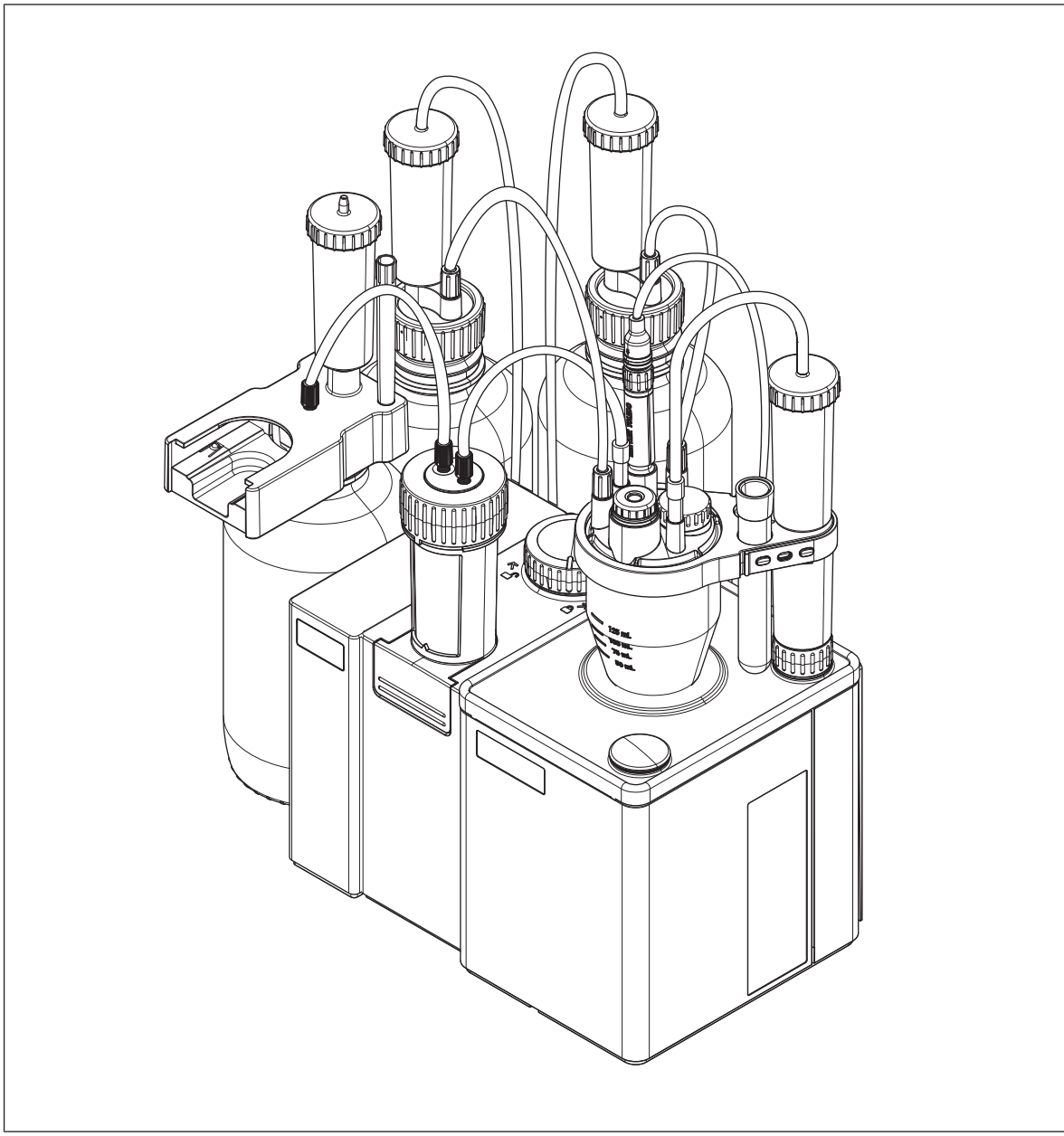
Reference Manual

Advanced Titrator

EVA V1/EVA V3



METTLER TOLEDO

Table of Contents

1 Introduction

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

Information is provided for the following titrators:

- EVA V1
- EVA V3

This document applies to the software version 1.0.0 or higher.

The screenshots show the user interface of an EVA V3 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 applications 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.

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 22].

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 volumetric 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.

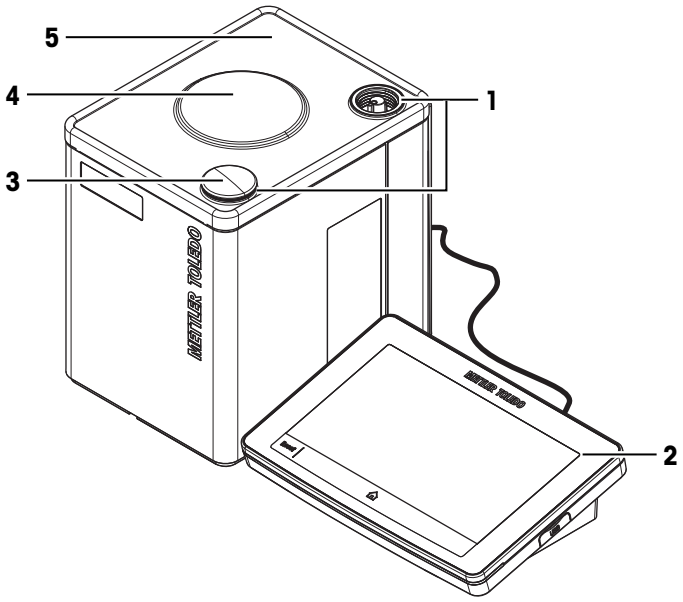
See also

Technical data ▸ Page 73

3 Design and function

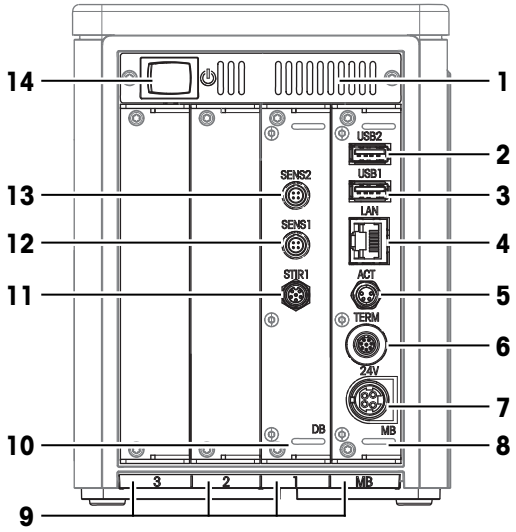
3.1 Titrator overview

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



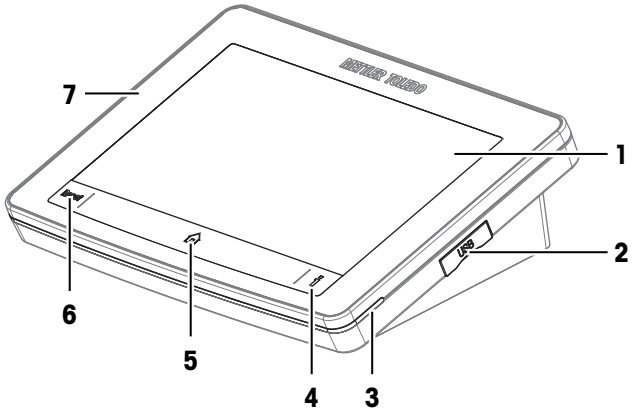
No.	Name	Function
1	Vents	Air outlet for cooling the titrator

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 a network
5	**ACT**	4-pin M8 socket to connect Actor Bus devices, for example, a burette drive
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	Device board (**DB**)	Device board installed in board slot 1
11	**STIR1**	Not supported by the titrator software
12	**SENS1**	4-pin socket to connect digital sensors
13	**SENS2**	4-pin socket to connect digital sensors
14	Power button	Push button to start up the titrator

See also

Technical data ▸ Page 73

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 73

3.1.4 Status light

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

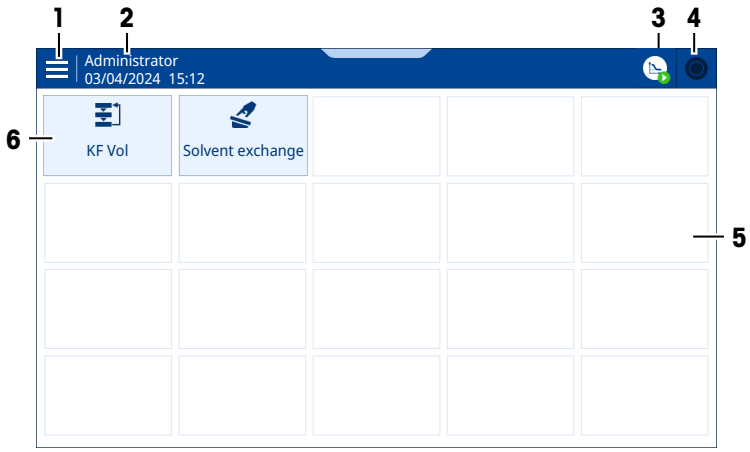
Status light	Titrator status
Steady, green light	The titrator is ready for operation.
Blinking, green light	Two states are possible: • The titrator is performing a task that requires no user interaction. • The Karl Fischer cell is ready for a titration. The titrator is performing the **KF Conditioning** 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 • Icon shows the state of the task or the action • Opens the window of the task or of the action
4	Task area button	• Icon shows if a task is running • Icon shows the state of the task • Opens the task area
5	Shortcut area	Shows user-defined shortcuts
6	Shortcut button	• Tapping the button starts a task or an action • Tapping and holding the button opens an editor to configure the task or the action

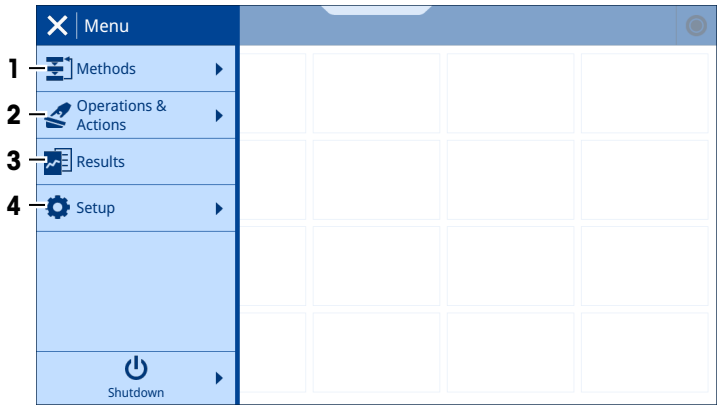
Explanation of the task area icon

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: • An analysis is running but the Karl Fischer cell is not ready for the titration to start. • User interaction is needed for the analysis to continue.

3.2.2 First level menus



No.	Name	Function
1	**Methods**	Access the following functions: • Create, edit or delete a method. • Configure method specific settings with the method editor. Examples for method specific settings: • Method name • Results that are calculated and displayed during the analysis • Control focus
2	**Operations & Actions**	Configure and start operations and actions. Examples: • Rinse the burette. • Exchange the solvent. • **KF Conditioning**: a dry state of the Karl Fischer cell is established and maintained.
3	**Results**	View and manage analysis results.

No.	Name	Function
4	**Setup**	Configure settings that apply to the entire instrument and not to a specific method, action or operation. Examples: • Date and time • Standards • Sensors

3.2.3 Menu structure

Submenus of Methods

KF Volumetric	
KF Concentration	
KF Vol External Extraction (EVA V3 only)	
KF Vol Blank (EVA V3 only)	

Submenus of Operations & Actions

KF Conditioning	
Solvent Exchange	
Burette	
Stirrer	
Homogenizer (EVA V3 only)	

Submenus of results Results

This menu has no submenus.

Submenus of Setup

Chemicals	**Titrants**
	Reagents
	Standards
Values & Tables (EVA V3 only)	**Blank Values** (EVA V3 only)

Hardware	**KF Cells**
	Burettes
	Sensors
	Pumps
	Stirrers
	Homogenizers (EVA V3 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

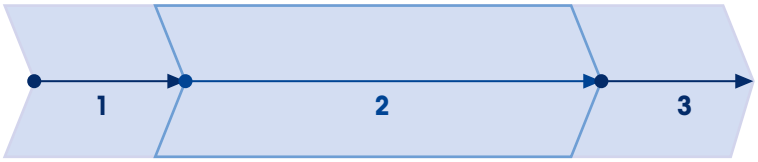
The hardware is the same for both titrator types but they have different functionality. The following table shows a summary of the functionality:

Functionality		EVA V1	EVA V3
Samples	• Liquid samples • Solid samples that are soluble in the solvent	•	•
	Solid samples that are not soluble in the solvent • Homogenized samples and blank values to correct results • External sample extraction	–	•
Data management	Secure data handling with LabX laboratory software	•	•
Data storage	Storage devices for reports and data exports: • Network share • USB flash drive	•	•
Printer types	• USB printers for the paper sizes A4 or Letter • Ethernet printers for the paper sizes A4 or Letter • METTLER TOLEDO thermal printers • METTLER TOLEDO dot matrix printers	•	•
User Management	User-specific access rights and user authorization	•	•
Reduced contact with chemicals	• Automatic exchange of solvent • Automatic emptying of burettes • Operation of the terminal outside a fume hood	•	•
Data transfer	• Direct transfer of sample weights from balance • Reading in SmartChemical data with a barcode reader	•	•

3.3.2 Customization of analyses

Water-content determination

The volumetric 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.

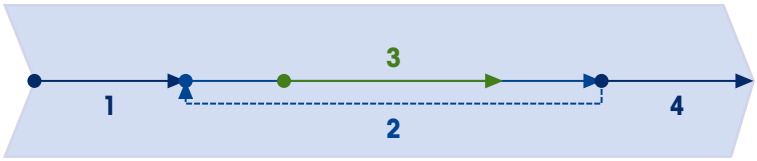


No.	Name	Function
1	Sample preparation	Performed by users without interaction with the titrator
2	Analysis	The titrator executes a series of steps that might or might not require the interaction of users. • An analysis can include one sample or several samples. • At the end of the analysis, results are 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. Examples: • The titrator displays a user-defined message. • 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. • The sample analysis always includes the addition of a sample and the measurement of physical quantities. • If more than one sample is analyzed, the titrator repeats the sample analysis for each sample. • 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. Examples: • The titrator calculates a mean value for all samples. • The titrator creates a report with all the results from the analysis.

See also

- Measurement technology ▸ Page 16
- Configuration of analysis settings ▸ Page 39
- Methods ▸ Page 39

3.4 Measurement technology

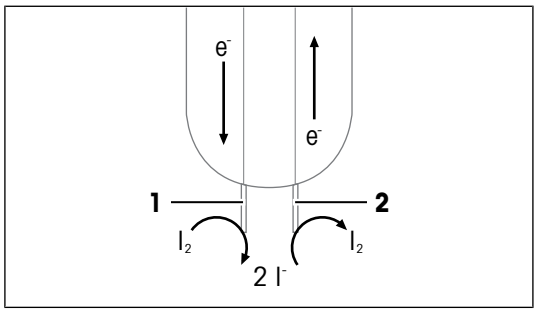
3.4.1 Measurement principle

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 and a base.

A Karl Fischer cell holds a solution that contains iodine. Water present in the Karl Fischer cell reacts with iodine. The iodine concentration is therefore an indicator for the presence of water.

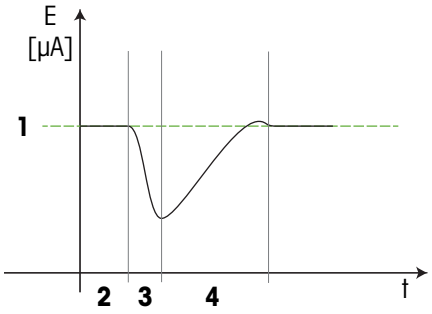
The titrator uses an amperometric measurement to track the iodine concentration. For this amperometric measurement, the titrator maintains a constant polarization potential between the two pins of a polarized sensor.

- Cathode, negatively charged pin (1): iodine molecules are reduced to iodide ions.
- Anode, positively charged pin (2): iodide ions are oxidized to iodine molecules.
- Due to the reactions at the cathode and the anode, electrons flow from the anode to the cathode. The titrator measures the intensity of the resulting current.



The current intensity varies with the iodine concentration. A high iodine concentration leads to a faster reaction at the cathode and the anode. A faster reaction results in a higher current intensity. 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. • 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. • 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. • As the water is consumed, the iodine concentration increases and the current intensity increases. • The titrator terminates the titration when the measured current intensity has reached the set current intensity.

See also

- Control algorithm ▸ Page 41
- Configure the sample analysis ▸ Page 42
- Configure titrant addition ▸ Page 45

3.4.2 Volumetric Karl Fischer titration

Titrant

In volumetric Karl Fischer titrations, the titrant contains the iodine for the reaction. The titrator controls and measures the volume of titrant that is added to the Karl Fischer cell. The titrant volume and the titrant concentration are used to calculate the amount of water that was removed from the Karl Fischer cell.

During the titration, the titrator measures the titrant volume but it does not measure the titrant concentration. The titrator uses the titrant concentration that is stored on the titrator to calculate the water content of the sample. To get accurate results, it is important that you regularly determine the titrant concentration. When you determine the titrant concentration, the titrator updates the stored value.

Sample size

The sample size is limited by the amount of water it adds to the Karl Fischer cell. For accurate results, it is important that the burette is not refilled during the titration. For this reason, the titrant volume added during the titration should be in the range of 30…70 % of the burette volume. As a consequence, the amount of water in a sample should not exceed a maximum amount. The maximum amount of water depends on the burette volume and the titrant concentration.

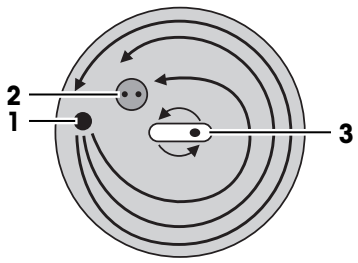
Solvent

The Karl Fischer cell is filled with solvent. The solvent dissolves the sample and participates in the reaction.

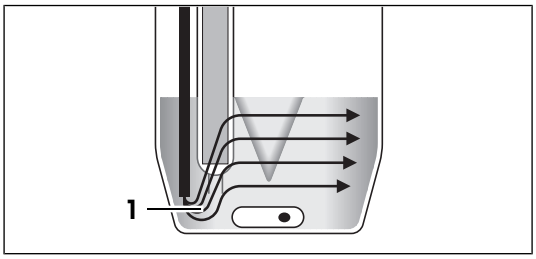
Mixing of the reactants

For a reliable measurement of the iodine concentration, it is important that sample, titrant and solvent are mixed well. An even distribution of the substances increases the likelihood that reactants meet and reduces the likelihood that iodine ions accumulate around the sensor. The following points are important to achieve good mixing:

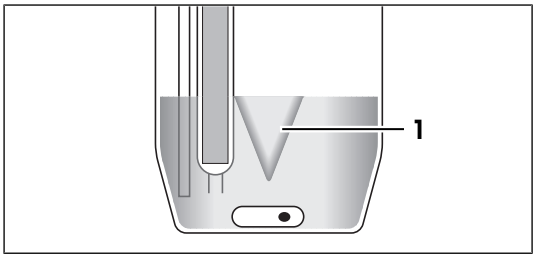
- In the direction of stirring (3), the titrant tube (1) is placed after the sensor (2). With this arrangement the iodine in the titrant has time to react with the water before it reaches the sensor.



- A short stir bar and the conical shape of the vessel lead to turbulence at the point of titrant addition (1). This turbulence effectively disperses the titrant.



- Stirring results in a distinct vortex (1). The following signs indicate that the stir speed is too high:
  - Bubbles form in the solution.
  - The vortex extends so far down that it partially exposes the pins of the sensor.



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

Water from the ambient air enters the Karl Fischer cell and reacts with the iodine in the solution. This water is one cause of the cell drift. The cell drift is a measure for all the water that enters the Karl Fischer cell. 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.

Titrant concentration

Water that diffuses into the titrant bottle reacts with the titrant and reduces the titrant concentration. The titrant concentration is used to calculate the water content of the sample. The result is only accurate if the titrant concentration used in the calculation corresponds to the actual titrant concentration.

Recommended measures:

- Determine the titrant concentration at the start of the work day.

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:

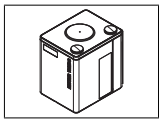
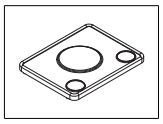
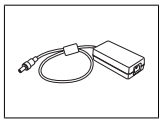
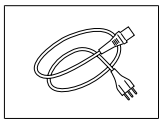
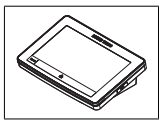
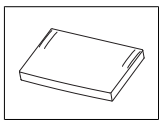
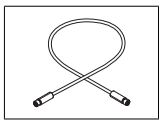
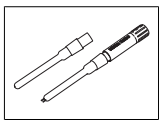
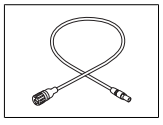
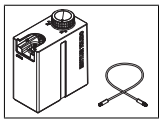
- Store samples in tightly sealed glass bottles with small openings.

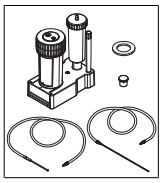
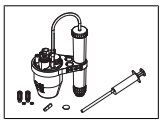
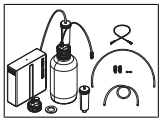
See also

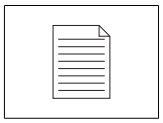
- Configure the sample analysis ▸ Page 42
- Raw results and calculation of water content ▸ Page 42

4 Installation

4.1 Scope of delivery

Part		Order number	EVA V1 EVA V3	EVA V1 Base EVA V3 Base
	EVA titrator	–	•	•
	Titrator cover	30869313	•	•
	Extern. Power Supply 120W (SP) AC/DC adapter	30298362	•	•
	Power cable (country specific)	–	•	•
	Terminal PSGT	–	•	•
	Terminal cover	30125377	•	•
	Terminal cable 68 cm	30003971	•	•
	Sensor dSens M143 • Sensor dSens M143 • Protective sleeve • Protection cap • Quality certificate • User Manual	30573200	•	•
	Cable dSens dVP4-T 70 cm	30635146	•	•
	Burette drive dDrive • dDrive • Cable ACT M8/F, M8/M, 20 cm • Test report • Declaration of Conformity • User Manual	30673134	•	•

Part		Order number	EVA V1 EVA V3	EVA V1 Base EVA V3 Base
	Burette 5 mL • Burette 5 mL • Burette parking station M6 GL45 • Drying tube NS14 • Stopper NS14 • Dispensing tube M6 65 cm • Suction tube M6 87 cm • Flat seal GL45 • Tube tip holder • User Manual	30869287	•	–
	Titration kit KFV L • Adapter plate KFV • Adapter plate seal KF • Vessel KFV L • Sample injection adapter NS24 • Septum set KF • Stopper M24 • Titration arm • Titration arm strap • Drying tube NS14 • Molecular sieves 250 g • Tapered connector NS7 • Air tube silicone • Stopper set M9 • Syringe 5 mL (2 pcs) • Injection needle 0.8 x 80 mm (2 pcs) • Magnetic Stirrer Bar	30869290	•	–
	Solvent pump dPump KF • dPump KF • Cable ACT M8/F, M8/M, 20 cm • Glass bottle clear 1 L • Drying tube NS14 (2 pcs) • Bottle adapter M9 GL45 (2 pcs) • Solvent tube • Air tube 100 cm (2 pcs)	30869285	•	–
	User Manual	–	•	•
	Declaration of conformity	–	•	•

Part		Order number	EVA V1 EVA V3	EVA V1 Base EVA V3 Base
	Test report	–	•	•

See also

Accessories, spare parts and consumables ▸ Page 77

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.
8 If the manual is not written for the installed software version, contact your authorized METTLER TOLEDO service representative or dealer.

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 20

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 73

4.5 Connect, adjust and disconnect the terminal

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

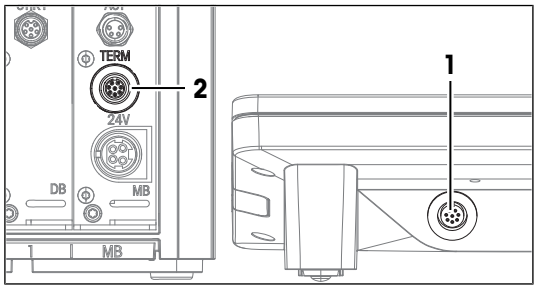
- The titrator is disconnected from the power supply.

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

2 Insert the plug into the 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.



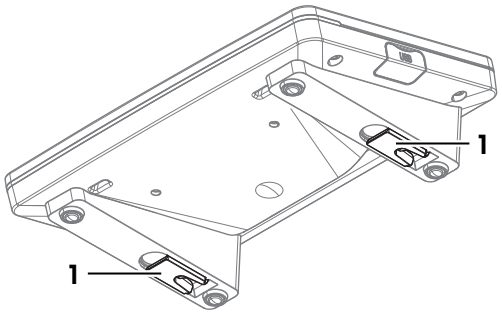
4.5.2 Adjust the angle of the terminal

The angle of the terminal has two positions.

Procedure

- No task is running.

– 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.

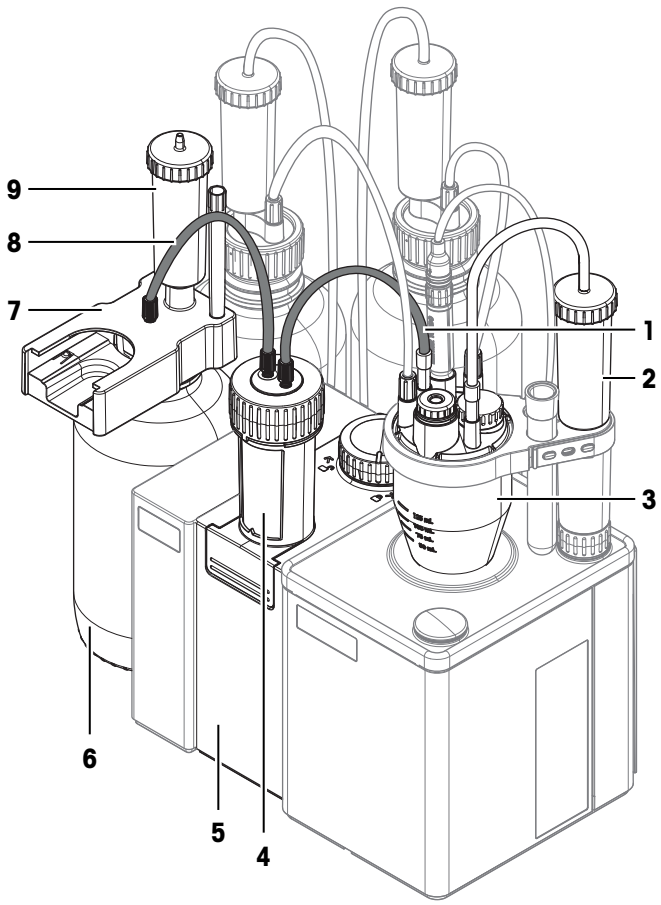
1 Remove the terminal cable from the socket on the back of the terminal.

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

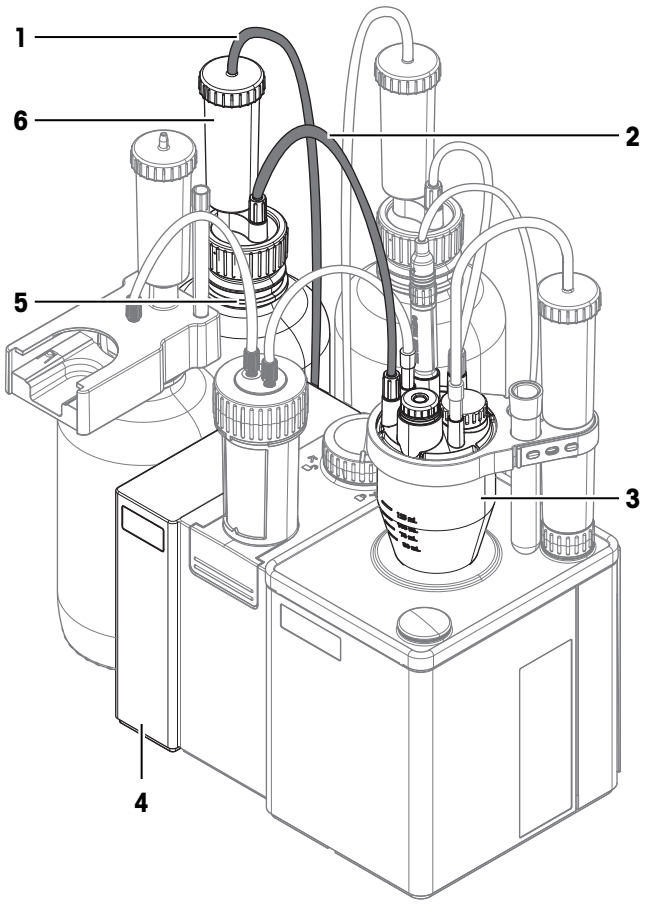
4.6.1 Overview of the setup

Titrant flow



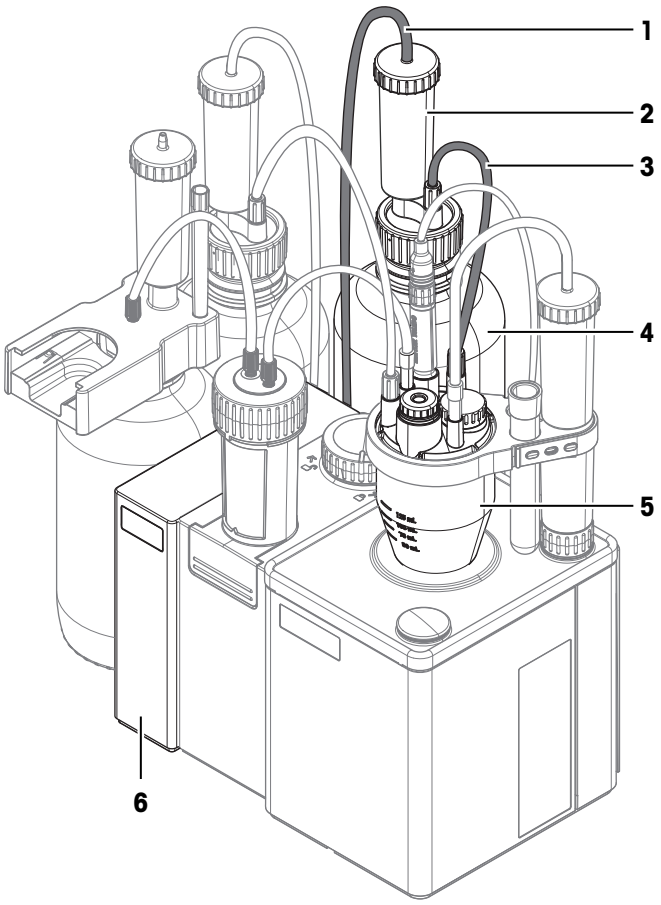
No.	Name	Function
1	Dispensing tube	Connects the burette to the Karl Fischer cell.
2	Drying tube	Removes moisture from the air that enters the Karl Fischer cell.
3	Karl Fischer cell	Assembled reaction vessel for the Karl Fischer titration.
4	Burette	Burette drive and burette form the dosing unit. The dosing unit aspirates titrant from the titrant bottle and dispenses the titrant into the Karl Fischer cell.
5	Burette drive	
6	Titrant bottle	Contains the titrant.
7	Burette parking station	Holds the burette when the burette is not connected to the Karl Fischer cell.
8	Suction tube	Connects the titrant bottle to the burette.
9	Drying tube	Removes moisture from the air that enters the titrant bottle.

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	Waste bottle	Contains the waste.
5	Karl Fischer cell	Assembled reaction vessel for the Karl Fischer titration.
6	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.

4.6.2 Overview of the actions

1 Install the burette drive. See [Install the burette drive dDrive ▸ Page 27].
2 Install the solvent pump. See [Install the solvent pump dPump KF ▸ Page 27].
3 Prepare drying tubes. See [Prepare drying tubes ▸ Page 27].
4 Install the titration arm. See [Install the titration arm ▸ Page 28].
5 Install the Karl Fischer cell. See [Install the Karl Fischer cell ▸ Page 28].
6 Install the waste bottle and solvent bottle. See [Install the waste bottle and the solvent bottle ▸ Page 31].
7 Install the titrant bottle. See [Install the titrant bottle ▸ Page 34].
8 Install the burette on the burette drive. See [Connect the burette to the Karl Fischer cell ▸ Page 36].
9 Connect the power supply. See [Connect and disconnect the power supply ▸ Page 37].

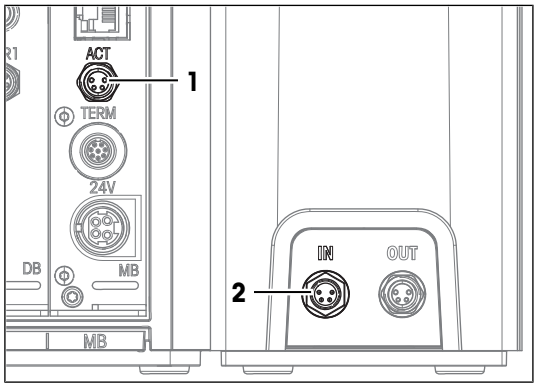
4.6.3 Install the burette drive dDrive

Read the User Manual of the burette drive for more information about the burette drive. See [Download manuals ▸ Page 22].

Procedure

- The titrator is disconnected from the power supply.
- The length of the ACT cable does not exceed 2.4 m.
- The burette drive has warmed to the temperature in the laboratory.

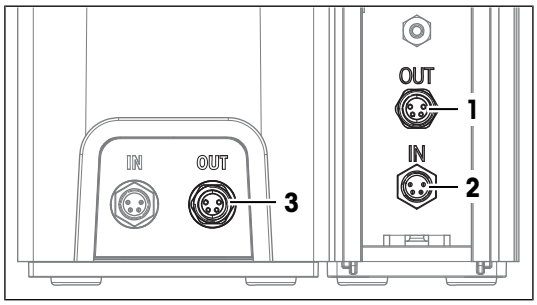
1 Rotate the female plug of the ACT cable until the arrow is on the upper side.
2 Insert the plug into the **IN** socket (2) on the burette drive.
3 Tighten the knurled nut to secure the connection.
4 Position the burette drive on the left side of the titrator.
5 Push the burette drive against the titrator.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



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.
- The burette drive is connected to the titrator.

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

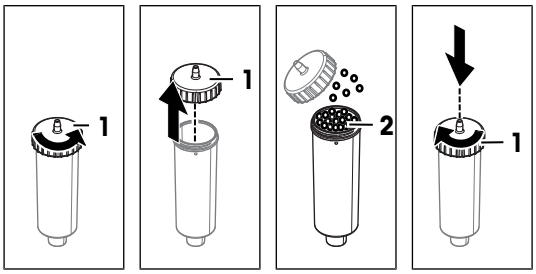


4.6.5 Prepare drying tubes

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.

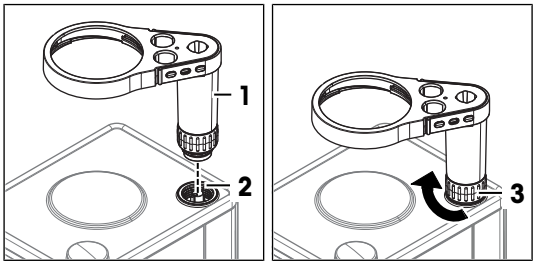
Fill the drying tube

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 (2).
2 Position the column (1) on the mounting position (2).
3 Rotate the column until it slides partway into the mounting position.
➡ You can no longer rotate the column.
4 Tighten the connector (3) clockwise.



4.6.7 Install the Karl Fischer cell

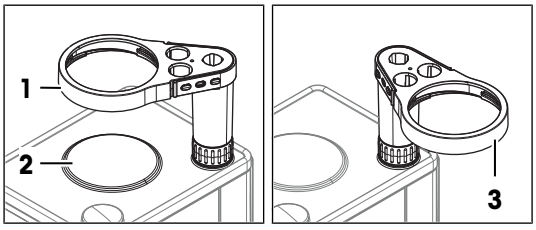
Overview of the actions

1 Install adapter plate and vessel. See [Swivel the titration arm ▸ Page 28] and [Install adapter plate and vessel ▸ Page 29].
2 Install the sensor. See [Install the sensor ▸ Page 30].
3 Install sample injection adapter and MS24 stopper. See [Install sample injection adapter and M24 stopper ▸ Page 30].
4 Install the drying tube. See [Install the drying tube ▸ Page 31]

4.6.7.1 Swivel the titration arm

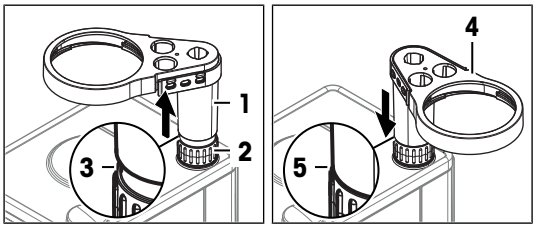
The titration arm can be swiveled to predefined positions:

- Swiveled in: The mounting position for the Karl Fischer cell (1) is centered over the internal magnetic stirrer (2).
- Swiveled out: The mounting position for the Karl Fischer cell (3) is to the right of the titrator. In this position the vessel can be installed of removed.



Procedure

1 Gently pull the column (1) upward, until there is a gap (3) of a few millimeters between connector (2) and column (1).
2 Swivel the titration arm (4) to the required position.
➡ When the titration arm (4) is aligned with a predefined position, the column is retracted (5) down to the connector.



4.6.7.2 Install adapter plate and vessel

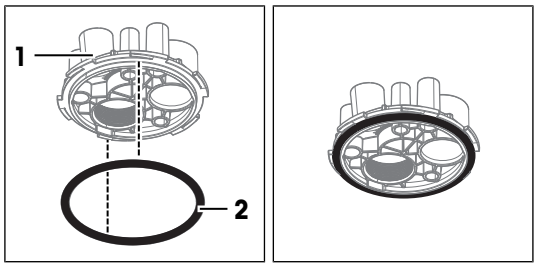
The following table shows the correct combination of vessel size and stir bar.

Vessel size	Stir bar length
Small	20 mm
Large	30 mm

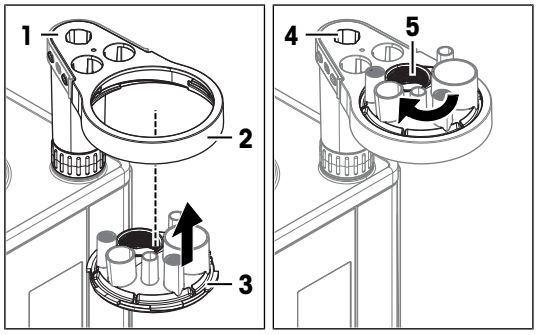
Install the adapter plate

- The titration arm is swiveled out.

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

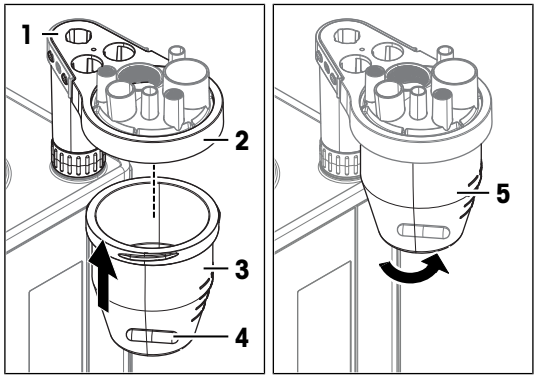


2 Stabilize the titration arm (1) with one hand.
3 Lift the adapter plate (3) up to its mounting position (2).
4 Rotate the adapter plate to align the M24 mounting position (5) with mounting position for the drying tube (4).
5 Insert the adapter plate into the mounting position.
6 Turn the adapter plate clockwise and tighten it.

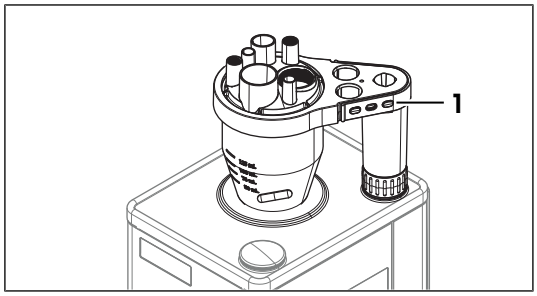


Install the vessel

1 Place the appropriate stir bar (4) into the vessel (3).
2 Stabilize the titration arm (1) with one hand.
3 Lift the vessel (3) up into the mounting position (2).
4 Tighten the vessel (5) counterclockwise.



5 Swivel in the titration arm (1).



4.6.7.3 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.

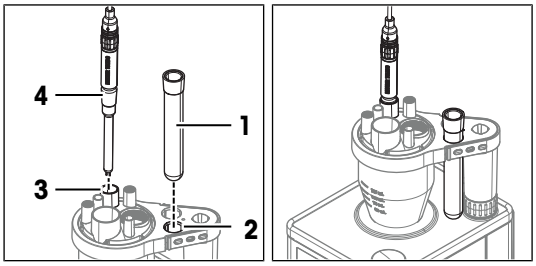
2 Insert the plug into the socket.

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).



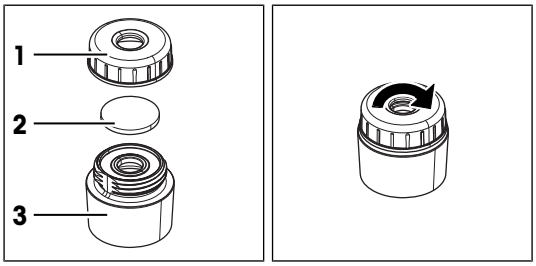
4.6.7.4 Install sample injection adapter and M24 stopper

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).

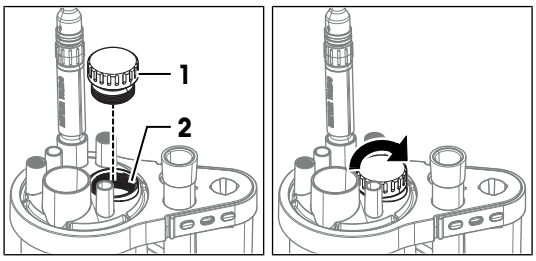
3 Screw the top clockwise on the bottom and tighten it.



Install sample injection adapter and M24 stopper

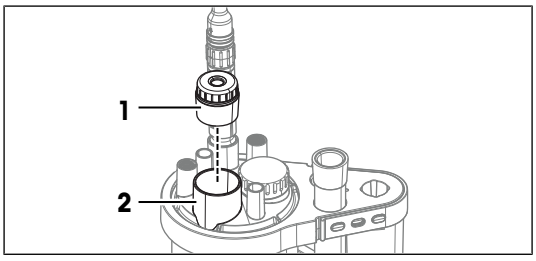
1 Screw the M24 stopper (1) clockwise into the mounting position (2).

2 Tighten the M24 stopper clockwise.



3 Insert the sample injection adapter (1) into the NS24 mounting position (2).

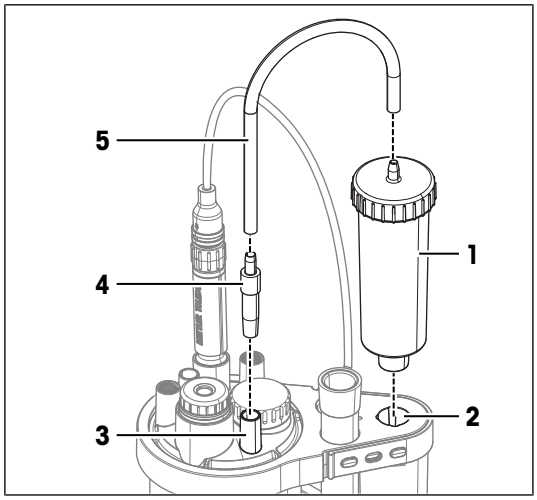
4 To tighten the connection, gently push the sample injection adapter down.



4.6.7.5 Install the drying tube

- The drying tube is prepared.

1 Push one end of the air tube (5) over the fitting on the tapered connector (4).
2 Insert the tapered connector (4) firmly into the NS7 mounting position (3).
3 Insert the drying tube (1) into the mounting position (2).
4 Push the free end of air tube (5) over the fitting (1).



4.6.8 Install the waste bottle and the solvent bottle

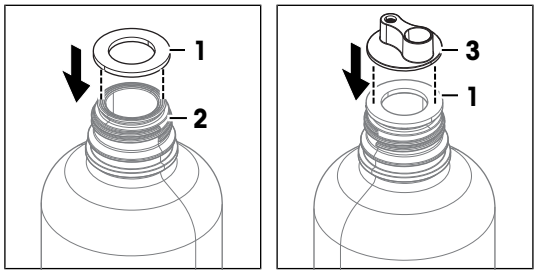
Overview of the actions

1 Install bottle adapters and drying tubes on the solvent bottle and on the waste bottle. See [Install bottle adapters and drying tubes ▸ Page 31].
2 Assemble the waste tube and the solvent tube. See [Assemble the waste tube and the solvent tube ▸ Page 32].
3 Connect the waste bottle. See [Connect the waste bottle ▸ Page 32].
4 Connect the solvent bottle. See [Connect the solvent bottle ▸ Page 33].

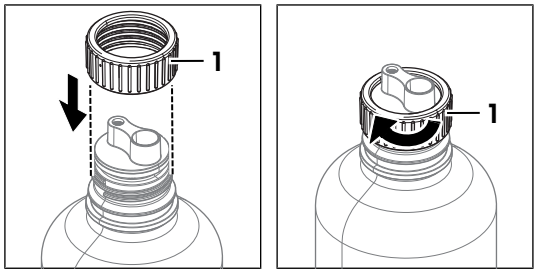
4.6.8.1 Install bottle adapters and drying tubes

- The drying tube is prepared.

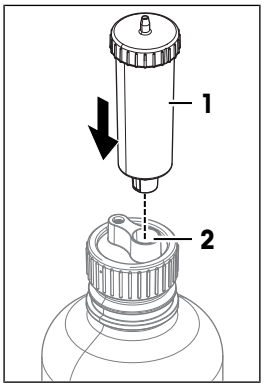
1 Place the flat seal (1) on the bottle (2).
2 Place the insert (3) on the flat seal (1).



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

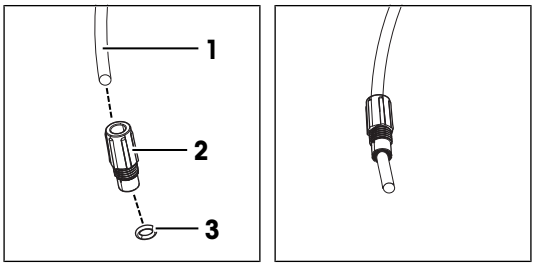
The solvent tube and the waste tube are identical tubes and are assembled in the same way.

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.



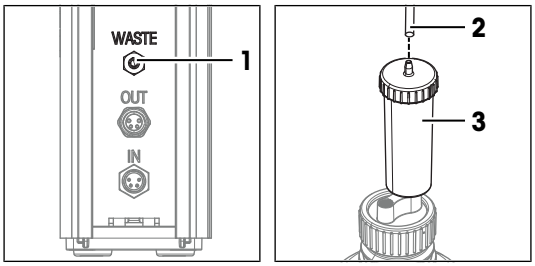
4.6.8.3 Connect the waste bottle

Material

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

Connect the waste bottle to the solvent pump

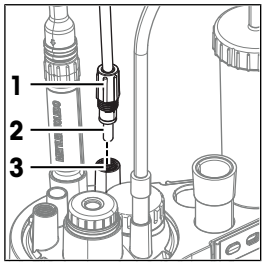
1 Push one end of the air tube over the **WASTE** fitting (1) on the pump.
2 Position the waste bottle behind the burette drive.
3 Make sure that there is no risk of knocking over the waste bottle.
4 Push the free end of the air tube (2) over the fitting on the drying tube (3).

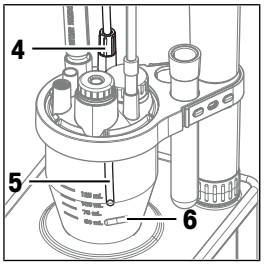


Connect the waste tube to the Karl Fischer cell

- The Karl Fischer cell is prepared.

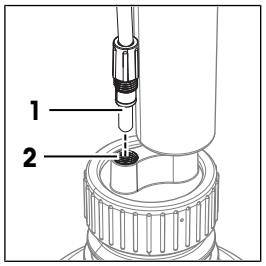
1 Insert one end of the waste tube (2) into the M9 mounting position (3).
2 Screw the M9 connector (1) clockwise into the M9 mounting position (3) without tightening it.
3 Slide the tube tip (5) down to the bottom of the Karl Fischer cell, without interfering with the stir bar (6).
4 Tighten the M9 connector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

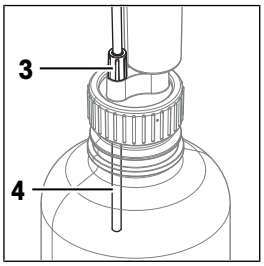




Connect the waste tube to the waste bottle

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 below the bottle adapter.
4 Tighten the M9 connector (3) clockwise.





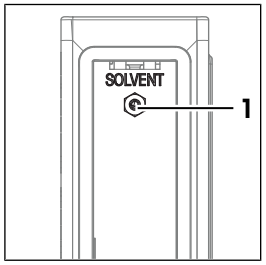
4.6.8.4 Connect the solvent bottle

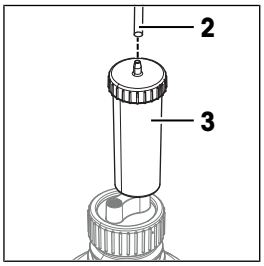
Material

- 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 behind 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).

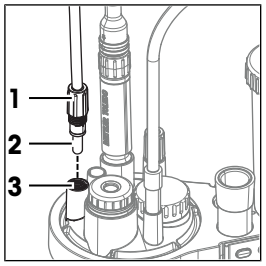


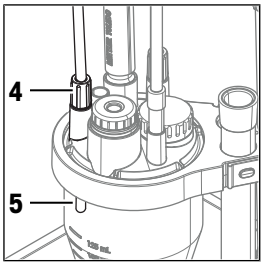


Connect the solvent tube to the Karl Fischer cell

- The Karl Fischer cell is prepared.

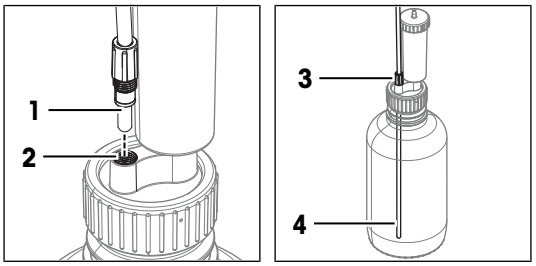
1 Insert one end of the solvent tube (2) into the M9 mounting position (3).
2 Screw the M9 connector (1) clockwise into the M9 mounting position (3) without tightening it.
3 Slide the solvent tube down into the Karl Fischer cell until the tube tip (5) is visible under the adapter plate.
4 Tighten the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

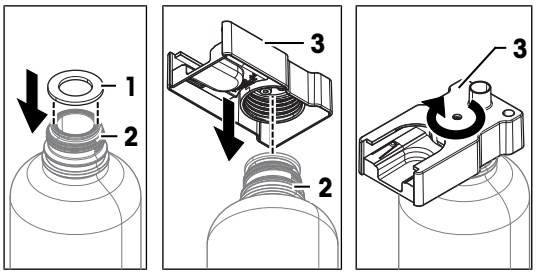
Overview of the actions

1 Install the burette parking station and the drying tube. See [Install the burette parking station ▸ Page 34].
2 Install the burette on the burette parking station. See [Install the burette on the burette parking station ▸ Page 34].
3 Connect the titrant bottle to the burette. See [Connect the titrant bottle to the burette ▸ Page 35].
4 Connect the burette to the Karl Fischer cell. See [Connect the burette to the Karl Fischer cell ▸ Page 36].

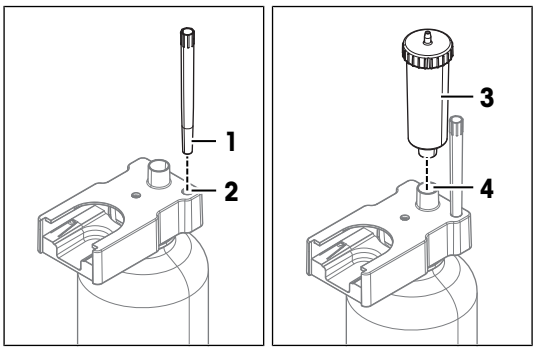
4.6.9.1 Install the burette parking station

- The drying tube is prepared.

1 Place the flat seal (1) on the bottle (2).
2 Screw the burette parking station (3) clockwise onto the bottle (2)
3 Tighten the burette parking station (3).

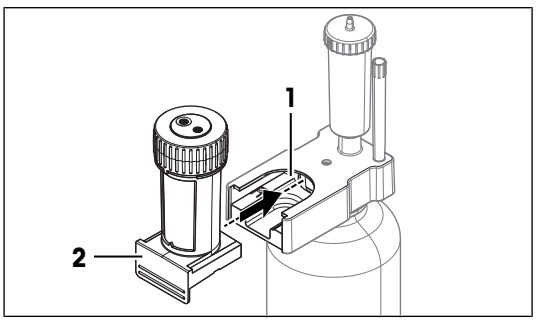


4 Insert the bottom end of the tube tip holder (1) into its mounting position (2).
5 Insert the drying tube (3) into the mounting position (4).



4.6.9.2 Install the burette on the burette parking station

– Slide the burette (2) into its mounting position (1) until it clicks into place.



4.6.9.3 Connect the titrant bottle to the burette

Connect the suction tube

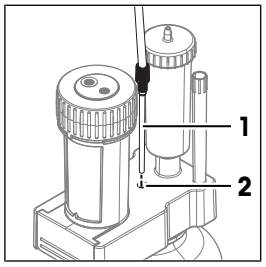
1 Position the titrant bottle next to the solvent pump.

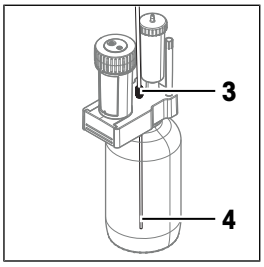
2 Make sure that there is no risk of knocking over the titrant bottle.

3 Insert the clear, exposed end of the suction tube (1) into the tube mounting position (2).

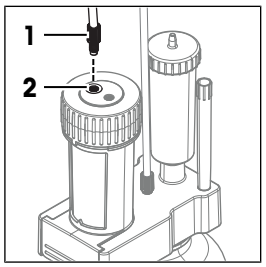
4 Slide the suction tube (4) down to the bottom of the titrant bottle.

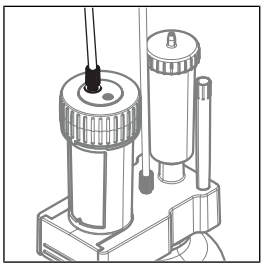
5 Screw the M6 connector (3) clockwise into the tube mounting position (2) and tighten it.





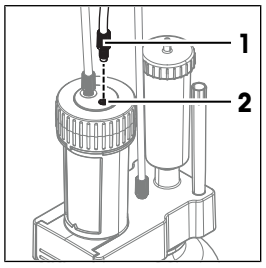
6 Screw the other M6 connector (1) clockwise into the inlet port (2) and tighten it.

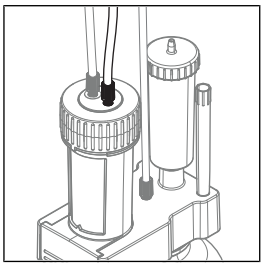




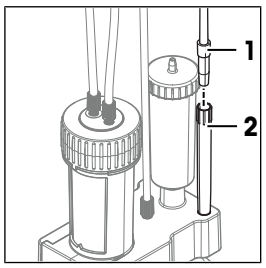
Connect the dispensing tube

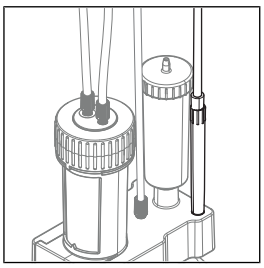
1 Screw the M6 connector (1) of the dispensing tube clockwise into the outlet port (2) and tighten it.





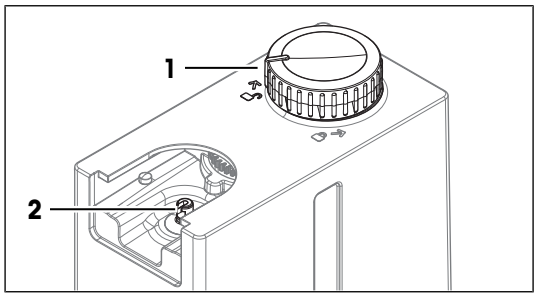
2 Insert the tapered connector (1) into the tube tip holder (2).



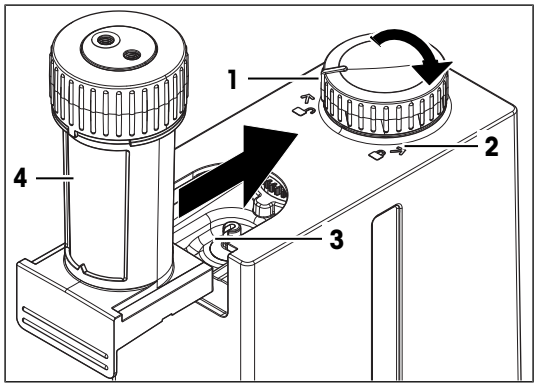


4.6.9.4 Connect the burette to the Karl Fischer cell

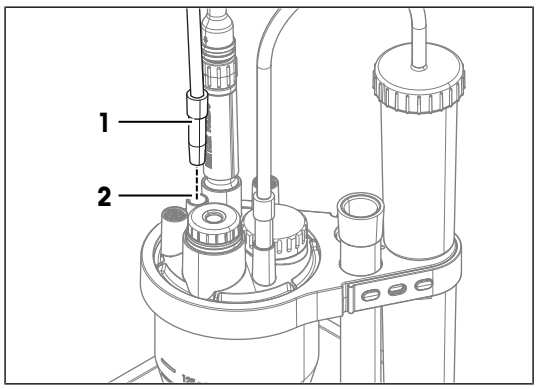
- The titrant bottle is connected to the burette.
- The piston rod (2) is in its lower position.
- The lock wheel points to the open-lock symbol (1).



1 Remove the burette from the burette parking station.
2 Slide the burette (4) into its mounting position (3).
3 Turn the lock wheel (1) clockwise to the closed-lock symbol (2).
4 Remove the tapered connector from the tube tip holder on the burette parking station.



5 Insert the tapered connector (1) firmly into the NS7 mounting position (2).



4.7 Set up 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 22].

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 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**.

4.8 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.

4.8.1 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.

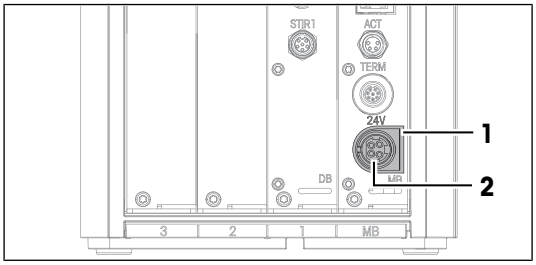
1 Install the cables in such a way that they cannot be damaged or interfere with operation.

2 Insert the plug of the power cable into the socket of the AC/DC adapter.

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

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

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



4.8.2 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 Configuration of analysis settings

5.1 Overview

5.1.1 Methods

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

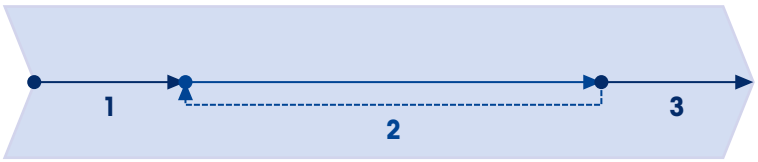
- Up to 500 customized methods can be stored on the titrator.
- You can execute customized methods repeatedly.

See also

Customization of analyses ▸ Page 15

5.1.1.1 Analysis sequence and method functions

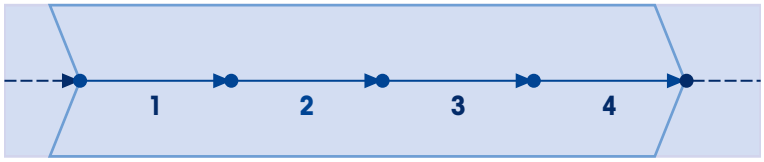
The steps that are performed during an analysis are grouped into different sequences. The following figure shows an example with three sequences.



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 volumetric 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 Vol)**	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 42
Methods ▸ Page 39

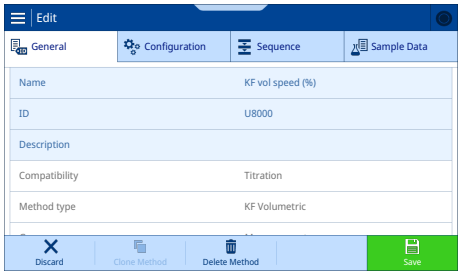
5.1.1.2 Method editor

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 volumetric Karl Fischer titration that includes an initial sequence, a sample sequence, and a final sequence.

General

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

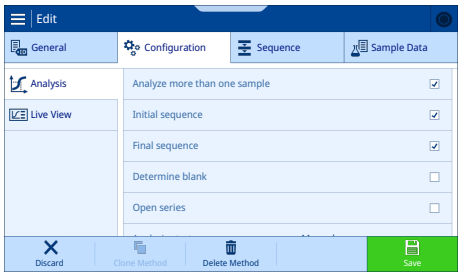


The following list shows some examples:

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

Configuration

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



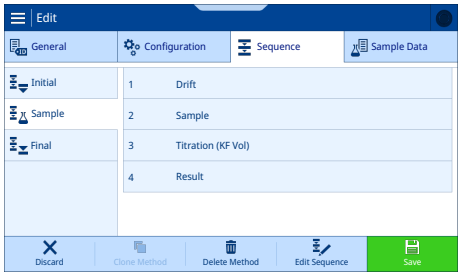
The following list shows some examples:

- 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

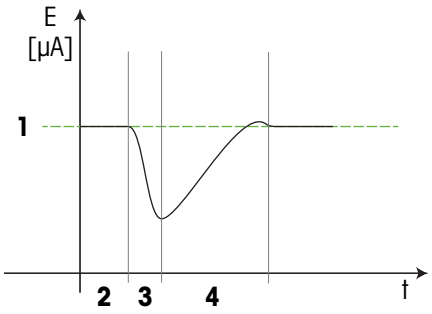
In the **Sample Data** tab you find parameters that define sample specific data.

The following list shows some examples:

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

5.1.2 Control algorithm

The control algorithm controls the titrant addition 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	The 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 titrant addition to keep the reaction rate high. A high reaction rate reduces the titration duration. 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 titrant addition without causing over-titration. • The chemical system is pushed to a state with iodine excess. The iodine excess increases the reaction rate. In chemical systems with slow reactions, the titration curve can temporarily overshoot the set current intensity. • The control algorithm uses information about the chemical system to predict the reduction in titrant addition that is necessary to avoid over-titration and terminate the titration at the set current intensity.

See also

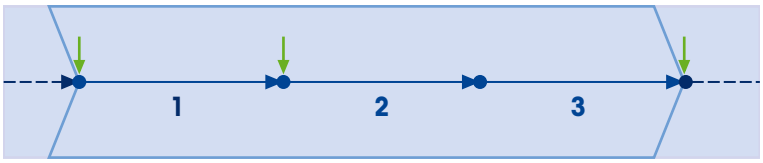
- Measurement principle ▸ Page 16
- Configure sample detection ▸ Page 44
- Configure titrant addition ▸ Page 45
- Configure the termination of the titration ▸ Page 47

5.2 Configure the sample analysis

5.2.1 Overview

5.2.1.1 Sample sequence

During the sample analysis, the sample sequence is executed. The sample sequence for a volumetric 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. 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. 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 Vol)** method function	This method function controls the actual titration and its termination.

See also

- Methods ▸ Page 39
- Analysis sequence and method functions ▸ Page 39
- Method editor ▸ Page 40

5.2.1.2 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]:

(VEQ*CONC-TIME*DRIFT/1000)

VEQ	Titrant volume that was added during titration
CONC	Titrant concentration as water equivalent in [mg] per titrant volume in [mL]
TIME	Duration of the interval between sample addition and termination of the titration
DRIFT	Water removed from the Karl Fischer cell during conditioning in [µg/min]

The DRIFT raw result is a measure for water that enters the Karl Fischer cell through physical drift and chemical drift. The following formula is used to calculate DRIFT:

DRIFT=DRIFTV*CONC

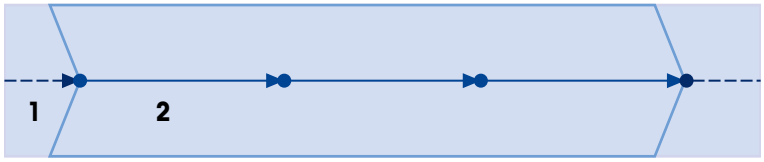
DRIFTV	Dispensing rate of titrant during conditioning in [µL/min] This dispensing rate is the raw result of the drift determination.
CONC	Titrant concentration as water equivalent in [mg] per titrant volume [mL]

See also

- Influence of atmospheric humidity ▸ Page 19
- Configure sample addition and sample detection ▸ Page 44
- Configure sample detection ▸ Page 44
- Configure the termination of the titration ▸ Page 47

5.2.2 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 and it is also 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. • **Min. start drift**: defines the lower limit of the range • **Max. start drift**: defines the upper limit of the range METTLER TOLEDO recommends to use **Absolute drift values** in combination with the termination criterion **Drift stop relative**.	**Absolute drift values**
The drift needs to be stable according to a set of internal criteria. This setting can be useful for samples that cause chemical drift. 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

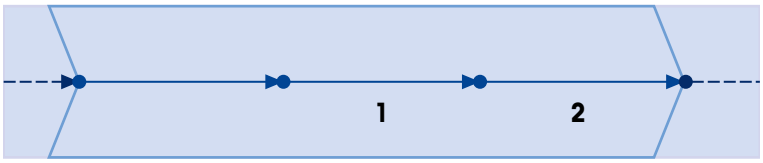
1 Open the method in the method editor.
2 Select the **Configuration** tab.
3 Change the settings for **Start criteria** as needed.
4 Change the settings for **Analysis start** as needed.
5 Tap **Save**.

See also

- Sample sequence ▸ Page 42
- Configure sample addition and sample detection ▸ Page 44
- Influence of atmospheric humidity ▸ Page 19
- Termination based on a set of criteria ▸ Page 47

5.2.3 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 Vol)** 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 42
- Configure start criteria and start of the sample analysis ▸ Page 43

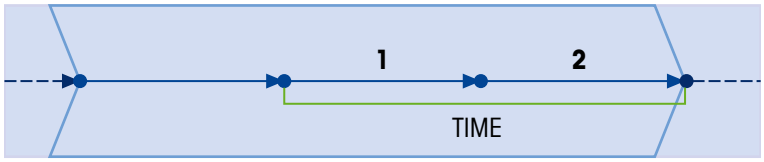
5.2.3.1 Configure sample detection

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. If users do not confirm the prompt within three minutes, the titrator skips the rest of the sample analysis.	**No**

Action of the system	Sample detection
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**

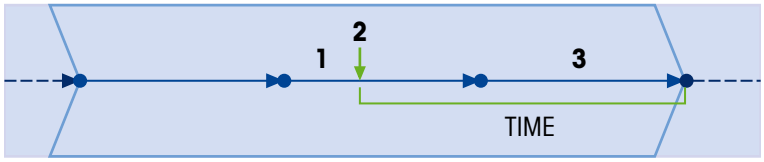
Manual confirmation of sample addition and TIME



TIME is defined as the duration from the start of the **Sample** method function (1) to the end of the **Titration (KF Vol)** 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 Vol)** 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 41
- Raw results and calculation of water content ▸ Page 42

5.2.4 Configure titrant addition

The control algorithm controls titrant addition during titration. You can customize the following aspects of the control algorithm:

- Optimization focus
- Risk of over-titration
- Polarization potential between the sensor pins
- Current intensity for titration termination

See also

- Control algorithm ▸ Page 41
- Measurement principle ▸ Page 16

5.2.4.1 Optimization focus and risk of over-titration

Optimization focus

The control algorithm optimizes titrant addition. **Control focus** defines which optimization focus the control algorithm applies when calculating titrant addition.

Optimization focus	Control focus
A shorter titration duration has a higher priority than termination at the exact user-defined current intensity. • Titrant is added more aggressively. • The variability between the current intensity at the termination of the titration and the set current intensity is higher.	**Speed**
Terminating the titration at the user-defined current intensity has a higher priority than a short titration duration. • Titrant is added more cautiously when the current intensity approaches the set current intensity. • The variability between the current intensity at the termination of the titration and the set current intensity is lower.	**Accuracy**

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 titrant addition. 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 Vol)** 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 41
- Measurement principle ▸ Page 16
- Polarization potential and current intensity ▸ Page 46

5.2.4.2 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.

When you select an option for **Control focus**, the settings for **Potential (Upol)** and **Set current** are set to values that work well for many systems. You can change the settings after you have selected an option for **Control focus**.

Control focus	Set current	Potential (Upol)
Speed	80 µA	100 mV
Accuracy	30 µA	100 mV

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 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 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

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

Procedure

1 Open the method in the method editor.
2 Select the **Sequence** tab.
3 Select the **Titration (KF Vol)** 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 41
Measurement principle ▸ Page 16

5.2.5 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.

5.2.5.1 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
- Maximum titrant volume

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: DRIFT+**Drift relative** A larger value for drift can reduce the analysis time. The potential error of the water determination increases with increasing values for drift. METTLER TOLEDO recommends to use **Drift stop relative** in combination with the start criterion **Absolute drift values**.	**Drift stop relative**
The drift needs to be stable according to a set of internal criteria. This setting can be useful for samples that cause chemical drift. • For **Control focus**=**Speed**: the change in drift is lower than 60 µg/min/s during 10 s. • For **Control focus**=**Accuracy**: the change in drift is lower than 40 µg/min/s during 10 s. METTLER TOLEDO recommends to use **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 is restarted.

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.

Maximum volume of titrant

The value of **At Vmax** defines the maximum volume of titrant that can be dispensed during the titration. If the set of termination criteria is not fulfilled before the maximum volume is dispensed, 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 Vol)** 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

- Raw results and calculation of water content ▸ Page 42
- Configure titrant addition ▸ Page 45
- Influence of atmospheric humidity ▸ Page 19
- Configure start criteria and start of the sample analysis ▸ Page 43

5.2.5.2 Termination after a user-defined time period

You can define two criteria for the termination of the titration. The titration is terminated when one of the criteria is fulfilled.

- **Duration**: defines the titration duration in [s].
- **At Vmax**: defines the maximum volume of titrant that can be dispensed during the titration. If the titration is terminated because the maximum titrant volume has been dispensed, 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 Vol)** 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 42
- Influence of atmospheric humidity ▸ Page 19

6 Operation

6.1 Start up and shut down the titrator

6.1.1 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:

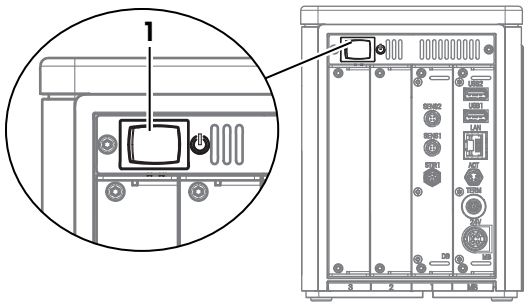
- Users can confirm the message and the titrator uses the device with default values. Users can change these default values later if they do not fit their needs.
- The titrator opens an editor so that users can edit the settings.

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 the water content of ethanol ▸ Page 50

6.1.2 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 power outlet.

See also

Forced shutdown ▸ Page 71

6.2 Example: determine the water content of ethanol

This example shows how to determine the water content of ethanol using a method of the **KF Volumetric** 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 24

6.2.1 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 the two methods:

- A method to determine the titrant concentration
- A method to determine the water content of samples

Determination of the titrant concentration

A method of the **KF Concentration** method type is used to determine the titrant concentration. The concentration determination corrects for systematic errors and is a prerequisite for accurate results. At the end of the method, the actual titrant concentration is calculated and stored in the resource entry of the titrant.

Water content determination of ethanol

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

Material

- Titrant: one-component volumetric Karl Fischer titrant, 5 mg/mL
- Solvent: anhydrous methanol
- Standard: liquid water standard, 1 %
- Sample: ethanol

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 51].
2 Fill the burette, the suction tube, and the dispensing tube. See [Fill the burette with titrant ▸ Page 54].
3 Fill the Karl Fischer cell with solvent. See [Fill the Karl Fischer cell with solvent ▸ Page 54].
4 Determine the titrant concentration. See [Determine the titrant concentration ▸ Page 55].
5 Determine the water content of ethanol. See [Determine the water content of ethanol ▸ Page 58].

6.2.2 Configure the resources for the example

For this example, the following resources are needed:

- Sensor
- Pump
- Burette
- Titrant
- Karl Fischer cell
- Standard

Some 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 these resources with the default values.

- Sensor
- Pump
- Burette
- Titrant

A resource entry for the Karl Fischer cell is predefined on the titrator. Because the titrator does not detect the Karl Fischer cell, you need to check the predefined settings.

No standards are predefined on the titrator. You need to create and configure a resource entry for the standard.

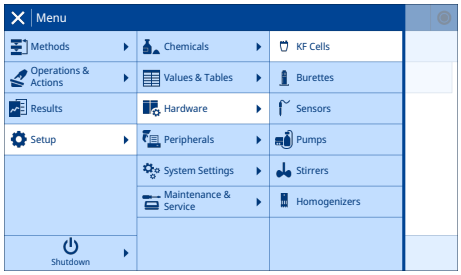
Read the Reference Manual for more information on how to configure resources. See [Download manuals ▸ Page 22].

See also

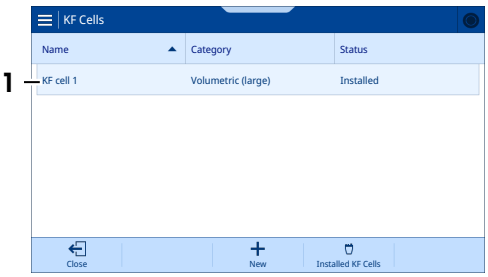
Download manuals ▸ Page 22

6.2.2.1 Edit the resource entry for the Karl Fischer cell

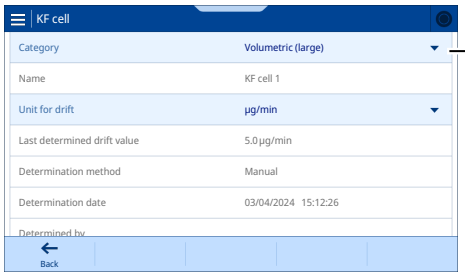
1 Go to ☰ > ⚙ **Setup** > **Hardware** > **KF Cells**.



2 Select the installed Karl Fischer cell (1).

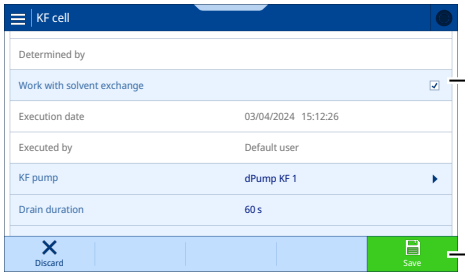


3 For **Category** (1), select the vessel size of the installed vessel.



4 Scroll down to **Work with solvent exchange** (1) and activate it.

5 Tap 💾 **Save** (2).



6.2.2.2 Create and edit a resource entry for the standard

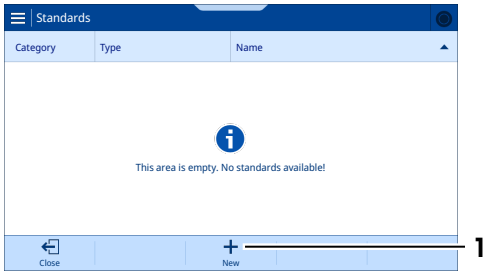
Material

- Certificate for the 1 % water standard

Procedure

1 Go to ☰ > ⚙ **Setup** > **Chemicals** > **Standards**.

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



3 In the **Generic Templates** tab (1), select **KF Liquid Standard %** (2).

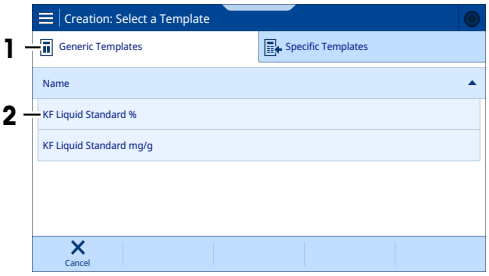
➡ The **Create: Standard** window with the **Standard** tab opens.

4 For **Name**, enter the required name.

5 For **Water content**, enter the water content as written on the certificate.

6 If needed, change the **Unit**.

7 Tap **Create**.



6.2.2.3 Edit the resource entries for the titrant and the burette

This chapter describes how you can change the titrant name and the burette volume. Both changes are optional.

Change the titrant name

- No task or action is running.
- The home screen is open.

1 Remove the burette from the burette drive.

2 Re-install the burette onto the burette drive.

➡ A message opens with options to set up the titrant.

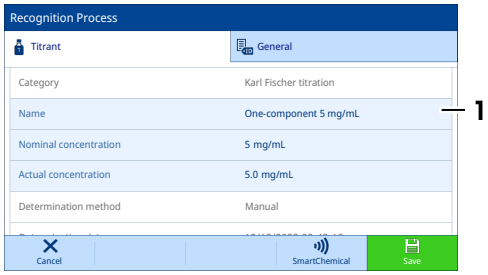
3 Tap **Edit**.

➡ The **Recognition Process**: **Titrant** window with the **Titrant** tab opens.

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

5 Tap **Save**.

➡ A message opens with options to set up the burette.



Change the burette volume

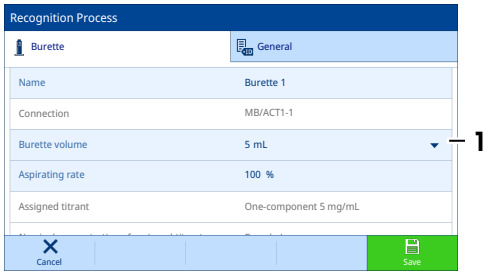
1 Tap **Edit**.

➡ The **Recognition Process**: **Burette** window with the **Burette** tab opens.

2 For **Burette volume** (1), select the correct volume.

3 Tap **Save**.

➡ The home screen opens.



6.2.3 Fill the burette with titrant

The **Rinse burette** operation automates the filling of the burettes and the tubes. To fill the burette and the tubes completely, four rinse cycles are recommended.

The titrant is only dispensed accurately if the tubes and the burette are filled completely. Inaccurate dispensing of titrant leads to inaccurate analysis results.

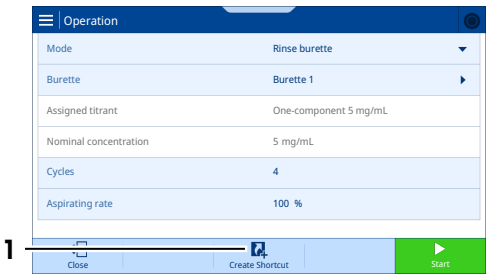
Configure the Rinse burette operation

- The burette is connected to the Karl Fischer cell and the titrant bottle.

1 Go to ☰ > **Operations & Actions** > **Burette**.
   ➡ The **Operation**: **Burette** window opens.
2 For **Mode**, select **Rinse burette**.
3 For **Burette**, select the required burette.
4 For **Cycles**, enter "4".

Create a shortcut for the operation

1 Tap **Create Shortcut** (1).
2 For **Name**, enter the name of the shortcut.
3 Tap **Create**.
4 To open the home screen, tap .



Fill the burette

1 Tap the shortcut (1).
2 Tap **Start**.
   ➡ The titrator performs the rinse cycles.
   ➡ The home screen opens.
3 Check that no air is trapped in the tubes or the burette.

Remove trapped air

1 Tap the shortcut for rinsing the burette.
2 For **Cycles**, enter "1".
3 Tap **Start**.
4 Lightly tap the tube with a finger during the rinse cycle.
5 Repeat the steps until the tubes and the burette are completely filled with titrant.

6.2.4 Fill the Karl Fischer cell with solvent

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

- Draining: removes the titrant that was dispensed into the Karl Fischer cell when the burette was filled.
- Filling: fills the Karl Fischer cell with solvent.

Configure the Solvent Exchange operation and create a shortcut

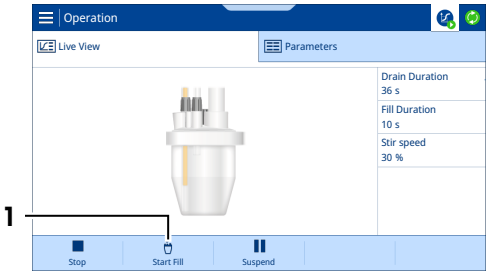
- The Karl Fischer cell is connected to the solvent bottle and to the waste bottle.

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

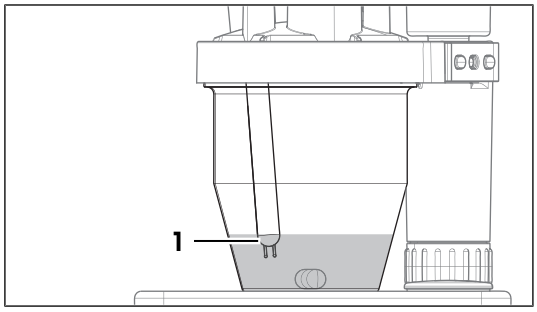
2 Tap **Create Shortcut**.
3 For **Name**, enter the name of the shortcut.
4 Activate **Immediate start**.
5 Tap **Create**.
6 To open the home screen, tap .

Drain and fill the Karl Fischer cell

1 Tap the shortcut for the solvent exchange.
➡ The pump drains titrant from the Karl Fischer cell.
2 To stop draining and start filling, tap **Start Fill** (1).
➡ The pump pumps solvent into the Karl Fischer cell.



3 When the solvent covers the sensor tip (1), tap **Stop**.
➡ The pump stops.
➡ The home screen opens.

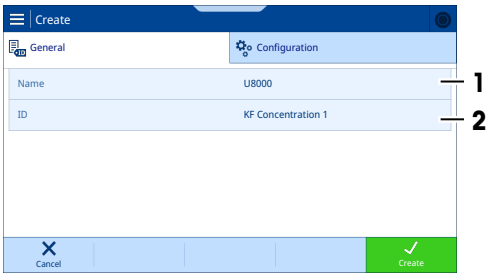


6.2.5 Determine the titrant concentration

6.2.5.1 Create and edit the method

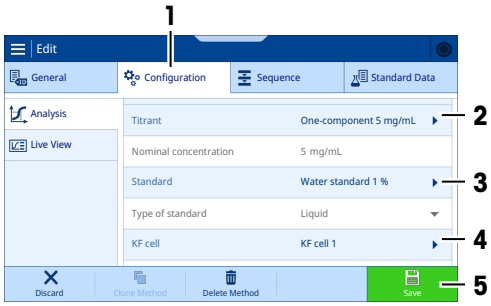
Create the method

1 Go to > **Methods** > **KF Concentration**.
2 Tap **New**.
3 In the **Generic Templates** tab, select the template **T009 KF conc speed (STD %)**.
4 For **Name** (1), enter the required name.
5 For **ID** (2), enter the required identifier.
6 Tap **Create**.
➡ The method is saved and listed with the name and the identifier.



Edit the method

1 Select the **Configuration** tab (1).
2 Scroll down to **Titrant** (2).
3 For **Titrant** select the entry you edited earlier.
4 For **Standard** (3) select the entry you created earlier.
5 For **KF cell** (4) select the entry you edited earlier.
➡ The settings in the method are updated with the current settings in the resource entry.
6 Tap **Save** (5).
7 Tap **Create Task**.



6.2.5.2 Create a shortcut

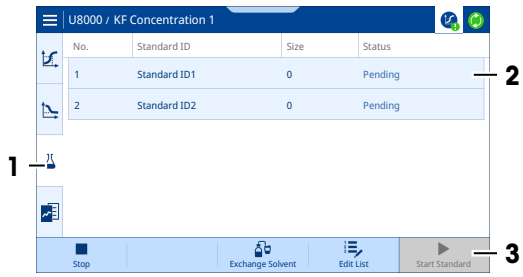
1 Tap **Create Shortcut**.
2 For **Name**, enter the name of the shortcut.
3 Activate **Immediate start**.
4 Tap **Create**.
5 To open the home screen, tap .
➡ The home screen opens.

6.2.5.3 Perform the analysis

6.2.5.3.1 Prepare the sample entries

Start the analysis and edit sample identifiers

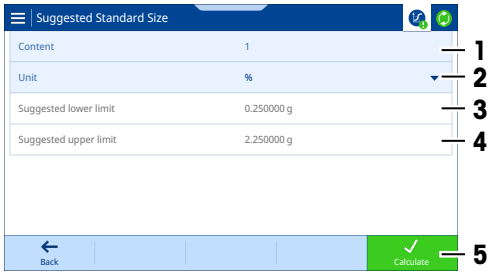
1 Tap the shortcut for the concentration method.
➡ The titrator prepares the Karl Fischer cell for titration.
➡ **Start Standard** (3) remains gray until the Karl Fischer cell is ready for titration.
2 Tap (1).
➡ The sample view opens.
3 Select the entry for the first sample of the chemical standard (2).
4 For **Standard ID**, enter the required identifier.



Calculate sample weight

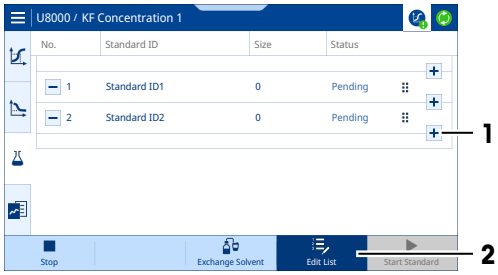
1 Tap **Size Calculation** (1).

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



Add sample entries

1 Tap **Edit List** (2).
2 Tap + (1).
3 Tap **Create**.
4 Edit the data of the chemical standard.
5 Return to the sample view.
6 To exit the editing mode, tap **Edit List**.



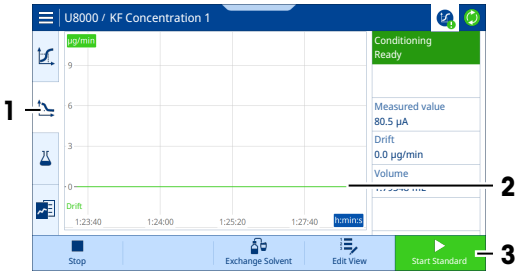
See also

Volumetric Karl Fischer titration ▸ Page 18

6.2.5.3.2 Perform the titration

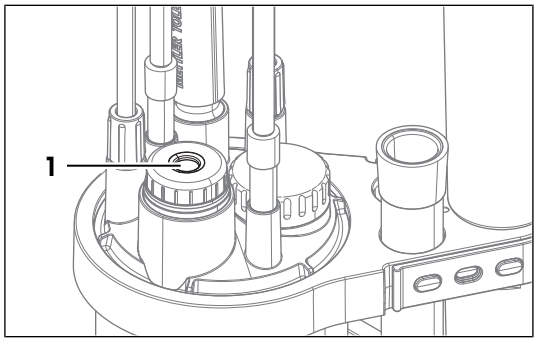
Prepare the titration

1 Tap (1) and check that the drift is stable (2).
2 Check that **Start Standard** (3) is green.
3 Draw approximately 1 mL of the chemical standard 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 chemical standard into the syringe.
2 Place the syringe on the balance.
3 Zero the balance.
4 On the titrator, tap **Start Standard**.
5 Inject approximately 1 mL of the chemical standard 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 **Standard size** window, enter the weight.
8 Tap **OK**.
➡ When the titration is completed, the calculated concentration is displayed.
9 Repeat the steps for the remaining samples of the chemical standard.
➡ When the last sample is analyzed, the titrator updates the actual concentration that is stored in the resource entry for the titrant.



➡ The titrator writes the actual concentration to the RFID chip of the burette.

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

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

See also

Prepare the sample entries ▸ Page 56

Volumetric Karl Fischer titration ▸ Page 18

6.2.6 Determine the water content of ethanol

6.2.6.1 Create and edit the method

1 Go to ☰ > **Methods** > **KF Volumetric**.

2 Tap + **New**.

3 In the **Generic Templates** tab, select the template **T001 KF vol speed (%)**.

4 For **Name**, entered the required name.

5 For **ID**, enter the required identifier.

6 Tap ✓ **Create**.

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

Edit the method

1 Select the **Configuration** tab.

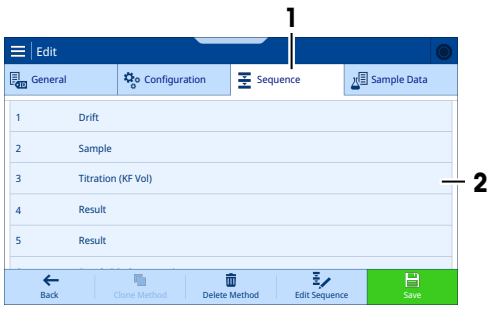
2 Scroll down to **KF cell**.

3 For **KF cell** select the entry you edited earlier.

➡ The settings in the method are updated with the current settings in the resource entry.

4 Select the **Sequence** tab (1).

5 Select the **Titration (KF Vol)** method function (2).



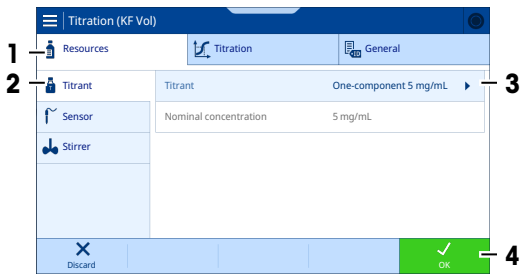
6 In **Resources** (1) > **Titrant** (2), select for **Titrant** (3) the entry you edited earlier.

7 Tap ✓ **OK** (4).

8 Tap ← **Back**.

9 Tap **Save**.

10 Tap ▶ **Create Task**.



6.2.6.2 Create a shortcut

1 Tap **Create Shortcut**.

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

3 Activate **Immediate start**.

4 Tap ✓ **Create**.

5 To open the home screen, tap .

➡ The home screen opens.

6.2.6.3 Perform the analysis

Prepare the sample entries

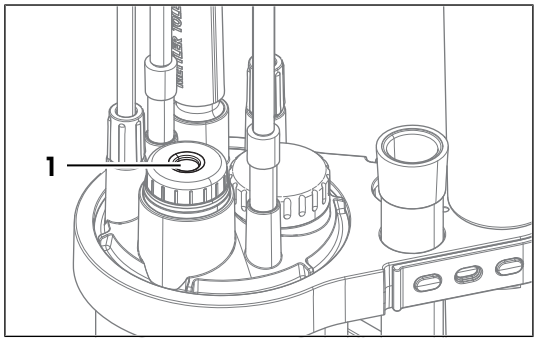
1 Tap the shortcut for the method.
2 Edit the sample identifiers.
3 Calculate sample weights.
4 If needed, add sample entries.

Prepare the titration

1 Tap and check that the drift is stable.
2 Check that **Start Sample** 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 the required amount 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 **OK**.
   ➡ 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

Perform the analysis ▸ Page 56

7 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

7.1 Maintenance schedule

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

7.1.1 Titrator

Before each measurement series

Task	Link
Check that the burette is filled completely.	[Fill the burette with titrant ▸ Page 54]
1 Check that the suction tube and the dispensing tube are filled with titrant. 2 Check that no air is trapped in the suction tube or the dispensing tube.	[Fill the burette with titrant ▸ Page 54]
1 Check if the desiccant in any of the drying tubes is saturated with moisture. 2 Replace desiccant that is saturated with moisture.	[Prepare drying tubes ▸ Page 27]
1 Check the septum for holes. 2 Replace any septum with holes.	[Install sample injection adapter and M24 stopper ▸ Page 30]

Every day

Task	Link
At the beginning of the workday, determine the titrant concentration.	[Determine the titrant concentration ▸ Page 55]

Every month

Task	Link
Clean the housing and the titrator cover.	[Clean the housing ▸ Page 61]
Clean the Karl Fischer cell.	[Empty and clean the Karl Fischer cell ▸ Page 65]
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 61]
Rinse the suction tube and the dispensing tube.	[Rinse burette and tubes with rinsing agent ▸ Page 63]
Empty and clean burette and tubes.	[Empty and clean the burette ▸ Page 62]
Clean the Karl Fischer cell.	[Empty and clean the Karl Fischer cell ▸ Page 65]

7.1.2 Terminal

Every month

Task	Link
Clean the terminal and the terminal cover.	[Clean the terminal ▸ Page 68]

Before periods of inactivity

Task	Link
Clean the terminal and the terminal cover.	[Clean the terminal ▸ Page 68]

7.1.3 Solvent pump dPump KF

Every month

Task	Link
Clean the housing.	[Clean the solvent pump dPump KF ▸ Page 69]

Before periods of inactivity

Task	Link
Clean the housing.	[Clean the solvent pump dPump KF ▸ Page 69]
Empty the solvent tube and the waste tube.	[Empty the Karl Fischer cell ▸ Page 65]

7.2 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.

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

▸ www.mt.com/contact

7.2.1 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.

7.2.2 Empty and clean the burette

With the operations **Empty mult. burettes** and **Rinse burette** you can empty the burette and remove titrant residue.

- **Empty mult. burettes**: automates the emptying of one or more burettes. After two cycles the burette and both tubes are empty.
  - The first cycle empties the burette and the dispensing tube.
  - The second cycle empties the suction tube.
- **Rinse burette**: automates the rinsing of the burette, the suction tube, and the dispensing tube. Rinsing the burette and the tubes with a rinsing agent removes titrant residue.

Overview of the actions

1 Remove titrant from burette and tubes with **Empty mult. burettes**.
2 Move the burette parking station from the titrant bottle to a bottle with rinsing agent.
3 Use **Rinse burette** to rinse burette and tubes with rinsing agent.
4 Remove rinsing agent from burette and tubes with **Empty mult. burettes**.
5 Remove and clean the burette.

See also

- Rinse burette and tubes with rinsing agent ▸ Page 63
- Empty the burette of titrant ▸ Page 62
- Disconnect the tubes and remove the burette ▸ Page 63
- Clean the burette ▸ Page 64

7.2.2.1 Empty the burette of titrant

- The burette is connected to the titrant bottle and the Karl Fischer cell.
- No task or action is running.

1 Go to ☰ > **Operations & Actions** > **Burette**.
2 For **Mode**, select **Empty mult. burettes**.
3 Activate the required burette.
4 For **Cycles**, enter "2".
5 Tap **Start**.
   ➡ The titrator performs the rinse cycles.

➡ The home screen opens.

7.2.2.2 Rinse burette and tubes with rinsing agent

METTLER TOLEDO recommends the following rinsing agents:

- Ethanol

Recommended volume of rinsing agent

The volume of rinsing agent depends on the burette volume.

Burette volume	Volume of rinsing agent
2 mL	6 mL
5 mL	15 mL
10 mL	30 mL

Preparation

1 Measure out the volume of rinsing agent.
2 Pour the rinsing agent into an empty bottle.
3 Unscrew the burette parking station counterclockwise from the titrant bottle.
4 Wipe the end of the suction tube with a clean tissue.
5 Screw the burette parking station clockwise onto the bottle with rinsing agent.
6 Make sure the suction tube is immersed in the rinsing agent.

Rinse the burette

- The burette is connected to the bottle with rinsing agent and the Karl Fischer cell.
- No task or action is running.

1 Go to > **Operations & Actions** > **Burette**.
2 For **Mode**, select **Rinse burette**.
3 For **Burette**, select the required burette.
4 For **Cycles**, enter "3".
5 Tap **Start**.
➡ The titrator performs the rinse cycles.
➡ The home screen opens.

Empty the burette

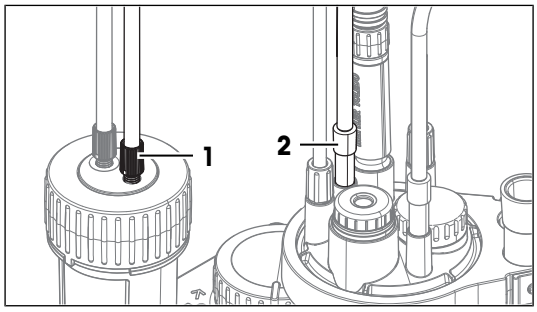
- The burette is connected to the bottle with rinsing agent and the Karl Fischer cell.

1 Go to > **Operations & Actions** > **Burette**.
2 For **Mode**, select **Empty mult. burettes**.
3 Activate the required burette.
4 For **Cycles**, enter "2".
5 Tap **Start**.
➡ The titrator performs the rinse cycles.
➡ The home screen opens.

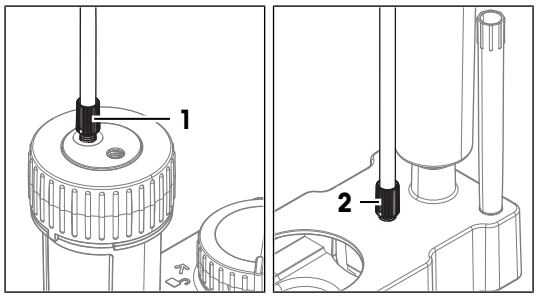
7.2.2.3 Disconnect the tubes and remove the burette

1 Shut down the titrator.

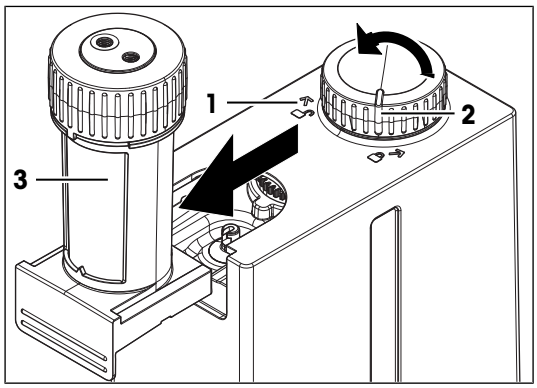
2 Loosen the M6 connector (1) counterclockwise and remove it from the burette.
3 Pull the tapered connector (2) out of the adapter plate and lift the dispensing tube out of the Karl Fischer cell.
4 Wipe the end of the dispensing tube with a clean tissue.



5 Loosen the M6 connector (1) counterclockwise and remove it from the burette.
6 Unscrew the burette parking station counterclockwise from the bottle with rinsing agent.
7 Wipe the end of the suction tube with a clean tissue.
8 Loosen the M6 connector (2) counterclockwise and lift the suction tube out of the burette parking station.



9 Turn the lock wheel (2) counterclockwise to the open-lock symbol (1).
10 Slide the burette (3) out of its mounting position.



7.2.2.4 Clean the burette

NOTICE

Incorrect results due to incorrect reassembly

The burette volume is saved to the RFID chip of the burette during production. If several burettes with different volumes are cleaned at the same time, a mismatch during reassembly is possible.

– Check the burette volume saved to the RFID chip and correct it if needed.

Read the User Manual of the burette for information on how to clean the burette. See [Download manuals ▸ Page 22].

See also

- Edit the resource entries for the titrant and the burette ▸ Page 53
- Install the titrant bottle ▸ Page 34

7.2.3 Empty and clean the Karl Fischer cell

7.2.3.1 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.

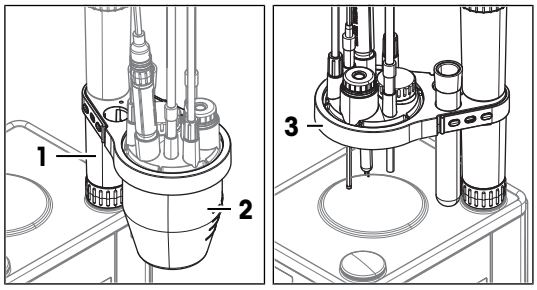
Empty the Karl Fischer cell and the waste tube

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.

7.2.3.2 Remove the vessel

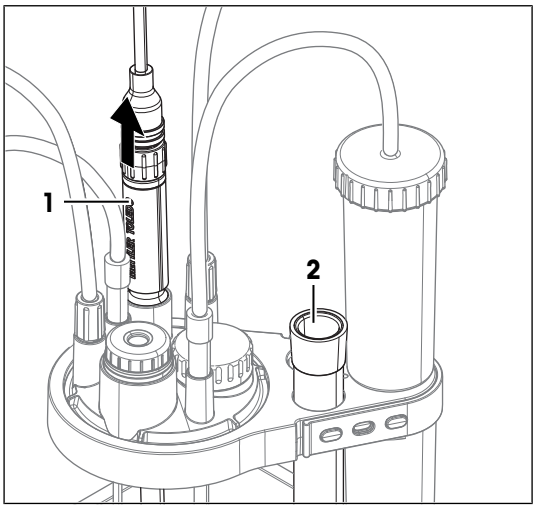
1 Shut down the titrator.
2 Slowly swivel out the titration arm and take care that none of the tubes is under tension.
3 Stabilize the titration arm (1) with one hand and unscrew the vessel (2) clockwise with the other hand.
4 Remove the vessel.
5 Wipe the ends of the tubes with a clean tissue.
6 Wipe the pins and the shaft of the sensor with a clean tissue.
7 Dispose of the solvent in the vessel as required by the safety data sheet and the rules of your workplace.



8 Slowly swivel in the titration arm (3) and take care that none of the tubes is under tension.

7.2.3.3 Remove the sensor

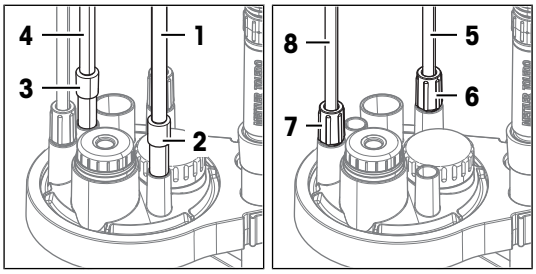
1 Pull the sensor (1) out of the adapter plate.
2 Hold the sensor over a suitable waste container and rinse it with the cleaning agent.
3 Insert the sensor into the protective sleeve (2).



7.2.3.4 Disconnect the tubes

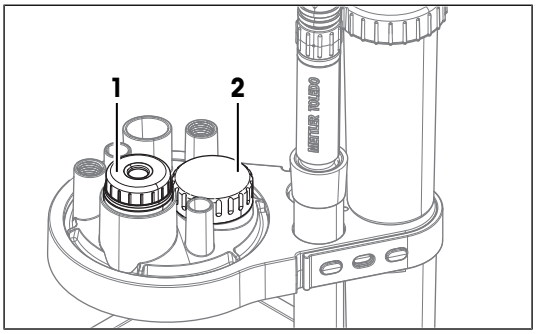
- The titrator is shut down.
- The Karl Fischer cell, the solvent tube, and the waste tube are empty.

1 Pull out the tapered connector (2) and remove the air tube (1).
2 Pull out the tapered connector (3) and lift the dispensing tube (4) out of the Karl Fischer cell.
3 Insert the tapered connector of the dispensing tube (4) into the tube tip holder on the burette parking station.
4 Unscrew the M9 connector (7) counterclockwise.
5 Lift the solvent tube (8) out of the Karl Fischer cell and slide the M9 connector (7) all the way back to the bottle adapter.
6 Unscrew the M9 connector (6) counterclockwise.
7 Lift the waste tube (5) out of the Karl Fischer cell and slide the M9 connector (6) all the way back to the bottle adapter.



7.2.3.5 Remove the M24 stopper and the sample injection adapter

1 Pull the sample injection adapter (1) out of the adapter plate.
2 Unscrew the M24 stopper (2) counterclockwise and remove it.



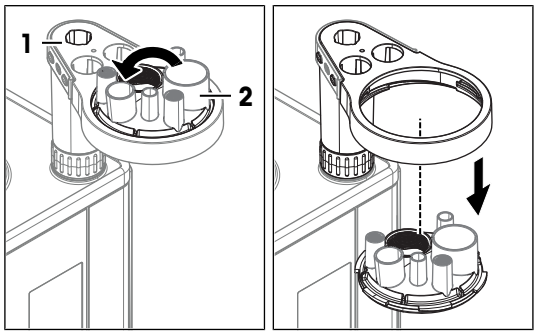
7.2.3.6 Remove adapter plate and O-rings

Material

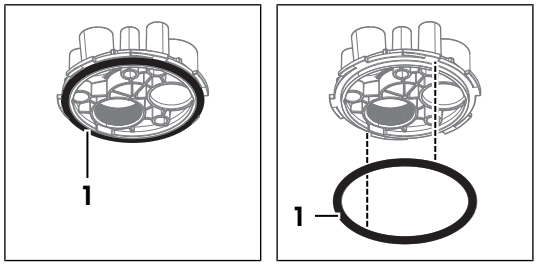
- Blunt, slim tool such as a small screwdriver

Remove the adapter plate

1 Swivel out the titration arm (1).
2 Stabilize the titration arm (1) with one hand.
3 Turn the adapter plate (2) counterclockwise, gently push it down and remove it.

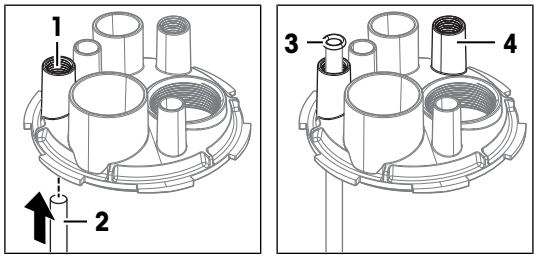


4 Remove the adapter plate seal (1) from the bottom of the adapter plate.



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) from below out of the M9 mounting position.
3 Repeat the steps with the other M9 mounting position (4)



7.2.3.7 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.

7.2.3.8 Reinstall the Karl Fischer cell

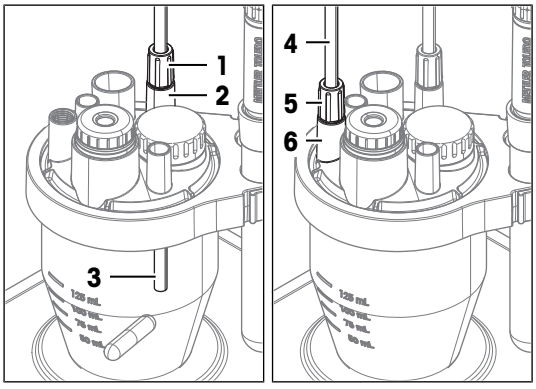
Install vessel, adapter plate and stoppers

- The titrator is shut down.

1 Install the adapter plate and the vessel. See [Install adapter plate and vessel ▸ Page 29].
2 Install the M24 stopper and the sample injection adapter. See [Install sample injection adapter and M24 stopper ▸ Page 30]

Connect the solvent bottle and the waste bottle

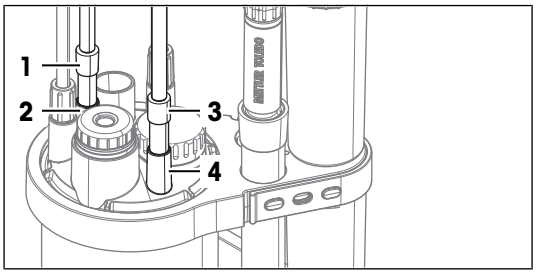
- The waste bottle is assembled.
- The solvent bottle is assembled.



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.
5 Tighten the M9 connector (1) clockwise.
6 Insert the free end of the solvent tube (4) into the M9 mounting position (6).
7 Slide the M9 connector of the solvent tube from the bottle adapter to the M9 mounting position (6) on the adapter plate.
8 Screw the M9 connector (5) clockwise into the M9 mounting position (6) without tightening it.
9 Slide the solvent tube down into the Karl Fischer cell until the tip of the tube is visible but does not come in contact with the liquid inside the vessel.
10 Tighten the M9 connector (5) clockwise.

Connect the burette and the drying tube

- The titrant bottle is assembled and connected to the burette.



1 Insert the tapered connector of the dispensing tube (1) into the NS7 mounting position (2).
2 Insert the tapered connector of the air tube (3) firmly into the NS7 mounting position (4).

Install the sensor

– Install the sensor. See [Install the sensor ▸ Page 30].

7.2.4 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.

7.2.5 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.

7.3 Replace tube ferrules

Tube ferrules are seals on the suction tube and the dispensing tube.

When connections involving tube ferrules leak, the tube ferrules need to be replaced.

Material

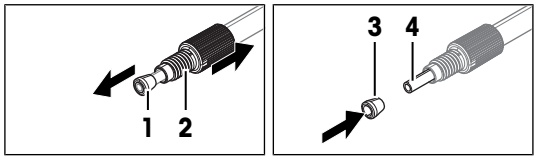
- Tube ferrules
- Tube cutter

Procedure

1 Empty and rinse the burette.

2 The tube is not connected to a bottle or the burette.

3 Push the M6 connector (2) back until the tube ferrule (1) and a small piece of the clear tube are visible.



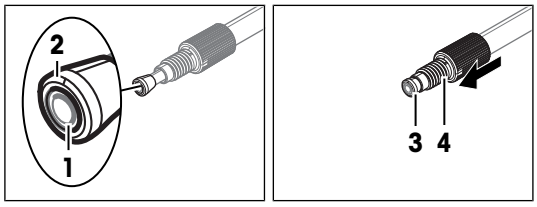
4 Remove the old tube ferrule (1) from the tube.

5 If the tip of the tube is damaged, use a tube cutter to perpendicularly cut off the damaged part.

6 Push a new tube ferrule (3) over the end of the clear tube (4).

7 Align the end of the tube ferrule (2) with the end of the inner tube (1).

8 Push the M6 connector (4) over the tapered end of the tube ferrule (3).



See also

Empty and clean the burette ▸ Page 62

7.4 Prepare the titrator for storage

1 Empty and rinse the burette.

2 Empty the Karl Fischer cell.

3 Empty all tubes.

4 Shut down the titrator.

5 Disconnect the terminal.

6 Disconnect the titrator from the power supply.

7 Disconnect any accessories from the titrator.

8 Remove all cables.

9 Remove and clean the burette.

10 Remove and clean the Karl Fischer cell.

11 Clean the titrator.

12 Store the titrator in a dry and clean place.

See also

- Technical data ▸ Page 73
- Empty and clean the burette ▸ Page 62
- Empty and clean the Karl Fischer cell ▸ Page 65
- Start up and shut down the titrator ▸ Page 50
- Disconnect the terminal ▸ Page 23
- Disconnect the power supply ▸ Page 38
- Clean the titrator and accessories ▸ Page 61

7.5 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 and rinse the burette.
2 Empty the Karl Fischer cell.
3 Empty all tubes.
4 Shut down the titrator.
5 Disconnect the terminal.
6 Disconnect the titrator from the power supply.
7 Disconnect any accessories from the titrator.
8 Remove all cables.
9 Remove and clean the burette.
10 Remove and clean the Karl Fischer cell.
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

- Empty and clean the burette ▸ Page 62
- Empty and clean the Karl Fischer cell ▸ Page 65
- Start up and shut down the titrator ▸ Page 50
- Disconnect the terminal ▸ Page 23
- Disconnect the power supply ▸ Page 38
- Clean the titrator and accessories ▸ Page 61

8 Troubleshooting

8.1 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.

9 Dispose of the titrator

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

Please dispose of this product 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 device. Should this device be passed on to other parties, the content of this regulation must also be related.

Procedure

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

See also

- Empty and clean the burette ▸ Page 62
- Empty and clean the Karl Fischer cell ▸ Page 65
- Start up and shut down the titrator ▸ Page 50
- Disconnect the terminal ▸ Page 23
- Disconnect the power supply ▸ Page 38
- Clean the titrator and accessories ▸ Page 61

10 Technical data

10.1 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
Materials	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	PBT (polybutylene terephthalate)

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 such as burette leakage.

Connections main board

Characteristic		Value
USB1/USB2	Host	USB 2.0, high-speed
	Socket	USB A
	Output rating	5 V DC ±5 %, 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 ±10 %, 3 A
	Cable length	Max. 2.4 m
TERM	Socket	M9, 8-pin, female
	Output rating	24 V DC ±10 %, 500 mA
	Cable length	Max. 2.5 m

Connections device board

Characteristic		Value
SENS1/SENS2	Socket	Self-locking, 4-pin, female
	Output rating	3.5 V DC ±2.8 %, 175 mA
	Galvanic isolation	Yes
	Sensor detection	Yes
	Cable length	Max. 5 m
STIR1 [1)]	Socket	M8, 6-pin, female
	Output rating	0…18 V DC ±10 %, 300 mA
	Stirrer detection	Yes

[1)] **STIR1** is not supported by the titrator software.

Stirrer

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

10.2 Terminal

Characteristic		Value
Dimensions	Width	194 mm
	Depth	129 mm
	Height	51 mm
Weight		1.12 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
Input	Input rating	24 V DC ±10 %, 375 mA
	Socket	M9, 8-pin, female
Output	Host	USB 2.0, high-speed
	Socket	USB C
	Output rating	5 V DC ±5 %, 500 mA
Angle adjustment	Mechanical	2-stage

10.3 Volumetric Karl Fischer cell and titration arm

Characteristic		Value
Material	Titration arm	PBT (polybutylene terephthalate)
	Strap	Silicone
	Vessel	Borosilicate-3.3
	Adapter plate	ETFE (ethylene tetra fluoro ethylene)
	O-ring	EPDM (ethylene propylene diene monomer)
Liquid temperature range		5 °C…50 °C

10.4 Burette parking station

Characteristic		Value
Dimensions	Width	68 mm
	Depth	118 mm
	Height	47 mm
Screw thread	Tube thread type	M6
	Bottle thread type	GL45
Materials	Burette parking station	PP (polypropylene)
	Drying tube	PP (polypropylene)
	Flat seal	EPDM (ethylene propylene diene monomer)
	Tube tip holder	PP (polypropylene)
	Stopper NS14	PP (polypropylene)

10.5 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 ±10 %, 2.7 A
	Socket	M8, 4-pin, female

[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)

11 Accessories, spare parts and consumables

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

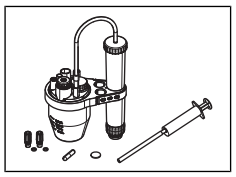
If you have any questions, contact your authorized METTLER TOLEDO service representative or dealer.

www.mt.com/contact

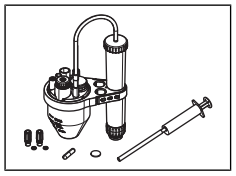
11.1 Karl Fischer cell and titrator

11.1.1 Titration kits and Karl Fischer cell

Titration kits

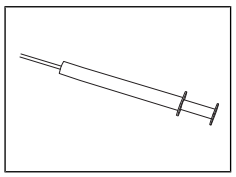


Titration kit KFV L **30869290**

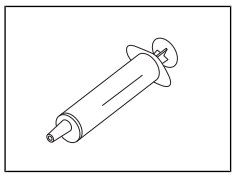


Titration kit KFV S **30869291**

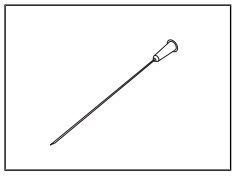
Sample injection and Karl Fischer cell



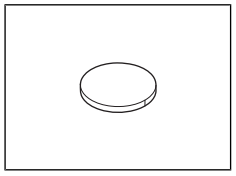
Syringe (120 pcs)
1 mL **30315987**



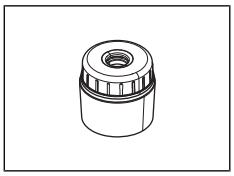
Syringes (100 pcs.)
10 mL **71482**



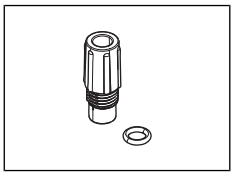
Injection needle (100 pcs)
80 × 0.8 mm **71484**



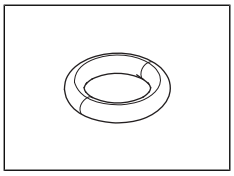
Septum set (5 pcs) **30869295**



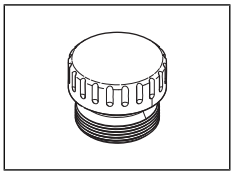
Sample injection adapter NS24 **30869294**



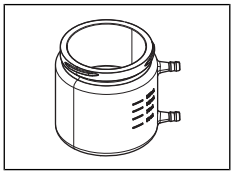
Stopper set M9 (2 pcs) **30869306**



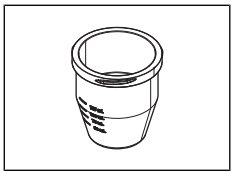
O-ring set M9 (2 pcs) **30869315**



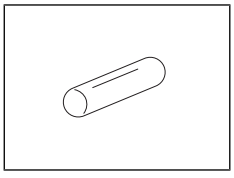
Stopper M24 **30869299**



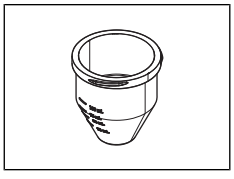
Vessel KFV L-TS **30869302**
Titration vessel with thermostat jacket



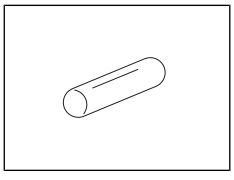
Vessel KFV L **30869300**



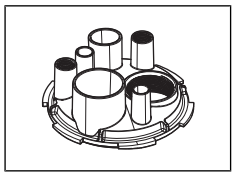
Magnetic stirrer bar **51191159**
Length: 30 mm, diameter: 6 mm



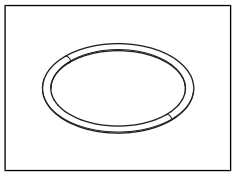
Vessel KFV S **30869301**



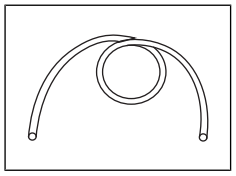
Stirrer bar **30869305**
Length: 20 mm, diameter: 6 mm



Adapter plate KFV **30869292**



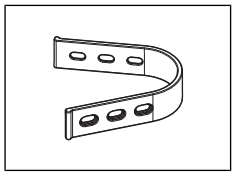
Adapter plate seal KF **30869293**



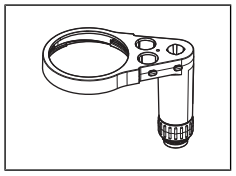
Air tube 100 cm (2 pcs) **30869317**

11.1.2 Titrator and terminal

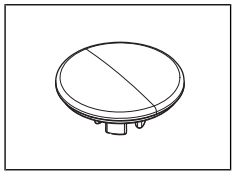
Titrator



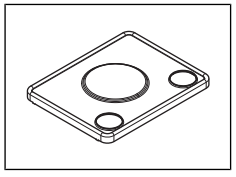
Titration arm strap **30869312**



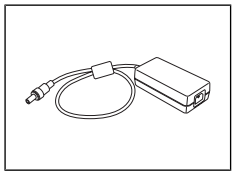
Titration arm **30869311**



Mounting position cover **30869308**

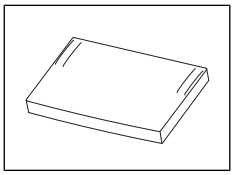


Titrator cover **30869313**

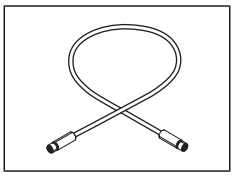


Extern. Power Supply 120W
AC/DC adapter **30298362**

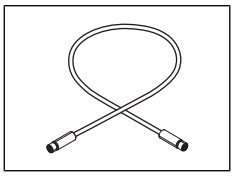
Terminal



In-use cover
Terminal cover
30125377

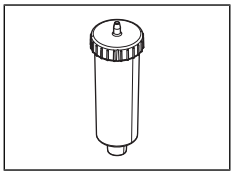


Terminal cable 68 cm
30003971

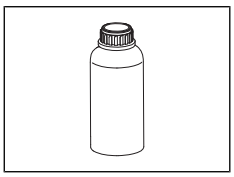


Terminal cable 250 cm
30869309

11.2 Drying tubes



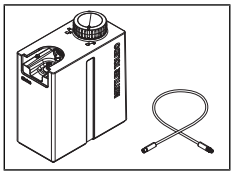
Drying tube NS14
30673119



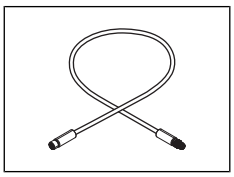
Molecular sieve
250 g
71478

11.3 Burettes and pumps

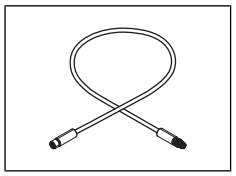
11.3.1 Burette drive



dDrive
Burette drive
30673134



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

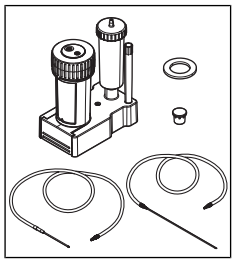


Cable ACT M8/F, M8/M
60 cm

30634420

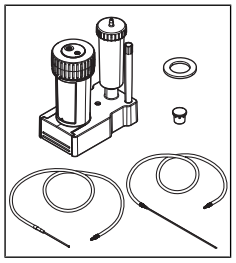
11.3.2 Burettes

Burette sets



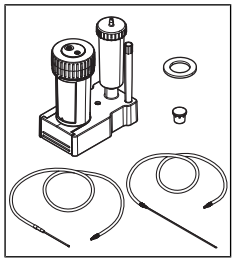
Burette 2 mL
Two-port burette

30869286



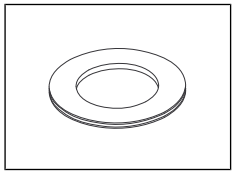
Burette 5 mL
Two-port burette

30869287



Burette 10 mL
Two-port burette

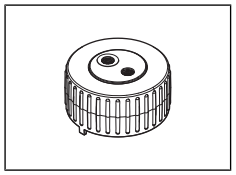
30869288



Flat seal GL45

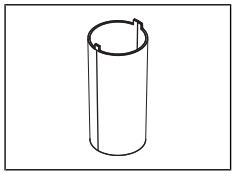
30673280

Common burette parts



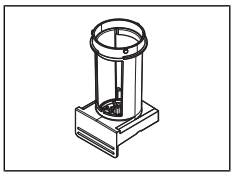
Burette valve head

30869339



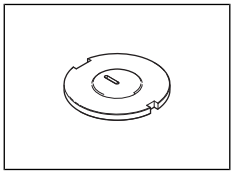
Burette rotary encoder

30869325

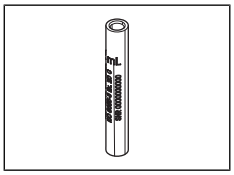


Burette housing **30869332**

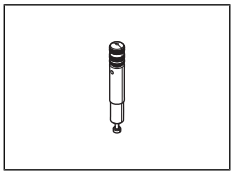
Burette 2 mL



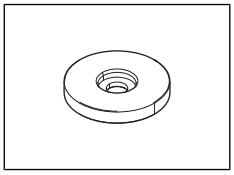
Burette cylinder adapter 2 mL **30869333**



Burette glass cylinder 2 mL **30869329**

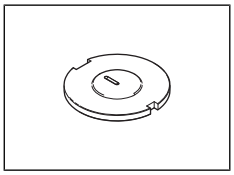


Piston 2 mL **30869336**

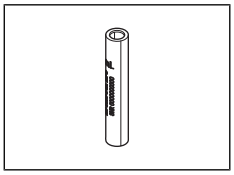


Burette centering ring 2 mL **30869326**

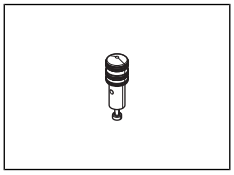
Burette 5 mL



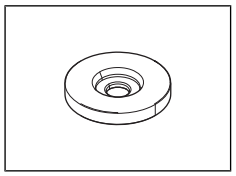
Burette cylinder adapter 5 mL **30869334**



Burette glass cylinder 5 mL **30869330**

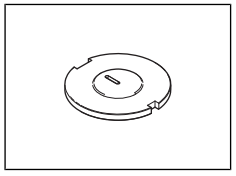


Piston 5 mL **30869337**

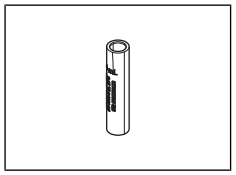


Burette centering ring 5 mL **30869327**

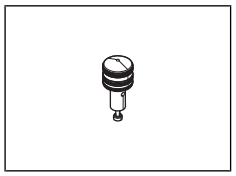
Burette 10 mL



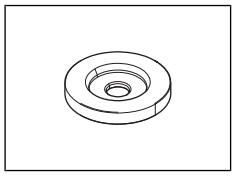
Burette cylinder adapter 10 mL **30869335**



Burette glass cylinder 10 mL **30869331**

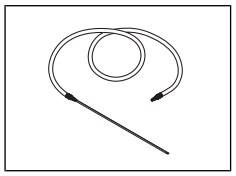


Piston 10 mL **30869338**

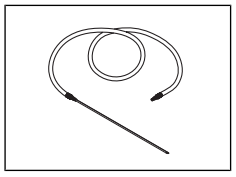


Burette centering ring 10 mL **30869328**

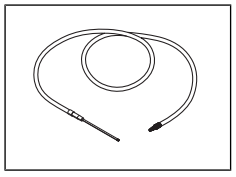
Suction tubes and dispensing tubes



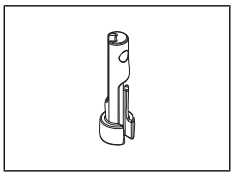
Suction tube M6 87 cm **30673121**
87 cm, two M6 connectors



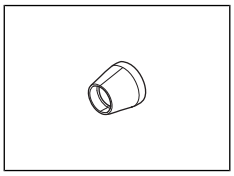
Suction tube M6 200 cm **30673124**
200 cm, two M6 connectors



Dispensing tube M6 65 cm **30869303**
65 cm, M6 connector and tapered connector



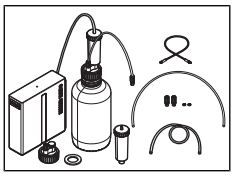
Tube syphon tip set (5 pcs) **30869304**



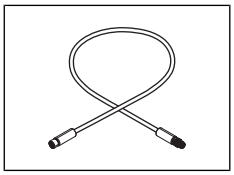
Tube ferrules (5 pcs) **30673126**

11.3.3 Solvent pump

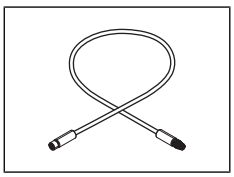
Solvent pump



Solvent pump dPump KF **30869285**

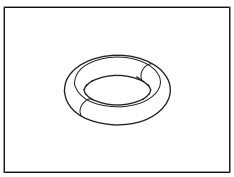


Cable ACT M8/F, M8/M
20 cm **30634406**

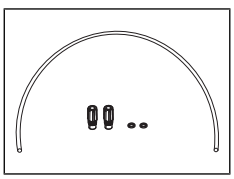


Cable ACT M8/F, M8/M
60 cm **30634420**

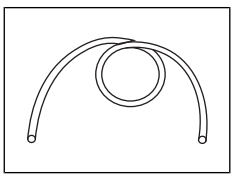
Tubes and bottle adapter



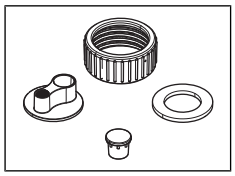
O-ring set M9 (2 pcs) **30869315**



Solvent tube (2 pcs) **30869316**

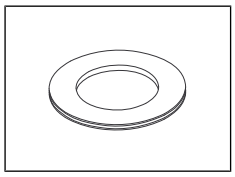


Air tube 100 cm (2 pcs) **30869317**

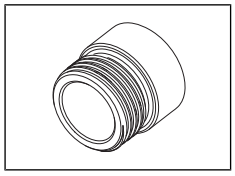


Bottle adapter M9 GL45 **30869314**

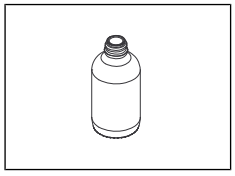
11.4 Bottle adapters and bottles



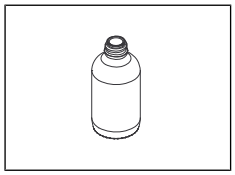
Flat seal GL45 **30673280**



Bottle adapter (Merck) **23774**

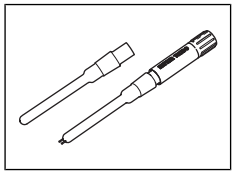


Clear glass bottle
1 L **30079610**

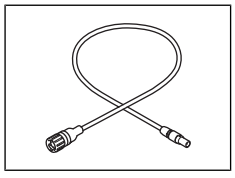


Brown glass bottle
1 L **71296**

11.5 Sensors

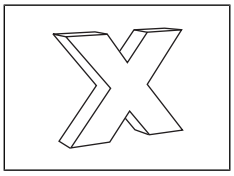


Sensor dSens M143
Polarized sensor **30573200**

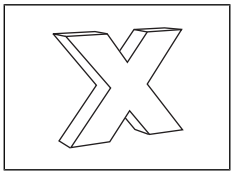


Sensor cable dVP4-T 70 cm **30635146**

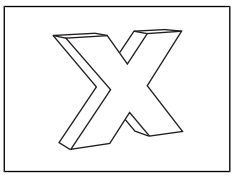
11.6 Software



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

11.7 Weighing

Balances

Balances connected with USB-A-C cable:

- MR
- MX

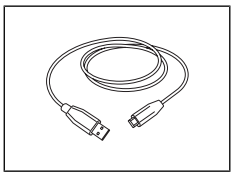
Balances connected with USB-A-B cable:

- XPR
- XSR

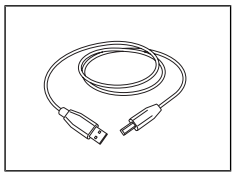
Balances connected with USB-A to RS-232 adapter:

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

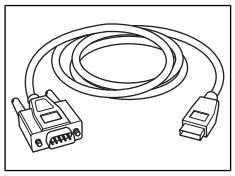
Cables to connect balances



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

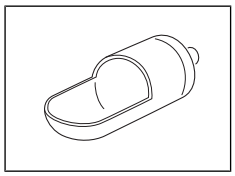


Cable USB (1.8 m A-B) for PC or printer **51191926**

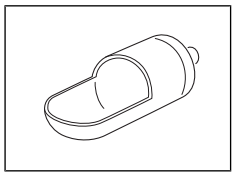


Cable USB To RS232 converter, FTDI **64088427**

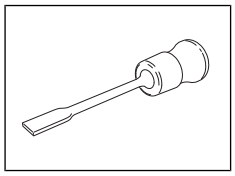
Weighing accessories



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

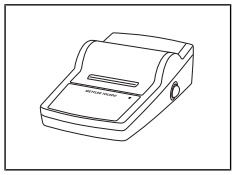


Glass Weighing Boat (5 pcs) **23952**
Diameter: 30 mm x 80 mm

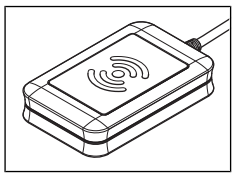


Visco-Spoon™ **51107668**

11.8 Peripherals



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



External SmartChemical Reader **30486743**
RFID reader

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.

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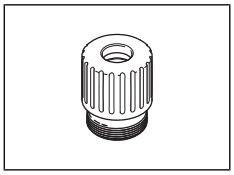
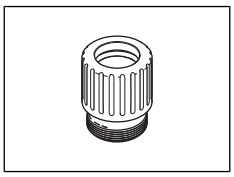
11.9 Homogenizer adapters (EVA V3 only)

Adapters



Homogenizer adapter M24 d12 mm **30869296**



Homogenizer adapter M24 d18 mm **30869297**

Third party supplies

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

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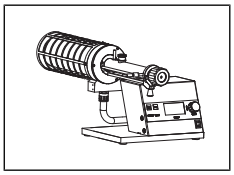
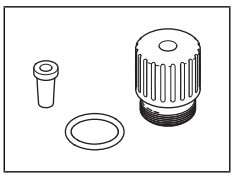
11.10 Ovens



KF Drying Oven DO308 **51371200**



Adapter M24 NS7 **30869298**

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