logout**

You can activate an automatic logout function with **Automatic logout**. With this function, users are logged out if they do not interact with the instrument for the duration that is defined in **Log out after**.

**Preparations**

- User management is activated.

**Procedure**

1 Go to ☰ > ⚙ **Setup** > ⚙ **System Settings** > 👤 **User Management**.
2 In the 👤 **Account Policies** tab, activate **Enforce password**.
3 Change the parameters as needed.
4 Tap 💾 **Save**.

**See also**

Configure the type of user management ▸ Page 39
Reset password or enforce password change ▸ Page 46
Change your password ▸ Page 83

### 5.1.4.2 Reset password or enforce password change

**Reset the password**

When you reset the password, the user has to enter the default password "123456" in the login window. When the user is logged in, the instrument prompts the user to change the password.

**Force users to change their password**

You can force users to change their password the next time that they log in. In this case users have to enter their own password in the login window. When the user is logged in, the instrument prompts the user to change the password.

**Preparations**

- User management is activated.
- User accounts are defined.

**Procedure**

1 Go to ☰ > ⚙ **Setup** > ⚙ **System Settings** > 👤 **User Management**.
2 In the 👤 **Users** tab, select the user account from the list.
3 To reset the password, activate **Reset password**.
   ➡ The instrument activates **Enforce password change** automatically.
4 To force the user to change the password, activate **Enforce password change**.
5 Tap 💾 **Save**.

**See also**

🔗 Activate user authentication ▸ Page 46
🔗 Change your password ▸ Page 83

## 5.1.5 Export and import user management data

You can export the user management data to an XML file. You have the following options for using the XML file:

- Restore the user management data on the instrument.
- Transfer the user management data to another instrument. In this case, the transferred user management data overwrite the user management data that are already on the instrument.

**Compatibility**

Instrument type and software version limit the compatibility of the XML file. You can import an XML file if the following conditions are met:

- You exported the XML file from an instrument with the same instrument type or an instrument type with fewer features. Examples:
  - If you export the XML file from a coulometric Karl Fischer titrator, you can import it to another coulometric Karl Fischer titrator.
  - If you export the XML file from an EVA C1 titrator, you can import it to an EVA C3 titrator.
  - If you export the XML file from an EVA C3 titrator, you cannot import it to an EVA C1 titrator.
- You exported the XML file from an instrument with a lower or equal software version. Examples:
  - If you export the XML file from an instrument with software version 1.0, you can import it to an instrument with software version 1.1.
  - If you export the XML file from an instrument with software version 1.1, you cannot import it to an instrument with software version 1.0.

### 5.1.5.1 Export user management data

When you export user management data, the instrument creates an XML file and saves this file to a USB flash drive. The following rules apply:

- The instrument saves the file to a folder that is named after the instrument category.
  - Example: If you export the data from a titrator, the titrator saves the file to a folder called "Titration".
- The instrument names the file "export_usermanagement.xml".
- If a file named "export_usermanagement.xml" already exists, the instrument overwrites the existing file.

You can use the following types of USB flash drives:

- USB-A flash drive with a USB-A socket on the rear panel
- USB-C flash drive with the USB-C socket on the terminal

**Preparations**

- Only one USB flash drive is connected to the instrument.

**Procedure**

1 Go to ☰ > ⚙ **Setup** > **Maintenance & Service** > **Import/Export**.
2 For **Action**, select **Export**.

3 For **Data**, select **User management**.

4 Tap **Start**.

➡ The instrument saves the file to the USB flash drive.

### 5.1.5.2 Import user management data

When you import the XML file, the instrument deletes the following data:

- Existing user management data
- Shortcuts

#### Preparations

- The XML file is named "export_usermanagement.xml".
- The XML file is in a folder named "Titration".
- The folder "Titration" is in the root directory of the USB flash drive.
- Only one USB flash drive is connected to the instrument.
- No task or action is running.

#### Procedure

1 Go to > **Setup** > **Maintenance & Service** > **Import/Export**.

2 For **Action**, select **Import**.

3 For **Data**, select **User management**.

4 Tap **Start**.

➡ The instrument restarts.

## 5.2 Configure a network connection

The instrument software supports Ethernet connections to a network or to an individual computer. You can deactivate this function to prevent data transfer to a network or a computer.

#### Ethernet connection to a network

The connection to a network enables the following functions:

- Connection to a network printer
- Use of the instrument with the LabX Cloud laboratory software
- Data export to a network share

#### Ethernet connection to an individual computer

An instrument that is connected to a computer can be used with a stand-alone installation of the LabX Cloud laboratory software.

Read the Reference Manual for the instrument in the connected mode for additional information on working with an instrument connected to the laboratory software. See [Download manuals ▸ Page 23].

#### Network configuration

To configure the network settings, you have the following options:

- The instrument automatically configures the network settings using one of the following methods:
  - DHCP (Dynamic Host Configuration Protocol)
  - Link-local address configuration
- You manually configure the network settings. For the manual configuration you need the following information from your network administrator:
  - IPv4 address
  - IPv4 subnet mask
  - IPv4 standard gateway

– IPv6 address

### Overview of the settings

The following table shows the available parameters and their settings for the different options.

| Action of the system | Enable | Obtain IPv4 address automatically<br>Obtain IPv6 address automatically |
|---|---|---|
| No network connection | Deactivated | – |
| Automatically configured Ethernet connection | Activated | Activated |
| Manually configured Ethernet connection | Activated | Deactivated |

### Procedure

1 Go to ☰ > ⚙ **Setup** > ⚙ **System Settings** > **Network**.
2 In the **Ethernet Settings** tab, change the settings as needed.
3 Tap **Save**.

### See also

Connect a network cable ▸ Page 36

# 6 Configuration of analysis settings

## 6.1 Overview

### 6.1.1 Methods

A method defines the sequence of steps that the titrator performs during an analysis. You can customize methods to fit your use case.

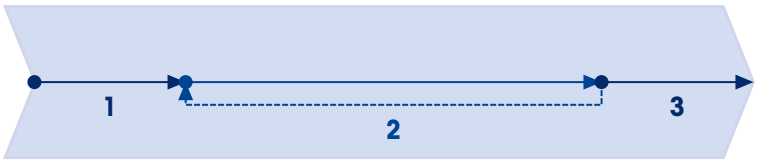
- Up to 500 methods can be stored on the titrator.
- You can execute methods repeatedly.

**See also**

Customization of analyses ▸ Page 15

#### 6.1.1.1 Analysis sequence and method functions

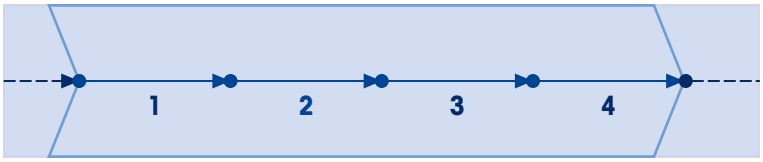
The steps that are performed during an analysis are grouped into different sequences. The following figure shows an example with three sequences.




| No. | Name | Function |
|---|---|---|
| 1 | Initial sequence | Steps that are performed one time at the beginning of the analysis. |
| 2 | Sample sequence | Steps that are performed during the sample analysis. These steps are repeated for each sample. |
| 3 | Final sequence | Steps that are performed one time at the end of the analysis. |

Each of these sequences is composed of one or more method functions. Method functions are executed sequentially. You can customize each method function with a set of parameters.

The following example shows typical method functions in a sample sequence of a Karl Fischer titration.




| No. | Name | Function |
|---|---|---|
| 1 | **Drift** | The titrator acquires the drift value that is used to correct the result. |
| 2 | **Sample** | Users add the sample. |
| 3 | **Titration (KF Coul)** | The titrator performs the titration and calculates raw results. |
| 4 | **Result** | The titrator calculates a result with a user-defined formula. |

**See also**

Sample sequence ▸ Page 55
Methods ▸ Page 50

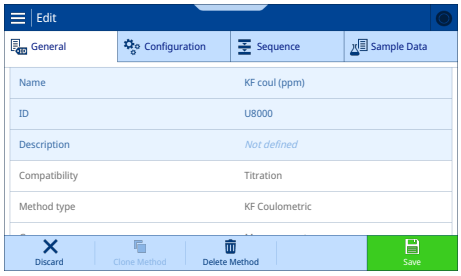
#### 6.1.1.2 Method editor

Methods are configured in the method editor. The method editor is divided into different tabs. The setup of the system and the method type define which tabs are displayed.

This chapter provides an overview of the tabs. The screenshots are from a method for a Karl Fischer titration that includes an initial sequence, a sample sequence, and a final sequence.

## General

In the **General** tab, you can find parameters that define general information about the entire method.

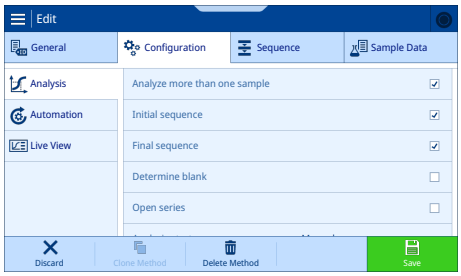



The following list shows some examples:

- Method name
- Method identifier
- Method type
- User who created the method
- User who last modified the method

## Configuration

In the **Configuration** tab, you can find parameters that apply to the entire method and are not specific to one particular method function.



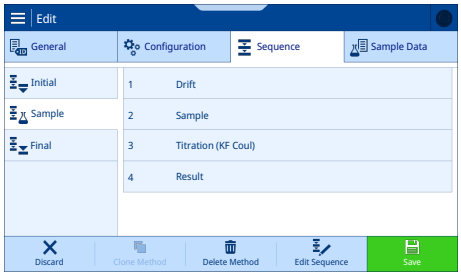

The following list shows some examples:

- Sequences that are performed during the analysis.
- Number of samples that are analyzed during the analysis.
- Criteria that must be met before the titration is started.
- Content of the window that is displayed during the titration.

## Sequence

The **Sequence** tab has two major functions:

- Add, reorder and delete method functions.
- Configure individual method functions.




## Sample Data

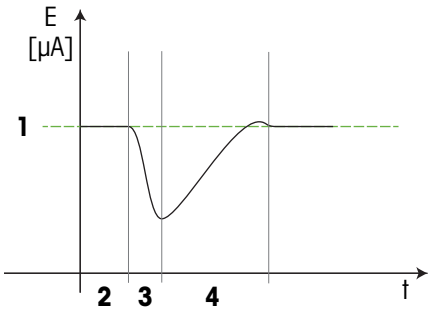
In the **Sample Data** tab you can find parameters that define sample specific data.


The following list shows some examples:

- Physical quantity for the sample size
- Limits for the sample size
- Default value for the sample identifier

### 6.1.2 Control algorithm

The control algorithm controls the iodine generation during conditioning and during titration. The following figure shows the functions of the control algorithm during the different phases of an analysis.




| No. | Name | Description |
|---|---|---|
| **1** | Set current intensity | Control of the Karl Fischer titration relies on a user-defined set current intensity. The set current intensity defines the current intensity at which the titrator terminates the titration. |
| **2** | Conditioning | The control algorithm establishes a dry state of the Karl Fischer cell and maintains it. |
| **3** | Sample addition | The addition of a sample causes a sharp drop in current intensity. The control algorithm can detect this change and use it to detect the sample addition. |
| **4** | Titration | The control algorithm optimizes the iodine generation to keep the reaction rate high. A high reaction rate reduces the titration duration.<br>To achieve this goal, the control algorithm evaluates the signal from the polarized sensor and its change over time. This data provides information about the chemical system in the Karl Fischer cell. Based on the characteristics of the chemical system, the control algorithm maximizes iodine generation without causing over-titration. |

**See also**


- Measurement principle ▸ Page 16
- Configure sample detection ▸ Page 58
- Configure iodine generation ▸ Page 59
- Configure the termination of the titration ▸ Page 60


## 6.2 Manage methods

### 6.2.1 Export and import all methods

You can export all methods to an XML file. You have the following options for using the XML file:

- Restore the methods on the instrument.
- Transfer the methods to another instrument. In this case, the transferred methods overwrite the methods that are already on the instrument.

**Compatibility**

Instrument type and software version limit the compatibility of the XML file. You can import an XML file if the following conditions are met:

- You exported the XML file from an instrument with the same instrument type or an instrument type with fewer features. Examples:

  - If you export the XML file from a coulometric Karl Fischer titrator, you can import it to another coulometric Karl Fischer titrator.
  - If you export the XML file from an EVA C1 titrator, you can import it to an EVA C3 titrator.
  - If you export the XML file from an EVA C3 titrator, you cannot import it to an EVA C1 titrator.
- You exported the XML file from an instrument with a lower or equal software version. Examples:
  - If you export the XML file from an instrument with software version 1.0, you can import it to an instrument with software version 1.1.
  - If you export the XML file from an instrument with software version 1.1, you cannot import it to an instrument with software version 1.0.

**See also**


- Export and import single methods ▸ Page 54
- Back up and restore the instrument configuration ▸ Page 83


### 6.2.1.1 Export all methods

When you export all methods, the instrument creates an XML file and saves this file to a USB flash drive. The following rules apply:

- The instrument saves the file to a folder that is named after the instrument category.
  - Example: If you export the data from a titrator, the titrator saves the file to a folder called "Titration".
- The instrument manes the file "export_all_methods.xml".
- If a file named "export_all_methods.xml" already exists, the instrument overwrites the existing file.

You can use the following types of USB flash drives:

- USB-A flash drive with a USB-A socket on the rear panel
- USB-C flash drive with the USB-C socket on the terminal

**Preparations**

- Only one USB flash drive is connected to the instrument.

**Procedure**

1 Go to ☰ > ⚙ **Setup** > **Maintenance & Service** > **Import/Export**.
2 For **Action**, select **Export**.
3 For **Data**, select **All methods**.
4 Tap ▶ **Start**.
➡ The instrument saves the file to the USB flash drive.

**See also**


- Export and import single methods ▸ Page 54


### 6.2.1.2 Import all methods

When you import the XML file, the instrument deletes the following data:

- Existing methods
- Shortcuts

**Preparations**

- The XML file is named "export_all_methods.xml".
- The XML file is in a folder named "Titration".
- The folder "Titration" is in the root directory of the USB flash drive.
- Only one USB flash drive is connected to the instrument.
- No task or action is running.

### Procedure

1 Go to ☰ > ⚙ **Setup** > **Maintenance & Service** > **Import/Export**.
2 For **Action**, select **Import**.
3 For **Data**, select **All methods**.
4 Tap ▶ **Start**.
➡ The instrument restarts.
➡ The imported methods are listed in the method list.

### See also

Export and import single methods ▸ Page 54

## 6.2.2 Export and import single methods

You can export a method to an XML file. You can use the XML file to transfer the method to another instrument.

### Compatibility

The instrument type and the method configuration limit the compatibility of the XML file. You can import an XML file if the following conditions are met:

- You exported the XML file from an instrument with the same instrument type or an instrument type with fewer features. Examples:
  - If you export the XML file from a coulometric Karl Fischer titrator, you can import it to another coulometric Karl Fischer titrator.
  - If you export the XML file from an EVA C1 titrator, you can import it to an EVA C3 titrator.
- If you exported the XML file from an instrument type with more features, none of the additional features are used in the method.

### See also

Export and import all methods ▸ Page 52

### 6.2.2.1 Export a single method

When you export a method, the instrument creates an XML file and saves this file to a USB flash drive. The following rules apply:

- The instrument saves the file to a folder that is named after the instrument category.
  - Example: If you export the data from a titrator, the titrator saves the file to a folder called "Titration".
- The instrument names the file "export_method_[methodname].xml". [methodname] is a placeholder for the name of the method.

You can use the following types of USB flash drives:

- USB-A flash drive with a USB-A socket on the rear panel
- USB-C flash drive with the USB-C socket on the terminal

### Preparations

- Only one USB flash drive is connected to the instrument.

### Procedure

1 Go to ☰ > ⚙ **Setup** > **Maintenance & Service** > **Import/Export**.
2 For **Action**, select **Export**.
3 For **Data**, select **Single method**.
4 For **Method name**, select the required method from the list.
5 Tap ▶ **Start**.
➡ The instrument saves the file to the USB flash drive.

**See also**

Export and import single methods ▸ Page 54
Export and import all methods ▸ Page 52

#### 6.2.2.2 Import a single method

**Preparations**

- The name of the XML file starts with "export_method_".
- The XML file is in a folder named "Titration".
- The folder "Titration" is in the root directory of the USB flash drive.
- Only one USB flash drive is connected to the instrument.
- No task or action is running.

**Procedure**

1 Go to ☰ > ⚙ **Setup** > **Maintenance & Service** > **Import/Export**.
2 For **Action**, select **Import**.
3 For **Method name**, select the required method from the list.
4 Tap ▶ **Start**.
➡ The instrument adds the method to the method list.

**See also**

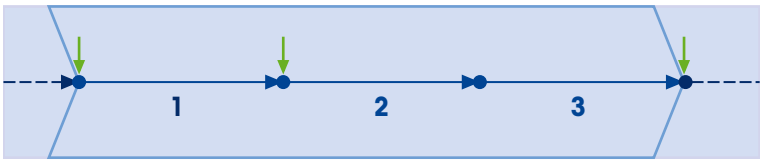
Export and import all methods ▸ Page 52

## 6.3 Configure the sample analysis

### 6.3.1 Overview

#### 6.3.1.1 Sample sequence

During the sample analysis, the sample sequence is executed. The sample sequence for a Karl Fischer titration has a minimum of three method functions. Additional method functions can be inserted at the places that are marked with vertical arrows.




| No. | Name | Function |
|---|---|---|
| | Sample analysis | Before the sample analysis can start, the Karl Fischer cell must be ready for a titration.<br>The titrator checks the start criteria. If the start criteria are fulfilled, the titrator either starts the sample sequence automatically or waits until a user starts it. |
| 1 | **Drift** method function | The settings in this method function define how the titrator determines the drift value.<br>The titrator uses this drift value to correct the calculated water content for the effect of physical drift and chemical drift. |
| 2 | **Sample** method function | The settings in this method function define how the titrator interacts with users when they add the sample. |
| 3 | **Titration (KF Coul)** method function | This method function controls the actual titration and its termination. |

**See also**

- Methods ▸ Page 50
- Configure the drift for correction ▸ Page 62
- Analysis sequence and method functions ▸ Page 50
- Method editor ▸ Page 50

### 6.3.1.2 Raw results and calculation of water content

At the end of the sample analysis, raw results are available. These raw results are used to calculate the water content. The following formula is used to calculate the water content in [mg]:

ICEQ/10.712-TIME*DRIFT/(60*1000)

| | |
|---|---|
| ICEQ | Charge in [mC] that passed through the anode during titration |
| TIME | Duration in [s] of the interval between sample addition and termination of the titration |
| DRIFT | Drift for correction in [µg/min] |

**See also**

- Influence of atmospheric humidity ▸ Page 19
- Configure sample addition and sample detection ▸ Page 57
- Configure sample detection ▸ Page 58
- Configure the termination of the titration ▸ Page 60

## 6.3.2 Configure start criteria and start of the sample analysis

This chapter describes the options for the transition from the previous sequence (1) to the first method function (2) of the sample sequence.


**Start criteria**

The sample sequence can only start when the Karl Fischer cell is ready for titration.

The control algorithm decides based on a set of criteria if the Karl Fischer cell is ready for titration. The drift is the only user-defined criterion in this set.

Drift is a start criterion for the sample analysis as well as a termination criterion for the titration.

The following table describes the options for drift as a start criterion and the required parameter settings.

| Action of the system | Start criteria |
|---|---|
| The drift needs to be within a user-defined range.<br>• **Min. start drift**: defines the lower limit of the range<br>• **Max. start drift**: defines the upper limit of the range<br>METTLER TOLEDO recommends to use **Absolute drift values** in combination with the termination criterion **Drift stop relative**. | **Absolute drift values** |
| The oscillation of the cell drift needs to be within a range around the average cell drift for 10 s. This setting can be useful for samples that cause chemical drift.<br>METTLER TOLEDO recommends to use **Drift stability** in combination with the termination criterion **Drift stability stop**. | **Drift stability** |

### Start of the sample analysis

When the Karl Fischer cell is ready for titration, the titrator can start the sample sequence. The **Analysis start** parameter defines what happens at this point.

| Action of the system | Analysis start |
|---|---|
| The titrator starts the sample sequence when users tap **Start Sample**. | **Manual** |
| The titrator starts the sample sequence as soon as the start criteria are fulfilled. | **Automatic** |

### Procedure

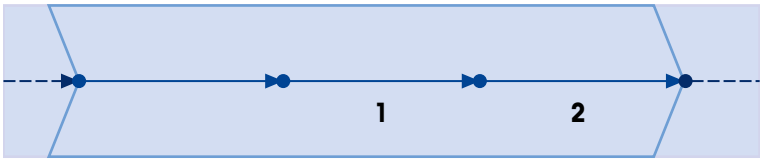
1 Open the method in the method editor.
2 Select the **Configuration** tab.
3 Change the settings for **Start criteria** as needed.
4 Change the settings for **Analysis start** as needed.
5 Tap **Save**.

### See also


- Sample sequence ▸ Page 55
- Configure sample addition and sample detection ▸ Page 57
- Influence of atmospheric humidity ▸ Page 19
- Termination based on a set of criteria ▸ Page 61


## 6.3.3 Configure sample addition and sample detection

The **Sample** method function (1) controls the prompts users receive for the sample addition and the detection of the sample. When the titrator has completed the **Sample** method function (1), it executes the next method function (2).




This chapter focuses on options that involve interactions of users with the titrator. These options are only available if **Prompt for sample addition** is activated.

| Action of the system | Prompt for sample addition |
|---|---|
| At the start of the **Sample** method function, the titrator prompts users to add the sample. | Activated |
| The titrator skips the **Sample** method function. If the **Titration (KF Coul)** method function directly follows the **Sample** method function, the titration might start without any sample present. | Deactivated |

### Procedure

1 Open the method in the method editor.
2 Select the **Sequence** tab.
3 Select the **Sample** method function.
4 Change the setting for **Prompt for sample addition** as needed.
5 Tap **OK**.
6 Tap ← **Back**.
7 Tap **Save**.

**See also**

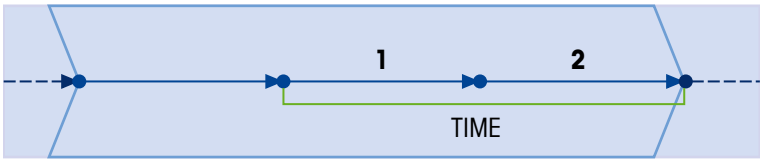

- Sample sequence ▸ Page 55
- Configure start criteria and start of the sample analysis ▸ Page 56


### 6.3.3.1 Configure sample detection

Sample detection defines how the titrator knows that the sample has been added. The two option also have an influence on the raw result TIME. TIME is used to calculate the raw result DRIFT.

| Action of the system | Sample detection |
|---|---|
| When users confirm the prompt to add the sample, they also confirm that they have added the sample.<br>If users do not confirm the prompt within three minutes, the titrator skips the rest of the sample analysis. | **None** |
| With the start of the **Sample** method function the titrator starts to monitor the current intensity in the Karl Fischer cell. The sample addition causes a sharp drop in current intensity. The titrator uses this sharp drop in current intensity to detect the sample addition. | **Automatic** |

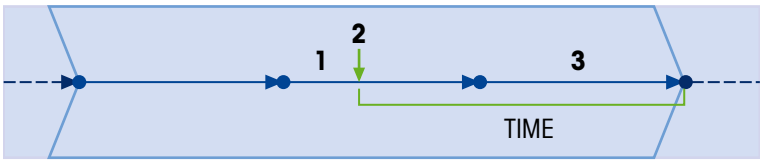
**Manual confirmation of sample addition and TIME**




TIME is defined as the duration from the start of the **Sample** method function (1) to the end of the **Titration (KF Coul)** method function (2).

Conditioning stops when the **Sample** method function starts.

**Sample detection and TIME**




TIME is defined as the duration from the detection of the sample (2) to the end of the **Titration (KF Coul)** method function (3).

Conditioning continues when the **Sample** method function (1) starts. Conditioning stops when the sample is detected.

**Procedure**

1 Open the method in the method editor.
2 Select the **Sequence** tab.
3 Select the **Sample** method function.
4 Change the setting for **Sample detection** as needed.
5 Tap **OK**.
6 Tap **Back**.
7 Tap **Save**.

**See also**


- Control algorithm ▸ Page 52
- Raw results and calculation of water content ▸ Page 56

## 6.3.4 Configure iodine generation

The control algorithm controls iodine generation during titration. You can customize the following aspects of the control algorithm:

- Current intensity at the generator electrode
- Risk of over-titration
- Polarization potential between the sensor pins
- Current intensity for titration termination

**See also**


Measurement principle ▸ Page 16

Control algorithm ▸ Page 52


### 6.3.4.1 Generator current and risk of over-titration

#### Current intensity at the generator electrode

The **Generator mode** parameter defines the current intensity at the generator electrode. The current intensity depends on the voltage applied at the generator electrode and the conductivity of the solvent. If the current intensity defined in **Generator mode** cannot be reached, the titration does not start. The maximum voltage that the titrator applies at the generator electrode is 30 V.

The following table shows the options for the current intensity and the parameter setting for the different options.

| Action of the system | Generator mode | Generator current |
|---|---|---|
| The titrator starts with the highest current intensity of 400 mA. If this current intensity cannot be reached, the titrator lowers the current intensity step by step. If the lowest current intensity of 50 mA cannot be reached, the titration does not start. | **Automatic** | Not available |
| The titrator tries to reach the current intensity selected for **Generator current**. If this current intensity cannot be reached, the titration does not start. | **Fixed** | Current intensities as listed |

#### Reduce the risk of over-titration

If the **Cautious mode** is activated, the risk for over-titration is reduced. The control algorithm limits the initial rate of iodine generation. The control algorithm optimizes other internal parameters to avoid overshooting the set current intensity.

#### Procedure

1 Open the method in the method editor.
2 Select the **Sequence** tab.
3 Select the **Titration (KF Coul)** method function.
4 In the **Titration** tab, select the **Control** side tab.
5 Change the parameters as needed.
6 Tap **OK**.
7 Tap **Back**.
8 Tap **Save**.

### 6.3.4.2 Polarization potential and current intensity

**Potential (Upol)** defines the fixed polarization potential in [mV] applied between the platinum pins of the sensor.

**Set current** defines the current intensity in [µA] at which the titration is terminated. The same current intensity is maintained during conditioning.

#### Interaction between current intensity and polarization potential

METTLER TOLEDO recommends combinations of mid-range values for current intensity and polarization potential. Tests during development have shown that combinations of extreme values for polarization potential and current intensity often lead to unwelcome effects. Examples of such effects are very long titration duration or low accuracy.

The following tables summarize behaviors of chemical systems that have been observed during product development. These observations might not apply to your specific use case because chemical systems differ in their behavior.

The following table shows observed behaviors at different current intensities.

| Characteristic | Low current intensity | High current intensity |
|---|---|---|
| Iodine excess | Lower | Higher |
| Reaction | Slower | Faster |
| Titration duration | Longer | Shorter |
| Minimal measurement error | Lower | Higher |

The following table shows observed behaviors at different polarization potentials.

| Characteristic | Low polarization potential | High polarization potential |
|---|---|---|
| Iodine excess | Higher | Lower |
| Reaction | Faster | Slower |
| Titration duration | Shorter | Longer |
| Minimal measurement error | Higher | Lower |
| Risk of over-titration | Higher | Lower |

#### Procedure

1 Open the method in the method editor.
2 Select the **Sequence** tab.
3 Select the **Titration (KF Coul)** method function.
4 In the **Titration** tab, select the **Control** side tab.
5 Change the parameters as needed.
6 Tap **OK**.
7 Tap **Back**.
8 Tap **Save**.

#### See also


- Control algorithm ▸ Page 52
- Measurement principle ▸ Page 16


## 6.3.5 Configure the termination of the titration

Two approaches are available for the termination of the titration.

- The titrator terminates the titration when a set of criteria is fulfilled. Some criteria such as the drift or a maximum duration are customizable.
- The titrator terminates the titration after a user-defined time period.

### 6.3.5.1 Termination based on a set of criteria

The set of termination criteria includes internal parameters and two user-defined parameters. When all termination criteria are fulfilled, the titrator terminates the titration and calculates the result. The following list shows the user-defined termination criteria:

- Set current intensity defined in the **Control** side tab
- Drift

You can configure additional conditions.

- Delay
- Minimum duration of the titration
- Maximum duration of the titration

#### Drift

Drift is a start criterion for the sample analysis and it is also a termination criterion for the titration.

The following table describes the options for drift as a termination criterion and the required parameter settings.

| Action of the system | Type |
|---|---|
| The drift is lower than the value calculated with the following formula:<br>DRIFT+**Drift relative**<br>A larger value for drift can reduce the analysis time.<br>The potential error of the water determination increases with increasing values for drift.<br>METTLER TOLEDO recommends to use **Drift stop relative** in combination with the start criterion **Absolute drift values**. | **Drift stop relative** |
| The oscillation of the cell drift needs to be within a range around the average cell drift for 10 s. This setting can be useful for samples that cause chemical drift.<br>METTLER TOLEDO recommends using **Drift stability stop** in combination with the start criterion **Drift stability**. | **Drift stability stop** |

#### Delay

The termination of the titration is delayed after the set of termination criteria has been fulfilled for the first time. If the set current intensity cannot be maintained during this interval, the countdown of the delay duration restarts.

The delay duration is defined in **Delay**.

#### Minimum duration

The value of **Min. time** defines the minimum duration of the titration. Even if the set of termination criteria is fulfilled, the titration continues for the minimum duration.

This setting can be useful for samples that release water slowly.

#### Maximum duration

The value of **Max. time** defines the maximum duration of the titration. If the set of termination criteria is not fulfilled during the maximum duration, no result is calculated for the sample.

#### Procedure

1 Open the method in the method editor.
2 Select the **Sequence** tab.
3 Select the **Titration (KF Coul)** method function.
4 In the **Titration** tab, select the **Termination** side tab.
5 For **Type**, select **Drift stop relative** or **Drift stability stop**.
6 Change the parameters as needed.
7 Tap **OK**.
8 Tap **Back**.

9 Tap **Save**.

**See also**

- Configure start criteria and start of the sample analysis ▸ Page 56
- Configure iodine generation ▸ Page 59
- Raw results and calculation of water content ▸ Page 56
- Influence of atmospheric humidity ▸ Page 19
- Configure the drift for correction ▸ Page 62

#### 6.3.5.2 Termination after a user-defined time period

In **Duration**, you can define the titration duration in [s].

**Procedure**

1 Open the method in the method editor.
2 Select the **Sequence** tab.
3 Select the **Titration (KF Coul)** method function.
4 In the **Titration** tab, select the **Termination** side tab.
5 For **Type** select **Fixed time**
6 Change the parameters as needed.
7 Tap **OK**.
8 Tap **Back**.
9 Tap **Save**.

**See also**

- Raw results and calculation of water content ▸ Page 56
- Influence of atmospheric humidity ▸ Page 19

## 6.4 Configure the drift for correction

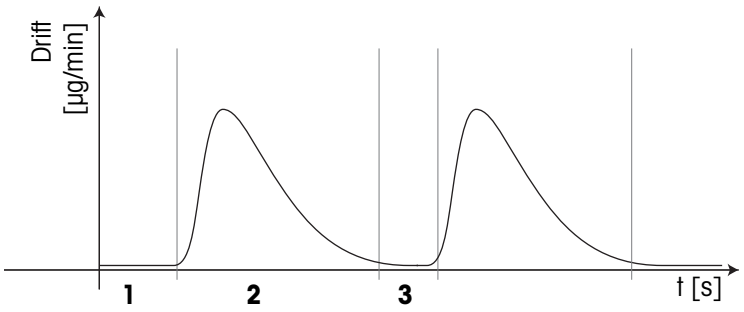
### 6.4.1 Overview

Water that enters the Karl Fischer cell causes cell drift. Cell drift has the following components.

- Physical drift: water from the ambient air that enters the Karl Fischer cell.
- Chemical drift: water that is released in side reactions.
- Water that is added with the sample.

During an analysis, the titrator continuously measures cell drift as a whole but it cannot measure each component separately. As a consequence, during titration, the titrator cannot distinguish between water in the sample and water added through physical drift and chemical drift. The titrator needs to estimate the amount of water added through chemical drift and physical drift to calculate the water content of the sample. This estimate is called drift for correction. In calculations, DRIFT stands for drift for correction.

The following figure shows the course of the cell drift in the different phases of an analysis.




| No. | Name | Description |
|---|---|---|
| **1** | Conditioning before sample addition | The cell drift has the following components:<br>• Physical drift<br>• Chemical drift<br>No water from a sample is present in the Karl Fischer cell until the first sample is added. The cell drift measured in this phase is a good estimate for the effect of physical drift and chemical drift. |
| **2** | Titration of the first sample | The cell drift has the following components:<br>• Physical drift<br>• Chemical drift<br>• Water that is added with the sample.<br>Because of the water from the sample, the titrator cannot determine the drift for correction during titration. |
| **3** | Conditioning between samples | The cell drift has the following components:<br>• Physical drift<br>• Chemical drift<br>The water of the previous sample has been removed during titration. The cell drift measured in this phase is a good estimate for the effect of physical drift and chemical drift. |

The source for the drift for correction is defined in the **Drift** method function.

The following table provides an overview over the different sources for drift for correction.

| Name | Description |
|---|---|
| Online drift determination | The titrator measures the cell drift when it executes the **Drift** method function and uses this value as drift for correction.<br>The drift for correction captures the cell drift at that moment. |
| Explicit drift determination | The titrator records the cell drift for a user-defined duration.<br>The titrator calculates the average of the recorded values and uses this average as drift for correction.<br>The titrator can determine the drift for correction within the sample sequence or outside the sample sequence. |
| User-defined value | Users define a fixed value as drift for correction when they configure the method. |

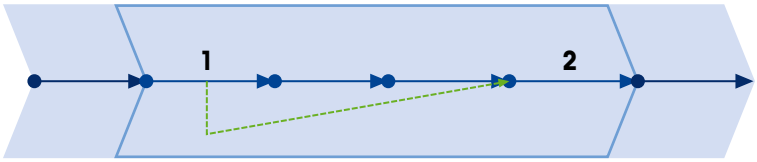
You can use the drift for correction as part of a termination criterion.

**See also**

- Influence of atmospheric humidity ▸ Page 19
- Raw results and calculation of water content ▸ Page 56
- View the changes in cell drift over time ▸ Page 74
- Configure online drift determination ▸ Page 64
- Configure explicit drift determination during sample analysis ▸ Page 65
- Configure explicit drift determination outside of the sample sequence ▸ Page 66
- Configure a user-defined value ▸ Page 68
- Termination based on a set of criteria ▸ Page 61

## 6.4.2 Configure online drift determination

The following figure shows how the online drift determination integrates into the analysis sequence.





| No. | Name | Description |
|---|---|---|
| | Sample sequence | Steps that the titrator performs during the sample analysis. The titrator repeats these steps for each sample. |
| 1 | **Drift** method function | • The titrator measures the cell drift when it executes the **Drift** method function.<br>• The titrator uses this value as drift for correction.<br>• The titrator ignores drift values in the resource entry of the Karl Fischer cell. |
| 2 | **Result** method function | The titrator uses the drift for correction to calculate the water content. |
| 3 | Resource entry for Karl Fischer cell | Stores the result of the last explicit drift determination. |

**Procedure**

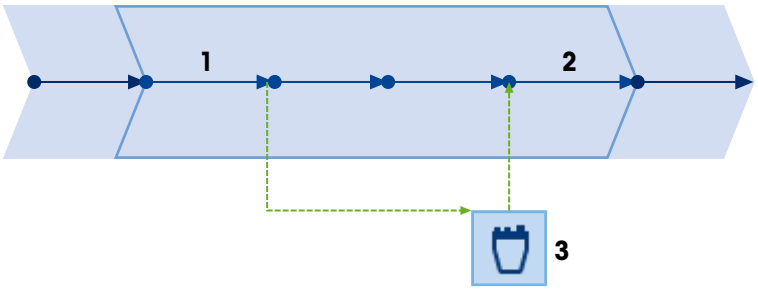
1 Open the method in the method editor.
2 Select the **Sequence** tab.
3 Select the **Drift** method function.
4 In the **Drift** tab, activate **Drift Determination**.
5 Activate **Determine online (during conditioning)**.
6 Tap **OK**.
7 Tap **Back**.
8 Tap **Save**.

**See also**

- Analysis sequence and method functions ▸ Page 50
- View the changes in cell drift over time ▸ Page 74
- Overview ▸ Page 62

### 6.4.3 Configure explicit drift determination during sample analysis

The titrator determines the drift for correction at user-defined intervals during the sample sequence.




| No. | Name | Function |
|---|---|---|
| | Sample sequence | Steps that the titrator performs during the sample analysis. The titrator repeats these steps for each sample. |
| 1 | **Drift** method function | • The titrator determines the cell drift during the execution of the **Drift** method function.<br>• The titrator updates the drift value in the resource entry of the Karl Fischer cell with the result of this drift determination.<br>• The titrator uses the drift value in the resource entry of the Karl Fischer cell as drift for correction. |
| 2 | **Result** method function | The titrator uses the drift for correction to calculate the water content. |
| 3 | Resource entry for Karl Fischer cell | Stores the result of the last explicit drift determination. |

You can configure two settings:

- Duration of the drift determination
- Frequency of the drift determination

#### Duration of the drift determination

You can define the duration of the drift determination in **Duration of determination**. During the drift determination, the titrator records the amount of iodine needed to maintain the set end current. The titrator calculates the average of the recorded values and stores the result in the resource entry for the Karl Fischer cell.

#### Frequency of the drift determination

The sample sequence and with it the **Drift** method function is executed for each sample. The **Determination interval** defines the frequency of the drift determination. You have the following options.

- The titrator determines the drift for each sample.
- The titrator skips the drift determination for some samples. For skipped samples, the titrator uses the value stored in the resource entry for the Karl Fischer cell to calculate the water content.

#### Example

- **Duration of determination** = 30 s: the drift for correction is the average of the drift values recorded for 30 s.
- **Determination interval** = 3:
  - The titrator determines the cell drift for the first sample.
  - The titrator updates the drift value in the resource entry of the Karl Fischer cell.
  - The titrator uses this drift value as drift for correction to calculate the water content for the first three samples.
  - The titrator determines the cell drift for the fourth sample.
  - The titrator updates the drift value in the resource entry of the Karl Fischer cell.
  - The titrator uses this drift value as drift for correction to calculate the water content for the fourth, the fifth, and the sixth sample.

### Procedure

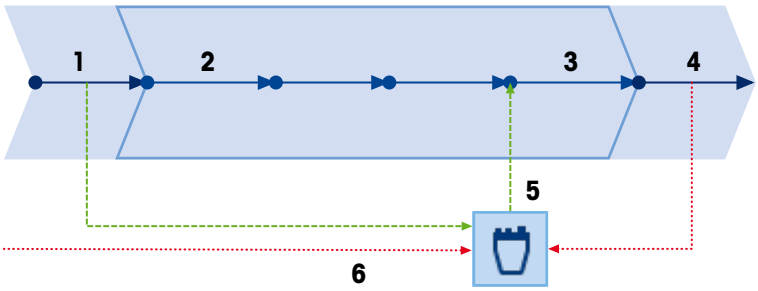
1 Open the method in the method editor.
2 Select the **Sequence** tab.
3 Select the **Drift** method function.
4 In the **Drift** tab, activate **Drift determination**.
5 Deactivate **Determine online (during conditioning)**.
6 Change the settings of **Duration of determination** and **Determination interval** as needed.
7 Tap **OK**.
8 Tap **Back**.
9 Tap **Save**.

### See also


- Overview ▸ Page 62
- View the changes in cell drift over time ▸ Page 74
- Analysis sequence and method functions ▸ Page 50


## 6.4.4 Configure explicit drift determination outside of the sample sequence

The titrator uses the drift value in the resource entry of the Karl Fischer cell as drift for correction. This drift value is always the result of an explicit drift determination. The point in time of the drift determination depends on the method configuration.




| No. | Name | Function |
|---|---|---|
| | Sample sequence | Steps that the titrator performs during the sample analysis. The titrator repeats these steps for each sample. |
| **1** | Drift during initial sequence | • The titrator determines the cell drift during the execution of the **Drift Determination** method function in the initial sequence.<br>• The titrator updates the drift value in the resource entry of the Karl Fischer cell with the result of this drift determination. |
| **2** | **Drift** method function | The titrator uses the drift value in the resource entry of the Karl Fischer cell as drift for correction. |
| **3** | **Result** method function | The titrator uses the drift for correction to calculate the water content. |
| **4** | Drift during final sequence | • The titrator determines the cell drift during the execution of the **Drift Determination** method function in the final sequence.<br>• The titrator updates the drift value in the resource entry of the Karl Fischer cell with the result of this drift determination.<br>• The titrator cannot use this drift value to calculate the water content in the previous sample sequence. |
| **5** | Resource entry for Karl Fischer cell | Stores the result of the last explicit drift determination. |

| No. | Name | Function |
|---|---|---|
| **6** | Drift determination outside of the method | Without a **Drift Determination** method function in the initial sequence, the titrator does not update the drift value in the resource entry of the Karl Fischer cell before calculating the water content.<br>In this case, the titrator might have determined the drift value with a different method. The drift value might not be an adequate estimate for the effect of chemical drift and physical drift. |

### Duration of the drift determination

You can define the duration of the drift determination in **Duration of determination**. During the drift determination, the titrator records the amount of iodine needed to maintain the set end current. The titrator calculates the average of the recorded values. The titrator stores the result as drift value in the resource entry for the Karl Fischer cell.

### Example

**Duration of determination** = 30 s: the drift for correction is the average of the drift values recorded for 30 s.

### Insert sequences and method functions

1 Open the method in the method editor.
2 Select the **Configuration** tab.
3 Activate **Initial sequence**.
4 Select the **Sequence** tab.
5 Select the **Initial** side tab.
6 Tap **Edit Sequence**.
7 Tap + and select **Drift Determination**.
8 Tap **Create**.
9 For **Duration of determination**, enter the required duration.
10 Tap ← **Back**.
11 Tap **Edit Sequence**.
12 Tap **Save**.

### Configure the Drift method function

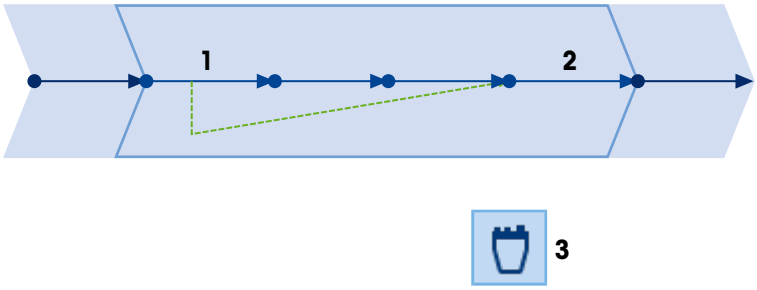
1 Select the **Sequence** tab.
2 Select the **Sample** side tab.
3 Select the **Drift** method function.
4 In the **Drift** tab, deactivate **Drift Determination**.
5 For **Source for drift value**, select **Last determination**.
6 Tap **OK**.
7 Tap ← **Back**.
8 Tap **Save**.

### See also


- Overview ▸ Page 62
- View the changes in cell drift over time ▸ Page 74
- Analysis sequence and method functions ▸ Page 50

### 6.4.5 Configure a user-defined value

The same user-defined drift value is used as drift for correction for all samples that are analyzed with the method.




| No. | Name | Function |
|---|---|---|
| | Sample sequence | Steps that the titrator performs during the sample analysis. The titrator repeats these steps for each sample. |
| **1** | **Drift** method function | • The titrator uses the value that is defined in **Drift value** as drift for correction.<br>• The titrator ignores drift values in the resource entry of the Karl Fischer cell. |
| **2** | **Result** method function | The titrator uses the drift for correction to calculate the water content. |
| **3** | Resource entry for Karl Fischer cell | Stores the result of the last explicit drift determination. |

**Procedure**

1 Open the method in the method editor.
2 Select the **Sequence** tab.
3 Select the **Drift** method function.
4 In the **Drift** tab, deactivate **Drift determination**.
5 For **Source for drift value**, select **Fix value**.
6 For **Drift value**, enter the required value.
7 Tap **OK**.
8 Tap **Back**.
9 Tap **Save**.

**See also**


- Overview ▸ Page 62
- View the changes in cell drift over time ▸ Page 74
- Analysis sequence and method functions ▸ Page 50

# 7 Operation

## 7.1 Start up and shut down the titrator

### 7.1.1 Start up the titrator

During startup, the titrator detects connected devices. When the titrator detects a device, it opens a message with options for the configuration of the detected device. The available options depend on the detected device. The following list shows two common options:

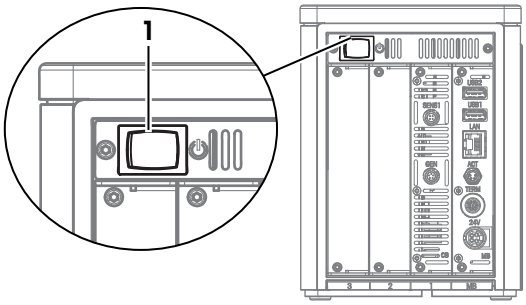
- Users can confirm the message and the titrator uses the device with default values. Users can change these default values later if they do not fit their needs.
- The titrator opens an editor so that users can edit the settings.

**Procedure**

- The titrator is set up and connected to the power supply.

1 Press the power button (1).
   - ➡ The titrator starts up and detects connected devices.
   - ➡ When the titrator detects a device, a message opens.
2 If you want to perform the example, confirm each message with ✓ **OK**.

➡ The home screen opens.




**See also**

🔗 Example: determine water content of toluene ▸ Page 69

### 7.1.2 Shut down the titrator

- The task area is empty or all tasks in the task area are interrupted.
- No action is running

1 If user management is deactivated, go to ☰ > ⏻ **Shutdown** >⏻ **Shut Down**.
2 If user management is activated, go to ☰ > ⏎ **Logout** > ⏻ **Shut Down**.
   - ➡ The titrator discards unsaved changes and shuts down.

➡ The AC/DC adapter and the control circuit for the power button are energized. The rest of the titrator is no longer energized.

**Shut down of the titrator in emergency situations**

– Pull the plug of the power cable out of the AC/DC adapter.

**See also**

🔗 Forced shutdown ▸ Page 87

## 7.2 Example: determine water content of toluene

This example shows how to determine the water content of toluene using a method of the **KF Coulometric** method type.

The description and the instructions are based on a setup for automated solvent exchange with a solvent pump as described in the installation chapter.

**See also**

🔗 Install a system with automated solvent exchange ▸ Page 25

## 7.2.1 Overview

For an analysis, the titrator executes a series of steps that might or might not require the interaction of users. At the end of the analysis, a result is available. To execute the analysis, the titrator needs a method and resources such as a sensor. The method defines the sequence of the steps that are performed during an analysis.

For this example you need:

- A method to determine the water content of samples.

### Water content determination of toluene

A method of the **KF Coulometric** method type is used to determine the water content of samples.

### Material

- Solvent: Karl Fischer reagent for coulometric water content determinations
- Sample: toluene

This example uses hazardous materials. Wear protective gear as required by the safety-data sheets of the chemicals you use and the safety rules of your workplace.

Dispose of the waste as required by the safety-data sheets of the chemicals you use and the rules of your workplace.

### Overview of the actions

1 Configure the resources. See [Configure the resources for the example ▸ Page 70].
2 Fill the Karl Fischer cell with solvent. See [Fill the Karl Fischer cell with solvent ▸ Page 70].
3 Determine the water content of toluene. See [Determine the water content of toluene ▸ Page 71].

## 7.2.2 Configure the resources for the example

For this example, the following resources are needed:

- Sensor
- Pump
- Generator electrode without diaphragm
- Karl Fischer cell

The resources are automatically detected during startup. When a resource is detected, a message opens. If you confirmed these messages with **OK**, the resources shown in the following list are configured with the default values. For the example, you can use all resources with the default values.

- Sensor
- Pump
- Generator electrode without diaphragm

## 7.2.3 Fill the Karl Fischer cell with solvent

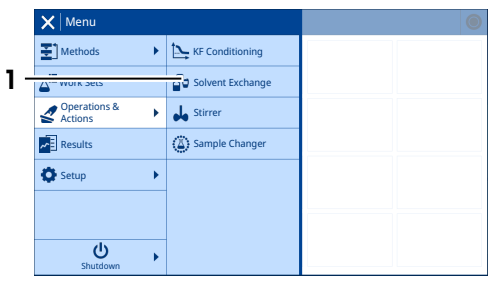
The **Solvent Exchange** operation automates filling of the Karl Fischer cell.

- Filling: fills the Karl Fischer cell with solvent.

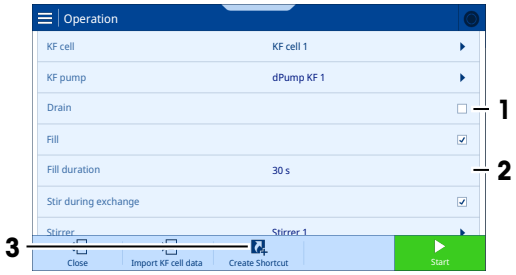
### Configure the Solvent Exchange operation and create a shortcut

■ The Karl Fischer cell is connected to the solvent bottle and to the waste bottle.

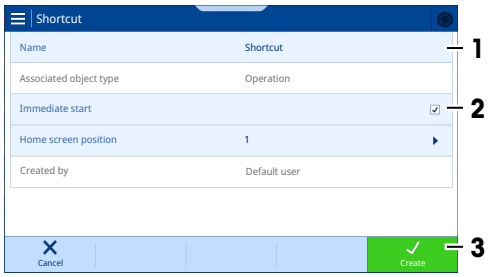
1 Go to ☰ > **Operations & Actions** > **Solvent Exchange** (1).



2 Deactivate **Drain** (1).
3 Set **Fill duration** to 30 s (2).
4 Tap **Create Shortcut** (3).



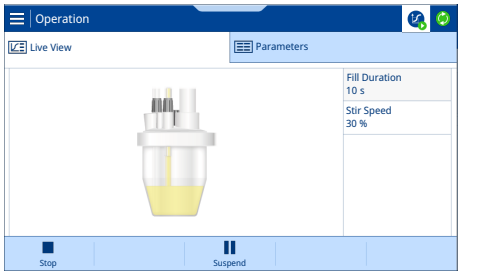

5 For **Name** (1), enter the name of the shortcut.
6 Activate **Immediate start** (2).
7 Tap **Create** (3).
8 To open the home screen, tap .



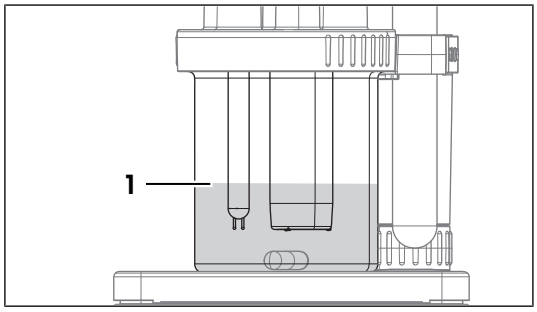

### Fill the Karl Fischer cell

1 Tap the shortcut for the solvent exchange (1).


➡ The pump pumps solvent into the Karl Fischer cell.




2 When the solvent reaches 100 mL (1), tap **Stop**.
➡ The pump stops.
➡ The home screen opens.

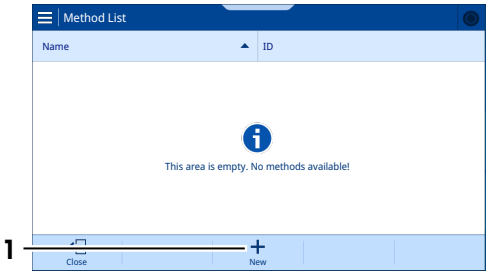



## 7.2.4 Determine the water content of toluene

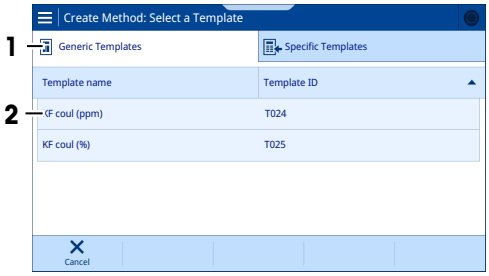
### 7.2.4.1 Create the method

1 Go to > **Methods** > **KF Coulometric**.

2 Tap + **New** (1).




3 In the **Generic Templates** tab (1), select **KF coul (ppm) T024** (2).



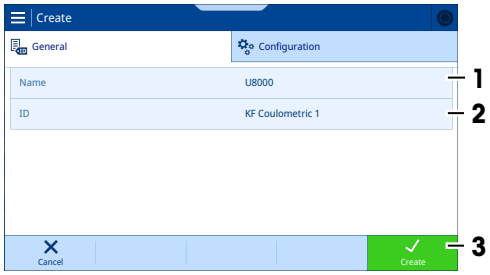

4 For **Name** (1), enter the required name.

5 For **ID** (2), enter the required identifier.

6 Tap **Create** (3).

➡ The method is saved and listed with the name and the identifier.

7 Tap **Create Task**.




### 7.2.4.2 Create a shortcut

1 Tap **Create Shortcut**.

2 For **Name**, enter the name of the shortcut.

3 Make sure **Immediate start** is not selected.

4 Tap **Create**.

5 To open the home screen, tap .

➡ The home screen opens.

### 7.2.4.3 Perform the analysis

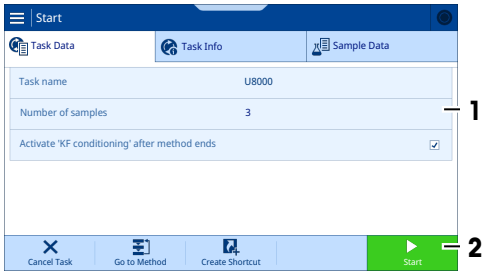
#### Prepare the sample entries

1 Tap the shortcut for the task.

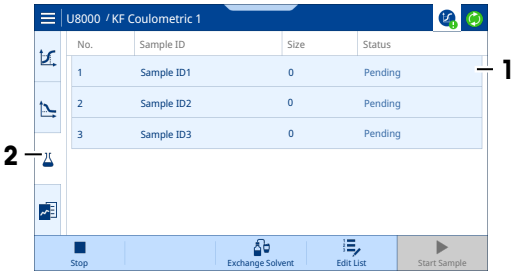
2 For **Number of samples** (1), enter "3".

3 Tap **Start** (2).

➡ The titrator prepares the Karl Fischer cell for titration.

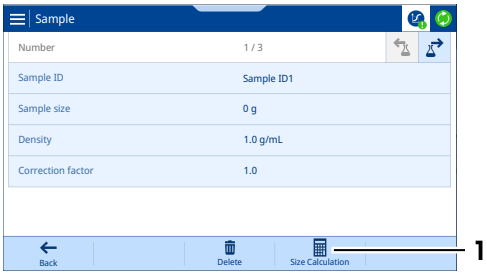


4 Tap (2).
➡ The sample view opens.
5 Select the entry for the first sample (1).
6 For **Sample ID**, enter the required identifier.
7 Tap **Save**.
8 Tap ← **Back**.
9 Enter the **Sample ID** for the remaining samples.

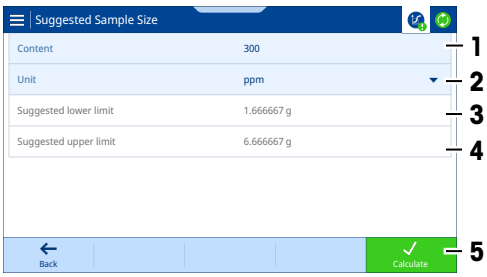



## Calculate sample weight

1 Select the entry for the first sample.
2 Tap **Size Calculation** (1).

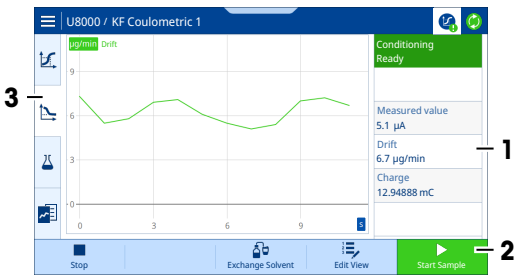



3 For **Content** (1), enter "300".
4 For **Unit** (2), select **ppm**.
5 Tap **Calculate** (5).
➡ The lower limit (3) and the upper limit (4) of the sample weight are calculated.
6 Write down the range of the calculated sample weight.
7 Return to the sample view.




## Prepare the titration

1 Tap (3) and check that the drift is stable (1).
2 Check that **Start Sample** (2) is green.
3 Draw approximately 1 mL of the sample into the syringe.
4 Fill the rest of the syringe with air and shake the syringe a few times.
5 Empty the syringe into a suitable waste container.




## Perform the titration

1 Draw the sample into the syringe.
2 Place the syringe on the balance.
3 Zero the balance.
4 On the titrator, tap **Start Sample**.

5 Inject approximately 3 mL of the sample through the septum (1) into the Karl Fischer cell.

6 Backweigh the syringe and note the absolute value of the displayed weight.

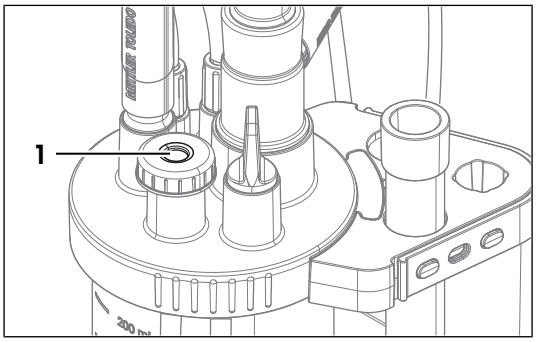
7 In the **Sample size** window, enter the weight.

8 Tap ✓.

➡ When the titration is completed, the result is displayed.

9 Repeat the steps for the remaining samples.

10 When the last sample is analyzed, tap ✓ **OK**.




➡ The titrator starts **KF Conditioning** to maintain the dry state of the Karl Fischer cell.

**See also**

🔗 Coulometric Karl Fischer titration ▸ Page 17

## 7.3 View the changes in cell drift over time

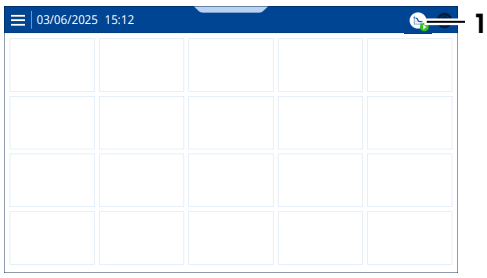
The titrator continuously measures the cell drift when it performs an analysis or a **KF Conditioning** action.

### View changes in cell drift between two samples

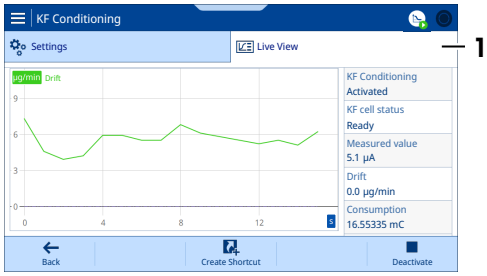
– Tap (1).


### View changes in cell drift while KF Conditioning is running

– Tap (1).




➡ The **KF Conditioning** window with the tab **Live View** (1) opens.




**See also**

🔗 Configure the drift for correction ▸ Page 62

🔗 Influence of atmospheric humidity ▸ Page 19

# 8 Maintenance

In this chapter you find descriptions of the maintenance tasks you should perform on your instrument. Any other maintenance tasks need to be performed by a service technician who has been qualified by METTLER TOLEDO.

If you experience problems with your instrument, contact your authorized METTLER TOLEDO service representative or dealer.

METTLER TOLEDO recommends that a preventive maintenance and calibration certification is done at least once a year through your authorized METTLER TOLEDO service representative or dealer.

www.mt.com/contact

## 8.1 Maintenance schedule

Follow this maintenance schedule, unless otherwise required by the standard operating procedures of your company.

### 8.1.1 Titrator

**Before each measurement series**

| Task | Link |
|---|---|
| 1 Check if the desiccant in any of the drying tubes is saturated with moisture.<br>2 Replace desiccant that is saturated with moisture. | [Prepare drying tubes ▸ Page 27] |
| 1 Check the septum for holes.<br>2 Replace any septum with holes. | [Install sample injection adapter and NS14 stopper ▸ Page 32] |

**Every month**

| Task | Link |
|---|---|
| Clean the housing and the titrator cover. | [Clean the housing ▸ Page 77] |
| Clean the Karl Fischer cell. | [Empty and clean the Karl Fischer cell ▸ Page 77] |
| Replace the desiccant in the drying tubes. | [Prepare drying tubes ▸ Page 27] |

**Before periods of inactivity**

| Task | Link |
|---|---|
| Clean the housing and the titrator cover. | [Clean the housing ▸ Page 77] |
| Clean the Karl Fischer cell. | [Empty and clean the Karl Fischer cell ▸ Page 77] |

### 8.1.2 Terminal

**Every month**

| Task | Link |
|---|---|
| Clean the terminal and the terminal cover. | [Clean the terminal ▸ Page 82] |

**Before periods of inactivity**

| Task | Link |
|---|---|
| Clean the terminal and the terminal cover. | [Clean the terminal ▸ Page 82] |

### 8.1.3 Solvent pump dPump KF

**Every month**

| Task | Link |
|---|---|
| Clean the housing. | [Clean the solvent pump dPump KF ▸ Page 83] |

**Before periods of inactivity**

| Task | Link |
|---|---|
| Clean the housing. | [Clean the solvent pump dPump KF ▸ Page 83] |
| Empty the solvent tube and the waste tube. | [Empty the Karl Fischer cell ▸ Page 77] |

### 8.1.4 Generator electrode

**Before each measurement series**

| Task | Link |
|---|---|
| 1 Check if the desiccant in the drying tube is saturated with moisture.<br>2 Replace desiccant that is saturated with moisture. | [Assemble the generator electrode ▸ Page 32] |

**Every month**

| Task | Link |
|---|---|
| Replace the desiccant in the drying tube. | [Assemble the generator electrode ▸ Page 32] |

**Before periods of inactivity**

| Task | Link |
|---|---|
| Clean the generator electrode and store it in the original packaging. | [Clean the generator electrode ▸ Page 81] |

## 8.2 Clean the titrator and accessories

**NOTICE**

**Damage to the titrator due to inappropriate cleaning methods**

Inappropriate cleaning agents can damage the housing or other parts of the titrator. If liquids enter the housing, they can damage the titrator.

1 Make sure the cleaning agent is compatible with the material of the part you want to clean.
2 Make sure that no liquid enters the interior of the titrator.

**NOTICE**

**Damage to electronic accessories due to inappropriate cleaning methods**

Inappropriate cleaning agents can damage the housing or other parts of electronic accessories. If liquids enter the housing, they can damage an electronic accessory.

1 Make sure the cleaning agent is compatible with the material of the part you want to clean.
2 Make sure that no liquid enters the interior of any electronic accessory.

Some of the recommended cleaning agents are hazardous materials. Wear protective gear as required by the safety-data sheets of the cleaning agents you use and the safety rules of your workplace.

Dispose of the waste as required by the safety-data sheets of the chemicals you use and the rules of your workplace.

If you have questions about the compatibility of cleaning agents, contact your authorized METTLER TOLEDO service representative or dealer.

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### 8.2.1 Clean the housing

METTLER TOLEDO recommends the following cleaning agents:

- Water with a mild detergent
- Ethanol

**Procedure**

- The titrator is shut down.
- The titrator is disconnected from the power supply.

1 Remove the titrator cover.
2 Wipe the titrator cover with a cloth moistened with the cleaning agent.
3 Air-dry the titrator cover or dry it with a soft tissue.
4 Wipe the housing with a cloth moistened with the cleaning agent.
5 Air-dry the housing or dry it with a soft tissue.
6 Install the titrator cover.

### 8.2.2 Empty and clean the Karl Fischer cell

#### 8.2.2.1 Empty the Karl Fischer cell

**Empty the solvent tube**

- The action **KF Conditioning** is not running.

1 On the solvent bottle, loosen the M9 connector counterclockwise.
2 Pull the tube out of the solvent bottle until it is no longer immersed in the solvent.
3 Tighten the M9 connector clockwise.
4 Go to > **Operations & Actions** > **Solvent Exchange**.
5 Deactivate **Drain**.
6 Activate **Fill**.
7 Set **Fill duration** to 10 s.
8 Tap **Start**.
   ➡ Air is pushed through the tube into the Karl Fischer cell.

➡ The home screen opens.

**Empty the Karl Fischer cell and the waste tube**

1 Go to > **Operations & Actions** > **Solvent Exchange**.
2 Activate **Drain**.
3 Deactivate **Fill**.
4 Set **Drain duration** to 60 s.
5 Tap **Start**.
   ➡ The solvent is drained from the Karl Fischer cell and the waste tube.

➡ The home screen opens.

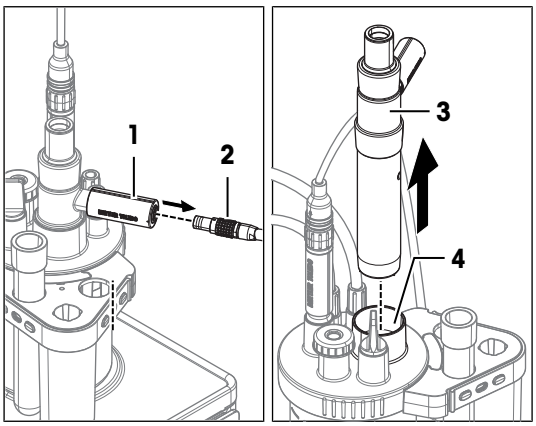
### 8.2.2.2 Remove the generator electrode

**Preparations**

- The titrator is shut down.
- The Karl Fischer cell, the solvent tube, and the waste tube are empty.
- The titrator is disconnected from the power supply.

**Procedure**

1 Disconnect the generator electrode cable (2) from the socket (1).
2 Lift the generator electrode (3) out of the mounting position (4).
3 Hold the generator electrode over a suitable waste container and rinse it with the cleaning agent.
4 Let the generator electrode air dry and then place it in the generator electrode holder.

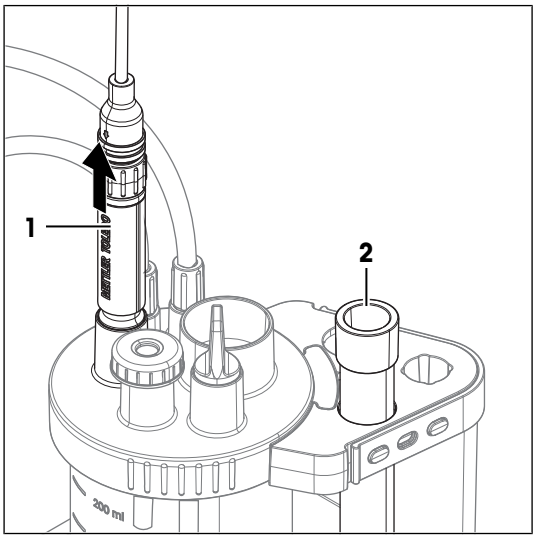



**See also**

Clean the generator electrode ▸ Page 81

### 8.2.2.3 Remove the sensor

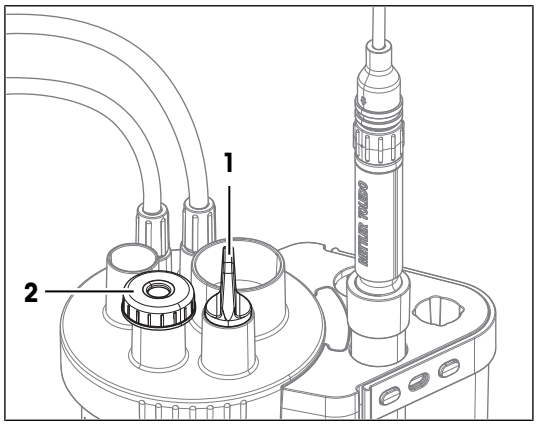
1 Pull the sensor (1) out of the adapter plate.
2 Hold the sensor over a suitable waste container and rinse it with the cleaning agent.
3 Insert the sensor into the protective sleeve (2).



### 8.2.2.4 Remove the NS14 stopper and sample injection adapter

1 Pull the NS14 stopper (1) out of the adapter plate.

2 Pull the sample injection adapter (2) out of the adapter plate.



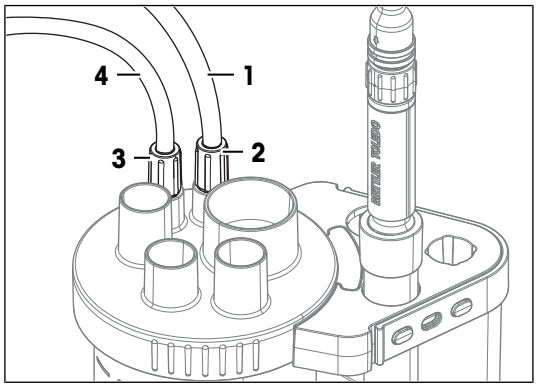

### 8.2.2.5 Disconnect the solvent and waste tubes

1 Unscrew the M9 connector (3) counterclockwise.

2 Lift the solvent tube (4) out of the Karl Fischer cell and slide the M9 connector (3) all the way back to the bottle adapter.

3 Unscrew the M9 connector (2) counterclockwise.

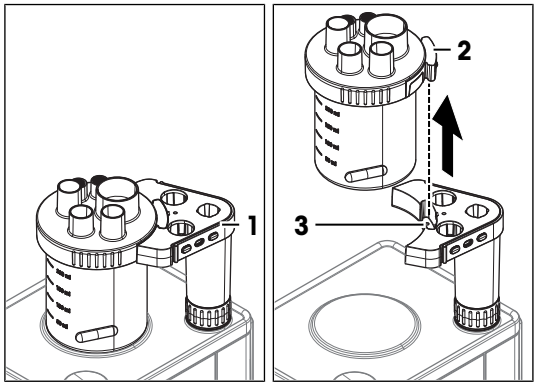
4 Lift the waste tube (1) out of the Karl Fischer cell and slide the M9 connector (2) all the way back to the bottle adapter.




### 8.2.2.6 Remove the Karl Fischer cell

1 Stabilize the titration arm (1) with one hand.

2 Pull the Karl Fischer cell up, lifting the mounting tab (2) out of the mounting slot (3).



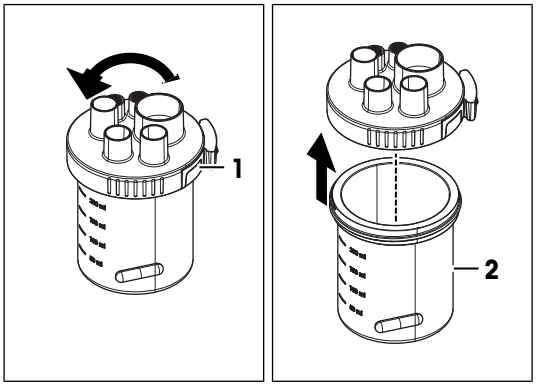

### 8.2.2.7 Disassemble the Karl Fischer cell

**Material**

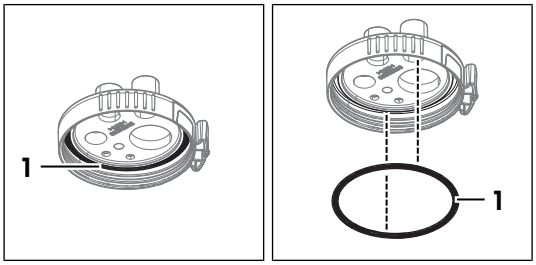
- Blunt, slim tool such as a small screwdriver

**Remove the adapter plate**

1 Turn the adapter plate (1) counterclockwise and remove it from the vessel (2).

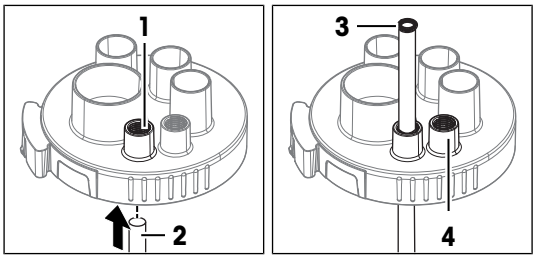



2 Remove the adapter plate seal (1) from the bottom of the adapter plate.




**Remove the O-rings from the M9 mounting positions**

1 Insert the blunt tool (2) from below into the M9 mounting position (1).
2 Push the O-ring (3) out of the M9 mounting position from below.
3 Repeat the steps with the other M9 mounting position (4).




### 8.2.2.8 Clean the parts

Any water that is adsorbed to an inner surface of the Karl Fischer cell is a cause for drift. To reduce this type of drift, clean the parts with water-free cleaning agents. If you use aqueous cleaning agents, dry the parts thoroughly before you reinstall the Karl Fischer cell.

METTLER TOLEDO recommends the following cleaning agents:

- Ethanol
- Methanol

**Procedure**

1 Wipe the vessel with a cloth moistened with the cleaning agent.
2 Rinse the adapter plate with the cleaning agents.
3 Air-dry the adapter plate and the vessel.

### 8.2.2.9 Reinstall the Karl Fischer cell

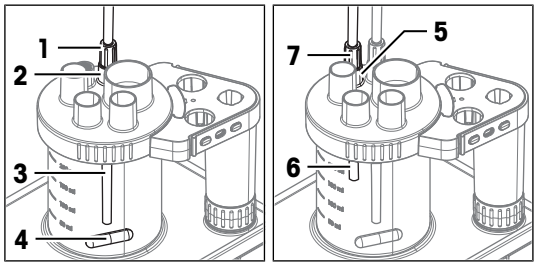
**Preparations**

- The titrator is shut down.
- The titrator is disconnected from the power supply.
- The waste bottle is assembled.
- The solvent bottle is assembled.

### Assemble the Karl Fischer cell

– Assemble the Karl Fischer cell. See [Assemble the Karl Fischer cell ▸ Page 28].

### Connect the solvent bottle and the waste bottle




1 Insert the free end of the waste tube (3) into the M9 mounting position (2).
2 Slide the M9 connector (1) of the waste tube from the bottle adapter to the M9 mounting position (2).
3 Screw the M9 connector (1) clockwise into the M9 mounting position (2) without tightening it.
4 Slide the waste tube (3) down to the bottom of the Karl Fischer cell, without interfering with the stir bar (4).
5 Tighten the M9 connector (1) clockwise.
6 Insert the free end of the solvent tube (6) into the M9 mounting position (5).
7 Slide the M9 connector (7) of the solvent tube from the bottle adapter to the M9 mounting position (5) on the adapter plate.
8 Screw the M9 connector (7) clockwise into the M9 mounting position (5) without tightening it.
9 Slide the solvent tube down into the Karl Fischer cell until the tip of the tube (6) is visible but will remain above the level of liquid inside the vessel.
10 Tighten the M9 connector (5) clockwise.

### Install sample injection adapter and NS14 stopper

– Install the sample injection adapter and NS14 stopper. See [Install sample injection adapter and NS14 stopper ▸ Page 32].

### Install the sensor

– Install the sensor. See [Install the sensor ▸ Page 32].

### Install the generator electrode

– Install the generator electrode. See [Install the generator electrode ▸ Page 33].

## 8.2.3 Clean the generator electrode

### 8.2.3.1 Clean the generator electrode without diaphragm

The generator electrode without diaphragm might need to be cleaned if conductivity is impeded.

**NOTICE**

**Damage to the generator electrode due to inappropriate cleaning methods**

Inappropriate cleaning agents or methods can damage the cathode or other parts of the generator electrode.

1 Do not touch or rub the mesh bottom of the generator electrode. Any pressure on the mesh might cause damage.
2 Do not touch the cathode wire inside the generator electrode housing.
3 Do not use water inside the electrode housing.

### Material

- Suitable cleaning agent

### Preparations

- A stir bar is in the Karl Fischer cell.

**Replace solvent with cleaning agent**

1 Go to ☰ > **Operations & Actions** > **Solvent Exchange**.
2 Activate **Drain**.
3 Deactivate **Fill**.
4 Set **Drain duration** to 60 s.
5 Tap **Start**.
➡ The solvent is drained from the Karl Fischer cell and the waste tube.
6 Remove the sample injection adapter.
7 Manually add 100 mL of cleaning agent to the Karl Fisher cell through the sample injection adapter mounting position.
8 Reinstall the sample injection adapter.

**Clean the generator electrode**

1 Go to ☰ > **Operations & Actions** > **Stirrer**.
2 Set **Speed** to 30 % and **Stir time** to ∞ s.
3 Tap **Start**.
4 Allow the cleaning agent to stir approximately 2–3 hours until the generator electrode is visibly clean.
5 To stop the stirrer, press **Stop**.

**Rinse with solvent**

1 Go to ☰ > **Operations & Actions** > **Solvent Exchange**.
2 Activate **Drain**.
3 Deactivate **Fill**.
4 Set **Drain duration** to 60 s.
5 Tap **Start**.
➡ The cleaning agent is drained from the Karl Fischer cell and the waste tube.
6 Go to ☰ > **Operations & Actions** > **Solvent Exchange**.
7 Activate **Fill**.
8 Deactivate **Drain**.
9 Set **Fill duration** to 10 s.
➡ The pump pumps solvent into the Karl Fischer cell.
10 Go to ☰ > **Operations & Actions** > **Solvent Exchange**.
11 Activate **Drain**.
12 Deactivate **Fill**.
13 Set **Drain duration** to 60 s.
14 Tap **Start**.
➡ The solvent is drained from the Karl Fischer cell and the waste tube.
➡ The generator electrode is clean and the Karl Fischer cell is ready for use.

**See also**

Empty the Karl Fischer cell ▸ Page 77

## 8.2.4 Clean the terminal

METTLER TOLEDO recommends the following cleaning agents:
- Water with a mild detergent
- Ethanol

**Procedure**

- The titrator is shut down.

1 Remove the terminal cover.
2 Wipe the terminal cover with a cloth moistened with the cleaning agent.
3 Air-dry the terminal cover or dry it with a soft tissue.
4 Wipe the terminal with a cloth moistened with the cleaning agent.
5 Air-dry the terminal or dry it with a soft tissue.
6 Install the terminal cover.

### 8.2.5 Clean the solvent pump dPump KF

METTLER TOLEDO recommends the following cleaning agents:

- Water with a mild detergent
- Ethanol

**Procedure**

- The titrator is shut down.

– Wipe the housing with a cloth moistened with the cleaning agent.

## 8.3 Change your password

1 Go to ☰ > ⊖ **Logout** > **User Data**.
2 Tap ✎ **Edit Password**.
3 For **Current password**, enter your current password.
4 Enter and confirm the new password.
5 Tap ✓ **OK**.

## 8.4 Back up and restore the instrument configuration

You can back up the instrument configuration to an XML file. You have the following options for using the XML file:

- Restore the instrument configuration of the instrument.
- Transfer the instrument configuration to another instrument.

**See also**


- Overview ▸ Page 83
- Back up the instrument configuration ▸ Page 84
- Restore the instrument configuration ▸ Page 85
- Export and import all methods ▸ Page 52


### 8.4.1 Overview

**Content of the backup**

The following table lists the data that are exported to the XML file.

| Description | Menu |
|---|---|
| All methods but no method templates | **Methods** |
| Work sets | **Work Sets** |

| Description | Menu |
|---|---|
| User-defined resource entries | **Chemicals** |
| The instrument does not export resource entries for identifiable electronic resources.<br>The instrument reads information stored on identifiable electronic resources when it detects the resources. | **Values & Tables**<br>**Hardware** |
| Settings for peripheral devices such as balances or printers | **Peripherals** |
| Settings for notifications, display of messages and behavior of resources | **Task & Resources Behavior** |
| Instrument settings<br>The instrument only imports the instrument identifier if you use the XML file to restore the configuration of the instrument. | **Instrument** |
| User-specific settings | **Personal** |
| User management data | **User Management** |
| Ethernet settings and settings for network storage<br>The instrument does not export the password for network storage.<br>The instrument only imports Ethernet settings if you use the XML file to restore the configuration of the instrument. | **Network** |
| Settings for the connection to the laboratory software.<br>The instrument only imports the settings if you use the XML file to restore the configuration of the instrument. | **LabX** |
| Shared shortcuts | **Shortcuts** |
| User-specific shortcuts | **Shortcuts** |

**Compatibility**

Instrument type and software version limit the compatibility of the XML file. You can import an XML file if the following conditions are met:

- You exported the XML file from an instrument with the same instrument type or an instrument type with fewer features. Examples:
  - If you export the XML file from a coulometric Karl Fischer titrator, you can import it to another coulometric Karl Fischer titrator.
  - If you export the XML file from an EVA C1 titrator, you can import it to an EVA C3 titrator.
  - If you export the XML file from an EVA C3 titrator, you cannot import it to an EVA C1 titrator.
- You exported the XML file from an instrument with a lower or equal software version. Examples:
  - If you export the XML file from an instrument with software version 1.0, you can import it to an instrument with software version 1.1.
  - If you export the XML file from an instrument with software version 1.1, you cannot import it to an instrument with software version 1.0.

### 8.4.2 Back up the instrument configuration

When you back up the instrument configuration, the instrument creates an XML file and saves this file to a USB flash drive. The following rules apply:

- The instrument saves the file to a folder that is named after the instrument category.
  - Example: If you export the data from a titrator, the titrator saves the file to a folder called "Titration".
- The instrument concatenates several strings to create the file name.
  - Concatenation formula: backup_[backup name]_[SerialNumber]_ Date_Time.xml
  - Example: backup_MonthlyBackup_W00FBZVT34_2024-08-19_12_33_05_215

| Place holder | Description | Parameter | Example |
|---|---|---|---|
| [backup name] | Text defined during export | **Backup name** | MonthlyBackup |
| [SerialNumber] | Serial number of the instrument as defined in > **Setup** > **System Settings** > **Instrument** > **Instrument Identification** | **Serial number** | W00FBZVT34 |
| Date | Date of export in the following format: year-month-day | Not applicable | 2024-08-19 |
| Time | Time of export in the following format: hours_minutes_seconds_milli seconds | Not applicable | 15_33_05_215 |

You can use the following types of USB flash drives:

- USB-A flash drive with a USB-A socket on the rear panel
- USB-C flash drive with the USB-C socket on the terminal

**Preparations**

- Only one USB flash drive is connected to the instrument.
- No task or action is running.

**Procedure**

1 Go to > **Setup** > **Maintenance & Service** > **Import/Export**.
2 For **Action**, select **Backup**.
3 For **Backup name**, enter the required text.
4 Tap **Start**.
➡ The XML file is saved to the USB flash drive.

### 8.4.3 Restore the instrument configuration

You can keep several XML files with backup data on a USB flash drive.

**Preparations**

- The name of the XML file starts with the following string: "backup_".
- Only one USB flash drive is connected to the instrument.
- No task or action is running.

**Procedure**

1 Go to > **Setup** > **Maintenance & Service** > **Import/Export**.
2 For **Action**, select **Restore**.
3 If needed, navigate to the folder with the required XML file.
4 For **Backup**, select the required XML file from the list.
5 Tap **Start**.
➡ The instrument imports the data.
➡ The instrument restarts.

**See also**

Overview ▸ Page 83

## 8.5 Prepare the titrator for storage

1 Empty the Karl Fischer cell.
2 Empty all tubes.
3 Shut down the titrator.

4 Disconnect the terminal.
5 Disconnect the titrator from the power supply.
6 Disconnect any accessories from the titrator.
7 Remove and clean the generator electrode.
8 Remove and clean the sensor.
9 Remove and clean the Karl Fischer cell.
10 Remove all cables.
11 Clean the titrator.
12 Store the titrator in a dry and clean place.

**See also**


- Technical data ▸ Page 89
- Empty and clean the Karl Fischer cell ▸ Page 77
- Start up and shut down the titrator ▸ Page 69
- Disconnect the terminal ▸ Page 24
- Disconnect the power supply ▸ Page 38
- Clean the titrator and accessories ▸ Page 76
- Clean the generator electrode ▸ Page 81


## 8.6 Transport the titrator

If you have questions about transporting your titrator, contact your authorized METTLER TOLEDO service representative or dealer.

www.mt.com/contact

**Procedure**

1 Empty the Karl Fischer cell.
2 Empty all tubes.
3 Shut down the titrator.
4 Disconnect the terminal.
5 Disconnect the titrator from the power supply.
6 Disconnect any accessories from the titrator.
7 Remove and clean the generator electrode.
8 Remove and clean the sensor.
9 Remove and clean the Karl Fischer cell.
10 Remove all cables.
11 Clean the titrator.
12 If you transport the titrator over long distances, use the original packaging.
13 Move the titrator to the new location.

**See also**


- Technical data ▸ Page 89
- Empty and clean the Karl Fischer cell ▸ Page 77
- Start up and shut down the titrator ▸ Page 69
- Disconnect the terminal ▸ Page 24
- Disconnect the power supply ▸ Page 38
- Clean the titrator and accessories ▸ Page 76
- Clean the generator electrode ▸ Page 81

# 9 Troubleshooting

## 9.1 Forced shutdown

– Press and hold the power button on the rear panel for more than 10 s.
  ➡ The titrator terminates running tasks.
  ➡ The titrator deactivates running actions.
  ➡ The titrator discards unsaved changes.

➡ The AC/DC adapter and the control circuit for the power button are energized. The rest of the titrator is no longer energized.

# 10 Dispose of the titrator

If you have questions about the disposal of your titrator, contact your authorized METTLER TOLEDO dealer or service representative.

www.mt.com/contact

In conformance with the European Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), this equipment may not be disposed of in domestic waste. This also applies to countries outside the EU, per their specific requirements.

Please dispose of this equipment in accordance with local regulations at the collecting point specified for electrical and electronic equipment. If you have any questions, please contact the responsible authority or the distributor from which you purchased this equipment. Should this equipment be passed on to other parties, the content of this directive must also be passed on to the other party.

### Procedure

1 Empty the Karl Fischer cell.
2 Empty all tubes.
3 Shut down the titrator.
4 Disconnect the terminal.
5 Disconnect the titrator from the power supply.
6 Disconnect any accessories from the titrator.
7 Remove and clean the generator electrode.
8 Remove and clean the sensor.
9 Remove and clean the Karl Fischer cell.
10 Remove all cables.
11 Clean the titrator.
12 Dispose of the titrator according to local laws and regulations.

### See also


- Technical data ▸ Page 89
- Empty and clean the Karl Fischer cell ▸ Page 77
- Start up and shut down the titrator ▸ Page 69
- Disconnect the terminal ▸ Page 24
- Disconnect the power supply ▸ Page 38
- Clean the titrator and accessories ▸ Page 76
- Clean the generator electrode ▸ Page 81

# 11 Technical data

## 11.1 Titrator

### Power supply

| Characteristic | | Value |
|---|---|---|
| **Titrator** | Input rating | 24 V DC, 5 A |
| | Socket | Power mini-DIN, 4-pin, female |
| **AC/DC adapter** | Input rating | 100–240 V AC, 1.5 A |
| | Fluctuation of supply line voltage | ±10 % |
| | Input frequency | 50–60 Hz |
| | Output rating | 24 V DC, 5 A, 120 W |

### Instrument

| Characteristic | | Value |
|---|---|---|
| **Dimensions** | Width | 135 mm |
| | Depth | 177 mm |
| | Height without titration arm | 185 mm |
| **Weight** | | 2.8 kg |
| **Material** | Housing | PBT (polybutylene terephthalate), stainless steel (1.4301), chrome-plated $ZnAl_4Cu_1$, EPDM M-class (ethylene propylene diene monomer (M-class) rubber) |
| | Titrator cover | PET (polyethylene terephthalate) |
| | Mounting position cover | PP (polypropylene) |

### Site requirements

| Characteristic | | Value |
|---|---|---|
| **Ambient conditions** | Ambient temperature | 5…40 °C |
| | Recommended operational temperature [1)] | 18…28 °C |
| | Relative humidity | Non-condensing, max. 80 % for temperatures up to 31 °C, decreasing linearly to 50 % at 40 °C |
| | Altitude | ≤5000 m above sea level |
| | Use | Indoor |
| | Overvoltage category | II |
| | Pollution degree | 2 |
| **Storage conditions** | Temperature | -20…+70 °C, no ice formation |
| | Relative humidity | 10…90 %, non-condensing |

[1)] METTLER TOLEDO produces and tests the equipment with test tools that are certified for this temperature range. Usage outside the given range could lead to inferior performance.

**Connections main board**

| Characteristic | | Value |
|---|---|---|
| **USB1/USB2** | Host | USB 2.0, high-speed |
| | Socket | USB A |
| | Output rating | 5 V DC, 500 mA |
| | Cable length | Max. 3 m |
| **LAN** | Socket | RJ45 |
| | Speed | 10/100 MBits/s |
| **ACT** | Socket | M8, 4-pin, female |
| | Output rating | 24 V DC, 3 A |
| | Cable length | Max. 2.4 m |
| **TERM** | Socket | M9, 8-pin, female |
| | Output rating | 24 V DC, 500 mA |
| | Cable length | Max. 2.5 m |

**Connections coulometer board**

| Characteristic | | Value |
|---|---|---|
| **SENS1** | Socket | Self-locking, 4-pin, female |
| | Output rating | 3.5 V DC, 175 mA |
| | Galvanic isolation | Yes |
| | Sensor detection | Yes |
| | Cable length | Max. 5 m |
| **GEN** | Socket | Self-locking, 5-pin, female |
| | Output rating | Max. 30 V DC, 400 mA |
| | Electrode detection | Yes |
| | Cable length | Max. 0.7 m |

**Stirrer**

| Characteristic | | Value |
|---|---|---|
| **Internal magnetic stirrer** | Drive | Stepper motor |
| | Min. speed | 240 rpm |
| | Max. speed | 1050 rpm |

## 11.2 Terminal

| Characteristic | | Value |
|---|---|---|
| **Dimensions** | Width | 194 mm |
| | Depth | 129 mm |
| | Height | 51 mm |
| **Weight** | | 725 kg |
| **Materials** | Top housing | Chrome-plated $ZnAl_4Cu_1$ |
| | Lower housing | PBT (polybutylene terephthalate) |
| | Cover glass | Aluminosilicate glass |
| | USB-C socket cover | TPV (thermoplastic vulcanizate) |
| | Terminal cover | PET (polyethylene terephthalate) |

| Characteristic | | Value |
|---|---|---|
| **Display** | Technology | TFT IPS color display with capacitive multi-touch screen |
| | Size | 7 inch (178 mm) |
| | Resolution | 1024 x 600 pixel |
| **INST** | Input rating | 12…24 V DC, 10 W |
| | Socket | M9, 8-pin, female |
| **USB** | Host | USB 2.0, high-speed |
| | Socket | USB C |
| | Output rating | 5 V DC, 500 mA |
| | Cable length | Max. 3 m |
| **Angle adjustment** | Mechanical | 2-stage |

## 11.3 Coulometric Karl Fischer cell and titration arm

### Coulometric Karl Fischer cell

| Characteristic | | Value |
|---|---|---|
| **Material** | Vessel | Borosilicate-3.3 |
| | Adapter plate | ETFE (ethylene tetra fluoro ethylene) |
| | O-ring | EPDM (ethylene propylene diene monomer) |

### Titration arm

| Characteristic | | Value |
|---|---|---|
| **Material** | Titration arm | PBT (polybutylene terephthalate) |
| | Strap | Silicone |

## 11.4 Generator electrode

### Generator electrode without diaphragm

| Characteristic | | Value |
|---|---|---|
| **Dimensions** | Diameter | 27 mm |
| | Length | 138 mm |
| **Weight** | | 58 g |
| **Socket** | | Self-locking, 5-pin, female |
| **Material** | Housing | Borosilicate-3.3 |
| | Anode | Platinum |
| | Cathode | Platinum |
| | Socket | PBT (polybutylene terephthalate), stainless steel (1.4301), Brass (CuZn21Si3P) |

### Generator electrode with diaphragm

| Characteristic | | Value |
|---|---|---|
| **Dimensions** | Diameter | 27 mm |
| | Length | 138 mm |
| **Weight** | | 61 g |
| **Socket** | | Self-locking, 5-pin, female |

| Characteristic | | Value |
|---|---|---|
| **Material** | Housing | Borosilicate-3.3 |
| | Anode | Platinum |
| | Cathode | Platinum |
| | Diaphragm | $SiO_2$ (silicon dioxide) |
| | Socket | PBT (polybutylene terephthalate), stainless steel (1.4301), Brass (CuZn21Si3P) |

## 11.5 Solvent pump dPump KF

**Power supply**

| Characteristic | | Value |
|---|---|---|
| **Input (IN)** | Power consumption | 24 V DC, 0.3 A |
| | Input rating | 24 V DC, 3 A |
| | Socket | M8, 4-pin, male |
| **Output (OUT)** [1)] | Output rating | 24 V DC, 2.7 A |
| | Socket | M8, 4-pin, female |
| | Cable length | Max. 2.4 m |

[1)] The output has been evaluated for connections to non-hazardous safety extra-low voltage (SELV) circuits. The output must only be connected with non-hazardous safety extra-low voltage (SELV) circuits.

**Pump**

| Characteristic | | Value |
|---|---|---|
| **Dimensions** | Width | 51 mm |
| | Depth | 169 mm |
| | Height | 170 mm |
| **Weight** | | 1160 g |
| **Fittings for air tubes** | Diameter | 4 mm |
| **Materials** | Housing | PBT (polybutylene terephthalate) |
| | Rubber feet | EPDM (ethylene propylene diene monomer (M-class) rubber) |
| | Rear panel | 1.4301 stainless steel |
| | Fittings for air tubes | CW617N+Ni plated |
| | Socket cover | PA (polyamide) |
| **Max. pump pressure** | | 0.5 bar |

**Solvent tubes**

| Characteristic | | Value |
|---|---|---|
| **Material** | Connector | PVDF (polyvinylidene difluoride) |
| | O-ring | EPDM (ethylene propylene diene monomer) |
| | Tube | FEP (fluorinated ethylene propylene) |

# 12 Accessories, spare parts and consumables

All accessories, spare parts and consumables are specified with their order number.

If you have any questions, contact your authorized METTLER TOLEDO service representative or dealer.

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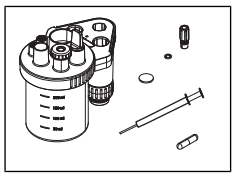
## 12.1 Karl Fischer cell and titrator

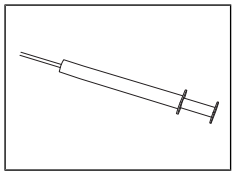
### 12.1.1 Titration kits and Karl Fischer cell

#### Titration kits

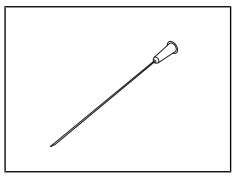


Titration kit KFC **30988520**

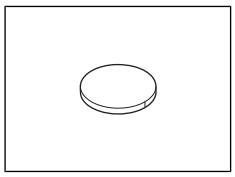
#### Sample injection and Karl Fischer cell



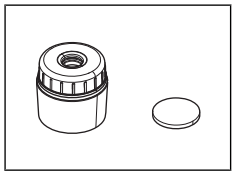
Syringe (120 pcs)
1 mL **30315987**



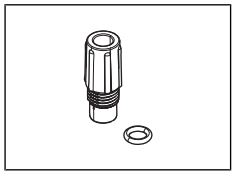
Injection needle (100 pcs)
80 × 0.8 mm **71484**



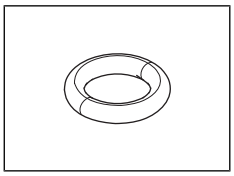
Septum set (5 pcs) **30869295**



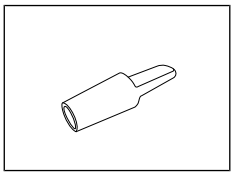
Sample injection adapter NS14 **30988538**



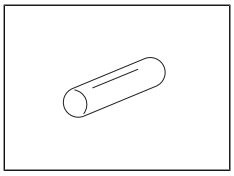
Stopper set M9 (2 pcs) **30869306**



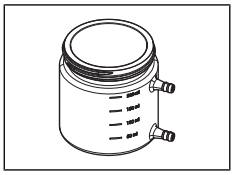
O-ring set M9 (2 pcs) **30869315**



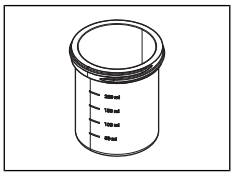
Stopper ST 14.5 **23451**



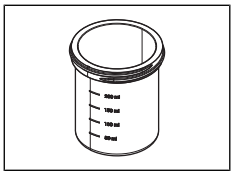
Magnetic stirrer bar **51191159**
Length: 30 mm, diameter: 6 mm



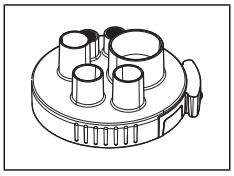
Vessel KFC TS GL80 **30988517**
Titration vessel with thermostat jacket



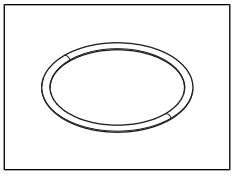
Vessel KFC clear GL80 **30988518**



Vessel KFC brown GL80 **30988519**

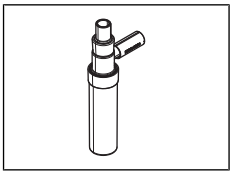


Adapter plate KFC GL80 **30988534**

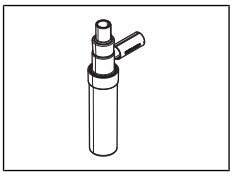


Adapter plate seal KF GL80 **30988535**

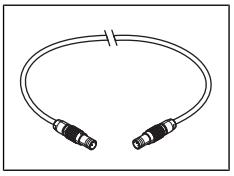
### 12.1.2 Generator electrodes



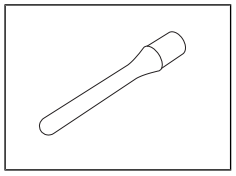
Generator electrode without diaphragm **31028003**



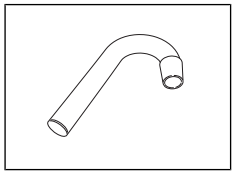
Generator electrode with diaphragm **31028002**



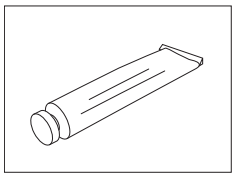
Generator electrode cable 70 cm **30927803**



Straight glass drying tube NS14 **51108733**



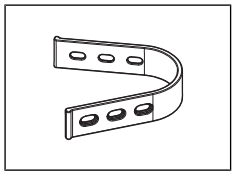
Curved glass drying tube NS14 **51108639**



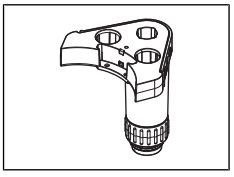
Silicone grease **71300**

### 12.1.3 Titrator and terminal

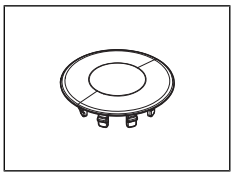
**Titrator**



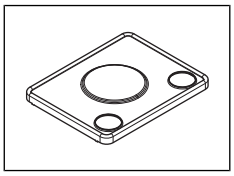
Titration arm strap **30869312**



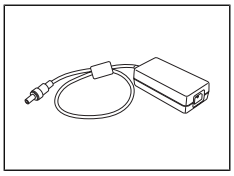
Titration arm GL80 **30988536**



Mounting position cover **30869308**

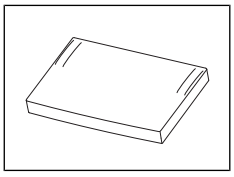


Titrator cover **30869313**

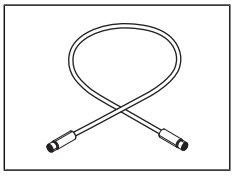


Extern. Power Supply 120W
AC/DC adapter **30298362**

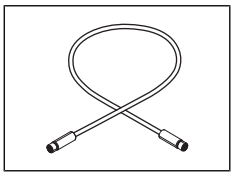
**Terminal**



In-use cover
Terminal cover **30125377**

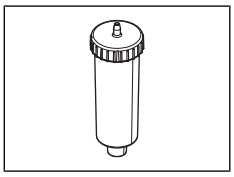


Terminal cable 68 cm **30003971**

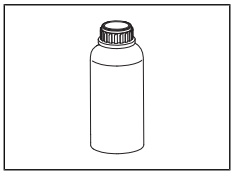


Terminal cable 250 cm **30869309**

## 12.2 Drying tubes



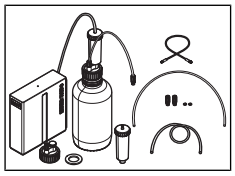
Drying tube NS14 **30673119**



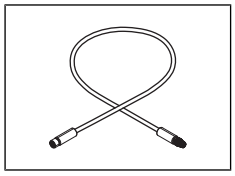
Molecular sieve
250 g **71478**

## 12.3 Solvent pump

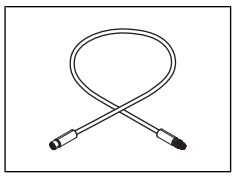
### Solvent pump



Solvent pump dPump KF **30869285**

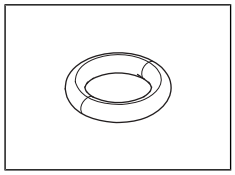


Cable ACT M8/F, M8/M
20 cm **30634406**

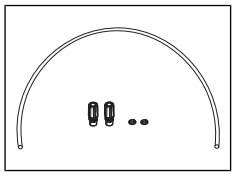


Cable ACT M8/F, M8/M
60 cm **30634420**

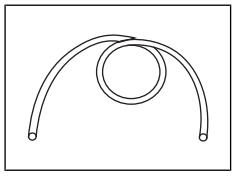
### Tubes and bottle adapter



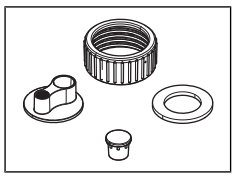
O-ring set M9 (2 pcs) **30869315**



Solvent tube (2 pcs) **30869316**

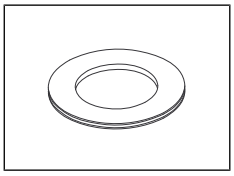


Air tube 100 cm (2 pcs) **30869317**

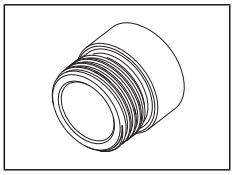


Bottle adapter M9 GL45 **30869314**

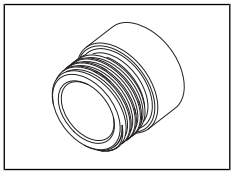
## 12.4 Bottle adapters and bottles



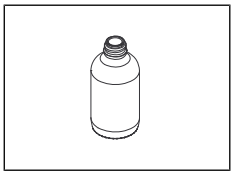
Flat seal GL45 **30673280**



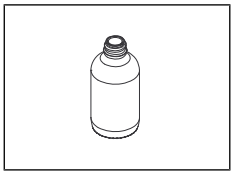
Bottle adapter (Merck) **23774**



Bottle adapter (Fisher) **23787**

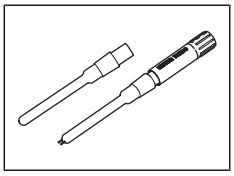


Clear glass bottle
1 L **30079610**

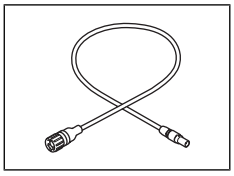


Brown glass bottle
1 L **71296**

## 12.5 Sensors

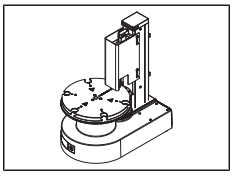


Sensor dSens M143
Polarized sensor **30573200**

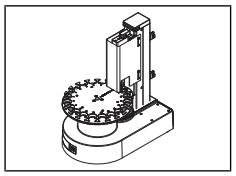


Sensor cable dVP4-T 70 cm **30635146**

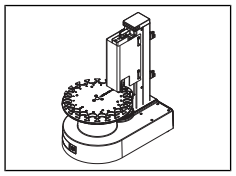
## 12.6 Sample changer



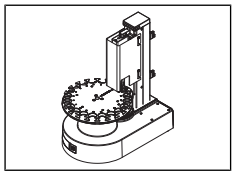
InMotion KF Six Oven Autosampler (10 mL) **30693191**
Rack 10 mL, 6 sample positions, 1 drift position



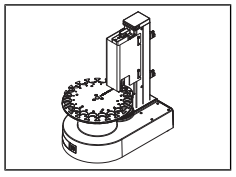
InMotion KF Flex **30407500**
Rack 10 mL, 23 sample positions, 1 drift position



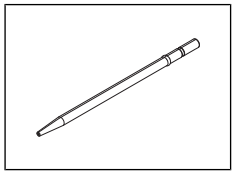
InMotion KF Pro **30407501**
Rack 20 mL, 19 sample positions, 1 drift position



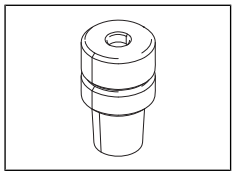
InMotion KF Pro **30407502**
Rack 10 mL, 23 sample positions, 1 drift position



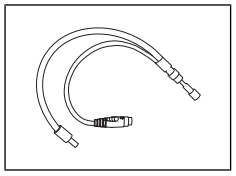
InMotion KF Pro **30407503**
Rack 5 mL, 25 sample positions, 1 drift position



Gas Inlet **51108669**
Inlet tube

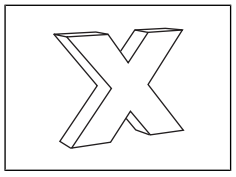


Stopper PTFE **51108668**
Inlet-tube adapter

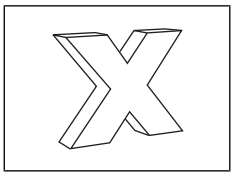


Transfer Tube, heated **51108836**

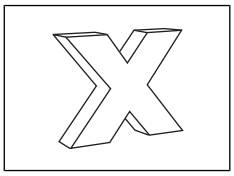
## 12.7 Software



License LabX Data Titration **30851289**
License for one instrument



License LabX Centralized Titration **30851291**
License for one instrument



License LabX Regulated Titration **30851293**
License for one instrument

## 12.8 Weighing

**Balances**

Balances connected with USB-A-C cable or USB-C-C:

- MR
- MX

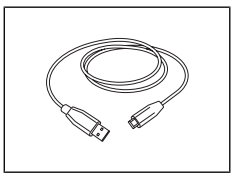
Balances connected with USB-A-B cable:

- XPR
- XSR

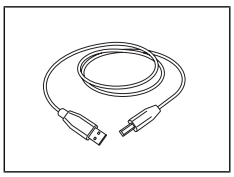
Balances connected with USB-A to RS-232 adapter:

- AX, AT
- LA
- MA
- ME, ME-T
- ML, ML-T
- MS, MS-S, MS-TS
- XA
- XP, XPE
- XS, XSE

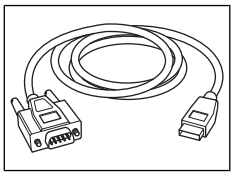
**Cables to connect balances**



Cable MX, MR USB-C (m) – USB-A (m) **30893022**

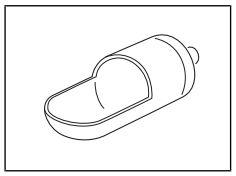


Cable USB (1.8 m A-B) for PC or printer **51191926**

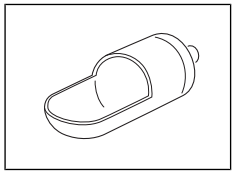


Cable USB To RS232 converter, FTDI **64088427**

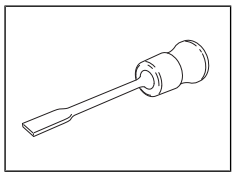
### Weighing accessories



Glass Weighing Boat small (5 pcs) **23951**
Diameter: 20 mm x 60 mm

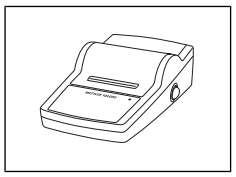


Glass Weighing Boat (5 pcs) **23952**
Diameter: 30 mm x 80 mm



Visco-Spoon™ **51107668**

## 12.9 Peripherals



Lab equip acc data writer USB-P25/00 **30702998**
Dot matrix printer

### Third party supplies

Barcode readers are available from their manufacturers. For information on compatible barcode readers, contact your authorized METTLER TOLEDO service representative or dealer.

www.mt.com/contact

Network printers are available from their manufacturers. Network printers that meet one of the following conditions are compatibly with the instrument.

- IPP Everywhere certification
- AirPrint software feature

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