Operating Instructions

Titration Excellence

T5/T7/T9

METTLER TOLEDO

Table of Contents

1 Introduction

Thank you for choosing a METTLER TOLEDO Titration Excellence titrator. Titration Excellence titrators are easy-to-operate instruments for titrations.

About this document

The instructions in this document refer to titrators running firmware version 5.2.0 or higher.

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▶ www.mt.com/licenses

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

▶ www.mt.com/contact

Conventions and symbols

Refers to an external document.

Note for useful information about the product.

Elements of instructions

- Prerequisites

1 Steps

2 ...

⇨ Intermediate results

⇨ Results

2 Safety information

- Read and understand the information in these Operating Instructions before you use the instrument.
- Keep these Operating Instructions for future reference.
- Include these Operating Instructions if you pass on the instrument to other parties.

If the instrument is not used according to the information in these Operating Instructions or if it is modified, the safety of the instrument may be impaired and Mettler-Toledo GmbH assumes no liability.

2.1 Definition of signal words and warning symbols

Safety notes are marked with signal words and warning symbols. These show safety issues and warnings. Ignoring the safety notes may lead to personal injury, damage to the instrument, malfunctions and false results.

Signal words

WARNING	for a hazardous situation with medium risk, possibly resulting in death or severe injury if not avoided.
CAUTION	for a hazardous situation with low risk, resulting in minor or moderate injury if not avoided.
NOTICE	for 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


Electrical shock


Hot surface

2.2 Product-specific safety notes

Intended use

This instrument is designed to be used in laboratories by trained staff. The instrument is suitable for the processing of reagents and solvents.

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

This device complies with Industry Canada licence-exempt RSS standard(s) and part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Responsibilities of the instrument owner

The instrument owner is the person that uses the instrument for commercial use or places the instrument at the disposal of the staff. The instrument owner is responsible for product safety and the safety of staff, users and third parties.

METTLER TOLEDO assume that the instrument owner provides the necessary protective gear, appropriate training for the daily work and for dealing with potential hazards in their laboratory.

Safety notes

⚠ WARNING

Danger of death or serious injury due to electric shock!

Contact with parts that contain a live current can lead to injury and death.

1 Only use a METTLER TOLEDO power cable and AC 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.
4 Replace damaged power cables and AC adapters immediately.

⚠ CAUTION

Danger of burns due to hot surfaces!

Parts of the cover of the coulometer board can reach temperatures that cause injuries if touched.

– Do not touch the place marked with the warning symbol.

NOTICE

Danger of damaging the touch screen with pointed or sharp objects!

Pressing on the touch screen with pointed or sharp objects may damage it.

– Operate the touch screen by applying gentle pressure with the pad of your finger.

NOTICE

Danger of damage to the instrument due to incorrect parts!

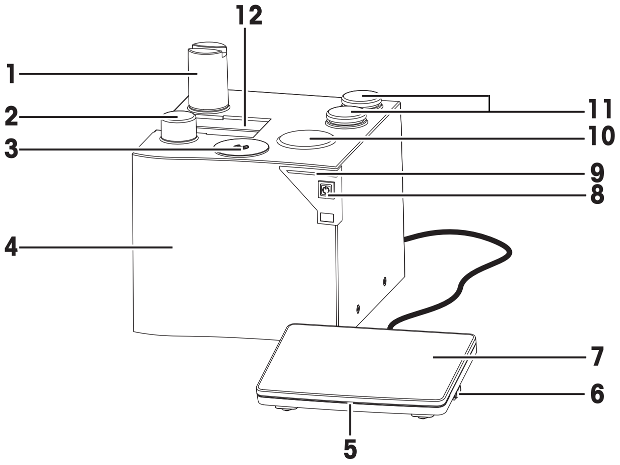
Using incorrect parts with the instrument can damage the Instrument or cause the instrument to malfunction.

– Only use parts supplied with the instrument, listed accessories and spare parts from METTLER TOLEDO.

3 Design and Function

3.1 Instrument

3.1.1 Overview titrator



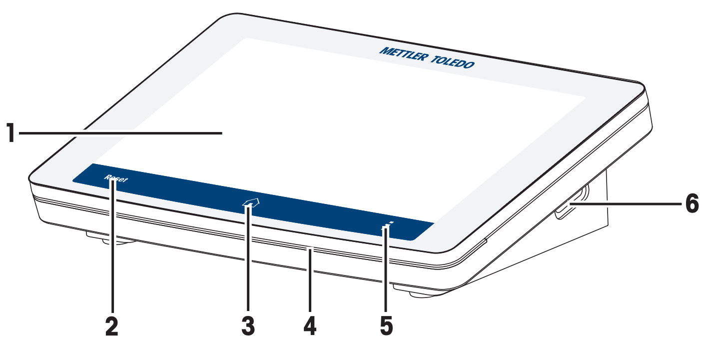
1	Burette drive	**7**	Touchscreen
2	Burette arrestment knob	**8**	Power button
3	SmartSample reader (SmartSample™)	**9**	Instrument status light (StatusLight™)
4	Instrument housing	**10**	Internal magnetic stirrer
5	Terminal status light (StatusLight™)	**11**	Mounting stations for titration stand
6	USB-connection for data transfer	**12**	Mounting rail for burettes

3.1.2 StatusLight

The StatusLight provides information about the status of the titrator.

StatusLight	Titrator status
Steady, green light	The titrator is ready for operation.
Blinking green light	The titrator is performing a task.
Steady, orange light	The titrator waits for the user to perform an action.
Blinking, orange light	The task has been interrupted, for example because a value lies outside of its limits.
Steady,red light	The titrator has an error.

3.1.3 Terminal

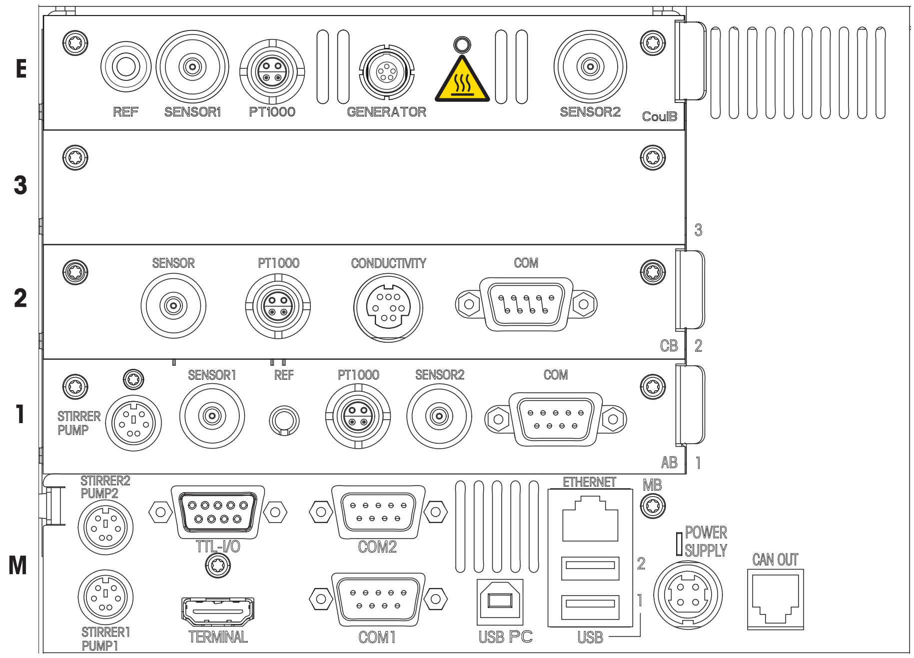


Nr.	Name	Function
1	Touch screen	Displays information and can be used to enter information.
2	**Reset** button	Ends all tasks that are currently running.
3	Home button	Returns you to the home screen from any menu position.

Nr.	Name	Function
4	StatusLight™	Provides information about the status of the titrator.
5	Info button	Accesses the interactive online help for the content of the current dialog.
6	USB A	USB connection for data transfer

3.1.4 Titrator rear panel connections

The overview includes the connections of the main board and the optional plug-in cards.



No.	Plug-in card type	Name	Use	Sensor/Device
E	Coulometer board (CoulB)*	**REF**	Reference input to **SENSOR1**	For example: DX200
		SENSOR1	Sensor types: mV, pH, ISE, phototrode	For example: DX223
		PT1000	PT1000 temperature sensor	DT1000
		GENERATOR	Generator electrode	Generator electrode with diaphragma, generator electrode without diaphragma
		Safety label for hot surfaces	Warning that the marked place can be hot enough to cause burns.	–
		SENSOR2	Sensor types: polarized, mV, pH, ISE, phototrode	For example: DM143-SC
3	Free	–	–	–
2	Conductivity board (CB)*	**SENSOR**	Sensor types: mV, pH, ISE, phototrode	For example: DGi111-SC
		PT1000	PT1000 temperature sensor	DT1000
		CONDCUTIVITY	Conductivity sensor, Thermotrode	For example: InLab® 717
		COM	Balance/auxiliary device	For example: XS analytical balance

No.	Plug-in card type	Name	Use	Sensor/Device
1	Analog board (AB) / pH board**	**STIRRER PUMP**	Stirrer/pump	For example: Compact stirrer/DV704 titration stand/SP280 pump/ OE06 output expander/Y-cable
		SENSOR1	Sensor types: mV, pH, ISE, phototrode	For example: DX223
		REF	Reference input to **SENSOR1**	For example: DX200
		PT1000	PT1000 temperature sensor	DT1000
		SENSOR2	Sensor types: polarized, mV, pH, ISE, phototrode	For example: DM143-SC
		COM	Balance/auxiliary device	For example: XS analytical balance
M	Main board (MB)	**STIRRER1 PUMP1**	Stirrer1/Pump1	For example: Compact stirrer/DV704 titration stand/SP280 pump/ OE06 output expander/Y-cable
		STIRRER2 PUMP2	Stirrer2/Pump2	For example: Compact stirrer/DV704 titration stand/SP280 pump/OE06 output expander/Y-cable
		TTL-I/O	TTL input/output/ auxiliary device	For example: T-Box/ Rondolino TTL/Stromboli
		COM1	Balance/auxiliary device	For example: Analytical Balance/TV6
		COM2	Balance/sample changer/ auxiliary device	For example: Analytical Balance/TV6
		USB PC	PC	For example: LabX
		USB 1	Printer/barcode reader/ memory stick/USB hub/ autosampler	For example: InMotion Autosampler/InMotion KF/ USB-P25
		USB 2	Printer/barcode reader/ memory stick/USB hub/ autosampler	For example: InMotion Autosampler/InMotion KF/ USB-P25
		ETHERNET	Network	For example: LabX
		POWER SUPPLY	AC adapter	AC adapter
		CAN OUT	CAN connection	Dosing unit
		TERMINAL	Terminal	Terminal

* Not part of the scope of delivery

** Not part of the scope of delivery for T5C

3.1.5 Titrator optional equipment features

The table below shows the number of accessories that you can connect to each type of titrator.

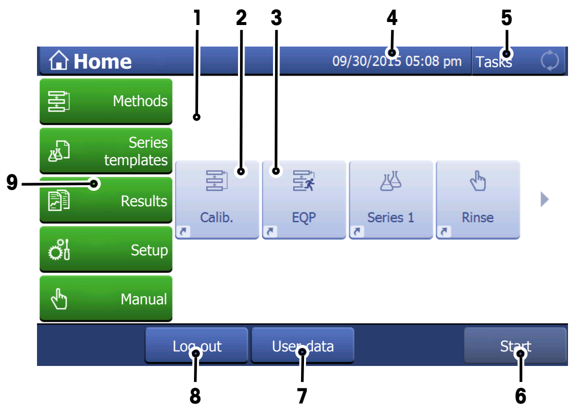
Accessory	T5	T7	T9
Dosing unit	Max. 3*	Max. 3	Max. 7
Number of boards	Max. 1	Max. 2	Max. 3
Analog board	Max. 1	Max. 2	Max. 3
Conductivity board	Max. 1	Max. 2	Max. 3
Coulometer board	Max. 1	Max. 1	Max. 1

Accessory	T5	T7	T9
InMotion	1	1	2
InMotion KF	–	2	2
Rondolino	1	1	1
Stromboli	–	•	•
Liquid Handler	1	1	2
Solvent manager	2	2	2
Homogenizer	TTL	TTL/RS	TTL/RS

* Only 1 can be used for titrant, others for dosing only

3.2 User Interface

3.2.1 Home screen



	Name	Explanation
1	**Shortcut area**	Shows indirect and direct shortcuts for frequently used methods. Shortcuts are saved in the user profile and can be defined, changed and deleted by the user.
2	**Indirect shortcut**	An indirect shortcut opens the window **Start analysis** of the method.
3	**Direct shortcut**	A direct shortcut starts the method without opening the window **Start analysis**.
4	**Status bar**	The status bar contains the current menu item, user name as well as date and time.
5	**Instrument status**	Shows the current working status of the instrument. **Blue** No measurement running **Green** Measurement running
6	**Start**	Switch to direct measurement (quick start for the defined standard measurement of this instrument).
7	**User data**	Opens a window with information about the currently logged in user.
8	**Log out**	Directly log out the current user. The window **Login** opens after logging out.

	Name	Explanation
9	Menus	**Methods** Create and handle methods for every measurement type.
		Series templates Open the menu for series templates for every method available on the instrument.
		Results Display all measurement results, print out or export them. Visit detail information about every single result.
		Setup Define all system settings in this menu, e.g,, hardware settings, user management or user preferences. These settings are usually made during installation of the instrument.
		Manual Display the manual operations available on the instrument.

3.2.2 Input field types

Various fields and lists allow you to enter or view data. Buttons on the right side show the type of the field or list.

Text input field

Any text comprised of letters (up tp 30 characters), numbers and symbols can be entered into these fields.

Text input field (extended)

Any text comprised of letters (up to 500 characters), numbers and symbols can be entered into these fields.

Number input field

Numbers, formulas and auxiliary values can be entered into these fields.

Drop-down list

A drop-down list opens from which you can select an entry.

Shortlist

A shortlist opens from which you can select an entry.

Formula field

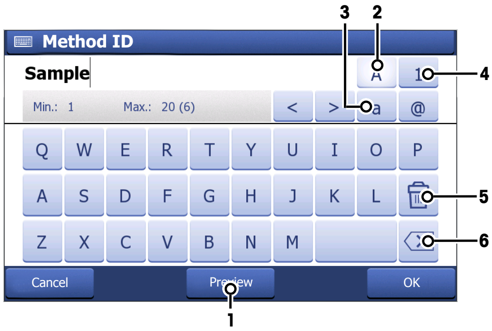
A formula must be entered in these fields.

Info field

The displayed content is only for information (read only).

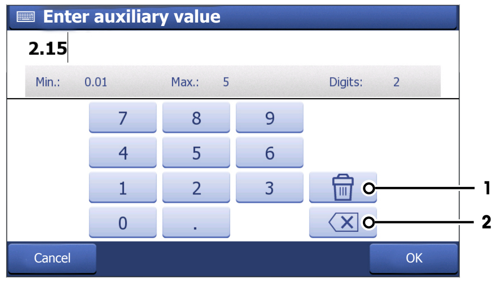
3.2.3 Keypads

Alphabetic keypad



- Tap (1) to see how your input looks like.
- Tap (2) for capital letters.
- Tap (3) for lowercase letters.
- Tap (4) to switch to a numeric keypad and (2) to turn back to alphanumeric.
- Tap (5) to delete all entered letters or numbers.
- Tap (6) to delete the last entered letter or number.

Numeric keypad



- Tap (1) to delete all entered numbers.
- Tap (2) to delete the last entered number.

3.2.4 Specific user dialogues

3.2.4.1 Start Analysis

An analysis - whether it be a single or multiple determination - can be started on the titrator in several different ways:

- By choosing **Start** from the method editor.
- By choosing **Start** from the Homescreen.
- By using a shortcut (or direct shortcut) from the Homescreen.
- By choosing **Start** from the screen **Series**.
- By choosing **Calibration** or **Titer** from the screen **Setup** dialog (in order to start a calibration or titer determination).

The screen **Start analysis** is always the first screen to appear once you choose **Start**, **Calibration**, **Sensor test** or **Titer** or the corresponding shortcut.

Note

- When a direct shortcut is activated, the screen **Start analysis** does not appear and the respective method starts immediately, provided that the other settings allow this.
- The parameters for the previously used method or series appear in the screen **Start analysis**, so that the same method can immediately be started again.
- Of course, all of the settings can also be adjusted prior to pressing **Start**. The type and number of settings displayed in the screen**Start analysis** depends on the type of analysis to be started and the resources used.

3.2.4.2 Online screen general titrations GT

The Online screen is displayed when an analysis or manual operation is being performed.

The method ID of the current method or the type of manual operation is displayed in the title bar. In the navigation bar below, the sample index, e.g. displayed as "Sample 2/5" (second of a total of five samples) and loop index, displayed as "Loop 1/3" (first of three loops) are shown. (The Loop index is only displayed if the method actually contains more than one loop). The navigation path is displayed in the navigation bar while a manual operation is being performed. The remainder of the online dialog is divided into a graphical area (left) and a data area (right). During a titration or measurement, the graphical area displays the measurement curve.

The Online dialog for a titration of type GT contains the following buttons:

Results

The **Results** button is used to display the results and statistics for the analyzed samples after the analysis.

Axes

You can select the units for the horizontal and vertical axes from a list.

Measured values

As an alternative to the online dialog, you can use the **Measured values** button to display a table of measured values during the analysis.

Samples

Choose **Samples** to change sample and series data.

Suspend

You can choose **Suspend** to displays the **Suspending options** dialog. You can save the series data or skip the sample or loop. In this dialog, you also have the option to continue the analysis or to stop it definitely

Note

- Depending on the type of method function being performed, the online dialog displays various data such as measured values, remaining run times, volume dispensed, stirrer speed, duration of the analysis, or temperature.

3.2.4.3 Online screen KF titrations

The Online screen is displayed when an analysis or manual operation is being performed.

The method ID of the current method or the type of manual operation is displayed in the title bar. In the navigation bar below, the sample index, e.g. displayed as "Sample 2/5" (second of a total of five samples) and loop index, displayed as "Loop 1/3" (first of three loops) are shown. (The Loop index is only displayed if the method actually contains more than one loop). The navigation path is displayed in the navigation bar while a manual operation is being performed. The remainder of the online dialog is divided into a graphical area (left) and a data area (right). During a titration or measurement, the graphical area displays the measurement curve.

3.2.4.3.1 Pretitration

Immediately following the start of a Karl Fischer titration, the online window for pretitration appears. In this window, the following buttons are available:

Results

Tap **Results** to display the results and statistics for the samples to be analyzed following the analysis. The system displays the results of the active determination type (sample, blank value). Furthermore, the dialog **Results** also contains the following buttons:

- **Add result**
- **Recalculate**
- **Undo all**
- **Outlier test**

Samples

You can change sample and series data. However, the number of samples cannot be changed while a blank determination is in progress. For changes to the sample data, refer to the analysis sequences:Starting an analysis

More

The **More** button provides you with additional functions. Using the More button in **Pretitration** mode, you can perform the following:

End series

You can end a series if all predefined samples have been processed. Any changes made in the **Start analysis** dialog or later are no longer taken into account. After the series has ended, you return to the pretitration or standby mode and the series can be restarted again. A new series is entered in the results. The system then uses the original sample parameters.

Note

- The **End series** function triggers printouts defined **Per series**.

Stop method

The current method is stopped immediately. No printout is generated.

Note

- Before actually stopping the process, the system displays a system message asking you to confirm the action.

Save series data

The analysis of a series is saved in its entirety under a name freely chosen by the titrator in the form "SeriesXY". Only sample data is included in the series. Blank value data is not included in the generated series. If the maximum number of permitted series has already been reached, the series is not saved.

Axes

You can select the units for the horizontal and vertical axes from a list.

Drift determination (only KF vol)

You have to add at least one titrant increment for a drift determination. When the determination has been completed successfully, the determined drift value is entered in the setup of the titration stand. The system then generates an automatic printout containing the sample data, raw results, and resource data.

Note

- The message **No titrant added / generated. Drift not determined.** can be confirmed, or the message disappears after a certain period of time (60s).
- If the drift falls below a defined value, the system automatically switches to **Standby** mode.

Sample size calculation

The optimum sample size can be calculated from the standby of an analysis.
The determined limits for the sample size do not have any impact on the lower and upper limits in the method or for the sample data memory.

You can determine the following parameters:

Parameters	Description	Values
Content	Expected water content of the sample.	0 .. 10^6
Unit	Unit for the content.	[%] l [ppm]

Use the **Calculate** button to obtain the upper and lower sample size limits for optimum titration.

Concentration determination (only KF vol)

You use this button to determine the concentration of the titrant. No predispensing is performed. The determined concentration or the mean value for a series of concentration determinations is entered in the Setup for the relevant titrant, if this falls within the limits. If the mean value falls outside the specified limits, this is not transferred to the Setup, but the system still switches to Standby. After the concentration has been determined successfully, the user receives a printout. If the value is not transferred to Setup, the system issues a message to inform you of this.

Tapping the **Start conc.** button opens the **Concentration sample** window. You can enter a comment and the temperature. When you tap **OK**, an **Info** dialog is displayed as a prompt to add the standard.

3.2.4.3.2 Standby

If the drift drops below a predefined value, the system automatically switches from **Pretitration** to **Standby** mode (see "Analysis flows: Analysis flow diagram").

In **Standby** mode, you can start the drift determination or sample analysis, or conduct a blank determination for the "external extraction" method type. The following buttons are available for this:

Start drift

For a drift determination, at least one increment of titrant must be generated.When the determination has been completed successfully, the determined drift value is entered in the setup of the titration stand. The system then generates an automatic printout containing the sample data, raw results, and resource data.

Start sample

This button is used to perform a sample analysis. When you press this button, an **Info** dialog is displayed prompting you to add the sample.

Once a sample has been added and the analysis started, you can use the **Samples** button to enter the sample size (see Method Function: **Sample (KF)** > **Sample**.

Start blank determination

Blank value determination can be performed for the method type **Ext. Extr.**. No predispensing is performed. The determined blank value or the mean value for a series of blank determinations is entered in the Setup for the relevant titrant, if this falls within the limits. If the mean value falls outside the specified limits, this is not transferred to the **Setup**, but the system still switches to **Standby**. After the blank value has been determined successfully,you receive a printout. If the value is not transferred to **Setup**, the system issues a message to inform you of this. When you tap this button, an **Info** dialog is displayed prompting you to add the sample.

Measured values

You can use the **More** and **Measured values** buttons to display a table of measured values during an analysis as an alternative to the online dialog.

Samples

You can use this button to change the sample size of the sample currently being processed or to define the sample size for a new sample.

Stop analysis

You can use this button to cancel the measurement immediately during a sample or blank determination.

Before actually terminating the process, the system displays a system message asking you to confirm the termination.

See also

- KFvol Analysis sequence ▶ Page 244
- Sample (KF) ▶ Page 99

3.2.5 Menu structure

Methods

The menu **Methods** has no submenus.

Series templates

The menu **Series templates** has no submenus.

Results

The menu **Results** has the following submenus.

- **All results**
- **Statistics**
- **Samples**
- **Add result**
- **Recalculate**
- **Reevaluate**
- **Buffer**
- **Undo all**

Setup

The menu **Setup** has the following submenus.

Menu level 2	Menu level 3
Chemicals	**Titrants**
	Auxiliary reagents
	Calibration standards
	Concentration and titer standards
	Substances
User settings	**Language**
	StatusLight
	Screen
	Audio signal
	Shortcuts
	Keyboard
Values	**Blanks**
	Auxiliary values
Hardware	**Sensors**
	Pumps
	Peripherals
	Titration Stands
	Auxiliary Instruments
	Homogenizer (only T7 and T9)
	Liquid Handler (only T7 and T9)
Global settings	**System**
	User management
	Analysis and resources behavior
	Solvent Control
Mainten. & Service	**MT-Service**
	Import / Export
	Reset to factory settings
	Titrator firmware history
	Board firmware
	Terminal
	Board data
	Drives
	Burettes
	Upgrade (only T7)
	Update
	Delete Mettler method template

Manual

The menu **Manual** has the following submenus.

- **Stirrer**
- **Sensor**
- **Burette**
- **Pump**
- **Auxiliary instrument**
- **Sample changer**
- **SmartSample**

4 Karl Fischer Water Determination

4.1 Measuring Principle

The Karl Fischer procedure is a titration method used for the quantitative determination of water content in liquids and solids. Karl Fischer titration is used in a variety of areas, e.g. for determining the water content of groceries, chemicals, pharmaceuticals, cosmetics and mineral oils.

To determine the water content, first sulfur dioxide and water react with iodine:

$2\ H_2O + SO_2 + I_2 \Rightarrow SO_4^{2-} + 2\ I^- + 4\ H^+$

The addition of alcohol (e.g. methanol, ethanol), causes a preliminary reaction to take place in which sulfur dioxide forms an acidic ester, which is then neutralized by the addition of a base (e.g. imidazole, referred to in the following as "RN"):

$CH_3OH + SO_2 + RN \Rightarrow (RNH)\cdot(CH_3OSO_2)$

In the presence of water, the alkyl sulfite anion is oxidized to alkyl sulfate by the iodine. This process reduces the yellow-brown iodine to colorless iodide:

$(RNH)\cdot(CH_3OSO_2) + I_2 + H_2O + 2\ RN \Rightarrow (RNH)\cdot(CH_3OSO_3) + 2\ (RNH)\cdot I$

The overall reaction proceeds as follows:

$H_2O + I_2 + SO_2 + CH_3OH + 3\ RN \Rightarrow [RNH]SO_4CH_3 + 2\ [RNH]I$

The reaction runs until all the water has been consumed and hence free iodine is detected in the titration solution. The end point is determined using bivoltametric indication, i.e. the potential at the polarized double-platinum-pin electrode falls below a certain value (e.g. 100mV).

4.2 Fundamentals of Coulometric Water Content and Bromine Index Determination

With the METTLER TOLEDO Titrators T5, T7 and T9 you can perform coulometric Karl Fischer titration and determine the bromine index if a coulometry board is installed. The fundamentals of coulometric water content and bromine index determination are summarized below.

4.2.1 Fundamentals of coulometric water content determination

In coulometric Karl-Fischer titration, iodine is generated in an electrochemical reaction by the anodic oxidation of iodide at the generator electrode:

$2\ I^- \Rightarrow I_2 + 2\ e^-$

If water is present in the anolyte, the generated iodine reacts directly with water. I_2 and H_2O react in the ratio 1:1. According to Faraday's law, the quantity of iodine generated is proportional to the electrical load (10.712 mC = 1 µg H_2O). The coulometric consumption up to the end point is therefore a measure of the quantity of water present.

Once all the water has been consumed by the reaction, the measurement solution contains a small excess of iodine.This iodine excess is detected by the polarized measurement electrode and the electrical current for iodine generation is stopped.Generator electrodes with and without a diaphragm are available.The generation and detection of iodine is the same in both cases.

Karl Fischer titration runs at a maximum rate in the pH range 5.5 to 8. In practice, therefore, the solution should not exceed pH 8 or fall below pH 4.For acidic and basic samples, the pH value must be altered to remain within the ideal range by the addition of buffer substances (imidazole for acids, salicylic acid for bases).

The titration cell consists of the anode compartment and the cathode compartment, which may be separated by a diaphragm. The anode compartment contains the anolyte, which contains sulfur dioxide, imidazole and iodide.Methanol or ethanol are used as the solvent. The cathode compartment contains the catholyte. Depending on the manufacturer, this may either be a specific reagent, or the same solution as in the anode compartment.

The coulometric Karl Fischer procedure is suitable for samples with a low water content (1 ppm to 5 %).

4.2.2 Coulometric bromine index determination

In coulometric bromine index determination, electrochemically generated bromine reacts with the double bonds in organic compounds according to the following equation:

$Br_2 + R1\text{-}CH{=}CH\text{-}R2 \Rightarrow R1\text{-}CHBr\text{-}CHBr\text{-}R2$ (1)

The bromine index [mg bromine / 100 g sample] specifies how much bromine is used, according to the equation (1), to react a sample.

The bromine is generated at the anode of the generator electrode:

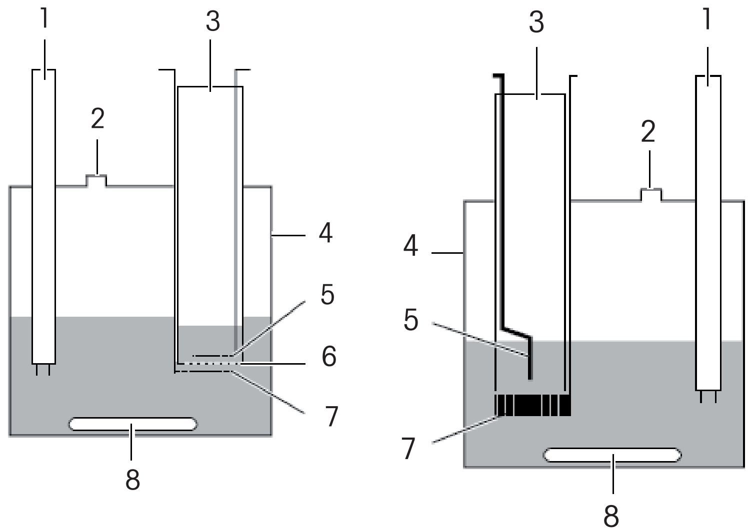
$2\ Br^- \Rightarrow Br_2 + 2\ e^-$ (2)

4.2.3 Generator electrodes

METTLER TOLEDO offers generator electrodes with and without diaphragms for both iodine and bromine generation (see schematic diagram below).

Note

- For bromine index determination we recommend the generator electrode without a diaphragm, as it is easier to clean.



1: Measuring electrode
2: Septum
3: Generator electrode
4: Cell
5: Cathode
6: Diaphragm
7: Anode
8: Magnetic stirring rod

Generator electrode with diaphragm

Generator electrode without diaphragm

4.3 Volumetric water content determination

In Karl Fischer (KF) volumetric determination, a titrant containing iodine is gradually added to the water-containing sample until the water is completely displaced and free iodine can be detected in the titration solution. The end point of the titration is recorded using bivoltametric indication. Volumetric Karl Fischer titration is suitable for samples with a water content in the range 100 ppm to 100 %. The optimum recording range is 10mg of water per sample.

For optimal execution of the KF titration, the pH of the solution should be in the range between 4 and 8. Acidic and basic samples should be buffered, ideally with imidazole for acids and salicylic acid for basic samples.

The following two conventional reagents are used for titration:

a) The single-component reagent

The titrant consists of iodine, sulfur dioxide and imidazole.The solvent is methanol.

The single-component reagent is simple to use and cost efficient. However, it is not stable for titration.

b) The two-component reagent

The titrant is an iodine solution containing methanol.The solvent for the sample contains sulfur dioxide and imidazole dissolved in methanol.

The two-component system can be used to perform very fast titrations (two to three times quicker than with the single-component reagent). Both components can be easily stored. The reagent is stable for titration,however, the solvent capacity is limited.

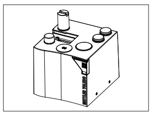
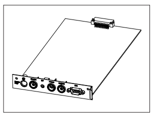
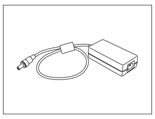
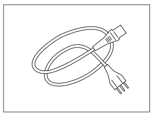
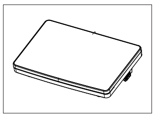
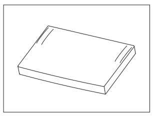
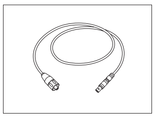
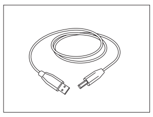
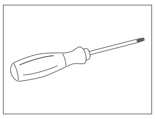
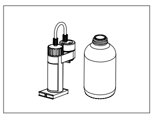
5 Installation

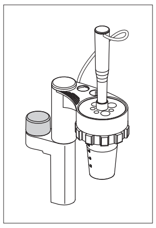
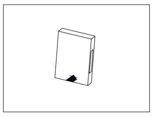
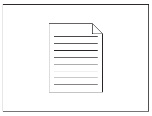
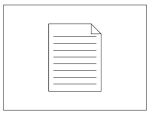
Standard equipment for the titrator types varies. For this reason, installation steps may vary.

5.1 Standard equipment

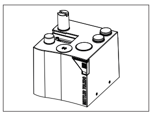
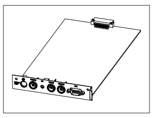
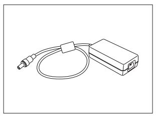
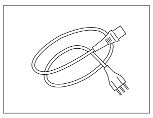
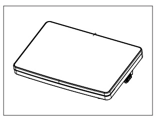
5.1.1 Scope of delivery

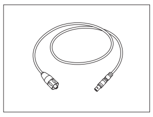
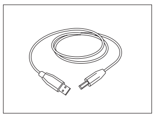
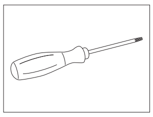
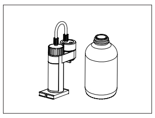
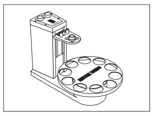
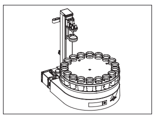
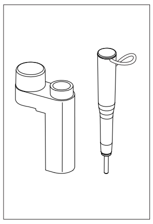
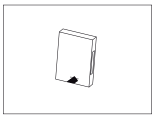
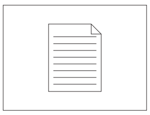
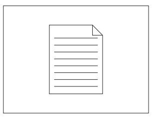
Titrators

Part	Order number	T5	T5C	T7	T9
 Titrator	–	•	•	•	•
 Analog board	51109818	•	–	•	•
 AC adapter	30298362	•	•	•	•
 Power cable (country specific)	–	•	•	•	•
 Terminal WVGA 7 inch AnaChem	–	•	•	•	•
 Terminal protection Cover	–	•	•	•	•
 Triaxial SC LEMO cable 70 cm	89601	•	–	•	•
 USB cable A-B 180 cm	51191926	•	–	•	•
 Torx screwdriver 10	51191659	•	•	•	•
 Burette DV1010 10 mL	51107501	•	–	–	–

Part		Order number	T5	T5C	T7	T9
	Manual titration kit • Manual titration stand, complete • Compact stirrer • Propeller stirrer • Magnetic stirrer bar • Adapter for dispensing tube • Electrode sleeve • NS 7.5 stopper (3 pcs.) • NS 14.5 stopper (4 pcs.) • Titration vessel 100 mL made from polypropylene (2 pcs.)	51109220	•	–	–	–
	CD Titration User Documentation	30297239	•	•	•	•
	User Manual	–	•	•	•	•
	Memo Card	–	•	•	•	•
	Test report	–	•	•	•	•
	EC declaration of conformity	–	•	•	•	•

Titrator bundles

Part		Order number	T5 InMotion Flex	T5 Rondolino
	Titrator	–	•	•
	Analog board	51109818	•	•
	AC adapter	30298362	•	•
	Power cable (country specific)	–	•	•
	Terminal WVGA 7 inch AnaChem	–	•	•

Part		Order number	T5 InMotion Flex	T5 Rondolino
	Triaxial SC LEMO cable 70 cm	89601	•	•
	USB cable A-B 180 cm	51191926	•	•
	Torx screwdriver 10	51191659	•	•
	Burette DV1010 10 mL	51107501	•	•
	Sample changer Rondolino TTL	51108500	–	•
	Sample Changer InMotion Flex Kit 100mL	30370014	•	–
	Auto titration kit • Electrode holder assembly • Compact stirrer • Propeller stirrer	51109221	•	•
	CD Titration User Documentation	30297239	•	•
	User Manual	–	•	•
	Memo Card	–	•	•
	Test report	–	•	•
	EC declaration of conformity	–	•	•

5.1.2 Unpack the titrator

1 Remove the titrator (and accessories) from the protective packing material.
2 Store the packing material for later transport over long distances.
3 Check if you 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 immediately and file a freight claim if needed.

5.1.3 Position the titrator

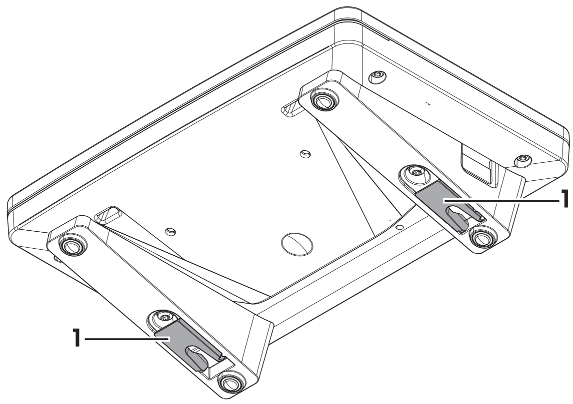
The instrument has been developed for indoor operation in a well-ventilated area. The following site requirements apply:

- The ambient conditions are 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

5.1.4 Adjust the angle of the terminal

The angle of the terminal has two positions.

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

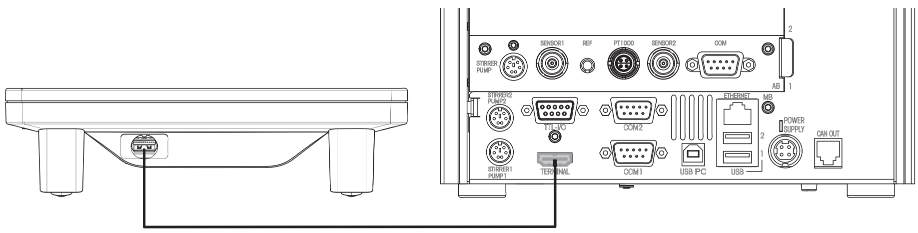


5.1.5 Connect and disconnect the terminal

Connect the terminal

▪ The titrator has shut down.

1 Plug the supplied terminal cable into the socket in the back of the terminal.



2 Plug the terminal cable into the **TERMINAL** socket on the rear panel of the titrator.

3 Start up the titrator.

⇨ The titrator automatically detects the terminal and activates it.

Disconnect the terminal

▪ The titrator has shut down.

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

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

5.1.6 Connect the titrator to the power supply

⚠ WARNING

Danger of death or serious injury due to electric shock!

Contact with parts that contain a live current can lead to injury and death.

1. Only use a METTLER TOLEDO power cable and AC 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.
4. Replace damaged power cables and AC adapters immediately.

NOTICE

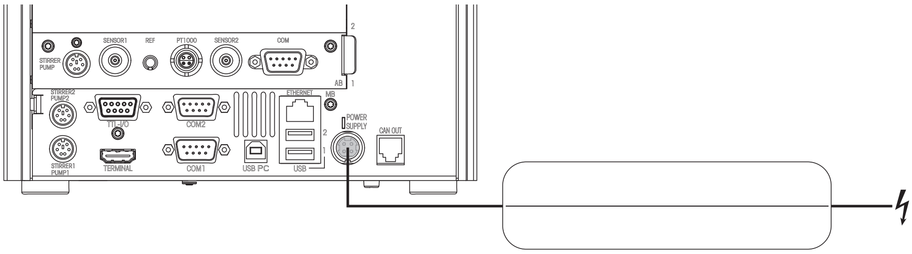
Danger of damage to the AC adapter due to overheating!

If the AC adapter is covered or in a container, it is not sufficiently cooled and overheats.

1. Do not cover the AC adapter.
2. Do not put the AC adapter in a container.

The titrator is operated using an AC adapter. The AC adapter is suitable for all supply line voltages ranging from 100...240 V AC ±10 % and 50-60 Hz.

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 in the socket of the AC adapter.



3. Insert the plug of the AC adapter in the **POWER SUPPLY** socket at the back of the titrator.
4. Insert the plug of the power cable in a grounded power outlet that is easily accessible.

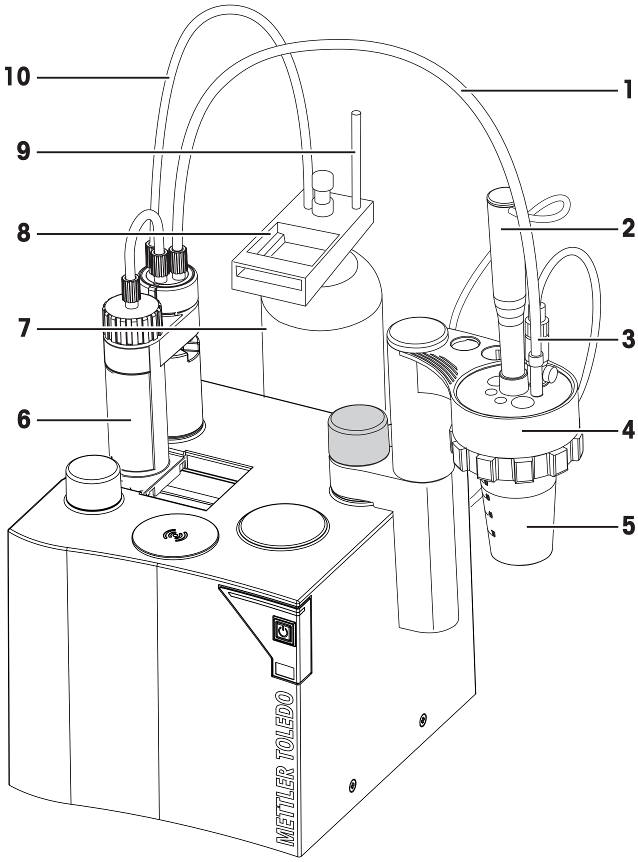
5.1.7 Disconnect the titrator from the power supply

- The titrator has shut down.

1. Pull the plug of the power cable out of the power outlet.
2. Pull the plug of the AC adapter out of the **POWER SUPPLY** socket at the back of the titrator.

5.1.8 Set up the titrator for a general titration

The illustration shows the setup of an Excellence Titrator for a general titration. For this setup you need a titrator, and the accessories "Manual titration kit" and "Interchangeable burette set."

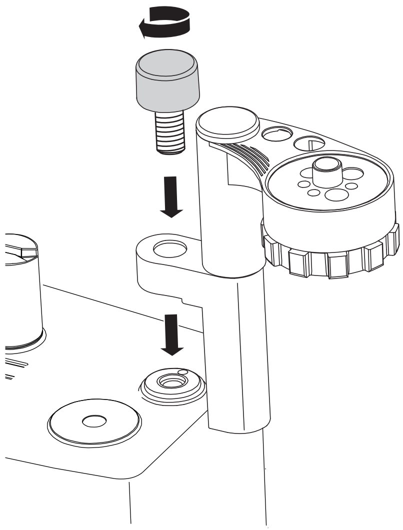


1	Dispensing tube	**6**	Burette
2	Compact stirrer	**7**	Titrant bottle
3	Electrode	**8**	Burette holder
4	Titration stand	**9**	Holder for dispensing tube
5	Titration vessel	**10**	Suction tube

5.1.8.1 Attach the titration stand to the titrator

- The spacing ring, clamping ring and threaded ring are mounted on the titration stand.

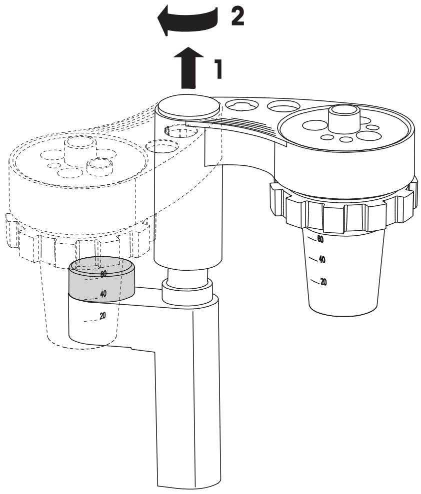
1 Remove the cover from one of the mounting holes.
2 Position the titration stand over the uncovered mounting hole.
3 Place the screw in the hole of the titration stand and screw it in the mounting hole.
4 Tighten the screw.



5.1.8.2 Swivel the titration stand

The titration stand can be swivelled among three predefined positions. If you use a compact stirrer, use the titration stand in the swivelled out position.

1 Pull the titration stand upward out of the holder until you feel resistance.
2 Swivel the titration stand to the desired position.
3 Slide the titration stand down until it rests on the holder.

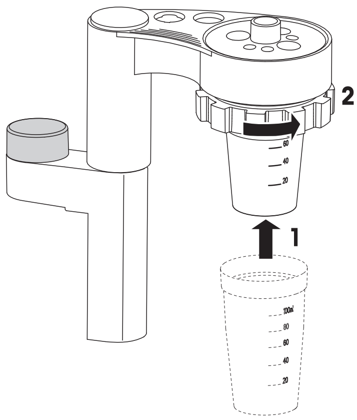


5.1.8.3 Attaching and removing the titration vessel

Attaching the titration vessel

- The titration stand is swivelled out.

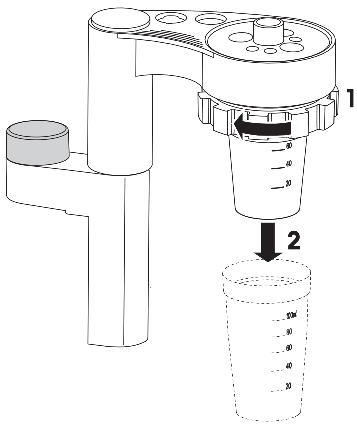
1 Turn the threaded ring a quarter to a half turn clockwise.
2 Guide the titration vessel upward (1) into the titration stand and hold the titration vessel in place.
3 Tighten the threaded ring (2).
4 Check that the titration vessel is firmly attached before you let it go.



Removing the titration vessel

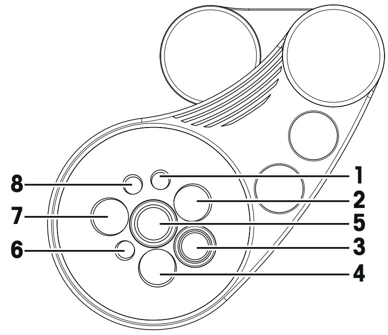
- The titration stand is swivelled out.

1 Hold the titration vessel with one hand.
2 Turn the threaded ring a quarter to a half turn clockwise (1).
3 Pull the titration vessel downward (2) out of the titration stand.



5.1.8.4 Recommended positions for sensors, tubes and stirrers

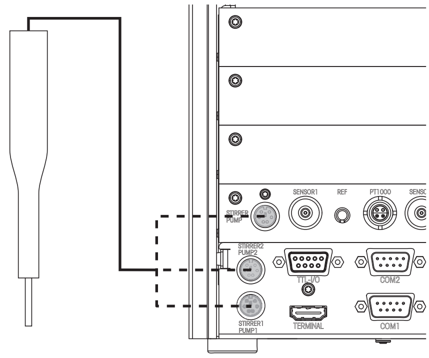
1 Dispensing tube
2 Sensor
3 Sensor or rinsing unit
4 Sensor
5 Compact stirrer
6 Dispensing tube
7 Sensor
8 Dispensing tube



5.1.8.5 Connect the compact stirrer

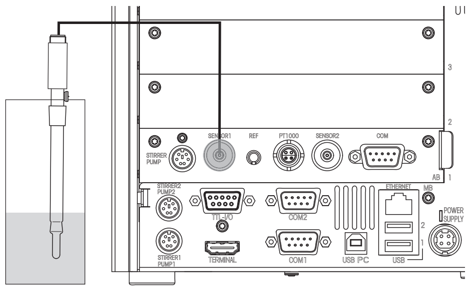
Depending on the configuration of the titrator, three or more compact stirrers can be connected. Compact stirrers attached directly to the titrator can be used in the manual titration stand or in connection with sample changers. The titrator controls turning on and off and stirrer speed.

1 Shut down the titrator.
2 Plug the compact stirrer into one of the **STIRRER PUMP** sockets on the rear of the titrator.
3 Start up the titrator.
⇨ The titrator detects the connected compact stirrer.



5.1.8.6 Connect the measuring electrode

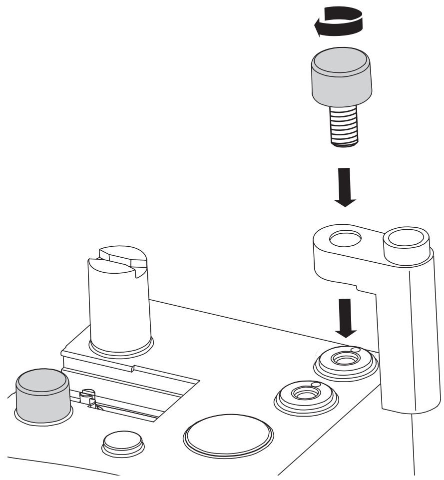
▪ No task is running on the titrator
1 Insert the measuring electrode into an opening in the titration stand.
2 Connect the triaxial cable to the **SENSOR1** socket or **SENSOR2** socket of the analog board on the rear of the titrator.
⇨ The titrator detects the measuring electrode.



5.1.8.7 Attaching the electrode arm

The electrode holder is used to receive an electrode in an electrode sleeve.

1 Remove the cover from one of the mounting holes.
2 Position the electrode holder over the uncovered mounting hole.
3 Place the screw in the hole of the electrode holder and screw it in.
4 Tighten the screw.



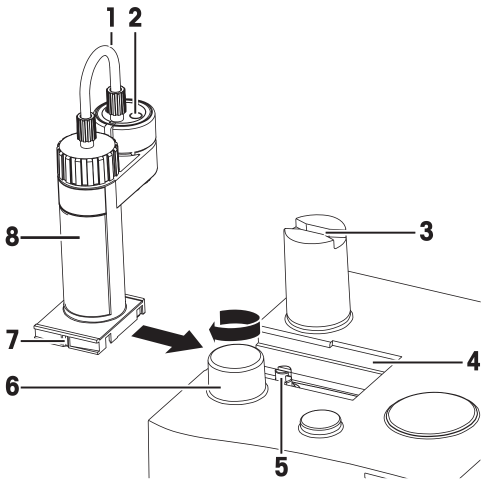
5.1.8.8 Insert and connect a burette

Current generation burettes are equipped with an Smart Tag on the holder (visible by the small, black cover plate). The Smart Tag is used for reading and writing properties such as titrate name, concentration or usable life.

For a description of the burette, refer to the operating instructions supplied with burettes.

- The burette is assembled.
- The burette holder is mounted on the titrant bottle.
- The piston rod (5) is in the home position.

1 Turn the arrestment knob (6) in the opposite direction of the arrow.
2 Orient the burette so that the recesses on the driver arm (3) are parallel to the groove (7) on the base of the burette housing.
3 Slide the burette (8) on to the titrator either from the left (as illustrated) or from the right (4).
4 Turn the arrestment knob (6) in the direction of the arrow to secure the burette.
5 Place the suction tube from the titrant botttle into the left hole (1) of the burette.
6 Place the dispensing tube into the right hole (2) of the burette.
7 To prevents spills, place the free end of the dispensing tube into the titration vessel, the waste bottle or another suitable container.



5.1.9 Plug & Play titration electrodes

Plug & Play electrodes have a chip in the sensor head in which sensor-specific data is stored, such as ID number, type and name of the sensor and the calibration values.

Observe the following points when handling Plug & Play electrodes:

- The titrator must be inactive when you connect or disconnect a Plug & Play electrode.
- A Plug & Play electrode is automatically detected when the titrator is inactive, i.e. no "task" is being performed (the"task" list is empty). Once the electrode has been connected to the titrator and the data transferred to it, you receive a notification stating which electrode is connected to which input.

- If additional "tasks" are running in parallel during an ongoing calibration method, the calibration data is not be transmitted to the sensor chip until the titrator is inactive. The electrode must remain connected to the titrator until all tasks are completed.
- Electrodes with an integrated temperature sensor must be connected to the same board (for example: AB1/Sensor1 and AB1/PT1000).
- If a Plug & Play electrode and an electrode without a sensor chip of the same type and with an identical name are specified in the titrator setup, the titrator automatically uses the Plug & Play electrode in a method.
- Plug & Play electrodes of the same type must have different names if they are used on the same titrator at the same time. If a measuring method starts and two identical Plug & Play electrodes are used, the method is terminated because the sensors cannot be identified.
- Use cable connectors with a blue ring.
- O-rings must not be fitted to the sensor connector, so that the electrical contact between the sensor and the cable is not compromised.

5.1.10 Connect a Rondolino TTL sample changer

The Rondolino sample changer is controlled by TTL signals from the titrator.

The installation of the sample changer is described in the separate Rondolino operating instructions.

▪ The sample changer is installed and switched off.

1 Shut down the titrator.

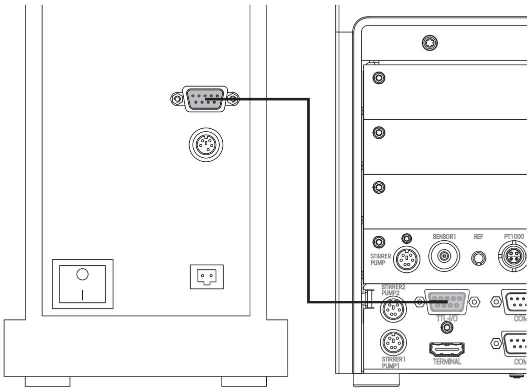
2 Plug the cable supplied with the sample changer into the **TTL-I/O** socket on the sample changer.

3 Plug the cable into the **TTL-I/O**socket on the rear panel of the titrator.

4 Start up the titrator.

5 Switch on the sample changer.

⇨ The titrator automatically detects the sample changer.



5.2 Optional equipment

5.2.1 Install plug-in cards

Depending on the type of titrator, plug-in cards can be installed in slots 1...3 and E. The number of plug-in cards that can be used depends on the type of titrator.

- T5: 1 plug-in card
- T7: 2 plug-in cards
- T9: 3 plug-in cards

If no coulometer board is installed, the slots 1..3 can be used in any sequence for analog boards and conductivity boards. If several plug-in cards of the same type are installed, they can be identified by their number. The titrator will display an analog board in Slot 3 as AB3 (Analog Board 3).

Slot E is reserved for the coulometer board. If a coulometer board is installed, slot 3 is deactivated.

The table shows for each plug-in card in which slot or slots it can be installed.

	T5				T7				T9			
Slot	1	2	3	E	1	2	3	E	1	2	3	E
Analog board	•	-	-	-	•	•	-	-	•	•	•	-
Conductivity board	•	-	-	-	•	•	-	-	•	•	•	-
Coulometer board	-	-	-	•	-	-	-	•	-	-	-	•

Examples:

- On a T5, a conductivity board has to be installed in slot 1.
- On a T9, if a coulometer board is installed, the conductivity board can be installed in slot 1 or slot 2.

NOTICE

Danger of damage to the board due to electrostatic discharges!

If you touch the board of the plug-in card, electrostatic discharges can damage the board.

– Only touch the cover plate of the plug-in card when you handle it.

5.2.1.1 Installing analog boards or conductivity boards

▪ The titrator is turned off and disconnected from the electrical outlet.

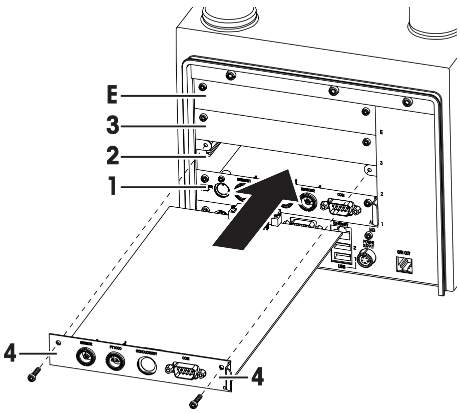
1 Unscrew and remove both Torx screws from the cover plate you want to remove.

2 Remove the cover plate.

3 Hold the plug-in card on the sides of the cover plate (4).

4 Insert the plug-in card into the guide rails and slide it in.

5 Secure the plug-in card with both screws.



Checking the installation

▪ The analog board or the conductivity board is installed.

1 Connect the AC adapter to a grounded electrical outlet.

2 Turn the titrator on.

⇨ The titrator detects the installed plug-in card.

3 Check under **Setup** > **Mainten. & Service** > **Board data** if the board has been detected.

4 If the board is not detected, repeat the procedure described at the beginning of the chapter.

5.2.1.2 Installing a coulometer board

NOTICE

Danger of damage to the titrator due to overheating!

The titrator can overheat if it has not enough ventilation openings or if more than 3 plug-in cards are installed.

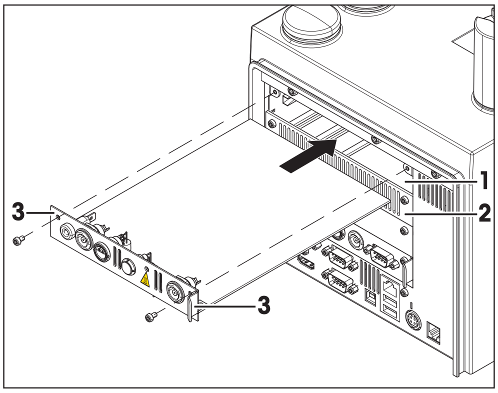
1 Install the cover plate with the ventilation openings on slot 3.

2 Never install more than 3 plug-in cards.

3 If slots 1…3 are occupied, install the cover plate with the ventilation openings on slot E.

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

1 Unscrew and remove both Torx screws from the cover plate on slot 3 (2).
2 Remove the cover plate.
3 Unscrew and remove both Torx screws from the cover plate on slot E (1).
4 Remove the cover plate and place it over slot 3 (2).
5 Secure the cover plate with two of the Torx screws.
6 Hold the plug-in card with the coulometer board on the sides of the cover plate (3).
7 Insert the plug-in card into the guide rails of slot E (1) and slide it in.
8 Secure the plug-in card with the two Torx screws.



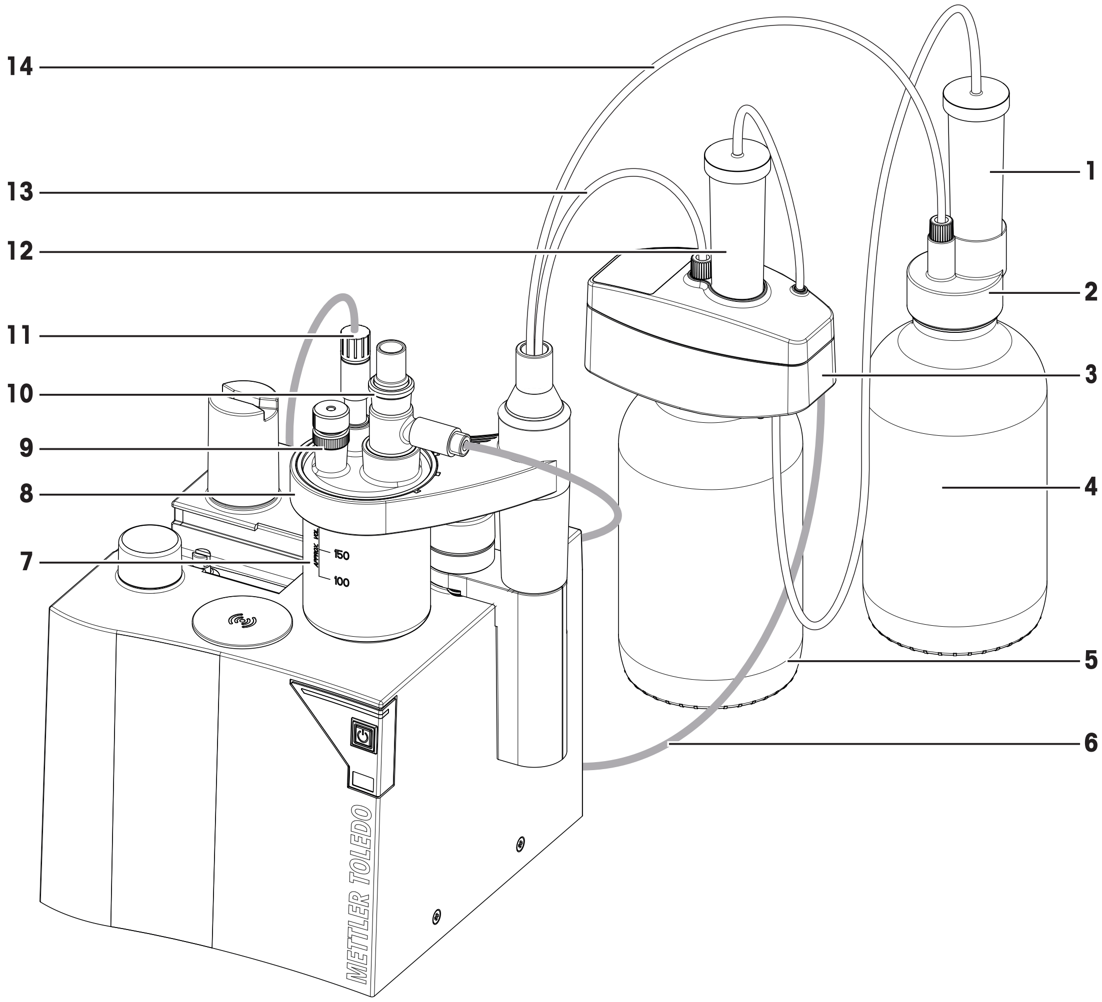
Checking the installation

- The coulometer board is installed.

1 Connect the AC adapter to a grounded electrical outlet
2 Turn the titrator on.
   ⇨ The titrator detects the installed plug-in card.
3 Check under **Setup** > **Mainten. & Service** > **Board data** if the board has been detected.
4 If the board is not detected, repeat the procedure described at the beginning of the chapter.

5.2.2 Set up the titrator for a coulometric Karl Fischer titration

The following illustration shows the setup of an Excellence Titrator for a coulometric Karl Fischer titration with automatic replacement of used solvent. For this setup you need a titrator, and the accessory "Coulometric Karl Fischer kit."



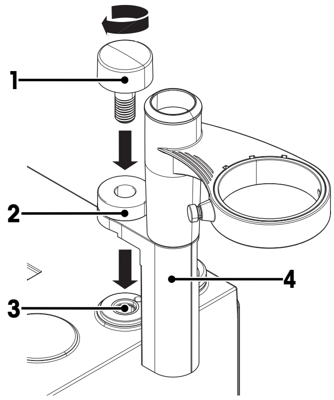
1	Drying tube of the solvent bottle	**8**	Titration arm
2	Screw top	**9**	Extraction adapter
3	Solvent manager	**10**	Generator electrode
4	Solvent bottle	**11**	Double platinum pin electrode
5	Waste bottle	**12**	Drying tube of waste bottle
6	Solvent manager cable	**13**	Suction tube for waste
7	Measuring cell	**14**	Dispensing tube for solvent

To install the coulometric Karl Fischer kit you need to perform the steps listed below.

1 [Install the coulometer board. ▸ Page 34]
2 [Install the titration stand. ▸ Page 37]
3 [Assemble titration stand and measuring cell. ▸ Page 37]
4 [Connect the measuring electrode and the generator electrode. ▸ Page 37]
5 Install the solvent manager on the waste bottle.
6 [Connect the solvent manager to the titrator. ▸ Page 38]
7 [Connect the waste bottle to the measuring cell. ▸ Page 39]
8 [Install the reagent exchange set on the solvent bottle. ▸ Page 40]
9 [Connect the solvent bottle to the measuring cell. ▸ Page 40]

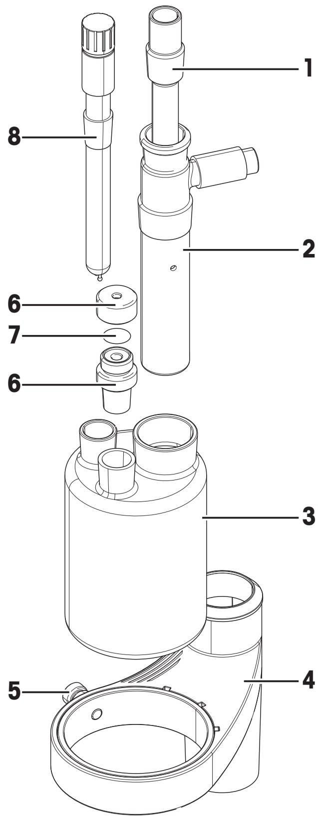
5.2.2.1 Installing the titration stand

1 Remove the cover from the front mounting hole (3).
2 Position the titration stand (4) and the height adapter (2) over the uncovered mounting hole (3).
3 Place the screw (1) in the hole of the titration stand and screw it in.
4 Tighten the screw (1).



5.2.2.2 Assembling titration stand and measuring cell

1 Slide the magnetic stirring rod carefully into the measuring cell (3).
2 Place the measuring cell (3) in the titration stand (4) and fasten it with the mounting bolt (5).
3 Lightly grease microsections with the silicone grease supplied.
4 Place the stopper (6) with septum (7) in one of the openings of the measuring cell (3).
5 Place the measuring electrode (8) in one of the openings of the measuring cell (3).
6 Place the generator electrode (2) in the biggest opening of the measuring cell (3).
7 Fill the drying tube (1) with molecular sieve and place it in opening of the generator electrode (2).

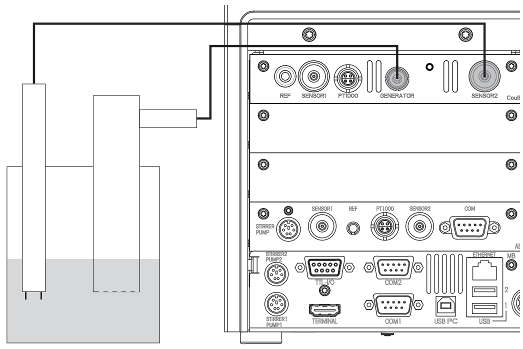


5.2.2.3 Connect the electrodes

The connection cables for the measuring and generator electrodes have different sized plug connectors on the device side. The cable for the generator electrode has a blue plug for the purposes of differentiation.

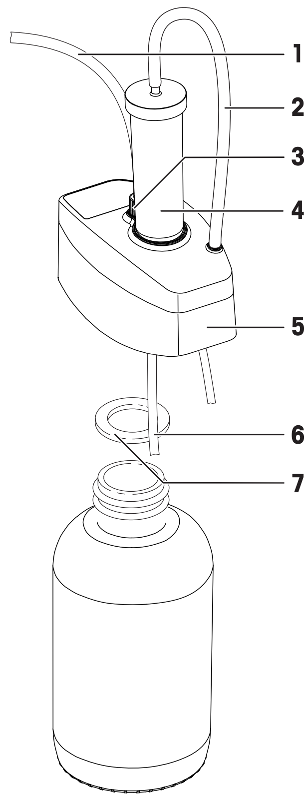
- The coulometer board is installed.
- No task is running on the titrator

1. To connect the generator electrode, plug the triaxial cable with the blue plug connector into the **GENERATOR** socket on the rear of the titrator.
2. To connect the measuring electrode, plug the triaxial cable with the gray plug connector into the **SENSOR2** socket on the rear of the titrator.



5.2.2.4 Assemble the waste bottle

1. Place the flat seal (7) on the opening of the bottle.
2. Screw the solvent manager (5) onto the bottle.
3. Loosen the threaded sleeve (3) on the solvent manager (5).
4. Push the thin end of the suction tube (1) through the threaded sleeve (3), so that it is just below the screw top.
5. Tighten the threaded sleeve (3).
6. Fill a drying tube (4) with molecular sieve.
7. Press the drying tube (4) into the appropriate opening of the solvent manager.
8. With a silicone tube (167 mm) (2), connect the drying tube (4) of the bottle to the appropriate adapter of the solvent manager.
9. To ensure that the system has no leaks, check all tubes and closing points for firm seating.

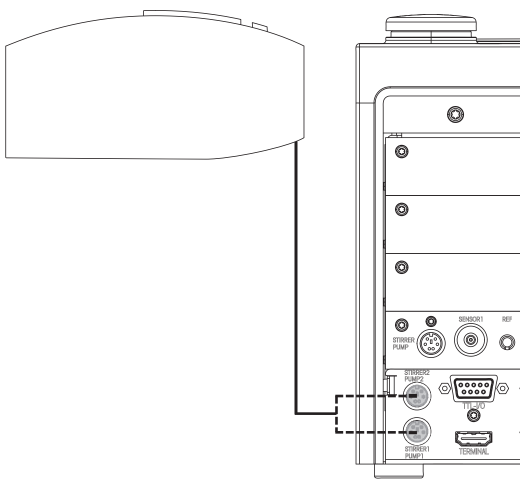


5.2.2.5 Connect the solvent manager to the titrator

Two solvent managers can be connected to a titrator.

1. Shut down the titrator.
2. Plug the cable supplied with the solvent manager into one of the two **STIRRER PUMP** sockets of the main board on the rear of the titrator.
3. Start up the titrator.

⇨ The titrator automatically detects the solvent manager.

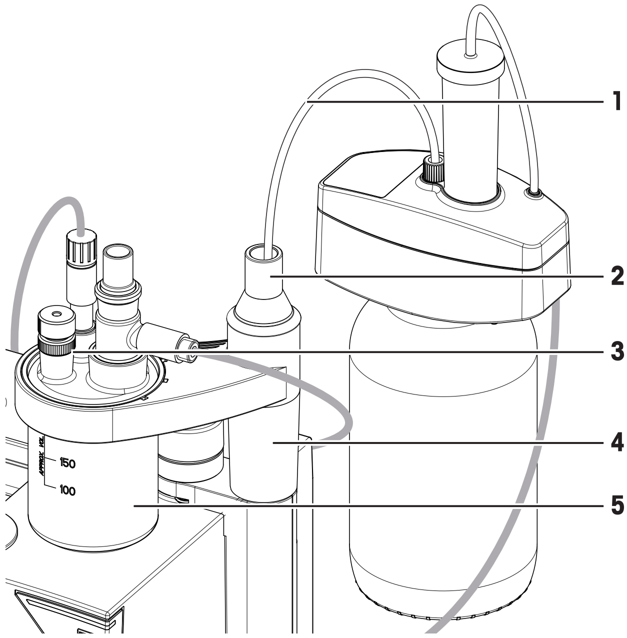


5.2.2.6 Connect the waste bottle

Manual exchange of solvent

- The solvent manager is installed on the waste bottle.

1. To extract exhausted solvent, remove the stopper (3) and push the free end of the suction tube (1) through the available opening and down to the bottom of the measuring cell (5).
2. To park the suction tube (1), place the free end of the suction tube (1) in the park sleeve (2) on the titration stand (4).
3. Add fresh solvent manually.

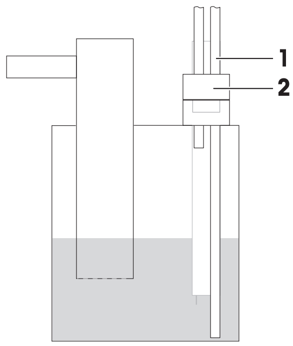


Automatic exchange of solvent

For the automatic exchange of solvent you need the optional reagent exchange set.

- The solvent manager is installed on the waste bottle.

1. Remove the stopper from the measuring cell.
2. Place the draining adapter (2) in the available opening of the measuring cell.
3. Push the free end of the suction tube (1) through one of the openings of the draining adapter (2) and down to the bottom of the measuring cell.

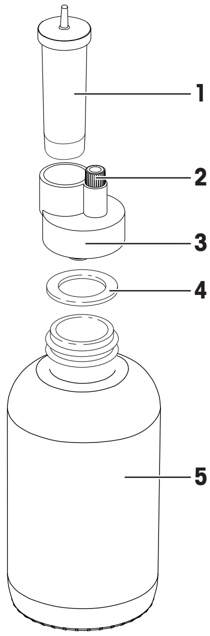


See also

🗎 Assemble the waste bottle ▶ Page 38

5.2.2.7 Assemble the solvent bottle

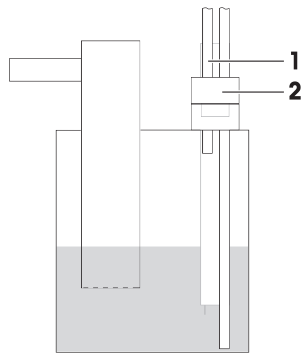
1 Place the flat seal (4) on the opening of the bottle (5) and screw the screw top (3) onto the bottle.
2 Loosen the threaded sleeve (2) on the screw top (3).
3 Push the dispensing tube through the threaded sleeve (2) and the screw top (3) and down to the bottom of the bottle.
4 Tighten the threaded sleeve (2).
5 Fill a drying tube (1) with a molecular sieve and press the drying tube (1) into the screw top (3) of the bottle (5).
6 Connect the drying tube of the screw top to the appropriate connection of the solvent manager.
7 Press the park sleeve into the opening on the titration stand.
8 To ensure that the system has no leaks, check all tubes and closing points for firm seating.

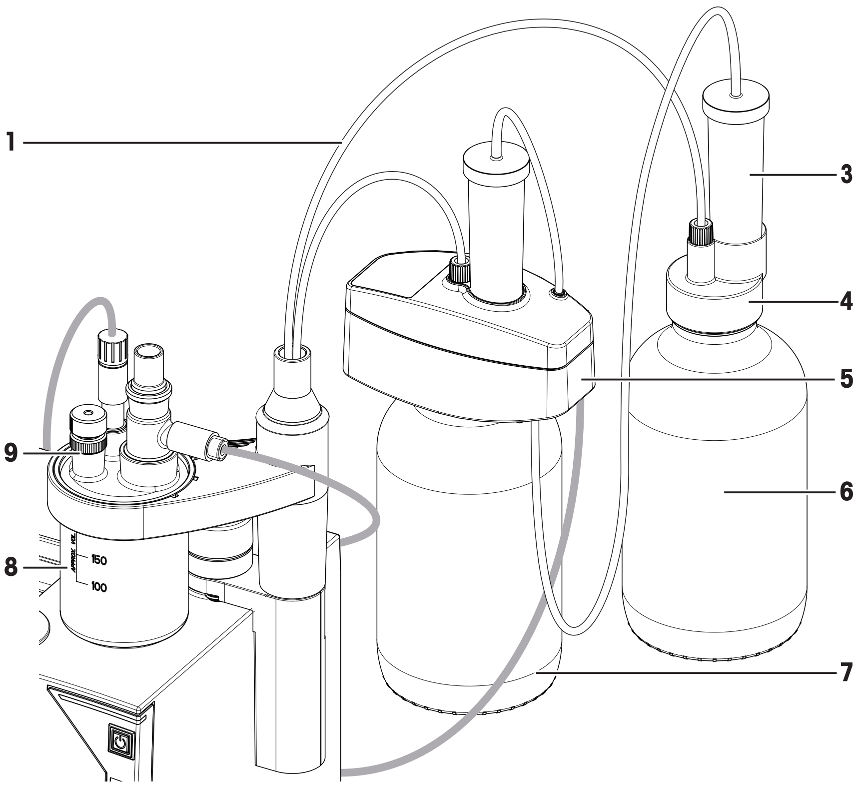


5.2.2.8 Connect the solvent bottle

- The solvent manager (5) is installed on the waste bottle (7).
- The optional reagent exchange set (3, 4) is installed on the solvent bottle (6).

1 Connect the drying tube (3) to the solvent manager (5).
2 Remove the stopper (9) from the measuring cell (8).
3 Place the draining adapter (2) in the available opening of the measuring cell (8).
4 Push the free end of the dispensing tube (1) through one of the openings of the draining adapter (2) into the measuring cell (8).



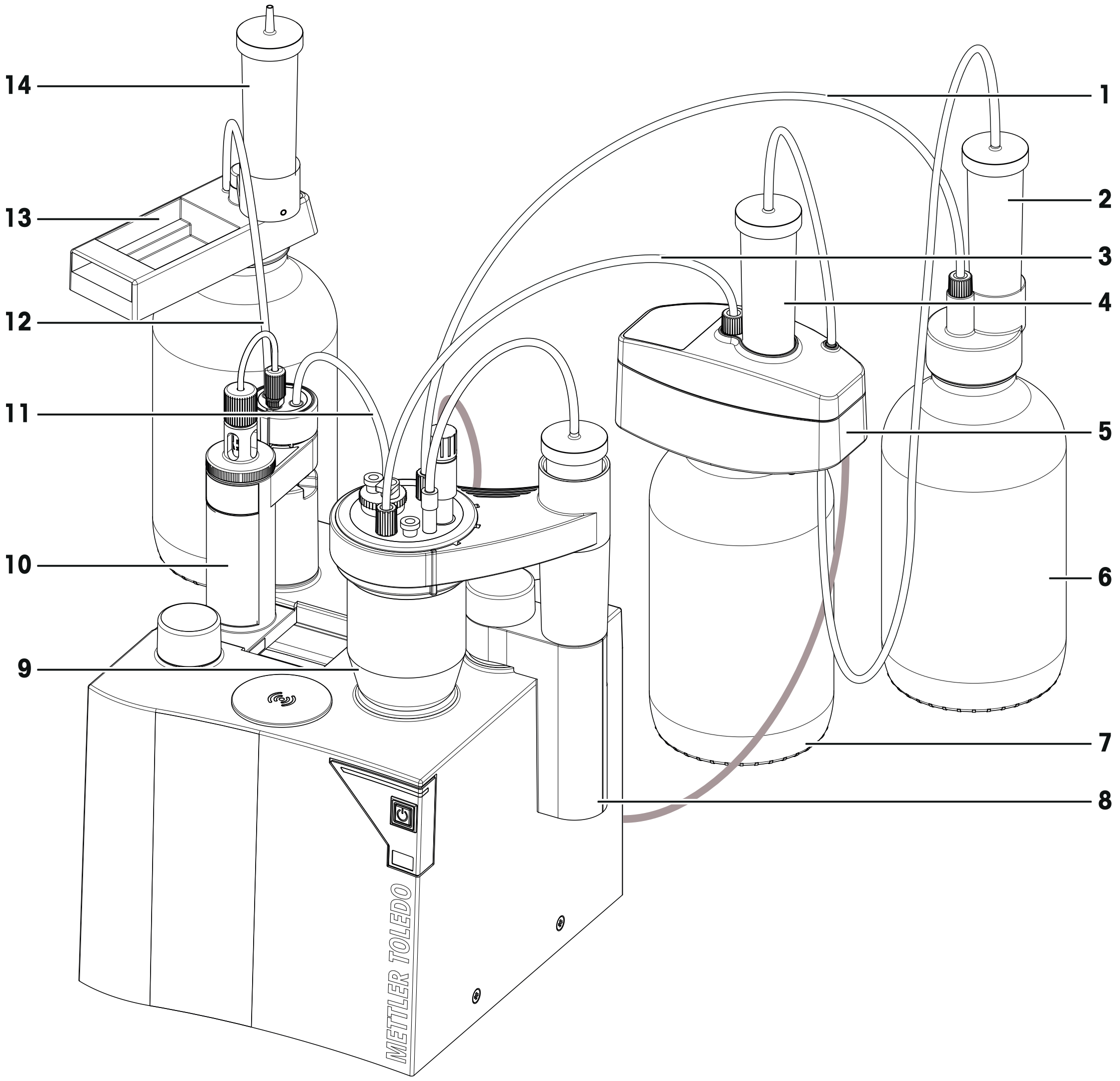


See also

🗎 Assemble the waste bottle ▸ Page 38
🗎 Assemble the solvent bottle ▸ Page 40

5.2.3 Set up the titrator for a volumetric Karl Fischer Titration

The following illustration shows the setup of an Excellence Titrator for a volumetric Karl Fischer titration with automatic replacement of used solvent. For this setup you need a titrator, and the accessories "Volumetric Karl Fischer kit" and "Reagent changing set."



1	Dispensing tube for solvent	**9**	Titration beaker
2	Drying tube of the solvent bottle	**10**	Burette
3	Suction tube for waste	**11**	Double platinum pin electrode
4	Drying tube of waste bottle	**12**	Dispensing tube for titrant
5	Solvent manager	**13**	Dispensing tube for titrant
6	Solvent bottle	**14**	Burette holder
7	Waste bottle	**15**	Drying tube of the titrant bottle
8	Titration arm		

To install the volumetric Karl Fischer kit the you need to perform the steps listed below.

1 [Install the titration stand. ▸ Page 42]
2 [Assemble titration stand and titration vessel. ▸ Page 42]
3 [Connect the measuring electrode. ▸ Page 43]
4 [Install the solvent manager on the waste bottle. ▸ Page 43]
5 [Connect the solvent manager to the titrator. ▸ Page 43]

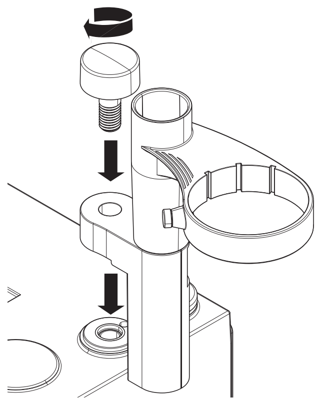
6 [Connect the waste bottle to the titration vessel. ▸ Page 44]
7 [Install a burette. ▸ Page 45]
8 [Connect the burette to the titrant bottle. ▸ Page 45]
9 [Connect the burette to the titration vessel. ▸ Page 45]

If you use the optional reagent exchange set. You need to perform the steps listed below in addition.

1 [Install the reagent exchange set on the solvent bottle. ▸ Page 46]
2 [Connect the solvent bottle to the titration vessel. ▸ Page 46]

5.2.3.1 Installing the titration stand

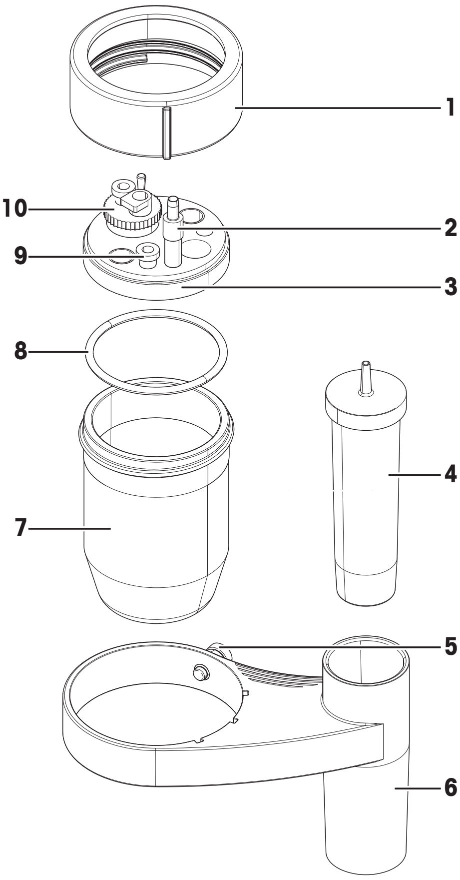
1 Remove the cover from the front mounting hole.
2 Position the titration stand over the uncovered mounting hole.
3 Place the screw in the hole of the titration stand and screw it in.
4 Tighten the screw.



5.2.3.2 Assembling titration stand and titration vessel

The titration arm can be pivoted in both directions.

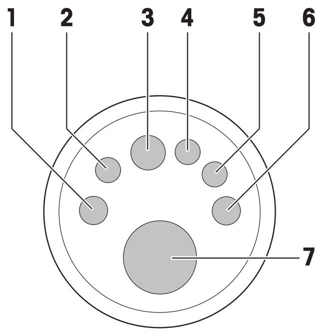
1 Carefully slide the magnetic stirring rod supplied into the titration vessel (7).
2 Place the O-ring (8) on the opening of the titration vessel (7).
3 Place the cover plate (3) over the opening of the titration vessel (7).
4 Place the threaded ring (1) on the titration vessel (7) and tighten the threaded ring (1).
   ⇨ The titration vessel is assembled.
5 Orient the titration vessel so the lobe on the threaded ring (1) is aligned with the center groove of the titration arm (6).
6 Slide the titration vessel (7) into the opening of the titration arm (6) and press it down until it rests on the internal magnetic stirrer.
7 To secure the titration vessel (7), tighten the fastening screw (5).
8 Place the three hole adapter (10), NS stopper (9) and connecting piece (2) into the lid openings.
9 Fill a drying tube (4) with molecular sieve and press it into the titration stand (6).
10 Push a silicon tube over the opening of the drying tube (4) and the connecting piece (2).



5.2.3.3 Recommended positions for sensors, tubes and stoppers

The titration vessel is normally connected as illustrated.

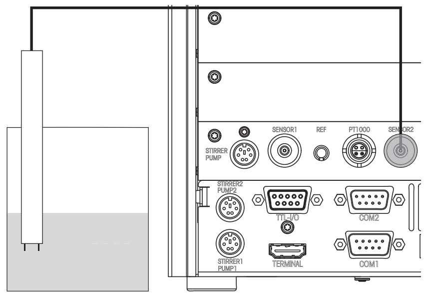
1 Dispensing tube for solvent
2 Dispensing tube for titrant
3 Measuring electrode
4 Stopper
5 Connection to drying tube on titration stand
6 Suction tube for used solvent
7 Three hole adapter



5.2.3.4 Connect the measuring electrode

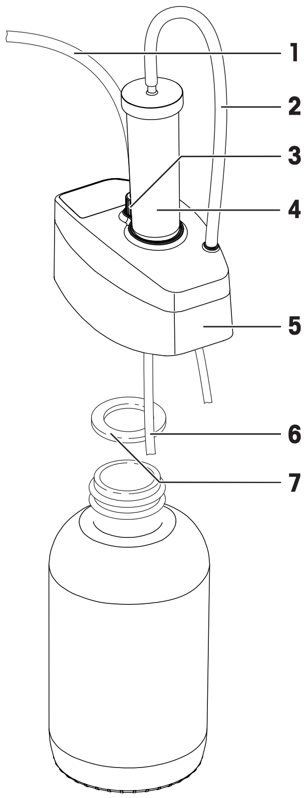
- No task is running on the titrator

1. Place the measuring electrode into the appropriate opening of the titration vessel.
2. To connect the measuring electrode, plug the triaxial cable into the **SENSOR2** socket on the rear of the titrator.



5.2.3.5 Assemble the waste bottle

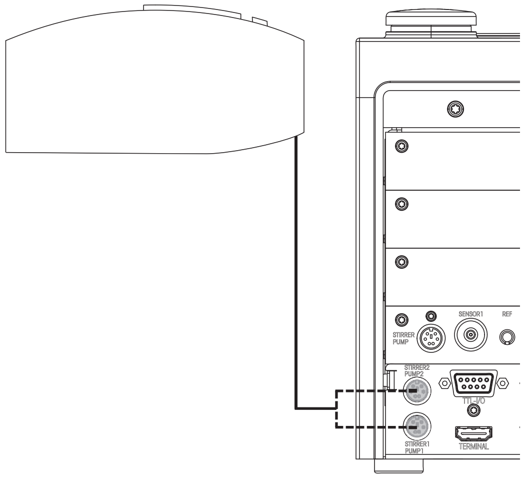
1. Place the flat seal (7) on the opening of the bottle.
2. Screw the solvent manager (5) onto the bottle.
3. Loosen the threaded sleeve (3) on the solvent manager (5).
4. Push the thin end of the suction tube (1) through the threaded sleeve (3), so that it is just below the screw top.
5. Tighten the threaded sleeve (3).
6. Fill a drying tube (4) with molecular sieve.
7. Press the drying tube (4) into the appropriate opening of the solvent manager.
8. With a silicone tube (167 mm) (2), connect the drying tube (4) of the bottle to the appropriate adapter of the solvent manager.
9. To ensure that the system has no leaks, check all tubes and closing points for firm seating.



5.2.3.6 Connect the solvent manager to the titrator

Two solvent managers can be connected to a titrator.

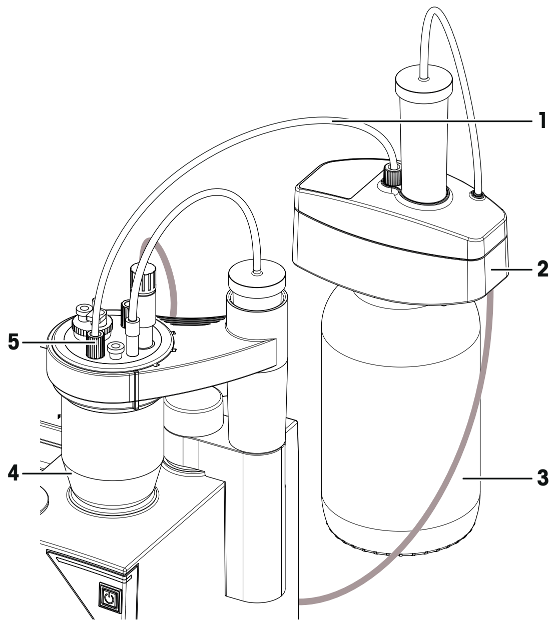
1 Shut down the titrator.
2 Plug the cable supplied with the solvent manager into one of the two **STIRRER PUMP** sockets of the main board on the rear of the titrator.
3 Start up the titrator.
⇨ The titrator automatically detects the solvent manager.



5.2.3.7 Connect the waste bottle to the titration vessel

Manual exchange of solvent

▪ The solvent manager (2) is installed on the waste bottle (3). See Installing the solvent manager.
1 Screw the adjusting sleeve (5) on the free end of the suction tube (1) into the cover plate.
2 To extract used solvent, push the suction tube (1) into the titration vessel (4) until it touches the bottom of the titration vessel.



Automatic exchange of solvent

NOTICE

Danger of blockage due to undissolved material

If a sample is not completely dissolved it can block tubes.

– Do not use the adapter for immediate draining if you work with samples that are not dissolved completely.

NOTICE

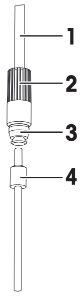
Danger of damage to the adapter for immediate draining by a homogenizer

The adapter for immediate draining can be damaged if it is sucked into the homogenizer.

– Do not use the adapter for immediate draining in connection with a homogenizer.

- The solvent manager is installed on the waste bottle. See Installing the solvent manager.

1 On the free end of the suction tube (1), push the adjusting sleeve (2) and PTFE ring (3) back a little.
2 Take the adapter for immediate draining (4) and carefully insert it into the suction tube (1).
3 Insert the suction tube (1) with the adapter for immediate draining (4) into one of the openings of the titration vessel.
4 Screw the adjusting sleeve (2) into the cover plate.
5 Push the suction tube (1) into the titration vessel until the adapter for immediate draining (4) touches the bottom of the titration vessel.



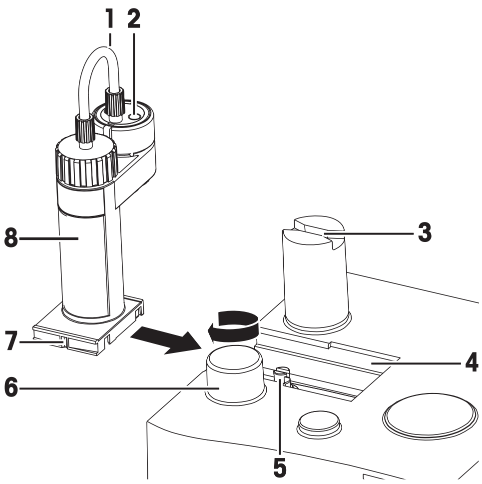
5.2.3.8 Insert and connect a burette

Current generation burettes are equipped with an Smart Tag on the holder (visible by the small, black cover plate). The Smart Tag is used for reading and writing properties such as titrate name, concentration or usable life.

For a description of the burette, refer to the operating instructions supplied with burettes.

- The burette is assembled.
- The burette holder is mounted on the titrant bottle.
- The piston rod (5) is in the home position.

1 Turn the arrestment knob (6) in the opposite direction of the arrow.
2 Orient the burette so that the recesses on the driver arm (3) are parallel to the groove (7) on the base of the burette housing.
3 Slide the burette (8) on to the titrator either from the left (as illustrated) or from the right (4).
4 Turn the arrestment knob (6) in the direction of the arrow to secure the burette.
5 Place the suction tube from the titrant botttle into the left hole (1) of the burette.
6 Place the dispensing tube into the right hole (2) of the burette.
7 To prevents spills, place the free end of the dispensing tube into the titration vessel, the waste bottle or another suitable container.



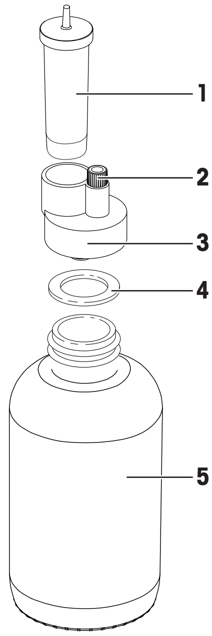
5.2.3.9 Connect the burette to the titration vessel

- The burette is installed and connected to the titrant bottle. See [Insert and connect a burette ▶ Page 45].

– Insert the free end of the dispensing tube for titrant into the next available opening in the titration stand, which is located counterclockwise from the electrode.

5.2.3.10 Assemble the solvent bottle

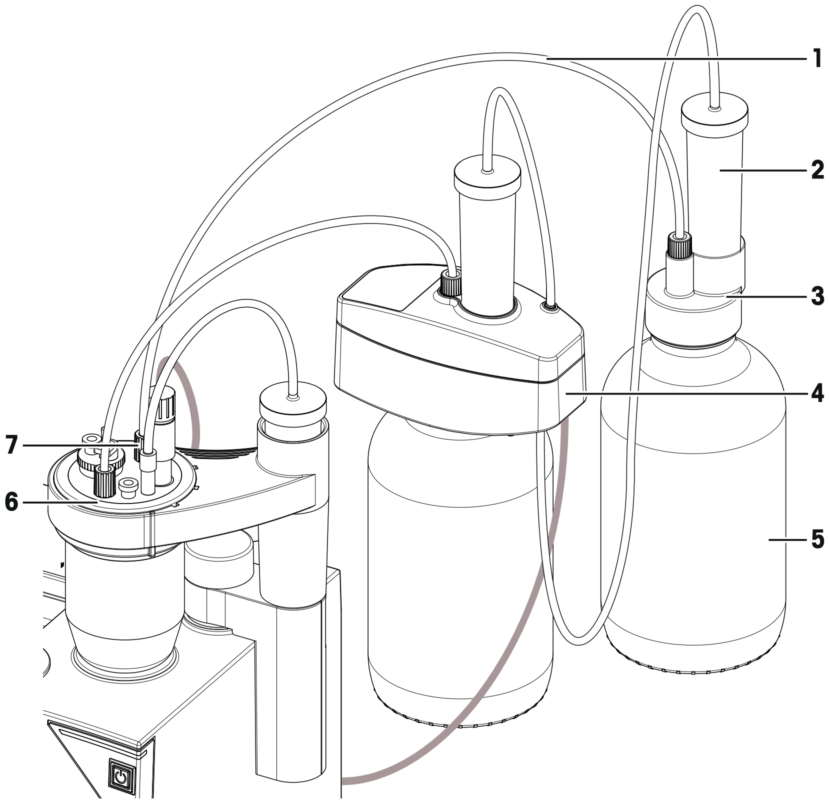
1 Place the flat seal (4) on the opening of the bottle (5) and screw the screw top (3) onto the bottle.
2 Loosen the threaded sleeve (2) on the screw top (3).
3 Push the dispensing tube through the threaded sleeve (2) and the screw top (3) and down to the bottom of the bottle.
4 Tighten the threaded sleeve (2).
5 Fill a drying tube (1) with a molecular sieve and press the drying tube (1) into the screw top (3) of the bottle (5).
6 Connect the drying tube of the screw top to the appropriate connection of the solvent manager.
7 Press the park sleeve into the opening on the titration stand.
8 To ensure that the system has no leaks, check all tubes and closing points for firm seating.



5.2.3.11 Connect the solvent bottle

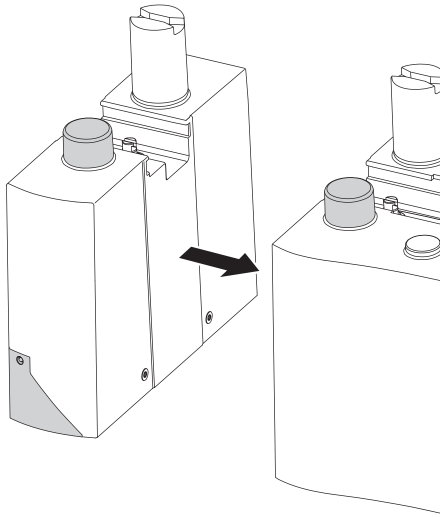
- The solvent manager (4) is installed on the waste bottle.
- The reagent exchange set (2, 3) is installed on solvent bottle (5).

1 Connect the drying tube (2) to the solvent manager (4).
2 Screw the free end of the dispensing tube (1) with the adjusting sleeve (7) into an opening of the cover plate (6).



5.2.4 Connecting dosing units

A burette drive is built into the instrument. Depending on the type of titrator, up to 3 or 7 additional dosing units can be installed. Connections between dosing units are established using CAN bus cables. Dosing units automatically detect current generation burettes. The control lamp attached to the front panel will light when the dosing unit is ready to operate.

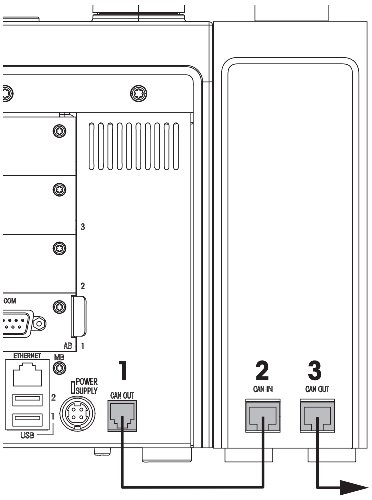


Connecting the first dosing unit

1 Turn the titrator off.
2 Place the first dosing unit next to the instrument.
   ⇨ The dosing unit is pulled toward the instrument and held in place with magnets.
3 Plug the supplied CAN bus cable into the port "CAN OUT" (1) on the titrator.
4 Plug the other end of the cable into the port "CAN IN" (2) on the dosing unit.
5 Turn the titrator on.
   ⇨ The titrator automatically detects the dosing unit.

Connecting additional dosing units

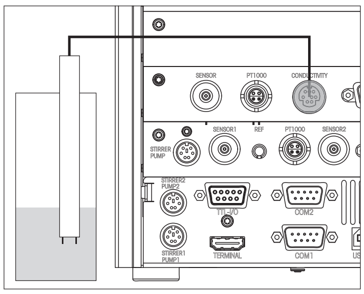
1 Turn the titrator off.
2 Place the dosing unit next to the previous dosing unit.
   ⇨ The dosing unit is pulled toward the previous dosing unit and held in place with magnets.
3 Plug the supplied CAN bus cable into the port "CAN OUT" (3) on the previous dosing unit.
4 Plug the other end of the cable into the port "CAN IN" on the dosing unit.
5 Turn the titrator on.
   ⇨ The titrator automatically detects the connected dosing units.



5.2.5 Connecting the Thermotrode

- A conductivity board with firmware version ≥1.4 and hardware revision >0 is installed.

1 Make sure that no task is running on the titrator.
2 To connect the Thermotrode, plug the cable on the conductivity board into the "CONDUCTIVITY" socket.



5.2.6 Set up an InMotion KF

The installation of the sample changer is described in the separate InMotion KF Operating Instructions.

5.2.6.1 Connect the sample changer to the titrator

- The sample changer is installed and shut down.

1 Plug the cable supplied with the sample changer into the **INSTRUMENT** socket on the sample changer.
2 Plug the cable into the **USB 1** or **USB 2** socket on the rear panel of the titrator.

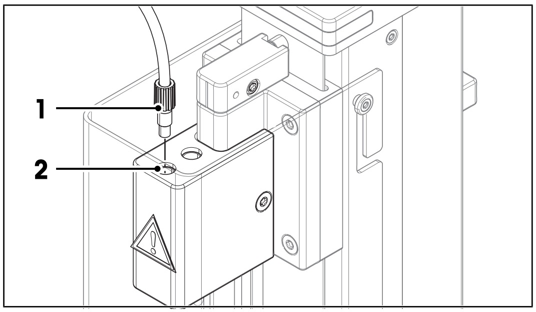
3 Start up the sample changer.

⇨ The titrator automatically detects the sample changer.

5.2.6.2 Connect the KF head to a volumetric titration vessel

- The sample changer is shut down.
- The titrator is set up for a volumetric Karl Fischer titration.

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

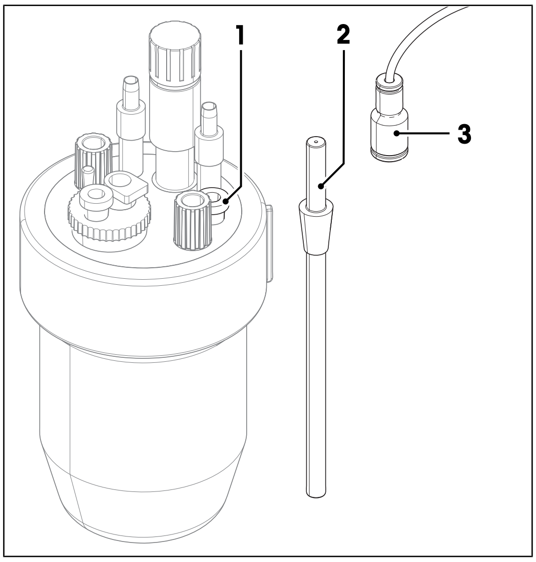


2 Remove the NS stopper (1) from the cover plate.

3 Insert the gas inlet for volumetric KF (2) in the opening.

4 Push the gas inlet as far as you can into the coupling (3) of the transfer tube.

⇨ You can no longer pull the gas inlet out without using force.



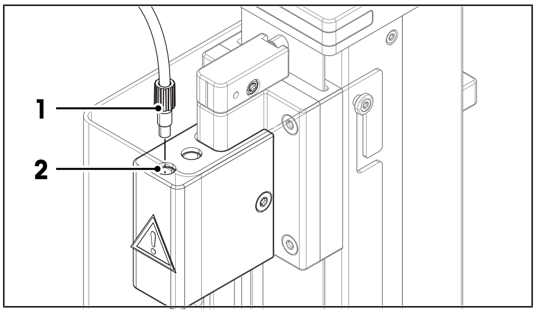
See also

Set up the titrator for a volumetric Karl Fischer Titration ▸ Page 41

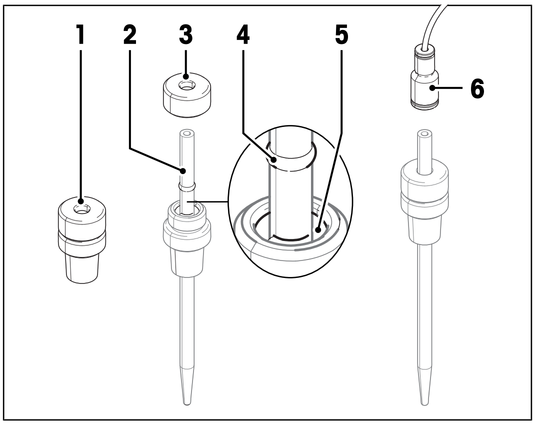
5.2.6.3 Connect the KF head to a coulometric measuring cell

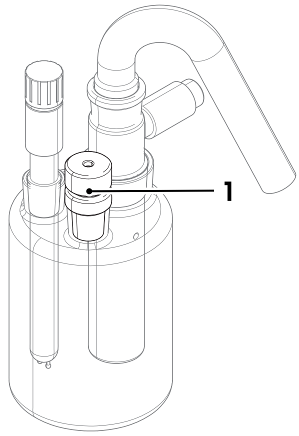
- The sample changer is shut down.
- The titrator is set up for a coulometric Karl Fischer titration.

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



2 Unscrew and remove the upper part of the gas inlet adapter.
3 Insert the gas inlet (2) from above in the gas inlet adapter (1) until the bulge (4) of the gas inlet adapter sits on the O-ring (5) of the gas inlet adapter.
4 Insert the gas inlet (2) through the hole in the upper part of the gas inlet adapter (3).
5 Screw the two parts of the gas inlet adapter together.
   ⇨ The gas inlet adapter is assembled.
6 Push the gas inlet as far as you can into the coupling (6) of the transfer tube.
   ⇨ You can no longer pull the gas inlet out without using force.
7 Remove the stopper (1).
8 Insert the assembled gas inlet adapter in the opening.





See also

🗎 Set up the titrator for a coulometric Karl Fischer titration ▸ Page 36

5.2.6.4 Configure the vial height

Set the vial height

- The sample changer is installed and connected to the titrator.
- The sample changer is running.

1 Make sure the screw cap sits tightly on the vial.
2 Measure the vial height including the screw cap.
3 Go to **Home** > **Setup** > **Hardware** > **Titration Stands**.
4 Select the **InMotion KF** titration stand that is connected to the titrator.
5 Set **Vial height** to the height you have measured.
6 Tap **Save**.

Test the vial height setting

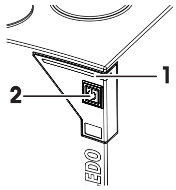
1 Place the vial in the drift position of the sample changer.
2 Go to **Home** > **Methods** > **New** > **Standard method templates**.
3 Depending on your setup, select the method **InMotion KF Vol.** or **InMotion KF Coul.**
4 Tap **Save**.
5 Tap **Start**.
   ⇨ The sample changer moves the drift position to the oven position.
   ⇨ If the drift determination starts, the setting is correct.
6 If the error message **No vial detected. Check vial height or height setting.** opens, increase the setting for **Vial height** by 1 mm.
7 If the error message **Tower lift blocked. Check vial cap or needle. Use vial with appropriate height or remove obstacle. Check height setting.** opens, decrease the setting for **Vial height** by 1 mm.

6 Operating the instrument

6.1 Start up the titrator and shut down the titrator

Start up the titrator

– Press the power button (2).
  ⇨ The StatusLight (1) turns green and turns off after a few seconds.
  ⇨ The titrator starts up and detects connected devices.
  ⇨ The titrator is ready for use when the StatusLight (1) is steady and green.



Shut down the titrator from the touch screen

– Tap **Home** > **Log out** > **Shut down**.
  ⇨ The titrator stops running tasks and shuts down.

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

Shut down the instrument using the power button

– Press the power button for less than 1 s.
  ⇨ The titrator stops running tasks and shuts down.

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

Shut down of the instrument in emergency situations

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

6.2 Running a general titration

To explain the procedure for a titration method, a simple acid-base titration with a manual titration stand is described. 5 ml of HCl solution (0.1 mol/L) is titrated with NaOH (0.1 mol/L).

Material

Sensor: DGi115-SC

Chemicals

For this titration you need the chemicals listed below.

- Approx. 5 ml of a HCl solution (0.1 mol/L)
- A titrant bottle containing a carbonate free NaOH solution (0.1 mol/L)
- 3 buffer solutions: pH 4.01, 7.00 and 9.21 from METTLER TOLEDO
- Approximately 50 mg potassium hydrogen phthalate

6.2.1 Preparation

▪ The titrator is assembled, connected, and installed (see Installation).
▪ A compact stirrer is placed in the appropriate opening on the titration stand and connected to the **STIRRER PUMP** output of the titrator.
▪ A USB printer is connected to port **USB 1** or **USB 2** of the titrator.

1. Tap **Setup** > **Hardware** > **Titration Stands** > **Manual stand** > **Save**.
2. Prepare the 10 ml burette for the sodium hydroxide.
3. To protect the NaOH solution against CO_2, install a drying tube on the burette holder of the NaOH bottle.
4. Insert the burette.
   ⇨ An **Info** dialog appears, which allows you to initialize the burette. Burettes only have to be initialized the first time they are used on the titrator.
5. If you use the burette for the first time on the titrator, tap **Initialize**.
   ⇨ The titrator initializes the burette.

6 When the burette is initialized, remove the burette from the titrator and place the burette back on the titrator.

⇨ The titrator recognizes the initialized burette.

7 To create a new titrant for the burette, tap **Create**.

8 To assign a titrant to the burette, tap **Assign** .

⇨ The system updates the burette data and the assigned titrant appears with the suffix **PnP** in the setup.

9 Attach a titration vessel to the titration stand and connect the dispensing tube for the titrant to the titration head.

6.2.2 Rinsing and filling the burette

To fill the burette and tubes with titrant and remove any air bubbles from the system, rinse the burette three times with titrant with the manual operation **Rinse**.

- The titrator is prepared as described in [Preparation ▸ Page 50].

1 To ensure that the system has no leaks, check all tubes and closing points for firm seating.

2 Make sure that the free end of the dispensing tube for the titrant is placed in the titration vessel or another container.

3 Tap **Manual** > **Burette** > **Rinse**.

⇨ The dialog **Rinse** opens.

4 Set **Titrant** to **NaOH 0.1 mol/L**.

5 Set **Cycles** to "3".

6 To start the rinse procedure, tap **Start**.

⇨ The rinse procedure starts and an animation shows the progress.

7 When the rinse procedure is complete, tap **OK**.

⇨ The dialog **Rinse** opens.

⇨ The burette is filled and the tubes are free of air bubbles.

See also

🗎 Preparation ▸ Page 54

6.2.3 Calibrating and testing the sensor

The following describes how to calibrate a pH sensor or carry out a sensor test.

Preparation

1 Make sure no analysis is running on the titrator.

2 Connect the plug of the sensor (DGi115-SC) to the port "SENSOR" of the titrator.

3 Insert the sensor into the titration head.

4 Prepare three titration vessels containing buffer solutions (pH 4.01, 7.00 and 9.21).

6.2.3.1 Calibrate the sensor

1 Tap **Methods** > **New** > **Standard method templates** > **Calibration**.

⇨ A list of method functions appears.

2 Tap **Sample (Calib)**.

⇨ The dialog **Sample (Calibration)** opens.

3 Make sure **Sensor** is set to DGi115-SC.

4 Make sure the settings for the buffer are as listed below.
Buffer 1: 4.01
Buffer 2: 7.00
Buffer 3: 9.21

5 Tap **OK** > **Save**

⇨ The new method is saved in the method list, with the next free ID and with the title **Calibration**.

6 Tap **Start**.
   ⇨ The dialog **Start analysis** opens.
7 To ensure that the system has no leaks, check all tubes and closing points for firm seating.
8 Tap **Start**.
   ⇨ The system asks you to attach the titration vessel with sample 1 to the titration arm.
9 Attach the titration vessel with the buffer solution with pH 4.01 to the titration arm and tap **OK**.
   ⇨ The measurement starts after the stirring time.
   ⇨ During the measurement the online screen displays the time, the measured value in [mV] and a curve.
   ⇨ During the calibration, the system will output a record on the printer.
   ⇨ When the measurement is completed, the system asks you to attach the titration vessel with the next sample to the titration arm.
10 Remove the titration vessel from the titration arm.
11 Rinse the electrode with deionized water.
12 Repeat the last 3 steps for the buffer solution with pH 7.00 and the buffer solution with pH 9.21.
   ⇨ When the calibration is completed, the calibration data is automatically copied to the setup.

6.2.3.2 Test the pH-sensor

1 Tap **Methods** > **New** > **Standard method templates** > **Sensor test**.
   ⇨ A list of method functions appears.
2 Tap **Sample (Calib)**.
   ⇨ The dialog **Sample (Calibration)** opens.
3 Make sure **Sensor** is set to DGi115-SC.
4 Make sure the settings for the buffer are as listed below.
   Buffer 1: 4.01
   Buffer 2: 7.00
   Buffer 3: 9.21
5 Tap **OK** > **Save**
   ⇨ The new method is saved in the method list with the next free ID and with the title **Sensor test**.
6 Tap **Start**.
   ⇨ The dialog **Start analysis** opens.
7 To ensure that the system has no leaks, check all tubes and closing points for firm seating.
8 Tap **Start**.
   ⇨ The system asks you to attach the titration vessel with sample 1 to the titration arm.
9 Attach the tiration vessel with the buffer solution with pH 4.01 to the titration arm and tap **OK**.
   ⇨ The measurement starts after the stirring time.
   ⇨ During the measurement the online screen displays the time, measurement in [mV] and the curve.
   ⇨ During the pH-sensor test, the system will output a record on the printer.
   ⇨ When the measurement is completed, the system asks you to attach the titration vessel with the next sample to the titration arm.
10 Remove the titration vessel from the titration arm.
11 Rinse the electrode with deionized water.
12 Repeat the last 3 steps for the buffer solution with pH 7.00 and the buffer solution with pH 9.21.
   ⇨ When the pH-sensor test is completed, the data is automatically copied to the setup.

6.2.4 Determining the titer

1 Weigh about 50 mg of potassium hydrogen phthalate and dissolve it in a titration vessel containing deionized water.
2 Tap **Methods** > **New** > **Standard method template** > **Titer with EQP**.
   ⇨ A list of method functions appears.
3 Tap **Sample (Titer)**.

4 Set the parameter **Entry** to **Before** and tap **OK**.
5 Tap **Titration (EQP)** > **Termination**.
6 Activate **After number of recognized EQPs**, set **Number of EQPs** to 1 and tap **OK**.
7 To exit the method function, tap **OK**
8 To save the new method, tap **Save**.
9 To ensure that the system has no leaks, check all tubes and closing points for firm seating.
10 Tap **Start**.
⇨ The **Start analysis** dialog opens.
11 Enter the sample size.
12 Tap **Start**.
⇨ The titer determination begins.
⇨ The titrator asks you to add sample 1/1.
13 Attach the titration vessel with potassium hydrogen phthalate solution to the titration head and tap **OK**.
⇨ The titration starts after the stirring time.
⇨ During the titer determination, the online screen displays the measured pH values over the titrated volume in [mL].
⇨ After the titer determination is completed, the titer is copied to the setup.
14 After the titer determination is completed, rinse the sensor with deionized water.

6.2.5 Run an EQP titration

6.2.5.1 Prepare the sample

1 Fill 5 ml HCl (0.1 mol/L) into a titration vessel and dilute it with approx. 50 mL deionized water.
2 Attach the titration vessel to the titration arm.

6.2.5.2 Configure the method

1 Tap **Methods** > **New** > **Standard method template** > **EQP**.
2 Tap **Title**.
3 Enter a title for the new method in the field **Title** and tap **OK**.
4 Tap **Sample**.
5 In the parameter **ID 1** enter your choice of ID for the sample to be analyzed.
6 Set **Entry type** to **Volume**.
7 Set **Lower limit** to 6.0 mL.
8 Set **Upper limit** to 50.0 mL.
9 Set **Entry** to **Before** and tap **OK**.
10 Tap **Titration (EQP)** > **Termination**.
11 Activate the parameter **After number of recognized EQPs**, set **Number of EQPs** to 1 and tap **OK**.
12 To exit the method function, tap **OK**.
13 Tap **Calculation R1**.
14 Tap **Result proposals**.
15 Select the result **Content** with the unit **mol/L**.
⇨ The main parameters in the method function **Calculation R1** are filled in automatically.
16 Set **M [g/mol]** to **Hydrochloric acid** and tap **OK**.
17 Tap **Calculation R2**.
18 Tap **Delete**.
19 Tap **Save**.

6.2.5.3 Create an indirect shortcut

1 Tap **Start**.
⇨ The **Start analysis** window opens.

2 Tap **AddToHome**.

⇨ The **Shortcut parameters** window opens.

3 Enter a name for the shortcut in **Description**.

4 Make sure **Immediate start** is deactivated.

5 Tap **Save**.

⇨ The home screen with the new shortcut opens.

6.2.5.4 Perform the analysis

1 To ensure that the system has no leaks, check all tubes and closing points for firm seating.

2 Select the shortcut on the home screen.

⇨ The dialog **Start analysis** opens.

3 In the parameter **Enter sample size** enter the sample size.

4 Tap **Start**.

⇨ You are prompted to add the sample.

5 If the titration vessel is not attached to the titration arm, attach the titration vessel containing the HCl solution to the titration arm and tap **OK**.

⇨ The titration starts after the pre-stirring period.

⇨ During the titration, the screen displays the measured pH values over the titrated volume in [mL].

⇨ After the titration, a record is printed.

⇨ All results are saved.

6 After the titration, rinse the sensor with deionized water.

7 To view the saved result, tap **Home** > **Results**.

6.3 Running a volumetric Karl Fischer titration

The following chapters show how to perform a simple volumetric Karl Fischer titration using the standard method KFVol 1-comp 5.

Chemicals

For this titration you need the chemicals listed below.

- 1% KF standard solution as sample
- KF 1-comp 5 as titrant
- Water-free methanol as KF solvent

6.3.1 Preparation

- The titrator is installed.
- The titration stand is installed and the titration vessel is assembled.
- The measuring electrode is connected.
- The solvent manager is installed on the waste bottle and connected to the titrator and the measuring cell.
- The reagent exchange set is installed and the solvent bottle is connected to the measuring cell.
- The burette is assembled.
- A USB printer is connected to port "USB1" or "USB2" of the titrator and configured.

1 Pivot the titration arm so the titration vessel is positioned over the internal magnetic stirrer.

2 Tap **Setup** > **Hardware** > **Titration Stands** > **KF stand**.

⇨ The menu **Titration stand parameters** opens.

3 Set **Stirrer output** to **Internal stirrer** and tap **Save**.

4 Insert the burette.

5 Insert the dispensing tube for the titrant into the opening on the titration vessel.

6 Follow the instructions on the Touchscreen until the PnP burette containing the titrant is displayed in the Setup.

6.3.1.1 Rinsing and filling the burette

To fill the burette and tubes with titrant and remove any air bubbles from the system, rinse the burette three times with titrant with the manual operation **Rinse**.

- The titrator is prepared as described in [Preparation ▸ Page 54].

1 To ensure that the system has no leaks, check all tubes and closing points for firm seating.
2 Make sure that the free end of the dispensing tube for the titrant is placed in the titration vessel or another container.
3 Tap **Manual** > **Burette** > **Rinse**.
  ⇨ The dialog **Rinse** opens.
4 Set **Titrant** to **KF 1-comp 5**.
5 Set **Cycles** to "3".
6 To start the rinse procedure, tap **Start**.
  ⇨ The rinse procedure starts. An animation shows the progress.
7 When the rinse procedure is complete, tap **OK**.
  ⇨ The dialog **Rinse** opens.

⇨ The burette is filled and the tubes are free of air bubbles.

6.3.1.2 Filling the titration vessel

- The titrator is prepared as described in [Preparation ▸ Page 54].

1 Tap **Manual** > **Pump**.
  ⇨ The dialog **Pump** opens.
2 Set **Action** to **Fill**.
3 Make sure **Reset counter** is activated.
4 Tap **Start**.
  ⇨ Solvent is pumped into the titration vessel.
5 To prevent the solvent from overflowing, watch the amount of solvent and tap **Stop** if too much solvent is added.

⇨ The titration vessel is filled with solvent.

6.3.2 Perform the volumetric KF titration

The following provides a brief description of the sequence involved in a volumetric KF titration. The analysis process is described as an example for the following sequence steps:

• Pretitration
• Standby
• Sample analysis.

6.3.2.1 Configure the method

- The titrator is prepared as described in [Preparation ▸ Page 56].
- The burette is rinsed and filled.
- The titration vessel is filled.

1 Tap **Methods** > **New** > **Standard method template** > **KFVol 1-comp 5**.
  ⇨ A list with of method functions appears.
2 Tap **Sample**.
  ⇨ The **Sample (KF)** dialog is opened.
3 Tap **Sample**.
4 Set **Entry type** to **Weight** and typ **OK**.
5 Tap **OK**.
  ⇨ A list of method functions appears.
6 Tap **Save**.

6.3.2.2 Create a direct shortcut

1 Tap **Start**.
   ⇨ The **Start analysis** window opens.
2 Tap **AddToHome**.
   ⇨ The **Shortcut parameters** window opens.
3 Enter a name for the shortcut in **Description**.
4 Activate **Immediate start**.
5 Tap **Save**.
⇨ The home screen with the new shortcut opens.

6.3.2.3 Start the pretitration

1 To ensure that the system has no leaks, check all tubes and closing points for firm seating.
2 Select the shortcut on the home screen.
   ⇨ The system performs the pretitration to remove any water from the solvent.
   ⇨ As soon as the continually determined drift value falls below a defined value, the system automatically switches to **Standby** mode and the **Start sample** button is active.

6.3.2.4 Perform the analysis

▪ The system is in **Standby** mode.
1 Measure 500 mg of a 1 % KF standard solution into a syringe.
2 Tap **Start sample**.
   ⇨ You are prompted to add the sample.
3 Inject the measured sample into the titration beaker.
4 Enter the sample weight, 0.5 [g], on the touch screen and tap **OK**.
   ⇨ The analysis starts.
⇨ Once the titration is completed, the **Results** dialog is displayed. The dialog shows **R1**, the water content.

6.4 Running a coulometric Karl Fischer titration

The following chapters show how to perform a simple coulometric Karl Fischer titration. You need the optional reagent exchange set to fill the measuring cell as it is described in this example.

Chemicals

For this titration you need the chemicals listed below.

- 1% KF standard solution (sample)
- Karl-Fischer reagent

6.4.1 Preparation

▪ The titrator is installed.
▪ The titration stand is installed and the measuring cell is assembled.
▪ The measuring electrode and generator electrode are connected.
▪ The solvent manager is installed on the waste bottle and connected to the titrator and the measuring cell.
▪ The optional reagent exchange set is installed and the solvent bottle is connected to the measuring cell.
▪ A USB printer is connected to port "USB1" or "USB2" of the titrator and configured.
1 Pivot the titration arm so the measuring cell is positioned over the internal magnetic stirrer.
2 To ensure that the system has no leaks, check all tubes and closing points for firm seating.
3 Tap **Setup** > **Hardware** > **Titration Stands** > **KF stand**.
   ⇨ The dialog **Titration stand parameters** opens.
4 Set **Stirrer output** to **Internal stirrer** and tap **Save**.

5 Tap **Manual** > **Pump**.
   ⇨ The dialog **Pump** opens.
6 Set **Action** to **Fill**.
7 Make sure **Reset counter** is activated.
8 Tap **Start**.
   ⇨ Reagent is pumped into the measuring cell.
9 To prevent the reagent from overflowing, watch the amount of reagent and tap **Stop** if too much reagent is added.

⇨ The measuring cell is filled with reagent.

6.4.2 Performing the coulometric KF titration

The following is a brief description of the sequence involved in a coulometric KF titration. The analysis process is described as an example for the following sequence steps:

- Pretitration
- Standby
- Sample analysis.

6.4.2.1 Configure the method

▪ The titrator is prepared as described in [Preparation ▸ Page 56].

1 Tap **Methods** > **New** > **Standard method template** > **KF Coul**.
   ⇨ A list of method functions appears.
2 Tap **Sample**.
   ⇨ The dialog **Sample (KF)** is opens.
3 Tap **Sample**.
4 Set **Entry type** to **Weight** and tap **OK**.
5 Tap **OK**.
   ⇨ A list with of method functions appears.
6 Tap **Save**.

6.4.2.2 Create a direct shortcut

1 Tap **Start**.
   ⇨ The **Start analysis** window opens.
2 Tap **AddToHome**.
   ⇨ The **Shortcut parameters** window opens.
3 Enter a name for the shortcut in **Description**.
4 Activate **Immediate start**.
5 Tap **Save**.

⇨ The home screen with the new shortcut opens.

6.4.2.3 Start the pretitration

1 To ensure that the system has no leaks, check all tubes and closing points for firm seating.
2 Select the shortcut on the home screen.
   ⇨ The system performs the pretitration to remove any water from the reagent.
   ⇨ As soon as the continually determined drift value falls below a defined value, the system automatically switches to **Standby** mode and the **Start sample** button is active.

6.4.2.4 Perform the analysis

▪ The system is in **Standby** mode.

1 Fill a syring with 1% KF standard solution, place it on a balance and tare the balance.

2 Tap **Start sample**.

⇨ You are prompted to add the sample.

3 Inject approx. 0.5 to 1.0 mL of the 1% KF standard solution into the measuring cell.

4 Place the syring on the balance and note the sample weight.

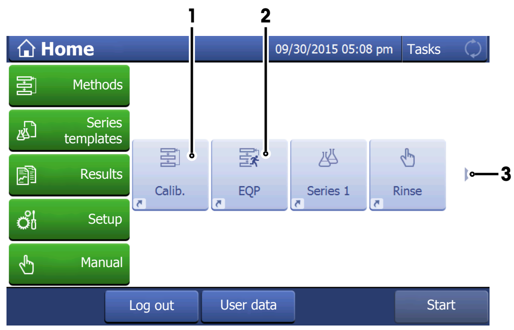
5 Enter the sample weight on the touch screen and tap **OK**.

⇨ The analysis starts.

⇨ Once the titration is complete, the **Results** dialog is displayed. The dialog shows **R1**, the water content.

6.5 Creating and handling Shortcuts

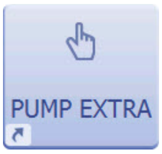
- Shortcuts (1, 2) can be created for methods, series templates and manual operations.
- With a shortcut (1) it is possible to access the dialog **Start analysis** with one tap on the homescreen.
- With a shortcut (2) it is possible to start a method, series or manual operation with one tap on the homescreen.
- The number of shortcuts depends on the type of titrator. If more than 12 shortcuts can be created, they can be placed on two screens. Tap (3) to switch between these two screens.
- Each user can manage the shortcuts that he has created in the instrument setup.



Types of shortcuts

Method

Sample Series



Manual operation

Creating a shortcut

1 Select **Methods** and choose your method category.

2 Create a new method or choose an existing method in the list.

3 Tap **Start**.

⇨ The **Start analysis** dialog opens. You can change some parameters or add some information to this method.

4 Tap **AddToHome** to create a shortcut.

5 Define the shortcut parameters.

6 Tap **Save**.

⇨ The shortcut is now set on the homescreen.

Deleting a shortcut

1 Select **Setup** > **User settings** > **Shortcuts**.

2 Select the shortcut which you want to delete in the list.

3 Tap **Delete**.

⇨ The shortcut is deleted.

Changing an existing shortcut

- At least one shortcuts has been created.

1 Tap **Setup** > **User settings** > **Shortcuts**.
   ⇨ A list of existing shortcuts opens.
2 Tap the shortcut you want to change.
3 If needed, change the settings for **Description** and **Immediate start**.
4 To change the position of the shortcut on the homescreen, tap .
   ⇨ A dialog opens that shows the free positions and the occupied positions on the homescreen.
5 Tap on the free position, where the shortcut should be placed.
   ⇨ The dialog closes.
6 To save the settings, tap **Save**.

Parameters	Description	Values
Type	Shows the type of action the shortcut stands for.	Method I Series I Manual operation
Description	Any name for the shortcut.	Arbitrary
Immediate start	The method, series, or manual operation can be started immediately. This enables you to start the analysis without any interfering dialog.	Activ I Inactive
Homescreen position	Defines the position of the shortcut on the homescreen.	-
Created by	Shows the name of the user who created the shortcut.	-

See also

Shortcuts ▸ Page 207

6.6 Creating Methods

You create a new method by changing the parameters of a delivered method template and saving it under a new method ID.

Navigation: **Home** > **Methods**

1 Tap **New** to create a new method on the basis of a template.
2 From the available templates, in **Mettler method templates** or **Standard method templates**, choose the one that is most similar to the method you wish to create.
   ⇨ You can now modify this method in line with your requirements by inserting or removing method functions or modifying its parameters.
3 In the method function **Title**, enter a new method ID. Afterwards, a new method will be stored under this method ID.
4 Assign a title to your new method.
5 Select available method functions to modify their parameters in line with your requirements.
6 Tap **Insert** to add additional method functions to the template.
7 Now use the arrow-shaped button to select the required position for the new method function in the method. (You will only be able to insert the method functions that are allowed in the corresponding location based on the method syntax.)
8 From the list, select the method function that you want to insert.
9 Modify the individual parameters of the method function in line with the resources.
   ⇨ The new method function appears in the method.
10 To delete a method function, select the function in question and then tap **Delete**.
   ⇨ The method function disappears from the method.
11 After inserting all required method functions, tap **Save**.

⇨ The method is saved under the method ID and appears in the list of available methods.

Note

- When establishing a new method, follow the rules specified by the instrument.

See also

🗎 Method Syntax – rules for establishing a method ▸ Page 71

6.7 Modifying or Deleting Methods

You can change user methods or Mettler methods and store them under new method IDs.

Note

- Once a Mettler method has been modified, you will only be able to save it as a copy (or as a user method) with a new method ID.

Navigation: **Home** > **Methods**

1 From the displayed list of methods, select the method that you want to modify.
2 As soon as the methods functions of the selected method appear on the screen, you can modify the method.
3 In the method function **Title**, enter a new method ID. Afterwards, a new method will be stored under this method ID. You can enter up to twenty alphanumeric characters.
4 Select available method functions to modify their parameters in line with your requirements.
5 Choose **Insert** to add additional method functions to the template.
6 Now use the arrow-shaped **Insert** button to select the required position for the new method function in the method. (You will only be able to insert the method functions that are allowed in the corresponding location based on the method syntax.)
7 From the list, select the method function that you want to insert.
8 Modify the individual parameters of the method function.
⇨ The new method function appears in the method.
1 To delete a method function, select the function in question and then choose **Delete**.
2 After you have made all of the necessary adjustments, you can store the method in the titrator by choosing **Save**.

Deleting Methods

You can easily delete user-defined methods from the titrator. Select:

Navigation: **Home** > **Methods**

1 Select the method that you want to delete.
2 Choose **Delete method** to delete the method from the titrator's memory.

6.8 Starting Methods

The titrator offers various ways of starting a method:

- From the method editor
- By choosing **Start** from the Home dialog
- By using a shortcut on the Home screen
- Via the **Series** dialog
- By using the **Setup** dialog (to perform a calibration or titer determination)

You can use the method editor to start any method stored in the titrator.

1 From the displayed list in the **Methods** dialog, select the method that you wish to start (Home > Methods).
2 As soon as the method functions of the selected method appear on the screen, you can open the **Start analysis** screen by choosing **Start**.
3 Choose **Start** again to reach an overview screen on the resources required for the method. (Only if this was defined in the analysis sequence settings.)
4 To execute the method, confirm the screen by choosing **OK**.

6.9 Stopping Methods

Analyses or series of analyses that are in progress can be interrupted or terminated by the user in order to intervene in the analysis process or by the titrator itself.

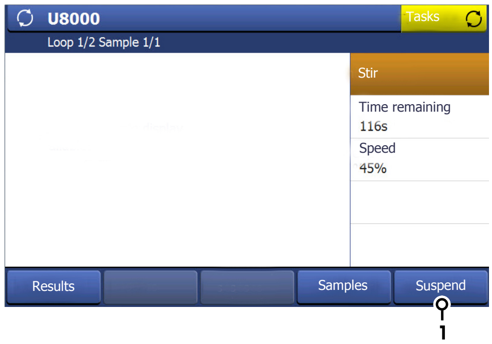
The options available in the event of an interruption of the analysis procedure are listed below.

6.9.1 Suspending or stopping an ongoing analysis (GT or BI) by the user

If you wish to make changes when an analysis or series is in progress, you can suspend the relevant method as follows:

1 Tap **Suspend** (1) to suspend the current analysis.

⇨ The dialog **Suspending options** opens.



2 Tap **Save series data** (1) to save the current sample series. Only the completed samples will be saved.

⇨ If the maximum permitted number of series has been reached, the series is not saved.

⇨ Sample data from a method that is waiting in a queue can be saved by selecting **Suspend** > **Save series data**.

3 Tap **Skip sample** (2) to skip the current sample and continue with the next sample of the series.

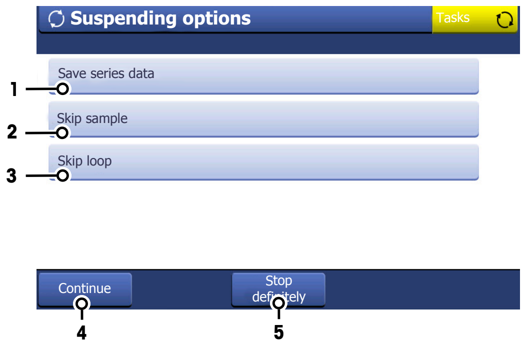
⇨ The current sample is marked in **Results** as **Excl.**.

4 Tap **Skip loop** (3) to skip the loop and continue with the next loop of the series.

⇨ The loop is marked in **Results** as **Excl.**.

5 Tap **Continue** (4) to continue with the current sample.

6 Tap **Stop definitely** (5) to stop the current method.



Note

- If a **Calib.** loop is skipped, the analysis continues in accordance with the corresponding method function **Calibration**.
- If required, it is possible to include a skipped sample (**Excl.**) into a statistic manually in the dialog **Results**.

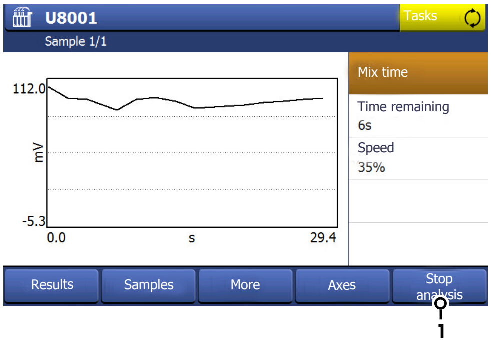
6.9.2 Stopping an ongoing analysis (KF, ext. extraction) by the user

Generally a KF- or ext. extraction method can not be suspended. They can only be stopped as follows:

Stop method directly on the measurement screen

1 Tap **Stop analysis** (1) to stop the current analysis.

⇨ A dialog opens where you have to confirm the stop.



Stop method in the dialog More KF functions

2 Tap **More** (1) to enter the dialog **More KF functions**.

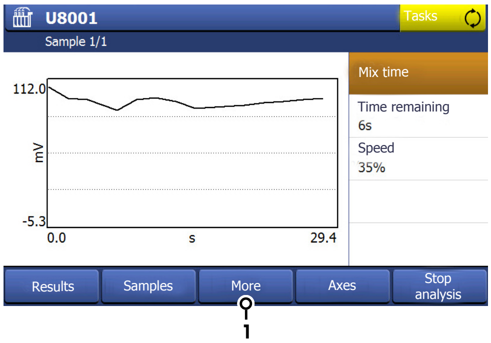
⇨ Depending on the measurement status, you will find different opportunities in this dialog.

3 Tap **End series** to end the current series.

4 Tap **Stop method** to stop the current method.

⇨ A dialog opens where you have to confirm the stop.

5 Tap **Back** to exit the dialog **More KF functions**.



6.9.3 Suspending of ongoing analysis by the titrator

The titrator can suspend an analysis that is in progress for the following reasons:

- Due to an instruction

  As soon as the method function **Instruction** has been processed, the analysis continues.

- Due to the monitoring actions for the method function **Stating** or **Dispense (controlled)**

  The analysis is interrupted if in the sub-function **Monitoring** the parameter **Action** = **Manual** is selected and the sensor signal exceeds or falls below the specified upper or lower limit. In this case, you have the option to either cancel or continue the titration. Once the titration is canceled, the analysis continues with the next sample.

  If **Action** = **Automatic** was selected, the titration is also interrupted in this case if the sensor signal exceeds or falls below the specified upper or lower limit. The titration is continued automatically when the sensor signal lies within the specified limits once again.

- Exceeding the specified termination parameters of the sub function **Termination** for the method functions **Titration (EP)** and **Titration (EQP)**.
- Due to equivalent points not being found during learn titrations

  If no equivalent points are found during a learn titration an error message appears and the analysis is suspended. You have the option to cancel the titration or to continue after refilling the burette.

6.10 Customizing touch screen and signals

Navigation: **Setup** > **User settings**

6.10.1 Changing the language

In the menu **Language** you can set the language of the touch screen and the language for printing.

1 Tap **Setup** > **User settings** > **Language**.

2 Customize the settings.

3 To save the settings, tap **Save**.

Parameters	Description	Values
Touchscreen	Defines the language for operation of the terminal.	German I English I French I Italian I Spanish I Portuguese I Chinese I Russian I Polish I Korean
Record	Defines the language in which the reports are to be printed out.	German I English I French I Italian I Spanish I Portuguese I Chinese I Russian I Polish I Korean

6.10.2 Configuring the StatusLight

In the menu **StatusLight** you can customize following features.

- Activate and deactivate the StatusLights of the terminal, the titrator and the connected autosampler.
- Adjust the brightness of the StatusLights of the terminal and the titrator.

1 Tap **Setup** > **User settings** > **StatusLight**.
2 Customize the settings.
3 To save the settings, type **Save**.

Parameters	Description	Values
Terminal StatusLight	Activate or deactivate the status indicator at the terminal.	On I Off
Brightness	Defines the brightness of the StatusLight of the terminal. Only if **Terminal StatusLight** is activated.	Low I Medium I High
Instrument StatusLight	Activate or deactivate the status indicator at the instrument.	On I Off
Brightness	Defines the brightness of the StatusLight of the instrument. Only if **Instrument StatusLight** is activated.	Low I Medium I High
InMotion T StatusLight	Activate or deactivate the StatusLight of the autosampler.	On I Off

6.10.3 Changing the screen settings

In the menu **Screen** you can customize following features.

- The color of the status bar, the borders and the buttons.
- The brightness of the touch screen.
- Activate or deactivate the screen saver and set the time before the screen saver is activated.

1 Tap **Setup** > **User settings** > **Screen**.
2 Customize the settings.
3 To save the settings, type **Save**.

Parameters	Description	Values
Primary color	Here various color schemes for the user interface can be selected.	Gray I Blue I Green I Red
Brightness	Specifies the display brightness in [%].	50 I 60 I 70 I 80 I 90 I 100 [%]
Screen saver	Here you can define whether the screen saver should be used.	Activ I Inactive
Wait time	Defines how long in [min] the system should wait after the user's last action on the terminal before activating the screen saver.	1…1000

6.10.4 Configuring the audio signals

In the menu **Audio signal** you can define if a tap on a button is confirmed by a beep.

1 Tap **Setup** > **User settings** > **Audio signal** .

2 Customize the settings.
3 To save the settings, type **Save**.

Parameters	Description	Values
At push of a button	Enables a beep when tapping on the touch screen.	Activ I Inactive
Sound	Activate or deactivate sound signals (e.g. after finishing a measurement).	Activ I Inactive
Volume	Defines the volume of the sound signals. Only if **Sound** is activated.	Low I Medium I High

6.10.5 Configuring the keyboards

In the menu **Keyboards** you can set the layout of the alphanumeric and the numeric keyboards.

1 Tap **Setup** > **User settings** > **Keyboards**.
2 Customize the settings.
3 To save the settings, type **Save**.

Parameters	Description	Values
ABC keyboard	Determines the layout of the alphanumeric input field.	English I French I German
123 keyboard	Defines the organization of the keys for the numeric input field.	Calculator I Phone

6.11 Monitoring the expiry date and life span of Resources

Monitoring the usable life of a resource

For certain resources, the titrator provides automatic monitoring of the usable life.

The usable life is the period after which the values for a specific resource should be remeasured. These values depend on the nature of the resource:

- The calibration parameters of a sensor.
- The titer of a titrant.
- The numerical value of an auxiliary value.
- The numerical value of a blank.
- The lot/batch from which a concentration/titer standard is taken.

Whether the usable life should be monitored can be defined in the setup for each individual resource.

If monitoring is activated then additional parameters become available in the respective resource with which the duration of the usable life can be determined. In addition a reminder may optionally be issued by the titrator before the expiration dates expire.

Parameters	Description	Values
Time period	Specifies the time range. Only if **Monitoring usable life** = **Active**.	Days I Hours
Usable life	Defines the time span of the expiration dates either in days or hours (depending on: **Time period**). Only if **Monitoring usable life** = **Active**.	Days: 1…1000 Hours: 1…10^4
Reminder	Determines whether the titrator should issue a warning before the usable life of a resource or a value elapses. Only if **Monitoring usable life** = **Active**.	Activ I Inactive
Days before expirat.	Determines the number of days before the service life of the resource that the titrator should issue a warning. The value entered must be less than the value in **Usable life**. Only if **Monitoring usable life** = **Active**, **Time period** = **Days** and **Reminder** = **Active**.	0…1000

Note

- If a resource is renewed (e.g. a sensor is recalibrated, or the titer of a titrant is re-determined), the Date/ Time field in the Setup for the affected resource is updated automatically and the expiration date (or the time of expiration) is recalculated.
- In **Analysis and resources behavior** define how the titrator should deal with the relevant resource if the expiration dates have been exceeded at the start of the analysis.

See also

🗎 Analysis and resources behavior ▸ Page 213

Monitoring the life span of a resource

The life span is the period after which a resource is exhausted and should be replaced. A life span can be defined for the following resources:

- **Sensors**
- **Titrants**

Whether the life span should be monitored can be defined in the setup for sensors and titrants.

If monitoring is activated then additional parameters become available in the respective resource with which the date of initial operation of the resource and the duration of its life span can be defined.

Define the following additional parameters:

Parameters	Description	Values
Initial operation	Here you can enter the date of initial activation of the resource.	Date
Life span	Defines the life span of the resource in months.	0…100

In **Global settings** define how the titrator deal with the affected resource if its life span has been exceeded at the start of an analysis.

See also

🗎 Analysis and resources behavior ▸ Page 213

7 Methods

To carry out an analysis with the titrator, you require a **method**. A method is an analysis program and consists of a sequence of method functions (some with method subfunctions), which are processed by the titrator in sequence.

In this chapter, you will learn how to access and define methods.

The basic building blocks of a titration method consist of sample preparation, stirring and wait times, the actual titration, result calculation and a record. The titrator defines these partial steps as functions that consist of parameters whose values can be changed.

Loops

Depending on the device type, a method can contain one or more loops (see [Method Syntax - Rules for Creating a Method ▸ Page 71]"). The ranges of a method through which several samples will pass are defined using a "loop". The method functions before and after a loop are each conducted only once, even if an analysis contains several samples.

The beginning and end of a sample loop are defined by the method functions "Sample" and "End of Sample". The "End of Sample" method function is executed, and the sample loop stopped, only after the last sample in a series.

There are the following loop types:

- A **sample loop** is for analyzing a sample.
- A **calibration loop** is for calibrating a sensor.
- A **titer loop** is for determining the titer of a titrant.
- A **standard addition loop** is for determining the titer of a titrant.

Types of Methods

The titrator distinguishes between the following method types with different objectives:

- **General titration (GT)**
  Method for general titration (contains only sample loops or mixed loops)
- **Calibration (Calib.)**
  method for sensor calibration (contains only calibration loops).
- **Titer**
  Method for titer determination, contains only titer loops
- **Volumetric Karl Fischer Titration (KF Vol)**
  Method for volumetric water content determination with the Karl Fischer method.
- **Coulometric Karl Fischer Titration (KF Coul)**
  Method for coulometric water content determination with the Karl Fischer method (according ASTM D1492).
- **Bromine Index (BI)**
  Method for coulometric Bromine Index (BI) determination.
- **External Extraction Volumetric (Ext. Extr. V.)**
  Ext. Extr. V. is a Karl Fischer method for samples with extremely inhomogeneous water dissipation. It is also used for insoluble solids which only release water slowly, even if broken into smaller pieces. The water content is determined with a volumetric Karl Fischer Titration.
- **External Extraction Coulometric (Ext. Extr. C.)**
  Ext. Extr. C. is a KF method for samples with extremely inhomogeneous water dissipation. It is also used for insoluble solids which only release water slowly, even if broken into smaller pieces. The water content is determined with a coulometric Karl Fischer Titration.
- **InMotion KF Volumetric (IM KF V.)**
  IM KF V. is a volumetric Karl Fischer titration with an InMotion KF sample changer as titration stand.
- **InMotion KF Coulometric (IM KF C.)**
  IM KF C. is a coulometric Karl Fischer titration with an InMotion KF sample changer as titration stand.
- **Scan KF Volumetric (Scan KF V.)**
  Scan KF V. is a volumetric Karl Fischer titration where the sample is heated at a constant rate from a defined start to a defined end temperature.

- **Scan KF Columetric (Scan KF C.)**
  Scan KF C. is a coulometric Karl Fischer titration where the sample is heated at a constant rate from a defined start to a defined end temperature.
- **Stromboli Volumetric (Stromb. V.)**
  Stromb. V. is a volumetric Karl Fischer titration with a Stromboli oven sample changer as titration stand.
- **Stromboli Coulometric (Stromb. C.)**
  Stromb. C. is a coulometric Karl Fischer titration with a Stromboli oven sample changer as titration stand.

Predefined methods

- **Mettler method templates**
  A number of methods have already been stored in the instrument. These methods were developed by METTLER TOLEDO for specific uses and can be used for the corresponding analysis.
- **Standard method templates**
  When creating methods you can revert to method templates, which specify the structure of the method, and whose parameters already contain the most suitable default values.

Method ID

You can distinguish between different types of method and individual methods of the same type using their ID:

- Each method has its own unique method identification.
- The method ID of the Mettler methods is composed of the starting letter "M", or "KFV" for volumetric Karl Fischer titration, followed by a sequential number. (M001, M002, ... or KFV01, KFV02, ...). However, the method ID can be freely chosen when you save a method.

See also

🗎 Mettler method templates ▶ Page 68

7.1 Method templates

7.1.1 Standard method templates

When you create a new method, the method templates prescribe the sequence of the method functions. These method templates are not application-specific, but are dependent on the type of titrator. They allow the user to establish user methods quickly and easily. Most of the settings in the method functions that occur in a standard method already have default values.

To convert a method template into a user method, it has to be saved under a method ID.

Title	Type of instrument	Method type
EQP	T5/T7/T9	General titration
EP	T5/T7/T9	General titration
Stating	T5/T7/T9	General titration
Measure	T5/T7/T9	General titration
2-phase	T5/T7/T9	General titration
Learn-EQP	T5/T7/T9	General titration
Titer with EQP	T5/T7/T9	Titer determination
Titer with EP	T5/T7/T9	Titer determination
Calibration	T5/T7/T9	Calibration
Calibration segmented	T5/T7/T9	Calibration
Blank with EQP	T5/T7/T9	General titration
Blank with EP	T5/T7/T9	General titration
EP/EQP	T5/T7/T9	General titration
EQP/EQP	T5/T7/T9	General titration
EP/EP	T5/T7/T9	General titration
Titer with EQP & EQP	T7/T9	General titration
Titer with EP & EP	T7/T9	General titration

Calibration & EQP	T7/T9	General titration
Calibration & EP	T7/T9	General titration
Calibration & titer with EQP & EQP	T7/T9	General titration
Calibration & titer with EP & EP	T7/T9	General titration
pH-Sensor test	T5/T7/T9	Calibration
Std. addition (direct)	T5/T7/T9	General titration
Std. addition (aliquot incl. ISA)	T5/T7/T9	General titration
Std. addition (aliquot excl. ISA)	T5/T7/T9	General titration
ISE sensor conditioning	T5/T7/T9	General titration
KFVol 1-comp 5	T5/T7/T9	Volumetric KF titration
KFVol 1-comp 5 fast	T5/T7/T9	Volumetric KF titration
KFVol 2-comp 5	T5/T7/T9	Volumetric KF titration
KFVol 2-comp 5 fast	T5/T7/T9	Volumetric KF titration
Ext. Extract./dissolution Vol.	T7/T9	Volumetric external extraction/dissolution
Stromboli Vol.	T7/T9	Volumetric Stromboli
KFVol 1-comp 1	T5/T7/T9	Volumetric KF titration
InMotion KF Vol.	T7/T9	InMotion KF volumetric
Scan KF Vol.	T7/T9	Scan volumetric
KF coul	T5/T7/T9	Coulometric KF titration
Ext. Extract./dissolution Coul.	T7/T9	Coulometric external extraction/dissolution
Stromboli Coul.	T7/T9	Coulometric Stromboli
InMotion KF Coul.	T7/T9	InMotion KF coulometric
Scan KF Coul.	T7/T9	Scan KF coulometric
EP coul / EP coul	T5/T7/T9	Bromine Index
Blank with EP coul	T5/T7/T9	Bromine Index
EP coul using blank	T5/T7/T9	Bromine Index

7.1.2 Mettler method templates

A number of methods have already been stored in the instrument. These methods were developed by METTLER TOLEDO for specific uses and can be used for the corresponding analysis. These methods not only provide the sequence of the method functions, but they also define all of the method function settings. You create a new method by changing the parameters of a delivered method template and saving it under a new method ID.

The assortment of available methods depends on the device type.

METTLER TOLEDO methods: GT

ID	Title	Description	Titrant	Sensor
M400	Acetic acid in vinegar	EQP titration	NaOH	DG111
M402	Free fatty acid content	EQP titration	KOH in Ethanol	DG113
M403	Blank solvent FFA	EQP titration	KOH in Ethanol	DG114

ID	Title	Description	Titrant	Sensor
M404	Chloride content in Ketchup	EQP titration	$AgNO_3$	DM141
M405	Total hardness of tap water	EQP titration	EDTA	DP5
M406	Ca and Mg content of tap water	EQP titration	EDTA	Ca ISE
M408	Barium content conductometric	EQP titration	Li_2SO_4	InLab717
M409	Copper content	EQP titration	$Na_2S_2O_3$	DM140
M410	Hydrogen peroxide content	EQP titration	$KMnO_4$	DM140
M411	Vitamin C content voltametric	EQP titration	DPI	DM143
M413	SDS content photometric	EQP titration	Hyamine	DP5
M414	SDS content potentiometric	EQP titration	Hyamine	DS500
M415	m-Value of tap water (EP)	EP titration	HCl	DG111
M417	Antacid (Stating)	pH stating	NaOH	DG111
M419	Free SO_2 content in wine (EP)	EP titration	I_2	DM143
M424	Bromine number ASTM D1159 (EP)	EP titration	Bromide, bromate	DM143
M425	Blank ASTM D1159 (EP)	EP titration	Bromide, bromate	DM143
M426	Acid number ASTM D664	EQP titration	KOH in 2-propanol	DG113
M427	Blank ASTM D664 (EP)	EP titration	KOH in 2-propanol	DG113
M428	Base number ASTM D4739	EQP titration	HCl in 2-propanol	DG113
M429	Blank ASTM D4739	EQP titration	HCl in 2-propanol	DG113
M433	Mercaptan sulfur ASTM D3227	EQP titration	$AgNO_3$ in 2-propanol	DM141
M435	Titer 0.1 mol/L NaOH	EQP titration	NaOH	DG111
M436	Calibration DG111-SC	Measure	-	DG111-SC
M657	Parallel preparation+titration	EQP titration	$AgNO_3$	DM141
M658A	Parallel titr. T/1A - Slave	EQP titration (only for T9)	NaOH	DG115
M658B	Parallel titr. T/1B - Master	EQP titration (only for T9)	$AgNO_3$	DM141
M659	COND+pH 100mL water bath 25°	Measure	–	InLab 731, DG111
M660	Aliquoting + LH - 25mL tubes	EQP Titration	NaOH	DG111
M664	FOS/TAC determination	EQP Titration	1/2 H_2SO_4	DG111-SC
M700	Sodium cont. in potato chips	Std. addition	Na^+	DX222-Na^+
M701	Sodium cont. in mineral water	Std. addition	Na^+	DX222-Na^+
M702	Sodium cont. liquid seasoning	Std. addition	Na^+	DX222-Na^+
M703	Sodium in biscuit autom.	Std. addition	Na^+	DX222-Na^+
M704	Sodium in filled pasta autom.	Std. addition	Na^+	DX222-Na^+
M705	Sodium in milk autom.	Std. addition	Na^+	DX222-Na^+
M707	Fluoride tooth paste autom.	Std. addition	F^-	DX219-F^-
M709	Calcium in mineral water	Std. addition	Ca^{2+}	DX240-Ca^{2+}
M710	Nitrate in spinach autom.	Std. addition	NO_3^-	DX262-NO_3^-
M712	Potassium in appel juice	Std. addition	K^+	PerfectIon K^+
M714	Chloride in ketchup	Std. addition	Cl^-	DX235-Cl^-
M715	Chloride in drink mix powder	Std. addition	Cl^-	DX235-Cl^-
M721	Acid Number thermometric	EQP Titration	KOH in 2-propanol	Thermotrode
M722	Blank Thermo AN	EQP Titration	KOH in 2-propanol	Thermotrode
M723	Titer (and blank) Thermo AN	EQP Titration	KOH in 2-propanol	Thermotrode

METTLER TOLEDO methods: KF Vol

Title	Description	ID	Method type
Water standard 10.0 mg/g	Concentration determination with standard 10 ppm	M300	KF Vol
Water standard 10.0 mg/g fast	Fast concentration determination with standard 10 ppm	M656	KF Vol
Di-Sodium-Tartrate 15.66 %	Concentration determination with sodium tartrate	M301	KF Vol
Toluene dry	Water determination for a sample with a water content in the ppm range	M302	KF Vol
Acetone dry	Water determination for a sample containing ketone with a water content in the ppm range	M303	KF Vol
Milk powder (homogenizer)	Internal extraction of a sample with a water content in the % range, with the use of a homogenizer	M304	KF Vol
Tobacco (ext. extraction)	External extraction of a sample with a water content in the % range	M305	Ext. Extr. V
Corn Starch (manual oven)	Manual gas phase extraction of a sample with a water content in the % range, with the use of the DO308 oven	M306	KF Vol
Air (gaseous samples)	Water content determination for a gaseous sample with a water content in the ppm range	M307	KF Vol
Oven stand. 5.55 % (Stromboli)	Stromboli check with oven standard from Riedel-de Haën with a water content of 5.55 %, with the use of the Stromboli oven sample changer. **Note**: This method contains one Sample Loop for blank determination and one for water determination.	M312	Stromb. V.
Temperature ramp (Stromboli)	Automatic gas phase extraction with a blank loop and 13 Sample Loops with various temperatures: increasing from 120 °C to 300 °C in increments of 15 °C with copper sulfate pentahydrate	M313	Stromb. V.

- Sensor: DM143-SC
- Titrant: KF 1-comp | KF 2-comp

METTLER TOLEDO methods: KF Coul.

Title	Description	ID	Method type
Water standard 1.0 mg/g	Check with a standard 1 ppm water in toluene.	M314	KF Coul
KF oven standard 1% (Stromboli)	Automatic gas phase extraction with an EMD standard oven with a water content of 1.0%. Note: This method includes one sample loop for the blank determination and one for the water content determination.	M315	Stromb. C.
Nitrogen gas	Water content determination of a gaseous sample with a water content in the ppm range.	M392	KF Coul
Acetone dry	Water content determination of a ketone-containing sample with a water content in the ppm range.	M393	KF Coul

Title	Description	ID	Method type
Sugar (ext. extraction)	External extraction of a sample with a water content in the ppm range.	M394	Ext. Extr. C.
PET granulates (manual oven)	Manual gas phase extraction of a sample with a water content in the ppm range, using the DO308 oven.	M395	KF Coul
Temperature ramp (Stromboli)	Automatic gas phase extraction with one blank loop and 13 sample loops with different temperatures: From 120 °C to 300 °C in 15° increments. Proposal: Polycarbonate or polyamide as sample.	M396	Stromb. C.
Bromine index (1 loop)	Bromine Index determination of cyclo-hexene/cyclohexane in mg/100 g, with the use of a blank.	M397	BI
Bromine index blank	Determination of the Bromine index blank.	M398	BI
KF oven standard 5.55%	For Stromboli Coul. introducing oven standard 5.55%.	M500	Stromb. C.
Bromine Index ASTM D1492 (1mA)	Bromine Index determination for low concentrations.	M716	BI

7.2 Method Syntax – rules for establishing a method

A method consists of a sequence of method functions that are executed consecutively when a method is processed.

Method functions can be located within a loop or outside of a loop. Method functions within a loop are performed for each sample if the loop contains more than one sample. Method functions outside of a loop are only performed once.

As an example, the list below shows the method functions for the standard method template **Measure (normal)**.

- **Title**
- **Sample**
- **Titration stand (Manual stand)**
- **Stir**
- **Measure (normal)**
- **Calculation R1**
- **End of sample**
- **Record**

The method function **Sample** marks the beginning of the loop and the method function **End of sample** marks the end of the loop. This means, that if this loop contains two samples, the method functions **Sample**, **Titration stand (Manual stand)**, **Stir**, **Measure (normal)** and **Calculation R1** are performed for each sample. The method function **End of sample** is performed, after the second sample is analysed. The loop is stopped and the method function **Record** is performed.

The number of loops and method functions allowed in a method differs depending on the method type and titrator type. When establishing a method, certain rules (method syntax) must be followed. These fundamental rules are described below.

7.2.1 General titration

7.2.1.1 Types and possible numbers of loops

The following table shows the maximum number of loops, the maximum numbers of method functions and the allowed loop types for the different types of titrators and method types.

Method type	Permissible loop types	Maximum number of loops per method			Maximum number of method functions per method		
		T5	T7	T9	T5	T7	T9
General titration	Sample loop Titer loop Calibration loop Standard addition loop	1	3	6	15	60	150
Titer	Titer loop	1	3	6	15	60	150
Calibration	Calibration loop	1	3	6	15	60	150

7.2.1.2 Possible numbers of method functions

The following table shows the maximum number of method functions that can be used within a method.

Method function	T5	T7	T9
Title	1	1	1
Sample	1	3	6
Sample (Titer)	1	3	6
Sample (Calibration)	1	3	6
Sample (Standard Addition)	1	3	6
Titration stand	1	12 (max. 6 per loop)	24 (max. 6 per loop)
Rinse	1	10	10
Conditioning	10	10	10
Pump	2	20	40
Park	1	6	12
Conditioning (controlled)	10	10	15
Stir	3	10	20
Dispense (normal)	3	10	100
Measure (normal)	2	20	20
Measure (MVT)	2	8	10
Titration (EP)	2	8	10
Titration (EQP)	2	8	10
Titration (Learn EQP)	2	8	10
Titration (2-phase)	2	8	10
Titration (Therm.)	2	8	10
Standard Addition	1	3	6
Stating	2	8	10
Dispense (controlled)	2	8	10
Calculation	6	40	40
End of sample	1	3	6
Titer	1	3	6
Calibration	1	3	6
Auxiliary value	4	30	30
Blank	2	10	10
Auxiliary instrument	10	30	60
Instruction	3	10	20
Sync	–	–	20

Method function	T5	T7	T9
Drain	1	10	10
Record	2	10	10
Liquid Handling	–	30	30
Line rinse	1	10	10

7.2.1.3 Inserting and deleting loops

Follow the rules listed below when you insert or delete loops.

- You can only insert or delete entire loops from a method.
- You can only insert loops outside of existing loops.
- When you insert a loop using the **Sample**, **Sample (Titer)**, **Sample (Calib)**, **Sample (Standard Addition)**, **Sample (Blank)** or **Sample (Standard)** method function, a regular, correct template is inserted.

Templates for loop types

General titration

Sample loop:	**Sample** **Titration stand (Manual stand)** **Stir** **Titration (EQP)** **Calculation** **Record** **End of sample**

Titer

Sample (Titer) loop:	**Sample (Titer)** **Titration stand (Manual stand)** **Stir** **Titration (EQP)** **Calculation** **Record** **End of sample** **Titer**

Calibration

Sample (Calib) loop:	**Sample (Calib)** **Titration stand (Manual stand)** **Stir** **Measure (normal)** **End of sample** **Calibration**

Standard Addition

Standard Addition loop:	**Sample (Standard Addition)** **Titration stand (Manual stand)** **Stir** **Standard Addition** **Calculation** **Record** **End of sample**

Sample (Blank)

Sample (Blank) loop:	**Sample (Blank)** **Titration stand (Manual stand)** **Stir** **Titration (EQP)** **Calculation** **Record** **End of sample** **Blank**

Sample (Standard)

Sample (Standard) loop:	**Sample (Standard)** **Titration stand (Manual stand)** **Stir** **Titration (EQP)** **Calculation** **Record** **End of sample**

7.2.1.4 Method functions within a loop

The method functions that are permitted within a loop are limited and depend on the loop type. Follow the rules listed below when you place a method function within a loop.

- One method function **Titration stand** must appear immediately after the loop-initializing functions **Sample**, **Sample (Standard Addition)**, **Sample (Calib)** or **Sample (Titer)**. Additional method functions **Titration stand** can be used in other position within the loop.
- The method function **Record** must be inserted after the method function that generates the results the record should contain.
- The method function **Calculation** must be inserted after the method function that determines the raw results for the calculation.
- A calibration loop must contain exactly one method function **Measure (normal)**.
- A titer loop must contain at least one method function titration.
- A standard addition loop must contain exactly one method function **Standard Addition**.

The table below shows the method functions allowed within a loop.

Method function	General titration, Titer	Calibration	Standard Addition
Titration stand	•	•	•
Rinse	•	•	•
Conditioning	•	•	•
Pump	•	•	•
Conditioning (controlled)	•	–	•
Stir	•	•	•
Dispense (normal)	•	•	•
Measure (normal)	•	•	•
Measure (MVT)	•	•	–
Titration (EP)	•	–	–
Titration (EQP)	•	–	–
Titration (Learn EQP)	•	–	–
Titration (2-phase)	•	–	–
Titration (Therm.)	•	–	–

Method function	General titration, Titer	Calibration	Standard Addition
Standard Addition	–	–	•
Stating	•	–	–
Dispense (controlled)	•	–	•
Calculation	•	•	•
Auxiliary value	•	•	•
Blank	•	•	•
Auxiliary instrument	•	•	•
Instruction	•	•	•
Sync	•	•	•
Drain	•	•	•
Record	•	•	•
Liquid Handling	•	•	•
Line rinse	•	•	•

7.2.1.5 Method functions outside of a loop

In addition to the preset method function **Title**, which always appears at the start, additional method functions can be inserted outside of a loop depending on the method type. Follow the rules listed below when you place a method function outside of a loop.

- The method function **Calibration** must appear immediately after the method function **End of sample** of a calibration loop.
- The method function **Titer** must appear immediately after the method function **End of sample** of a titer loop.
- The method function **Park** must appear immediately after the method function **End of sample**, **Calibration** and **Titer**.

The table below shows the method functions allowed outside of a loop.

Method function	General titration, Calibration, Titer	Standard Addition
Rinse	•	•
Conditioning	•	•
Pump	•	•
Park (position is fixed)	•	•
Conditioning (controlled)	•	•
Dispense (normal)	•	•
Calculation	•	•
Titer (position is fixed)	•	•
Calibration (position is fixed)	•	•
Auxiliary value	•	•
Blank	•	•
Auxiliary instrument	•	•
Instruction	•	•
Sync	•	•
Drain	•	•
Record	•	•
Liquid Handling	•	•
Line rinse	•	•

7.2.2 Volumetric Karl Fischer titration

7.2.2.1 Types and possible numbers of loops

The following table shows the maximum number of loops, the maximum numbers of method functions and the allowed loop types for the different types of titrators and method types.

Method type	Permissible loop types	Maximum number of loops per method			Maximum number of method functions per method		
		T5	T7	T9	T5	T7	T9
KF Vol	KF loop	1	1	1	12	150	150
Ext. Extr. V.	KF loop	–	1	1	–	150	150
Scan KF V.	KF loop	–	1	1	–	150	150
IM KF V.	KF loop	–	20	20	–	180	180
Stromb. V.	KF loop	–	14	14	–	150	150

7.2.2.2 Possible numbers of method functions

The following table shows the maximum number of method functions that can be used within a method.

Method function	KF Vol, Ext. Extr. V.			Scan KF V.		IM KF V.		Stromb. V.	
	T5	T7	T9	T7	T9	T7	T9	T7	T9
Title	1	1	1	1	1	1	1	1	1
Sample (KF)	1	1	1	1	1	20	20	14	14
Titration stand (KF stand)	1	1	1	1	1	20	20	14	14
Drift determination	–	–	–	–	–	21	21	15	15
Homogenizer	–	2	2	–	–	–	–	–	-
Mix time	1	1	1	1	1	20	20	14	14
Titration (KF Vol)	1	1	1	–	–	20	20	14	14
Scan (KF Vol)	–	–	–	1	1	–	–	–	–
Calculation	4	40	40	3	3	40	40	40	40
Record	1	10	10	2	2	20	20	14	14
Auxiliary value	–	30	30	3	3	30	30	30	30
Blank	–	–	–	–	–	20	20	10	10
Instruction	1	10	20	3	3	20	20	10	20
Standby	–	–	–	1	1	1	1	1	1
End of sample	1	1	1	1	1	20	20	14	14

7.2.2.3 Inserting and deleting loops

Follow the rules listed below when you insert or delete loops.

- You can only insert loops into methods of the method type **Stromb. V.** and **IM KF V.**.
- You can only insert or delete entire loops from a method.
- You can only insert loops outside of existing loops.
- When you insert a loop using the **Sample**, **Sample (Blank)** or **Sample (Standard)** method function, a regular, correct template is inserted.

  Sample (Blank) and **Sample (Standard)** are only available for the **IM KF V.** method type.
- When you insert a sample loop into a method of the **IM KF V.** method type, the new sample loop inherits some of the settings of the first loop of the method.

Templates for loop types

IM KF V.

Sample loop	**Sample** **Titration stand (InMotion KF)** **Mix time** **Titration (KF Vol)** **Calculation** **Record** **End of sample**
Sample (Blank) loop:	**Sample (Blank)** **Titration stand (InMotion KF)** **Mix time** **Titration (KF Vol)** **Calculation** **Record** **End of sample** **Blank**
Sample (Standard) loop:	**Sample (Standard)** **Titration stand (InMotion KF)** **Mix time** **Titration (KF Vol)** **Calculation** **Record** **End of sample**

Stromb. V. without blank value

Sample loop	**Sample** **Titration stand (Stromboli)** **Mix time** **Titration (KF Vol)** **Calculation** **Record** **End of sample**

KF Vol and Ext. Extr. V.

Sample loop	**Sample** **Titration stand (KF stand)** **Mix time** **Titration (KF Vol)** **Calculation** **Record** **End of sample**

Scan KF V.

Sample loop	**Sample** **Titration stand (InMotion KF)** **Mix time** **Scan KF Vol** **Calculation** **Record** **End of sample**

7.2.2.4 Method functions within a loop

The method functions that are permitted within a loop are limited and depend on the loop type. Follow the rules listed below when you place a method function within a loop.

- The sequence below must be followed in a loop.
  - **Sample (KF)** (only once)
  - **Titration stand** (only once)
  - **Drift determination** (optional, only once)
  - **Homogenizer** (optional)
  - **Mix time** (only once)
  - **Titration (KF Vol)** or **Scan (KF Vol)** (only once)
  - **Calculation** (optional)
  - **Record** (optional)
- The method function **Titration stand** must follow immediately after the function **Sample (KF)** which introduces the loop.
- The method function **Calculation** must be inserted after the method function that determines the raw results for the calculation.
- The method function **Record** must be inserted after the method function that generates the results the record should contain.

The table below shows the method functions allowed within a loop.

Method function	KF Vol	Ext. Extr. V.	Scan KF V.	IM KF V.	Stromb. V.
Titration stand	•	•	•	•	•
Drift determination	–	–	–	•	•
Homogenizer	•	–	–	–	–
Mix time	•	•	•	•	•
Titration (KF Vol)	•	•	–	•	•
Scan (KF Vol)	–	–	•	–	–
Calculation	•	•	•	•	•
Record	•	•	•	•	•
Auxiliary value	•	•	•	•	•
Blank	–	–	–	•	•
Instruction	•	•	•	•	•
Liquid Handling	•	•	–	•	•

7.2.2.5 Method functions outside of a loop

In addition to the preset method function **Title**, which always appears at the start, additional method functions can be inserted outside of a loop depending on the method type. Follow the rules listed below when you place a method function outside of a loop.

- The method function **Standby** must be the last method function and must only be used once.

The table below shows the method functions allowed outside of a loop.

Method function	KF Vol, Ext. Extr. V.	Scan KF V.	IM KF V., Stromb. V.
Auxiliary value	–	•	•
Blank	–	–	•
Calculation	–	•	•
Drift determination	–	–	•
Instruction	–	•	•
Liquid Handling	–	–	•
Record	–	•	•
Standby	–	•	•

7.2.3 Coulometric Karl Fischer titration

7.2.3.1 Types and possible numbers of loops

The following table shows the maximum number of loops, the maximum numbers of method functions and the allowed loop types for the different types of titrators and method types.

Method type	Permissible loop types	Maximum number of loops per method			Maximum number of method functions per method		
		T5	T7	T9	T5	T7	T9
KF Coul	KF loop	1	1	1	12	150	150
Ext. Extr. C.	KF loop	–	1	1	–	150	150
Scan KF C.	KF loop	–	1	1	–	150	150
IM KF C.	KF loop	–	20	20	–	180	180
Stromb. C.	KF loop	–	14	14	–	150	150

7.2.3.2 Possible numbers of method functions

The following table shows the maximum number of method functions that can be used within a method.

Method function	KF Coul, Ext. Extr. C.			Scan KF C.		IM KF C.		Stromb. C.	
	T5	T7	T9	T7	T9	T7	T9	T7	T9
Title	1	1	1	1	1	1	1	1	1
Sample (KF)	1	1	1	1	1	20	20	14	14
Titration stand	1	1	1	1	1	20	20	14	14
Drift determination	–	–	–	–	–	21	21	15	15
Mix time	1	1	1	1	1	20	20	14	14
Titration (KF Coul)	1	1	1	–	–	20	20	14	14
Scan (KF Coul)	–	–	–	1	1	–	–	–	–
Calculation	3	40	40	3	3	40	40	40	40
Record	1	10	10	2	2	20	20	14	14
Auxiliary value	–	30	30	3	3	30	30	30	30
Blank	–	–	–	–	–	20	20	10	10
Instruction	1	10	20	3	3	20	20	10	20
Standby	–	–	–	1	1	1	1	1	1
End of sample	1	1	1	1	1	20	20	14	14

7.2.3.3 Inserting and deleting loops

Follow the rules listed below when you insert or delete loops.

- You can only insert loops into methods of the method type **Stromb. C.** and **IM KF C.**.
- You can only insert or delete entire loops from a method.
- You can only insert loops outside of existing loops.

- When you insert a loop using the **Sample**, **Sample (Blank)** or **Sample (Standard)** method function, a regular, correct template is inserted.

  Sample (Blank) and **Sample (Standard)** are only available for the **IM KF C.** method type.
- When you insert a sample loop into a method of the **IM KF C.** method type, the new sample loop inherits some of the settings of the first loop of the method.

Templates for loop types

IM KF C.

Sample loop	**Sample (KF)** **Titration stand** (**InMotion KF**) **Mix time** **Titration (KF Coul)** **Calculation** **Record** **End of sample**
Sample (Blank) loop:	**Sample (Blank)** **Titration stand (InMotion KF)** **Mix time** **Titration (KF Coul)** **Calculation** **Record** **End of sample** **Blank**
Sample (Standard) loop:	**Sample (Standard)** **Titration stand (InMotion KF)** **Mix time** **Titration (KF Coul)** **Calculation** **Record** **End of sample**

Stromb. C. without blank value

Sample loop	**Sample (KF)** **Titration stand (Stromboli)** **Mix time** **Titration (KF Coul)** **Calculation** **Record** **End of sample**

KF Coul and Ext. Extr. C.

Sample loop (KFCoul):	**Sample (KF)** **Titration stand (KF stand)** **Mix time** **Titration (KF Coul)** **Calculation** **Record** **End of sample**

Scan KF C.

Sample loop (KFCoul):	**Sample (KF)** **Titration stand** (**InMotion KF**) **Mix time** **Scan (KF Coul)** **Calculation** **Record** **End of sample**

7.2.3.4 Method functions within a loop

The method functions that are permitted within a loop are limited and depend on the loop type. Follow the rules listed below when you place a method function within a loop.

- The sequence below must be followed in a loop.
  - **Sample (KF)** (only once)
  - **Titration stand** (only once)
  - **Drift determination** (optional, only once)
  - **Mix time** (only once)
  - **Titration (KF Coul)** or **Scan (KF Coul)** (only once)
  - **Calculation** (optional)
  - **Record** (optional)
- The method function **Titration stand** must follow immediately after the function **Sample (KF)** which introduces the loop.
- The method function **Calculation** must be inserted after the method function that determines the raw results for the calculation.
- The method function **Record** must be inserted after the method function that generates the results the record should contain.

The table below shows the method functions allowed within a loop.

Method function	KF Coul, Ext. Extr. C.	Scan KF C.	IM KF C., Stromb. C.
Titration stand	•	•	•
Drift determination	–	–	•
Mix time	•	•	•
Titration (KF Coul)	•	–	•
Scan (KF Coul)	–	•	–
Calculation	•	•	•
Record	•	•	•
Auxiliary value	•	•	•
Blank	–	–	•
Instruction	•	•	•

7.2.3.5 Method functions outside of a loop

In addition to the preset method function **Title**, which always appears at the start, additional method functions can be inserted outside of a loop depending on the method type. Follow the rules listed below when you place a method function outside of a loop.

- The method function **Standby** must be in the last method function and must only be used once.

The table below shows the method functions allowed outside of a loop.

Method function	KF Coul, Ext. Extr. C.	Scan KF C.	IM KF C., Stromb. C.
Auxiliary value	–	•	•
Blank	–	–	•
Calculation	–	•	•

Method function	KF Coul, Ext. Extr. C.	Scan KF C.	IM KF C., Stromb. C.
Drift determination	–	–	•
Instruction	–	•	•
Record	–	•	•
Standby	–	•	•

7.2.4 Bromine index

7.2.4.1 Types and possible numbers of loops

The following table shows the maximum number of loops, the maximum numbers of method functions and the allowed loop types for the different types of titrators and method types.

Method type	Permissible loop types	Maximum number of loops per method			Maximum number of method functions per method		
		T5	T7	T9	T5	T7	T9
Bromine Index	Sample loop	2	3	3	15	150	150

7.2.4.2 Possible numbers of method functions

The following table shows the maximum number of method functions that can be used within a method.

Method function	Max. number per method		
	T5	T7	T9
Title	1	1	1
Sample	2	3	3
Titration stand	2	3	3
Pretitration	2	3	3
Mix time	2	3	3
Titration (EP Coul)	2	3	3
Calculation	3	40	40
Record	2	10	10
Auxiliary value	4	30	30
Blank	1	10	10
Instruction	3	10	20
End of sample	2	3	3

7.2.4.3 Inserting and deleting loops

Follow the rules listed below when you insert or delete loops.

- You can only insert or delete entire loops from a method.
- You can only insert loops outside of existing loops.
- When you insert a loop using the **Sample** method function, a regular, correct template is inserted.

Templates for loop types

Bromine Index

Sample loop:	**Sample** **Titration stand (KF stand)** **Mix time** **Titration (EP Coul)** **Calculation** **Record** **End of sample**

7.2.4.4 Method functions within a loop

The method functions that are permitted within a loop are limited and depend on the loop type. Follow the rules listed below when you place a method function within a loop.

- The sequence below must be followed in a loop.
  - **Sample** (only once)
  - **Titration stand** (only once)
  - **Pretitration** (optional, only once)
  - **Mix time** (only once)
  - **Titration (EP Coul)** (only once)
  - **Calculation** (optional)
  - **Record** (optional)
- The method function **Titration stand** must follow immediately after the function **Sample** which introduces the loop.
- The method function **Calculation** must be inserted after the method function that determines the raw results for the calculation.
- The method function **Record** must be inserted after the method function that generates the results the record should contain.

The method functions allowed within a loop are listed below.

- **Titration stand**
- **Pretitration**
- **Mix time**
- **Titration (EP Coul)**
- **Auxiliary value**
- **Instruction**
- **Record**
- **Calculation**
- **Blank**

7.2.4.5 Method functions outside of a loop

In addition to the preset method function **Title**, which always appears at the start, additional method functions can be inserted outside of a loop depending on the method type.

The method functions allowed outside a loop are listed below.

- **Calculation**
- **Auxiliary value**
- **Blank**
- **Instruction**
- **Record**

7.3 Overview of method functions

7.3.1 General titration

Method function	Explanation	Inside loop	Outside loop
Title	Title and characteristics of the method.	No	Yes
Sample	Start of a sample loop.	Start of loop	
Sample (Titer)	Start of a loop for titer determination	Start of loop	
Sample (Calibration)	Start of a loop for sensor calibration.	Start of loop	
Sample (Standard Addition)	Start of a loop for standard addition.	Start of loop	
Titration stand	Selects titration stand.	Yes	No
Rinse	Rinsing function for a sensor or stirrer.	Yes	Yes

Method function	Explanation	Inside loop	Outside loop
Conditioning	Conditioning function for sample changer.	Yes	Yes
Pump	Pumps a defined volume of a liquid.	Yes	Yes
Park	Park function for sample changer.	No	Yes
Conditioning (controlled)	Conditioning makes a sensor suitable for the next analysis.	Yes	Yes
Stir	Activates a stirrer.	Yes	No
Dispense (normal)	Dispenses a defined quantity of titrant.	Yes	Yes
Measure (normal)	For the controlled acquisition of a measured value from a sensor.	Yes	No
Measure (MVT)	Creates a table of measured values from the measured values of a sensor over a certain period of time.	Yes	No
Titration (EQP)	Conducts an equivalence-point titration.	Yes	No
Titration (Learn EQP)	Conducts an equivalence-point titration to determine optimal settings for the parameters of an equivalence-point titration. Once the equivalence point is found, the **Titration (Learn EQP)** is transformed into a **Titration (EQP)** with the optimal parameters. If the analysis has more than one sample, the subsequent samples are titrated and analyzed with these optimal parameters.	Yes	No
Titration (EP)	Conducts an end-point titration.	Yes	No
Titration (2-phase)	Conducts a two-phase titration	Yes	No
Titration (Therm.)	Conducts a thermometric equivalence-point titration.	Yes	No
Standard Addition	Determines the concentration for a sample solution using the standard addition principle.	Yes	No
Stating	A sample solution can be maintained at a constant pH value using the stating function.	Yes	No
Dispense (controlled)	Controlled dispensing with potential or temperature monitoring.	Yes	No
Calculation	Converts the analysis results.	Yes	Yes
End of sample	Concludes a sample loop.	End of loop	
Titer	Assigns the result of a titer sample loop to a titer.	No	Yes
Calibration	Assigns the result of a calibration loop to a sensor.	No	Yes
Auxiliary value	Assigns a result or an arbitrary value to an auxiliary value and updates the value stored in **Setup**.	Yes	Yes
Blank	Assigns a result or an arbitrary value to a blank and updates the value stored in **Setup**.	Yes	Yes
Auxiliary instrument	Activates external auxiliary instruments.	Yes	Yes
Instruction	Halts the analysis and displays instructions on the screen for the user.	Yes	Yes

Method function	Explanation	Inside loop	Outside loop
Sync	Synchronization codes are used for synchronizing methods running simultaneously in both workspaces A and B for a T9.	Yes	Yes
Drain	Drains a volume from the sample vessel.	Yes	Yes
Record	Defines the record data to be output to the printer.	Yes	Yes
Liquid Handling	Automated dosing of aqueous or non-aqueous liquids with a Liquid handler.	Yes	Yes
Line rinse	Rinse the lines of an InMotion sample changer.	Yes	Yes

7.3.2 Volumetric Karl Fischer titration

Method function	Explanation	Inside loop	Outside loop
Title	Title and characteristics of the method.	No	Yes
Sample (KF)	Start of a sample loop for a Karl Fischer titration.	Start of loop	
Titration stand	Selects titration stand.	Yes	No
Drift determination	Determines the drift for Karl Fischer titrations.	Yes	Yes
Homogenizer	Controls a homogenizer and defines the speed (only for RS homogenizer) and duration of its usage.	Yes	No
Mix time	Duration of the mixing process. This value is gained from experience. It can be entered specifically for each sample.	Yes	No
Titration (KF Vol)	Conducts a volumetric Karl Fischer titration.	Yes	No
Scan (KF Vol)	Volumetric Karl Fischer titration of a sample that is heated at a constant rate from a defined start to a defined end temperature.	Yes	No
Calculation	Converts the analysis results.	Yes	Yes
Record	Defines the record data to be output to the printer.	Yes	Yes
Auxiliary value	Assigns a result or an arbitrary value to an auxiliary value and updates the value stored in **Setup**.	Yes	Yes
Blank	Assigns a result or an arbitrary value to a blank and updates the value stored in **Setup**.	Yes	Yes
Instruction	Halts the analysis and displays instructions on the screen for the user.	Yes	Yes
Liquid Handling	Automated dosing of aqueous or non-aqueous liquids with a Liquid handler.	Yes	Yes
Standby	Returns the titrator to standby mode on completion of a series, so that a new series can be started quickly.	No	Yes
End of sample	Concludes a sample loop.	End of loop	

7.3.3 Coulometric Karl Fischer titration

Method function	Explanation	Inside loop	Outside loop
Title	Title and characteristics of the method.	No	Yes
Sample (KF)	Start of a sample loop for a Karl Fischer titration.	Start of loop	
Titration stand	Selects titration stand.	Yes	No
Drift determination	Determines the drift for Karl Fischer titrations.	Yes	Yes
Mix time	Duration of the mixing process. This value is gained from experience. It can be entered specifically for each sample.	Yes	No
Titration (KF Coul)	Conducts a coulometric Karl Fischer titration.	Yes	No
Scan (KF Coul)	Coulometric Karl Fischer titration of a sample that is heated at a constant rate from a defined start to a defined end temperature.	Yes	No
Calculation	Converts the analysis results.	Yes	Yes
Record	Defines the record data to be output to the printer.	Yes	Yes
Auxiliary value	Assigns a result or an arbitrary value to an auxiliary value and updates the value stored in **Setup**.	Yes	Yes
Blank	Assigns a result or an arbitrary value to a blank and updates the value stored in **Setup**.	Yes	Yes
Instruction	Halts the analysis and displays instructions on the screen for the user.	Yes	Yes
End of sample	Concludes a sample loop.	End of loop	
Standby	Returns the titrator to standby mode on completion of a series, so that a new series can be started quickly.	No	Yes

7.3.4 Bromine Index

Method function	Explanation	Inside loop	Outside loop
Title	Title and characteristics of the method.	No	Yes
Sample	Start of a sample loop.	Start of loop	
Titration stand	Selects titration stand.	Yes	No
Pretitration	Pretitration for a method function **Titration (EP Coul)** that is performed with low currents and samples with low concentrations.	Yes	No
Mix time	Duration of the mixing process. This value is gained from experience. It can be entered specifically for each sample.	Yes	No
Titration (EP Coul)	Conducts an end-point titration with coulometric production of the titrant.	Yes	No
Calculation	Converts the analysis results.	Yes	Yes
Record	Defines the record data to be output to the printer.	Yes	Yes
Auxiliary value	Assigns a result or an arbitrary value to an auxiliary value and updates the value stored in **Setup**.	Yes	Yes

Method function	Explanation	Inside loop	Outside loop
Blank	Assigns a result or an arbitrary value to a blank and updates the value stored in **Setup**.	Yes	Yes
Instruction	Halts the analysis and displays instructions on the screen for the user.	Yes	Yes
End of sample	Concludes a sample loop.	End of loop	

7.4 Description of method functions

7.4.1 Title

Defines the title and type of a method and manages properties such as the creation and change date, the author, and whether or not the method is to be protected.

Parameters	Description	Values
Type	Shows the method type.	Compatible method types
Compatible with	Shows the titrator types for which this method can be loaded and executed.	Compatible titrator types
ID	Unique ID of the method.	Arbitrary
Title	Title of the method.	Arbitrary
Author	Shows the author of the method.	-
Created on	Shows creation date and creation time of the method.	–
Modified on	Shows date and time of the last change to the method.	-
Modified by	Shows the name of the user who made the last change.	–
Protect	Protects the method against changes and deletion by any user other than the author or the administrator.	Activ I Inactive
SOP	Standard operating procedure.	Activ I Inactive
SOP-Text	Text for a standard operating procedure Only if **SOP** = **Text** is selected.	Arbitrary
SOP-ID	ID for the link to a standard operating procedure. Only if **SOP** = **Link** is selected.)	Arbitrary

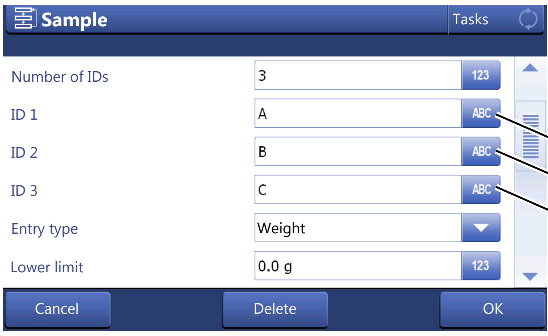
7.4.2 Sample

With the parameters in the method function **Sample** you can define information about the sample and how this information is entered.

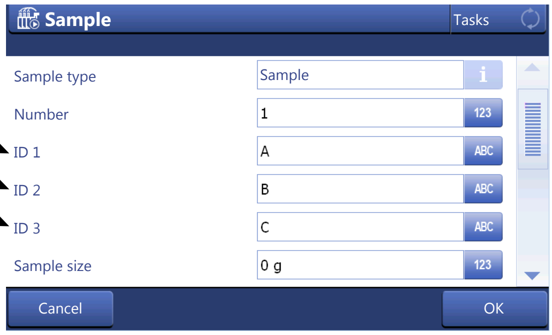
Identification of the sample

For each sample up to 3 IDs can be defined, depending on the setting of the parameter **Number of IDs**. **ID 1** is always available. **ID 2** and **ID 3** are only available if the parameter **Number of IDs** is set to 2 or 3 respectively. The values defined in the method function **Sample** are used as default values and can be changed before or during an analysis.

ID 1 is displayed in the window **Start analysis**. **ID 2** and **ID 3** are displayed in the window **Sample data**.



Sample

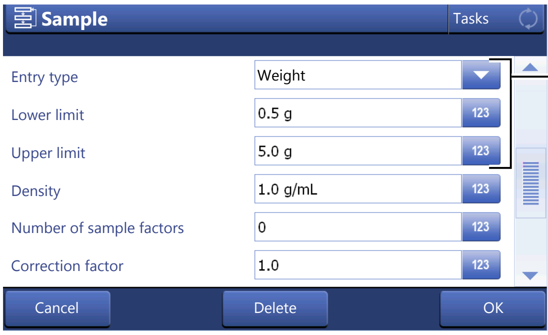


Sample data

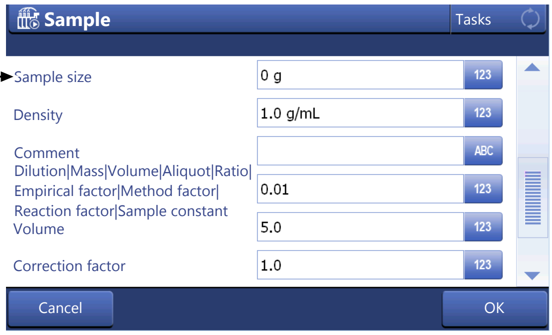
Definition of the sample size

You can define if the sample size is given as weight, volume or number of pieces and if the sample size can be entered or is set to a fixed value.

Weight, **Volume** and **Pieces** allow the user to enter the sample size in the window **Start analysis**. You can define a range for the sample size with the parameters **Lower limit** and **Upper limit**. The user can change **Weight per piece** and **Density** for a sample in the window **Sample data**.



Sample



Sample data

The following table shows the parameters available for each option.

	Weight	Volume	Pieces
Lower limit	•	•	•
Upper limit	•	•	•
Weight per piece	-	-	•
Density	•	•	-

For **Fixed weight**, **Fixed volume** and **Fixed pieces** the predefined sample size is displayed in the window **Start analysis** but the user cannot change it. You can define the sample size with the parameters **Weight**, **Volume** and **Pieces**. The user can change **Weight per piece** and **Density** for a sample in the window **Sample data**.

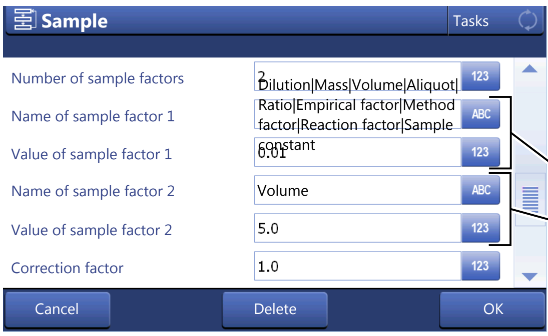
The following table shows the parameters available for each option.

	Fixed weight	Fixed volume	Fixed pieces
Weight	•	-	-
Volume	-	•	-
Pieces	-	-	•
Weight per piece	-	-	•
Density	•	•	-

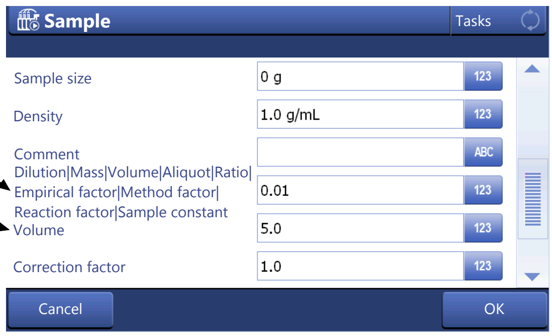
Definition of additional information about the sample

You can use the parameter **Correction factor** and up to 3 additional sample factors to define additional information about the sample. The values defined in the method function **Sample** are used as default values. The user can change the values before or during an analysis. and when the results are recalculated.

The values of the correction factor and of the sample factors are included in reports and can be used in calculations.



Sample



Sample data

Definition of the method for entering sample size and additional data

You can define if the sample size and some additional data is read from the sample by one of the devices listed below or if the data needs to be entered by hand.

- SmartSample reader of the titrator
- SmartSample reader of a connected InMotion Autosampler
- Barcode reader

The table below shows which data can be read depending on the setting of the parameter **Titrator reader** or **InMotion reader**. **InMotion reader** is displayed, if an InMotion Autosampler is used as titration stand.

	ID 1	ID 2	Sample size	Density	Correction factor
SmartSample	•	•	•	•	•
MT 2D barcode	•	-	•	-	-
ID 1 barcode	•	-	-	-	-

Definition of time for entering sample size and additional data

With **Entry**, you can define if the user has to enter sample size and additional data before the analysis starts or before and during the analyses. This option only exists If the user needs to enter the sample size manually.

Parameter description

Parameters	Description	Values
Sample type	Defines the type of sample used in the sample loop. The sample type is shown in the method editor, the sample data window and the report.	Sample I Standard I Blank
Number of IDs	Defines the number of sample IDs to be defined.	1…3
ID 1…ID 3	Defines ID 1, ID 2 or ID 3 of the sample.	0…20 characters
Entry type	Defines whether the sample should be added with a defined mass, defined volume or defined number of pieces. The sample data query will then adjust according to the unit of measurement. **Fixed volume** or **Fixed pieces**: The sampling weight, sample volume or number of pieces will be entered as the parameter in this method function and will not be prompted when conducting the method.	Weight I Fixed weight I Volume I Fixed volume I Pieces I Fixed pieces
Lower limit	Defines the lower limit for the variable entry data. The unit will depend on the setting for **Entry type** parameter. Only appears if none fixed values are selected in **Entry type**.	[g]: 0 … 1000 [mL]: 0 … 1000 [pcs.]: 0 … 10^6
Upper limit	Defines the upper limit for the variable entry of data. The unit will depend on the setting for **Entry type** parameter. Only appears if none fixed values are selected in **Entry type**.	[g]: 0 … 1000 [mL]: 0 … 1000 [St.]: 0 … 10^6
Weight	Weight in [g]. Appears only if **Entry type** = **Fixed weight** was selected.	0…1000
Volume	Volume in [mL]. Appears only if **Entry type** = **Fixed volume** was selected.	0…1000
Pieces	The number of sample(s). Appears only if **Entry type** = **Fixed pieces** was selected.	0…10^6
Weight per piece	The weight in [g] per pirece. Appears only if **Entry type** = **Pieces** or **Fixed pieces** was selected.	0 … 1000
Density	The density of a liquid sample substance, in [g/mL]. Appears only if **Entry type** is set to **Weight**, **Volume**, **Fixed weight** or **Fixed volume**.	0.0001…100
Number of sample factors	Defines the number of additional sample factors that can be used.	0…3

Name of sample factor 1	Defines the name of the additional sample factor. This name is displayed in reports and in windows where the user can enter sample data.	0…20 characters
Value of sample factor 1	Defines the value of the additional sample factor.	0.0000…10^6
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200
Entry	Determines the entry time for the sample size. **Before**: The sample size must be entered before the titration. **Arbitrary**: The sample size will have to be entered at any time during the titration (no later than when it is used during the calculations). Only appears if none fixed values are selected in **Entry type**.	Before I Arbitrary
InMotion reader	Defines how sample data is read. **None**: no sample data reader is used. **SmartSample**: the InMotion reader reads the sample ID1,2, sample size, density and factor from the Smart Tag on the beaker. **MT 2D barcode**: the titrator prompts the operator to read the barcode with a connected barcode reader before the sample analysis starts. The sample ID1 and the sample size are filled automatically at analysis start if the barcode has an MT specific barcode layout. **ID 1 barcode**: the titrator prompts the operator to read the barcode with a connected barcode reader before the sample analysis starts. The sample ID1 is filled automatically at analysis start. Only appears for **Titration stand** = **InMotion**.	SmartSample I MT 2D barcode I ID 1 barcode I None
Titrator reader	Defines how sample data is read. **None**: no sample data reader is used. **SmartSample**: the titrator will prompt the operator to position the sample on the SmartSample reader. The sample ID1,2, sample size, density and correction factor are filled automatically at analysis start. **MT 2D barcode**: the titrator prompts the operator to read the barcode with a connected barcode reader before the sample analysis starts. The sample ID1 and the sample size are filled automatically at analysis start if the barcode has an MT specific barcode layout. **ID 1 barcode**: the titrator prompts the operator to read the barcode with a connected barcode reader before the sample analysis starts. The sample ID1 is filled automatically at analysis start. Only appears if **Titration stand** is set to **Manual stand**, **External stand** or **Auto stand**.	None I SmartSample I MT 2D barcode I ID 1 barcode

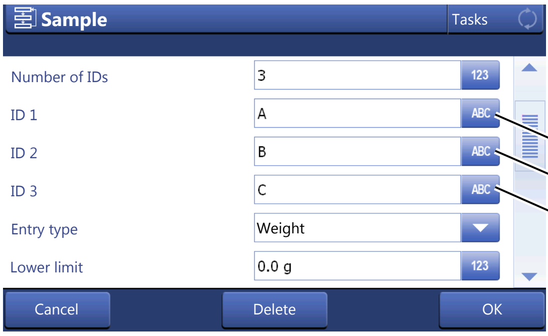
7.4.3 Sample (Standard addition)

With the parameters in the method function **Sample (Standard Addition)** you can define information about the sample, how this information is entered, how the sample is prepared and what type of analysis is performed.

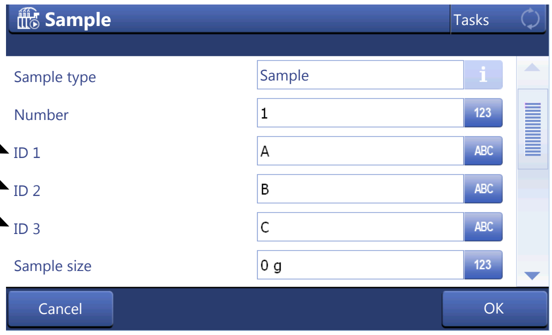
Identification of the sample

For each sample up to 3 IDs can be defined, depending on the setting of the parameter **Number of IDs**. **ID 1** is always available. **ID 2** and **ID 3** are only available if the parameter **Number of IDs** is set to 2 or 3 respectively. The values defined in the method function **Sample** are used as default values and can be changed before or during an analysis.

ID 1 is displayed in the window **Start analysis**. **ID 2** and **ID 3** are displayed in the window **Sample data**.



Sample



Sample data

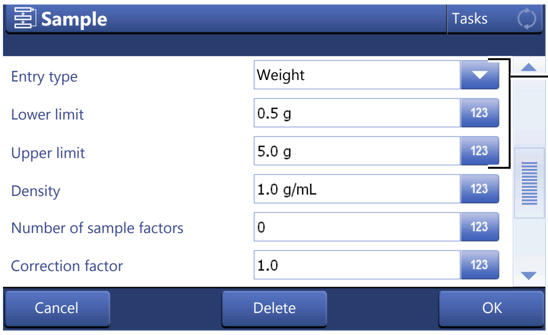
Definition of the analysis type

You can define if a blank value is determined, the concentration of a sample is measured directly or compensated with a blank value. For the determination of a blank value, no entries for sample size are needed.

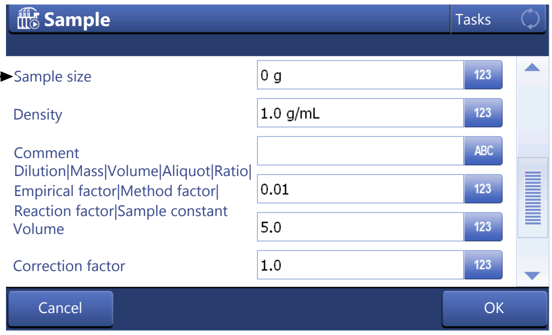
Definition of the sample size

You can define if the sample size is given as weight, volume or number of pieces and if the sample size can be entered or is set to a fixed value. Pieces is only available for solid samples.

Weight, **Volume** and **Pieces** allow the user to enter the sample size in the window **Start analysis**. You can define a range for the sample size with the parameters **Lower limit** and **Upper limit**. The user can change **Weight per piece** and **Density** for a sample in the window **Sample data**.



Sample



Sample data

The following table shows the parameters available for each option.

	Weight	Volume	Pieces
Lower limit	•	•	•
Upper limit	•	•	•
Weight per piece	-	-	•
Density	•	•	-

For **Fixed weight**, **Fixed volume** and **Fixed pieces** the predefined sample size is displayed in the window **Start analysis** but the user cannot change it. You can define the sample size with the parameters **Weight**, **Volume** and **Pieces**. The user can change **Weight per piece** and **Density** for a sample in the window **Sample data**.

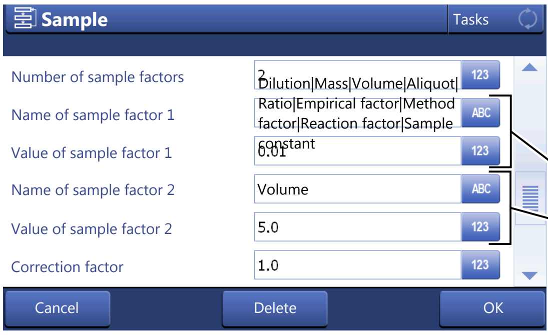
The following table shows the parameters available for each option.

	Fixed weight	Fixed volume	Fixed pieces
Weight	•	-	-
Volume	-	•	-
Pieces	-	-	•
Weight per piece	-	-	•
Density	•	•	-

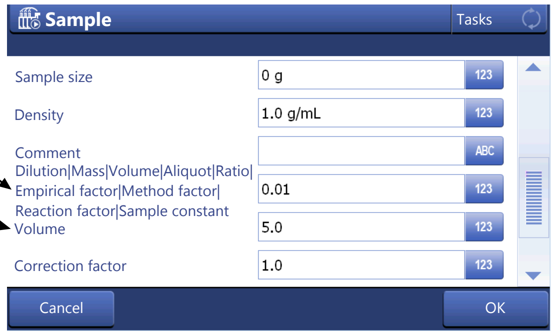
Definition of additional information about the sample

You can use the parameter **Correction factor** and up to 3 additional sample factors to define additional information about the sample. The values defined in the method function **Sample** are used as default values. The user can change the values before or during an analysis. and when the results are recalculated.

The values of the correction factor and of the sample factors are included in reports and can be used in calculations.



Sample

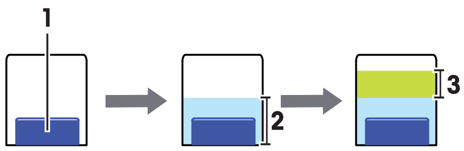


Sample data

Definition of sampling method

You can select the way the sample is be prepared fo the analysis. Depending on the method, different parameters can be entered by the user. The following methods can be selected in the parameter **Sampling**.

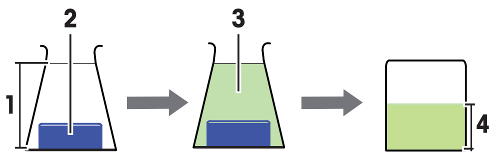
Direct: The sample (1), a predefined volume of water (2) and a predefined volume of ISA solution (3) are added directly to the analysis beaker. The entire content of the analysis beaker is used for the analysis.



Parameters

1 **Sample size**
2 **Water volume**
3 **ISA volume**

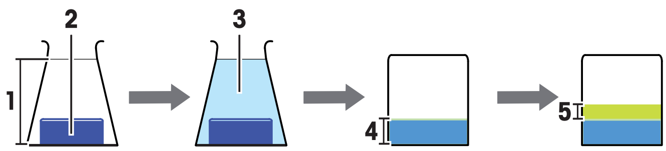
Aliquot incl. ISA: ISA solution (3) is added to the sample (2) until a defined volume (1) is reached. A predefined volume (4) of the mixture is transferred to the analysis beaker and is used for the analysis.



Parameters

1 **Dilution volume**
2 **Sample size**
4 **Aliquot volume**

Aliquot excl. ISA: Water (3) is added to the sample (2) until a defined volume (1) is reached. A defined volume of the mixture (4) is transferred to the analysis beaker. A defined volume of ISA solution (5) is added to the analysis beaker. The entire content of the analysis beaker is used for the analysis.



Parameters

1 **Dilution volume**
2 **Sample size**
4 **Aliquot volume**
5 **ISA volume**

The table below shows which parameters are available for each sampling method.

Sampling method	Water volume	ISA volume	Dilution volume	Aliquot volume
Direct	•	•	-	-
Aliquot incl. ISA	-	-	•	•
Aliquot excl. ISA	-	•	•	•

Definition of the method for entering sample size and additional data

You can define if the sample size and some additional data is read from the sample by one of the devices listed below or if the data needs to be entered by hand.

- SmartSample reader of the titrator
- SmartSample reader of a connected InMotion Autosampler
- Barcode reader

The table below shows which data can be read depending on the setting of the parameter **Titrator reader** or **InMotion reader**. **InMotion reader** is displayed, if an InMotion Autosampler is used as titration stand.

	ID 1	ID 2	Sample size	Density	Correction factor
SmartSample	•	•	•	•	•
MT 2D barcode	•	-	•	-	-
ID 1 barcode	•	-	-	-	-

Definition of time for entering sample size and additional data

With **Entry**, you can define if the user has to enter sample size and additional data before the analysis starts or before and during the analyses. This option only exists If the user needs to enter the sample size manually.

Parameter description

Parameters	Description	Values
Number of IDs	Defines the number of sample IDs to be defined.	1…3
ID 1…ID 3	Defines ID 1, ID 2 or ID 3 of the sample.	0…20 characters
Analysis type	**Direct** Determination of the concentration of the sample. **Blank determination** Determination of the ion concentration of the solvent. The result will be stored as blank value. **Blank compensated** Before the results are calculated, the ion concentration of the analysis beaker is compensated with the blank value.	Direct I Blank determination I Blank compensated
Sample type	Define if the sample is liquid or solid.	liquid I solid
Entry type	Defines whether the sample should be added with a defined mass, defined volume or defined number of pieces. The sample data query will then adjust according to the unit of measurement. **Fixed volume** or **Fixed pieces**: The sampling weight, sample volume or number of pieces will be entered as the parameter in this method function and will not be prompted when conducting the method.	Weight I Fixed weight I Volume I Fixed volume I Pieces I Fixed pieces
Lower limit	Defines the lower limit for the variable entry of data. The unit will depend on the setting for the **Entry type** parameter. Only appears if **Entry type** is set to **Weight**, **Volume** or **Pieces**.	[g]: 0 … 1000 [mL]: 0 … 10^4 [pcs.]: 0…10^6
Upper limit	Defines the upper limit for the variable entry of data. The unit will depend on the setting for the **Entry type** parameter. Only appears if **Entry type** is set to **Weight**, **Volume** or **Pieces**.	[g]: 0 … 10^3 [mL]: 0 … 10^3 [pcs.]: 0 … 10^6
Weight	Weight in [g]. Appears only if **Entry type** = **Fixed weight** was selected.	0…1000
Volume	Volume in [mL]. Appears only if **Entry type** = **Fixed volume** was selected.	0…1000
Pieces	The number of sample(s). Appears only if **Entry type** = **Fixed pieces** was selected.	0…10^6
Weight per piece	The weight in [g] per pirece. Appears only if **Entry type** = **Pieces** or **Fixed pieces** was selected.	0 … 1000

Density	The density of a liquid sample substance, in [g/mL]. Appears only if **Entry type** is set to **Weight**, **Volume**, **Fixed weight** or **Fixed volume**.	0.0001…100
Number of sample factors	Defines the number of additional sample factors that can be used.	0…3
Name of sample factor 1	Defines the name of the additional sample factor. This name is displayed in reports and in windows where the user can enter sample data.	0…20 characters
Value of sample factor 1	Defines the value of the additional sample factor.	0.0000…10^6
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200
Entry	Determines the entry time for the sample size. **Before**: The sample size must be entered before the titration. **Arbitrary**: The sample size will have to be entered at any time during the titration (no later than when it is used during the calculations). Only appears if none fixed values are selected in **Entry type**.	Before I Arbitrary
Sampling	Defines the way the sample will be prepared fo the analysis. **Direct**: The sample, water (volume defined in **Water volume**) and ISA solution (volume defined in **ISA volume**) are added directly to the analysis beaker. **Aliquot incl. ISA**: ISA solution is added to the sample until the volume defined in **Dilution volume** is reached. A volume defined in **Aliquot volume** is transferred to the analysis beaker. **Aliquot excl. ISA**: The sample is diluted to the volume defined in **Dilution volume**. A volume defined in **Aliquot volume** is transferred to the analysis beaker and ISA solution (volume defined in **ISA volume**) is added to the analysis beaker.	Direct I Aliquot incl. ISA I Aliquot excl. ISA
Water volume	Defines the volume of water added to dilute the analysis solution to achieve the needed ISA concentration in the analysis beaker. Only if **Sampling** is set to **Direct**.	0.00000...1000 mL
ISA volume	Define the ISA volume added to the analysis beaker. Only if **Sampling** is set to **Direct** or **Aliquot excl. ISA**.	0.00000...1000 mL
Dilution volume	Defines the volume of the dilution solution in [mL]. Only if **Sampling** is set to **Aliquot incl. ISA** or **Aliquot excl. ISA**.	0.00000...1000
Aliquot volume	Defines the volume of the aliquot taken from the dilution solution. The aliquot is added to the analysis beaker. Only if **Sampling** is set to **Aliquot incl. ISA** or **Aliquot excl. ISA**.	0.00000...1000 [mL]

Titrator reader	Defines how sample data is read. **None**: no sample data reader is used. **SmartSample**: the titrator will prompt the operator to position the sample on the SmartSample reader. The sample ID1,2, sample size, density and correction factor are filled automatically at analysis start. **MT 2D barcode**: the titrator prompts the operator to read the barcode with a connected barcode reader before the sample analysis starts. The sample ID1 and the sample size are filled automatically at analysis start if the barcode has an MT specific barcode layout. **ID 1 barcode**: the titrator prompts the operator to read the barcode with a connected barcode reader before the sample analysis starts. The sample ID1 is filled automatically at analysis start. Only appears if **Titration stand** is set to **Manual stand**, **External stand** or **Auto stand**.	None I SmartSample I MT 2D barcode I ID 1 barcode
InMotion reader	Defines how sample data is read. **None**: no sample data reader is used. **SmartSample**: the InMotion reader reads the sample ID1,2, sample size, density and factor from the Smart Tag on the beaker. **MT 2D barcode**: the titrator prompts the operator to read the barcode with a connected barcode reader before the sample analysis starts. The sample ID1 and the sample size are filled automatically at analysis start if the barcode has an MT specific barcode layout. **ID 1 barcode**: the titrator prompts the operator to read the barcode with a connected barcode reader before the sample analysis starts. The sample ID1 is filled automatically at analysis start. Only appears for **Titration stand** = **InMotion**.	SmartSample I MT 2D barcode I ID 1 barcode I None

7.4.4 Sample (titer)

Start of a loop for titer determination Contains all of the necessary data regarding the titrant and the standard to be used.

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-
Standard	Select the name of the standard from the standards list.	Select from the standards defined in the setup.
Type of standard	Shows the type of standard.	solid I liquid
Entry type	Defines whether the quantity (weight or volume) of a liquid or solid standard should be entered when the analysis is started or whether a **Fixed weight** or a **Fixed volume** should be defined in the method function. The available options depend on the setting of **Type of standard**.	Weight I Fixed weight I Volume I Fixed volume I Pieces I Fixed pieces
Lower limit	Defines the lower limit for the variable entry of sample data in [mL] or [g]. The unit will depend on the setting for **Entry type** parameter. Applies only for **Entry type** = **Weight** and **Volume**.	0...1000
Upper limit	Defines the upper limit for the variable entry of data. The unit will depend on the setting for **Entry type** parameter. Only appears if none fixed values are selected in **Entry type**.	[g]: 0 … 1000 [mL]: 0 … 1000 [St.]: 0 … 10^6

Weight	Weight in [g]. Appears only if **Entry type** = **Fixed weight** was selected.	0…1000
Volume	Volume in [mL]. Appears only if **Entry type** = **Fixed volume** was selected.	0…1000
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200
Entry	Determines the entry time for the sample size. **Before**: The sample size must be entered before the titration. **Arbitrary**: The sample size will have to be entered at any time during the titration (no later than when it is used during the calculations). Only appears if none fixed values are selected in **Entry type**.	Before I Arbitrary
InMotion reader	Defines how sample data is read. **None**: no sample data reader is used. **SmartSample**: the InMotion reader reads the sample ID1,2, sample size, density and factor from the Smart Tag on the beaker. **MT 2D barcode**: the titrator prompts the operator to read the barcode with a connected barcode reader before the sample analysis starts. The sample ID1 and the sample size are filled automatically at analysis start if the barcode has an MT specific barcode layout. **ID 1 barcode**: the titrator prompts the operator to read the barcode with a connected barcode reader before the sample analysis starts. The sample ID1 is filled automatically at analysis start. Only appears for **Titration stand** = **InMotion**.	SmartSample I MT 2D barcode I ID 1 barcode I None
Titrator reader	Defines how sample data is read. **None**: no sample data reader is used. **SmartSample**: the titrator will prompt the operator to position the sample on the SmartSample reader. The sample ID1,2, sample size, density and correction factor are filled automatically at analysis start. **MT 2D barcode**: the titrator prompts the operator to read the barcode with a connected barcode reader before the sample analysis starts. The sample ID1 and the sample size are filled automatically at analysis start if the barcode has an MT specific barcode layout. **ID 1 barcode**: the titrator prompts the operator to read the barcode with a connected barcode reader before the sample analysis starts. The sample ID1 is filled automatically at analysis start. Only appears if **Titration stand** is set to **Manual stand**, **External stand** or **Auto stand**.	None I SmartSample I MT 2D barcode I ID 1 barcode

7.4.5 Sample (calibration)

Start of a loop for sensor calibration. **Sample (Calibration)** contains the necessary data regarding the sensor and the calibration standard. Some of the parameters are available for all sensors, other are specific to a sensor type.

Common parameters

Parameters	Description	Values
Sensor type	Defines the type of sensor that is calibrated.	List of available sensor types

Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure used for the measurement.	List of available units

Parameters for pH sensors

Parameters	Description	Values
Action	Defines if a calibration or a sensor test is performed.	Calibration I Sensor test
Automatic buffer recognition	Defines whether the titrator should automatically identify the buffers via the pH buffer list. Only possible for pH sensors.	Activ I Inactive
pH buffer list	Defines the pH buffer list to be used for the calibration of a pH sensor.	Select from the pH buffer lists (Auto pH buffer lists) defined in Setup.
Calibration	Here you can define whether the calibration of a pH or ISE sensor should be done in a linear or segmented manner.	Linear I Segmented
Number of buffers	The number of buffers to be used for the calibration of a pH sensor.	1…9
Buffer 1…9	Defines the buffers used for the calibration or sensor test of a pH sensor. For the calibration, up to nine buffers can be selected from the pH buffer list. For the sensor test, two buffers must be selected from the pH buffer list.	List of available pH buffers
Temperature	The temperature during the calibration in [°C] if temperature acquisition has not been selected in the method function **Measure (normal)**. Does not appear for temperature sensors.	-20°C…200°C

Parameters for ISE sensors

Parameters	Description	Values
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary
List of standards	Defines the standards list to be used for the calibration of an ISE or conductivity sensor.	Select from the standards lists defined in Setup.
Calibration	Here you can define whether the calibration of a pH or ISE sensor should be done in a linear or segmented manner.	Linear I Segmented
Number of standards	The number of standards to be used for the calibration of an ISE sensor.	1…9
Standards 1…9	For the calibration of an ISE sensor, up to nine standards can be selected from the standards list.	Select from the standards list.
Temperature	The temperature during the calibration in [°C] if temperature acquisition has not been selected in the method function **Measure (normal)**. Does not appear for temperature sensors.	-20°C…200°C

Parameters for conductivity sensors

Parameters	Description	Values
List of standards	Defines the standards list to be used for the calibration of an ISE or conductivity sensor.	Select from the standards lists defined in Setup.
Standard	Select the name of the standard from the standards list.	Select from the standards defined in the setup.
Temperature	The temperature during the calibration in [°C] if temperature acquisition has not been selected in the method function **Measure (normal)**. Does not appear for temperature sensors.	-20°C…200°C

Parameters for temperature sensors and thermometric sensors

Parameters	Description	Values
Standard	Defines the standard used for the calibration.	Available standards

7.4.5.1 pH sensor test

The sensor test is used to check the slope, zero point and drift of pH sensors.

The test can be started either by using a method or sample series via the "Calibration" method function or directly from the Setup of the sensor concerned (see also "Setup: Hardware > Sensors > Sensor Calibration and Sensor Test").

Note

- The calibration data of the pH sensor is not affected by the test.
- The results of the sensor test can be printed out.

Starting the sensor test via a method

Start the sensor test as follows:

1 Select a method of the "Calibration" type or create the appropriate method.
2 Select the "Sample (Calibration)" method function.
3 In the **Sample (Calibration)** dialog window, select the following parameters:
- "Sensor type" = "pH"
- "Action" = "Sensor test"
4 Specify the buffer parameters to be used (See "Methods: Method functions > Sample (Calibration)". The sensor test is carried out using two buffer solutions.
5 Press **OK**.
6 Select the "Calibration" method function
7 Define the following parameters in the **Calibration** dialog:

Parameters	Description	Values
Message outside limits	Defines whether a message opens that informs the user that the value lies outside of the limits.	Activ I Inactive
Stop outside limits	Defines whether the analysis is stopped if the value lies outside the defined limits.	Activ I Inactive
Min. slope 1-8	The lower limit for the slope, in [%]. (100% refers to -59.16 mV/pH.)	10…200
Max. Slope 1-8	The upper limit for the slope, in [%].	10…200
Min. zero point 1-8	The lower limit for the zero point.	-100…100
Max. zero point 1-8	The upper limit for the zero point.	-100…100
Min. drift	The minimum drift value in [mV/30s].	-100 to 100
Max. drift	The maximum drift value in [mV/30s].	-100 to 100

Note

- If the values are within the limits, the sensor test is regarded as having been passed.
- Slope and drift relate to 25°C.

To provide an overview, the relevant method functions have been summarized and listed in the following table:

Method functions for the pH sensor test

Method function	Description
Sample (Calibration)	This method function is used firstly in order to carry out a calibration and secondly for the sensor test. It is selected via the "Action" parameter. Only two buffers can be defined for the sensor test.
Measure (normal)	The measured values of both calibration solutions (pH buffers) are determined here. In addition, another drift determination is carried out for the second buffer.

Method function	Description
Calibration	In the method, the "Calibration" method function for the sensor test is placed after the "End of sample" method function. Essentially, "Calibration" corresponds to a calculation function. In the process, it calculates the calibration parameters from the measured values of the calibration loop and the calibration standard values (pH buffer values). These are then compared with the inputted limit values for the zero point, slope and drift.
Record	The results of the sensor test are displayed in the "Overview" section of the record. The various selection parameters for titration curves (E – V, dE/dV – V, etc.) which are available during standard titration are invalid for the record.

7.4.6 Sample (KF)

The method function **Sample (KF)** for Karl Fischer titration is subdivided into the subfunctions **Sample**, **Concentration**, and **Blank values**. The method type determines which subfunctions are available.

Method type	Sample	Concentration	Blank values
KF Vol	•	•	–
Ext. Extr. V.	•	•	•
Scan KF V.	•	•	–
IM KF V.	•	•	–
Stromb. V.	•	•	–
KF Coul	•	–	–
Ext. Extr. C.	•	–	•
Scan KF C.	•	–	–
IM KF C.	•	–	–
Stromb. C.	•	–	–

You can define the following parameters:

Subfunction: Sample

Sample type is only available for the following method types:

- **IM KF C.**
- **IM KF V.**

Parameters	Description	Values
Sample type	Defines the type of sample used in the sample loop. The sample type is shown in the method editor, the sample data window and the report.	Sample I Standard I Blank
Number of IDs	Defines the number of sample IDs to be defined.	1…3
ID 1…ID 3	The name defined here will be used as the default name for the respective sample on the sample loop. Only appears subject to the settings made in **Number of IDs**.	Arbitrary
Entry type	Defines whether the sample should be added with a defined mass, defined volume or defined number of pieces. The sample data query will then adjust according to the unit of measurement. **Fixed volume** or **Fixed pieces**: The sampling weight, sample volume or number of pieces will be entered as the parameter in this method function and will not be prompted when conducting the method.	Weight I Fixed weight I Volume I Fixed volume I Pieces I Fixed pieces
Lower limit	Defines the lower limit for the variable entry of data. The unit will depend on the setting for the **Entry type** parameter. Only appears if **Entry type** is set to **Weight**, **Volume** or **Pieces**.	[g]: 0 … 1000 [mL]: 0 … 10^4 [pcs.]: 0…10^6

Upper limit	Defines the upper limit for the variable entry of data. The unit will depend on the setting for the **Entry type** parameter. Only appears if **Entry type** is set to **Weight**, **Volume** or **Pieces**.	[g]: 0 … 10^3 [mL]: 0 … 10^3 [pcs.]: 0 … 10^6
Weight	Weight in [g]. Appears only if **Entry type** = **Fixed weight** was selected.	0…1000
Value	Volume in [mL]. Only appears if for **Entry type** "Fixed" values are selected.	0…10^4
Pieces	The number of sample(s). Appears only if **Entry type** = **Fixed pieces** was selected.	0…10^6
Weight per piece	The weight in [g] per pirece. Appears only if **Entry type** = **Pieces** or **Fixed pieces** was selected.	0 … 1000
Density	The density of a liquid sample substance, in [g/mL]. Appears only if **Entry type** is set to **Weight**, **Volume**, **Fixed weight** or **Fixed volume**.	0.0001…100
Solvent weight	Quantity of solvent in [g] in which the sample was extracted or dissolved. Only for method type = **Ext. Extr.**.	0…1000
Wt. extracted sample	Total weight of sample in [g] which was extracted or dissolved in the solvent. Only for method type = **Ext. Extr.**.	0…1000
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200
Autostart	If activated, KF titration starts following a significant signal increase within 30 seconds after the start of the analysis (not for Stromboli or InMotion KF methods). If deactivated, the sample addition must be confirmed before titration can begin.	Activ | Inactive
Analysis start	If **Automatic** is selected, the analysis begins without any user confirmation if the value falls below the maximum start drift and the defined stability criterion **Drift stability**/dt and the set temperature are reached. If the standby is executed by the method function **Standby** (only for Stromboli and inMotion KF), the automatic start is not performed (affects the 2nd, 3rd….series). If the analysis is started manually, the series must be started explicitly in the Standby dialog.	Automatic | Manual
Drift stability	Maximum permitted drift difference in [µg/min]. Only for "Stromboli" method type and if **Analysis start** = **Automatic** is selected.	0…1000
dt	dt in [sec] is the time taken to determine the drift stability. The time recording can begin before the set temperature is reached and before the value falls below the maximum start drift. Only for "Stromboli" method type and if **Analysis start** = **Automatic** is selected.	1…1000

Entry	Determines the input time for the sample size. **Before**: The sample size must be entered before the titration. **Arbitrary**: The sample size will have to be entered at any time during the titration (no later than when it is used during the calculations). Only appears if for **Entry type** no "Fixed" values are selected. **After addition**: You are prompted to enter the sample data once the sample has been added. The sample size - even during the method execution - can be entered later on (however, no later than when required for use in formulas).	Arbitrary I After addition

Subfunction: Concentration

To correctly determine the water content of a sample, the concentration of the titrant should be determined using Karl Fischer water standards. The concentration determination is performed using control and termination parameters.
Any predispensing defined in the method is not performed. A defined blank value is also not taken into account in the calculation. Following a concentration determination, the system always switches to standby mode to enable double and multiple determinations.
The concentration determination can be started manually. You can start the concentration determination of the KF titrant from **Standby** of any volumetric Karl Fischer (KF) method except **Scan KF V.**. You can determine the following parameters:

Parameters	Description	Values
Standard	Select the name of the standard from the standards list.	Select from the standards defined in the setup.
Entry type	Defines whether the sample should be added with a defined mass, defined volume or defined number of pieces. The sample data query will then adjust according to the unit of measurement. **Fixed volume** or **Fixed pieces**: The sampling weight, sample volume or number of pieces will be entered as the parameter in this method function and will not be prompted when conducting the method.	Weight I Fixed weight I Volume I Fixed volume I Pieces I Fixed pieces
Lower limit	Defines the lower limit for the variable entry of data. The unit will depend on the setting for the **Entry type** parameter. Only appears if **Entry type** is set to **Weight**, **Volume** or **Pieces**.	[g]: 0 … 1000 [mL]: 0 … 10^4 [pcs.]: 0…10^6
Upper limit	Defines the upper limit for the variable entry of data. The unit will depend on the setting for the **Entry type** parameter. Only appears if **Entry type** is set to **Weight**, **Volume** or **Pieces**.	[g]: 0 … 10^3 [mL]: 0 … 10^3 [pcs.]: 0 … 10^6
Weight	Weight in [g]. Appears only if **Entry type** = **Fixed weight** was selected.	0…1000
Value	Volume in [mL]. Only appears if for **Entry type** "Fixed" values are selected.	0...10^4
Pieces	The number of sample(s). Appears only if **Entry type** = **Fixed pieces** was selected.	0…10^6
Mix time	The duration of stirring in [s] with the defined "Stir" speed.	0…10^4
Autostart	If activated, KF titration starts following a significant signal increase within 30 seconds after the start of the analysis (not for Stromboli or InMotion KF methods). If deactivated, the sample addition must be confirmed before titration can begin.	Activ I Inactive

Entry	Determines the input time for the sample size. **Before**: The sample size must be entered before the titration. **Arbitrary**: The sample size will have to be entered at any time during the titration (no later than when it is used during the calculations). Only appears if for **Entry type** no "Fixed" values are selected. **After addition**: You are prompted to enter the sample data once the sample has been added. The sample size - even during the method execution - can be entered later on (however, no later than when required for use in formulas).	Arbitrary I After addition
Conc. lower limit	Defines the lower limit of the concentration limit.	0.1…100
Conc. upper limit	Defines the upper limit of the concentration limit.	0.1…100

Note

- Outside of these limits, the actual concentration is not entered in the settings.

Subfunction: Blank

The subfunction **Blank** assigns a determined water content to the solvent. The blank can be a fixed value, can be taken from the settings, or can be requested by the system. The subfunction **Blank** is only available for the method type **Ext. Extraction Coul.** and **Ext. Extraction Vol.**.

You can determine the following parameters:

Parameters	Description	Values
Source for blank	**Setup**: After the blank value is determined, the value and the unit of the blank are transferred to the settings. **Fix**: The value defined in the method is used. **Request**: The blank value in the relevant unit is requested before each sample. The specified blank value is labeled with "B" in the method function **Calculation**.	Setup I Fix value [%] I Fix value [ppm] I Request [%] I Request [ppm]
Value	Here you can enter a numerical value. Only appears if for **Entry type** "Fixed" values are selected.	$0...10^6$
Blank	The blank value assigned to the solvent to be determined. You can select a blank value defined in the settings.	Value from the settings
Unit	Defines the unit in which the blank value is calculated and used in a calculation. The unit for calculation with a blank value must be the same as the unit set here. Applies for the **Setup** option only.	% I ppm
Entry type	Defines whether the sample should be added with a defined mass or defined volume. The sample data query will then adjust according to the unit of measurement. For **Fixed weight** or **Fixed volume**, the sample mass and the sample volume are entered as parameters in the method function and not requested in the sequence of the method.	Weight I Fixed weight I Volume I Fixed volume
Lower limit	Defines the lower limit for the variable entry of sample data in [mL] or [g]. The unit will depend on the setting for **Entry type** parameter. Applies only for **Entry type** = **Weight** and **Volume**.	0...1000
Upper limit	Defines the upper limit for the variable entry of sample data in [ml] or [g]. The unit will depend on the setting for the **Entry type** parameter. Applies only for **Entry type** = **Weight** and **Volume**.	0...1000
Weight	Weight in [g]. Appears only if **Entry type** = **Fixed weight** was selected.	0…1000
Volume	Volume in [mL]. Appears only if **Entry type** = **Fixed volume** was selected.	0…1000

Density	The density of the liquid sample in [g/mL] for **Entry type** = **Volume** or **Fixed volume**.	0…1000
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200
Mix time	The duration of stirring in [s] with the defined "Stir" speed.	0…10^4
Autostart	If activated, KF titration starts following a significant signal increase within 30 seconds after the start of the analysis (not for Stromboli or InMotion KF methods). If deactivated, the sample addition must be confirmed before titration can begin.	Activ I Inactive
Entry	Determines the input time for the sample size. **Before**: The sample size must be entered before the titration. **Arbitrary**: The sample size will have to be entered at any time during the titration (no later than when it is used during the calculations). Only appears if for **Entry type** no "Fixed" values are selected. **After addition**: You are prompted to enter the sample data once the sample has been added. The sample size - even during the method execution - can be entered later on (however, no later than when required for use in formulas).	Arbitrary I After addition
Limits	Determines whether limits should be taken into account for acquisition of a value. If the value is outside these limits, the value is not transferred to Setup.	Activ I Inactive
Lower limit	Defines the lower limit of the blank. Appears only if **Limits** = **Active** was selected. Outside these limits, the blank value is not entered in the setup.	0...10^6
Upper limit	Defines the upper limit of the blank. Appears only if **Limits** = **Active** was selected. Outside these limits, the blank value is not entered in the setup.	0...10^6

See also

Blanks ▶ Page 220

7.4.7 Titration stand

The method type determines which titration stands are available.

The following titration stands have no parameters that are specific for the titration stand.

- **Auto stand**
- **Manual stand**
- **External stand**
- **Rondolino**

These titration stands are available for the following method types:

- **General titration**
- **Titer**
- **Calibration**

Parameters common to all titration stands

Parameters	Description	Values
Type	Defines the type of the titration stand.	Available titration stands
Titration stand	Defines which titration stand is to be used.	List of available titration stands

7.4.7.1 Rondo

Rondo is available for the following method types:

- **General titration**
- **Titer**
- **Calibration**

Parameters	Description	Values
Lid handling	Defines whether before titration the lid of a sample should be removed with an attached CoverUp™ unit.	Activ I Inactive

7.4.7.2 InMotion T

InMotion T is available for the following method types:

- **General titration**
- **Titer**
- **Calibration**

Parameters	Description	Values
Titration head position	The vertical position to which the titration head of the sample changer should be brought. **Cond. measure**: This position is 20 mm above the Sample position and is intended to immerse the conductivity sensor into the sample but not the pH sensor, preventing electrolyte contamination from the pH sensor.	Sample I Cond. measure
Lid handling	Defines whether before titration the lid of a sample should be removed with an attached CoverUp™ unit.	Activ I Inactive

7.4.7.3 KF Stand

KF stand is available for the following method types:

- **KF Vol**
- **Ext. Extr. V.**
- **KF Coul**
- **Ext. Extr. C.**
- **Bromine Index**

Source for drift and **Max. start drift** are not available for **Bromine Index**.

Parameters	Description	Values
Source for drift	Defines the source for the drift value used in the method function **Calculation**. **Online**: Drift value determined in the Standby mode, at the time the user taps **Start sample**. **Determination**: Result of a drift determination started from the **More KF functions** window. The result is saved in the KF titration stand that is used in the method. **Fix value**: Value defined in **Drift** **Request**: Value that the user enters after starting a sample analysis or a series.	Online I Determination I Fix value I Request
Drift	Defines the drift value.	0...1000 µg/min
Max. start drift	The maximum drift for which a sample determination can still be started.	0...1000 µg/min

7.4.7.4 InMotion KF

InMotion KF is available for the following method types:

- **IM KF V.**
- **Scan KF V.**
- **IM KF C.**
- **Scan KF C.**

Controlled heating of the sample

With **Temperature ramp** you can heat a sample to the measurement temperature at a controlled rate. The water that the sample releases while it is heated, is included when the water content is calculated.

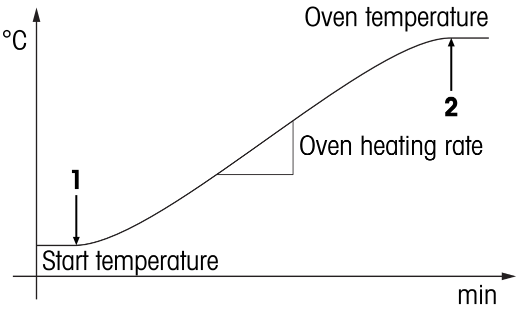
If the ambient temperature is higher than 30°C, the **Start temperature** needs to be at least 10 °C higher than the ambient temperature.

Temperature ramp is available for the following method functions:

- **IM KF V.**
- **IM KF C.**

Temperature ramp is activated:

- The sample changer inserts the sample in the oven when the temperature defined in **Start temperature** is reached (1).
- The sample is heated at the rate defined in **Oven heating rate**.
- The measurement starts when the oven reaches the temperature defined in **Oven temperature** (2) and the conditions defined in **Max. start drift** and **Drift stability** are met.
- At the end of the measurement the oven returns to the start temperature before the next sample is inserted.



Temperature ramp is deactivated:

- The sample changer inserts the sample in the oven when the temperature defined in **Oven temperature** is reached.

Define the maximum drift at the start of a measurement

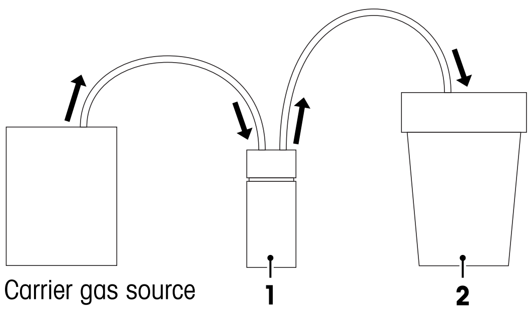
Max. start drift defines the upper limit for the drift at the start of the measurement. The measurement only starts, when the drift is lower than the value defined in **Max. start drift**. Drift is caused by water that continually diffuses into the titration stand and that is not part of the sample. The drift should be small and stable, because it is subtracted from the measured value when the water content is calculated. METTLER TOLEDO recommends a drift <10 µg/mL and if possible <5 µg/mL.

Source for drift defines which drift value is used in the method function **Calculation**. **Source for drift** is available for the following method types:

- **IM KF V.**
- **IM KF C.**

Define the carrier gas source

A gas flow carries the water from the vial (1) in the oven to the titration vessel (2).



Three basic setups are possible for the carrier gas source:

- An air pump KF from METTLER TOLEDO is installed on the InMotion KF to pump ambient air through the system. Set **Carrier gas source** to **InMotion KF** and define the flow rate of the carrier gas in **Flow rate**.
- A gas stop valve from METTLER TOLEDO is installed on the InMotion KF to control the gas flow from a pressurized gas cylinder or gas pipes. Set **Carrier gas source** to **InMotion KF** and define the flow rate of the carrier gas in **Flow rate**.

- It is possible to use another system. In this case the titrator cannot control the flow rate. If you want to use another system, contact your authorized METTLER TOLEDO dealer or service representative.

▶ www.mt.com/contact

Transfer tube heating

To minimize the amount of water that is lost due to condensation in the transfer tube, you can use a heated transfer tube and activate **Transfer tube heating**. If **Transfer tube heating** is activated, the heated transfer tube is heated.

Parameters	Description	Values
Temperature ramp	Defines whether a sample is heated at a controlled rate or not.	Activ I Inactive
Start temperature	Defines the start temperature of the temperature ramp. If the ambient temperature is higher than 30°C, the start temperature needs to be at least 10 °C higher than the ambient temperature.	40…280 °C
Oven heating rate	Defines the maximum heating rate of the temperature ramp.	0.1…75 °C/min
Oven temperature	Defines the measurement temperature of the oven sample changer.	40...280 °C
Source for drift	Defines the source for the drift value used in the method function **Calculation**. **Determination**: Result of a drift determination started from the **More KF functions** window. The result is saved in the KF titration stand that is used in the method. **Fix value**: Value defined in **Drift** **Request**: Value that the user enters after starting a sample analysis or a series.	Determination I Fix value I Request
Drift	Defines the drift value.	0...1000 µg/min
Max. start drift	The maximum drift for which a sample determination can still be started.	0...1000 µg/min
Carrier gas source	Defines the source of the carrier gas. **InMotion KF**: Either the air pump KF or the gas stop valve installed on the sample changer are used. **External**: A source independent of the sample changer is used.	InMotion KF I External
Flow rate	Defines the flow rate of the carrier gas.	20…200 mL/min
Transfer tube heating	Defines whether the titrator switches the heating of a heated transfer tube on or off.	Activ I Inactive

7.4.7.5 Stromboli

Stromboli is available for the following method types:

- **Stromb. V.**
- **Stromb. C.**

Parameters	Description	Values
Oven temperature	Defines the measurement temperature of the oven sample changer.	50...300 °C
Source for drift	Defines the source for the drift value used in the method function **Calculation**. **Determination**: Result of a drift determination started from the **More KF functions** window. The result is saved in the KF titration stand that is used in the method. **Fix value**: Value defined in **Drift** **Request**: Value that the user enters after starting a sample analysis or a series.	Determination I Fix value I Request
Drift	Defines the drift value.	0...1000 µg/min

Max. start drift	The maximum drift for which a sample determination can still be started.	0...1000 µg/min

7.4.8 Line Rinse

The Line Rinse function, for InMotion sample changer, starts at the Rinse Position (or when using higher beakers at a higher position) and moves down at a variable speed (**Descent rate**). Operating the pump at a flow rate (always 100%) faster than the descent speed, air bubbles are introduced with the reagent in the beaker for mechanical cleaning of the tube. Use **Line rinse** at very high descent rate to replace solvents in Conditioning beakers with the desired interval for **Refill** = **Yes**.

Parameters	Description	Values
Titration stand	Defines which titration stand is to be used. This parameter is only visible outside the loop. Inside the loop the titration stand of the previous method function **Titration stand** is used.	List of available InMotion titration stands
Interval	Defines the rinsing interval, i.e., after how many samples rinsing will be performed.	1...303
Position	Defines the position on the autosampler where the rinse procedure should be executed. For **Position** = **Current sample**, rinsing is only possible within the loop.	Current position I Rinse beaker I Special beaker 1…Special beaker 4 I Conditioning beaker I Current sample
Drain pump	Defines, which pump is used for draining.	Available pumps
Pump property	Defines the properties for the pump used.	1-way I 1-way, two rates I 2-way, fine rate
Direction	Defines the the pump direction to be used. Only if **Pump property** = **2-way, fine rate** is selected.	Forward I Reverse
Descent rate	Defines the speed at which the lift of the autosampler is lowered. This parameter affects the ratio of intake air and liquid. The suction of air improves the cleaning effect.	Very low I Low I Medium I High I Very high I

Proposed rates by pump types

	Descent rate	
Beaker/Tube	**SP280/SPR200**	**SD660**
25 mL	**High**	**Very high**
80 mL	**Medium**	**High**
100 mL	**Low**	**Medium**
180 mL	**Very low**	**Low**
250 mL	**Very low**	**Low**

Refill	Defines whether the beaker will be refilled with the auxiliary reagent after rinsing.	Activ I Inactive
Auxiliary reagent	Specifies the auxiliary reagent to be added. Only if **Refill** = **Active** is selected.	List of available auxiliary reagents
Volume	Defines the volume in [mL] of reagent to be pumped or filled.	0…1000

7.4.9 Liquid Handling

The method function **Liquid Handling** allows you to perform the following tasks:

- **Prepare**: This task shall be performed in order to rinse the respective port of the multi port valve of the Liquid Handler, if the port, i.e. the liquid is changed. This procedure avoids carry-over.
- **Aspirate** or **Dispense** of solutions.

Liquid Handling can be applied inside or outside of a sample loop.
At the end of the Liquid Handler's operation instruction, a method is shown that can be used for the system test of the Liquid Handler.

If **Liquid Handling** is applied in combination with a sample changer, you can decide whether you want to use the fix or flexible start position:

- If you select the parameter **Fix**, after each sample loop the titration head moves always to the specified start position.
- For **Flexible**, the titration head's position is incremented with +1 for each loop run.
  Note: This option is only available if the method function **Liquid Handling** is placed inside the sample loop.

In the following the **Liquid Handling** parameters are described. There are parameters which are only available for the related task **Action**; others are available for all tasks:

Parameters available for all tasks

Parameters	Description	Values
Liquid Handler	You can select the Liquid Handler detected by the titrator.	Liquid Handler 1 I Liquid Handler 2
Action	The type of Liquid Handling.	Prepare I Aspirate I Dispense
Connection	You can select the ports specified in the settings.	List field (the values are defined in the settings.
Port	Information on the current connected port for the selected action.	-
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Type	Defines the kind of the sample changer's start position. Only available for **Titration stand** = **Rondo** or **InMotion**.	Fix I Flexible
Position	Defines the kind of the sample changer's start position. Only available for **Titration stand** = **Rondo** or **InMotion** and **Type** = **Fix**.	Conditioning beaker I Rinse beaker I Special beaker 1…Special beaker 4 I Position number
Position number	You can enter a number of the sample changer's start position. Only available for **Titration stand** = **Rondo** or **InMotion**, **Type** = **Fix** and **Position** = **Position number**.	1...303 I H (auxiliary value)
Start position <name of the Titration stand>	Defines the first start position of the sample changer. The start position for each sample loop is incremented with +1. Only available for **Titration stand** = **Rondo** or **InMotion**, **Type** = **Flexible**. **Note**: The flexible type of the start position is not available for the Liquid Handling method function applied outside of a loop. Rondo only offers numbers in the range of 1...60.	1...60 I 1...303 I H
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

Specific Parameters for Prepare

Parameters	Description	Values
Aspiration rate	The relative aspiration rate in [%]	0.1…80 80% => 120 mL/min
Discharge rate	The relative dispensing rate in [%]	0.1 …80 H (auxiliary value) I F (formula)
Rinse port	The implementation of a two-stage purification process of the specified connections with solution. If **Inactive** is selected, the multiport valve changes to Waste (port 6) and the burette cylinder is emptied.	Activ I Inactive
No. of rinse cycles 1…2	Determines the number of rinse cycles, which will be performed. In general, there are two rinse cycles, one with a large volume and the other one with low volume. Only available if **Rinse port** = **Active**.	1…5
Volume per cycle 1…2	Specifies the rinse volume in [mL] per rinse cycle. Only available if **Rinse port** = **Active**.	0.010…50

Specific Parameters for Aspirate

Parameters	Description	Values
Aspiration rate	The relative aspiration rate in [%]	0.1…80 80% => 120 mL/min
Aspiration volume	The aspiration volume in [mL].	0.01…50
Spindle backlash compensation	Specifies spindle backlash compensation in order to compensate spindle tolerances during the operation period of aspirating and pipetting solutions. Also to eliminate air bubbles trapped during aspiration in tubes or in the burette. Only available for **Action** = **Aspirate**.	Activ I Inactive
Wait time	With this parameter a waiting period in [s] can be defined after the aspiration that enables complete aspiration of viscous liquids.	0…300
Air gap before aspiration	Avoids the mixing of the sample solution with the transfer solution in the tube. Only available for **Action** = **Aspirate** and for **Titration stand** = **Rondo** or **InMotion**.	Activ I Inactive
Aspiration rate	The relative aspiration rate in [%]	0.1…80 80% => 120 mL/min
Volume	Specifies the volume in [mL] of the related air gap. Only available for **Action** = **Aspirate** and for **Air gap before aspiration** = **Active**.	0.010 ... 1 I H (auxiliary value) I F (formula)
Air gap after aspiration	Avoids sample loss due to droplet formation. Only available for **Action** = **Aspirate** and for **Air gap before aspiration** = **Active**.	Activ I Inactive
Aspiration rate	The relative aspiration rate in [%]	0.1…80 80% => 120 mL/min
Volume	Specifies the volume in [mL] of the related air gap. Only available for **Action** = **Aspirate** and for **Air gap before aspiration** = **Active**.	0.010 ... 1 I H (auxiliary value) I F (formula)

Specific Parameters for Dispense

Parameters	Description	Values
Discharge rate	The relative dispensing rate in [%]	0.1 …80 H (auxiliary value) I F (formula)
Discharge volume	The dispensing volume in [mL].	0.01…500 H (auxiliary value) I F (formula)
Refill	This parameter is used if volumes are required which exceeds the maximum burette volume (50 mL). If activated, you can specify the **Connection** and the **Aspiration rate** for the automatic refilling of the burette. For multiple aspiration, be aware that volume shall be a multiple of 25 µL.	Activ I Inactive

Note

- Both, **Aspiration rate** and **Discharge rate** depend on the viscosity of the solution. Low rate values are required for highly viscous liquids and high rate values for liquids with a low viscosity (for more information about the viscosity of some liquids at room temperature refer to:
  - http://hyperphysics.phy-astr.gsu.edu/Hbase/tables/viscosity.html
  - 5,000 centipoise is the maximum value. Aspiration of high viscous samples require a waiting time after the aspiration step is completed.

See also

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7.4.10 Mix time

You can use the "Mix time" method function to define the stir time in [s] for Karl Fischer titration. This value is obtained from experience and can be entered individually for each sample.
The stir speed, however, is entered in the method function "Titration" using the "Stir" parameter. This applies for the whole method.

Parameters	Description	Values
Duration	Duration in [s].	1…10^4

7.4.11 Rinse

You can use this method function to rinse a sensor. You can define the following parameters:

Parameters	Description	Values
Titration stand	Selects a titration stand defined in the setup. Appears only if the method function **Rinse** is used outside of a sample loop.	Select the titration stands from the list specified in Setup.
Auxiliary reagent	The auxiliary reagent to be added.	List of available auxiliary reagents
Rinse cycles	The number of rinse cycles to be run.	1…100
Vol. per cycle	The rinse volume in [mL] per cycle.	0…1000
Position	Defines the position on the sample changer where the rinse procedure should be executed. The rinsing beaker can only be selected for a connected Rondo. Rinsing in the **Current sample** position is only possible within the loop.	Current position I Rinse beaker I Current sample
Drain	Defines whether the contents of the rinse vessel should be drained before starting the rinse procedure. This is always automatically set to "**Active**" if the **Position** has been set to **Rinse beaker** or if more than one rinse cycle is executed.	Activ I Inactive
Drain pump	Defines, which pump is used for draining.	Available pumps

Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.12 Conditioning

Use this method function to prepare a sensor for the next analysis. This method function becomes active when a sample changer is selected.

Parameters	Description	Values
Titration stand	Activates a sample changer defined in the setup. Appears only if the method function **Conditioning** is used outside of a sample loop.	List of titration stands
Interval	Defines the conditioning interval, i.e., after how many samples conditioning will be performed. Appears only when inside a loop.	1...60 (Rondo) I 1... 303 (InMotion)
Position	Defines the position of the conditioning beaker. **Variable position** uses the defined interval to define the position(s). **Variable position** can only be selected if **Titration stand** = **InMotion** selected and method function is used within a loop.	Variable position I Special beaker 1...4 I Conditioning beaker
Cond. beaker spacing	Defines where the conditioning beakers are positioned on the rack for variable conditioning beaker positions: value = number of sample beakers between two conditioning beakers. Note that the beaker series must start with a conditioning beaker. The start position in the series or in analysis start must be set to the first conditioning beaker. E.g. **Cond. beaker spacing** = 3 defines following beaker series: C S S S C S S S C etc. where C is a conditioning beaker and S is a sample beaker.	1...303
Time	Defines the conditioning period in [sec].	$1...10^4$
Speed	Defines the stirring speed in [%].	0...100
Lid handling	Defines whether before titration the lid of a sample should be removed with an attached CoverUp™ unit. Appears only for **Type** = **InMotion**.	Activ I Inactive
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.13 Conditioning (controlled)

Titration stand	Defines which titration stand is to be used.	List of available titration stands

Position	Defines the position in which to park the titration head. For **Current position**, the head is parked in the last active position (for example: **Sample**). For **Current position + 1**, the head is parked in the beaker after the last active position.	Conditioning beaker I Rinse beaker I Special beaker 1…Special beaker 4 I Current position I Current position + 1
Speed	Defines the stirring speed in [%].	0…100
Lid handling	Defines whether before titration the lid of a sample should be removed with an attached CoverUp™ unit. Appears only for **Type** = **InMotion**.	Activ I Inactive
Sensor type	Choose the type of sensor which is connected to the instrument.	mV I pH I Phototrode I Conductivity I ISE
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Measuring unit of the selected sensor.	Arbitrary
Acquisition	Defines how the measured value is acquired. **Equilibrium controlled**: The measured value is acquired as soon as it stabilizes. **Fix**: The measured value is acquired after a defined waiting period.	Equilibrium controlled I Fix
dE	**dE** and **dt** define when a measured value is considered stable in the sub steps of the first addition. **dE** defines the maximal potential difference for a stable value during the time span dt. Only if **Acquisition** is set to **Equilibrium controlled**.	0.1...15 [mV]
dt	**dE** and **dt** define when a measured value is considered stable in the sub steps of the first addition. **dt** defines the time interval for calculating dE/dt. Only if **Acquisition** is set to **Equilibrium controlled**.	1...150 [s]
t(min)	Defines the minimal time before the next measured value acquisition in the sub steps of the first addition. Only if **Acquisition** is set to **Equilibrium controlled**.	1...1800 [s]
t(max)	Defines the maximal time before the next measured value acquisition in the sub steps of the first addition. Only if **Acquisition** is set to **Equilibrium controlled**.	1...10000 [s]
Action	Defines the behaviour of the titrator if **t(max)** is exceeded. **None**: the titrator moves on to the next step of the analysis. **Stop**: The analysis is stopped. **User interaction**: The titrator prompts the user to select between moving to the next step or stopping the analysis. Only if **Acquisition** is set to **Equilibrium controlled**.	None I Stop I User interaction
Time	Defines the conditioning period. Only if **Acquisition** is set to **Fix**.	1…10^5 [s]
Temperature acquisition	Select if you want to activate a temperature acquisition. For this a temperature sensor must be connected to the instrument.	Activ I Inactive
Temperature	Define the temperature in [°C] during the analysis. If **Temperature acquisition** is activated, this temperature value will be ignored.	-20…200
Temperature sensor	Select the connected temperature sensor from the list. Only if **Temperature acquisition** is activated.	Arbitrary
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	°C I K I °F

Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.14 Pump

You can use this method function to drain a reagent into a sample vessel.

Parameters	Description	Values
Auxiliary reagent	The auxiliary reagent to be added.	List of available auxiliary reagents
Volume	Volume in [mL].	0.0001...1000 I Auxiliary value I Formula
Pump property	Defines the properties for the pump used.	1-way I 1-way, two rates I 2-way, fine rate
Rate	Allows to reduce the pump rate. Only if the pump supports this and if the pump is connected to the instrument (Pump1 / Pump2) or InMotion.	10...100 (2-way, fine rate) I 50/100 (1-way, two rates)
Direction	Defines the pump direction for a 2-way pump	Forward I Reverse
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.15 Park

Activates the park function for a sample changer. So that for instance the sensor can be deposited into a selected sample vessel at the end of a sample series.

Parameters	Description	Values
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Position	Defines the position in which to park the titration head. For **Current position**, the head is parked in the last active position (for example: **Sample**). For **Current position + 1**, the head is parked in the beaker after the last active position.	Conditioning beaker I Rinse beaker I Special beaker 1...Special beaker 4 I Current position I Current position + 1
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive

Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.16 Stir

Activates or deactivates (speed ="0") the stirrer of the current titration stand.

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100
Duration	The stirring time, in [sec]. (Can also be defined by an auxiliary value or a formula.) After the stirring time has elapsed, the titrator will continue to the next method function without switching off the stirrer. The method functions **End of sample** and **Titration stand** switch off the stirrer. The stirrer output is defined by the prior method function **Titration stand**.	0…10^5 I Auxiliary value/Formula
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.17 Dispense (normal)

You can use this method function to dispense a precisely defined quantity of titrant.

The smallest increment (dV(min)) is 1/20000 of the burette volume, i.e. for the following burettes:

1 mL burette: dV(min) = 0.05 µL
5 mL burette: dV(min) = 0.25 µL
10 mL burette: dV(min) = 0.50 µL
20 mL burette: dV(min) = 1 µL

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-
Volume	Volume in [mL].	0.0001…1000 I Auxiliary value I Formula
Dosing rate	Defines the dosing rate (not including the filling time), in [mL/min]. You can also select a burette type-dependent maximum number.	0.01…60
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive

Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.18 Sync

This function is only supported by the titrator model T9.

Five synchronization codes are used for synchronizing methods running simultaneously in both workspaces A and B. Each of the codes is accessible for any running method using this method function. Methods can be designed so that one method syncs another and vice versa.

When the parameter **Action** is set to **Wait** within a method function **Sync**, the method will be waiting at this point. The method will be continued as soon as the parameter **Action** set to **Send** from a second running method is reached for the same number selected in **Code**.

Always begin an analysis by starting the method that first contains a parameter **Action** = **Send**. This fixes the status of the codes and enables the correct order of the sequence.

If using a series sequence containing two series, order the series with method containing the **Action** = **Send** first in the sequence series.

Define the following parameters:

Parameters	Description	Values
Action	Defines if a code is to be sent or received.	Send I Wait
Code	Individually identifies the code to be sent or received.	1 I 2 I 3 I 4 I 5

7.4.19 Pretitration

The method function **Pretitration** can be used in combination with the method function **Titration (EP Coul)** to determine the Bromine Index for low currents and for samples with low concentrations.

The **Termination delay** has a setting that is specific for the pretitration. For the parameters listed below, the settings from the subfunctions **Control** and **Termination** of the method function **Titration (EP Coul)** are used.

- **End point**
- **Rate**
- **Control band**
- **Generator current**
- **Current**
- **At EP**

When the pretitration has reached the termination criteria, the user is informed by a pop-up. The pretitration continues until the user confirms the pop-up. After the user has confirmed the pop-up, he is prompted to add the sample.

Parameters	Description	Values
Termination delay	Time in [s] from the time the end point is first reached until the termination of the pretitration.	0…10^8

7.4.20 Measure (normal)

For the controlled acquisition of a measured value from a sensor. If a temperature sensor or a thermometric sensor is selected for the measurement, the subfunction **Temperature acquisition** is omitted.

Subfunction: Sensor

Parameters	Description	Values
Type	Defines the type of sensor used to perform the measurement.	List of available sensor types

Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure used for the measurement.	List of available units
Indication	Defines how to do the indication. Depending on the unit of measure: [mV] = **Voltametric**, [µA] = **Amperometric**.	Voltametric I Ampero-metric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA
Upol	Defines the polarization voltage [mV], for an amperometric indication. Only for polarized sensors and **Indication** = **Amperometric**.	0…2000.0
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	Defines the temperature unit to be used.	°C I K I °F

Subfunction: Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

Subfunction: Acquisition of measured values

Parameters	Description	Values
Acquisition	Defines how the measured value is acquired. **Equilibrium controlled**: The measured value is acquired as soon as it stabilizes. **Fix**: The measured value is acquired after a defined waiting period. **Set value**: The measured value is acquired as soon as it has exceeded, or fallen short of, a specific set value, or as soon as it is within a range defined by the lower and upper limits. (The Set Value option is not available if the method function is used within a **Sample (Calib)** loop.)	Equilibrium controlled I Fix I Set value

Parameters for sensor types: mV, pH, ISE, Phototrode, Polarized, Conductivity

Parameters	Description	Values
dE	Defines the measured value interval. As soon as the change in the measured value over the time period dt is less than dE, the measured value will be acquired. This occurs within the defined time interval of t(min) to t(max). dE is specified in the unchanged unit of the sensor per second: - mV for the mV sensor type, pH, ISE, phototrode and polarized voltametric - µA for polarized amperometric - mS I µS for conductivity sensor (only for "Acquisition " = "Equilibrium controlled".)	0.02…15
dt	Defines the time component, in [sec] for dE/dt. Only if **Acquisition** = **Equilibrium controlled**	1…150
t(min)	Earliest possible time for the measured value acquisition, in [sec]. Only if **Acquisition** = **Equilibrium controlled**.	1…150

t(max)	Latest possible time for the measured value acquisition, in [sec]. Only if **Acquisition** = **Equilibrium controlled**	1…10^5
Time	Waiting time, in [sec], before acquisition of a measured value. Only if **Acquisition** = **Fix**	1…10^5
Mode	Mode for the measured value acquisition of the "set value". **E > set value** acquires the measured value as soon as the set value has been exceeded. **E < set value** acquires the measured value as soon as the measured value falls below the set value. Not available within a calibration loop. Only for **Acquisition** = **Set value**.	E > set value I E < set value
Set value	Set value in the sensor unit. Measured values will be acquired after they exceed or fall below this value, depending on the mode setting. Only if **Acquisition** = **Set value**. Not available within a calibration loop.	(See "[Value Ranges of Sensor Measuring Units and Control Band ▶ Page 191]")
t(max)	Latest time for the measured value acquisition, in [sec]. Only if **Acquisition** = **Set value**. Not available within a calibration loop.	1…10^5
Mean value	The system finds a mean value for the saved measured value, using a maximum of 10 measured values.	Activ I Inactive
No. of measured values	When you want to calculate a mean value, you can define the number of measured values used to find that mean value here.	1…10
dt	Defines the time interval, in [sec], for the measured value acquisition of the measured values to be averaged. Only if **Mean value** = **Active**	1…60

Parameters for sensor types: Temperature and Thermometric

Parameters	Description	Values
dT	Defines the measured value interval. As soon as the change in the measured value during the time period dt is less than dT, the measured value will be acquired. This occurs within the defined time interval of t(min) to t(max). This value is specified in the unchanged unit of the sensor, per second: °C I K I °F Only if **Acquisition** = **Equilibrium controlled**	0.1 … 10 Unit: °C I K I °F
dt	Defines the time component, in [sec] for dT/dt. Only if **Acquisition** = **Equilibrium controlled**	1…150
t(min)	Earliest possible time for the measured value acquisition, in [sec]. Only if **Acquisition** = **Equilibrium controlled**.	1…150
t(max)	Latest possible time for the measured value acquisition, in [sec]. Only if **Acquisition** = **Equilibrium controlled**	1…10^5
Time	Waiting time, in [sec], before acquisition of a measured value. Only if **Acquisition** = **Fix**	1…10^5

Mode	Mode for the measured value acquisition of the "set value". **T > set value**: acquires the measured value as soon as the set value has been exceeded. **T < set value**: value acquires the measured value as soon as the measured value falls below the set value. Not available within a calibration loop. **T within range**: acquires the measured value as soon as the measured temp. value is within the range including the limits. Only for **Acquisition** = **Set value**.	T > set value | T < set value | T within range | T within range
Set value	Set value in the sensor unit. Measured values will be acquired after they exceed or fall below this value, depending on the mode setting. Only if **Acquisition** = **Set value**. Not available within a calibration loop.	(See "[Value Ranges of Sensor Measuring Units and Control Band ▸ Page 191]")
Lower limit	Defines the lower limit for the temperature acquisition. Only appears if **Mode** = **T within range**.	-20.0…200.0
Upper limit	Defines the upper limit for the temperature acquisition. Only appears if **Mode** = **T within range**.	-20.0…200.0
t(max)	Latest time for the measured value acquisition, in [sec]. Only if **Acquisition** = **Set value**. Not available within a calibration loop.	1…10^5
Mean value	The system finds a mean value for the saved measured value, using a maximum of 10 measured values.	Activ | Inactive
No. of measured values	When you want to calculate a mean value, you can define the number of measured values used to find that mean value here.	1…10
dt	Defines the time interval, in [sec], for the measured value acquisition of the measured values to be averaged. Only if **Mean value** = **Active**	1…60

Subfunction: Condition

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ | Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.21 Measure (MVT)

This method function enables the continuous acquisition of measured values for a sensor (maximum of 1000 measured values within a defined time interval).. If a temperature sensor is selected for the measurement, the subfunction "Temperature acquisition" is omitted.

Subfunction: Sensor

Parameters	Description	Values
Type	Defines the type of sensor used to perform the measurement.	List of available sensor types
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure used for the measurement.	List of available units

Indication	Defines how to do the indication. Depending on the unit of measure: [mV] = **Voltametric**, [µA] = **Amperometric**.	Voltametric I Amperometric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA
Upol	Defines the polarization voltage [mV], for an amperometric indication. Only for polarized sensors and **Indication** = **Amperometric**.	0…2000.0

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	Defines the temperature unit to be used.	°C I K I °F

Subfunction: Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

Subfunction: Saving measured values

Parameters	Description	Values
Interval	Defines the interval, in [sec], at which the date should be saved.	0.1…10^6
t(max)	Defines the time, in [min], during which the measured values should be collected.	1…10^6

Subfunction: Condition

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

🗎 Evaluate and calculate ▸ Page 256

7.4.22 Titration (EQP)

Carries out an equivalence-point titration. You can define the relevant parameters for the following subfunctions:

Subfunction: Titrant

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-

Subfunction: Sensor

Parameters	Description	Values
Type	Defines the type of sensor used to perform the measurement.	List of available sensor types

Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure used for the measurement.	List of available units
Indication	Defines how to do the indication. Depending on the unit of measure: [mV] = **Voltametric**, [µA] = **Amperometric**.	Voltametric I Ampero-metric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA
Frequency	Polarization frequency in [Hz]. The standard frequency is 4 Hz; other values should only be used for special applications. Only for **Type** = **Polarized**, and **Unit** = **mV**.	4 I 2 I 1 I 0.5
Upol	Defines the polarization voltage [mV], for an amperometric indication. Only for polarized sensors and **Indication** = **Amperometric**.	0…2000.0
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	Defines the temperature unit to be used.	°C I K I °F

Subfunction: Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

Subfunction: Predispense

Parameters	Description	Values
Mode	Specifies the type of addition: **Volume**: predispenses a specific volume. **Potential**: system predispenses a substance until a certain potential is reached. **Factor**: A multiple of the sample size is predispensed. **None**: does not predispense.	Volume I Potential I Factor I None
Volume	The volume to be predispensed in [mL]. Only for **Mode** = **Volume**.	0.0001…1000 I Auxiliary value I Formula
Potential	The potential at which predispensing is stopped. Only for **Mode** = **Potential**.	Depends on the sensor
Factor	The system calculates the predispensing volume by multiplying the factor by the sample size. For **Mode** = **Factor** only.	0…10^5 I Auxiliary value I Formula
Wait time	Defines a waiting time, in [sec]. After predispensing or, if **Mode** = **None**, before the start of titration.	0…32000

Subfunction: Control

Parameters	Description	Values
Control	Here you can select from among three predefined control modes, or you can select **User** to define all the parameters as freely editable. If you change from **Normal**, **Fast**, **Cautious** to **User**, the system will copy over the predefined parameter settings and they will then be freely editable.	Normal I Fast I Cautious I User
Mode	Select an application depending on the sensor type. The selected application will then provide its own specific parameter set. Not available for **Control** = **User**.	Application list
Show parameters	Here you can select whether to display the preset parameters of the control modes **Normal**, **Fast** or **Cautious** as non-editable info fields. Not for **Control** = **User**.	Activ I Inactive
Titrant addition	Defines whether to always dispense the same volume defined by dV (**Incremental**) or to adjust the volume to be titrated per step as the titration progresses (**Dynamic**). Only for **Control** = **User**.	Dynamic I Incremental
dE(set value)	Defines the potential difference targeted per titrant addition. Only for **Control** = **User** and **Titrant addition** = **Dynamic**.	[mV/µA] 0.1…100 [mS/µS] 0.01…100
dT(set value)	Defines the temperature difference in the unit of the temperature sensor that is targeted for a temperature sensor per titrant addition. For **Control** = **User** and **Titrant addition** = **Dynamic** only.	0.1…100
dV(min)	Defines the minimum amount for a titrant addition, in [mL]. For **Control** = **User** and **Titrant addition** = **Dynamic** only.	0.0001…1
dV(max)	Defines the maximum amount for a titrant addition, in [mL]. For **Control** = **User** and **Titrant addition** = **Dynamic** only.	0.0001…10
dV	Defines the volume increment, in [mL], for the incremental titrant addition. For **Control** = **User** and **Titrant addition** = **Incremental** only.	0.0001…10
Meas. val. acquisition	Type of measuring value acquisition: **Equilibrium controlled**: The system acquires the measured value and makes the next titrant addition as soon as a stable measured value is established. **Fixed time**: The measured values acquisition and the titrant addition occur according to fixed time intervals. Only for **Control** = **User**.	Equilibrium controlled I Fixed time
dE	As soon as the change in the measured value during the time period **dt** is less than **dE**, the measured value will be acquired. Acquisition takes place no earlier than after **t(min)** and no later than after **t(max)**. Then the next titrant addition is conducted. For **Control** = **User** and **Meas. val. acquisition** = **Equilibrium controlled** only.	[mV/µA] 0.1 … 15 [mS/µS] 0.01 … 15
dT	As soon as the change in the measured value during the time period **dt** is less than **dT**, the measured value will be acquired. Acquisition takes place no earlier than after **t(min)** and no later than after **t(max)**. Then the next titrant addition is conducted. For **Control** = **User** and **Meas. val. acquisition** = **Equilibrium controlled** for a temperature sensor only.	1…150

dt	Defines the time interval, in [sec], for calculating dE/dt (or dT/dt for a temperature sensor). For **Control** = **User** and **Meas. val. acquisition** = **Equilibrium controlled** only.	0.1…15
t(min)	Earliest possible time for the measured value acquisition, in [sec]. Only for **Control** = **User** and **Meas. val. acquisition** = **Equilibrium controlled**.	0.5…150
t(max)	Latest possible time for the measured value acquisition, in [sec]. Only for **Control** = **User** and **Meas. val. acquisition** = **Equilibrium controlled**.	1…10^5
dt	Defines the time interval, in [sec], for **Fixed time**. For **Control** = **User** and **Meas. val. acquisition** = **Fixed time** only.	0.5…6000

Subfunction: Evaluation and Recognition

Parameters	Description	Values
Procedure	Defines which evaluation procedure to use.	Standard I Asymmetric I Minimum I Maximum I Segmented
Threshold	Defines the threshold (absolute amount) that must be exceeded for the recognition of an EQP. **Procedure** = **Minimum** and **Maximum**: This threshold value refers to the original curve [UoM] **Procedure** = **Standard** and **Asymmetric**: It refers to the 1st derivative of the original curve [UoM*/mL]. **Procedure** = **Segmented**: It refers to the 2nd derivative of the original curve [UoM/mL].	Standard, Asymmetric and Segmented: 0 … 10^6 Minimum and Maximum: Depends on the sensor

* UoM: Unit of Measurement

Tendency	Defines the tendency for which the EQP is to be detected. For **Procedure** = **Standard**, **Asymmetric** and **Segmented**.	Positive I Negative I None
Ranges	You can define up to three recognition ranges. Outside these ranges, the system will recognize neither EQP's nor EQP candidates. Depending on what is defined here, upper and lower limits are defined for each recognition range and also whether additional EQP criteria are to be used for each recognition range.	1 I 2 I 3 I 0
Range type 1…3	Defines the type of the definition range. **Potential**: each range is defined by an upper limit and a lower limit of a potential. **Volume**: each range is defined by an upper limit and a lower limit of a volume. **Potential & volume**: each range is defined by an upper limit and a lower limit of a potential and an upper and a lower limit of a volume.	Potential I Volume I Potential & volume
Lower limit potential 1…3	Defines the lower limit for the recognition range as potential. The unit of measure will depend on the sensor used.	Depends on the sensor
Upper limit potential 1…3	Defines the upper limit for the recognition range as potential. The unit of measure will depend on the sensor used.	Depends on the sensor
Lower limit volume 1…3	Defines the lower limit for the recognition range as volume.	1…1000 mL
Upper limit volume 1…3	Defines the upper limit for the recognition range as volume.	1…1000 mL

Add. EQP criteria	Defines whether to take additional EQP criteria into consideration. The available selection will depend on the evaluation procedure chosen. They can be defined individually for each recognition range or for the overall recognition range (**Ranges** = 0). **Last EQP**: The system only considers the quantity of EQPs defined. **Steepest jump**: The system only considers the number of steepest jumps defined. **Lowest value**: The system only considers the number of lowest values defined. **Highest value**: The system only considers the number of highest values defined.	Last EQP I Steepest jump I Lowest value I Highest value I No
Last jumps	The quantity of last jumps to be taken into consideration. Only for **Add. EQP criteria** = **Last EQP**.	1…9
Steepest jumps	The quantity of steepest jumps to be taken into consideration. Only for **Add. EQP criteria** = **Steepest jump**.	1…9
Lowest values	The quantity of lowest values to be taken into consideration. Only for **Add. EQP criteria** = **Lowest value**.	1…9
Highest values	The quantity of highest values to be taken into consideration. Only for **Add. EQP criteria** = **Highest value**.	1…9
Buffer capacity	Determination of buffer capacity with VEQ/2. Only possible for sensor unit "pH" and volume-based sample entry (**Sample** > **Entry type** = **Volume** or **Fixed volume**).	Activ I Inactive

Subfunction: Termination

Parameters	Description	Values
At Vmax	Defines the maximum volume, in [mL], at which the titration must be terminated if it has not been terminated already.	0.1…1000 I Auxiliary value I Formula
At potential	Defines whether to terminate the titration after reaching a defined potential (with the correct tendency!).	Activ I Inactive
Potential	The potential at which to terminate the titration. The unit of measure will depend on the sensor used. Only for **At potential** = **Active**.	-100…100 I Auxiliary value I Formula (Depends on the sensor)
Termination tendency	Defines for which tendency the titration should be terminated. Only for **At potential** = **Active**.	Positive I Negative I None
At slope	Defines whether to terminate the titration after reaching a defined slope. This absolute value must be exceeded by one measured value and then be greater than two measured values to result in termination.	Activ I Inactive
Slope	The slope, in [unit of measure/mL], at which to terminate the titration. Only for **At slope** = **Active**.	0…10^5 I Auxiliary value I Formula
After number of recognized EQPs	Specifies whether the titration should be terminated after the recognition of a specific quantity of EQP candidates. The EQP candidates must fulfill the following conditions: - It lies within the recognition range defined in **Ranges**. - It is above the threshold defined in **Threshold** - It show the correct tendency as defined in **Tendency**. If no additional EQP criteria should be considered, then EQP candidate = EQP applies.	Activ I Inactive
Number of EQPs	Defines the quantity of EQP candidates after the recognition of which the system should terminate the titration. Only for **After number of recognized EQPs** = **Active**.	1…10 I Auxiliary value I Formula

Combined termination criteria	**Inactive**: Termination as soon as the first of the selected criteria from the (**Potential** | **Slope** | **After number of recognized EQPs**) group has been fulfilled. **Active**: Termination as soon as all the selected criteria have been fulfilled. Termination of the titration in any case if the maximum volume is reached.	Activ | Inactive

Subfunction: Accompanying Stating

For T7/T9 only. The "Stating" method function is used as a subfunction here to titration that is accompanied by stating. The settings correspond to those for the method function "Stating" and can therefore be found in the description of the method function "Stating". Titration accompanied by stating allows a sample solution to be maintained at a specific electrode potential during EQP, EP or two-phase titration. This is a stating that runs parallel to the actual titration and differs from the "Stating" method function as follows: • The accompanying stating begins and ends with the "Main" method function (titration) and therefore does not include the subfunction "Termination." • The accompanying stating does not include the settings "Stirring," and "Saving Measured Values." • The subfunctions "Predispensing" and "Pretitration" are conducted prior to the main method function. • As soon as the subfunctions "Predispensing" and "Pretitration" have been concluded, the main method function begins, in which the stating continues to run parallel for the duration of the titration. • Temperature acquisition is specified in the main method function.

Subfunction: Condition

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ | Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

- Evaluate and calculate ▶ Page 256
- Value ranges from sensor measuring units and control band ▶ Page 191
- Stating ▶ Page 147

7.4.23 Titration (EP)

Carries out an end-point titration. You can define the relevant parameters for the following subfunctions:

Subfunction: Titrant

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-

Subfunction: Sensor

Parameters	Description	Values
Type	Defines the type of sensor used to perform the measurement.	List of available sensor types
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure used for the measurement.	List of available units
Indication	Defines how to do the indication. Depending on the unit of measure: [mV] = **Voltametric**, [µA] = **Amperometric**.	Voltametric | Amperometric

Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA
Upol	Defines the polarization voltage [mV], for an amperometric indication. Only for polarized sensors and **Indication** = **Amperometric**.	0…2000.0
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	Defines the temperature unit to be used.	°C I K I °F

Subfunction: Stir

Speed	Defines the stirring speed in [%].	0…100

Subfunction: Predispense

Parameters	Description	Values
Mode	Specifies the type of addition: **Volume**: predispenses a specific volume. **Potential**: system predispenses a substance until a certain potential is reached. **Factor**: A multiple of the sample size is predispensed. **None**: does not predispense.	Volume I Potential I Factor I None
Volume	The volume to be predispensed in [mL]. Only for **Mode** = **Volume**.	0.0001…1000 I Auxiliary value I Formula
Potential	The potential at which predispensing is stopped. Only for **Mode** = **Potential**.	Depends on the sensor
Factor	The system calculates the predispensing volume by multiplying the factor by the sample size. For **Mode** = **Factor** only.	0…10^5 I Auxiliary value I Formula
Wait time	Defines a waiting time, in [sec]. After predispensing or, if **Mode** = **None**, before the start of titration.	0…32000

Subfunction: Control

Parameters	Description	Values
End point type	Absolute: Titration is ended when the absolute measured value is reached. Relative: The system will take into consideration the difference between the desired end point and the measured value at the start of the titration.	Absolute I Relative
Tendency	Defines the direction of change for the measured value during the titrant addition. If the starting potential, end point and tendency are inconsistent at the start of the analysis, the system will terminate the analysis immediately. For **End point type** = **Absolute** only.	Positive I Negative I None
End point value	The defined titration end point. The unit will depend on the sensor used.	Depends on the sensor I Formula I Auxiliary value

Control band	This number defines the width of the control band. Outside the control band, the system will titrate with the maximum dispensing rate. The smaller the control band, the faster the titrator will react to a deviation from the potential of the defined end point. When the measurement curve reaches the control band, the titrator will slow down the titrant addition to approach the end point in a cautious manner. The unit will depend on the sensor used.	Depends on the sensor I Auxiliary value
Dosing rate (max)	The maximum dosing rate in [mL/min].	0.001…60
Dosing rate (min)	The minimum dosing rate in [µL/min].	$1 \ldots 10^4$

Subfunction: Termination

Parameters	Description	Values
At EP	Defines whether to terminate the titration after reaching the end point. If **Inactive** is selected, after reaching the end point the system will continue acquiring measured values without adding titrant until the maximum time period is reached.	Activ I Inactive
Termination delay	The termination delay which defines the time period, in [sec], between reaching the end point and terminating the titration. If during the termination delay the measured value drops below the end point, the system will add further increments and restart the termination delay. Only if **At EP** = **Active** is selected.)	$0 \ldots 10^8$ I Auxiliary value
At Vmax	Defines the maximum volume, in [mL], at which the titration must be terminated if it has not been terminated already.	0.1…1000 I Auxiliary value I Formula
Max. time	Defines the maximum time of the titration, in [sec].	$0 \ldots 10^8$ I ∞ I Auxiliary value

Subfunction: Accompanying Stating

For T7/T9 only.
The "Stating" method function is used as a subfunction here to titration that is accompanied by stating. The settings correspond to those for the method function "Stating" and can therefore be found in the description of the method function "Stating".
Titration accompanied by stating allows a sample solution to be maintained at a specific electrode potential during EQP, EP or two-phase titration. This is a stating that runs parallel to the actual titration and differs from the "Stating" method function as follows:

- The accompanying stating begins and ends with the "Main" method function (titration) and therefore does not include the subfunction "Termination."
- The accompanying stating does not include the settings "Stirring," and "Saving Measured Values."
- The subfunctions "Predispensing" and "Pretitration" are conducted prior to the main method function.
- As soon as the subfunctions "Predispensing" and "Pretitration" have been concluded, the main method function begins, in which the stating continues to run parallel for the duration of the titration.
- Temperature acquisition is specified in the main method function.

Subfunction: Condition

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

Stating ▸ Page 147
Evaluate and calculate ▸ Page 256
Value ranges from sensor measuring units and control band ▸ Page 191

7.4.24 Titration (Therm.)

Subfunction Titrant

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-

Subfunction Sensor

Parameters	Description	Values
Type	Defines the type of sensor used to perform the measurement.	List of available sensor types
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure used for the measurement.	List of available units

Subfunction Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

Subfunction Control

Parameters	Description	Values
Dosing rate	Defines the dosing speed, in [mL/min]. The maximum value that is possible depends on the burette type. If the value for **Dosing rate** is above the maximum value possible, the system will dispense at the maximum rate.	0.1…60

Subfunction Evaluation and Recognition

Parameters	Description	Values
Procedure	Defines which evaluation procedure is used.	Segmented
Threshold	Defines the threshold (absolute amount) that must be exceeded for the recognition of an EQP. It refers to the 2nd derivative of the original curve [UoM/mL^2]. * UoM: Unit of Measurement	0…10^6
Tendency	Defines the tendency for which the EQP is detected. **None**: The tendency is not used for the detection of the EQP. **Positive**: The titration curve must go up for the detection of the EQP. **Negative**: The titration curve must go down for the detection of the EQP.	None	Positive	Negative
Ranges	You can define up to three recognition ranges. Outside these ranges, the system will recognize neither EQP's nor EQP candidates. Depending on what is defined here, upper and lower limits are defined for each recognition range and also whether additional EQP criteria are to be used for each recognition range.	1	2	3	0

Range type 1…3	Defines the type of the definition range. **Potential**: each range is defined by an upper limit and a lower limit of a potential. **Volume**: each range is defined by an upper limit and a lower limit of a volume. **Potential & volume**: each range is defined by an upper limit and a lower limit of a potential and an upper and a lower limit of a volume.	Potential I Volume I Potential & volume
Lower limit potential 1…3	Defines the lower limit for the recognition range as potential. The unit of measure will depend on the sensor used.	Depends on the sensor
Upper limit potential 1…3	Defines the upper limit for the recognition range as potential. The unit of measure will depend on the sensor used.	Depends on the sensor
Lower limit volume 1…3	Defines the lower limit for the recognition range as volume.	1…1000 mL
Upper limit volume 1…3	Defines the upper limit for the recognition range as volume.	1…1000 mL
Add. EQP criteria	Defines whether to take additional EQP criteria into consideration. Additional EQP criteria can be defined individually for each recognition range or for the overall recognition range. **Inactive**: No additional EQP criteria are considered. **Last EQP**: The system only considers the quantity of EQPs defined. **Steepest jump**: The system only considers the number of steepest jumps defined.	Inactive I Last EQP I Steepest jump
Last jumps	The quantity of last jumps to be taken into consideration. Only for **Add. EQP criteria** = **Last EQP**.	1…9
Steepest jumps	The quantity of steepest jumps to be taken into consideration. Only for **Add. EQP criteria** = **Steepest jump**.	1…9

Subfunction Termination

Parameters	Description	Values
At Vmax	Defines the maximum dispensed volume, in [mL], at which the titration must be terminated if it has not been terminated already. The titration is terminated when the titrant in the burette has been dispensed. Even if Vmax has not been reached.	0.1…1000 I Auxiliary value I Formula
After number of recognized EQPs	Specifies whether the titration should be terminated after the recognition of a specific quantity of EQP candidates. The EQP candidates must fulfill the following conditions: - It lies within the recognition range defined in **Ranges**. - It is above the threshold defined in **Threshold** - It show the correct tendency as defined in **Tendency**. If no additional EQP criteria should be considered, then EQP candidate = EQP applies.	Activ I Inactive
Number of EQPs	Defines the quantity of EQP candidates after the recognition of which the system should terminate the titration. Only for **After number of recognized EQPs** = **Active**.	1…10 I Auxiliary value I Formula

Subfunction Condition

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive

Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

- Value ranges from sensor measuring units and control band ▸ Page 191
- Evaluate and calculate ▸ Page 256

7.4.25 Titration (2-phase)

This method function performs an end-point titration. You can determine the relevant parameters for the following subfunctions:

Subfunction: Titrant

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-

Subfunction: Sensor

Parameters	Description	Values
Type	Defines the type of sensor used to perform the measurement.	List of available sensor types
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure used for the measurement.	List of available units
Indication	Defines how to do the indication. Depending on the unit of measure: [mV] = **Voltametric**, [µA] = **Amperometric**.	Voltametric I Amperometric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA
Upol	Defines the polarization voltage [mV], for an amperometric indication. Only for polarized sensors and **Indication** = **Amperometric**.	0…2000.0

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	Defines the temperature unit to be used.	°C I K I °F

Subfunction: Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

Subfunction: Predispense

Parameters	Description	Values
Mode	Specifies the type of addition: **Volume**: predispenses a specific volume. **Potential**: system predispenses a substance until a certain potential is reached. **Factor**: A multiple of the sample size is predispensed. **None**: does not predispense.	Volume I Potential I Factor I None

Volume	The volume to be predispensed in [mL]. Only for **Mode** = **Volume**.	0.0001…1000 I Auxiliary value I Formula
Potential	The potential at which predispensing is stopped. Only for **Mode** = **Potential**.	Depends on the sensor
Factor	The system calculates the predispensing volume by multiplying the factor by the sample size. For **Mode** = **Factor** only.	0…10^5 I Auxiliary value I Formula
Wait time	Defines a waiting time, in [sec]. After predispensing or, if **Mode** = **None**, before the start of titration.	0…32000

Subfunction: Control

Parameters	Description	Values
Titrant addition	Defines whether to always dispense the same volume defined by dV (**Incremental**) or to adjust the volume to be titrated per step as the titration progresses (**Dynamic**). Only for **Control** = **User**.	Dynamic I Incremental
dV	Defines the volume increment, in [mL], for the incremental titrant addition. For **Control** = **User** and **Titrant addition** = **Incremental** only.	0.0001…10
dE(set value)	Defines the potential difference targeted per titrant addition. Only for **Control** = **User** and **Titrant addition** = **Dynamic**.	[mV/µA] 0.1…100 [mS/µS] 0.01…100
dV(min)	Defines the minimum amount for a titrant addition, in [mL]. For **Control** = **User** and **Titrant addition** = **Dynamic** only.	0.0001…1
dV(max)	Defines the maximum amount for a titrant addition, in [mL]. For **Control** = **User** and **Titrant addition** = **Dynamic** only.	0.0001…10
Meas. val. acquisition	Type of measuring value acquisition: **Equilibrium controlled**: The system acquires the measured value and makes the next titrant addition as soon as a stable measured value is established. **Fixed time**: The measured values acquisition and the titrant addition occur according to fixed time intervals. Only for **Control** = **User**.	Equilibrium controlled I Fixed time
Mix time	The duration of stirring in [s] with the defined "Stir" speed.	0…10^4
dE	As soon as the change in the measured value during the time period **dt** is less than **dE**, the measured value will be acquired. Acquisition takes place no earlier than after **t(min)** and no later than after **t(max)**. Then the next titrant addition is conducted. For **Control** = **User** and **Meas. val. acquisition** = **Equilibrium controlled** only.	[mV/µA] 0.1 … 15 [mS/µS] 0.01 … 15
dt (Separation time)	Defines the time interval for calculating dE/dt (or dT/dt for a temperature sensor).	1…150 s
t(min) (Separat. time)	Earliest possible time for the measured value acquisition.	1…150 s
t(max) (Separat. time)	Latest possible time for the measured value acquisition.	1…1000000 s
Separation time	Parameter for the next increment addition. The separation time, regulates the time period available for the separation of the two phases.	1…10000 s
Stir speed (S. time)	Defines the stir speed during the separation time.	1…100 %

Subfunction: Evaluation and Recognition

Parameters	Description	Values
Procedure	Defines which evaluation procedure to use.	Standard I Asymmetric I Minimum I Maximum I Segmented
Threshold	Defines the threshold (absolute amount) that must be exceeded for the recognition of an EQP. **Procedure** = **Minimum** and **Maximum**: This threshold value refers to the original curve [UoM] **Procedure** = **Standard** and **Asymmetric**: It refers to the 1st derivative of the original curve [UoM*/mL]. **Procedure** = **Segmented**: It refers to the 2nd derivative of the original curve [UoM/mL].	Standard, Asymmetric and Segmented: 0 … 10^6 Minimum and Maximum: Depends on the sensor

* UoM: Unit of Measurement

Tendency	Defines the tendency for which the EQP is to be detected. For **Procedure** = **Standard**, **Asymmetric** and **Segmented**.	Positive I Negative I None
Ranges	You can define up to three recognition ranges. Outside these ranges, the system will recognize neither EQP's nor EQP candidates. Depending on what is defined here, upper and lower limits are defined for each recognition range and also whether additional EQP criteria are to be used for each recognition range.	1 I 2 I 3 I 0
Range type 1…3	Defines the type of the definition range. **Potential**: each range is defined by an upper limit and a lower limit of a potential. **Volume**: each range is defined by an upper limit and a lower limit of a volume. **Potential & volume**: each range is defined by an upper limit and a lower limit of a potential and an upper and a lower limit of a volume.	Potential I Volume I Potential & volume
Lower limit potential 1…3	Defines the lower limit for the recognition range as potential. The unit of measure will depend on the sensor used.	Depends on the sensor
Upper limit potential 1…3	Defines the upper limit for the recognition range as potential. The unit of measure will depend on the sensor used.	Depends on the sensor
Lower limit volume 1…3	Defines the lower limit for the recognition range as volume.	1…1000 mL
Upper limit volume 1…3	Defines the upper limit for the recognition range as volume.	1…1000 mL
Add. EQP criteria	Defines whether to take additional EQP criteria into consideration. The available selection will depend on the evaluation procedure chosen. They can be defined individually for each recognition range or for the overall recognition range (**Ranges** = 0). **Last EQP**: The system only considers the quantity of EQPs defined. **Steepest jump**: The system only considers the number of steepest jumps defined. **Lowest value**: The system only considers the number of lowest values defined. **Highest value**: The system only considers the number of highest values defined.	Last EQP I Steepest jump I Lowest value I Highest value I No
Last jumps	The quantity of last jumps to be taken into consideration. Only for **Add. EQP criteria** = **Last EQP**.	1…9
Steepest jumps	The quantity of steepest jumps to be taken into consideration. Only for **Add. EQP criteria** = **Steepest jump**.	1…9

Lowest values	The quantity of lowest values to be taken into consideration. Only for **Add. EQP criteria** = **Lowest value**.	1…9
Highest values	The quantity of highest values to be taken into consideration. Only for **Add. EQP criteria** = **Highest value**.	1…9
Buffer capacity	Determination of buffer capacity with VEQ/2. Only possible for sensor unit "pH" and volume-based sample entry (**Sample** > **Entry type** = **Volume** or **Fixed volume**).	Activ I Inactive

Subfunction: Termination

Parameters	Description	Values
At Vmax	The titration will be terminated no later than at this dispensed maximum volume, in [mL].	$0 \ldots 10^8$
At potential	Defines whether to terminate the titration after reaching a defined potential (with the correct tendency!).	Activ I Inactive
Potential	The potential at which to terminate the titration. The unit of measure will depend on the sensor used. Only for **At potential** = **Active**.	-100...100 I Auxiliary value I Formula (Depends on the sensor)
Termination tendency	Defines for which tendency the titration should be terminated. Only for **At potential** = **Active**.	Positive I Negative I None
At slope	Defines whether to terminate the titration after reaching a defined slope. This absolute value must be exceeded by one measured value and then be greater than two measured values to result in termination.	Activ I Inactive
Slope	The slope, in [unit of measure/mL], at which to terminate the titration. Only for **At slope** = **Active**.	$0 \ldots 10^5$ I Auxiliary value I Formula
After number of recognized EQPs	Specifies whether the titration should be terminated after the recognition of a specific quantity of EQP candidates. The EQP candidates must fulfill the following conditions: - It lies within the recognition range defined in **Ranges**. - It is above the threshold defined in **Threshold** - It show the correct tendency as defined in **Tendency**. If no additional EQP criteria should be considered, then EQP candidate = EQP applies.	Activ I Inactive
Number of EQPs	Defines the quantity of EQP candidates after the recognition of which the system should terminate the titration. Only for **After number of recognized EQPs** = **Active**.	1…10 I Auxiliary value I Formula
Combined termination criteria	**Inactive**: Termination as soon as the first of the selected criteria from the (**Potential** I **Slope** I **After number of recognized EQPs**) group has been fulfilled. **Active**: Termination as soon as all the selected criteria have been fulfilled. Termination of the titration in any case if the maximum volume is reached.	Activ I Inactive

Subfunction: Condition

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

🗎 Evaluate and calculate ▸ Page 256

🗎 Value ranges from sensor measuring units and control band ▸ Page 191

7.4.26 Titration (LearnEQP)

Titration (Learn EQP) is used to determine the best parameters for carrying out an EQP titration. As soon as the settings have been successfully recorded, the titration detection in the method is converted to a **Titration (EQP)** with the recorded settings. If the analysis has more than one sample, the subsequent samples are titrated and analyzed with the recorded settings parameters.
You can determine the relevant parameters for the following subfunctions:

Subfunction: Titrant

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list

Subfunction: Sensor

Parameters	Description	Values
Type	The type of sensor to be used to perform the measurement.	mV I pH I ISE I Phototrode I I
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure used for the measurement.	List of available units
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	Defines the temperature unit to be used.	°C I K I °F

Subfunction: Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

Subfunction: Condition

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calcu-lation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calcu-lation

See also

🗎 Evaluate and calculate ▸ Page 256

7.4.27 Titration (KF Vol)

A volumetric Karl Fischer titration is performed using the **Titration (KF Vol)** method function. This function contains subfunctions which each have their own parameters.

7.4.27.1 Titrant

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Nominal conc.	Specified concentration of the Karl Fischer titrant in [mg/mL].	0.1…100
Reagent type	Defines the type of Karl Fischer titrant used in the titration.	1-comp I 2-comp

See also

Titration (KF Vol) ▸ Page 133

7.4.27.2 Sensor

For Karl Fischer titrations, only polarized sensors are used.

Parameters	Description	Values
Type	Shows the type of sensor used to perform the measurement	Polarized
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure that is used for the measurement.	mV
Indication	Shows how the indication is done.	Voltametric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA

7.4.27.3 Temperature acquisition

Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	°C I K I °F

7.4.27.4 Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

7.4.27.5 Predispense

Parameters	Description	Values
Mode	Specifies the type of addition: **Volume**: predispenses a specific volume. **None**: does not predispense.	Volume I None
Volume	The volume to be predispensed in [mL]. Only for **Mode** = **Volume**.	0.0001…1000 I Auxiliary value I Formula
Wait time	Defines a waiting time, in [sec]. After predispensing or, if **Mode** = **None**, before the start of titration.	0…32000

7.4.27.6 Control

The maximum dosing rates are dependent on the size of the burette. The user is able to edit the entire value range. When Start is pressed, the system then checks whether the entered values are actually possible with the current burette size.

Burette size [ml]	Maximum dosing rate [mL/min]
1	3

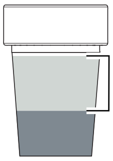
Burette size [ml]	Maximum dosing rate [mL/min]
5	15
10	30
20	60

Parameters	Description	Values
End point	End point in [mV] of the Karl Fischer titration and the standby titration.	-2000 … 2000
Control band	The value in [mV] defines the width of the control band. Outside the control band, the system will titrate with the maximum dispensing rate. The control band allows the dynamic behavior of the controller to be influenced. Reducing the control band causes a more aggressive control behavior, while increasing the control band gives a gentler control behavior. When the measurement curve reaches the control band, the titrator slows down the addition of titrant to approach the end point cautiously.	0.1...2000
Dosing rate (max)	The maximum dosing rate in [mL/min].	0.001…60
Dosing rate (min)	The minimum dosing rate in [µL/min].	1…10^4
Start	Cautious or normal start of a Karl Fischer titration.	Cautious I Normal

7.4.27.7 Termination

The titration is terminated when the value of **Max. time** or of **Drift** is reached and the time defined in **Min. time** has not passed.

To prevent the sample vessel from overflowing, the analysis is stopped at the latest when a defined maximum volume of titrant has been added. If the maximum volume of titrant has been added, the analysis is stopped even if other criteria are not met. The maximum volume is defined in **At Vmax**.



Parameters	Description	Values
Type	Termination of titration following defined drift and if the value falls below the end-point value (EP). **Drift stop relative**: Actual drift stop value = online drift + drift **Drift stop absolute**: Actual drift stop value = drift **Delay time**: Termination after a delay time below the EP.	Drift stop relative I Drift stop absolute I Delay time
Drift	The drift value in [µg/min] for the termination criterion drift stop relative or drift stop absolute.	1.0 … 10^6
Delay time	Time in [s] from the time the end point is first reached until the termination of the titration.	0...6000
Min. time	Titration is not to be terminated before this time in [s] is reached (exception: the maximum volume has been reached).	0…10^8 I Auxiliary value
Max. time	Defines the maximum duration of the titration.	0…10^8 I ∞ I Auxiliary value
At Vmax	Defines the maximum volume of titrant that can be added before the analysis is stopped at the latest.	Activ I Inactive

7.4.27.8 Condition

The subfunction **Condition** is only available on T9 titrators.

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

🖹 Evaluate and calculate ▸ Page 256

7.4.28 Titration (KF Coul)

A coulometric Karl Fischer titration is performed using the **Titration (KF Coul)** method function. This function contains subfunctions which each have their own parameters.

7.4.28.1 Sensor

For Karl Fischer titrations, only polarized sensors are used.

Parameters	Description	Values
Type	Shows the type of sensor used to perform the measurement	Polarized
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure that is used for the measurement.	mV
Indication	Shows how the indication is done.	Voltametric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA

7.4.28.2 Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

7.4.28.3 Control

The titrant generation is controlled by the generator current. Defined current increments can be defined user-specifically or automatically. You can also set the titration end point (recommended value:100 mV). You can determine the rate of titrant generation - whether it is generated normally or slowly (cautiously). The **Cautious** mode is used to avoid overtitration for smaller sample volumes.

Parameters	Description	Values
End point	End point in [mV] of the Karl Fischer titration and the standby titration.	-2000 … 2000
Rate	Cautious or normal current regulation.	Cautious I Normal
Control band	The value in [mV] defines the width of the control band. Outside the control band, the system will titrate with the maximum dispensing rate. The control band allows the dynamic behavior of the controller to be influenced. Reducing the control band causes a more aggressive control behavior, while increasing the control band gives a gentler control behavior. When the measurement curve reaches the control band, the titrator slows down the addition of titrant to approach the end point cautiously.	0.1...2000

Generator current	Defines how the pulse strength is regulated. **Automatic**: The pulse strength is regulated automatically. Possible values for the pulse strength are 100 mA, 200 mA, 300 mA and 400 mA. **Fix**: The pulse strength has a fixed values that is entered by the user.	Automatic I Fix

7.4.28.4 Termination

The titration is terminated when the value of **Max. time** or of **Drift** is reached and the time defined in **Min. time** has not passed.

Parameters	Description	Values
Type	Termination of titration following defined drift and if the value falls below the end-point value (EP). **Drift stop relative**: Actual drift stop value = online drift + drift **Drift stop absolute**: Actual drift stop value = drift **Delay time**: Termination after a delay time below the EP.	Drift stop relative I Drift stop absolute I Delay time
Drift	The drift value in [µg/min] for the termination criterion drift stop relative or drift stop absolute.	1.0 … 10^6
Delay time	Time in [s] from the time the end point is first reached until the termination of the titration.	0…6000
Min. time	Titration is not to be terminated before this time in [s] is reached (exception: the maximum volume has been reached).	0…10^8 I Auxiliary value
Max. time	Defines the maximum duration of the titration.	0…10^8 I ∞ I Auxiliary value

Condition

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

🗎 Evaluate and calculate ▸ Page 256

7.4.28.5 Condition

The subfunction **Condition** is only available on T9 titrators.

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

🗎 Evaluate and calculate ▸ Page 256

7.4.29 Titration (EP Coul)

This method function is used to determine the Bromine Index (BI). For low currents and samples with low concentrations, you may need to include the method function **Pretitration** into the sample loop. This method function contains subfunctions which each have their own parameters.

The subfunction **Condition** is only available on T9 titrators.

You can define the relevant parameters for the following subfunctions:

Subfunction: Sensor

For coulometric titrations, only polarized sensors are used.

Parameters	Description	Values
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA

Subfunction: Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

Subfunction: Control

The titrant generation is controlled by the generator current. Defined current increments can be defined user-specifically or automatically. You can also set the titration endpoint. You can define the rate of titrant generation, whether it is generated normally or slowly (cautiously). The **Cautious** mode is used to avoid overtitration for smaller sample volumes.

Parameters	Description	Values
End point	The defined titration end point. The unit will depend on the sensor used.	Depends on the sensor I Formula I Auxiliary value
Rate	Cautious or normal current regulation.	Cautious I Normal
Control band	The value in [mV] defines the width of the control band. Outside the control band, the system will titrate with the maximum generation rate. The control band allows the dynamic behavior of the controller to be influenced. Reducing the control band causes a more aggressive control behavior, while increasing the control band gives a gentler control behavior. When the measurement curve reaches the control band, the titrator slows down the generation of titrant to approach the end point cautiously.	0.1...2000
Generator current	Defines how the pulse strength is regulated. **Automatic**: The pulse strength is regulated automatically. Possible values for the pulse strength are 100 mA, 200 mA, 300 mA and 400 mA. **Fix**: The pulse strength has a fixed values that is entered by the user.	Automatic I Fix
Current	Defines the pulse strength generated by the generator electrode in [mA].	1 I 5 I 100 I 200 I 300 I 400

Subfunction: Termination

Parameters	Description	Values
At EP	Defines whether to terminate the titration after reaching the end point. If **Inactive** is selected, after reaching the end point the system will continue acquiring measured values without generating titrant until the maximum time period is reached.	Activ I Inactive
Termination delay	Time in [s] from the time the end point is first reached until the termination of the titration.	$0…10^8$

Max. time	Defines the maximum duration of the titration.	$0...10^8$ | ∞ | Auxiliary value

Condition

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ | Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

🗎 Evaluate and calculate ▶ Page 256

7.4.30 Standard addition (1)

Subfunction: Titrant

Parameters	Description	Values
Titrant standard	Define your titrant standard or select from the list.	Arbitrary
Concentration	Define the concentration of your titrant standard.	-

Subfunction: Sensor

Parameters	Description	Values
Type	Shows the connected sensor type prior to the definition of the following parameters.	Arbitrary
Sensor	Select a sensor from the setup list (for the selected sensor type).	Arbitrary
Unit	Measuring unit of the selected sensor.	Arbitrary
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Select if you want to activate a temperature acquisition. For this a temperature sensor must be connected to the instrument.	Activ | Inactive
Temperature sensor	Select the connected temperature sensor from the list.	Arbitrary
Unit	Select the temperature unit for the measured temperature.	°C | K | °F

Subfunction: Stir

Parameters	Description	Values
Speed	Define the stirrer speed in percent.	0...100%

Subfunction: Control

Parameters	Description	Values
Control	Selection of various control parameter sets for dE (Value acquisition) dt, t_{min}, t_{max}.	Normal | Fast | Cautious | User
dE (Potential difference)	Define the potential difference per addition.	1...60 [mV]
Number of additions	Define the number of standard additions performed during the analysis.	2...8
Show parameters	Here you can select whether to display the preset parameters of the control modes **Normal**, **Fast** or **Cautious** as non-editable info fields. Not for **Control** = **User**.	Activ | Inactive

Meas. val. acquisition	**Equilibrium controlled**: Acquisition of measured values and subsequent titrant addition are done once the measured value is stable. Only if **Show parameters** is activated or **Control** is set to **User**	-
dE	Maximum potential change for the measurement value acquisition which takes place not earlier than **t(min)** and not later than **t(max)**. Only if **Show parameters** is activated or **Control** is set to **User**. Read only if **Control** is set to **Normal**, **Fast** or **Cautious**.	0.01...15 [mV]
dt	Time span for potential change during a measurement value acquisition. Only if **Show parameters** is activated or **Control** is set to **User**. Read only if **Control** is set to **Normal**, **Fast** or **Cautious**.	1...150 [s]
t(min)	Minimum time for a measurement value acquisition. Only if **Show parameters** is activated or **Control** is set to **User**. Read only if **Control** is set to **Normal**, **Fast** or **Cautious**.	1...150 [s]
t(max)	Maximum time for a measurement value acquisition. Only if **Show parameters** is activated or **Control** is set to **User**. Read only if **Control** is set to **Normal**, **Fast** or **Cautious**.	1...100000 [s]
Show parameters for first addition	Defines if the extra parameters used for the addition of titrant in the substeps of the first addition are displayed.	Activ I Inactive
Titrant addition	Defines how the volume of titrant added per sub step of the first addition is determined. **Dynamic**: the volume is adjusted for each sub step. **Incremental**: the volume defined in **dV** is added. Only if **Show parameters for first addition** is activated. Read only, if **Control** is set to **Normal**, **Fast** or **Cautious**.	Dynamic I Incremental
dE(set value)	Defines the potential difference targeted in each sub steps during the first addition of titrant. Only if **Show parameters for first addition** is activated. Read only, if **Control** is set to **Normal**, **Fast** or **Cautious**	0.1...100 [mV]
dV(min)	Defines the minimal volume of titrant added in each sub step of the first addition. Only if **Show parameters for first addition** is activated. Read only, if **Control** is set to **Normal**, **Fast** or **Cautious**.	0.0001...1 [mL]
dV(max)	Defines the maximal volume of titrant added in each sub step of the first addition. Only if **Show parameters for first addition** is activated. Read only, if **Control** is set to **Normal**, **Fast** or **Cautious**.	0.0001...10 [mL]
dV	Defines the volume of titrant added in each sub step of the first addition. Only if **Show parameters for first addition** is activated, if**Control** is set to **User** and if **Titrant addition** is set to **Incremental**.	0.0001…10 [mL]
Meas. val. acquisition	Defines the type of measured value acquisition for the sub steps of the first addition. **Equilibrium controlled**: Acquisition of measured values and subsequent titrant addition are done once the measured value is stable. **Fixed time**: Acquisition of measured values and subsequent titrant addition are done after a fixed time, that is defined in **dt**. Only if **Show parameters for first addition** is activated. Read only, if **Control** is set to **Normal**, **Fast** or **Cautious**.	-

dE	**dE** and **dt** define when a measured value is considered stable in the sub steps of the first addition. **dE** defines the maximal potential difference for a stable value during the time span dt. Only if **Show parameters for first addition** is activated. Read only, if **Control** is set to **Normal**, **Fast** or **Cautious**.	0.01...15 [mV]
dt	**dE** and **dt** define when a measured value is considered stable in the sub steps of the first addition. **dt** defines the time interval for calculating dE/dt. Only if **Show parameters for first addition** is activated. Read only, if **Control** is set to **Normal**, **Fast** or **Cautious**.	1...150 [s]
t(min)	Defines the minimal time before the next measured value acquisition in the sub steps of the first addition. Only if **Show parameters for first addition** is activated. Read only, if **Control** is set to **Normal**, **Fast** or **Cautious**.	1...150 [s]
t(max)	Defines the maximal time before the next measured value acquisition in the sub steps of the first addition. Only if **Show parameters for first addition** is activated. Read only, if **Control** is set to **Normal**, **Fast** or **Cautious**.	1...100000 [s]
dt	Defines the time interval for the measured value acquisition in the sub steps of the first addition. Only if **Show parameters for first addition** is activated, if **Control** is set to **User** and if **Meas. val. acquisition** is set to **Fixed time**.	1...6000 [s]

Subfunction: Termination

Parameters	Description	Values
At Vmax	Define the maximum volume for termination. The termination will be active when the maximum volume is reached at the latest.	0.10...1'000

Subfunction: Condition

Parameters	Description	Values
Condition	Activate if you want to create a condition for your standard addition.	Activ I Inactive
Formula	Define the specific formula for your condition. Only if **Condition** is activated.	Arbitrary

7.4.31 Dispense (controlled)

Controlled dispensing is used for monitored dosing. Controlled dispensing continually monitors the potential or the temperature of the sample solution and records if the predefined criteria have been exceeded.
The relevant parameters can be determined for the following subfunctions:

Subfunction: Titrant

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Continuous addition	Continuous addition requires a second burette and a second drive with the same titrant. If the first burette empties and is refilled, the second burette will continue dispensing seamlessly. (not with T50)	Activ I Inactive
Titrant 2	The second titrant to be used for the continuous addition. (Only if "continuous addition" is selected.) (not with T50)	Titrant list in Setup

Subfunction: Sensor

Parameters	Description	Values
Type	Defines the type of sensor used to perform the measurement.	List of available sensor types

Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure used for the measurement.	List of available units

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	Defines the temperature unit to be used.	°C I K I °F

Subfunction: Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

Subfunction: Dispensing

Volume	The volume to be dispensed, in [mL].	0.001 … 1000 I Auxiliary value I Formula
Dosing rate	The dosing speed, in [mL/min]. If the number is above the maximum value possible, the system will dispense at the maximum rate. You can also select a burette type-dependent maximum number.	0.001…60
t(max)	Defines a time period, in [min], after which dispensing will be terminated, even if the volume has not yet been reached.	$0.1…10^{6}$

Subfunction: Monitoring

Parameters	Description	Values
Monitoring	Defines whether to monitor the sensor signal or temperature during the main stating process.	Activ I Inactive
Signal	If you want to run monitoring, this is where you specify whether to monitor the sensor signal or the temperature. (For **Monitoring** = **Active** only.)	Sensor signal I Temperature
Lower limit	Defines the lower limit of the range within which the signal or temperature will be allowed to vary. If the signal or temperature violate this range, that will trigger the defined "Action". The unit of measure will depend on the sensor used.	-
Upper limit	Defines the upper limit of the range within which the signal or temperature will be allowed to vary. If the signal or temperature violate this range, that will trigger the defined "Action". The unit of measure will depend on the sensor used.	-
Action	Defines an action for violations of the upper or lower monitoring parameters. **Cancel**: Stating will be canceled. **Manual**: The stating will be interrupted and a message will appear on the display. The user can cancel or continue the stating process. **Automatic**: Stating will be interrupted and continued when the monitoring parameters have returned within the limits.	Automatic I Manual I Cancel

Subfunction: Saving measured values

Parameters	Description	Values
Interval	Defines the interval, in [sec], at which the date should be saved.	$0.1…10^{6}$

Subfunction: Condition

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.32 Scan (KF Vol)

Scan (KF Vol) is available on the following titrator types:

- T7
- T9

7.4.32.1 Titrant

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Nominal conc.	Specified concentration of the Karl Fischer titrant in [mg/mL].	0.1…100
Reagent type	Defines the type of Karl Fischer titrant used in the titration.	1-comp I 2-comp

See also

Titration (KF Vol) ▸ Page 133

7.4.32.2 Sensor

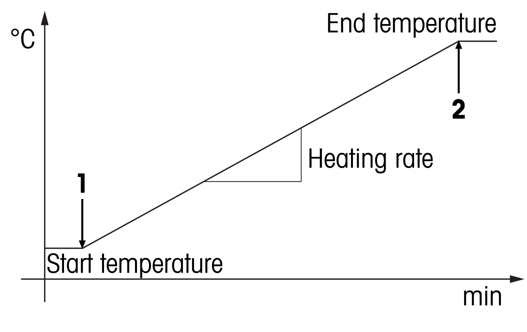
For Karl Fischer titrations, only polarized sensors are used.

Parameters	Description	Values
Type	Shows the type of sensor used to perform the measurement	Polarized
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure that is used for the measurement.	mV
Indication	Shows how the indication is done.	Voltametric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA

7.4.32.3 Temperature program

The parameters of the temperature program defines the temperature range and heating rate for the measurement. If the ambient temperature is higher than 30°C, the **Start temperature** needs to be at least 10 °C higher than the ambient temperature.

- The measurement starts (1) when the start temperature is reached and the conditions defined in **Max. start drift** and **Drift stability** are met..
- The measurement ends (2) when the end temperature is reached.



Parameters	Description	Values
Start temperature	Defines the temperature at which the measurement starts. If the ambient temperature is higher than 30°C, the start temperature needs to be at least 10 °C higher than the ambient temperature.	40…280 °C
Heating rate	Defines the rate at which the oven is heated during the measurement.	0.5…75 °C/min
End temperature	Defines the final temperature at the end of the measurement.	40…280 °C

7.4.32.4 Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

7.4.32.5 Control

The maximum dosing rates are dependent on the size of the burette. The user is able to edit the entire value range. When Start is pressed, the system then checks whether the entered values are actually possible with the current burette size.

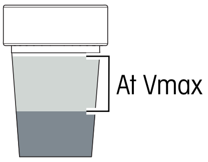
Burette size [ml]	Maximum dosing rate [mL/min]
1	3
5	15
10	30
20	60

Parameters	Description	Values
End point	End point in [mV] of the Karl Fischer titration and the standby titration.	-2000 … 2000
Control band	The value in [mV] defines the width of the control band. Outside the control band, the system will titrate with the maximum dispensing rate. The control band allows the dynamic behavior of the controller to be influenced. Reducing the control band causes a more aggressive control behavior, while increasing the control band gives a gentler control behavior. When the measurement curve reaches the control band, the titrator slows down the addition of titrant to approach the end point cautiously.	0.1...2000
Dosing rate (max)	The maximum dosing rate in [mL/min].	0.001…60
Dosing rate (min)	The minimum dosing rate in [µL/min].	1…10^4

7.4.32.6 Termination

The analysis stops when the end temperature is reached.

To prevent the sample vessel from overflowing, the analysis is stopped at the latest when a defined maximum volume of titrant has been added. If the maximum volume of titrant has been added, the analysis is stopped even if other criteria are not met. The maximum volume is defined in **At Vmax**.



Parameters	Description	Values
At Vmax	Defines the maximum volume of titrant that can be added before the analysis is stopped at the latest.	Activ I Inactive

7.4.32.7 Condition

The subfunction **Condition** is only available on T9 titrators.

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.33 Scan (KF Coul)

Scan (KF Coul) is available on the following titrator types:

- T7
- T9

7.4.33.1 Sensor

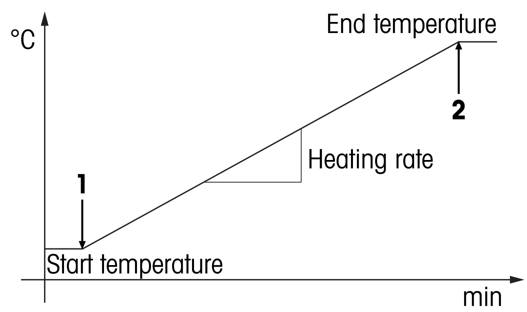
For Karl Fischer titrations, only polarized sensors are used.

Parameters	Description	Values
Type	Shows the type of sensor used to perform the measurement	Polarized
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	Defines the unit of measure that is used for the measurement.	mV
Indication	Shows how the indication is done.	Voltametric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA

7.4.33.2 Temperature program

The parameters of the temperature program defines the temperature range and heating rate for the measurement. If the ambient temperature is higher than 30°C, the **Start temperature** needs to be at least 10 °C higher than the ambient temperature.

- The measurement starts (1) when the start temperature is reached and the conditions defined in **Max. start drift** and **Drift stability** are met..
- The measurement ends (2) when the end temperature is reached.



Parameters	Description	Values
Start temperature	Defines the temperature at which the measurement starts. If the ambient temperature is higher than 30°C, the start temperature needs to be at least 10 °C higher than the ambient temperature.	40…280 °C
Heating rate	Defines the rate at which the oven is heated during the measurement.	0.5…75 °C/min
End temperature	Defines the final temperature at the end of the measurement.	40…280 °C

7.4.33.3 Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

7.4.33.4 Control

Parameters	Description	Values
End point	End point in [mV] of the Karl Fischer titration and the standby titration.	-2000 … 2000
Control band	The value in [mV] defines the width of the control band. Outside the control band, the system will titrate with the maximum dispensing rate. The control band allows the dynamic behavior of the controller to be influenced. Reducing the control band causes a more aggressive control behavior, while increasing the control band gives a gentler control behavior. When the measurement curve reaches the control band, the titrator slows down the addition of titrant to approach the end point cautiously.	0.1…2000
Generator current	Defines how the pulse strength is regulated. **Automatic**: The pulse strength is regulated automatically. Possible values for the pulse strength are 100 mA, 200 mA, 300 mA and 400 mA. **Fix**: The pulse strength has a fixed values that is entered by the user.	Automatic I Fix
Current	Defines the pulse strength generated by the generator electrode in [mA].	100 I 200 I 300 I 400

7.4.33.5 Condition

The subfunction **Condition** is only available on T9 titrators.

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.34 Application Modes

An application mode can be selected in the **Control** subfunction for the EQP and EP titration method functions if the **Control** setting is not set to **User**. Application modes are available for various types of titration (acid/base, redox, argentometry, etc.). If an application mode is selected, the settings for the Control subfunction will be specified based on what is best for the primary uses for the corresponding type of titration. The user can choose between three different parameter sets for each application mode (**Normal**, **Fast** and **Cautious**).

Sensor type	Unit	Unit for dE(set value) and dE	Mode
pH	pH	mV	Acid / Base
	mV		Acid / Base (non aqu.)

mV	mV	mV	Precipitation
			Precipitation (non aqu.)
			Redox
ISE	mV	mV	Precipitation
	ppm		
	pX		
	pM		
Phototrode	mV	mV	Precipitation
	%T		Complexation
	A		
Polarized	mV	mV	Redox
	µA	µA	Redox
Temperature	°C	°C, °F, K	Acid / Base
	°F		
	K		
Conductivity	mS	µS, mS	Acid / Base
	µS		Precipitation
	mS/cm		
	µS/cm		

7.4.35 Stating

Stating is used to maintain a sample solution at a particular set potential.

Initial potential

At the beginning, the initial potential of the pH-stating is determined. The average of the last 10 measured values is taken as the initial potential.

Pretitration

The pretitration is performed in consideration of the control band, the tendency and the maximum and minimum rate to the set potential. A message that the titration is completed is displayed. As long as this is not confirmed, the control remains active. After confirmation, the titration is stopped and a further message to the actual sample addition is displayed. Throughout the titration, all data points are recorded.

Predispense

After the sample was added, and all messages are acknowledged, the predispensing is carried out.

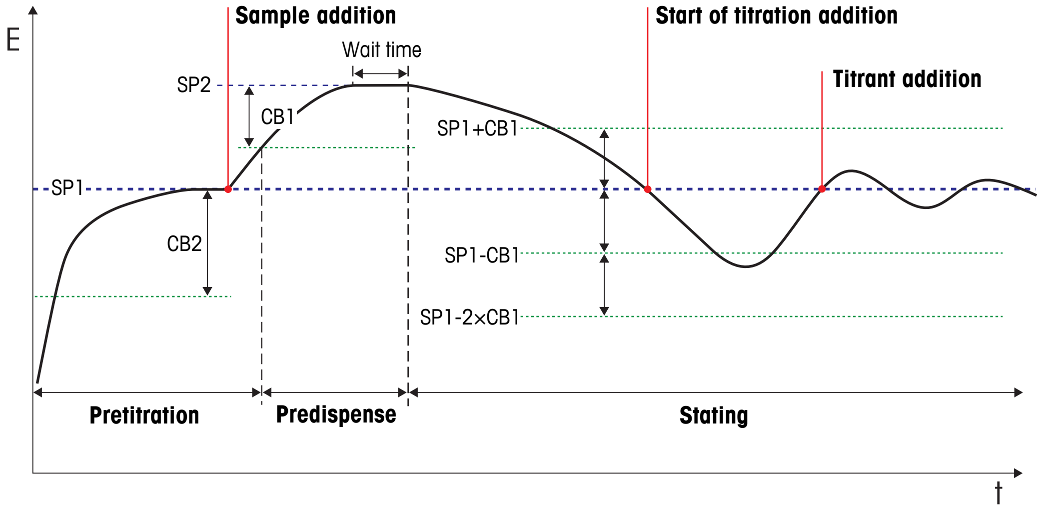
Predispense = **Volume**
The volume is carried out at the maximum dosing rate of the burette drive in one step. Data points will be recorded prior and after the predispensing.

Predispense = **Potential**
Corresponds to a prior endpoint titration. The data points are recorded according to the parameters in the subfunction **Measured value storage**.

Stating

In order to prevent drifting of the sensor signal at the beginning of the stating, the control is inactive until the first drop below the set potential.

The following figure illustrates the stages using "pretitration" and "predispense to potential" functions before running the stating. In this example, a positive tendency is assumed.



SP1: The set potential defined in the subfunction **Control**.

SP2: Set potential of the subfunction **Predispense** (**Mode** = **Potential**).

CB1: Control band defined in subfunction **Control**.

CB2: Control band defined in subfunction **Pretitration**.

The relevant parameters can be determined for the following subfunctions:

Subfunction: Titrant

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Continuous addition	Continuous addition requires a second burette and a second drive with the same titrant. If the first burette empties and is refilled, the second burette will continue dispensing seamlessly. (not with T50)	Activ I Inactive
Titrant 2	The second titrant to be used for the continuous addition. (Only if "continuous addition" is selected.) (not with T50)	Titrant list in Setup

Subfunction: Sensor

Parameters	Description	Values
Type	The type of sensor to be used to perform the stating.	mV I pH
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I pH

Subfunction: Temperature acquisition

Parameters	Description	Values
Temperature acquisition	Defines whether to record the temperature, with the aid of a temperature sensor, during the execution of the analysis function.	Activ I Inactive
Temperature sensor	Defines which temperature sensor to use for the temperature acquisition. Only for **Temperature acquisition** = **Active**.	Sensor list
Unit	Defines the temperature unit to be used.	°C I K I °F

Subfunction: Stir

Parameters	Description	Values
Speed	Defines the stirring speed in [%].	0…100

Subfunction: Pretitration

Parameters	Description	Values
Pretitration	Pretitration specifies whether a pretitration should be performed. Pretitration takes place until the target potential defined in the subfunction "control" is reached.	Activ I Inactive
Control band	This number defines the width of the control band. Outside the control band, the system will titrate with the maximum dispensing rate. The smaller the control band, the faster the titrator will react to a deviation from the potential of the defined end point. When the measurement curve reaches the control band, the titrator will slow down the titrant addition to approach the end point in a cautious manner. The unit will depend on the sensor used.	Depends on the sensor I Auxiliary value

Sub function: Predispense

Parameters	Description	Values
Mode	Specifies the type of addition: **Volume**: predispenses a specific volume. **Potential**: system predispenses a substance until a certain potential is reached. The control band defined in the subfunction **Control** is used. **Factor**: A multiple of the sample size is predispensed. **None**: does not predispense.	Volume I Potential I Factor I None
Volume	The volume to be predispensed in [mL]. Only for **Mode** = **Volume**.	0.0001…1000 I Auxiliary value I Formula
Potential	The potential at which predispensing is stopped. Only for **Mode** = **Potential**.	Depends on the sensor
Factor	The system calculates the predispensing volume by multiplying the factor by the sample size. For **Mode** = **Factor** only.	0…10^5 I Auxiliary value I Formula
Wait time	Defines a waiting time, in [sec]. After predispensing or, if **Mode** = **None**, before the start of titration.	0…32000

Subfunction: Control

Parameters	Description	Values
Set potential	Defines the target potential at which the sample solution should be kept as constantly as possible. The unit of measure will depend on the sensor used.	-
Control band	This number defines the width of the control band. Depending on the tendency, the system will titrate with the maximum rate or will stop the titrant addition. Compare the upper graph. The smaller the control band, the faster the titrator will react to a deviation from the potential of the defined end point. The titrant addition depends on the tendency and the actual measured potential. Below the set potential, the titrant addition rate will be adapted (speed up or slow down) to the reaction rate of the system to approach the set potential in a cautious manner. When the measured curve drifts below the control area, the system will increase the titrant addition to the maximum dispensing rate. Above the set potential, the titrant addition rate will only be reduced within the control band, reaching zero when the measurement curve drifts above the upper control band. The smaller the control band, the faster the titrator will react to a deviation from the set potential.	Depends on the sensor I Auxiliary value

Tendency	Defines the direction in which the sensor signal should be shifted by the titrant addition.	Positive I Negative
Dosing rate (max)	The maximum dosing rate in [mL/min].	0.001…60
Dosing rate (min)	The minimum dosing rate in [µL/min].	1…10^4

Subfunction: Monitoring

Parameters	Description	Values
Monitoring	Defines whether to monitor the sensor signal or temperature during the main stating process.	Activ I Inactive
Signal	If you want to run monitoring, this is where you specify whether to monitor the sensor signal or the temperature. (For **Monitoring** = **Active** only.)	Sensor signal I Temperature
Lower limit	Defines the lower limit of the range within which the signal or temperature will be allowed to vary. If the signal or temperature violate this range, that will trigger the defined "Action". The unit of measure will depend on the sensor used.	-
Upper limit	Defines the upper limit of the range within which the signal or temperature will be allowed to vary. If the signal or temperature violate this range, that will trigger the defined "Action". The unit of measure will depend on the sensor used.	-
Action	Defines an action for violations of the upper or lower monitoring parameters. **Cancel**: Stating will be canceled. **Manual**: The stating will be interrupted and a message will appear on the display. The user can cancel or continue the stating process. **Automatic**: Stating will be interrupted and continued when the monitoring parameters have returned within the limits.	Automatic I Manual I Cancel

Subfunction: Termination

Parameters	Description	Values
At Vmax	The volume, in [mL], after the dispensing of which the stating will be terminated.	0.01…1000
From t(min)	Specifies whether to define a time for the earliest possible termination of the stating.	Activ I Inactive
t(min)	The earliest time, in [min], at which termination can take place, if the maximum volume has not yet been reached. (Only if "from t(min)" = "yes" is selected.)	0.1…10^6
At t(max)	Specifies whether to define a time at which the stating will be terminated if it has not ended already.	Activ I Inactive
t(max)	The time, in [min], at which the stating will be terminated if it has not ended already. (Only if "At "t(max)" = "Yes" is selected.)	0.1…10^6
After stating duration	Specifies whether to define a time period after which the stating will be terminated after reaching the end point for the first time.	Activ I Inactive
Stating duration	The time period, in [min], after which the stating will be terminated after reaching the first end point. If defined, "t(min)" will be taken into consideration. (Only if "After stating duration" = "Yes" is selected.)	0.1…10^6
At minimum rate	Defines whether to take a minimum rate into consideration which will terminate the stating if violated.	Activ I Inactive
dV	The volume increment, in [mL/dt], for calculating the minimum rate. (Only if "at minimum rate" = "yes" is selected.)	0.0001…10

dt	The time increment, in [min], for calculating the minimum rate. (Only if "at minimal rate" = "yes" is selected.)	$1...10^6$

Subfunction: Measured value storage

Parameters	Description	Values
Interval	Defines the interval, in [sec], at which the date should be saved.	$0.1...10^6$
Start condition	Defines the starting condition for saving the data: • **After pretitration**: The system will start saving the data after the pretitration. • **After predispensing**: The system will start saving the data after the predispensing.	After pretitration I After predispensing

Subfunction: Condition

Parameters	Description	Values
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.36 Calculation

The **Result type** cannot always be changed by the user. If **Result type** is not available, it is set to **Predefined** or **User defined** depending on the type of titrator and the type of titration.

Define limits for the results

If **Result limits** is activated, the titrator checks if the result falls within the limits defined in **Lower limit** and **Upper limit**. If the result lies outside the limits, it is marked as such.

Configure the action of the system if the result lies outside the limits

The table below shows the settings for the four possible actions of the system if the value of the result lies outside of the limits.

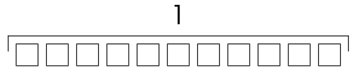
Action of the system	Message outside limits	Stop outside limits
The analysis continues. The user is not informed that the value lies outside of the limits.	**Inactive**	**Inactive**
A message opens and informs the user that the value lies outside of the limits. The analysis is interrupted until the user confirms the message.	**Active**	**Inactive**
The analysis is stopped. A message opens and informs the user that the value lies outside of the limits.	**Active**	**Active**
The analysis is stopped. The user is not informed that the value lies outside of the limits.	**Inactive**	**Active**

Define a maximum relative standard deviation for all samples or groups of samples

You can only define a maximum relative standard deviation if you use the **Calculation** method function within a loop.

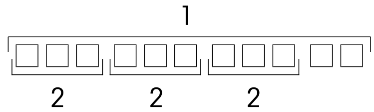
Activate **Extra statistical functions** to define a maximum relative standard deviation for all samples in the sample loop. If the calculated relative standard deviation (srel) is higher than the value defined in **Max. srel**, it is marked in the record.

- Example: The relative standard deviation is calculated for all 11 samples in the loop (1). This realtive standard deviation is compared to the value defined in **Max. srel**.



Activate **Extra statistical functions** and **Multiple determination** to calculate the relative standard deviation for groups of samples in addition to the relative standard deviation of all samples. **Number of samples** defines how many results are combined to calculate the relative standard deviation of groups. The relative standard deviation of each group is compared to the value defined in **Max. srel** and marked if it exceeds the value.

- Example: The relative standard deviation is calculated for all 11 samples in the loop (1). In addition the relative standard deviation is calculated for groups of three samples (2) because **Multiple determination** is activated and the **Number of samples** is set to 3.



Configure the action of the system if the maximum relative standard deviation is exceeded

You can only configure the action of the system if **Multiple determination** is activated.

The table below shows the settings for the four possible actions of the system if the relative standard deviation exceeds the maximum relative standard deviation.

Action of the system	Message above max. srel	Stop above max. srel
The titrator only records that the relative standard deviation of a group is higher than the value defined in **Max. srel**.	**Inactive**	**Inactive**
A message opens and informs the user that the relative standard deviation of a group is higher than the value defined in **Max. srel**. The analysis is interrupted until the user confirms the message.	**Active**	**Inactive**
The analysis is stopped. A message opens and informs the user that the relative standard deviation of a group is higher than the value defined in **Max. srel**.	**Active**	**Active**
The analysis is stopped. The user is not informed that the relative standard deviation of a group is higher than the value defined in **Max. srel**.	**Inactive**	**Active**

Parameter description

The subfunction **Condition** is only available on T9 titrators.

Parameters	Description	Values
Result type	**Predefined**: a predefined result from the proposal list has to be used and the parameters **Result unit**, **Formula**, and **Constant C=** cannot be changed. The parameters **Result**, **Result unit**, **Formula**, and **Constant C=** are adjusted automatically in accordance with the parameter settings in the method function **Sample**, **Sample (KF)** or **Sample (Standard Addition)** . **User defined**: a predefined result from the proposal list or a user defined result can be used. All parameters can be changed. There is no automatic adjustment of the parameters **Result**, **Result unit**, **Formula**, and **Constant C=**	Predefined | User defined

Result	Defines the name for the result of the calculation. If you select a result from the dropdown list **Result proposals**, the system automatically sets the parameters **Result unit**, **Formula** and **Constant C=** parameters. You can change the parameters **Result**, **Result unit**, **Formula** and **Constant C=** independently from each other, if **Result type** is set to **User defined**.	Results list I Arbitrary
Result unit	Defines the unit of the result. If you select a result from the dropdown list **Result proposals**, the system automatically sets the parameter **Result unit**. You can change the parameter **Result unit** independently, if **Result type** is set to **User defined**.	Results list I Arbitrary
Formula	Defines the formula for calculating the result. If you select a result from the dropdown list **Result proposals**, the system automatically sets the parameter **Formula**. You can change the parameter **Formula** independently, if **Result type** is set to **User defined**.	Results list I Arbitrary
Constant C=	Defines the constant C which can be used in the calculation. The constant C can itself be a formula. If you select a result from the dropdown list **Result proposals**, the system automatically sets the parameter **Constant C=**. You can change the parameter **Constant C=** independently, if **Result type** is set to **User defined**.	Results list I Arbitrary
M [g/mol]	Defines the molar mass of the substance [g/mol]. Only in method function **GT** (general titration).	List of concentration/ titer standards and substances
z (Equivalent number)	Shows the equivalent number (z) of the molar mass entry. Only in method function **GT** (general titration).	-
Decimal places	The number of decimal places for the result.	0…6
Result limits	Defines whether limits should be observed for the result. If this function is activated, there will be a message in the record if the result falls outside the defined limits.	Activ I Inactive
Lower limit	Defines the lower limit of the result.	-10^8 … 10^8
Upper limit	Defines the upper limit of the result.	-10^8…10^8
Message outside limits	Defines whether a message opens that informs the user that the value lies outside of the limits.	Activ I Inactive
Stop outside limits	Defines whether the analysis is stopped if the value lies outside the defined limits.	Activ I Inactive
Record statistics	Specifies whether statistics should also be issued with the results in the report along with the result. The statistics are not printed, if in the method function **Record** the parameter **Results** is not selected.	Activ I Inactive
Extra statistical functions	Defines whether the relative standard deviation is compared to a maximum relative standard deviation. **Active**: the relative standard deviation of all samples in a loop is compared to the value defined in **Max. srel**. If the relative standard deviation is higher than **Max. srel**, it is marked in the record. **Inactive**: the relative standard deviation is not evaluated.	Activ I Inactive
Max. srel	Defines the maximum relative standard deviation.	0…100

Multiple determi-nation	Defines whether the relative standard deviation is calculated for groups of samples and compared to a maximum relative standard deviation. **Active**: the relative standard deviation of groups of samples is compared to the value defined in **Max. srel**. If the relative standard deviation is higher than **Max. srel**, it is marked in the record. **Inactive**: the relative standard deviation is only calculated for all samples in a loop.	Activ I Inactive
Number of samples	Defines the sample groups for a multiple determination. For example, a value of 3 means that the system will run a statistical evaluation on three consecutive samples.	2…9
Max. srel	Defines the maximum relative standard deviation.	0…100
Message above max. srel	Defines whether a message opens as soon as the relative standard deviation of a sample group within a multiple determi-nation is above the value defined in **Max. srel**.	Activ I Inactive
Stop above max. srel	Defines whether the analysis is stopped if the relative standard deviation of a group is higher than the value defined in **Max. srel**.	Activ I Inactive
Record	If selected, the multiple determination function will create a record listing the groups after a double determination whose relative standard deviation lies above a "Max. srel" number defined in the method. Appears only if **Extra statistical functions** and **Multiple deter-mination** = **Active**.	Activ I Inactive
Send to buffer	Defines if the results that are generated outside and inside a loop are stored in the result buffer. The result buffer only contains the results of a single method. The result buffer can be accessed using a variety of methods (both inside and outside a loop). The content of the result buffer is visible to the user and can be deleted or printed out. Once the titrator has been restarted the result buffer is empty.	Activ I Inactive
Write to Smart Tag	Defines if the calculation result is written to the Smart Tag on the beaker. **None**: the calculation result is not written to the Smart Tag. **Density**: the calculation result is written to the **Density** data field of the Smart Tag. If the calculation result lies outside the limits for density defined in the MF **Sample**, the default value for density is written to the Smart Tag. If the calculation result has more decimal places than allowed for the density, the calcu-lation result is rounded off. **Correction factor**: The calculation result is written to the data field **Correction factor** of the Smart Tag. If the calculation result lies outside the limits for the correction factor defined in the MF **Sample**, the default value for the correction factor is written to the Smart Tag. If the calculation result has more decimal places than allowed for the correction factor, the calculation result is rounded off. Only appears for **GT** (general titration) and **Titration stand** = InMotion.	None I Density I Correction factor
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calcu-lation formula (see the parameter **Formula**).	Activ I Inactive

Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.37 End of sample

The "End of Sample" method function closes a sample loop. A sample loop refers to the range of a method through which a sample series will pass for each sample. The commencement of a sample loop is specified using the "Sample" method function.

Parameters	Description	Values
Open series	Determines whether the subsequent method functions are processed after the method function **End of sample**, or if the titrator returns to Standby mode.	Activ I Inactive

Note

The "Open series" parameter is only available for Karl Fischer titration without the Stromboli oven sample changer. If "Open series" is set, the titrator enters "Standby" mode at the end of the analysis and the method remains active. If "Open series" is not set, the method is ended after the final sample.

7.4.38 Titer

The **Titer** method function is only available outside a loop. This method function assigns the result of a sample loop to a titer and updates the value stored in Setup.

Define limits for the result assigned to the titer

If **Limits** is activated, the titrator checks if the result falls within the limits defined in **Lower limit** and **Upper limit**. If the result lies outside the limits, it is not assigned to the titer.

Configure the action of the system if the result lies outside the limits

The table below shows the settings for the four possible actions of the system if the value of the result lies outside of the limits.

Action of the system	Message outside limits	Stop outside limits
The analysis continues. The user is not informed that the value lies outside of the limits.	**Inactive**	**Inactive**
A message opens and informs the user that the value lies outside of the limits. The analysis is interrupted until the user confirms the message.	**Active**	**Inactive**
The analysis is stopped. A message opens and informs the user that the value lies outside of the limits.	**Active**	**Active**
The analysis is stopped. The user is not informed that the value lies outside of the limits.	**Inactive**	**Active**

Parameters	Description	Values
Titrant	Shows the titrant used in the method function.	-
Concentration	Shows the concentration of the selected titrant, in [mol/L].	-
TITER=	Specifies for how many results the titer should be determined. (For i=1, i does not have to be defined.)	Mean[Ri], i=1…30
Limits	Determines whether limits should be taken into account for acquisition of a value. If the value is outside these limits, the value is not transferred to Setup.	Activ I Inactive

Message outside limits	Defines whether a message opens that informs the user that the value lies outside of the limits.	Activ | Inactive
Stop outside limits	Defines whether the analysis is stopped if the value lies outside the defined limits.	Activ | Inactive
Lower limit	Defines the lower limit of a value. Only if **Limits** = **Active**	0...100
Upper limit	Defines the upper limit of the concentration limit. Only if **Limits** = **Active**	0.1...100
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ | Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.39 Calibration

This method function assigns the result of a calibration loop to a sensor and updates the sensor setup. Calibration is only performed outside a loop. This method function can be applied both for **Calibration** and **Sensor test**. The calibration can be performed for **Action** = **Calibration** in the **Sample (Calib)** method function and the sensor test for **Action** = **Sensor test**. The sensor test is only available for pH sensors

Define limits for the result assigned to the sensor

If **Limits** is activated, the titrator checks if the result falls within the limits defined in **Min. slope**, **Max. Slope**, **Min. zero point** and **Max. zero point**.

- If the result of a calibration lies outside the limits, it is not assigned to the sensor.
- If the result of a pH test lies outside the limits, the sensor does not pass the test.

Configure the action of the system if the result lies outside the limits

The table below shows the settings for the four possible actions of the system if the value of the result lies outside of the limits.

Action of the system	Message outside limits	Stop outside limits
The analysis continues. The user is not informed that the value lies outside of the limits.	**Inactive**	**Inactive**
A message opens and informs the user that the value lies outside of the limits. The analysis is interrupted until the user confirms the message.	**Active**	**Inactive**
The analysis is stopped. A message opens and informs the user that the value lies outside of the limits.	**Active**	**Active**
The analysis is stopped. The user is not informed that the value lies outside of the limits.	**Inactive**	**Active**

Parameters	Description	Values
Limits	Determines whether limits should be taken into account for acquisition of a value. If the value is outside these limits, the value is not transferred to Setup.	Activ | Inactive

Message outside limits	Defines whether a message opens that informs the user that the value lies outside of the limits.	Activ | Inactive

Note

In cases of segmented calibration for pH and ISE sensors, the limits will be defined and observed for each segment.

Depending on the sensor type (pH, ISE, conductivity), if the **Limits** checkbox is activated, the following parameters can be determined (100% represents -59.16 mV/pH (sensor type: pH) or to -59.16 mV/[unit]) /Ion charge (sensor type: ISE). The unit corresponds to the unit specified in the previous method function, **Sample (Calib)**.

For pH and ISE sensors:

Parameters	Description	Values
Min. slope 1-8	The lower limit for the slope, in [%]. (100% refers to -59.16 mV/pH.)	10…200
Max. Slope 1-8	The upper limit for the slope, in [%].	10…200
Min. zero point 1-8	The lower limit for the zero point.	-100…100
Max. zero point 1-8	The upper limit for the zero point.	-100…100
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ | Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

For conductivity sensors:

Parameters	Description	Values
Min. cell constant	Defines the lower limit for the cell constant of a conductivity sensor, in [1/cm].	0…100
Max. cell constant	Defines the upper limit for the cell constant of a conductivity sensor, in [1/cm].	0…100
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ | Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

For temperature and thermometric sensors:

Parameters	Description	Values
Min. zero point	The lower limit for the zero point.	-100…100
Max. zero point	The upper limit for the zero point.	-100…100
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ | Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

Additional parameters for Sensor test:

Parameters	Description	Values
Min. drift	The minimum drift value in [mV/30s].	-100 to 100
Max. drift	The maximum drift value in [mV/30s].	-100 to 100

See also

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7.4.40 Auxiliary value

This method function assigns a result or arbitrary value to an auxiliary value.

Define limits for the auxiliary value

If **Limits** is activated, the titrator checks if the auxiliary value falls within the limits defined in **Lower limit** and **Upper limit**. If the auxiliary value lies outside the limits, it is marked as such.

Configure the action of the system if the auxiliary value lies outside the limits

The table below shows the settings for the four possible actions of the system if the auxiliary value lies outside of the limits.

Action of the system	Message outside limits	Stop outside limits
The analysis continues. The user is not informed that the value lies outside of the limits.	**Inactive**	**Inactive**
A message opens and informs the user that the value lies outside of the limits. The analysis is interrupted until the user confirms the message.	**Active**	**Inactive**
The analysis is stopped. A message opens and informs the user that the value lies outside of the limits.	**Active**	**Active**
The analysis is stopped. The user is not informed that the value lies outside of the limits.	**Inactive**	**Active**

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Formula H=	Here you can enter a formula that will be used to convert the result of the sample loop to the auxiliary value. You can also enter a number or an auxiliary value.	Formula (see "[Evaluation and calculation ▸ Page 256]") | Auxiliary Value | Number
Limits	Determines whether limits should be taken into account for acquisition of a value. If the value is outside these limits, the value is not transferred to Setup.	Activ | Inactive
Message outside limits	Defines whether a message opens that informs the user that the value lies outside of the limits.	Activ | Inactive
Stop outside limits	Defines whether the analysis is stopped if the value lies outside the defined limits.	Activ | Inactive
Lower limit	Defines the lower limit of the value. Only if **Limits** = **Active**	$-10^8 \ldots 10^8$
Upper limit	Defines the upper limit of the value. Only if **Limits** = **Active**	$-10^8 \ldots 10^8$
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ | Inactive

Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.41 Blank

This method function assigns a result or arbitrary value to a blank value, including the unit.

Define limits for the blank value

If **Limits** is activated, the titrator checks if the blank value falls within the limits defined in **Lower limit** and **Upper limit**. If the blank value lies outside the limits, it is marked as such.

Configure the action of the system if the blank value lies outside the limits

The table below shows the settings for the four possible actions of the system if the blank value lies outside of the limits.

Action of the system	Message outside limits	Stop outside limits
The analysis continues. The user is not informed that the value lies outside of the limits.	**Inactive**	**Inactive**
A message opens and informs the user that the value lies outside of the limits. The analysis is interrupted until the user confirms the message.	**Active**	**Inactive**
The analysis is stopped. A message opens and informs the user that the value lies outside of the limits.	**Active**	**Active**
The analysis is stopped. The user is not informed that the value lies outside of the limits.	**Inactive**	**Active**

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Value B=	Here you can enter a formula that will be used to convert the sample loop result to the blank. You can also enter a number or an auxiliary value.	Formula (see "[Evaluation and Calculation ▸ Page 256]") I Auxiliary value I Number
Unit	The units in which the blank is specified.	Arbitrary
Limits	Determines whether limits should be taken into account for acquisition of a value. If the value is outside these limits, the value is not transferred to Setup.	Activ I Inactive
Message outside limits	Defines whether a message opens that informs the user that the value lies outside of the limits.	Activ I Inactive
Stop outside limits	Defines whether the analysis is stopped if the value lies outside the defined limits.	Activ I Inactive
Lower limit	Defines the lower limit of the value. Only if **Limits** = **Active**	$-10^8 \ldots 10^8$
Upper limit	Defines the upper limit of the value. Only if **Limits** = **Active**	$-10^8 \ldots 10^8$

Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.42 Auxiliary instrument

This method function activates external auxiliary instruments and enables the titrator to be controlled by such auxiliary instruments. The parameters described in the following can be defined for all control types. These are followed by parameters that can be defined explicitly for the relevant control type:

Parameters	Description	Values
Control type	The control type of the auxiliary instrument.	Output 24 V I Stirrer I Out TTL (Single pin) I Input TTL (Single pin) I TTL (Multipin) I RS-232
Name	Select the auxiliary instrument to be controlled from the list.	Auxiliary instrument
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.42.1 Control type: Output 24V

Parameters	Description	Values
Mode	Defines the mode for controlling the control output. **Fixed time**: The control output is switched on for the defined time interval. **On** I **Off**: The control outlet is switched on or off. After a sample series the control outlet is automatically switched off.	On I Off I Fixed time
Time	A time span in [sec] can be defined here for which the control outlet should be switched on. Only if **Mode** = **Fixed time**.	$0 \ldots 10^6$

7.4.42.2 Control type: Stirrer

Parameters	Description	Values
Mode	Defines the mode for controlling the control output. **Fixed time**: The control output is switched on for the defined time interval. **On** I **Off**: The control outlet is switched on or off. After a sample series the control outlet is automatically switched off.	On I Off I Fixed time

Time	A time span in [sec] can be defined here for which the control outlet should be switched on. Only if **Mode** = **Fixed time**.	0...10^6
Speed	Defines the stirring speed in [%].	0...100

7.4.42.3 Control type: Out TTL (Single pin)

Parameters	Description	Values
Mode	Defines the mode for controlling the control output. For TTL signals, the number and type of the output signals is determined. **Fixed time**: The control output is switched on for the defined time period. **On** I **Off**: The control output is switched on or off. **Input controlled**: A signal received at the control inlet controls the control outlet. The Auxiliary instrument function is terminated as soon as the signal changes at the control input or after a defined maximum time has expired. **Sequential**: The control output runs through a defined sequence.	On I Off I Fixed time I Input controlled I Sequential
Time	A time span in [sec] can be defined here for which the control outlet should be switched on. Only if **Mode** = **Fixed time**.	0...10^6
Input	Select the auxiliary instrument to serve as the signal input (control input). Only if **Mode** = **Input controlled**.	Auxiliary instrument
Output signal	**Normal**: The signal is transmitted without conversion. **Inverted**: The signal is transmitted in inverted form. Only if **Mode** = **Input controlled**.	Normal I Inverted
Max. time	The maximum waiting time for a signal change, in [sec]. After it expires, the method is continued even if no signal change was detected. Only for signal inputs.	0...10^6
Number of pulses	The number of impulses in the planned sequence. Only if **Mode** = **Sequential**.	0...10^4
Pulse duration	The duration of a pulse in [sec] (time switched on + time switched off). Only if **Mode** = **Sequential**.	0...10^6
Interval	Defines the time span, in [sec], between two impulse starts. Only if **Mode** = **Sequential**.	0...10^6 I 0...10^4

7.4.42.4 Control type: Input TTL (single pin)

Parameters	Description	Values
Input signal	Indicates whether an rising or a falling input signal should be detected.	Rising I Falling
Max. time	The maximum waiting time for a signal change, in [sec]. After it expires, the method is continued even if no signal change was detected. Only for signal inputs.	0...10^6

7.4.42.5 Control type: TTL (multipin)

Parameters	Description	Values
Input/Output	Defines the communication direction.	Output I Input

Pin	Select a pin and define the type of control. **Output**: 1, 2, 3, 4 **Input**: 1, 2,	1…4
Mode	Defines the mode for controlling the control output. For TTL signals, the number and type of the output signals is determined. **Fixed time**: The control output is switched on for the defined time period. **On** I **Off**: The control output is switched on or off. **Input controlled**: A signal received at the control inlet controls the control outlet. The Auxiliary instrument function is terminated as soon as the signal changes at the control input or after a defined maximum time has expired. **Sequential**: The control output runs through a defined sequence.	On I Off I Fixed time I Input controlled I Sequential
Time	A time span in [sec] can be defined here for which the control outlet should be switched on. Only if **Mode** = **Fixed time**.	$0 \ldots 10^6$
Input	Select the auxiliary instrument to serve as the signal input (control input). Only if **Mode** = **Input controlled**.	Auxiliary instrument
Output signal	**Normal**: The signal is transmitted without conversion. **Inverted**: The signal is transmitted in inverted form. Only if **Mode** = **Input controlled**.	Normal I Inverted
Max. time	The maximum waiting time for a signal change, in [sec]. After it expires, the method is continued even if no signal change was detected. Only for signal inputs.	$0 \ldots 10^6$
Number of pulses	The number of impulses in the planned sequence. Only if **Mode** = **Sequential**.	$0 \ldots 10^4$
Pulse duration	The duration of a pulse in [sec] (time switched on + time switched off). Only if **Mode** = **Sequential**.	$0 \ldots 10^6$
Interval	Defines the time span, in [sec], between two impulse starts. Only if **Mode** = **Sequential**.	$0 \ldots 10^6$ I $0 \ldots 10^4$
Pin	Select a pin and define the type of control. **Output**: 1, 2, 3, 4 **Input**: 1, 2,	1…4
Input signal	Indicates whether an rising or a falling input signal should be detected.	Rising I Falling

7.4.42.6 Control type: RS-232

Parameters	Description	Values
Send output sequence	Defines whether an output sequence should be sent.	Activ I Inactive
Output sequence	The control sequence for the signal receiver - can also contain a formula or result enclosed in characters % or control characters in format \xxx where xxx is the decimal number of the ASCII control character. \013 for Carriage Return \010 for line feed. Only if **Send output sequence**= **Active**.	ASCII character
Wait for response	Defines whether the system should wait for a response sequence from the device.	Activ I Inactive

Max. time	The maximum waiting time for an input sequence in [sec]. After it expires, the method will be continued even if no input sequence was detected. Only if **Wait for input sequence** = **Active**.	$0 \ldots 10^6$ I ∞
Input sequence	The response sequence from the external device. Only if **Wait for response** = **Active** was selected.	Arbitrary
Input sequence with result	Defines whether the input sequence of the external device contains results which have to be imported.	Activ I Inactive
Start sequence	Start sequence of the incoming sequence from the external device. This is the reference position for the following results. The start sequence can also contain control characters in format \xxx where xxx is the decimal number of the control character.	1…20
Total length	Length from the beginning of the start sequence up to end of the last result.	1…1000
Number of results	The number of results from the sequence of the external device.	1...10

Note

Results are saved in the variable "AuxInst x". (x: The index of the result).

Start position 1 ... Start position 10	Start position (beginning) of the result 1…10 counted from the beginning of the start sequence. Leading space characters before the result will be ignored.	1…1000
Max. length 1 ... Max. length 10	Maximum length of the result 1…10 beginning at the start position of the result.	1...1000
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

Note

For more information about ASCII control characters, refer to: http://www.asciitable.com/

See also

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7.4.43 Instruction

Interrupts the analysis and outputs an instruction to the user on the screen. Either the user has to confirm the instructions or they will disappear automatically after a certain period.

Parameters	Description	Values
Instruction	The text of the instructions to be output to the display. This text can also contain a formula or auxiliary values, enclosed in percent symbols. Example: "Add %VEQ*m/z% g".	Arbitrary, including enclosed formula (control characters: %)
Continue after	**Confirmation**: The analysis will continue as soon as the user confirms the instructions. **Time interval**: The analysis is continued after the defined time period has elapsed.	Confirmation I Time interval
Time interval	The time period, in [sec], during which the analysis is terminated and the instructions are displayed on the screen. Only appears if **Continue after** = **Time interval** is selected.	$0 \ldots 10^6$
Print	If selected, the instructions will be output to a connected printer.	Activ I Inactive

Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.44 Drain

You use this method function to drain a specific volume from a sample vessel using a pump.

Parameters	Description	Values
Drain pump	Defines, which pump is used for draining.	Available pumps
Drain volume	The volume to be drained, in [mL].	0…1000 I Auxiliary value I Formula
Pump property	Defines the properties for the pump used.	1-way I 1-way, two rates I 2-way, fine rate
Rate	Allows to reduce the pump rate. Only if the pump supports this and if the pump is connected to the instrument (Pump1 / Pump2) or InMotion.	10…100 (2-way, fine rate) I 50/100 (1-way, two rates)
Direction	Defines the pump direction for a 2-way pump	Forward I Reverse
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.45 Record

This method function defines the type and scope of the data to be output for a record using the printer (see [Printer ▸ Page 193]).

- If the method function **Record** is placed within a sample loop, the record will include all previous method functions within the current sample loop.
- If the method function **Record** is placed outside of a sample loop, the data from the preceding loop and the data between the **End of sample** and method functions **Record** are output. A few settings are not available outside of a loop.
- For the method type **Titer**, it is advisable for the method function **Record** to be inserted outside the loop, directly after the method function **Titer**. The parameter **Summary** should be activated.
- For the method type **Calibration**, it is advisable for the method function **Record** to be inserted outside the loop, directly after the method function **Calibration**. The parameter **Summary** should be activated.
- For the method type **GT**, the method function **Record** should be located inside the loop, directly in front of **End of sample**. Either **Per sample** or **Per series** should be selected for the parameter **Summary**.

Parameters	Description	Values
Summary	States whether or not a short summary of the results should appear at the top of the protocol.	Inactive I Per sample I Per series out of loop: Activ I Inactive

Results	The results from the **Calculation** method functions. Any statistic selected will be recorded after the last sample of a series or multiple determination.	within loop: Per sample I Per series I Inactive Out of Loop: Activ I Inactive
Raw results	The raw results produced during the determination	within loop: Per sample I Per series I No Out of Loop: Activ I Inactive
Table of measured values	The table of measured values of the current sample (not available out of loop).	Activ I Inactive

For KF methods, you can only select "Yes" or "No" for the parameter "Table of measured values".

Sample data	The sample data of a sample loop. (Not available outside of loop)	Per sample I Per series I Inactive
Resource data	All data in the setup regarding the resources used in the method.	Per sample I Per series I Inactive
E - V	Titration curve of the current sample. The potential is plotted against the volume (not available out of loop).	Last titration function I All titration functions I Inactive

For KF methods, you can only select "Yes" or "No" for the parameter "E – V".

dE/dV - V	The 1st derivation of the titration curve, potential against volume (with linear coordinate representation) (not available out of loop).	Last titration function I All titration functions I Inactive

The parameter "dE/dV – V" is only available for the titration type "GT".

log dE/dV - V	The 1st derivative of the titration curve for potential against volume. (With logarithmic ordinate display) (not available outside of loop)	Last titration function I All titration functions I Inactive

The parameter "log dE/dV – V" is only available for the titration type "GT".

d^2E/dV^2 - V	The 2nd derivative of the titration curve for potential against volume. (With linear coordinate display) (not available out of loop)	Last titration function I All titration functions I Inactive

The parameter "d^2E/dV^2 – V" is only available for the titration type "GT".

BETA - V	Buffer capacity against volume (not available out of loop)	Last I All I No

The parameter "BETA – V" is only available for the titration type "GT".

E - t	Titration curve of the current sample. The potential is plotted versus the time. (Not available outside of loop)	Last titration function I All titration functions I Inactive

For KF methods, you can only select "Yes" or "No" for the parameter "E – t".

V - t	Titration curve of the current sample. The volume is plotted versus the time. (Not available outside of loop)	Last titration function I All titration functions I Inactive

For KF methods, you can only select "Yes" or "No" for the parameter "V – t".

H2O - t	Titration curve of the current sample. The water content is plotted against the time (not available out of loop).	Activ I Inactive

The parameter "H2O – t" is not available for the titration type "GT".

Drift - T	The titration curve "Drift" against "Time" (not available out of loop).	Activ I Inactive

The parameter "Drift-t" is not available for the titration type "GT".

H2O - T & Drift - T	Two overlaid titration curves "H_2O – t" and "Drift-t" of the current sample (not available out of loop).	Activ I Inactive

The parameter "H2O-t & Drift-t" is not available for the titration type "GT".

V - t & Drift - t	Two overlaid titration curves "V – t" and "Drift-t" of the current sample (not available out of loop).	Yes | No

The parameter "V-t & Drift-t" is not available for the titration type "GT".

dV/dt - t	The 1st Derivative of the titration curve volume against time" (not available out of loop).	Last titration function | All titration functions | Inactive

The parameter "dV/dt – t" is only available for the titration type "GT".

T - t	Titration curve of the current sample. The temperature is plotted versus the time. (Not available outside of loop)	Last titration function | All titration functions | Inactive

The parameter "T – t" is only available for the titration type "GT".

E - V & dE/dV - V	Two superposed titration curves **E - V** and **dE/dV - V** for the current sample. (Not available outside of loop)	Last titration function | All titration functions | Inactive

The parameter "E – V & dE/dV – V" is only available for the titration type "GT".

V - t & dV/dt - t	Two overlaid titration curves **V - t** and **dV/dt - t** of the current sample (not available out of loop).	Last titration function | All titration functions | Inactive
E-Log(c) - Curve	The overlaid E-log(c) curve for standard addition loops in GT methods.	Activ | Inactive
Calibration curve	The sensor unit of measurement is plotted against the measured values of all samples (not available within loop).	Activ | Inactive

The parameter "Calibration curve" is only available for the titration type "GT".

Method	Printout of the method used.	Activ | Inactive
Series data	All data from the series run.	Activ | Inactive
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ | Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

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7.4.46 Drift determination

You can use the "Drift determination" method function to record the drift after a specific wait time for Karl Fischer titration. This method function can be inserted both within the loop (per sample) and outside the loop (per series).

Note

The method function "Drift determination" applies only for methods of the type "Stromboli".

Parameters	Description	Values
Wait time	Here you can enter the time in [s] until the drift is to be recorded.	0…1000
Duration	You can enter the length of time in [min] for which the drift determination should last.	0 … 10
Interval	Defines the drift determination interval, i.e., after how many samples the drift determination will be performed. Appears only if the method function is used within a loop.	0 … 10

7.4.47 Homogenizer

There are two different homogenizer types: RS and TTL. The TTL Homogenizer can only be switched on for a defined period of time. For the RS Homogenizer, the speed can also be set in the method.

The method function **Homogenizer** applies only for Karl Fischer titrations when not using the Stromboli oven sample changer, and does not apply for the method type **External extraction**.

You can define the following parameters: First select the relevant homogenizer:

Parameters	Description	Values
Name	Select the type of homogenizer.	Homogenizer RS I Homogenizer TTL
Duration	Duration in [s].	1...10^4
Speed	Here you can enter the homogenizer speed in [%]. Only if **Homogenizer** = **Homogenizer RS**	25 ... 100
Condition	Logical condition that determines whether or not a method function is executed based on a result (true or false). A method function can be executed using a specified calculation formula (see the parameter **Formula**).	Activ I Inactive
Formula	Here you can enter a formula whose result (true or false) will determine the execution of the method function. The method function is only executed if the result is "True", and only for **Condition** = **Active**.	Mathematical calculation

See also

🗎 Evaluate and calculate ▸ Page 256

7.4.48 Standby

The "Standby" method function can only be inserted into Stromboli methods following the "End of sample" method function. This method function determines whether the method is terminated at the end of the series, or if the method remains active and then enters standby mode for the first loop. (This method function is only available for Karl Fischer titrations with the "Stromboli" titration stand.)

7.4.49 Hidden method functions

The following hidden functions exist for Karl Fischer methods: Pretitration and standby.

Following the start of a Karl Fischer method, a pretitration is performed. The titrator then switches to Standby mode. The system switches automatically between Standby and Pretitration. The switch criterion is the drift value.
If the pretitration lasts longer than 30 minutes, a system message is displayed informing you that the pretitration cannot be ended because the drift value is too high. You can end the pretitration, and then cancel the method or series or restart the pretitration.

8 Series Templates

You can use series templates to gather up to 303 individual samples to form a **sample series**. All samples in the series are analyzed one after the other with a defined method (analysis template for sequential processing of samples using the same method). In addition, for T9x you can gather multiple sample series (up to 20) to form a **series sequence** (analysis template for sequential processing of different sample series).

A **free sample series** (not available for KF methods) allows you to choose the method for executing the series when you actually launch the series template (unlike for normal sample series where the method is defined in the series template). The free sample series can then be used with multiple methods. You can store the sample series even though no methods were assigned.

Note

- You can create a shortcut on the Home screen for all series templates.
- A maximum of 60 sample series (sample series and free sample series) and 10 series sequences can be stored in the titrator. With the T9x you can save an additional 20 series sequences (maximum).
- Series are not possible for Karl Fischer concentration and blank value determinations (without Stromboli).

The list of series templates shows you all the series templates defined in the titrator. Each series template is listed in this list with its type (PS = sample series, FPS = free sample series, SSQ = series sequence) and its name.

If you select a series template from this list by clicking on it, you can change its parameters or delete the entire template.

You can choose **New** to create a new series template. The following parameters will be available:

Parameters	Description	Values
Type	The type of the serial template.	Sample series I Series sequence I Free sample series

*Series sequence: Only for T9x

You will be able to set various additional parameters depending on the type selected:

8.1 Sample Series

For the parameter **Type**, **Sample series** must be selected.

Parameters	Description	Values
Sample series ID	Here you can assign any ID to the sample series.	Arbitrary
Method ID	Here you can select the Method ID for the relevant method.	Method list
Comment	You can enter a brief comment about the series.	Arbitrary
Number of samples	Defines the number of samples to be analyzed. The number depends on the selected titration stand.	1…303
Number of standards	The number of standards to be analyzed with a method or series.	1…303
Continuous run	After each termination of the analysis (using series or methods) the analysis is automatically restarted (this is done until the process is canceled manually).	Activ I Inactive
Start position <name of the Titration stand>	Appears per method function **Titration stand** = **Rondo** or **InMotion**. Defines the starting position for the analysis of the series on the rack of the titration stand in question (x) **CP** means current position. Rondo only offers numbers in the range of 1…60.	1…60 I 1…303 I CP I CP+1 I CP+2

Note

- The parameters **Loop**, **Number of samples**, **Number of buffers**, **Number of standards** and **Start position** will repeat in accordance to the number of loops in the assigned method (max. 6 times for T9 and 14 for Stromboli methods)
- If you select a template of type **Stromboli TTL**, the parameters **Loop** and **No. of samples** are repeated according to the number of loops in the assigned method (maximum 14).

- During the creation of a sample series, you can use the button **Samples** to go to the loop list (if the assigned method includes more than one loop) or go directly to the sample list (if the assigned method only contains one loop). From the loop list, you can select a loop to go to the sample list for that loop.

8.2 Series Sequence (T9)

For the **Type** parameter, **Series sequence** must be selected.

Parameters	Description	Values
Series sequence ID	Here you can assign any ID to the series sequence.	Arbitrary
Comment	You can enter a brief comment about the series.	Arbitrary
Number of sample IDs	The number of sample series included in the series sequence.	2 … 20
1. Sample series	The name of the 1st Sample series	Sample series list
Workspace	The workspace in which the sample series or analysis is to be run. (In Workspaces A and B, tasks can be performed in parallel if they do not use the same resources. Tasks in each workspace will be performed one after the other.) The workspace must be defined for each sample series in the series sequence.	A I B

Note

- The parameters **Sample series** and **Workspace** are repeated according to the number of sample series defined under **No. of sample series**.
- A series sequence cannot be saved until at least two sample series have been assigned to it.

8.3 Free Sample Series

For the **Type** parameter, **Free sample series** must be selected.

Note

Free sample series are not available for standard additions

Parameters	Description	Values
Sample series ID	Here you can assign any ID to the sample series.	Arbitrary
Comment	You can enter a brief comment about the series.	Arbitrary
Number of samples	Defines the number of samples to be analyzed. The number depends on the selected titration stand.	1…303
Entry type	Defines whether the sample should be added with a defined mass, defined volume or defined number of pieces. The sample data query will then adjust according to the unit of measurement. **Fixed volume** or **Fixed pieces**: The sampling weight, sample volume or number of pieces will be entered as the parameter in this method function and will not be prompted when conducting the method.	Weight I Fixed weight I Volume I Fixed volume I Pieces I Fixed pieces
Continuous run	After each termination of the analysis (using series or methods) the analysis is automatically restarted (this is done until the process is canceled manually).	Activ I Inactive

At the start of a free sample series, you will only be able to select from among methods that are suitable for the series template. (For example, a method that uses a Rondolino sample changer as the titration stand can only be selected if the free sample series contains a maximum of nine samples.) The system will also only suggest methods whose entry type in the **Sample** method function matches the entry type of the free sample series (not for KF methods).

While creating a free sample series, you can choose **Samples** at any time to go directly to the sample list, because free sample series can only be created for methods with only one loop.

8.4 Sample or Standard Parameters

The sample list, which can be opened by choosing **Samples** in the series template, displays all samples of a loop with a number, the first ID, and the sample size (depending on entry type - see "[Method functions: Sample" ▶ Page 87]). You can also edit the samples here.

Note

Series IDs must be unique, although sample IDs do not have to be.

For titer loops, the standard name and the sample size are listed, and for calibration loops the name of the list of standards and the individual standards.

When you select an entry from the list, you can define the following parameters for each sample, depending on the type of the loop in question and on whether it is a template for a sample series or free sample series:

Series template: Sample series

Type of loop: Sample GT loop

Parameters	Description	Values
Number	Defines the number of the sample.	1…303
ID	A user-defined name for the ID of the sample, in accordance with the "Sample" method function.	Arbitrary
Sample size	You can enter the sample size here. For fixed entry types, this field only appears as an info field.	0…1000 [g] l [mL] 0…10^6 [pcs.]
Weight per piece	The weight in [g] per pirece. Appears only if **Entry type** = **Pieces** or **Fixed pieces** was selected.	0 … 1000
Density	The density of the sample for the entry types "Weight", "Fixed weight", "Volume" and "Fixed volume".	0.0001…100
Comment	You can enter a brief comment about the series.	Arbitrary
Sample factor 1…3	Defines the values for a sample factor. The name of this parameter depends on the name defined in the parameter **Name of sample factor** of the method function **Sample**.	0…10^6
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200

Note

For entering the sample parameters, particularly for numerous samples, the titrator provides you with assistance in the entry windows of the **ID 1** and **Sample size** parameters:

These extra icons are a quick, direct way to jump to the entry window of the previous sample or next sample.

You can also choose **Sample ID 1** and **Sample size** to switch directly between the entry windows for the sample parameters **ID 1** and **Sample size**.

Series template: Sample series

Type of loop: Titer loop

Parameters	Description	Values
Number	Defines the number of the sample.	1…303
Comment	You can enter a brief comment about the series.	Arbitrary
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200

Series template: Sample series

Type of loop: Calibration loop

Parameters	Description	Values
Number	Defines the number of the sample.	1…303
Comment	You can enter a brief comment about the series.	Arbitrary
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200

Series template: Sample series

Type of loop: Standard addition loop

Parameters	Description	Values
Number	Defines the number of the sample.	1…303
ID	A user-defined name for the ID of the sample, in accordance with the "Sample" method function.	Arbitrary
Sample size	You can enter the sample size here. For fixed entry types, this field only appears as an info field.	0…1000 [g] I [mL] 0…10^6 [pcs.]
ISA volume	Define the ISA volume added to the analysis beaker. For NA^+, the target concentration of the ISA is 0.5 M.	0...1000
Water volume	Define the volume of water added to dilute the analysis solution to achieve the needed ISA concentration in the analysis beaker. For Na^+, the typical ISA concentration is 0.5 M.	0...1000
Aliquot volume	Defines the volume of the aliquot taken from the dilution solution. The aliquot is added to the analysis beaker. Only if **Sampling** is set to **Aliquot incl. ISA** or **Aliquot excl. ISA**.	0.00000...1000 [mL]
Dilution volume	Defines the volume of the dilution solution in [mL]. Only if **Sampling** is set to **Aliquot incl. ISA** or **Aliquot excl. ISA**.	0.00000...1000
Weight per piece	The weight in [g] per pirece. Appears only if **Entry type** = **Pieces** or **Fixed pieces** was selected.	0 … 1000
Density	The density of the sample for the entry types "Weight", "Fixed weight", "Volume" and "Fixed volume".	0.0001…100
Comment	You can enter a brief comment about the series.	Arbitrary
Sample factor 1…3	Defines the values for a sample factor. The name of this parameter depends on the name defined in the parameter **Name of sample factor** of the method function **Sample**.	0…10^6
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200

Series template: Sample series

Type of loop: Karl Fischer loop

Parameters	Description	Values
Number	Defines the number of the sample.	1…303
ID	A user-defined name for the ID of the sample, in accordance with the "Sample" method function.	Arbitrary
Sample size	You can enter the sample size here. For fixed entry types, this field only appears as an info field.	0…1000 [g] I [mL] 0…10^6 [pcs.]

Density	The density of the sample for the entry types "Weight", "Fixed weight", "Volume" and "Fixed volume".	0.0001…100
Weight per piece	The weight in [g] per pirece. Appears only if **Entry type** = **Pieces** or **Fixed pieces** was selected.	0 … 1000
Solvent weight	Quantity of solvent in [g] in which the sample was extracted or dissolved. Only for method type = **Ext. Extr.**.	0…1000
Wt. extracted sample	Total weight of sample in [g] which was extracted or dissolved in the solvent. Only for method type = **Ext. Extr.**.	0…1000
Comment	You can enter a brief comment about the series.	Arbitrary
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200

Series template: Free sample series (only for single-sample loop methods)

Type of loop: Sample loop

Parameters	Description	Values
Number	Defines the number of the sample.	1…303
ID	A user-defined name for the ID of the sample, in accordance with the "Sample" method function.	Arbitrary
Sample size	You can enter the sample size here. For fixed entry types, this field only appears as an info field.	0…1000 [g] I [mL] 0…10^6 [pcs.]
Weight per piece	The weight in [g] per pirece. Appears only if **Entry type** = **Pieces** or **Fixed pieces** was selected.	0 … 1000
Density	The density of the sample for the entry types "Weight", "Fixed weight", "Volume" and "Fixed volume".	0.0001…100
Comment	You can enter a brief comment about the series.	Arbitrary
Correction factor	Any correction factor that can be used in calculations.	0.0001…10^6
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200

Note

When assigning a method at the start of the series template of a free sample series, the system ignores the following parameters (which are also defined in the **Sample** method function of the assigned method), and use the ones defined here. If no values are entered here for these parameters, the values saved in the **Sample** method function will be used.

- **ID 1**
- **Sample size**
- **Weight per piece**
- **Density**
- **Correction factor**
- **Sample factor 1…3**
- **Temperature**

See also

🗎 Sample ▸ Page 87

9 Results

The dialog **Results** can be accessed directly from **Home** using the relevant button.

Note

- In the T5 and T7, the system only saves the results from the last analysis (series or individual sample). In the T9 tap on **Select Series** to select the results from the last four analyses.
- On T5 and T7, when you start a new analysis, you will lose the results from the previous analysis.
- Ont T9, when you start a new analysis, you will lose the results from the fourth last analysis.
- You can see the results immediately after they are generated.

You can use the various buttons in the dialog **Results** to access different functions. Some examples are listed below.

- View all results of the last analysis (in the T9, these are the results of the last four individual samples or series).
- Add a supplementary result calculation both within the loop (for all samples in the analysis), and outside a loop (once for the entire analysis).
- Access results that are stored in the buffer (does not apply for Karl Fischer titration).
- View statistics, perform an outlier test and if necessary, exclude samples from the statistics.
- Perform recalculations for results in which certain raw data (e.g. sample sizes) have to be adapted retrospectively for a single sample or for all samples in a series.
- Perform a reevaluation for the method functions Titration (EQP) and Titration (2-phase) in which the criteria for identification and evaluation of the equivalence point are retrospectively adapted.
- View and print the status and the calculated results of each individual sample.

Results are retained until new results are generated by methods. The results of the "older" of the two sample series are replaced.
In KF methods, the function **End series** can be used to generate a new result entry during the execution of a method. After the series is finished, the original sample parameters are used, i.e. the changes made in the dialog **Start analysis** or later are not taken into account. A new series is entered in the results.

Note

- In Karl Fischer (KF) titrations, the results are divided into the three determination types **Sample type**, **Concentration**, and **Blank**. All options for managing results only have an effect on the determinations of one particular determination type.
- While an analysis is running, only the current determination type is available.

If a determination type (**Sample type**, **Concentration**, or **Blank**) is started for a second time, existing data are overwritten.

All the changes performed on the saved results can be reversed by tapping **Undo all**.

Note

- Changes to results are indicated by an asterisk in the record. Example: VEQ*.

9.1 All results

You can use the **All Results** button to view the results of the last analysis and print them if a printer is connected to the titrator (see "Printer").

From the **Results** dialog, you also have the following additional options:

- **New** Add an additional result
- **Samples** View or print the results of an individual sample or exclude the entire sample
- **Statistics** Switch to the "Statistics" dialog

See also

🗎 Description of method functions ▸ Page 87

9.2 Add result

Tap **Add result** to add a subsequent result calculation to your analysis results. To do that, you will first have to specify whether the calculation should be run inside or outside a loop. For calculations within a loop, the result will be added for all the samples (of the same loop) of a series. You may still be able to select the required loop. The other parameters must be entered in accordance with the method function **Calculate**.

Tap **Calculate** to calculate the additional result and add it to your analysis results. If you are missing raw data or raw results for the calculation and cannot calculate the result for that reason, the result **NaN** (not a number) will be added.

To view predefined result proposals for KF vol titration, tap **Results** > **Add result** > **Result proposals**.

See also

🗎 Result proposal lists ▸ Page 263
🗎 Description of method functions ▸ Page 87

9.3 Statistics

For results within a sample loop, you can display and print out statistics.

Note

- The statistics are only created if more than one sample was analyzed in the corresponding loop.
- If you selected "Statistics functionalities" = "Yes" and "Multiple determination" = "Yes" in the associated "Calculate" method function, the system will create the statistics for the entire series and also individually for multiple samples within the series.

The following calculated values will be displayed as statistical components:

- Mean value x `of a result` Rx (Mean [Rx])
- Standard deviation `s`
- Relative standard deviation `srel`
- Number of samples per loop `nTOT`

If a result was excluded from the statistics, all the results from that sample will always be excluded as well. The system will then recalculate the statistics without the excluded sample and label them accordingly. If the sample's results are then put back into the statistical evaluation, the label will be removed from the statistics.

From the **Statistics** dialog, you also have the following additional options:

- **Samples** View, print, or exclude the results of an individual sample
- **Results** View or print all results
- **Outlier test** Perform a test for outliers in the statistical evaluation.

9.3.1 Outlier test

If the results of individual samples in a measurement series deviate greatly from the calculated mean value, it may make sense to question the significance of these (few) results and treat them as "outliers".

Outliers will have the following effects on the overall result of an analysis:

- The mean value is significantly shifted higher or lower.
- The standard deviation is increased.
- The distribution of the individual values around the mean value is distorted and no longer follows a normal distribution.

The titrator has an automatic function for identifying and labeling outliers. You can call this function from the **Statistics dialog** using the "**Outlier test**" softkey.

Note

You can run an outlier test if you have the results from more than three samples.

The procedure used by the titrator is the Grubbs outlier test. For this procedure, the measured value [x*] that has the greatest deviation from the calculated mean value is analyzed.This number is used in the following equation, together with the mean value [$\bar{x}$] and the standard deviation [s]:

$$PG = \frac{|x^* - \bar{x}|}{s}$$

The test variable [PG] is then compared with the corresponding value in the Grubbs table G (N, 90%), which in turn depends on the number of measured values N:

N (number of samples)	1	2	3	4	5	6	7	8	9	10
90 %	-	-	1.15	1.46	1.67	1.82	1.94	2.03	2.11	2.18
N (number of samples)	11	12	13	14	15	16	17	18	19	20
90 %	2.23	2.29	2.33	2.37	2.41	2.44	2.48	2.5	2.53	2.56
N (number of samples)	21	22	23	24	25	26	27	28	29	30
90 %	2.58	2.6	2.61	2.63	2.65	2.67	2.69	2.7	2.72	2.74
N (number of samples)	31	32	33	34	35	36	37	38	39	40
90 %	2.75	2.77	2.78	2.79	2.81	2.82	2.83	2.84	2.86	2.87
N (number of samples)	41	42	43	44	45	46	47	48	49	50
90 %	2.88	2.89	2.9	2.91	2.92	2.92	2.93	2.94	2.95	2.96
N (number of samples)	51	52	53	54	55	56	57	58	59	60
90 %	2.97	2.97	2.98	2.99	3	3	3.01	3.02	3.02	3.03
N (number of samples)	61	62	63	64	65	66	67	68	69	70
90 %	3.03	3.04	3.04	3.05	3.05	3.06	3.06	3.07	3.07	3.08
N (number of samples)	71	72	73	74	75	76	77	78	79	80
90 %	3.08	3.08	3.09	3.09	3.1	3.1	3.11	3.11	3.12	3.12
N (number of samples)	81	82	83	84	85	86	87	88	89	90
90 %	3.12	3.13	3.13	3.14	3.14	3.15	3.15	3.16	3.16	3.17
N (number of samples)	91	92	93	94	95	96	97	98	99	100
90 %	3.17	3.17	3.18	3.18	3.19	3.19	3.2	3.2	3.21	3.21
N (number of samples)	101	102	103	104	105	106	107	108	109	110
90 %	3.21	3.22	3.22	3.22	3.23	3.23	3.23	3.23	3.24	3.24
N (number of samples)	111	112	113	114	115	116	117	118	119	120
90 %	3.24	3.22	3.25	3.25	3.26	3.26	3.26	3.26	3.27	3.27

If the calculated test variable PG is greater than the corresponding value taken from the table, the measured value x* is identified as an outlier and marked accordingly.
After an outlier has been identified, the test is repeated with the remaining measured values (without the already identified outlier) using the newly calculated mean value and new standard deviation. This process is repeated continually until no further outlier can be identified.
It is then the user's responsibility to exclude any identified outliers from the statistics. After confirmation, the entire sample is excluded and the statistics are recalculated without the identified and excluded outliers.

9.4 Recalculate

The function **Recalculate** lets you subsequently recalculate existing results from one sample or from an entire series. On the basis of this new calculation, specific sample data can be subsequently changed or a new formula can be entered.
For example, the sample size or the correction factor can be adjusted, if these values were erroneously entered incorrectly in the method or in the method start.

A recalculation can be performed for:

- Samples or determinations within a sample or titer loop, and for all concentration or blank determinations.
- An individual GT sample (of the type sample or titer) or a Karl Fischer (KF) determination (sample, blank or concentration).

Note

- New raw data cannot be generated, therefore changes can only be made to existing data.
- If you change data in the function **Recalculate**, all the calculations that depend on that data (both directly and indirectly), inside and outside loops, are rerun and labeled accordingly.
  For Karl Fischer titrations, these calculations refer only to the current determination type. The original raw results are not deleted.
- The maximum number of results that can be recalculated within a method depends on the maximum number of results that can be generated within a method using the method function **Calculate**. The total of the generated results and recalculated results may not exceed this maximum number.

The following sample data can be subsequently changed:

For titrations of type GT

Changeable parameters	Can be changed in recalculations					
	Individual sample of type			All samples of loop type		
	Sample	Titer	Standard Addition	Sample	Titer	Standard Addition
Sample size	Yes**	-	Yes	Yes*	--	Yes
Standard size	-	Yes**	-	-	Yes*	-
Density	Yes	-	Yes	Yes	--	Yes
Weight per piece	-	-	-	Yes	--	-
Correction factor	Yes	Yes	Yes	Yes	Yes	Yes
Sample factor sf 1… 3	Yes	-	Yes	Yes	-	Yes
Purity	-	-	-	-	Yes	-
Stand. concentration	-	-	-	-	Yes	-
Standard density	-	Yes	-	-	Yes	-
Water volume	-	-	Yes	-	-	-
ISA volume	-	-	Yes	-	-	-
Dilution volume	-	-	Yes	-	-	-
Aliquot volume	-	-	Yes	-	-	-

For titrations of type KF

Changeable parameters	Can be changed in recalculations					
	Individual determination of type			All determinations of loop type		
	Sample	Blank	Concen-tration	Sample	Blank	Concen-tration
Sample size	Yes**	Yes**	-	Yes*	Yes*	-
Standard size	-	-	Yes**	-	-	Yes*
Density	Yes	Yes	-	Yes	Yes	-
Weight per piece	-	-	-	Yes	-	Yes
Correction factor	Yes	-	-	Yes	-	-
Water content	-	-		-	-	Yes
Standard density	-	-	Yes	-	-	Yes

* Only for **Entry type** = Fix

** Only for **Entry type** = Variable

9.5 Samples

You can use the **Samples** button to display and print the status and calculated results for each individual sample. The same applies for a series of additional data sets that can be accessed via "**Data**". This will let you view and print the sample, method and resource data for each sample and view and print the raw results and the measured values.

You can use the **Exclude** button in the Results: **Samples** dialog to exclude individual samples from the statistical evaluation. The system will not delete the results of the samples excluded in this way but merely label them as excluded. They will no longer be included in the statistics. Samples that have been excluded can be returned to the statistics at any time by choosing "**Include**".

After a sample is excluded, all affected calculations (inside and outside of loops) are performed again. In KF titrations, the new calculations refer only to the current determination type.

Note

If you exclude a sample from a sample group in a multiple determination, no more statistics will be generated for that group. The system will continue to create individual statistics for the remaining sample groups and for all the remaining samples overall.

9.6 Reevaluate

This function is only available if a method function **Titration (EQP)**, **Titration (Therm.)** or **Titration (2-phase)** is included in the method. This function lets you make subsequent adjustments to the Recognition and evaluation criteria for an equivalence point and thus run a new evaluation of the measurement data.

If the method contains multiple titration functions, select the one whose recognition criteria you want to adjust. You can run a reevaluation for all the samples of a loop or for one specific sample in a loop.

You can adjust the following parameters in the subfunction **Evaluation and Recognition**:

- **Procedure** (only for **Titration (EQP)** and **Titration (2-phase)**)
- **Threshold**
- **Add. EQP criteria**
- **Tendency**
- **Recognition**
  - **Lower limit**
  - **Upper limit**

Note

The reevaluation is only run for the selected sample (or samples) and the selected method function. All calculations affected directly or indirectly, inside or outside loops, will be rerun and the results obtained will be labeled.

- For the titrator model T9: Logical conditions (**Condition**) that determines whether or not a method function is executed are ignored when recalculating any results.

9.7 Undo all

If you make changes to the results saved by the titrator after the analysis, you can use **Undo all** to discard them. Afterward, the system will reinstate the initial status directly after the conclusion of the analysis, in its original and unchanged state.

9.8 Delete all results

You can use this button to delete all the data (raw data, raw results, and results) saved by the titrator in the results range.

For Karl Fischer (KF) titrations, the deletion only affects one determination type. If the last determination type in a KF sample series is deleted, the whole KF sample series is automatically deleted.

9.9 Access to buffer

The results of a method can be stored in the buffer of the titrator and then reused. Results are stored in the buffer using the "Calculation" method function and the "Send to buffer" parameter (see "[Parameters of method functions ▸ Page 87]"). Results stored in the buffer may be accessed both from inside and outside a loop.

These results are assigned a unique method ID, allowing them to be reused for other calculations. They can be accessed using the method of your choice, for example via `Rx = Ry[method ID]`.

If, while an analysis is running, a method is waiting for a result with a corresponding method ID, the analysis process is interrupted until the relevant result is generated and present in the buffer.

Note

- An analysis which is in this waiting state can only be ended using **Reset** or **Stop**. It is not possible to proceed without a result.
- Once the titrator has been restarted the buffer is empty. (Recalculation is only possible using older, internally stored analysis data, (see "[Recalculation ▶ Page 175]").
- Implicit sample indexing ensures that the "Calculation" method for sample x only accesses results for sample x.

10 Setup

This section tells you how to set up the titrator in accordance with your requirements so that you can carry out titration.

Expired resources

Navigation: **Home** > **Setup**

Resources for which monitoring was selected in the settings can expire. Tap **Expired resources** to open an overview of all expired resources with the type, name and date of expiry of the respective resource.

See also

🗎 Monitoring the life span of a resource ▸ Page 65
🗎 Monitoring the usable life of a resource ▸ Page 64

10.1 Chemicals

Navigation: **Home** > **Setup** > **Chemicals**

In Chemicals, configure and manage the titrant, auxiliary reagents, concentration/titer standard, and other substances. You can view and print out lists of chemicals that have already been defined. You can also specify new chemicals or delete created chemicals.

Auxiliary reagents must be assigned to a pump with which they can be added. Titrants (independently of the type) must each be assigned to a drive.

Settings	Explanation
Titrants	Titrants are managed together with burettes and burette drive.
Auxiliary reagent	Auxiliary reagents are liquid chemicals that can be used to aid the titration process.
Calibration standards	Calibration standards are used for the calibration of sensors.
Concentration and titer standards	The titer standards required to determine the titer for the titrant used can be stored and managed.
Substances	Any chemical substances that are required for performing your analyses can be managed using name, empirical formula, molecular weight, and equivalent number.

10.1.1 Titrants

Navigation: **Home** > **Setup** > **Chemicals** > **Titrants**

Titrants are managed together with burettes and burette drive (PnP with chip and traditional burettes without chips).
For classical burettes, the relevant titrant data is entered manually. For PnP (Plug&Play) burettes, the data is automatically read from the chip and automatically transferred to the instrument. If the chip is still blank, the data must be entered in **Setup** or assigned to a titrant. The data is saved in both the titrator and in the chip.

Add a titrant

1 In **Titrants** choose **New**.
2 To read data from a SmartChemical Tag, tap **More** and then **Read SmartChemical**.
3 Place the container over the SmartSample reader.
 ⇨ The titrator reads the data.
 ⇨ The **Parameters** window opens.
4 Check the parameter settings and if needed, adjust them.
5 Tap **Save**.

Parameters	Description	Values
Type	The type of titrant. You can select from the following types of titrant: **General titration**: Classical titrants for general titration. **Auxiliary reagent**: If you are adding reagents manually using a burette. **Karl Fischer titration**: Karl Fischer titrant. **Standard Addition**: For adding standards using a burette.	General titration I Auxiliary reagent I Karl Fischer titration I Standard Addition
Name	Specify a descriptive name of your choice.	Arbitrary
Concentration	The concentration of the titrant, in [mol/L]. For **Type** = **General titration**.	0.00001…100
	The non-dimensional concentration of an auxiliary reagent. For Type = Auxiliary reagent.	0.00001…10^4
	The concentration of the titrant in [mg/L] For Type = Standard Addition.	0.00001...40'000
Titer	The titer for the titrant. For **Type** = **General titration**, **Standard Addition**	0.00001…10
Reagent type	Defines the type of Karl Fischer titrant used in the titration.	1-comp I 2-comp
Nominal conc.	Specified concentration of the Karl Fischer titrant in [mg/mL].	0.1…100
Current conc.	Actual concentration of the Karl Fischer titrant in [mg/mL].	0.1…100
Monitoring usable life	Specifies whether the usable life of a resource or a value is to be monitored.	Activ I Inactive
Monitoring life span	Specifies whether the life span of the resource is to be monitored.	Activ I Inactive
Shelf life	Defines the expiration date of the chemical as given by the supplier.	Date
Lot/Batch	The lot or batch of the reagent. Enter any designation.	Arbitrary
Fill rate	The filling rate of the burette in percent. 100% stands for maximum filling rate.	30…100
Burette volume	Select the burette volume in [mL].	1 I 5 I 10 I 20
Drive	Defines the drive on which you will use the burette containing the titrant. Select the "PnP" entry for available but unused PnP burettes.	1…8 I PnP
Serial number	The serial number of the relevant device type.	Arbitrary

Note

- Titrants (independently of the type) must each be assigned to a drive.
- A maximum of 100 titrants can be defined in the instrument.
- In PnP burettes, the serial number is entered automatically. This can, however, be changed.

See also

🗎 Monitoring the usable life of a resource ▸ Page 64
🗎 Titration (KF Vol) ▸ Page 133
🗎 Monitoring the life span of a resource ▸ Page 65

10.1.2 Auxiliary reagents

Navigation: **Home** > **Setup** > **Chemicals** > **Auxiliary reagents**

Auxiliary reagents are liquid chemicals that can be used to aid the titration process. Auxiliary reagents must be added using a pump and can be used via the method functions **Pumps** and **Rinse**.

Adding an auxiliary reagent

– In **Auxiliary reagents** choose [**New**].
⇨ The windows to edit the parameters opens.

Define the following parameters for each auxiliary reagent here:

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Pump	Use this setting to select a pump.	List of available pumps

Note

- Auxiliary reagents must be assigned to a pump with which they can be added.
- A maximum of 50 auxiliary reagents can be defined in the instrument.

10.1.3 Calibration standards

Navigation: **Home** > **Setup** > **Chemicals** > **Calibration standards**

Calibration standards are used for the calibration of sensors. The instrument contains various calibration standard lists for the calibration of pH sensors (pH buffer lists), ISE sensors (ISE standard lists) and conductivity sensors (conductivity standard lists) (see Appendix). In this dialog, you can view and print the predefined lists stored in the titrator, and create additional user-defined calibration standard lists for pH buffers and ISE and conductivity standards.

Adding a user-defined calibration standard lists

1 In **Calibration standards**, choose [**New**].
   ⇨ The windows to edit the parameters opens.
2 Edit the parameters and save the settings.

⇨ After you have created a calibration standard list, you can add various buffers and standards to this list, depending on the type selected.

Parameters	Description	Values
Type	Select the corresponding type for the new calibration standard list.	pH I Auto pH I ISE I Conductivity
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	The unit of measure to be used will depend on the type selected.	pH I pM I pX I ppm I mS/cm I µS/cm
Base list	Add the calibration standard lists of various pH buffers by selecting them from the list. Only for **Type** = **Auto pH**.	List of available calibration standards
Ref. temperature	Define the reference temperature of the buffer.	-20…200

Note

- To delete a user-defined calibration standard list from the titrator, you must first access the parameters in the list via [**Info**]. From this dialog, you can delete the calibration standard list from the titrator memory by selecting [**Delete**].
- A maximum of 20 user-defined calibration standard lists and 10 auto pH buffer lists can be defined in the titrator.

Adding a pH Calibration Standard (pH Buffer)

▪ After creating a calibration standard list of the type **pH**, add various pH buffers to it.

1 Add various pH buffers by choosing [**New**].
2 Enter the respective pH value of the buffer, based on the reference temperature from the calibration standard list and tap [**OK**].
   ⇨ To reflect the temperature influence of a pH buffer, enter a maximum of 20 value pairs for each individual buffer composed of the temperature and corresponding pH value.
3 Choose a buffer and add various values by choosing [**New**].
4 Enter the respective pH value of the buffer, based on the reference temperature from the calibration standard list.
5 Save the list by tapping [**Save**].

Adding a pH Calibration Standard (pH buffer) of type Auto pH

- For a calibration standard list of the type **Auto pH**, the various pH buffers are detected by the titrator automatically. In order to ensure positive identification, the pH values of the individual solutions must differ from each other by at least two units.

1 Add various pH buffers to the calibration standard list by choosing [**Add**] and selecting them from the specified list.

2 Save the list by tapping [**Save**].

⇨ By doing so, the titrator offers only suitable pH buffers in order to ensure that the selected pH buffers always differ from each other by at least two pH points.

Note

- The temperature dependency of the individual pH buffers is also taken from the base list and cannot be edited, only viewed.

Adding an ISE Calibration Standard (ISE Standard)

- After creating a calibration standard list of the type **ISE**, you can add various ISE standards to it.

1 Add various ISE standards to it by choosing [**New**].

2 Enter the corresponding value for the standard in the desired unit of measure, based on the reference temperature from the calibration standard list and tap [**OK**].

   ⇨ To reflect the temperature influence of an ISE standard, enter a maximum of 20 value pairs for each individual standard composed of the temperature and corresponding standard value.

3 Choose a buffer and add various values by choosing [**New**].

4 Save the list by tapping [**Save**].

Adding a Conductivity Calibration Standard (Conductivity Standard)

- After creating a calibration standard list of the type **Conductivity**, add various conductivity standards to it.

1 Add various conductivity standards to it by choosing [**New**].

2 Enter the conductivity for each standard based on the reference temperature from the calibration standard list and tap [**OK**].

   ⇨ To reflect the temperature influence of a conductivity standard, enter a maximum of 20 value pairs for each individual standard composed of the temperature and corresponding conductivity value.

3 Choose a buffer and add various values by choosing [**New**].

4 Save the list by tapping [**Save**].

10.1.4 Concentration and titer standards

Navigation: **Home** > **Setup** > **Chemicals** > **Concentration and titer standards**

Enter and manage the titer and concentration standards required for titer determinations and the Karl Fischer water standards for the concentration determination of KF titrants.

Add a standard

1 In **Concentration and titer standards**, choose **New**.

2 To read data from a SmartChemical Tag, tap **Read SmartChemical**.

3 Place the container over the SmartSample reader.

   ⇨ The titrator reads the data.

   ⇨ The **Parameters** window opens.

4 Check the parameter settings and if needed, adjust them.

5 Tap **Save**.

Parameters	Description	Values
Type	Defines the type of standard.	solid I liquid I KF
Name	Specify a descriptive name of your choice.	Arbitrary
Purity	The purity of a solid standard, in percent. Only for **Type** = **solid**.	0.001…100.000

Concentration	The concentration of a liquid standard, in [mol/L]. Only for **Type** = **liquid**.	0.00001…100
Water content	The water content of a Karl Fischer standard.	0.00001…10^6
Unit	Unit for the water content of the Karl Fischer standard.	mg/g I mg/mL I % I ppm I mg/piece
M	The molar mass of a solid standard, in [g/mol].	10^{-5}…10^3
Density	The density of a liquid standard, in [g/mL]. Only for **Type** = **liquid** or **KF**.	0.0001…100
Equivalent number	The equivalent number "z" of the standard	1…9
Lot/Batch	The lot or batch of the reagent. Enter any designation.	Arbitrary
Container ID	Defines the ID of the container that contains the chemical.	1…30 characters
Article number	Defines the article number of the chemical.	1…30 characters
Supplier	Defines the name of the company that supplied the chemical.	1…30 characters
Monitoring usable life	Specifies whether the usable life of a resource or a value is to be monitored.	Activ I Inactive
Shelf life	Defines the expiration date of the chemical as given by the supplier.	Date

Note

- All fields except for **Lot/Batch** must be filled before the standard can be saved.
- A maximum of 50 titer standards can be defined.

See also

🗎 Monitoring the usable life of a resource ▸ Page 64

10.1.5 Substances

Navigation: **Home** > **Setup** > **Chemicals** > **Substances**

Any chemical substances that are required for performing your analyses can be managed using name, empirical formula, molecular weight, and equivalent number.

Adding a substance

– In **Substances** choose [**New**].

⇨ The windows to edit the parameters opens.

Define the following parameters:

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Empirical formula	Defines the empirical formula of the substance.	Arbitrary
Molecular weight	Defines the molecular weight of the substance.	0.0001…10^4
Equivalent number	The equivalent number "z" of the standard	1…9

Note

- A maximum of 100 substances can be defined.

10.2 Hardware

In **Hardware**, configure all the hardware components connected to the titrator.

Navigation: **Home** > **Setup** > **Hardware**

Settings	Description
Sensors	Configure and manage sensors to be used with the titrator.
Pumps	Configure a maximum of 20 pumps for use with the titrator.

Settings	Description
Peripherals	Peripherals encompasses all input and output devices that belong to the titrator environment.
Titration Stands	Configure the titration stands connected to the titrator.
Auxiliary Instruments	Auxiliary instruments can be any instruments that access a titrator's TTL or 24 V output, stirrer or RS-232 connection and that are to be used in a method.
Homogenizer	Lists the available homogenizers according to their control type.
Liquid Handlers	Specify the setup parameters, for example to assign the ports to the related connections.

10.2.1 Sensors

Navigation: Home > Setup > Hardware > Sensors

You can configure and manage sensors to be used with the titrator as well as change settings already stored in the titrator. The settings for an individual sensor can also be output to a printer. In addition, the corresponding method for sensor calibration can be accessed from here.

Note

- A maximum of 50 sensors can be defined in the device.
- Each sensor is associated with a specific type. Each sensor type can deliver measured values in one or more units of measure. The following table provides information regarding which units of measure can be selected for a corresponding sensor type:

Sensor type	Default unit of measure	Eligible units of measure
mV[1)]	mV	mV
pH[1)]	pH	pH I mV
ISE	pM	pM / pX I ppm I mV
Phototrode	%T	%T I A I mV
Polarized	mV	mV I µA
Temperature	°C	°C I K I °F
Thermometric	°C	°C I K I °F
Conductivity	µS/cm	µS/cm I mS/cm I µS I mS

[1)]Plug and Play sensors (PnP) are available for pH or mV measurements.

- Changing the unit of measurement for a sensor may render the calibration parameters and expiration date parameters meaningless and result in their subsequent omission. This may also mean that the calibration parameters are recalculated by the titrator (for temperature sensors), or that another set of calibration parameters is displayed (for ISE sensors).

Monitoring usable life and life span of a sensor

Depending on the sensor type, you can monitor the life span and the usable life of the sensor. For a description of the parameters see [Monitoring the expiry date and life span of Resources ▸ Page 64].

Sensor type	Usable life	Life span
mV	--	•
pH	•	•
ISE	•	•
Phototrode	•	•
Polarized	--	•
Temperature **Thermometric**	•	•
Conductivity	•	•

Adding a sensor

– In **Sensors** choose [**New**].

⇨ The windows to edit the parameters opens.

Plug and Play sensors (PnP)

- If a PnP sensor is connected to the sensor input, this automatically generates an entry in the setup. All information (sensor name, type or inputs) is updated by the titrator (if a PnP sensor is not connected, the entry "PnP" appears for the sensor input).
- The setup may contain several PnP sensors with identical sensor IDs but with different sensor input information. When the analysis starts, a validation is carried out during which the user is prompted to remove a sensor. For several PnP sensors with the same ID, all entries apart from one are deleted when the sensors are removed.

The following settings are available for configuring a sensor depending on the sensor type selected:

Sensor type: mV

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	Defines the unit of measure that is used for the measurement.	mV
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary

Sensor type: pH

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	Defines the unit of measure used for the measurement.	List of available units
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary
Calibration	Determines the calibration type. Displayed if **Unit** is set to **pH**.	Linear I Segmented
Zero point	The pH value where the sensor reads 0.0 mV.	-100…100
Slope (TCalib)	The slope of the sensor at the calibration temperature in [mV/pH].	-100…100
Slope (25.0°C)	Defines the slope of the sensor at 25.0 °C in [mV/pH]. The slope is calculated based on the value of **Slope (TCalib)** and **Calib. temperature**.	-100…100
Slope	Defines the slope of the sensor in [%].	-200.0…200.0
Number of segments	Defines the number of segments for a segmented calibration.	2…8
Zero point 1…8	Defines the zero point for the specified segment.	-100.0…100.0
Slope (TCalib) 1…8	Defines the slope of the segment at the calibration temperature in [mV/pH].	-100…100
Slope (25.0°C) 1…8	The slope of the segment at 25.0 C in [mV/pH]. The slope is calculated based on the segment's value of **Slope (TCalib)** and **Calib. temperature**.	-100…100
Slope 1…8	Defines the slope of the segment in [%].	-200.0…200.0
Seg. limit 1,2…7,8	Defines the boundary between the two segments in [pH].	-100.0…100.0
Internal temperature sensor	Select this option if the sensor has an internal temperature sensor. In this case the system will automatically make an entry in the sensor setup for the internal temperature sensor.	Activ I Inactive
Calib. temperature	Defines the temperature at which the calibration was performed.	-20…200
Calibration method	Shows the method of the last change to the calibration values. **Manual**: The calibration values were entered or changed manually in the sensor setup. **Name of calibration method**: The calibration values were change by a calibration method.	Manual I Name of calibration method

Date / Time	Shows date and time of the last change to the calibration values, regardless of whether the values are changed manually, automatically, or with the calibration method.	
Performed by	Shows which user was logged in when the calibration value was determined or changed.	User name

Note

- The parameters zero point, slope and the corresponding calibration temperature are required to convert the mV signal of the sensor to the selected unit. These appear only for the unit [pH].

Sensor type: Phototrode

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I %T I A
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary
Wavelength	The Phototrode DP5 features a selection of 5 fixed wavelengths in [nm].	520 I 555 I 590 I 620 I 660
Zero point	The percentage of transmittance where the sensor reads 0.0 mV.	-100 … 100
Slope	The slope of the phototrode in [mV/%T].	-100…100
Calib. temperature	Defines the temperature at which the calibration was performed.	-20…200
Calibration method	Shows the method of the last change to the calibration values. **Manual**: The calibration values were entered or changed manually in the sensor setup.	Manual
Date / Time	Shows date and time of the last change to the calibration values, regardless of whether the values are changed manually, automatically, or with the calibration method.	
Performed by	Shows which user was logged in when the calibration value was determined or changed.	User name

Note

- The parameter **Calib. temperature** cannot be edited for segmented calibration; in this case, the system displays an information field.

Sensor type: Polarized

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I µA
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary

Sensor type: Temperature or Thermometric

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	°C I K I °F
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary
Zero point	The adjusted point from the theoretical value for reading 0.0 °C.	-20 … 200 [°C] -4.0 … 392 [°F] 253.2 … 473.2 [K]

Calibration method	Shows the method of the last change to the calibration values. **Manual**: The calibration values were entered or changed manually in the sensor setup. **Name of calibration method**: The calibration values were change by a calibration method.	Manual I Name of calibration method
Date / Time	Shows date and time of the last change to the calibration values, regardless of whether the values are changed manually, automatically, or with the calibration method.	
Performed by	Shows which user was logged in when the calibration value was determined or changed.	User name

Sensor type: Conductivity

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	µS/cm I mS/cm I µS I mS
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary
Internal temperature sensor	Select this option if the sensor has an internal temperature sensor. In this case the system will automatically make an entry in the sensor setup for the internal temperature sensor.	Activ I Inactive
T compensation	For the temperature compensation, the titrator converts the conductivity to a defined reference temperature. **Linear**: The conductivity is linearly converted to a reference temperature. The linearity is described by the temperature coefficient [%/°C]. **Non linear**: The conductivity is converted to a reference temperature non-linearly, in accordance with the EN norm 27 888. **Inactive**: The conductivity is determined without temperature compensation. Only appears for **Unit** = **µS/cm** or **mS/cm**.	Linear I Non linear I Inactive
T coefficient	The temperature coefficient in [%/°C] defines the percentage of the change in conductivity for linear temperature compensation for a temperature increase of 1°C. Appears for **T compensation** = **Linear** only.	0.001…100
Ref. temperature	The reference temperature in [°C] for the temperature compensation. Appears for **T compensation** = **Linear** or **Non linear** only.	25.0 I 20.0
Cell constant	The cell constant in [1/cm] can be entered here. The cell constant is required for conversion of the measured sensor conductance value [mS I µS] into the conductivity [mS/cm I µS/cm]. The temperature compensation only affects the conductivity, not the conductance. Only appears for **Unit** = **µS/cm** or **mS/cm**.	0…100
Calib. temperature	Defines the temperature at which the calibration was performed.	-20…200
Calibration method	Shows the method of the last change to the calibration values. **Manual**: The calibration values were entered or changed manually in the sensor setup. **Name of calibration method**: The calibration values were change by a calibration method.	Manual I Name of calibration method
Date / Time	Shows date and time of the last change to the calibration values, regardless of whether the values are changed manually, automatically, or with the calibration method.	
Performed by	Shows which user was logged in when the calibration value was determined or changed.	User name

Note

- The temperature compensation is only performed for the units µS/cm and mS/cm (conductivity). Temperature compensation is not conducted for units of measure µS and mS (conductance).
- The parameter **Calib. temperature** is required during the calibration to determine the temperature-dependent conductivity of conductivity standards.
  (Only appears for **Unit** = **µS/cm** or **mS/cm**.)

Sensor type: ISE

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Ion charge	Shows the ion charge for the selected ISE sensor.	Arbitrary
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	pM I pX I ppm
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Serial number	The serial number of the relevant device type.	Arbitrary
Calibration	Determines the calibration type. Not displayed if **Unit** is set to **mV**.	Linear I Segmented
Zero point	The pM or pX value where the sensor reads 0.0 mV.	-100…100
Slope (TCalib)	The slope of the sensor at the calibration temperature in [mV/pX] or [mV/pM].	-100…100
Slope (25.0°C)	Defines the slope of the sensor at 25.0 °C in [mV/pX] or [mv/pM]. The slope is calculated based on the value of **Slope (TCalib)** and **Calib. temperature**.	-100…100
Number of segments	Defines the number of segments for a segmented calibration.	2…8
Zero point 1…8	Defines the zero point for the specified segment.	-100.0…100.0
Slope (TCalib) 1…8	Defines the slope of the segment at the calibration temperature in in [mV/pX] or [mv/pM].	-100…100
Slope (25.0°C) 1…8	The slope of the segment at 25.0 C in in [mV/pX] or [mv/pM]. The slope is calculated based on the segment's value of **Slope (TCalib)** and **Calib. temperature**.	-100…100
Seg. limit 1,2…7,8	Defines the boundary between the two segments in the selected unit.	For pM or pX: -100.0…100.0 For ppm: 0…1,000,000
Calib. temperature	Defines the temperature at which the calibration was performed.	-20…200
Calibration method	Shows the method of the last change to the calibration values. **Manual**: The calibration values were entered or changed manually in the sensor setup. **Name of calibration method**: The calibration values were change by a calibration method.	Manual I Name of calibration method
Date / Time	Shows date and time of the last change to the calibration values, regardless of whether the values are changed manually, automatically, or with the calibration method.	
Performed by	Shows which user was logged in when the calibration value was determined or changed.	User name

Note

- For ISE sensors there are two independent calibration sets, one for the units "pM" or "pX" and one for the unit "ppm".
- When calibrating an ISE sensor in ppm units, the sensor's slope and zero point are specified in pX or pM units.

10.2.1.1 Sensor calibration and sensor test

Navigation: **Home** > **Setup** > **Hardware** > **Sensors**

pH, ISE, temperature and conductivity sensors can all be calibrated with the titrator. The phototrode can only be manually calibrated. To do this the relationship between sensor signal and transmission capacity must be determined and the calibration parameter to be determined (normally only the gradient from a single point calibration) must be entered "manually" in the selected phototrode.

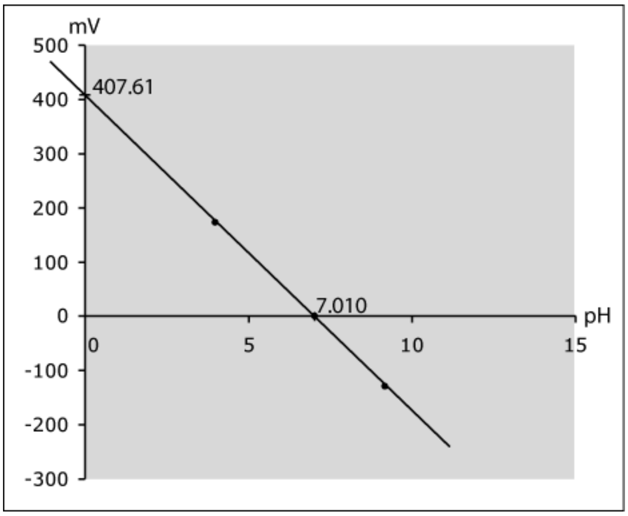
Temperature sensors are calibrated with the temperature standard "freezing water" (0°C). For conductivity sensors, you can choose the desired standard for the calibration from a standards list. Here a single point calibration is performed to determine the cell constant.

Two calibration modes are available for the calibrating pH and ISE sensors that can be selected. Linear calibration and segmented calibration.

If you want to calibrate a sensor with the titrator, you can either directly start an appropriate calibration method or specifically for pH sensors use [**Calibration/Sensor test**] in the sensor setup.

10.2.1.1.1 Linear calibration

Linear calibration is explained below taking the example of pH sensor.



In linear calibration the 1st step is the capture of measurement data and the interpolation of the pH values with the buffer table to the effective values (the values used are only provided as an example):

	Selected buffer solutions	During the calibration of the recorded temperature	mV values measured during calibration	pH (effective) by interpolation according to the pH buffer table
1st Buffer	4.01 (at 25°C)	17 °C	172 mV	4.00
2nd Buffer	7.00 (at 25°C)	22 °C	0 mV	7.012
3rd Buffer	9.21 (at 25°C)	27 °C	-129 mV	9.19

In a second step, the mV measured values are converted to the averaged temperature "$T_{Average}$" (17°C+22°C +27°C) / 3 = 22°C):

	Selected buffer solutions	mV values measured during calibration	Temperature-corrected measured values for TMean = 22°C
1st Buffer	4.01 (at 25°C)	172 mV	174.96 mV
2nd Buffer	7.00 (at 25°C)	0 mV	0 mV
3rd Buffer	9.21 (at 25°C)	-129 mV	-126.85 mV

In the third stage, the gradient (T_{Mean}) and the mV value at pH 0 are determined by linear regression with the value pairs from mV (T_{Mean}) and pH (effective). The zero value is found from the mV value at pH 0, divided by the gradient (TMean):

- Slope (TMean) = -58.15
- mV value at pH 0 = 407.61 mV

- Zero point [pH]= mV value at 0 pH/Slope (TMean) = 7.010 [pH]

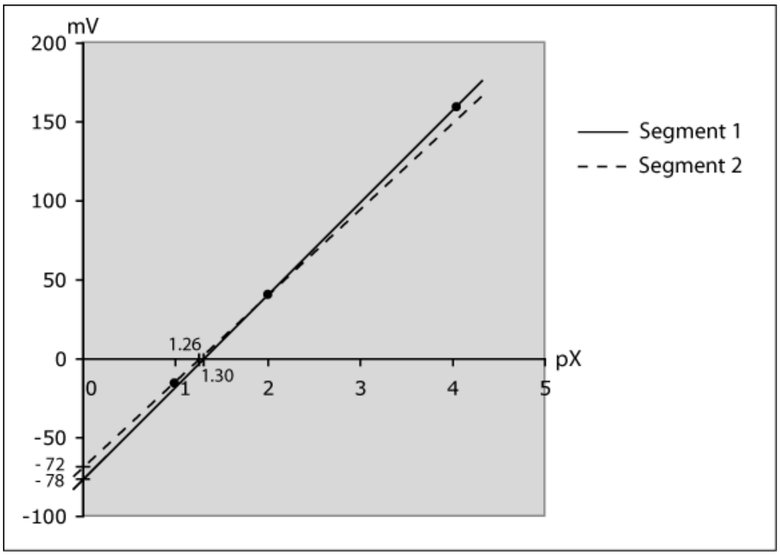
Lastly, the slope at (T_{Mean}) is back-calculated to the slope at (25°C).

- Slope (25°C) = -58.74 (=99.3% of the theoretical value)

10.2.1.1.2 Segmented calibration

With segmented calibration, no linear regression is performed across all measured points; instead, line segments that connect the individual calibration points are used. In this way allowance can be made for a non-linear performance of the sensor over a larger measurement range. For n standard solutions, (n-1) segments are evaluated.

The segmented calibration is explained below taking the example of an ISE sensor (F-).



Just as in the case of linear segmentation initially the readings are recorded:

	During the calibration of the recorded temperature	Standard value (pX) at measuring temperature	mV values measured during calibration
Standard 1	25 °C	4.00 (at 25°C)	162.0 mV
Standard 2	25 °C	2.00 (at 25°C)	42.0 mV
Standard 3	25 °C	9.21 (at 25°C)	-15.0 mV

The mV measured values are then converted to the averaged temperature (not necessary in the example because the temperature is constantly 25°C) and a linear regression is conducted for each segment. Thus for each segment a gradient and the mV value at pH 0 are determined (both related to the mean temperature) and from both values the zero point is respectively calculated:

	During the calibration of the recorded temperature	mV value at 0 pH (based on TMean)	Slope (TMean)	Zero point [pX]
Segment 1	25 °C	-78.00 mV	60.00	1.30
Segment 2	25 °C	-72.00 mV	57.00	1.26

Afterward, the slope is converted to the reference temperature of 25°C (not necessary in this example, because (T_{Mean}) is already 25°C.

10.2.1.1.3 pH Sensor Test / Calibration

Navigation: **Home** > **Setup** > **Hardware** > **Sensors**

The pH sensor test is used to test the slope, zero point and drift of pH sensors. For the test, two buffers and the drift of the pH sensor are measured. The measured values are transferred into the titrator settings.

1 In **Sensors** select the relevant pH sensor.

⇨ The windows to edit the parameters opens.

2 Tap [**Calibration/Sensor test**].

⇨ The screen **Start analysis** opens.

3 In **Action**, select [**Calibration**] or [**Sensor test**].

4 In **Method ID**, select the relevant method.

5 Tap [**Start**] to perform the calibration or the sensor test.

Note

- The button [**Start**] is only activated if a calibration method or a pH sensor test method is available.

See also

🗎 Sample (calibration) ▸ Page 96

10.2.1.2 Value ranges from sensor measuring units and control band

Sensor type	Meas. unit	Value range	Value range EP relative	Value range Control band
mV	mV	$-2x10^{3}$…$2x10^{3}$	$-4x10^{3}$…$4x10^{3}$	0.1…$4x10^{3}$
pH	pH	-100…100	-100.00…100.00	0.01…100
	mV	$-2x10^{3}$…$2x10^{3}$	$-4x10^{3}$…$4x10^{3}$	0.1…$4x10^{3}$
ISE	pM I pX	-100…100	-100.00…100.00	0.01…100
	ppm	0…10^{6}	-10^{7}…10^{7}	0.001…10^{7}
	mV	$-2x10^{3}$…$2x10^{3}$	$-4x10^{3}$…$4x10^{3}$	0.1…$4x10^{3}$
Phototrode	%T	0.001…100	$-1x10^{3}$…$1x10^{3}$	0.1…$1x10^{3}$
	A	0…5	-10^{6}…10^{6}	0.01…10^{6}
	mV	$-2x10^{3}$…$2x10^{3}$	$-4x10^{3}$…$4x10^{3}$	0.1…$4x10^{3}$
Polarized	mV	0…$2x10^{3}$	$-2x10^{3}$…$2x10^{3}$	0.1…$2x10^{3}$
	µA	0…220	-220.0…220.0	0.1…220
Temperature	°C	-20…200	-220.0…220.0	0.1…220.0
	K	253.2…473.2	-220.0…220.0	0.1…220.0
	°F	-4…392	-396.0…396.0	0.1…396.0
Conductivity	µS/cm	0…10^{6}	-10^{6}…10^{6}	0.001…10^{6}
	mS/cm	0…10^{6}	-10^{6}…10^{6}	0.001…10^{6}
	µS	0…10^{8}	-10^{6}…10^{6}	0.001…10^{6}
	mS	0…10^{8}	-10^{8}…10^{8}	0.001…10^{6}

10.2.2 Pumps

Navigation: **Home** > **Setup** > **Hardware** > **Pumps**

Solvent Managers and air pumps

Two Solvent Managers and two air pumps can be defined on a titrator.

You cannot configure a Solvent Manager or an air pump individually. Predefined settings are used when you connect a Solvent Manager or an air pump to the back of the titrator or the sample changer.

Parameters	Description	Values
Type	Defines the type of pump.	Available pump types
Name	Specify a descriptive name of your choice.	Arbitrary
Pump output	The output where you want to operate the pump.	Available outputs

Peristaltic, membrane and reversible pumps

You can configure a maximum of 20 pumps for use with the titrator. Starting from the pump list, you can add new pumps or select existing ones and change their settings. The list can also be printed and pumps can be deleted.

You can set up different pumps. For each pump, you need to specify an explicit, user-defined name, the pumping rate and the connection from which the pump should operate.

Steps to add a pump:

– In **Pumps** choose [**New**].

⇨ The window to edit the parameters opens.

Parameters	Description	Values
Type	Defines the type of pump.	Available pump types
Name	Specify a descriptive name of your choice.	Arbitrary
Pump output	The output where you want to operate the pump.	Available outputs
Max. pump rate	Displays the pump rate in [mL/min] when the pump is operated at 100%. This is stated by the manufacturer or determined experimentally.	0.1…1000

10.2.3 Peripherals

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals**

These settings encompass all input and output devices that belong to the titrator environment but that are not essential instruments for processing an analysis (peripherals cannot be accessed in methods). The computer also counts as a peripheral device. The list of all peripheral instruments defined in the titrator, together with the parameters of each individual instrument can be printed out by a printer.

10.2.3.1 Balance

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **Balance**

Before defining a balance, you need to select the balance type. The titrator supports the following types of balance:

Balance type	Supported balances
Mettler	AB I PB I PB-S I AB-S I PB-E I AB-E I College-S I SB I CB I GB I College-B I HB I AG I PG I PG-S I SG I HG I XP I XS I XA I XPE I XSE I XVE I AX I MX I UMX I PR I SR I HR I AT I MT I UMT I PM I AM I SM I CM I MS I ML
Sartorius	Sartorius
More	--

METTLER TOLEDO Balances

These balances support Plug'n'Play and are automatically recognized and configured by the titrator.

For automatic balance recognition, you need to ensure the following:

1. The balance has been started up and is connected to the titrator by a suitable cable,
2. The balance has been set to "Bidirectional" (if necessary, set the "Host" parameter accordingly),
3. The parameters for the RS-232 interface on the balance correspond with those on the titrator.

Note

- As long as the balance is not connected to the titrator, the settings "Baud Rate", "Data Bit", "Stop Bit", "Parity" and "Handshake" can be entered manually. These are however automatically overwritten with the values identified by the PnP as soon as the user sets the same transmission parameters at the balance and the titrator.

Sartorius I Others

After you have selected this option and the system has recognized the balance, you can define the following parameters:

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Serial number	The serial number of the relevant device type.	Arbitrary
Connection	The serial port to which the device is connected. Possible connections are located on the mainboard, the analog board and the conductivity board.	MB/COM1 I MB/COM2
Baud rate	The baud rate for data transmission via the RS-232 interface.	1200 I 2400 I 4800 I 9600 I 19200
Data bit	Defines the number of data bits.	7 I 8

Stop bit	Defines the number of stop bits. (2 stop bits can only be selected if 7 data bits are also selected at the same time.)	1 | 2
Parity	Defines the parity protocol.	Even | Odd | None
Handshake	Data transmission via the RS-232 interface. (Only the handshake option "Xon-Xoff" is available for serial connections on the analog and conductivity board in conjunction with a baud rate of 9600.)	None | Xon-Xoff

Note

- The settings for the baud rate, data bit, stop bit, parity, and handshake must agree for the balance and titrator!
- If **None** is selected as balance type that means that no balance is to be connected to the titrator.

10.2.3.2 Barcode reader

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **Barcode reader**

When a barcode is imported, the system checks whether the imported barcode is suitable for starting the method. If so, the analysis start dialog is opened; all known data is entered there. If not, the barcode is ignored. If an analysis is already running with the same method ID, the sample is added to the end of the current analysis. An exception to this occurs if the **End series** barcode has previously been read. In this case, a new analysis is started (with the same method).

Note

- Only one barcode reader can be defined.

Define the following parameters for a barcode reader:

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Serial number	The serial number of the relevant device type.	Arbitrary
Transfer SmartCodes to LabX	Transfer barcode to LabX.	Activ | Inactive

10.2.3.3 USB-Stick

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **USB-Stick**

Commercially available USB sticks from USB Version 1.1 are supported.

You can assign a relevant name to the USB stick.

10.2.3.4 Printer

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **Printer**

The type of printer and data export is defined by **Printer type**.

Parameters	Description	Values
Printer type	Defines the type of printer or data export used.	USB printer | RS-232 compact printer | USB compact printer | RS-232 data export | Network printer | PDF file writer | XML file writer

The available printers can be divided in 3 groups depending on the kind of output.

Printer	Paper	Files	XML stream
USB printer	•	-	-
RS-232 compact printer	•	-	-
USB compact printer	•	-	-
RS-232 data export	-	-	•

Printer	Paper	Files	XML stream
Network printer	•	-	-
PDF file writer	-	•	-
XML file writer	-	•	-

Printing and data export can be triggered by the options listed below. Not all printers support all options.

- Method function **Record** inside or outside of loops
- **Print** button at the bottom of setup screens or result screens.
- Specific settings in the method function **Calculation**, **Instruction**, **Titration (LearnEQP)**. Only supported by USB printer and Network printer.
- **Print autom. KF protocols** in **Setup** > **Global settings** > **Analysis and resources behavior** > **Analysis sequence settings** (see [Analysis and resources behavior ▸ Page 213]). Supported by all printers.
- **Save results CSV** in **Setup** > **Global settings** > **Analysis and resources behavior** > **Analysis sequence settings** (see [Analysis and resources behavior ▸ Page 213])

Record

With the method function **Record** you can define which types of data are output. Not all printers support all types of data. For a detailed description of the parameters see [Record ▸ Page 164]

MF Record inside of loop

Parameter	USB Printer / Network printer / PDF file writer	RS-232 compact printer / USB compact printer	RS-232 data export / XML file writer
Summary	•	•	Export of predefined data (sample data and results) if set to **Per sample** or **Per series**.
Results	•	•	Settings are ignored.
Raw results	•	•	
Table of measured values	•	-	•
Sample data	•	•	Settings are ignored.
Resource data	•	•	
Charts	•	-	
Method	•	•	
Series data	•	•	

MF Record outside of loop

Parameter	USB Printer / Network printer / PDF file writer	RS-232 compact printer / USB compact printer	RS-232 data export / XML file writer
Summary	•	•	Predefined data export if activated.
Results	•	•	Settings are ignored.
Raw results	•	•	
Resource data	•	•	
Calibration curve	•	-	
Method	•	•	
Series data	•	•	

Print button

The print button allows you to print out lists and parameter settings. In the menu **Results**, statistics can be printed in addition.

Printing with the print button is only supported by the printers listed below.

- USB printer
- USB compact printer

- Network printer
- PDF file writer

The parameters depend on the selected printer type and are described below.

USB printer

Printers with PCL protocol version 4 and higher are supported.

Parameters	Description	Values
Status	Indicates whether the selected printer type is installed.	Installed
Name	Specify a descriptive name of your choice.	Arbitrary
Serial number	The serial number of the relevant device type.	Arbitrary
Connection	Information on the USB port to which the printer is connected. **PnP** is displayed if the printer is not connected to the titrator.	MB/USB 1/2/Terminal

RS-232 compact printer

- PnP recognition of sample changers and balances is deactivated on the COM port configured for printing, even if no printer is connected.
- Does not support all languages

Parameters	Description	Values
Status	Indicates whether the selected printer type is installed.	Installed
Name	Information on the name of the installed printer is displayed.	RS-P26
Serial number	The serial number of the relevant device type.	Arbitrary
Connection	The serial port to which the device is connected. Possible connections are located on the mainboard, the analog board and the conductivity board.	MB/COM1 ǀ MB/COM2
Baud rate	Information on the baud rate for data transmission via the RS-232 interface.	2400
Data bit	Information on the number of data bits is displayed.	8
Stop bit	Information the number of stop bits is displayed.	1
Parity	Information on the parity defined for the report is displayed.	No
Handshake	Information on data transmission via the RS-232 interface.	None

USB compact printer

Does not support all languages.

Parameters	Description	Values
Status	Indicates whether the selected printer type is installed.	Installed
Name	Specify a descriptive name of your choice.	Arbitrary
Serial number	The serial number of the relevant device type.	Arbitrary
Connection	Information on the USB port to which the printer is connected. **PnP** is displayed if the printer is not connected to the titrator.	MB/USB 1/2/Terminal

RS-232 data export

Parameters	Description	Values
Status	Indicates whether the selected printer type is installed.	Installed
Connection	The serial interface for the RS-232 data export.	MB/COM1 ǀ MB/COM2
Baud rate	The baud rate for data transmission via the RS-232 interface.	1200 ǀ 2400 ǀ 4800 ǀ 9600 ǀ 19200
Data bit	Information on the number of data bits is displayed.	8
Stop bit	Information the number of stop bits is displayed.	1
Parity	Defines the parity protocol.	Even ǀ Odd ǀ None
Handshake	Data transfer via the RS-232 interface.	None ǀ Xon-Xoff

The max. Xoff duration for transmitted data is around 30 s.

Network printer

Printers with PCL protocol version 3 and higher are supported.

Parameters	Description	Values
Type	Defines the printing protocol used by the network printer.	HP PCL 3 I Epson ESC/P 2
Network name	Defines the network name of the connected printer.	-
Port number	Enter the specific port number for the connected printer.	-
Paper size	Defines the paper size for the printout of your data export.	A4 I Letter

PDF file writer

The data is written to a PDF file.

Parameters	Description	Values
Storage location	Defines where the file containing the exported data is stored. **USB-Stick**: Export to the connected USB-stick. **Ethernet**: Export to the shared folder defined in **Network storage**.	USB-Stick I Ethernet

XML file writer

The data is written to an XML file. XML files created with **XML file writer** cannot be imported in LabX.

Parameters	Description	Values
Storage location	Defines where the file containing the exported data is stored. **USB-Stick**: Export to the connected USB-stick. **Ethernet**: Export to the shared folder defined in **Network storage**.	USB-Stick I Ethernet

If measure value table is selected as part of the output, the measure value table data structure in the xml file contains an identifier which defines the kind method function the table is related to. The identifier is written in the tag <type></type>.

Method function	Number in xml file
Dispense (controlled)	17
Measure (MVT)	23
Standard Addition	126
Titration (EP)	52
Titration (EP Coul)	117
Titration (EQP)	51
Titration (KF Coul)	53
Titration (KF Vol)	54
Titration (Learn EQP)	56
Titration (Therm.)	136
Titration (2-phase)	57
Scan (KF Coul)	143
Scan (KF Vol)	142

10.2.3.5 PC settings

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **PC settings**

Configure these settings if you have your instrument connected to the PC software **LabX**.

Note

- The PC with LabX installed must always be connected to the USB PC or Ethernet port on the mainboard.
- After the settings have been modified, it may be necessary to restart the instrument.

Parameters	Description	Values
Connect to LabX at start-up	If this parameter is activated, a connection to LabX will be established on startup.	Activ I Inactive
Connection type	Defines how the titrator is connected to the PC, either via the network connection or via the USB connection.	Ethernet I USB
Status	Information on the connection status from the instrument to LabX.	Connected I Discon-nected
Port number	Defines the port for a network connection of the titrator to LabX. Only appears for **Connection type** = **Ethernet**.	1024…65535

10.2.3.6 Network settings

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **Network settings**

Configure these settings if you have your instrument connected to a network.

Parameters	Description	Values
Obtain IP address automatically	Indicates whether the IP address should be automatically obtained over the network.	Activ I Inactive
IP address	If the IP is not to be automatically obtained, you can enter it here.	000.000.000.000 … 255.255.255.255
Subnet mask	If you want to run the instrument on a local subnetwork, you can define the subnet mask here that you want to use to link the subnet's IP address.	000.000.000.000 … 255.255.255.255
Standard gateway	This is where you can enter the address of the standard gateway for communication between the various networks.	000.000.000.000 … 255.255.255.255

10.2.3.7 Network storage

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **Network storage**

Configure these settings if you want to save data on a shared folder of a network drive. The instrument and the network drive have to be in the same subnet.

Parameters	Description	Values
Transfer via	Method for transferring data (only **Network share**).	-
Server	PC or server name. Users should have read-write access. Maximum 60 alphanumeric characters.	-
Share name	Name of the share which is defined for the shared folder.	-
User name	Type in the user name for accessing the shared folder. The user name must be defined in the setup for the shared folder.	-
Domain	Domain name of the server where the shared folder is located.	-
Password	Password for the network share.	-
Target folder	Defines the name of the **Target folder** where the data is saved. The **Target folder** is a subfolder in the shared folder.	-
First folder level	Defines if a subfolder is created in the folder defined in **Target folder** and how the subfolder is named. **None**: No subfolder is created. **User name**: A subfolder is created. The user name is used as name for the subfolder. **Titrator ID**: A subfolder is created. The titrator ID is used as name for the subfolder. **Date**: A subfolder is created. The date is used as name for the subfolder. **Method ID**: A subfolder is created. The method ID is used as name for the subfolder.	None I User name I Titrator ID I Date I Method ID

Second folder level	Defines if a subfolder is created in the folder defined in **First folder level** and how the subfolder is named. **None**: No subfolder is created. **User name**: A subfolder is created. The user name is used as name for the subfolder. **Titrator ID**: A subfolder is created. The titrator ID is used as name for the subfolder. **Date**: A subfolder is created. The date is used as name for the subfolder. **Method ID**: A subfolder is created. The method ID is used as name for the subfolder. Only if **First folder level** is activated.	None I User name I Titrator ID I Date I Method ID

10.2.3.8 Fingerprint reader

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **Fingerprint reader**

You can use a fingerprint reader to authenticate users on the titrator. In order to do this, the fingerprint reader must be activated on the titrator. The following parameters are available for this:

Parameters	Description	Values
Activate fingerprint reader	Activates the fingerprint reader for authenticating users when logging onto the titrator.	Activ I Inactive
Status	Indicates whether the fingerprint reader is connected to the titrator.	Installed I Not installed
Name	The designation of the fingerprint reader.	Arbitrary
Connection	Information on the USB port to which the fingerprint reader is connected. **PnP** is displayed if the fingerprint reader is not connected to the titrator.	PnP I USB 1

Register fingerprint

Navigation: **Home** > **User data**

The following procedure must be performed in order to register each user:

1. Log on to the titrator with your user name (and possibly your password).
2. In **Home**, tap [**User data**] to open the corresponding window.
3. In **User data**, tap [**Register fingerprint**] to open the corresponding window.
4. Place the preferred finger on the fingerprint reader and repeat the step as prompted.
   ⇨ When completed, the message **Registration successful.** appears.
5. Confirm the message with the [**OK**] to return to the **User data** window.
6. Confirm with [**OK**] to return to the homescreen.

⇨ The next time you log on, the **Fingerprint login** window will appears. To log on, place the appropriate finger on the fingerprint reader.

Note

- You can only log on using the fingerprint reader if **Activate fingerprint reader** is selected.
  Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **Fingerprint reader**
- You are still able to log on using a password. To do this, tap [**Password login**].

10.2.3.9 LevelSens

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **LevelSens**

The level sensor (**LevelSens**) can be used either to monitor the fill level of titration or solvent vessels or to prevent the overflow of waste vessels.

The level sensor is connected to the "LevelSens box", which is connected to the titrator via the CAN interface. The titrator automatically recognizes up to two of these boxes (PnP recognition). These appear in the settings.
Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **LevelSens**

1 In **LevelSens**, tap on a "LevelSens box".

⇨ The windows to edit the parameters opens.

2 The parameters **Level**, **Waste** or **Inactive** can be defined for the relevant sensor type

Activating level monitoring

- At the start of a method or a manual operation.
  The level is checked for all activated and connected sensors, regardless of whether they are used in the method.
- At the start of each sample (GT).
- After completion of a Karl Fischer analysis (KF).
- Before the start of a KF Stromboli method.
- Before replacing the solvent.
- During the course of the following manual operations: **Burette** (**Rinse**, **Rinse multiple burettes**, **Dispense**, **Manual titration**), **Pump**, **Auxiliary instrument** (output 24V), **Sample changer** (**Pump**, **Rinse**).

If the fill level is not reached or exceeded, a message appears with a prompt either to empty or fill the vessel (depending on the Setup setting: **Waste** or **Level**). The analysis is interrupted during this time. After the vessel has been emptied or filled and the message has been confirmed, the analysis is resumed.

Note

- Only two LevelSens boxes can be entered in the settings. Additional boxes do not generate an additional entry.
- Entries in the settings can only be deleted if the corresponding LevelSens box is not installed.
- The sensor must be fitted in such a way that when the maximum fill level is reached, the analysis of a sample, the entire loop of a Stromboli method or a solvent replacement can be performed.
- The fill level is only checked before a sample analysis, at the start of a Stromboli method or before a solvent replacement.

Parameters	Description	Values
Name	Information on the designation of the LevelSens box. In the settings, the first detected box is entered as LevelSens Box 1, the second as LevelSens Box 2.	-
Chip ID	Information on the Chip-ID of the detected LevelSens box.	-
Position	Information on the position of the LevelSens box connected to the titrator.	PnP l PnP1 l PnP2
Sensor 1 type… Sensor 4 type	Specifies the sensor type to be used.	Level l Waste l Inactive

10.2.3.10 TBox

Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **TBox**

The following parameters are available for the METTLER TOLEDO TBox: **TBox connected**. This parameter specifies whether or not the TBox is connected to the titrator.

If the TBox is installed on the titrator, then the TTL-outputs of the titrator are available in the pump setup.
Navigation: **Home** > **Setup** > **Hardware** > **Peripherals** > **TBox**

10.2.4 Titration stands

Navigation: **Home** > **Setup** > **Hardware** > **Titration Stands**

Starting from the titration stand list, you can add new titration stands or select existing ones and modify their parameters. Furthermore the list can be printed out or individual titration stands can be deleted, whereby one of each type must be in the list.

Configure the following titration stands that can be connected to the titrator.

- **Manual stand**
- **Auto stand**
- **External stand**
- **Rondo/Tower A** and **Rondo/Tower B**

- **InMotion T/Tower A** and **InMotion T/Tower B**
- **Rondolino TTL**
- **InMotion KF** , available on:
  - T7
  - T9
- **Stromboli TTL**, available on:
  - T7
  - T9
- **KF stand**

Add a titration stand

1 Go to **Home** > **Setup** > **Hardware** > **Titration Stands**

2 In **Titration Stands** tap **New**.

⇨ The window to edit the parameters opens.

3 In **Type** choose the type of titration stand to be added.

⇨ The parameters for the selected titration stand are displayed.

4 Edit the parameters according to the type of titration stand.

10.2.4.1 Manual stand

The manual stand is typically used for the METTLER TOLEDO Manual Titration Stands. Before each sample in the series is analyzed, a popup window requesting confirmation that the respective sample is in place will appear. The selected titration stand defines the stirrer output used in following method functions requiring a function **Stir**.

Parameters	Description	Values
Type	Defines the type of the titration stand.	Available titration stands
Name	Defines the name of the titration stand. Additional titration stands of a kind will have an index number assigned.	List of available names
Stirrer output	Defines the stirrer output.	Available stirrer outputs

10.2.4.2 Auto stand

If you use an auto stand, the popup window that reminds you to add the respective sample does not appear. Thus an interruption-free analysis sequence can be guaranteed for multiple determinations with an automation unit. The selected titration stand defines the stirrer output used in following method functions requiring a function **Stir**.

Parameters	Description	Values
Type	Defines the type of the titration stand.	Available titration stands
Name	Defines the name of the titration stand. Additional titration stands of a kind will have an index number assigned.	List of available names
Stirrer output	Defines the stirrer output.	Available stirrer outputs

10.2.4.3 External stand

The external stand is typically used for stands not directly attached to the titrator. Before each sample in the series is analyzed, a popup window requesting confirmation that the resepective sample in place will appear. The selected titration stand defines the stirrer output used in following method functions requiring a function **Stir**.

Parameters	Description	Values
Type	Defines the type of the titration stand.	-
Name	Defines the name of the titration stand. Additional titration stands of a kind will have an index number assigned.	List of available names
Stirrer output	Defines the stirrer output.	Available stirrer outputs

10.2.4.4 Rondolino TTL

The Rondolino sample changer can hold 9 samples to be tested in sequence. The Rondolino connects to the TTL port on the titrator. The selected titration stand defines the stirrer output used in following method functions requiring a function **Stir**.

Parameters	Description	Values
Type	Defines the type of the titration stand.	Available titration stands
Name	Defines the name of the titration stand. Additional titration stands of a kind will have an index number assigned.	List of available names
Stirrer output	Defines the stirrer output.	Available stirrer outputs
Connection	Indicates the connection type.	Available connections

10.2.4.5 Stromboli TTL

The Stromboli oven sample changer can hold 14 sample vials and one drift vial. The Stromboli connects to the TTL port on the titrator.

Parameters	Description	Values
Type	Defines the type of the titration stand.	Available titration stands
Name	Defines the name of the titration stand. Additional titration stands of a kind will have an index number assigned.	List of available names
Stirrer output	Defines the stirrer output.	Available stirrer outputs
Connection	Indicates the connection type.	Available connections
Drift	Value of the last drift determination [µg/min].	$0.0 \ldots 10^6$
Determination method	Method name of the method used for the determination.	Method name
Determination type	Determination type (volumetric, coulometric titration).	-
Date / Time	Date and time of the determination.	Date and time
Performed by	Name of the user performing the determination.	User name

10.2.4.6 InMotion KF

InMotion KF titration stands are available on the following titrator types:

- T7
- T9

Parameters	Description	Values
Type	Defines the type of the titration stand.	Available titration stands
Name	Defines the name of the titration stand. Additional titration stands of a kind will have an index number assigned.	List of available names
Base type	Indicates the sample changer type.	Available types
Stirrer output	Defines the stirrer output.	Available stirrer outputs
Connection	Indicates the connection type.	Available connections
Chip ID	Shows the ID of the identification chip of the sample changer.	Unique number
Gas stop valve	Indicates whether a gas stop valve is installed on the sample changer.	Installed | Not installed
Air pump KF	Indicates whether an air pump is installed on the sample changer.	Installed | Not installed
Heated transfer tube	Indicates whether a heated transfer tube is installed on the sample changer.	Installed | Not installed

Rack	Indicates the type of the installed rack. **KF**: a standard rack is detected. **PnP**: no rack is detected.	KF I PnP
Rack size	Indicates the size of the installed rack.	Number of positions on the rack
Vial height	Defines the height of the vials used on the rack.	34…60 mm
Drift	Value of the last drift determination [µg/min].	0.0…10^6
Determination method	Method name of the method used for the determination.	Method name
Determination type	Determination type (volumetric, coulometric titration).	-
Date / Time	Date and time of the determination.	Date and time
Performed by	Name of the user performing the determination.	User name

10.2.4.7 InMotion T

The InMotion Autosamplers can hold multiple samples depending on the base unit (**Flex**, **Pro** or **Max**) and the accompanying sample rack. The InMotion Autosampler connects to USB1 on the titrator. InMotion Autosamplers and attached towers are PnP devices that are automatically recognized and installed upon connection to the titrator. If a second InMotion Autosampler is to be attached, a USB expander must be used at the titrator for the second USB connection. The USB expander ports on the back of the first InMotion Autosampler attached can also be used for the connection. The first InMotion device attached is labelled **InMotion T/1A** and the second attached to the system will be labeled **InMotion T/2A** in the list. If unattached and reattached after the initial installation, the titrator will know which InMotion Autosampler is /1 and /2 according their Chip ID. An InMotion Autosampler can also manually be added to the Titration Stand list with default parameters if needed for method programming.

Parameters	Description	Values
Type	Defines the type of the titration stand.	-
Name	Defines the name of the titration stand. Additional titration stands of a kind will have an index number assigned.	List of available names
Base type	Indicates the sample changer type.	Available types
Stirrer output	Defines the stirrer output.	Available stirrer outputs
Connection	Indicates the connection type.	Available connections
Chip ID	Shows the ID of the identification chip of the sample changer.	Unique number
CoverUp	Indicates whether this option is installed.	Installed I Not installed
SmartSample inner	Indicates whether a SmartSample reader is installed for the inner row.	Installed I Not installed
SmartSample outer	Indicates whether a SmartSample reader for the outer row is installed.	Installed I Not installed
Barcode reader	Indicates whether this option is installed. Only the outer rack row can be used with the barcode option.	Installed I Not installed
Rack	Indicates the type of the installed rack. **Standard**: Standard rack. **Water bath**: Rack including a wather bath. **Dual**: Rack type with two types of beaker sizes. **PnP**: No rack is detected.	Standard I Water bath I Dual I PnP
Rack size	Indicates the size of the installed rack.	Number of positions on the rack
Beaker height	Defines the beaker height [mm]. For **COD kit** = **Active** the value range is different.	65…215
Conditioning beaker	Defines if a specific condition beaker is used. The last beaker position of the rack is the specific conditioning beaker position. This parameter is stored in the rack.	Activ I Inactive
Rinse beaker	Defines if a specific rinse beaker is used.	Activ I Inactive

Special beaker 1…Special beaker 4	Defines if specific special beaker are used. Rinse beaker positions are next to the conditioning beaker. These parameters are stored in the rack.	Activ I Inactive

Note

When fixed beakers are defined, they cannot be used for samples and are reserved for **Conditioning**, **Rinse** and **Line rinse** method functions only. The fixed beakers reserve the last available positions on the rack, in the order stated above, with conditioning beaker being last.

COD kit	Defines if the system is used with the Aliquot Kit. For InMotion **Pro** with 25 mL rack only. This parameter is stored on the InMotion.	Activ I Inactive
Aliquot beaker	Defines whether the extension on InMotion is installed for an aliquot beaker. Aliquoting is not possible with all rack types. For InMotion **Pro** only. This parameter is stored on the InMotion.	Activ I Inactive

10.2.4.8 Rondo60

The Rondo autosampler can hold 12-60 samples depending on the accompanying sample rack. The Rondo is connected to either **MB1/COM** or **MB2/COM** ports on the titrator. The Rondo60 is automatically named /1 or /2 according to the COM port is attached. The Rondo and attached Towers are PnP devices that are automatically recognized and installed upon connection to the titrator. A Rondo can also manually be added to the Titration Stand list with default parameters if needed for method programming.

Parameters	Description	Values
Type	Defines the type of the titration stand.	-
Name	Defines the name of the titration stand. Additional titration stands of a kind will have an index number assigned.	List of available names
Stirrer output	Defines the stirrer output.	Available stirrer outputs
Connection	Indicates the connection type.	Available connections
Rack	Indicates the size off the installed rack.	20 I 12 I 15 I 30 I 60
Beaker height	Beaker configuration of the installed rack.	90 I 110 I 150 I 210
Tower position	Indicates the tower position configuration off Rondo.	Left I Right
Conditioning beaker	Conditioning beaker setting of the installed rack.	Installed I Not installed
Rinse beaker	Indicates the beaker setting of the installed rack.	Installed I Not installed
Special beaker 1	Indicates the special beaker setting of the installed rack.	Installed I Not installed
Special beaker 2	Indicates the special beaker setting of the installed rack.	Installed I Not installed
CoverUp	Defines whether a CoverUp unit is connected to the Rondo and, if so, to which port. Select **None** if there is no CoverUp unit on your Rondo. Only appears when **Rack** = **20** has been selected.	Rondo/1 TTL-Out 1 I Rondo/1 TTL-Out 2 I Rondo/2 TTL-Out 1 I Rondo/2 TTL-Out 2 I MB/TTL-Out 1 I MB/TTL-Out 2 I None

10.2.4.9 KF stand

The selected titration stand defines the stirrer output used in following method functions requiring a function **Stir**.

Parameters	Description	Values
Type	Defines the type of the titration stand.	Available titration stands
Name	Defines the name of the titration stand. Additional titration stands of a kind will have an index number assigned.	List of available names
Stirrer output	Defines the stirrer output.	Available stirrer outputs
Drift	Value of the last drift determination [µg/min].	0.0…10^6

Determination method	Method name of the method used for the determination.	Method name
Determination type	Determination type (volumetric, coulometric titration).	-
Date / Time	Date and time of the determination.	Date and time
Performed by	Name of the user performing the determination.	User name

10.2.5 Auxiliary instruments

Navigation: **Home** > **Setup** > **Hardware** > **Auxiliary instrument**

Auxiliary instruments can be any instruments that access a titrator's TTL or 24 V output, stirrer or RS-232 connection and that are to be used in a method (e.g. valves, dispensers).
An auxiliary instrument is switched on for a predefined period or switched on and then switched off again via the corresponding command. The instruments are controlled via the method function **Auxiliary instrument**.
Auxiliary instruments form part of a method, while peripherals are classified as input/output devices (printers, balances, barcode readers etc.), which do not have direct access to methods.

Starting from the auxiliary instrument list, you can add new auxiliary instruments or select existing ones or modify their parameters. Furthermore the list can be printed out at a printer or selected auxiliary instruments can be deleted.

Note

- A maximum of 50 auxiliary instruments can be saved in the titrator.

Adding an auxiliary instrument

1 In **Auxiliary instrument** choose [**New**].
  ⇨ The windows to edit the parameters opens.
2 In **Control type** you must first select the manner in which the auxiliary instrument is to be controlled.

⇨ After you have selected the relevant type, you can determine the parameters.

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Control type	Select the manner in which the auxiliary instrument is to be controlled.	Output 24 V | Out TTL (Single pin) | Input TTL (Single pin) | TTL (Multipin) | Stirrer | RS-232

Output 24 V/Stirrer (0-18V output)

Parameters	Description	Values
Output	Indicates which port on the titrator you want to use for the auxiliary instrument.	MB/PUMP1 | MB/PUMP2 | AB1/PUMP | More depending on configuration

TTL

Parameters	Description	Values
Output	Indicates which port and which pin on the titrator you want to use for the auxiliary instrument. Does not appears for **Control type** = **Input TTL (Single pin)**.	MB/TTL-Out 1 | MB/TTL-Out 2 | MB/TTL-Out 3 | MB/TTL-Out 4 | More depending on configu-ration
Input	The input where the auxiliary instrument should be queried. Only appears for **Control type** = **Input TTL (Single pin)**.	MB/TTL-In 1 | MB/TTL-In 2

RS-232

Parameters	Description	Values
Connection	The serial port to which the device is connected. Possible connections are located on the mainboard, the analog board and the conductivity board.	MB/COM1 I MB/COM2
Baud rate	The baud rate for data transmission via the RS-232 interface.	1200 I 2400 I 4800 I 9600 I 19200
Data bit	Defines the number of data bits.	7 I 8
Stop bit	Defines the number of stop bits. (2 stop bits can only be selected if 7 data bits are also selected at the same time.)	1 I 2
Parity	Defines the parity protocol.	Even I Odd I None
Handshake	Data transmission via the RS-232 interface. (Only the handshake option "Xon-Xoff" is available for serial connections on the analog and conductivity board in conjunction with a baud rate of 9600.)	None I Xon-Xoff

10.2.6 Homogenizer

Navigation: **Home** > **Setup** > **Hardware** > **Homogenizer**

This window lists the available homogenizers according to their control type. The list can be sorted and printed out.
Depending on the control type, there are two different types of homogenizer.

– In **Homogenizer** choose the required entry.

⇨ The window to edit the parameters opens.

Homogenizer TTL

Parameters	Description	Values
Output	Defines the output to which the device is connected.	MB/TTL-Out 1…MB/TTL-Out 4 I Rondo/1 TTL-Out 1…Rondo/2 TTL-Out 4 I (More depending on configuration)

Homogenizer RS

Parameters	Description	Values
Status	Determines whether or not the titrator is connected to the homogenizer.	Installed I Not installed
Output	Indicates which port on the titrator you want to use.	MB/COM1 I MB/COM2 I AB1/COM I (More depending on configuration)

Note

- For the homogenizer of type PT 1300D (RS interface), the panel for changing or saving the speed during operation is blocked via the titrator (GLP conformity).
- It is not possible to change an entry while a method that uses a homogenizer is running.
- For the status **Installed**, balance and sample changer polling is deactivated.
- The parameters for serial connection are for information only and cannot be changed.

10.2.7 Liquid Handler

Navigation: **Home** > **Setup** > **Hardware** > **Liquid Handler**

If a Liquid Handler is connected, the titrator detects the Liquid Handler automatically (PnP) and the identification parameters are transferred to the titrator's setup. Specify the setup parameters, for example to assign the ports to the related connections. Port 6 is fixed assigned to the waste port. The waste port is required to discharge residual solutions upon liquid exchange or to remove excessive liquid volumes from the burette.

– In **Liquid Handler** choose the detected Liquid Handler.

⇨ The window to edit the parameters opens.

In this dialog you obtain the following parameters:

Parameters	Description	Values
Name	The first connected Liquid Handler is displayed as Liquid Handler 1 and the second one as Liquid Handler 2. For T9 you can change the name only if one Liquid Handler is available and is not connected.	Liquid Handler 1 I Liquid Handler 2
Chip ID	Information on the ID of the Liquid Handler's PnP chip.	Arbitrary
Position	Information on the position of the Liquid Handler.	1 I 2 I PnP (default value)
Burette volume	Information on the volume [mL] of the Liquid Handler's burette.	50 mL (default)
SNR Burette glass	The serial number of the burette glass can be entered.	Arbitrary
Port 1…6	Indicates the position of the multiport valve.	Activ I Inactive
Connection	The corresponding ports and the connected components can be designated. The names can then be selected within the method function **Liquid Handling**.	Arbitrary

Note

- After the removing of the Liquid Handler, the data (name, chip-ID, burette volume, SNR burette glass, connections and port assignments) remain at the titrator's setup.
- When a Liquid Handler is connected, the chip-ID will be overwritten.
- When more than one Liquid Handler are connected, the existing Setup entries will be assigned to the related.
  Liquid Handler, according to the connection order.
- The last Liquid Handler in the list cannot be deleted.

10.3 User settings

Navigation: **Home** > **Setup** > **User settings**

These settings contains the options that can be made specifically for each currently logged in user.

You can configure the language, the screen settings (for the touchscreen), the layout of the alphanumeric and numeric keyboard, the use of beeps, and shortcuts for each user.

10.3.1 Language

Navigation: **Home** > **Setup** > **User settings** > **Language**

Define the following parameters:

Parameters	Description	Values
Touchscreen	Defines the language for operation of the terminal.	German I English I French I Italian I Spanish I Portuguese I Chinese I Russian I Polish I Korean
Record	Defines the language in which the reports are to be printed out.	German I English I French I Italian I Spanish I Portuguese I Chinese I Russian I Polish I Korean

Note

- For the Chinese and Korean language settings, it is not possible to print using the USB-P25 tape printer.
- For Polish, records can be printed on the USB-P25 tape printer without special characters.

10.3.2 StatusLight

Navigation: **Home** > **Setup** > **User settings** > **StatusLight**

Parameters	Description	Values
Terminal StatusLight	Activate or deactivate the status indicator at the terminal.	On I Off
Brightness	Defines the brightness of the StatusLight of the terminal. Only if **Terminal StatusLight** is activated.	Low I Medium I High
Instrument StatusLight	Activate or deactivate the status indicator at the instrument.	On I Off
Brightness	Defines the brightness of the StatusLight of the instrument. Only if **Instrument StatusLight** is activated.	Low I Medium I High
InMotion T StatusLight	Activate or deactivate the StatusLight of the autosampler.	On I Off

10.3.3 Screen

Navigation: **Home** > **Setup** > **User settings** > **Screen**

Define the following parameters:

Parameters	Description	Values
Primary color	Here various color schemes for the user interface can be selected.	Gray I Blue I Green I Red
Brightness	Specifies the display brightness in [%].	50 I 60 I 70 I 80 I 90 I 100 [%]
Screen saver	Here you can define whether the screen saver should be used.	Activ I Inactive
Wait time	Defines how long in [min] the system should wait after the user's last action on the terminal before activating the screen saver.	1…1000

10.3.4 Audio signals

Navigation: **Home** > **Setup** > **User** > **Audio signal**

Define the following parameter:

Parameters	Description	Values
At push of a button	Enables a beep when tapping on the touch screen.	Activ I Inactive
Sound	Activate or deactivate sound signals (e.g. after finishing a measurement).	Activ I Inactive
Volume	Defines the volume of the sound signals. Only if **Sound** is activated.	Low I Medium I High

10.3.5 Shortcuts

Navigation: **Home** > **Setup** > **User settings** > **Shortcuts**

Each user can manage the shortcuts that they have created. Individual shortcuts can be selected and deleted and the following parameters of a shortcut can be changed:

Parameters	Description	Values
Type	Shows the type of action the shortcut stands for.	Method I Series I Manual operation
Description	Any name for the shortcut.	Arbitrary
Immediate start	The method, series, or manual operation can be started immediately. This enables you to start the analysis without any interfering dialog.	Activ I Inactive

Homescreen position	Defines the position for the shortcut on the homescreen. 1..12: Positions on the first page of the homescreen. 13...24: Positions on the second page of the homescreen.	1...24
Created by	Shows the name of the user who created the shortcut.	-

10.3.6 Keyboards

Navigation: **Home** > **Setup** > **User settings** > **Keyboards**

In this dialog, you can define the layout for the alphanumeric and the numeric input fields. The following settings are available:

Parameters	Description	Values
ABC keyboard	Determines the layout of the alphanumeric input field.	English I French I German
123 keyboard	Defines the organization of the keys for the numeric input field.	Calculator I Phone

10.4 Global settings

In **Global settings**, you can make general settings on the titrator that apply for all users. The settings in this dialog can only be changed by users with the appropriate authorizations.

Navigation: **Home** > **Setup** > **Global settings**

Settings	Explanation
System settings	General settings that apply to all users (time, date.).
User management	Managing user accounts and assigning rights.
Analysis and resources behavior	Settings for monitoring the expiration dates and life span of resources (determining the actions of the titrator before, during and after the performance of an analysis). Settings for the response of the titrator when resources are deleted or when PnP resources are identified.
Solvent Control	Prompts the user to replace the solvent. For information on the process for replacing the solvent (**Manual operation**).

10.4.1 System

Navigation: **Home** > **Global settings** > **System**

Titrator identification

You can enter and assign any ID consisting of at least four characters to the titrator.

Parameters	Description	Values
Titrator ID	Define the instrument identification.	-
Titrator	Indicates the titrator type.	Titrator types
Serial number	Information on the serial number of the instrument.	-
Titrator FW version	Information on the firmware version of the instrument.	-

Date / Time

You can define the format used to display the date and time and set the titrator date and time.

Parameters	Description	Values
Date format	Defines the format for displaying the date.	mm/dd/yyyy I dd/mm/yyyy
Time format	Defines the format for displaying the time.	24h I a.m./p.m.
Date	Enter the current date.	-
Time	Enter the current time.	-

Header and footer

Define whether all printouts generated by the titrator should have a header or footer. The content of these headers and footers can be entered directly into the respective setting.

As part of the end of record, signature fields are appended to the respective printout consisting of a declaration (e.g. **Approved by**) followed by an empty line. A personal signature can be then be entered on this line.

Parameters	Description	Values
Header	Activates the header on print outs.	Activ I Inactive
Text	Defines the text for the header. Only for **Header** = **Active**.	Arbitrary
Footer	Activates the footer on print outs.	Activ I Inactive
Text	Defines the text for the footer. Only for **Footer** = **Active**.	Arbitrary
End of report	Select the information to be printed at the end of a report.	Created by I Modified by I Checked by I Approved by

Data storage

In this menu you can define if data is stored and if data is deleted when the instrument shuts down.

Parameters	Description	Values
Delete data on shut down	Define if analysis data is to be deleted from the titrator memory when the titrator is shut down.	Activ I Inactive
No storage of results	Results are not stored and cannot be viewed anymore after termination of a method.	Activ I Inactive

See also

🗎 Configure titrator as stand alone instrument without storage of results ▸ Page 211

10.4.2 User Management

Navigation: **Home** > **Setup** > **Global settings** > **User management**

Here you manage users, user groups, and account policies for the titrator.
A maximum of 30 different users can be defined for the titrator, but only one user at a time can be logged onto the instrument (single user operation). One user with administrative rights is already saved on the instrument. In a user profile you can define different access rights (e.g. possibility for using or changing shortcuts, methods, series etc.). This can be helpful to reduce the changing possibilities for the logged in user to the minimum which means, the user has no possibilities to change defined measurement methods.

User accounts can be deleted, printed out and edited.

Users

1 In **User management** tap [**Users**] to open the list of users.

2 To add a new user, tap [**New**].
- or -
Edit an existing user.

You can define the following parameters for each user account:

Parameters	Description	Values
User name	The user's login ID.	Arbitrary
Full name	The user's full name.	Arbitrary
User group 1	The first user group to which the user is assigned.	List of user groups
Member of user group 2… Member of user group 10	Specifies whether the user is assigned to other user groups (2 to a maximum of 10). Always appears in a pair with the parameter.	Activ I Inactive
User group 2… User group 10	Always appears paired with the parameters **Member of user group 2**…**Member of user group 10**.	List of user groups
Description	Any description for the user account or for the user.	Arbitrary

Reset password	If activated, the user's password is reset to "123456" and the user is prompted to change their password the next time they log in. Only appears if **Enforce password/fingerprint** = **Active** is selected in **Account policies**.	Activ I Inactive
Block user	If activated, the user account is locked. Only appears if **Enforce password/fingerprint** = **Active** is selected in **Account policies**.	Activ I Inactive
Enforce password change	If activated, the user is forced to change their password the next time they log on to the titrator. Only appears if **Enforce password/fingerprint** = **Active** is selected in **Account policies**.	Activ I Inactive
Created by	Shows the name of the administrator who created the user account.	-
Created on	Shows the date and time the user account was created.	-
Modified by	Shows the name of the administrator who modified the user account.	-
Modified on	Shows the date and time of the last change to the user account.	-

Note

- If the parameter **Reset password** is activated, the parameter **Enforce password change** will be automatically activated.
- The default password for this user (User ID: "Administrator") is "123456" (do not enter inverted commas).

Groups

Here you define and manage up to 10 different user groups. Different rights can be assigned to each user group. A user is always assigned to at least one user group. All user groups, up to the administrators' user group that possesses full authority, can be deleted.

1 In **User management** tap [**Groups**] to open the list of groups.

2 To add a new group, tap [**New**].
- or -
Edit an existing group.

You can define the following parameters for each group:

Parameters	Description	Values
Group name	A freely definable name for the user group.	Arbitrary
Description	Any description for the user account or for the user.	Arbitrary
Editing methods	If a user group enjoys this right then the members of this group can create methods in the method editor and may freely edit them.	Activ I Inactive
Editing series and samples	If a user group has this authorization, a member of this group will be able to create serial templates and samples and have full editing privileges for them.	Activ I Inactive
Editing resources and peripherals	If a user group enjoys this right then the members of this group can create resources and peripheral devices and may freely edit them.	Activ I Inactive
Global and analysis sequence settings	If a user group enjoys this right then the members of this group can edit global settings in the setup.	Activ I Inactive
Editing user specific settings	If a user group enjoys this right then the members of this group can edit user-specific settings in the setup.	Activ I Inactive
Editing results	If a user group enjoys this right then the members of this group can edit the saved results in the setup.	Activ I Inactive
Starting methods and series	If a user group has this right, then a group member may start methods from the method list or from the analysis start screen.	Activ I Inactive

Executing manual operations	If a user group enjoys this right then the members of this group can perform manual operations.	Activ I Inactive

Account policies

In account policies define the actions of the titrator when it is started up.

Parameters	Description	Values
Enforce password/ fingerprint	If this parameter is activated, the titrator always starts with the login screen (even if only one user is defined for the instrument). The user name must always be entered in the login screen manually (the corresponding input box is always initially empty).	Activ I Inactive

Note

- If this option is selected for an instrument with factory settings, the titrator will demand the password for the predefined user (User ID: "Administrator") the next time it is booted up. This password is "123456" (do not enter inverted commas).

Min. no. of characters	Specifies the minimum number of characters required for user passwords. If this parameter is changed, then users whose password does not meet this requirement will be requested to change their password accordingly the next time that they log in.	Activ I Inactive
No identification for routine-user	If this parameter is activated, a routine user will be logged in automatically on startup. This routine user profile can be defined in the setup. During startup the dialogue for user selection will be skipped and the button **Continue** will appear instead of **Login**. If you want to log in as an administrator during startup, the button **Password login** will be available.	Activ I Inactive

See also

🗎 Configure titrator as stand alone instrument without storage of results ▶ Page 211

10.4.2.1 Configure titrator as stand alone instrument without storage of results

For regulations purposes the instruments need a function to forget all results after printing. This has to be set up once before the installation is approved. The advantage of this function is easier validation. The instrument is no longer handled as a computer-based system and does not fall under the electronic signature regulations. Each record is printed with the time and date and has to be approved manually with the operator's signature(s). An instrument in this mode is considered a **stand alone instrument**. In this mode it is important that results can only be printed once.

Generally the routine user has no possibilities to change any parameters on the instrument. The routine user can only start methods and manual operations via shortcut(s) which have to be defined by the administrator.

Note

- This configuration is only possible when the instrument is used in stand alone mode. Stand alone mode means that the instrument is not connected to LabX® or to a network.
- This configuration is only possible if exactly 2 users are defined, the predefined "Administrator" and the routine user.
- A printer must be connected to the instrument (**USB printer** or **USB compact printer**). If no printer is connected, methods cannot be started.
- When using the instrument as a stand alone instrument without storage of results, the installation of a fingerprint reader is unnecessary.

The steps needed to configure a stand alone instrument without storage of results are described below.

Creating a routine user profile

1 Tap **Setup** > **Global settings** > **User management** > **User**.

2 If other users than the predefined **Administrator** are configured, delete those users.

3 Tap **New**.

⇨ The dialog **User parameters** opens.

4 For **User name** define **Routine User**.

5 For **User group 1** select **Operators** and tap **Save**.

6 Go to **Setup** > **Global settings** > **User management** > **Groups** > **Operators**.

⇨ The dialog **Group parameters** opens.

7 Make sure that all rights are disabled (no checkmarks set) and tap **Save**.

8 Go to **Setup** > **Global settings** > **User management** > **Account policies**.

⇨ The dialog **Account policies** opens.

9 Enable **Enforce password/fingerprint** and check the setting of **Min. no. of characters**.

10 Enable **No identification for routine-user** and tap **Save**.

11 Go to **Setup** > **Global settings** > **System** > **Data storage**.

⇨ The dialog **Data storage** opens.

12 Enable **No storage of results** and tap **Save**.

13 Go to **Setup** > **Hardware** > **Peripherals** > **Printer**.

⇨ The dialog **Printer** opens.

14 Configure a **USB printer** or a **USB compact printer** and tap **Save**.

15 Go to **Setup** > **Global settings** > **Analysis and resources behavior** > **Analysis sequence settings**.

⇨ The dialog **Analysis sequence settings** opens.

16 Enable **Check local printer connection and wait**.

17 For **Save results CSV** select **Inactive** and tap **Save**.

18 Go to **Setup** > **Hardware** > **Peripherals** > **PC settings**.

⇨ The dialog **PC settings** opens.

19 Disable **Connect to LabX at start-up** and tap **Save**.

Creating methods for the routine user

Note

- For each task the routine user needs to perform, a shortcut must be created. In the routine user profile, methods and manual operations can only be started via shortcut.
- After finishing a measurement, the results are printed automatically. The results are not stored and cannot be printed again.

▪ A routine user profile has been created.

1 Go to **Setup** > **Global settings** > **User management** > **User** and select **Routine User**.

⇨ The dialog **User parameters** opens.

2 For **User group 1** select **Administrators** and tap **Save**.

3 Create your specific measurement methods and manual operations with shortcuts.

4 Go to **Setup** > **Global settings** > **User management** > **User** and select **Routine User**.

⇨ The dialog **User parameters** opens.

5 For **User group 1** select **Operators** and tap **Save**.

6 Go to **Home** and tap **Log out**.

7 For the settings to take effect, tap **Shut down** and restart the instrument.

Login as routine user

▪ A routine user profile but also the measurement methods must have been created.

– On the **Login** screen, tap **Continue** to login as routine user.

⇨ **Results** and **Manual** are no longer visible on the homescreen. The routine user has no possibilities to change any parameters on the instrument.

Login as administrator

1 On the **Login** screen, tap **Password login**.

2 Set **User name** to "Administrator".

3 Enter the password and tap **Login**.

10.4.3 Analysis and resources behavior

The settings that you make here relate to the sequence of the analysis of samples or series with the aid of methods.

- You can define the actions of the titrator when started, during an analysis and afterward.
- You can also program the response of the titrator to the deletion of resources or when it identifies PnP resources.

Navigation: **Home** > **Setup** > **Global settings** > **Analysis and resources behavior**

Analysis sequence settings

The analysis sequence settings can only be modified if no tasks are currently being performed by the titrator.

You can make the following settings that influence the sequence of an analysis.

Parameters	Description	Values
Show required resources at start	When an analysis is started a screen appears displaying all resources required for the analysis and their status (available, not-available, locked or in use). If an individual entry is selected from this screen then the user receives additional information about the respective resource. However, if "no" is selected, then the required resources are still checked when the analysis is started and if necessary, an appropriate error message is issued.	Activ I Inactive
Show SOP	If an SOP (standard operating procedure) has been defined in the **Title** method function then this will be displayed before the method is started provided that **Active** has been selected.	Activ I Inactive

Note

- If **Show required resources at start** and **Show SOP** parameters were set to "Yes", all SOPs and subsequently all resources for the individual sample series must be confirmed before the analysis is started. In this way, a **Series sequence** can be performed after it has been started without any further interruption.

Confirm after a completed rack rotation	This setting affects analyses that are to be performed on the sample changer and require more beakers than can be accommodated on the rack of the sample changer. If activated, a warning message is issued after a complete revolution of the sample changer and before a position is approached on the tray that has already been titrated. This warning must be acknowledged by the user.	Activ I Inactive
InMotion sample detection auto-skip	For InMotion T: if the beaker is not detected or the sample data is not readable (e.g. Smart Tag or barcode) the system automatically skips the sample after 10 min without requiring confirmation. For InMotion KF: if the vial is not detected or the vial is higher than allowed, a message informs the user of the problem, moves the drift vial to the oven position and goes into standby mode. The system automatically skips the sample after 10 min without requiring confirmation.	Activ I Inactive
Delete Smart Tag data after reading	Defines if the Smart Tag data is deleted from the Smart Tag after successful reading. All data on the Smart Tag will be deleted.	Activ I Inactive

Show results after analysis	If a manual or external titration stand is being used, then the results for a sample are automatically displayed after they have been analyzed and must be acknowledged by the user before the analysis can be continued. With **Auto stand** the results are displayed for a certain period and are not to be confirmed. The activated parameter is valid for the following functions: **Analysis**: the results for a sample are shown **Calibration/Loop**: The results of the calibration are shown (slope, zero point) **Sensor test**: The results of the test are shown (slope, zero point, drift and sensor test OK / not OK)	Activ | Inactive
Check local printer connection and wait	When selected, the availability of a printer is checked at the beginning of the method. If not selected and no printer is connected, the method function **Record** is skipped. If a printer is connected, the method function **Record** is executed even if this parameter is not selected. Only for **USB printer**, **USB compact printer**.	Activ | Inactive
Print autom. KF protocols	Controls printouts for manual drift, concentration, and blank value determinations.	Activ | Inactive
Save results CSV	Defines if some of the sample date and some of the results are saved to a CSV file. **No**: No data is saved. **To USB-Stick**: The CSV files are saved on the connected USB stick. If a USB-stick is not detected during the data writing, you can stop the process or you can plug in another USB stick for the data writing. **To network**: The CSV files are saved in the shared folder defined in **Network storage**. **Note** • A CSV file is exported for each sample when the method function **End of sample** is reached. There is no export outside of a loop. • The method function **Calculation** must be included inside the loop. • The export is in the record language. • When importing the CSV file into excel make sure, the data formats match.	To USB-Stick | To network | No
Check USB-Stick connection and wait	If this parameter is activated, the presence of a USB - Stick is validated at the start of the analysis. Only for **Save results CSV** = **To USB-Stick**.	Activ | Inactive

Resources behavior

Use the following parameters to configure how the titrator responds to the deletion of resources and its response to the automatic identification of PnP resources.

Parameters	Description	Values
Information when deleting resources	Defines if a confirmation will be requested before a resource is deleted.	Activ | Inactive
Information when recognizing PnP resources	Defines if a confirmation will be requested every time a PnP resource is identified.	Activ | Inactive

Action when exceeding usable life

If it is determined by the titrator that the expiration dates of a resource have been exceeded, then the titrator may perform various actions.

Warning The user is warned that the resource's usable life has been exceeded and the raw results and results determined with the respective resource will be labeled accordingly.

Block The user is notified that the usable life of the resource has been exceeded and it is no longer possible to start the analysis with the affected resource. (Methods that result in renewal of this resource can however still be started.)

None If you select "none" then the analysis is started without message in spite of the exceeded usable life. The expiry of the expiration date will, however, be logged.

Parameters	Description	Values
Sensors	The action is executed if the system determines at the start of an analysis that the usable life of a sensor has been exceeded.	None I Warning I Block
Titrants	The action is executed if the system determines at the start of an analysis that the expiration date of a titrant has been exceeded.	None I Warning I Block
Titer/conc. stds	The action is executed if the system determines at the start of an analysis that the expiration date of a titrant or a concentration standard has been exceeded.	None I Warning I Block
Auxiliary values	This action is performed if the system determines at the start of an analysis that the usable life of an auxiliary value that is to be used in the analysis has been exceeded.	None I Warning I Block
Blank values	This action is performed if the system determines at the start of an analysis that the usable life of a blank value that is to be used in the analysis has been exceeded.	None I Warning I Block

Action when exceeding life span

If, at the start of an analysis, it is determined that the life span of a resource to be used for the analysis has expired, the titrator can set various actions.

Warning The user is warned that the resource life span has been exceeded and the raw results and results determined with the respective resource will be labeled accordingly.

Block The user is notified that the life span of the resource has been exceeded and it is no longer possible to start the analysis with the affected resource.

None The analysis is started in spite of the exceeded life span.

Parameters	Description	Values
Sensors	The action is executed if the system determines at the start of an analysis that the life span of a sensor has been exceeded.	None I Warning I Block
Titrants	The action is executed if the system determines at the start of an analysis that the life span of a titrant has been exceeded.	None I Warning I Block

Pump and stirrer detection

Parameters	Description	Values
Stirrer detection	Defines if the automatic stirrer detection is activated. This may be necessary, for example, if you connect additional devices via the stirrer outputs that are not automatically identified by the titrator.	Activ I Inactive
Pump detection	Defines if the automatic pump detection is activated. This may be necessary, for example, if you connect additional devices via the pump outputs that are not automatically identified by the titrator.	Activ I Inactive

10.4.4 Solvent Control

Solvent control allows you to monitor the solvent for volumetric Karl Fischer titrations or the reagent for coulometric Karl Fischer titrations.

On T9 you can run parallel titrations. If you run parallel Karl Fischer titrations you can either run two volumetric Karl Fischer titrations or one volumetric and one coulometric Karl Fischer titration.

For each instance of solvent control you can configure the parameters listed below. Parameters that are specific for coulometric or volumetric Karl Fischer titrations are listed in the next chapter.

Parameters	Description	Values
Instance	Shows the selected instance of Solvent control.	Solvent Control 1 | Solvent Control 2
Control type	Defines the type of Karl Fischer titration that the solvent control is used for. **Solvent (volumetric)**: solvent control is used for a volumetric Karl Fischer titration. **Reagent (coulometric)**: solvent control is used for a coulometric Karl Fischer titration.	Solvent (volumetric) | Reagent (coulometric)

See also

Pump ▸ Page 232

10.4.4.1 Volumetric Karl Fischer titrations

For solvent control to work, you need a Karl Fischer titration stand and pumps that can be used to drain or fill the titration vessel. You can configure a second instance of solvent control, **Solvent Control 2**, if you either add a second **KF stand**, a second **InMotion KF**, or a second **Stromboli TTL 2**.

The following table summarizes the options.

Solvent Control	Drain pump	Fill pump	Titration stand
Solvent Control 1	• **Solvent Manager** • **Peristaltic** • **Membrane**	• **Solvent Manager** • **Peristaltic** • **Membrane**	• **KF stand** • **Stromboli TTL 1** (only T7 and T9) • **InMotion KF/1** (only T7 and T9)
Solvent Control 2	• **Solvent Manager 2** • **Peristaltic** • **Membrane**	• **Solvent Manager 2** • **Peristaltic** • **Membrane**	• **KF stand 2** • **Stromboli TTL 2** (only T7 and T9) • **InMotion KF/2** (only T7 and T9)

The monitoring parameters available are listed below.

- **Monitoring usable life of solvent**: The time interval for the use of the solvent.
- **Monitoring capacity of solvent**: The capacity limit, i.e. a fixed maximum value of the total water volume of samples titrated (including standby and pre-titration) in the same solvent.
- **Monitoring no. of samples**: Maximum number of samples to be titrated in the solvent.

You can configure the action of the system when the defined monitoring parameters reach their limits. The available actions are listed below.

- **Enforce replacement when exceeding usable life**: The user has to replace the solvent before he can start the next titration.
- **Autom. exchange when exceeding usable life**: The solvent manager replaces the solvent or reagent automatically.
- If neither **Enforce replacement when exceeding usable life** nor **Autom. exchange when exceeding usable life** is activated, the system displays a reminder that the solvent should be exchanged. The user can either replace the solvent or start a new titration.

Exchange of solvent with a Stromboli oven sample changer

For sample analysis using the Stromboli oven sample changer, the solvent can only be replaced in standby mode before analysis of the first sample, or at the end of the series, if the titrator returns to standby mode.

Exchange of solvent with an InMotion KF Pro

For sample analysis using an InMotion KF, the solvent can be replaced in standby mode before analysis of the first sample, at the end of the series if the titrator returns to standby mode, or within a series if the **Allow replacement within InMotion KF Pro series** parameter is activated

Parameter description

Navigation: **Home** > **Setup** > **Global settings** > **Solvent Control**

Parameters	Description	Values
Drain pump	Defines, which pump is used for draining.	Available pumps
Fill pump	Defines, which pump is used for filling.	Available pumps
Titration stand	Shows the selected titration stand (e.g. KF stand).	-
Monitoring usable life of solvent	Defines if the usable life of the solvent is monitored.	Activ I Inactive
Last replacement	Shows date and time of the last solvent-replacement.	-
Performed by	Shows the person or instance who performed the last replacement.	-
Usable life	Defines the time interval in days for the use of the solvent. Only if **Monitoring usable life of solvent** is activated.	$1 \dots 10^4$
Expiry date	Shows the expiry date of the solvent in use. Only if **Monitoring usable life of solvent** is activated.	-
Enforce replacement when exceeding usable life	If activated, the user is forced to replace the solvent before he can start a new Karl Fischer titration. Only if **Monitoring usable life of solvent** is activated.	Activ I Inactive
Autom. exchange when exceeding usable life	The exchange of solvent is performed automatically when exceeding the specified usable life. Only if **Monitoring usable life of solvent** is activated.	Activ I Inactive
Monitoring capacity of solvent	Defines if the capacity of the solvent is monitored.	Activ I Inactive
Max. amount of water	The maximum volume of water in [mg] for a solvent. Only if **Monitoring capacity of solvent** is activated.	$0 \dots 10^6$
Curr. amount of water	Shows the current amount of water [mg] in the solvent.	-
Enforce replacement when exceeding capacity	If activated, the user is forced to replace the solvent before he can start a new Karl Fischer titration. Only if **Monitoring capacity of solvent** is activated.	
Autom. exchange when exceeding capacity	The exchange of solvent is performed automatically when exceeding the specified capacity of the solvent. Only if **Monitoring capacity of solvent** is activated.	Activ I Inactive
Monitoring no. of samples	Defines if the number of samples is monitored.	Activ I Inactive
Max. no. of samples	Defines the maximum number of samples before replacing the solvent. Only if **Monitoring no. of samples** is activated.	0...120
Curr. no. of samples	Shows the current number of samples.	-
Enforce replacement at max. no. of samples	If activated, the user is forced to replace the solvent before he can start a new Karl Fischer titration. Only if **Monitoring no. of samples** is activated.	Activ I Inactive
Autom. exchange at max. no. of samples	The exchange of solvent is performed automatically when exceeding the specified maximum number of samples. Only if **Monitoring no. of samples** is activated.	Activ I Inactive
Allow replacement within InMotion KF Pro series	Defines whether the solvent or reagent can be replaced within a series or not.	Activ I Inactive

Stir	Enables the stirrer during solvent exchange.	Activ I Inactive
Drain duration	Defines the pumping time for draining the exhausted solvent from the titration vessel. The pumping time should be as long as possible to ensure that the tubes are completely free of solvent following draining. Only if **Autom. exchange when exceeding usable life**, **Autom. exchange when exceeding capacity** or **Autom. exchange at max. no. of samples** is activated.	0…1000
Drain volume	Defines the volume that is pumped out of the titration vessel.	0…1000 mL
Fill time	Defines the pumping time for filling the titration vessel with new solvent. Only if **Autom. exchange when exceeding usable life**, **Autom. exchange when exceeding capacity** or **Autom. exchange at max. no. of samples** is activated.	0…1000
Fill volume	Defines the volume that is pumped into the titration vessel.	0…1000 mL

10.4.4.2 Coulometric Karl Fischer titrations

For solvent control to work, you need a Karl Fischer titration stand and pumps that can be used to drain or fill the titration vessel. You can configure a second instance of solvent control, **Solvent Control 2**, if you either add a second **KF stand**, a second **InMotion KF**, or a second **Stromboli TTL 2**.

The following table summarizes the options.

Solvent Control	Drain pump	Fill pump	Titration stand
Solvent Control 1	• **Solvent Manager**	• **Solvent Manager**	• **KF stand** • **Stromboli TTL 1** (only T7 and T9) • **InMotion KF/1** (only T7 and T9)
Solvent Control 2	• **Solvent Manager 2**	• **Solvent Manager 2**	• **KF stand 2** • **Stromboli TTL 2** (only T7 and T9) • **InMotion KF/2** (only T7 and T9)

The monitoring parameters available are listed below.

- **Monitoring usable life of reagent**: The time interval for the use of the reagent.
- **Monitoring capacity of reagent**: The capacity limit, i.e. a fixed maximum value of the total water volume of samples titrated (including standby and pre-titration) in the same reagent.
- **Monitoring no. of samples**: Maximum number of samples to be titrated in the reagent.

You can configure the action of the system when the defined monitoring parameters reach their limits. The available actions are listed below.

- **Enforce replacement when exceeding usable life**: The user has to replace the reagent before he can start the next titration.
- If **Enforce replacement when exceeding usable life** is not activated, the system displays a reminder that the reagent should be exchanged. The user can either replace the reagent or start a new titration.

Exchange of reagent with a Stromboli oven sample changer

For sample analysis using the Stromboli oven sample changer, the reagent can only be replaced in standby mode before analysis of the first sample, or at the end of the series, if the titrator returns to standby mode.

Exchange of reagent with an InMotion KF Pro

For sample analysis using an InMotion KF, the reagent can be replaced in standby mode before analysis of the first sample, at the end of the series if the titrator returns to standby mode, or within a series if the **Allow replacement within InMotion KF Pro series** parameter is activated

Parameter description

Navigation: **Home** > **Setup** > **Global settings** > **Solvent Control**

Parameters	Description	Values
Drain pump	Defines, which pump is used for draining.	Available pumps
Fill pump	Defines, which pump is used for filling.	Available pumps
Titration stand	Shows the selected titration stand (e.g. KF stand).	-
Monitoring usable life of reagent	Defines if the usable life of the reagent is monitored.	Activ I Inactive
Last replacement	Shows date and time of the last reagent-replacement.	-
Performed by	Shows the person or instance who performed the last reagent-replacement.	-
Usable life	Defines the time interval in days for the use of the reagent. Only if **Monitoring usable life of reagent** is activated.	$1...10^4$
Expiry date	Shows the expiry date of the reagent in use. Only if **Monitoring usable life of reagent** is activated.	-
Enforce replacement when exceeding usable life	If activated, the user is forced to replace the reagent before he can start a new Karl Fischer titration. Only if **Monitoring usable life of reagent** is activated.	Activ I Inactive
Monitoring capacity of reagent	Defines if the capacity of the reagent is monitored.	Activ I Inactive
Max. amount of water	Defines the maximum volume of water in [mg] for a reagent. Only if **Monitoring capacity of reagent** is activated.	$0...10^6$
Curr. amount of water	Shows the current amount of water [mg] in the reagent.	-
Enforce replacement when exceeding capacity	If activated, the user is forced to replace the reagent before he can start a new Karl Fischer titration. Only if **Monitoring capacity of reagent** is activated.	
Monitoring no. of samples	Defines if the number of samples is monitored.	Activ I Inactive
Max. no. of samples	Defines the maximum number of samples before replacing the reagent. Only if **Monitoring no. of samples** is activated.	0...120
Curr. no. of samples	Shows the current number of samples.	-
Enforce replacement at max. no. of samples	If activated, the user is forced to replace the reagent before he can start a new Karl Fischer titration. Only if **Monitoring no. of samples** is activated.	Activ I Inactive
Allow replacement within InMotion KF Pro series	Defines whether the solvent or reagent can be replaced within a series or not.	Activ I Inactive
Stir	Enables the stirrer during solvent exchange.	Activ I Inactive

10.5 Values

Navigation: **Home** > **Setup** > **Values**

Blanks and auxiliary values can be created, edited and deleted and the list of defined blanks or auxiliary values can be viewed and printed out. It is also possible to print out the individual values with their parameters.

Settings	Explanation
Blanks	Blank values can be used in formulas for calculations.

Settings	Explanation
Auxiliary values	You can use auxiliary values in formulas.

10.5.1 Blanks

Navigation: **Home** > **Setup** > **Values** > **Blanks**

Blanks can be used in formulas for calculations. They can either be created manually with the aid of their various parameters or generated as the result of a method. A resulting blank (or calculated mean value) can then be assigned to a blank using the method function **Blank**. The blank will then appear under the assigned name in the Blank list in Setup.

Adding a blank value

– In **Blanks** choose [**New**].

⇨ The windows to edit the parameters opens.

Define the following parameters to define the blank:

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Unit	The units in which the blank is specified.	Arbitrary
Value	Here you can enter a numerical value.	$-10^8 \ldots 10^8$
Determination method	Method name of the method used for the determination.	Method name
Date / Time	Date and time of the determination.	Date and time
Performed by	Name of the user performing the determination.	User name
Monitoring usable life	Specifies whether the usable life of a resource or a value is to be monitored.	Activ I Inactive
Time period	Specifies the time range. Only if **Monitoring usable life** = **Active**.	Days I Hours
Usable life	Defines the time span of the expiration dates either in days or hours (depending on: **Time period**). Only if **Monitoring usable life** = **Active**.	Days: 1…1000 Hours: $1 \ldots 10^4$
Expiry date	Shows the expiry date of the resource or the value. Only if **Monitoring usable life** = **Active**.	-
Reminder	Determines whether the titrator should issue a warning before the usable life of a resource or a value elapses. Only if **Monitoring usable life** = **Active**.	Activ I Inactive
Days before expirat.	Determines the number of days before the service life of the resource that the titrator should issue a warning. The value entered must be less than the value in **Usable life**. Only if **Monitoring usable life** = **Active**, **Time period** = **Days** and **Reminder** = **Active**.	0…1000

Note

- A maximum of 100 blanks can be saved in the titrator.
- Blanks cannot be deleted or modified if they are currently in use.
- When a blank is assigned with the "Blank" method function, this is updated in the setup immediately after completion of the method function.

See also

🗎 Monitoring the usable life of a resource ▸ Page 64

10.5.2 Auxiliary values

Navigation: **Home** > **Setup** > **Values** > **Auxiliary values**

You can use auxiliary values in formulas. They can either be manually created and edited or can be generated using a method. A result, a mean derived from several results or a raw result can be assigned to an auxiliary value by means of the "Auxiliary Value" method function. The auxiliary value then appears under the assigned name in the auxiliary values list in the Setup.

Adding an auxiliary value

– In **Auxiliary values** choose [**New**].

⇨ The windows to edit the parameters opens.

Define the following parameters to define the auxiliary value:

Parameters	Description	Values
Name	Specify a descriptive name of your choice.	Arbitrary
Comment	A brief comment (e.g. unit) to the auxiliary value can be entered .	Arbitrary
Value	Here you can enter a numerical value.	$-10^8 \ldots 10^8$
Determination method	Method name of the method used for the determination.	Method name
Date / Time	Date and time of the determination.	Date and time
Performed by	Name of the user performing the determination.	User name
Monitoring usable life	Specifies whether the usable life of a resource or a value is to be monitored.	Activ I Inactive

Note

- A maximum of 100 auxiliary values can be saved in the titrator.
- Auxiliary values cannot be deleted or modified when they are currently in use.
- When an auxiliary value is assigned with the method function **Auxiliary value**, this is updated in the setup immediately after completion of the method function.

Time period	Specifies the time range. Only if **Monitoring usable life** = **Active**.	Days I Hours
Usable life	Defines the time span of the expiration dates either in days or hours (depending on: **Time period**). Only if **Monitoring usable life** = **Active**.	Days: 1…1000 Hours: $1 \ldots 10^4$
Expiry date	Shows the expiry date of the resource or the value. Only if **Monitoring usable life** = **Active**.	-
Reminder	Determines whether the titrator should issue a warning before the usable life of a resource or a value elapses. Only if **Monitoring usable life** = **Active**.	Activ I Inactive
Days before expirat.	Determines the number of days before the service life of the resource that the titrator should issue a warning. The value entered must be less than the value in **Usable life**. Only if **Monitoring usable life** = **Active**, **Time period** = **Days** and **Reminder** = **Active**.	0…1000

See also

🗎 Monitoring the usable life of a resource ▸ Page 64

10.6 Maintenance & Service

Navigation: **Home** > **Setup** > **Mainten. & Service**

10.6.1 MT service

Navigation: **Home** > **Setup** > **Mainten. & Service** > **MT-Service**

In this dialog, you can view and print out a list of the most recent (max. 10) METTLER TOLEDO services. Under each date, the user name of the METTLER TOLEDO service technicians and the date and time of the service appointment are displayed. The most recently performed service always appears at the top of the list.

You can change the service life (in days) of the last service date and configure the titrator to issue a warning at a defined time before the service life elapses (requires administrator rights).

– In **MT-Service** tap [**Settings**].

⇨ The windows to edit the parameters opens.

Parameters	**Description**	**Values**
Initial operation	Defines the date of the initial operation of the titrator.	Date
Last service	Shows the date of the last service.	Date
Service life	Defines the service life (in days) from the most recently performed service.	$0...10^4$
Next service	Shows the due date of the next service.	Date
Reminder	Determines whether the titrator should issue a warning before the service life expires. Only if **Monitoring usable life** = **Active**.	Activ I Inactive
Days before expiration	Determines the number of days before expiry of the service life that the titrator should issue a warning. The value entered here must be smaller than the service life. (Appears only if "Reminder" is activated.)	0...1000

10.6.2 Import/Export

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Import / Export**

You can use this function to save titrator data on a USB stick (export) and reload the data back to a titrator later on (import).

Thus is it possible to create a backup of most data that has been changed from the titrator's default settings.

Uploading data from a backup copy results in the existing data in the titrator being overwritten. In this way you can immediately duplicate the status of one titrator in another one or restore titrator settings after repair.

The following two rules should be observed:

- Memory copies can only be imported from the same titrator type.
- Memory copies, user management and methods can only be imported from the same or from a lower firmware version.

You can select whether you want to export or import a backup copy, an individual method, all methods or the user management.

A memory copy includes the information listed below.

- All parameters of methods and series
- Setup including all resources
- User settings
- Global settings (incl. user management)
- Settings for manual operations

A memory copy does **not** contain all saved results, data saved on a PnP component and the default parameters for manual operations.

Import/export of individual methods

When you import/export an individual method, you can select which method is to be exported or imported. You require the right to edit methods.

Import/export of all methods

When you export all methods, all methods are exported to individual XML files on the USB-stick.

When you Import all methods, all method related XML files on the USB-stick are checked and when a method is compatible with the titrator type, the method is imported. If not enough memory is free, a message is displayed. The user has to delete existing user or mettler methods on the titrator before he can import the methods. The user is asked whether an existing method should be overwritten if a method with the same method ID exists

Import/export of user management settings

When you import/export user management settings, the entire user management settings with all users and their properties are exported or imported.

1 Open **Setup** > **Mainten. & Service** > **Import / Export**.

2 Configure the following parameters:

Parameters	Description	Values
Action	Here you can select whether you wish to export the titrator data to a memory stick or to import it from a memory stick to a titrator.	Export I Import
Data	Defines which data is exported or imported. **Memory copy**: Exports or imports a backup copy. **Single method**: Exports or imports an individual method. **All methods**: Exports or imports all methods. **User management**: Exports or imports the user management.	Memory copy I Single method I All methods I User management
Method ID	Defines which method is imported or exported.	Method list

10.6.3 Reset to factory settings

NOTICE

Danger of data loss due to reset!

In the process of resetting the titrator all data and changes to settings made by users of the titrator are erased.

– Back up all data and settings.

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Reset to factory settings**

10.6.4 Titrator firmware history

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Titrator firmware history**

The **Titrator firmware history** button displays a list of the firmware updates or model upgrades. The first entry in the list represents the initial operation of the titrator.
All list entries are stored with date, type, FW version and the user name of the user who performed the action.

10.6.5 Board firmware

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Board firmware**

Display a list of all boards and burette drives available on the titrator along with the relevant firmware version. You can carry out an update.

10.6.6 Terminal

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Terminal**

Displays the ID of the currently installed chip.

10.6.7 Board data

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Board data**

Display and print out a list of all the boards fitted in the titrator. Each board is listed by name and module location.

If a board is selected from the list, then its chip ID and all data on available inputs and outputs including the adjustment data will be displayed.

10.6.8 Drives

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Drives**

Display and print a list of all connected drives. The list contains the position, serial number, chip-ID and status of each drive.

10.6.9 Burettes

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Burettes**

Display and print out a list of connected PnP burettes. Each PnP burette is listed with its chip ID, serial number, volume and position of the attached drive.

10.6.10 Upgrade

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Upgrade**

With this function you can upgrade a T7 to a T9 Titrator. **Upgrade** is only available on T7 and if the titrator is idle.

Parameters	Description	Values
Upgrade	Shows the upgrade type. The upgrade type is needed to order the Upgrade-Key. (Info field)	T7 -> T9
Item number	Shows the item number. The item number is needed to order the Upgrade-Key. (Info field)	Titrator specific number
Upgrade-Key	Shows the Upgrade-Key that is needed to order an upgrade.	-

10.6.11 Update

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Update**

It is possible to update the firmware of your titrator. If you want to update the firmware of your titrator, contact your authorized METTLER TOLEDO dealer or service representative.

▶ www.mt.com/contact

10.6.12 Delete Mettler method template

Navigation: **Home** > **Setup** > **Mainten. & Service** > **Delete Mettler method template**

You can delete Mettler method template from the titrator.

1 Select the method that you want to delete.

2 Choose **Remove** method to delete the method from the titrator's memory.

11 Manual operations

You can use manual operations to access various titrator functions that are not directly connected to the execution of an analysis, but that might be useful during the sample preparation, for example.
You can call up the following manual operations from here with the relevant titrator components:

Hardware components	Possible manual operations	Possible usages
Stirrer	**Stir**	Dissolve a solid sample
Sensor	**Measure**	Determine the pH or temperature of a solution
Burette	**Rinse**	Rinse burette before changing a titrant
	Rinse multiple burettes	Rinsing several burettes simultaneously
	Dispense	Dispense during sample preparation
	Manual titration	Manual titration using a color indicator
Pump	**Pump**	Pump auxiliary reagents in and out, fill and empty sample vessels, replace the solvent (for Karl Fischer water determination).
Auxiliary instrument	**Control**	Activating a valve
Sample changer	**Move to position**	Prepare an analysis
	Move titration head	
	Rinse	
SmartSample reader	**Delete data**	Delete data from a Smart Tag or initialize an unformatted Smart Tag.
	Read	Change data on a Smart Tag
	Write	

Note

- With the T7 and T9 models, you can perform a maximum of six manual operations simultaneously (with one hardware component each), if your power consumption permits.
- With the T7 and T9 you cannot start another manual operation if a manual titration is being executed.
- The T5 model does not allow parallel execution of multiple manual operations.
- Manual operations can also be executed while an analysis is running, if the hardware components that you want to operate manually are not going to be used by the analysis and if the power consumption permits (T7 and T9 only). SmartSample reader functions are only active when the instrument is idle.
- The resource parameters in all editable fields can be changed temporarily (only for the execution of the manual operation in question) and can vary from the setup settings. The changes made will not be copied over to the setup, however.

11.1 Stirrer

To switch a connected stirrer (Rod stirrer or magnetic stirrer) on or off for a definable time interval and at a definable stirring speed, select the following:

Navigation: **Home** > **Manual** > **Stirrer**

1 Make a selection in **Titration stand**.
2 Select the desired stirrer in **Stirrer output** and enter the speed in [%].
3 Enter the stir time in [sec] or select "∞" for an infinite duration.
4 Tap **Start** to start the stirrer.

⇨ The stirrer starts. Tap **Stop** to stop the stirrer at any time (terminating the manual operation).

Define the following parameters:

Parameters	Description	Values
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Stirrer output	Defines the stirrer output.	List of available outputs

Speed	Defines the stirring speed in [%].	0…100
Stir time	The stirring time, in [sec], during which the stirrer should be in operation. Select "∞" for unlimited stirring time.	0…10^4 | ∞

Note

- Entries made here will only be applied to the manual operation and will have no effect on the instrument settings.

11.2 Sensor

To take a measurement using any connected sensor, select the following:

Navigation: **Home** > **Manual** > **Sensor**

1 Make a selection in **Sensor**.
2 Select the desired stirrer and enter a speed.
3 For polarized, potentiometric and conductivity sensors, specify whether the temperature should be entered manually or automatically.
4 For manual temperature acquisition, enter the temperature.
- or -
For automatic temperature acquisition, select a connected temperature sensor and the temperature unit to be used.
5 Enter the duration of the measurement in [sec] or select "∞" for an infinite duration.
6 Select whether to output a record on the printer.
7 To output a record on the printer, use dt [sec] to define the time interval between measurements.
8 Tap **Start** to start the measurement.

⇨ The measurement starts. Tap **Stop** to stop the measurment at any time (terminating the manual operation).

⇨ During the measurement, the system will display the online curve (measured values in the selected unit versus time). Use **Measured values** to display a table of measured values instead of the curve.

11.2.1 Temperature sensor

You can define the following parameters for a manual operation:

Parameters	Description	Values
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Sensor input	The input to which you want to connect the sensor.	AB1/PT1000 | More depending on configuration
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	°C | K | °F
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Stirrer output	Defines the stirrer output.	List of available outputs
Speed	Defines the stirring speed in [%].	0…100
Duration	The measurement and stirring time, in [sec]. Select "∞" for unlimited measurement time.	0…10^4 | ∞
Record	If activated, the measured values will be printed out.	Activ | Inactive
dt	Defines the time interval in [sec] for outputting measured values to the printer. Only appears if **Record** = **Active** was selected.	1…6000

Note

- Entries made here will only be applied to the manual operation and will have no effect on the instrument settings.

11.2.2 Potentiometric Sensor

You can define the following parameters for a manual operation:

Potentiometric sensors are potentiometric indicator electrode, such as glass electrodes for pH measurement, Redox electrode for measuring the redox potential or ion-selective electrodes (ISE) for determining of ion content in the solution. Below, the editable parameters are listed for both potentiometric sensors and photrodes used for turbidimetric and color induced titrations:

Parameters	Description	Values
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Unit	The unit of measure to be used for the measurement; the unit will depend on the sensor type selected.	mV I pH I pM I A I %T
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Stirrer output	Defines the stirrer output.	List of available outputs
Speed	Defines the stirring speed in [%].	0…100
Temperature manual	Defines whether to enter the temperature manually (**Active**) or via a temperature sensor (**Inactive**).	Activ I Inactive
Temperature	If the temperature is entered manually, you can enter it here, in [°C]. Only appears if **Temperature manual** = **Active** was selected.	-20…200
Temperature sensor	Here you can select the required temperature sensor. Only appears if **Temperature manual** = **Inactive** is selected.	List of available sensors
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Temperature unit	The unit of measure for the temperature measurement. Only appears if **Temperature manual** = **Inactive** was selected.	°C I K I °F
Duration	The measurement and stirring time, in [sec]. Select "∞" for unlimited measurement time.	0…10^4 I ∞
Record	If activated, the measured values will be printed out.	Activ I Inactive
dt	Defines the time interval in [sec] for outputting measured values to the printer. Only appears if **Record** = **Active** was selected.	1…6000

Note

- The parameters for temperature acquisition or entering the temperature, **Temperature manual**, **Temperature**, **Temperature sensor**, **Sensor input** and **Temperature unit** are omitted for mV sensors and the phototrode.
- Entries made here will only be applied to the manual operation and will have no effect on the instrument settings.

11.2.3 Polarized sensor

You can define the following parameters for a manual operation:

Parameters	Description	Values
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Sensor input	The input to which you want to connect the sensor.	AB1/SENSOR2 I More depending on configu-ration
Indication	Defines how to do the indication. Depending on the unit of measure: [mV] = **Voltametric**, [µA] = **Amperometric**.	Voltametric I Ampero-metric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA

Upol	Defines the polarization voltage [mV], for an amperometric indication. Only for polarized sensors and **Indication** = **Amperometric**.	0…2000.0
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Stirrer output	Defines the stirrer output.	List of available outputs
Speed	Defines the stirring speed in [%].	0…100
Temperature manual	Defines whether to enter the temperature manually (**Active**) or via a temperature sensor (**Inactive**).	Activ I Inactive
Temperature	If the temperature is entered manually, you can enter it here, in [°C]. Only appears if **Temperature manual** = **Active** was selected.	-20…200
Temperature sensor	Here you can select the required temperature sensor. Only appears if **Temperature manual** = **Inactive** is selected.	List of available sensors
Sensor input	The input to which you want to connect the sensor.	AB1/PT1000 I More depending on configu-ration
Temperature unit	The unit of measure for the temperature measurement. Only appears if **Temperature manual** = **Inactive** was selected.	°C I K I °F
Duration	The measurement and stirring time, in [sec]. Select "∞" for unlimited measurement time.	$0…10^4$ I ∞
Record	If activated, the measured values will be printed out.	Activ I Inactive
dt	Defines the time interval in [sec] for outputting measured values to the printer. Only appears if **Record** = **Active** was selected.	1…6000

Note

- Entries made here will only be applied to the manual operation and will have no effect on the instrument settings.

11.2.4 Conductivity sensor

You can define the following parameters for a manual operation:

Parameters	Description	Values
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Sensor input	The input to which you want to connect the sensor.	CB1/Conductivity I More depending on configuration
Unit	Defines the unit of measure to be used for the measurement.	µS/cm I mS/cm I µS I mS
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Stirrer output	Defines the stirrer output.	List of available outputs
Speed	Defines the stirring speed in [%].	0…100
Temperature manual	Defines whether to enter the temperature manually (**Active**) or via a temperature sensor (**Inactive**).	Activ I Inactive
Temperature	If the temperature is entered manually, you can enter it here, in [°C]. Only appears if **Temperature manual** = **Active** was selected.	-20…200
Temperature sensor	Here you can select the required temperature sensor. Only appears if **Temperature manual** = **Inactive** is selected.	List of available sensors
Sensor input	The input to which you want to connect the sensor.	AB1/PT1000 I More depending on configu-ration

Temperature unit	The unit of measure for the temperature measurement. Only appears if **Temperature manual** = **Inactive** was selected.	°C | K | °F
Duration	The measurement and stirring time, in [sec]. Select "∞" for unlimited measurement time.	$0 \ldots 10^4$ | ∞
Record	If activated, the measured values will be printed out.	Activ | Inactive
dt	Defines the time interval in [sec] for outputting measured values to the printer. Only appears if **Record** = **Active** was selected.	1…6000

Note

- Entries made here will only be applied to the manual operation and will have no effect on the instrument settings.

11.3 Burette

In this window, carry out various manual operations with the available burettes.

Rinse an available burette or rinse multiple burettes at the same time, dispense a defined quantity of titrant or run a manual titration with a selected burette.

Navigation: **Home** > **Manual** > **Burette**

11.3.1 Rinse burette

Navigation: **Home** > **Manual** > **Burette** > **Rinse**

This operation lets you rinse a burette and its connecting tubes and fill it with fresh titrant, for example if you want to remove air bubbles from the system.

1 Select the titrant you want to rinse with.
2 Select the drive on which the titrant is installed. (For PnP burettes, the system automatically selects the appropriate drive.)
3 Enter the number of cycles you want to run.
4 Enter the discharge volume in [%] to define the percentage of the burette's total volume that you want to discharge during each rinse passage.
5 Enter the filling rate in [%] to define the speed at which you want to refill the burette. (100% is the maximum rate.)
6 Tap **Start** to start the procedure.
⇨ The procedure starts. Tap **Stop** to stop the procedure at any time.

Note

- Make sure that the dispensing tube is directed into a vessel which is a multiple of the volume of the burette.
- For reagents with a higher viscosity or volatile reagents, we recommend reducing the filling rate to prevent air from being drawn in and the titrant from outgassing.

You can determine the following parameters:

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Drive	The drive on which the burette with the selected titrant is installed.	1…8
Cycles	Defines the number of rinse cycles to be executed.	1…100
Discharge volume	The volume of titrant, in [mL], to be discharged during the rinsing process.	10…100
Fill rate	The filling rate of the burette in percent. 100% stands for maximum filling rate.	30…100

11.3.2 Rinse multiple burettes

Navigation: **Home** > **Manual** > **Burette** > **Rinse multiple burettes**

Several burettes can be rinsed at the same time using this operation. If more than four burettes are rinsed at the same time, the corresponding drives are actuated sequentially, i.e. the first four burettes are rinsed simultaneously first, followed by the next four burettes.

1 Select the corresponding drives to rinse the burettes with titrant.
2 Enter the number of cycles during which rinsing is to take place.
3 Tap **Start** to start the procedure.
⇨ The procedure starts. Tap **Stop** to stop the procedure at any time.

You can determine the following parameters:

Parameters	Description	Values
Drive 1…Drive 8	Drives on which the burettes with titrant are installed.	Activ I Inactive
Cycles	Defines the number of rinse cycles to be executed.	1…100

Note

- The drives can only be seen if they are connected.
- Drives that are equipped with a PnP burette are opened again at the specific fill rate of the titrant, whereas conventional drives are opened at 100% fill rate.

11.3.3 Dispense

Navigation: **Home** > **Manual** > **Burette** > **Dispense**

This manual operation lets you manually dispense a defined quantity of titrant.

1 Select the titrant you would like to dispense.
2 Select the drive on which the titrant is installed. (For PnP burettes, the system automatically selects the appropriate drive.)
3 Enter the volume to be dispensed in [mL].
4 Enter the filling rate in [%] to define the speed at which you want to refill the burette. (100% is the maximum rate.)
5 Tap **Start** to start the procedure.
⇨ The procedure starts. Tap **Stop** to stop the procedure at any time.

You can determine the following parameters:

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Drive	The drive on which the burette with the selected titrant is installed.	1…8
Volume	Defines the volume to be dispensed, in [mL].	0.001…100
Fill rate	The filling rate of the burette in percent. 100% stands for maximum filling rate.	30…100

11.3.4 Manual titration

Navigation: **Manual** > **Burette** > **Manual titration**

To perform a manually controlled titration, proceed as follows:

1 Select the titrant you would like to titrate with.
2 Select the drive on which the titrant is installed. (For PnP burettes, the system automatically selects the appropriate drive.)
3 Enter the filling rate in [%] to define the speed at which you want to refill the burette. (100% is the maximum rate.)
4 Select the sensors you would like to use for the measurement from the list of sensors defined in the setup.
5 Select the stirrer output for the stirrer and enter a speed.
6 Specify whether the temperature should be entered manually or automatically.

7 For manual temperature acquisition, enter the temperature.
- or -
For automatic temperature acquisition, select a connected temperature sensor and the temperature unit to be used.

8 Select whether the results should be given in the form of consumption (of the titrant) or content (in the sample).

9 Select the measurement unit and the number of decimal places for the results.

10 For results given as content, select the sample's entry type (**Volume** or **Weight**) and enter the sample quantity m, the density d (for entry types **Volume** or **Weight**), the molar mass M and the equivalent number z for the substance to be tested.

11 Specify whether a record should be output to the printer and select which elements should be contained in that record (**Results**, **Table of measured values** and **Curve**).

12 Tap **Start** to start the manual titration and move to the online dialog.

13 Tap **Dispense** once to add a minimum volume of titrant. If you touch and hold **Dispense**, the system will continuously add titrant.
⇨ The dispensing rate will increase as you hold down the button.
⇨ After you release the button, the system will titrate at the minimum speed again the next time you tap the button.

14 Tap **Exit** to end the manual titration.

During the manual titration, the system will display the measured value, the titrant consumption, and a curve (measured value versus consumption) on the screen. After you finish, a record can automatically be output to the printer. You can also view the results, measured values and curve on the screen.

Note

- For the results of the manual titration, the system takes as a basis the titrant consumption until the conclusion of the titration. The EQP is not calculated!

You can determine the following parameters:

Parameters	Description	Values
Titrant	Select a titrant from the list of the defined titrants.	Titrant list
Drive	The drive on which the burette with the selected titrant is installed.	1…8
Fill rate	The filling rate of the burette in percent. 100% stands for maximum filling rate.	30…100
Sensor	Defines the sensor used to perform the measurement.	List of available sensors
Sensor input	Defines the input the sensor is connected to.	List of available inputs
Unit	Defines the unit of measure used for the measurement.	List of available units
Indication	Defines how to do the indication. Depending on the unit of measure: [mV] = **Voltametric**, [µA] = **Amperometric**.	Voltametric I Amperometric
Ipol	Ipol is the polarization current for the voltametric indication.	0.0…24.0 µA
Upol	Defines the polarization voltage [mV], for an amperometric indication. Only for polarized sensors and **Indication** = **Amperometric**.	0…2000.0
Titration stand	Defines which titration stand is to be used.	List of available titration stands
Stirrer output	Defines the stirrer output.	List of available outputs
Speed	Defines the stirring speed in [%].	0…100
Temperature manual	Defines whether to enter the temperature manually (**Active**) or via a temperature sensor (**Inactive**).	Activ I Inactive
Temperature	If the temperature is entered manually, you can enter it here, in [°C]. Only appears if **Temperature manual** = **Active** was selected.	-20…200
Temperature sensor	Here you can select the required temperature sensor. Only appears if **Temperature manual** = **Inactive** is selected.	List of available sensors

Sensor input	Defines the input the sensor is connected to.	List of available inputs
Temperature unit	The unit of measure for the temperature measurement. Only appears if **Temperature manual** = **Inactive** was selected.	°C I K I °F
Result	Select whether to output the result of the manual titration as the amount of titrant consumed or as the content in the sample.	Consumption I Content
Unit	The unit for stating the result in the form of the titrant consumption. Only for **Result** = **Consumption**.	mL I mmol
Unit	The unit for stating the result as the sample content. Only for **Result** = **Content**.	mol/L I mol/kg I g/L I g/kg I % I ppm
Decimal places	Specify the required number of decimal places for the results.	1...4
Entry type	The entry type for the sample size. Only for **Result** = **Content**	Weight I Volume
Sample size	The sample size, in [mL] or in [g], depending on the entry type selected. Only for **Result** = **Content**.	0.0001...100
Density	The density of the sample substance to be determined, in [g/mL]. Only for **Result** = **Content**.	0.0001...100
M [g/mol]	Defines the molar mass of the substance [g/mol]. Only in method function **GT** (general titration).	List of concentration/titer standards and substances
Record	Defines whether to output a record to the printer after the titration.	Activ I Inactive
Incl. result	Here you can specify whether the record should contain all the results. Only appears for **Record** = **Active**.	Activ I Inactive
Incl. table of measured values	Here you can specify whether the record should contain a table of measured values. Only appears for **Record** = **Active**.	Activ I Inactive
Incl. curve	Here you can specify whether the record should contain a curve. Only appears for **Record** = **Active**.	Activ I Inactive

Note

- The parameters for temperature acquisition or entering the temperature, **Temperature manual**, **Temperature**, **Temperature sensor**, **Sensor input** and **Temperature unit** are omitted for mV sensors and the phototrode.

11.4 Pump

Within Pump, the following actions are available.

- **Pump**
- **Drain**
- **Fill**
- **Replace solvent**

Parameters	Description	Values
Action	Determines the actions for the pump process.	Pump I Drain I Fill I Replace solvent

For **Drain**, **Fill** and **Replace solvent** you can activate and configure a stirrer and reset the counters that are used to monitor a solvent or reagent.

The parameters available for each action, stirrers and resetting the counters are described in the following chapter.

11.4.1 Pump

This manual operation will use a connected pump to pump in any volume of auxiliary reagent or - depending on the connection of the tubes - to drain it from the titration vessel.

Proceed as follows to start a pump process:

1 Go to **Home** > **Manual** > **Pump**.
2 Set **Action** to **Pump**
3 Select the pump and adjust the pump rate.
4 Enter the volume in [mL] to be added.
5 Tap **Start** to start the procedure.
⇨ The procedure starts. Tap **Stop** to stop the procedure at any time.

You can determine the following parameters:

Parameters	Description	Values
Auxiliary reagent	The auxiliary reagent to be added.	List of available auxiliary reagents
Pump	Use this setting to select a pump.	List of available pumps
Max. pump rate	Displays the pump rate in as defined in the settings. Changing this value does not change the rate of the pump, only the time calculated for the addition.	0.1…1000 mL/min
Pump output	The output where you want to operate the pump.	Available outputs
Volume	The volume to be dispensed, in [mL]. Select "∞" for unlimited pumping.	0…1000 | ∞
Pump property	Defines the properties for the pump used.	1-way | 1-way, two rates | 2-way, fine rate
Rate	Allows to reduce the pump rate. Only if the pump supports this and if the pump is connected to the instrument (Pump1 / Pump2) or InMotion.	10…100 (2-way, fine rate) | 50/100 (1-way, two rates)
Direction	Defines the pump direction for a 2-way pump	Forward | Reverse

11.4.2 Drain

Parameters	Description	Values
Drain pump	Defines, which pump is used for draining.	Available pumps
Pump output	The output where you want to operate the pump.	Available outputs
Drain duration	Defines the pumping time for draining a fluid. The duration of the drain operation for the tubes should be as long as possible to ensure that the tubes are completely free of liquids following draining.	0...1000 s | ∞
Drain volume	Defines the volume that is pumped out of the titration vessel.	0…1000 mL
Max. pump rate	Displays the pump rate in as defined in the settings. Changing this value does not change the rate of the pump, only the time calculated for the addition.	0.1…1000 mL/min

See also

🗎 Reset counter ▸ Page 234
🗎 Stirrer ▸ Page 234
🗎 Replace solvent ▸ Page 234

11.4.3 Fill

Parameters	Description	Values
Fill pump	Defines, which pump is used for filling.	Available pumps
Pump output	The output where you want to operate the pump.	Available outputs
Fill time	Defines the pumping time for filling a titration vessel.	0...1000 s | ∞

Fill volume	Defines the volume that is pumped into the titration vessel.	0…1000 mL
Max. pump rate	Displays the pump rate in as defined in the settings. Changing this value does not change the rate of the pump, only the time calculated for the addition.	0.1…1000 mL/min

See also

- Reset counter ▶ Page 234
- Stirrer ▶ Page 234
- Replace solvent ▶ Page 234

11.4.4 Replace solvent

Replace solvent combines draining and filling the titration vessel.

The parameters for draining, filling, resetting the counter and using a stirrer are the same as in the actions **Drain** and **Fill**.

See also

- Drain ▶ Page 233
- Fill ▶ Page 233
- Reset counter ▶ Page 234
- Stirrer ▶ Page 234

11.4.5 Reset counter

Resetting the counters for monitoring the solvent or the reagent is available on the following titrator types:

- T5
- T7
- T9

Parameters	Description	Values
Reset counter	If this parameter is set, all counters are reset when the manual operation starts. The fill date for the titration vessel is also reset.	Activ I Inactive
Instance	Defines for which instance of solvent control the counters are reset.	Available Solvent Controls

11.4.6 Stirrer

Parameters	Description	Values
Stirrer	A stirrer can be switched on. Only for **Action** = **Fill** or **Drain**.	Activ I Inactive
Titration stand	The name of the titration stand. only if stirrer is activated.	List of titration stands
Stirrer output	Defines the stirrer output.	Available stirrer outputs
Speed	Speed in [%]. Only if stirrer is activated.	0…100

11.5 Auxiliary instrument

Navigation: **Home** > **Manual** > **Auxiliary instrument**

Selectively control here the titrator's inputs and outputs. You can transmit outgoing signals and query incoming signals. This lets you check whether the communication is functioning between the titrator and a connected auxiliary instrument (lid handler, dispenser, etc.). In this way, manually triggered auxiliary instrument functions can be used as support for a titration.

To activate an auxiliary instrument, proceed as follows:

1 In **Control type**, select the auxiliary instrument to be controlled.

2 Enter the specific communication parameters for the control type.

3 Tap **Start** to start the procedure.

⇨ The procedure starts. Tap **Stop** to stop the procedure at any time.

Note

- For **Control type** = **Stirrer**, you may use a second stirrer simultaneously to a stirrer started by the manual operation **Stirrer**. (Only for the T7 and T9)

The following parameters are available, depending on the type:

Parameters	Description	Values
Control type	The control type of the auxiliary instrument.	Output 24 V I Stirrer I Out TTL (Single pin) I Input TTL (Single pin) I TTL (Multipin) I RS-232

For Control type = Output 24 V, the following parameters are available:

Parameters	Description	Values
Name	Select the auxiliary instrument to be controlled from the list.	Auxiliary instrument
Output	Indicates which port on the titrator you want to use for the auxiliary instrument.	MB/PUMP1 I MB/PUMP2 I AB1/PUMP I More depending on configuration
Duration	The time, in [sec], the auxiliary instrument should be switched on. Select "∞" for unlimited time.	$0 \ldots 10^4$ I ∞

Note

- An auxiliary instrument controlled by the control type **Output 24 V** can be switched on and off or operated for a defined period of time.

For Control type = Out TTL (Single pin) , the following parameters are available:

Parameters	Description	Values
Name	Select the auxiliary instrument to be controlled from the list.	Auxiliary instrument
Output	Indicates which port and which pin on the titrator you want to use for the auxiliary instrument.	Rondo/1 TTL-Out 1… Rondo/1 TTL-Out 4 I MB/TTL-Out 1…MB/TTL-Out 4 I More depending on configu-ration
Mode	Determines the number and type of TTL signal issued. **Fixed time**: The control output is switched on for the defined time period. **Input controlled**: A signal received at the control inlet controls the control outlet. The Auxiliary Instrument function will be terminated as soon as the signal changes at the control inlet or after a defined maximum time has expired. **Sequential**: The control output runs through a defined sequence.	Fixed time I Input controlled I Sequential
Duration	The time, in [sec], the auxiliary instrument should be switched on. Select "∞" for unlimited time.	$0 \ldots 10^4$ I ∞
Input aux. instr.	The name of the auxiliary instrument to serve as the signal input (control input). Only appears for **Mode** = **Input controlled**.	List of auxiliary instrument
Input	The input where the auxiliary instrument should be queried. Only appears for **Mode** = **Input controlled**.	MB/TTL-In 1 I MB/TTL-In 2
Max. wait time	The maximum waiting time for a signal change. After it expires, the method will be continued even if no input sequence was detected. Only appears for **Mode** = **Input controlled**.	$0 \ldots 10^4$ I ∞

Output signal	**Normal**: The signal is transmitted without conversion. **Inverted**: The signal is transmitted in inverted form. Only if **Mode** = **Input controlled**.	Normal I Inverted
Number of pulses	The number of impulses in the planned sequence. Only if **Mode** = **Sequential**.	$0...10^4$
Pulse duration	The duration of a pulse, in [sec]. Only appears for **Mode** = **Sequential**.	$0...10^4$
Interval	Defines the time span, in [sec], between two impulse starts. Only if **Mode** = **Sequential**.	$0...10^6$ I $0...10^4$

Note

- If **Mode** = **Input controlled** was selected, the system checks the incoming input signal until the maximum time expires or a signal is received.

For Control type = Input TTL (Single pin), the following parameters are available:

Parameters	Description	Values
Name	Select the auxiliary instrument to be controlled from the list.	Auxiliary instrument
Input	The input where the auxiliary instrument should be queried. Only appears for **Mode** = **Input controlled**.	MB/TTL-In 1 I MB/TTL-In 2
Input signal	Indicates whether an rising or a falling input signal should be detected.	Rising I Falling
Max. wait time	The maximum waiting time for a signal change. After it expires, the method will be continued even if no input sequence was detected. Only appears for **Mode** = **Input controlled**.	$0...10^4$ I ∞

Note

- Use the control type **Input TTL (Single pin)** to wait for a rising or falling input signal. The manual operation will be ended as soon as an input signal is received or the maximum waiting time is exceeded.

For Control type = Stirrer, the following parameters are available:

Parameters	Description	Values
Name	Select the auxiliary instrument to be controlled from the list.	Auxiliary instrument
Speed	Defines the stirring speed in [%].	0...100
Output	Indicates which port on the titrator you want to use for the auxiliary instrument.	MB/PUMP1 I MB/PUMP2 I AB1/PUMP I More depending on configuration
Duration	The time, in [sec], the auxiliary instrument should be switched on. Select "∞" for unlimited time.	$0...10^4$ I ∞

Note

- An auxiliary instrument controlled by the control type **Stirrer** can be switched on and off or operated for a defined period of time.

For Control type = RS-232, the following parameters are available:

Parameters	Description	Values
Name	Select the auxiliary instrument to be controlled from the list.	Auxiliary instrument
Connection	The serial port to which the device is connected. Possible connections are located on the mainboard, the analog board and the conductivity board.	MB/COM1 I MB/COM2

Output sequence	Defines the output sequence to be transmitted by the titrator. ASCII control characters are generated with sequences started by the backslash character followed by three digits. For example: \013 for Carriage Return \010 for line feed.	ASCII characters
Wait for response	Defines whether the system should wait for a response sequence from the device.	Activ I Inactive
Input sequence	The response sequence from the external device. Only if **Wait for response** = **Active** was selected.	Arbitrary
Max. wait time	The maximum waiting time for a signal change. After it expires, the method will be continued even if no input sequence was detected. Only appears for **Mode** = **Input controlled**.	0…10^4 I ∞

Note

- Use the control type **RS-232** to transmit any signal and (if you so specify) to wait for a response.

11.6 Sample changer

Navigation: **Home** > **Manual** > **Sample changer**

Use this manual operation to move the titration head of a connected sample changer, approach a specific position on the rack and use the rinse function on the sample changer.
The available options may vary depending on the type and configuration of sample changer.

To perform the required action for a sample changer, proceed as follows:

1 Make a selection in **Sample changer**.

2 Select an option in **Action**.

3 According to the selection, enter the additional values and options.

4 Tap **Start** to start the action.

⇨ The action starts. Tap **Stop** to stop the action at any time.

You can determine the following parameters:

Parameters	Description	Values
Sample changer	Defines which sample changer is used.	Available sample changers
Action	Defines the action to be executed on the sample changer.	Move to position I Move titration head I Rinse

Depending on the action to be executed, the following parameters will be available:

Move to position

Parameters	Description	Values
Position	Defines the position on the rack to which the system should move.	1…maximum number of positions on the rack
Direction	Specifies whether to rotate the rack forward or backward.	Forward I Backward
Titration head position	The vertical position to which the titration head of the sample changer should be brought. **Cond. measure**: This position is 20 mm above the Sample position and is intended to immerse the conductivity sensor into the sample but not the pH sensor, preventing electrolyte contamination from the pH sensor. Only available with InMotion.	Sample I Rotate I Rinse I Cond. measure

Move titration head

Move here the sample changer's titration head to one of possible vertical positions.

Parameters	Description	Values
Titration head position	The vertical position to which the titration head of the sample changer should be brought. **Cond. measure**: This position is 20 mm above the Sample position and is intended to immerse the conductivity sensor into the sample but not the pH sensor, preventing electrolyte contamination from the pH sensor. Only available with InMotion.	Sample I Rotate I Rinse I Cond. measure

Rinse

The sensors, stirrer, tubes, etc. on a sample changer can be rinsed, with or without draining the rinse liquid.

Parameters	Description	Values
Auxiliary reagent	The auxiliary reagent to be added.	List of available auxiliary reagents
Pump	Use this setting to select a pump.	List of available pumps
Max. pump rate	Displays the pump rate in as defined in the settings. Changing this value does not change the rate of the pump, only the time calculated for the addition.	0.1…1000 mL/min
Pump output	The output where you want to operate the pump.	Available outputs
Rinse cycles	The number of rinse cycles to be run.	1…100
Vol. per cycle	The rinse volume in [mL] per cycle.	0…1000
Position	Defines the position on the rack to which the system should move.	1…maximum number of positions on the rack
Drain	Defines whether to drain the rinse liquid.	Activ I Inactive
Drain pump	Defines, which pump is used for draining.	Available pumps
Max. pump rate	Displays the pump rate in as defined in the settings. Changing this value does not change the rate of the pump, only the time calculated for the addition.	0.1…1000 mL/min
Pump output	The output where you want to operate the pump.	Available outputs

See also

🖹 Solvent Control ▸ Page 215

11.7 Changing data on a Smart Tag

With the manual operation **SmartSample** you can use the SmartSample reader of the titrator to change data on a Smart Tag.

You can create a shortcut for the manual operation with predefined values for the parameters **ID 1**, **ID 2**, **Sample size**, **Density** and **Correction factor**.

The values that are displayed in the window **SmartSample**, depend on the way you start the manual operation.

- If you start the manual operation from the shortcut, the window **SmartSample** displays the values that were saved when the shortcut was created.
- If you start the manual operation from **Home** > **Manual** > **SmartSample**, the window **SmartSample** displays the values of the last time the manual operation was run

Read data from a Smart Tag

▪ No task is running on the titrator

1 Go to **Home** > **Manual** > **SmartSample**.

⇨ The window **SmartSample** opens and displays the values of the last time the manual operation was run.

2 Place the titration beaker on the SmartSample reader of the titrator.

3 Tap **Read**.

⇨ The titrator reads the values of the parameters **ID 1**, **ID 2**, **Sample size**, **Density** and **Correction factor** from the Smart Tag and displays the values.

Write data to a Smart Tag

The parameter **Entry type** is not written to the Smart Tag. It only shows the user the unit and the number of digits that are expected for the sample size. When the Smart Tag is read in a method, the settings of the parameter **Entry type** in the method function **Sample** define how the value for the parameter **Sample size** is interpreted and used.

▪ No task is running on the titrator

1 Go to **Home** > **Manual** > **SmartSample**.

⇨ The window **SmartSample** opens and displays the values of the last time the manual operation was run.

2 Place the titration beaker on the SmartSample reader of the titrator.

3 Set the parameters to the correct values and tap **Write**. See [Definition of parameters ▶ Page 239].

⇨ The values of the parameters **ID 1**, **ID 2**, **Sample size**, **Density** and **Correction factor** are written to the Smart Tag.

Delete data from a Smart Tag or initialize an unformatted Smart Tag

With this function you can replace data on a formatted Smart Tag with the default values or initialize an unformatted Smart Tag. The default values are listed below.

- **ID 1**…**ID 2**: --
- **Sample size**: 0
- **Density**: 1.0
- **Correction factor**: 1.0

▪ No task is running on the titrator

1 Go to **Home** > **Manual** > **SmartSample**.

⇨ The window **SmartSample** opens and displays the values of the last time the manual operation was run.

2 Place the titration beaker on the SmartSample reader of the titrator.

3 Tap **Delete data**.

⇨ If the Smart Tag is not formatted, the METTLER TOLEDO Smart Tag data structure is written to the Smart Tag.

⇨ The default values are written to the Smart Tag and displayed in the window **SmartSample**.

Definition of parameters

Parameters	Description	Values
ID 1…ID 2	Defines ID 1 or ID 2 of the sample.	0…20 characters
Entry type	Defines how the sample size is entered. **Weight**: Sample size is entered as weight in [g]. **Volume**: Sample size is entered as volume in [mL]. **Pieces**: Sample size is entered as number of pieces.	Weight I Volume I Pieces
Sample size	Defines the size of the sample. The unit depends on the setting for **Entry type**.	0…1000
Density	Defines the density of the sample in [g/mL].	0…100
Correction factor	Defines the correction factor. The correction factor can be used in calculations.	0…10^5

12 Analysis Sequences

12.1 Starting an Analysis

An analysis, whether it be a single or multiple determination, can be started on the titrator in several different ways:

1. By choosing one of the following options:
   – **Start** from the method editor
   – **Start** from the home screen
   – **Start** from the **Series** widow
   – **Setup** > **Chemicals** > **Titrant** > **Titrant parameter** > **Titer** to perform a titer determination in Setup. (Not for Karl Fischer titrations).
2. Using a user-specific shortcut or a direct shortcut from the home screen.

When you create a shortcut by choosing **AddToHome** (see "Description of Functions > The User Interface > Shortcuts and Direct Shortcuts"), the following parameters are available:

Parameters	Description	Values
Description	Any name for the shortcut.	Arbitrary
Immediate start	The method, series, or manual operation can be started immediately. This enables you to start the analysis without any interfering dialog.	Activ I Inactive
Homescreen position	Defines the position for the shortcut on the homescreen. 1..12: Positions on the first page of the homescreen. 13...24: Positions on the second page of the homescreen.	1…24

After you create the shortcut, it appears in the selected position in "Home", from where you can select it by tapping the touchscreen.
When you start an analysis, whether by using a button or with a shortcut, the system always opens the **Start analysis** dialog (see "Descripton of Functions > The User Interface > The Start Analysis Dialog"). The only exceptions are direct shortcuts ("Immediate start" = "Yes"), whose selected settings permit a direct start.

At the start of an analysis, you can still make changes to various settings in the **Start analysis** dialog. It is therefore possible, for example, to modify the sample size and define the number of samples to be determined.

If the analysis you want to start is a single determination, you can enter the sample size or sample ID directly as a parameter in the **Start analysis** dialog.
In general, the sample data can be entered for each individual sample using the **Samples** button in the **Start analysis** dialog. In the **Sample data** dialog that opens when you choose this button, a list of the individual samples is displayed.

In addition, the status is displayed for every sample (regardless of the loop type) in the **Sample data** dialog. The following status levels can be assigned to a sample:

- **Idle**: The sample is not yet running and the sample data can still be edited
- **Running**: The sample is running but the sample data can still be edited
- **Active**: The sample is running and the sample data can no longer be edited
- **Done**: Done – the sample has run and concluded and the sample data can no longer be edited

If you select a sample, you can define the following sample data.

Parameters	Description	Values
Number	Defines the number of the sample.	1…303
ID 1	The ID for the first or only sample of an analysis.	Arbitrary
Sample size	You can enter the sample size here. For fixed entry types, this field only appears as an info field.	0…1000 [g] I [mL] 0…10^6 [pcs.]
Water volume	Define the volume of water added to dilute the analysis solution to achieve the needed ISA concentration in the analysis beaker. For Na^+, the typical ISA concentration is 0.5 M.	0...1000

ISA volume	Define the ISA volume added to the analysis beaker. For NA^+, the target concentration of the ISA is 0.5 M.	0…1000
Weight per piece	The weight in [g] per pirece. Appears only if **Entry type** = **Pieces** or **Fixed pieces** was selected.	0 … 1000
Density	You can enter the sample's density, in [g/mL], here. Does not appear for the **Entry type** = **Pieces** and **Fixed pieces**.	0…100
ID 2…ID 3	The name defined here will be used as the default name for the respective sample on the sample loop. Only appears subject to the settings made for **Number of IDs**.	Arbitrary
Comment	You can enter a brief comment about the series.	Arbitrary
Sample factor 1…3	Defines the values for a sample factor. The name of this parameter depends on the name defined in the parameter **Name of sample factor** of the method function **Sample**.	$0…10^6$
Correction factor	Any correction factor that can be used in calculations.	$0.0001…10^6$
Temperature	The temperature in [°C] during the analysis. If temperature monitoring is activated in a titration function, the system will ignore the sample temperature given here.	-20…200

You can enter the following parameters in the **Start analysis** window, depending on the type of analysis to be started and the resources used:

Parameters	Description	Values
Type	The type of analysis to be started.	Method I Series
Workspace	The workspace in which the sample series or analysis is to be run. (In Workspaces A and B, tasks can be performed in parallel if they do not use the same resources. Tasks in each workspace will be performed one after the other.) The workspace must be defined for each sample series in the series sequence.	A I B
Number of standards	The number of standards to be analyzed with a method or series.	1…303
Number of samples	Defines the number of samples to be analyzed. The number depends on the selected titration stand.	1…303
ID 1	The ID for the first or only sample of an analysis.	Arbitrary
Loop	Shows the number of the loop to which a sample belongs.	1…max. number of loops
Sample type	Defines the type of sample used in the sample loop. The sample type is shown in the method editor, the sample data window and the report.	Sample I Standard I Blank
Sample size	You can enter the sample size here. For fixed entry types, this field only appears as an info field.	0…1000 [g] I [mL] $0…10^6$ [pcs.]
Continuous run	After each termination of the analysis (using series or methods) the analysis is automatically restarted (this is done until the process is canceled manually).	Activ I Inactive
Start position	Defines the start position of the first sample on the sample changer. **CP** means current position.	1…max. number of positions I CP I CP+1 I CP+2

- All the parameters that can be edited in the **Start analysis** dialog or the sample data dialog will overwrite the settings defined in the method for the same parameters.
- All non-editable parameters that are displayed as an info field are only shown for orientation purposes and list the settings from the method.
- If the sample size must be entered before the analysis but the user does not do so, the user will be required to enter it immediately before the start of the analysis.

12.2 Analysis Sequence Steps

General analysis introduction

During the processing of an analysis, starting from the start of the analysis and sample addition through to the results display, the titrator displays a range of dialog windows, some of which the user has to confirm in order for the analysis to continue. These dialog windows are used to ensure faultless processing, and also to provide the user with information. Depending on the required degree of automation for an analysis, it can, however, be useful and desirable to deactivate particular security questions or information dialogs to ensure that the sequence is processed without interruption. Below are some process flow examples.
For Karl Fischer titrations, the sequence of the analysis with the **KF stand** or with the stromboli sample changer is displayed. This includes the behavior during **Pretitration** and **Standby**, the various functions during standby operation, and the associated behavior for results and statistics. Furthermore, the use of **Series** and **Open series** and the behavior of the method function **Record** are also described.

Introduction for GT analysis

For GT analyses, the sequence with the use of a manual or external titration stand and with the use of an automatic titration stand is displayed. In each case, you are told where the individual screens can be switched off in the user interface.

Introduction for KFcoul analysis

When a KF method is started, the system first performs a pretitration. The pretitration always takes place to ensure that the Karl Fischer reagent is in a water-free state. When a particular drift value is reached, the system switches to Standby mode. The standby mode is used to stabilize the potential as much as possible around the end point. The system switches automatically between pretitration and Standby. The determined drift value is used as the criterion for switching between the different modes. If the pretitration is not finished, the system issues a message after 30 minutes informing you that the pretitration cannot be completed because the drift values are too high. You can then end the pretitration, thus terminating the method or series, or restart the pretitration. On the other hand, if the system switches from Standby to pretitration during a parameter request, or if the maximum start drift is exceeded, you can end data entry and save the data by choosing **OK**.

12.2.1 GT Analysis sequence

Note

- The following is a sample analysis sequence for an analysis with a titration stand of type **Manual stand** or **External stand**.

<Start>	
↓	
Dialog: Analysis start	Can be switched off for the start via shortcut with the "Immediate start" parameter during the creation or management of a shortcut.
↓	
<Start>	
↓	
Check: Resources	Can be switched off with the "Show required resources at start" parameter in the analysis sequence settings. (An error message will appear if the resources have already been allocated or are missing.)
↓	
<OK>	
↓	

Request: Sample size	Appears when "Entry" = "Before" was selected in the "Sample" method function and the sample size = 0. Can be avoided by selected a "fixed" entry type.
↓	
<OK>	
↓	
Add sample	Can be switched off for the start via shortcut with the "Immediate start" parameter during the creation or management of a shortcut for the first sample.
↓	
<OK>	
↓	
Dialog: Online	
↓	
Request: Sample size	For "Entry" = "Arbitary" parameter in the "Sample" method function.
↓	
<OK>	
↓	
Results	This can be switched on or off via the "Show results after analysis" parameter. (Navigation: Setup > Global settings > Analysis and resources behavior > Analysis sequence setting).
↓	
<OK>	
↓	

Homescreen / Analysis start

- Sample analysis sequence for a GT analysis with a titration stand of the type "Auto stand", "Rondo" or "Rondolino TTL":

<Start>	
↓	
Dialog: Analysis start	Can be switched off for the start via shortcut with the "Immediate start" parameter during the creation or management of a shortcut.
↓	
<Start>	
↓	
Check: Resources	Can be switched off with the "Show required resources at start" parameter in the analysis sequence settings (Navigation: Setup > Global settings > Analysis and resources behavior > Analysis sequence settings).

↓

<OK>

↓

Online Dialog

↓

Results

Can be switched off with the "Show results after analysis" parameter in the analysis sequence settings (Navigation: Setup > Global settings > Analysis and resources behavior > Analysis sequence settings).

Note:
At the end of a series, all results are listed. The display of this list can be switched on or off via the "Show results after analysis" parameter.

↓

Homescreen / Analysis start

12.2.2 KFvol Analysis sequence

<Start>

↓

Dialog: Analysis start

This dialog can be switched off for a start using the "Shortcut parameters" dialog and the "Immediate start" parameter when creating or managing a shortcut.

↓

<Start>

↓

Check: Resources

Can be switched off with the "Display required resources at start" parameter in the analysis sequence settings. (An error message will appear if the resources have already been allocated or are missing.)

↓

<OK>

↓

Online dialog: Pretitration

Selection of function options: **Stop method**, **Samples** (for changing samples and series data), **End series**, **Save series data**, **Results**, **Axes**,
(see " `Description of Functions > User Interface >` [Online Dialog ▸ Page 17]").

↕

Automatic switch between Pretitration and Standby.

Online dialog: Standby	Selection of function options: **Start sample**, **Start concentration**, **Start blank** (for external extraction, **Samples** (for changing samples and series data), **Start drift determination**, **End series**, **Stop method**, **Save series data**, **Results**[*], **Axes**,**Sample size calculation** (see " `Description of Functions > User Interface >` [Online Dialog ▸ Page 17]").
↓	
<Start Sample> I <Start Concentration> I <Start Blank>	If the maximum number of samples, concentration determinations, and blank determinations has been reached and a measurement has been started, a message appears informing you that a new series can be started. From the start of the first sample analysis in a predefined series to the processing of the last sample in the series, the concentration and blank determination functions cannot be selected in the "Standby" dialog. If the voltage value of the measuring sensor is too low at the start of a sample, concentration, drift, or blank determination, when the user presses **Start**, they are informed that the system is overtitrated.
↓	
<OK>	
↓	
Online dialog: Mix time	Displays the time remaining and stirrer speed.
↓	
Online dialog: Titration (KF Vol)	You have the following options during an analysis: Cancel the sample, concentration, drift, blank determination or the method, you can modify sample data, view results or measured values, save a series, or specify the axes of the measurement diagram.
↓	
Online dialog: Calculation	
↓	
Online dialog: Standby	

[*]During Standby or Pretitration mode, you can access the results of the current determination type (sample, concentration, blank determination). Here you can perform the following actions (see "[Results ▸ Page 173]"):

- Recalculate (can only be changed for individual samples, and not for a whole loop)[1]
- Exclude samples[1]
- Perform outlier test[1]
- Results
- Display statistics
- Undo changes

[1]For titrations using the "Stromboli" oven sample changer, these functions are only available at the start of the series or in Standby mode and with Analysis start "manual".

Drift determination

There are several different ways to determine the drift:

1. Using the "Drift determination" method function. Here you can enter the duration of determination. The method function can be inserted outside the loop (in determination per series) or inside the loop (in determination per sample) (only for KF methods of the type "Stromboli").
2. Spontaneous drift determinations: The drift can be determined from Standby mode of any KF method. The drift determined here is used if the "Source for drift" parameter in the "Titration stand" method function is set to "Setup".
3. Online drift determination: The drift that is constantly determined during standby operation is the current and correct drift value which is used in the calculations. To enable this, the "Source for drift" parameter in the "Titration stand" method function must be set to "Online" (see "[Method functions: Titration stand ▸ Page 103]").

Concentration determination

The concentration determination of the titrant can only be started spontaneously, and hence only from "Standby" mode.
When a concentration determination is started, as with a sample determination, this opens an "Open series". After every determination, the mean value of the open concentration determination series is assigned to the titrant in Setup. The open concentration determination series is ended by the start of a sample and blank determination (and vice versa). In general, the open series can be terminated by choosing **End series**, **Stop method**, or **Reset**. A spontaneous drift determination, however, does not terminate the series.

12.2.2.1 Series analyses with the "Stromboli" oven sample changer

Before starting a Stromboli method, the pump must be switched on and the set temperature specified. Every Stromboli method begins in the Start position (beaker is in the drift position). In this position, the pretitrations, the manual and automatic drift determinations, and the concentration determinations (only for KF Vol) are performed. The pretitration already takes place during the heating process.

Note

- The heating and the pump remain active in Standby mode. When a Stromboli method is active, the set temperature is controlled automatically.

After a series analysis is started via **Start** in the **Standby** dialog or because Analysis start = "automatic" is set, the series is processed automatically. After each sample is processed, the next sample is analyzed without prompting. To enable automatic analysis start, the following conditions must be fulfilled:

- The set temperature must be reached.
- The online drift must be smaller than the maximum start drift.
- The system must not be overtitrated.
- The drift stability must be fulfilled.

Once the titration is complete, Standby mode is active until the end of the loop in the current sample beaker. If the maximum start drift value is exceeded during this time, the sample changer returns to pretitration (drift position). The analysis is then continued automatically when the maximum start drift value is reached. If the last sample in a loop has been processed and further loops still remain, the current position (sample or drift beaker) is maintained until the next sample is approached. The current drift is reviewed before the start of the next sample. The following is a description of the behavior when particular actions are performed:

Analysis start

Each analysis starts in position 1, immediately after the "Drift" position.

When using Stromboli, no positions can be controlled. The sample changer always moves forward by one position and performs an analysis or a blank determination in that position. Stromboli only returns to the "Drift" position to perform a drift determination.

Cancel method

The method is terminated with no further action. The temperature control and the pump are switched off immediately. Stromboli returns to the "Drift" position.

Note

- Before actually stopping the process, the system displays a system message asking you to confirm the termination.

Drift determination

The manual drift determination and the drift determination via method functions always take place in the "Drift" position. After manual drift determination, the sample changer remains in this position. In contrast, with drift determination using the method function, the sample changer moves to the next planned sample position.

Concentration determination (only KFvol)

The manual concentration determination is performed in the drift beaker. The heating and pump remain active.

Canceling the drift determination or concentration determination

Because the drift and concentration determination is performed in the drift beaker, terminating the process has no effect on the actions of the sample changer. The standby titration is started again.

Pressing Reset

If the Reset button is pressed while a KF analysis or manual operations are active, all Karl Fischer methods and manual operations are terminated. For Stromboli, this means that the pumps are switched off, the titrator returns to the resting position (via the drift beaker), and the heating is turned off. If a KF analysis (method or sample series) is terminated, the system continues with the pending analyses from the list. The sample data for the terminated samples or sample series (such as weigh-ins, etc.) are still saved with the results.

12.2.2.2 External extraction

For the Karl Fischer "External extraction" method type, there is no automated sample analysis. Each sample in a series must be started individually from "Standby" mode.
If the "Open series" parameter is set (see "[Method Function: End of Sample ▸ Page 155]"), additional samples can be added after a series has been processed. If "Open series" is not set, the series is completed after the specified number of samples, and the method is stopped.

Note

Manual blank value determination can be carried out from "Standby" mode..

12.2.2.3 Switching between determination types

You can determine statistics for sample, blank, and concentration determinations. If you switch between two determination types during an analysis, the determination series is ended. The system displays a message. You can then decide whether to choose **Cancel** to return to Standby mode, or choose **OK** to start the selected determination.

When you end a determination series, the relevant results are not deleted. The results memory of this determination type is not deleted and refilled until a new determination type is started and if results are available. The other determination types are not deleted and no new series entry is created in the results memory.
For example: If you carry out multiple blank determinations and then carry out a concentration determination, the blank value statistics are terminated. The next time a blank determination is started, the memory for the blank determination is deleted and filled with new blank value data.

Note

There are no mean values for drift determinations, each determination generates a new drift value that is transferred to Setup.

12.2.2.4 Analysis records

Analysis records are the printouts specified by the user in the "Records" method function (see "[Method functions: Records ▸ Page 164]"). When a manual drift, concentration, and blank determination is created, the system creates a separate expression.

Printouts per series

Printouts "per series" are created if the user presses the **End series** button or if a series is terminated via **Start concentration** or **Start blank**.

An open series does not count as finished until **End series** has been selected or a series is ended by choosing **Start concentration** or **Start blank**. After confirming the corresponding message, the "Record" method function can be used to print out all parts of the record defined for each series.

Printouts per sample

The printouts are created for each sample when the "Records" method function is processed.

12.2.2.5 Replacing the titrant or reagent

The reagent in the beaker can be replaced when a certain number of samples is reached, if the solvent capacity is used up, or after a defined period of time (Intelligent Solvent Controlling). This causes a brief interruption in the series sequence.

Note

- The titrant replacement procedure is semi-automatic, i.e. the user has to initiate the replacement.
- Titrant = KF vol
  Reagent = KF coul

12.2.3 KFcoul Analysis sequence

Note

- The start of a new KF method or a spontaneous blank determination automatically terminates the current series.

<Start>	
↓	
Dialog: Start analysis	This dialog can be switched off for a start using the "Shortcut parameters" dialog and the "Immediate start" parameter when creating or managing a shortcut.
↓	
<Start>	
↓	
Check: Resources	Can be switched off with the "Display required resources at start" parameter in the analysis sequence settings. (An error message will appear if the resources have already been allocated or are missing.)
↓	
<OK>	
↓	
Online dialog: Pretitration	Selection of function options: **Terminate method**, **Samples** (for changing samples and series data), **End series**, **Save series data**, **Results**, **Axes**, (see " `Description of functions>User interface>`[Online dialog ▸ Page 17]").
↕	Automatic switch between Pretitration and Standby.
Online dialog: Standby	Selection of function options: **Start sample**, **Start blank** (for external extraction, **Samples** (for changing samples and series data), **Start drift determination**, **End series**, **Terminate method**, **Save series data**, **Results***, **Axes**, **Sample size calculation** (see " `Description of functions>User interface>`[Online dialog ▸ Page 17]").
↓	

<Start sample> I **<Start blank>**	If the maximum number of samples or blank determinations has been reached and a measurement has been started, a message appears informing you that a new series can be started. From the start of the first sample analysis in a predefined series to the processing of the last sample in the series, the blank determination function cannot be selected in the "Standby" dialog. If the voltage value of the measuring sensor is too low at the start of a sample, drift, or blank determination, when the user presses **Start**, they are informed that the system is overtitrated.
↓	
<OK>	
↓	
Online dialog: Mix time	Displays the time remaining and stirrer speed.
↓	
Online dialog: Titration (KF coul)	You have the following options during an analysis: To cancel the sample, drift, or blank determination or the method, you can modify sample data, view results or measured values, save a series, or specify the axes of the measurement diagram.
↓	
Online dialog: Calculation	
↓	
Online dialog: Standby	

[*]During Standby or Pretitration mode, you can access the results of the current determination type (sample or blank determination). Here you can perform the following actions (see "[Results ▸ Page 173]"):

- Recalculate (can only be changed for individual samples, and not for a whole loop)[1]
- Exclude samples[1]
- Perform outlier test[1]
- Results
- Display statistics
- Undo changes

[1]For titrations using the "Stromboli" oven sample changer, these functions are only available at the start of the series or in Standby mode and with Start analysis "manual".

Drift determination

There are several different ways to determine the drift:

1. Using the "Drift determination" method function. Here you can enter the duration of determination. The method function can be inserted outside the loop (in determination per series) or inside the loop (in determination per sample) (only for KF methods of the type "Stromboli").
2. Spontaneous drift determinations: The drift can be determined from Standby mode of any KF method. The drift determined here is used if the "Source for drift" parameter in the "Titration stand" method function is set to "Setup".
3. Online drift determination: The drift that is constantly determined during standby operation is the current and correct drift value which is used in the calculations. To enable this, the "Source for drift" parameter in the "Titration stand" method function must be set to "Online" (see "[Method functions: Titration stand ▸ Page 103]").

12.2.3.1 Series analyses with the "Stromboli" oven sample changer

Before starting a Stromboli method, the pump must be switched on and the set temperature must be set. Every Stromboli method begins in the Start position (beaker is in the drift position). In this position, the pretitrations, manual and automatic drift determinations are performed. The pretitration already takes place during the heating process.

Note

- The heating and the pump remain active in Standby mode. When a Stromboli method is active, the set temperature is controlled automatically.

After a series analysis is started via **Start** in the **Standby** dialog or because Start analysis = "automatic" is set, the series is processed automatically. After each sample is processed, the next sample is analyzed without prompting. To enable automatic Start analysis, the following conditions must be fulfilled:

- The set temperature must be reached.
- The online drift must be smaller than the maximum start drift.
- The system must not be overtitrated.
- The drift stability must be fulfilled.

Once the titration is complete, Standby mode is active until the end of the loop in the current sample beaker. If the system is switched to Pretitration mode during this time, the sample changer returns to the start position (beaker in the drift position) and performs the pretitration followed by the standby titration.The analysis of the next sample is then continued automatically when the maximum start drift value is reached. If the last sample in a loop has been processed and further loops still remain, the current position (sample or drift beaker) is maintained until the next sample is approached. The current drift is reviewed before the start of the next sample. The following is a description of the behavior when particular actions are performed:

Start analysis

Each analysis starts in position 1, immediately after the "Drift" position.

When using Stromboli, no positions can be controlled. The sample changer always moves forward by one position and performs an analysis or a blank determination in that position. Stromboli only returns to the "Drift" position to perform a drift determination.

Cancel method

The method is terminated with no further action. The temperature control and the pump are switched off immediately. Stromboli returns to the "Drift" position.

Note

- Before actually canceling the process, the system displays a system message asking you to confirm the termination.

Drift determination

The manual drift determination and the drift determination via method functions always take place in the "Drift" position. After manual drift determination, the sample changer remains in this position. In contrast, with drift determination using the method function, the sample changer moves to the next planned sample position.

Canceling the drift determination

Because the drift and concentration determination is performed in the drift beaker, terminating the process has no effect on the actions of the sample changer. The standby titration is started again.

Pressing Reset

If the Reset button is pressed while a KF analysis or manual operations are active, all Karl Fischer methods and manual operations are terminated. For Stromboli, this means that the pumps are switched off, the titrator returns to the resting position (via the drift beaker), and the heating is turned off. If a KF analysis (method or sample series) is terminated, the system continues with the pending analyses from the list. The sample data for the terminated samples or sample series (such as weigh-ins, etc.) are still saved with the results.

12.2.3.2 Switching between determination types

You can determine statistics for sample and blank determinations. If you switch between two determination types during an analysis, the determination series is ended. The system displays a message. You can then decide whether to choose **Cancel** to return to Standby mode, or choose **OK** to start the selected determination.

When you end a determination series, the relevant results are not deleted. The results memory of this determination type is not deleted and refilled until a new determination type is started and if results are available. The other determination types are not deleted and no new series entry is created in the results memory.
For example: If you carry out multiple sample determinations and then carry out a blank determination, the sample statistics are terminated. If you restart a sample determination, the memory for the samples is deleted and filled with new sample data.

Note

- There are no mean values for drift determinations, each determination generates a new drift value that is transferred to Setup.

12.2.3.3 Replacing the reagent solution

The reagent in the beaker can be replaced when a certain number of samples is reached, if the solvent capacity is used up, or after a defined period of time (Intelligent reagent controlling). This causes a brief interruption in the series sequence.

The titrant replacement procedure is semi-automatic, i.e. the user has to initiate the replacement.

13 Titrator Evaluation Procedure

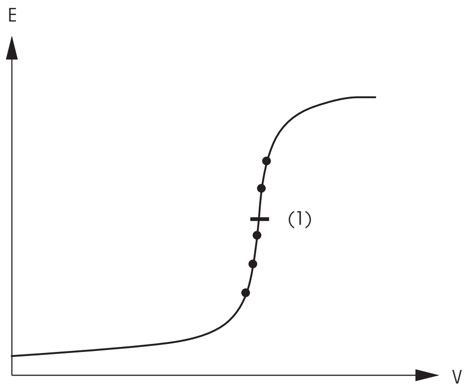
The identification of equivalence point candidates within a defined recognition range can be done using four different evaluation methods:

- Standard
- Minimum / Maximum
- Segmented
- Asymmetric

Which method you use for the evaluation will depend on the type of titration or the form of the resulting titration curve. The procedure to be used is defined in the "Evaluation and recognition" method subfunction of the "Titration (EQP)" and "Titration (two-phase)" method functions.

13.1 Standard Evaluation Procedure

The titrator's standard evaluation procedure is based on the chemical model of a classic acid-base titration. In this model, the equivalence point of such a titration will be at the point of inflection of the S-shaped titration curve and the curve will be symmetrical with regard to this inflection point.



For the recognition of an inflection point using the standard procedure, the titrator will always look at one group of measured values (a "measured value window"). It will examine whether an inflection point is detectable for that group of measured values. This window will then be shifted along the curve by one measured value and reexamined for points of inflection. The system repeats this procedure until it detects no inflection point twice in a row. It then uses the inflection points found to define the most suitable one as the final inflection point of the titration.

(1) Inflection point

Note

These criteria can be defined in the "Evaluation and recognition" subfunction of the "Titration EQP" and "Titration (two-phase)" method functions.

The standard evaluation procedure initially only identifies points of inflection. Criteria defined by the user in the method can influence whether and when an inflection point is to be registered as an EQP candidate.

If so defined in the method, the following criteria will have to be fulfilled:

- The inflection point must lie within a recognition range.
- It must be above a threshold (refers to the first derivative).
- The titration curve must demonstrate a specified tendency in the area of the inflection point.

EQPs are only detected in the range of the measured curve which is the specified by the "Tendency" parameter (Positive, Negativ), refer to method function "Titration (EQP): Evaluation and Recognition".

If these criteria are fulfilled, the inflection point becomes an EQP candidate.
The additional EQP criteria can now be used to influence which EQP candidates are ultimately recognized as equivalence points.
For the standard evaluation, the additional EQP criteria "Last EQP" and "Steepest jump" are available. They can be selected individually for each defined recognition range.

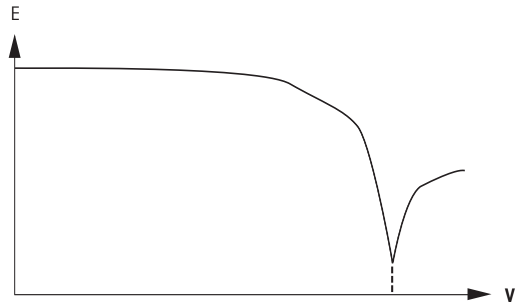
See also

🗎 Titration method function ▸ Page 259

🗎 Titration method function ▸ Page 259

13.2 Minimum / Maximum

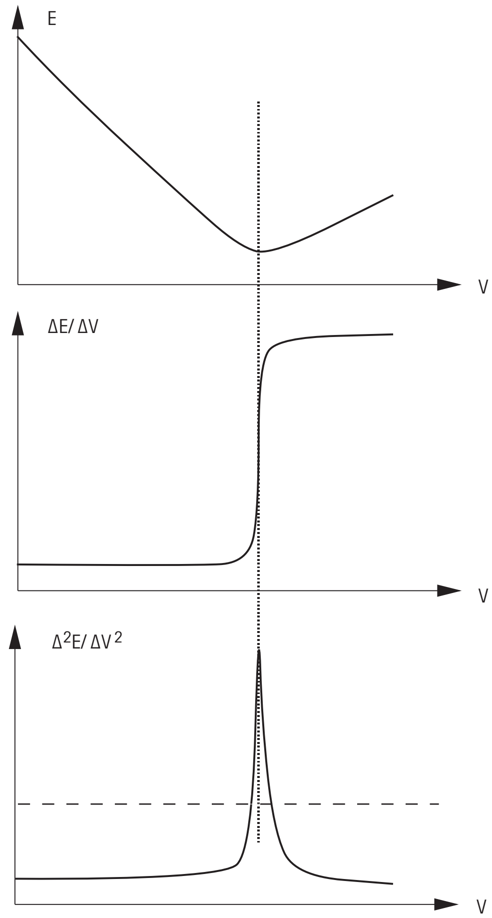
The result of this evaluation is the calculated minimum (maximum) of the measured titration points. The classic example of a titration curve with a minimum is the photometrically indexed surfactant determination.



The minimum (maximum) is calculated using a polynomial approximation of the titration curve in the range of the minimum (maximum). The equivalence point recognition is done directly from the titration curve data.

13.3 Segmented Evaluation

Various indication methods (including photometry, conductometry, and amperometry) generate titration curves with linear or approximately linear sections (segmented curves). The titrator uses individual procedures to evaluate these curves. For a precise determination of the equivalence point, it is very important that these curves have both linear segments and a clear bend.



Titration curve

The titration curve contains two more less linear segments and a bend between these two segments. The evaluation of segmented curves is generally done with the aid of the standard procedure for S-shaped curves, with the system using as its evaluation basis not the titration curve's measured points but the data calculated from them in the first derivative.

1. Derivative

The first derivative of a segmented curve is the first to demonstrate the typical S shape. Its inflection point is the titration's equivalence point.

2. Derivative

The threshold references the second derivative of the titration curve. In other words, the equivalence point for a defined threshold must be above this threshold number.

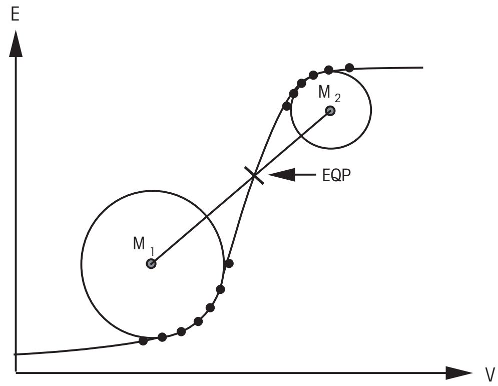
EQPs are only detected in the range of the measured curve which is the specified by the "Tendency" parameter (Positive, Negativ), refer to method function "Titration (EQP): Evaluation and Recognition". Within the segmented procedure the tendency refers to the 1. derivative.

13.4 Asymmetric

For markedly asymmetrical curves, the standard procedure can result in a systematic error. The difference between the true equivalence point and the point of inflection can be greater than the normally achievable precision. For these cases, the titrator uses an evaluation that uses the Tubbs method.

This empirical approximation method is a procedure for the evaluation of asymmetrical, analog-registered titration curves. It can also be used for digitally recorded titration curves. The Tubbs procedure result will be closer to the true equivalence point for some asymmetrical curves than the inflection point.

This evaluation procedure is based on the following considerations:



Each of the two branches of the titration curve will have a writable osculating circle with a minimal radius. The relationship between the two radii is determined by the curve's asymmetry. The intersection of the connecting lines between the circle center points M1 and M2 and the titration curve produces the desired equivalence point. Theoretical calculations show that the true equivalence point for asymmetrical titration curves will always lie between the inflection point and the branch of the titration curve with the greater degree of curvature (i.e. the smaller osculating circle).

The titrator uses a hyperbola to approximate those parts of the titration curve located in the area of the greatest curvature. For each approximated hyperbola, the system determines the peak (the point with the greatest curvature). The center points of the assigned smallest osculating circles are the focal points of both hyperbolas. The intersection of the connection lines from the two focal points and the titration curve produces the desired equivalence point, as shown above.

The evaluation requires at least six measured values in the area of the greatest curvature before and after the titration curve's inflection point. If the course of the titration curve does not permit the inclusion of the osculating circles, the titrator will use the standard procedure to calculate the equivalence point. You will be notified of this in the record of the "raw results".

EQPs are only detected in the range of the measured curve which is the specified by the "Tendency" parameter (Positive, Negativ), refer to method function "Titration (EQP): Evaluation and Recognition".

14 Analysis Data

The "Analysis data" include different types of data that can be used at various times during the planning and execution of an analysis.

The system differentiates between the following types of analysis data:

Displaying raw data	Raw data are defined when you create a method or series. They are automatically generated and stored during the analyses. Raw data are always created for each analysis and cannot be influenced by the user.
Method data	All data for the method run.
Series data	All data from the series run, such as e.g. the series ID and the number of samples.
Sample data	All data from the analyzed samples, such as e.g. the sample size, sample density and sample ID.
Resource data	Data for all resources used during the execution of an analysis (for example, titrant, auxiliary instrument, auxiliary value). The data for a resource are copied from the setup at the time when it is used in an analysis.
Table of measured values	Tables of measured values are created by some method functions during an analysis and can be output in the record.
Raw results	Raw results are data determined by the titrator during an analysis, such as used titrant volumes and measured values. The raw results can be converted into the actual analysis results in the "Calculate" method function using the appropriate symbols and formulas. Some of the raw results are always produced automatically and others are only generated when used within a calculation.
Results	Results are the results of the conversions of raw results run within the "Calculate" method function. The results of an analysis can be influenced by the user.

Of these, the following can be used in calculations:

- Sample data (such as the sample size or the sample density)
- Resource data (e.g. mole quantity and equivalence quantity for a substance)
- Raw results (e.g. auxiliary value, blank)
- Results (the results of a calculation can then be used in a subsequent calculation.)

15 Evaluate and calculate

15.1 Formulas

Calculation formulas can be used in the "Calculate" and "Condition" method functions. Some parameters within method functions can also be defined in the form of formulas.

Formulas within the "Calculation" method function

One typical example for a formula within the "Calculation" method function would be the expression **R=VEQ** in the "Formula" parameter. In this case, the consumed volume of titrant up to the point at which the end point is reached is assigned to R. All the symbols can be used for analysis data in relations like this. The analysis data to be used must be generated by the method before the "Calculate" method function.

Formulas for entering values for parameters

Formulas can also be used to specify the values for some parameters. For example, you can enter the stirring time in a "Stir" method function in the form of a formula. The result of the formula will then be copied over as a nondimensional value in the unit of the parameter in question.

Conditions

A condition is a formula whose result comes in the form of "true" or "false". Conditions can be used in various method functions in the "Condition" parameter or subfunction. Depending on the condition's result, the method function in question will be executed (condition true) or not executed (condition false).

Note

- Auxiliary values and blanks defined in the setup can generally be used in formulas in the same manner as symbols. The general form for an auxiliary value is: H[Name] (as defined in the setup).
- Likewise, results from other "Calculation" method functions can be referenced in the "Calculation" method function. (E.g. R3=R2+R1)

  (What is important in this case is to make sure that the results used must already be in existence at the time they are to be used!)

15.1.1 Using analysis data in formulas

All analysis data that can be accessed via a symbol can be used in calculation formulas (see "[Naming Conventions for Using Analysis Data in Calculations ▸ Page 284]").

All analysis data must be generated in the method before the point at which they will be used in a calculation formula. For some analysis data, this could be as checked early as during the validation in the processing of a method. For others, whether or not the data are available at the time in question may not be decided until the execution of the method. If the analysis data is not available at the time of the calculation, the result of the calculation formula will be "NaN" ("Not a number").

Note

- The formula must be assigned to a result (Rx) in the "Formula" parameter in the "Calculate" method function.

Analysis data for which symbols have been defined can be used in the most general cases in the following format (the separators '_' are only used for clarification purposes here; they are not used in the formulas):

Basic symbol plus symbol extension_group ID_symbol index_unit(x,y)_[group index]

Shortcuts

- Instead of using VEQ and QEQ, you can also use the corresponding short forms (V and Q) in the formulas.
- If you leave out the symbol index of a symbol, Symbol Index 1 will be used.

  Example: VEQ stands for VEQ1
- If you leave out the group index of a symbol, Group Index 1 will be used.

  Example: VEQ1 stands for VEQ1[1]

All three rules can also be combined, for example:

Q stands for QEQ1[1]

Assignments in the form X(condition)

Using the "Calculate" method function within a loop makes it possible to make assignments containing a condition.

Conditional assignments of this type can be made using the symbols QEQ, VEQ and EEQ and indexed using the group index.

Note

Use of the logical operators AND and OR is not permitted within conditional assignments. Likewise, you cannot use the mathematical operators (+, -, * and /) within the parenthetical expression.

	Explanation	Examples
Basic symbol and symbol extension	Taken together, they serve as an identifier for the analysis data.	**VEQ** identifies the equivalence/end point of a titration.
GroupID	Defines the group of method functions (Ti, Me, Di, or St) to which the method function used to create the analysis data belongs.	**SLOPESt** designates the slope of a sensor used by a stating method function.
Symbol index	Specifies precisely which analysis data are meant if one method function generates analysis data multiple times using the same symbol. If multiple titrants are used in one method function, so the titer and nominal concentration will be used multiple times per generating method function. In this case, the index can be used to define the titrant data to be used in a calcu-lation.	**VEQ2** designates the consumed volume at the 2nd equivalence point of an EQP titration. **c2** references the nominal concentration of the 2nd titrant **TITER2** references the titer of the second titrant used.
Unit(x) / Unit(x,y)	**Unit(x)** specifies which time ("t"), potential ("E") or conversion ("CON") the analysis data should reference. **Unit(x,y)** specifies the time interval the analysis data should reference.	**VE(7)** designates the titrant volume required to reach a pH of 7 (for the pH unit). **CVt(1.5)** designates the mean stating use per minute in the time interval between one and five minutes.
Group index	Specifies which method function within a method function group generates the analysis data.	**ESTSt[3]** is the designation of the start potential of the 3rd method function from the method function group "Stating".

Shortcuts

General examples for the use of a formula in the "Calculate" method function:

R1=VStt(1.5)[2]

This example provides the volume (basic symbol = V) consumed during stating until the time of 1.5 (1 minute, 30 seconds) (unit(x) = time t(x)) as a result for the second method function (group index = 2) from the Stating group (group ID = St).

R2=SLOPEMeE(7)

This example provides the slope (basic symbol = SLOPE) of the sensor used at pH 7 (unit(x) = potential E(x)) as a result for the first method function (group index = 1, can be omitted) from the Measure group (group ID = Me).

15.1.2 Indexing of method functions

The method functions Titration (EP, EQP, 2-phase, LearnEQP), Stating, Measure (normal), Measure (MVT), Dispense, and Dispense (controlled) provide their own raw results within a method.
These raw results are saved by the titrator in the order in which the generating method functions are processed within the method. To ensure that any time these method functions are used more than once the raw results can still be given a unique assignment to their individual method functions, they are divided into four groups:

- Group 1 (all titrations): Method function Titration (EP, EQP, two-phase, Lern EQP)
- Group 2 (Stating): Method function Stating (normal)
- Group 3 (all measurements): Method functions Measure (normal) and Measure (MVT)
- Group 4 (all dispenses): Method function Dispense (normal) and Dispense (controlled)

If method functions from a group are used multiple times within a method, they are given indexes (beyond the loop limits). This group index allows unique referencing of the raw results during calculations.

If the structure of a method is changed, the group indices are automatically updated, guaranteeing the serial numbering at all times.

Note

- Make sure your calculations take this into consideration!

Calculations can be used independently of the method functions that generated the results. For the results, we suggest using the IDs R1...Rn, following the sequence of the calculations in the method.

Example

Method function	Group index	Result
Title		
Sample		
Titration stand		
Stir		
Titration (EQP)	1	
Titration (EP)	2	
Dispense	1	
Titration (EQP)	3	
Calculation		R1
Calculation		R2
Calculation		R3
End of sample		
Sample		
Titration stand		
Dispense	2	
Stating	1	
Titration (EP)	4	
Titration (EQP)	5	
Calculation		R4
End of sample		
Calculation		R5

For Titration (KF Vol) (multiple loops are permitted for the Stromboli method type)

Method function	Group index	Result
Title		
Sample (KF)		
Titration stand (Stromboli)		
Mix time		
Titration (KF Vol)	1	
Calculation		R1
Calculation		R2
Calculation		R3
End of sample		
Sample (KF)		
Titration stand		

Method function	Group index	Result
Mix time		
Titration (KF Vol)	3	
Calculation		R4
End of sample		
Calculation		R5

Note

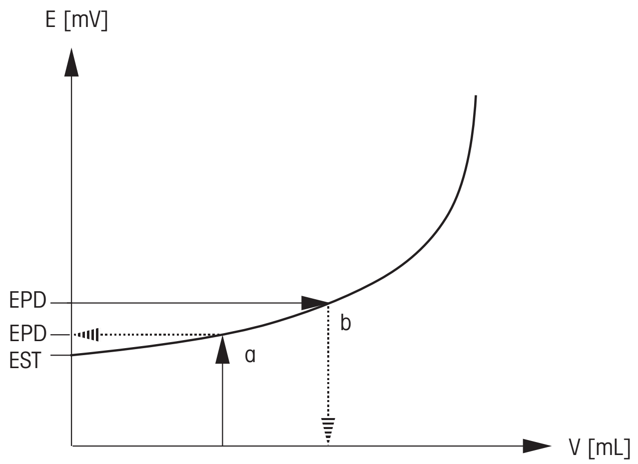
- The group index "1" can be omitted because when a group index is missing, the system automatically assigns the group index "1".

For Titration (KF Coul) (multiple loops are permitted for the Stromboli method type)

Method function	Group index	Result
Title		
Sample (KF)		
Titration stand (Stromboli)		
Mix time		
Titration (KF Coul)	1	
Calculation		R1
Calculation		R2
Calculation		R3
End of sample		
Sample (KF)		
Titration stand (Stromboli)		
Mix time		
Titration (KF Coul)	2	
Calculation		R4
End of sample		
Calculation		R5

15.1.3 Explanatory examples

15.1.3.1 Titration method function



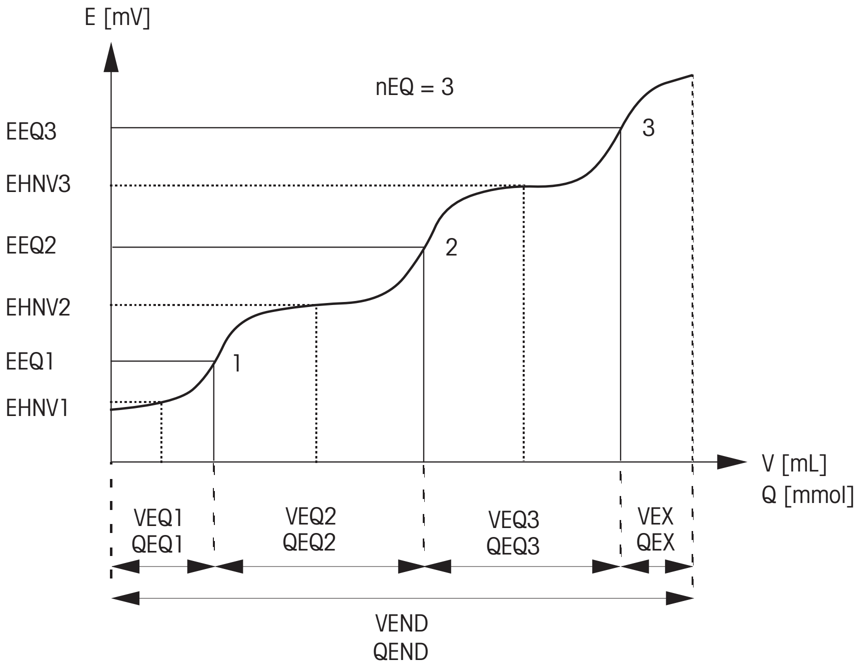
Predispensing

The following shows the various type of predispensing that can be used during a titration method:

a: Reference to a defined volume (or to the product of a factor and the sample size)
b: Reference to a defined potential

EST	Provides the potential at the start of the titration.

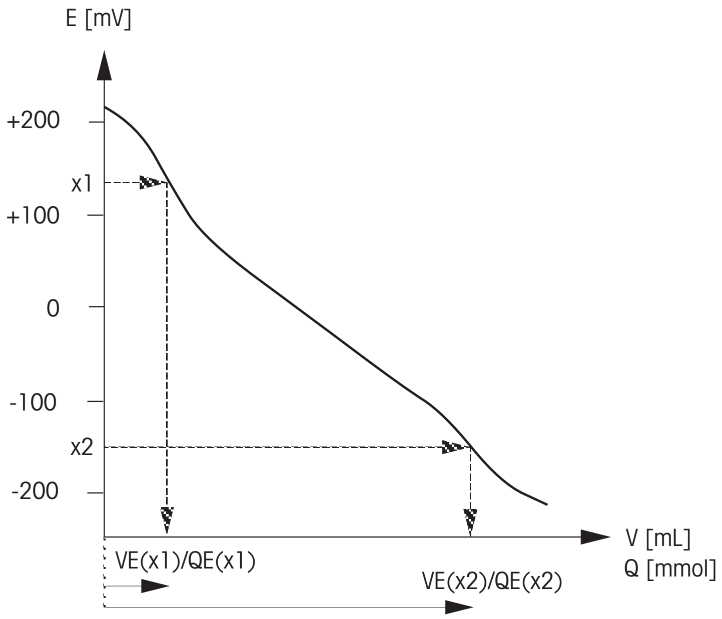
EPD	Provides the potential after dispensing and the waiting time.



Sample EQP titration containing three equivalence points

The following shows the three (nEQ = 3) recognized equivalence points (1, 2 and 3).

VEQ1, **VEQ2** and **VEQ3**	Provide the calculated volume used until each EQP.
QEQ1, **QEQ2** and **QEQ3**	Provide the calculated substance quantity used until each EQP.
EEQ1, **EEQ2** and **EEQ3**	Provide the potential at each EQP.
EHNV1, **EHNV2** and **EHNV3**	Provide the "half neutralization point" for each EQP.
VEX and **QEX**	Provide the excess volume titrated and the excess substance quantity titrated.
VEND and **QEND**	Provide the volume used by the end of the method and the substance quantity of the titrant.

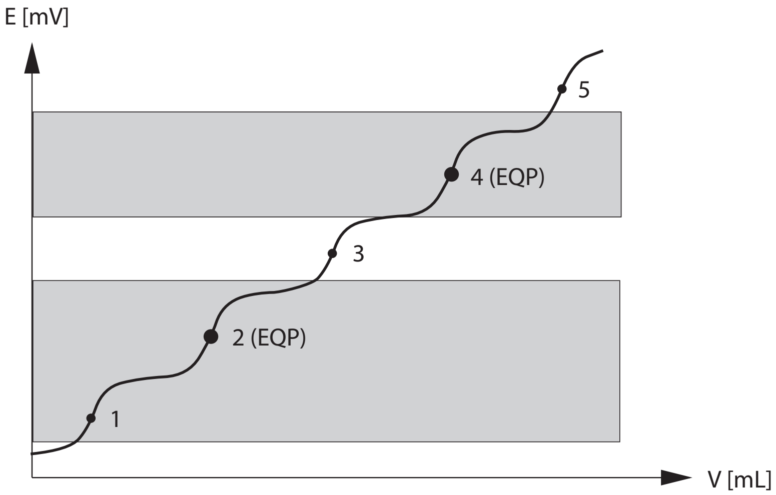


Example of an EQP titration with the evaluation of defined potentials (x1 and x2)

The following shows the evaluation of a titration curve with regard to the titrant consumption at certain potentials (x1 and x2).

VE(x1) and **VE(x2)**	Provide the titrant volume consumption at Potentials x1 and x2.

QE(x1) and **QE(x2)**	Provide the substance quantity of the titrant consumed at Potentials x1 and x2.



Theoretical example for the evaluation of a titration curve with five points of inflection

Explanation:

This titration curve shows five points of inflection (1 – 5).

Inflection points 1, 2 and 4 are recognized as EQP candidates, since only these points lie within the 2 recognition ranges while also fulfilling the "Tendency" and "Threshold" parameters.
The specified "Additional EQP criteria" then determine whether the EQP candidates are actually recognized as EQP. These additional EQP criteria can be defined for every recognition range.

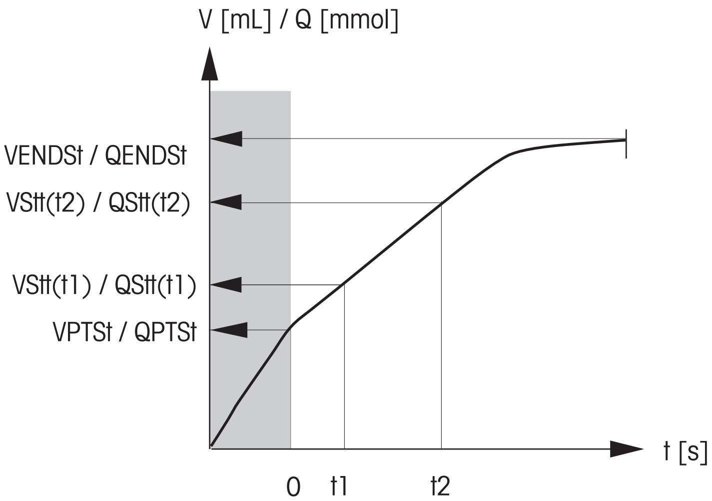
In the example shown above, the following were specified as additional EQP criteria:

Recognition Range 1: "Last EQP"
Recognition Range 2: "No"

Of the two EQP candidates found in Recognition Range 1, the system only identifies the second one as an EQP due to the "Final jump" criterion. The first one remains merely an EQP candidate.

The termination criterion defined was that the titration should be terminated after the recognition of three EQP candidates ("Termination after EQP" = "3"). In the above example the titration is terminated on identification of the 4th turning point (3rd EQP candidate).

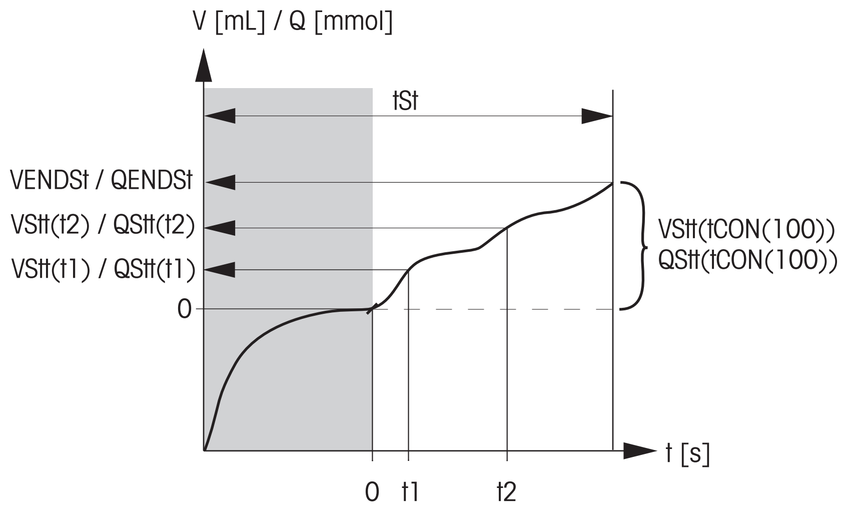
15.1.3.2 Stating method function



Stating example including evaluation at specified points in time (t1, t2) where 0 is the start of the Stat titration following the pretitration.

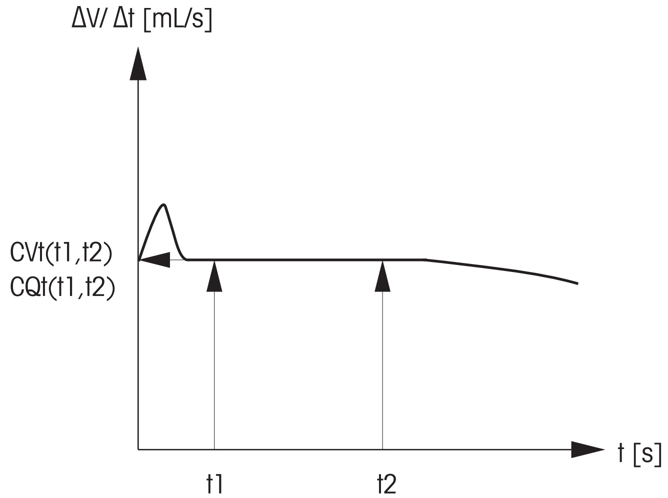
VENDSt, **QENDSt**	Provide the entire volume consumed and the entire substance quantity consumed
VStt(t1) and **VStt(t2)**	Provide the titrant volume consumed at Times t1 and t2
QStt(t1) and **QStt(t2)**	Provide the substance quantity consumed at Times t1 and t2

VPTSt	Volume used for pretitration: {mL}
QPTSt	Substance quantity of titrant used for pretitration: {mmol}



Stating example including pretitration (gray area) and evaluation at specified points in time (t1, t2)

VENDSt, **QENDSt**	Provide the entire volume used and the entire substance quantity used at the end of stating (including the pretitration)
VStt(t1) and **QStt(t1)**	Provide the titrant volume consumption and the substance quantity consumption at Time t1 (not including pretitration)
VStt(t2) and **QStt(t2)**	Provide the titrant volume consumption and the substance quantity consumption at Time t2 (not including pretitration))
VStt(tCON(100))/ QStt(tCON(100))	Provide the titrant volume consumption and the substance quantity consumption at the end of stating (not including pretitration)



Stating example including evaluation of the mean titrant consumption

The following is a stating example including the evaluation of the mean consumption between Times t1 and t2. CVt(t1,t2) and CQt(t1,t2) are determined using linear regression over the measured values between Times t1 and t2. CORRt(t1,t2) specifies the coefficient of correlation of this linear regression.

CVt(t1,t2)	Provides the mean titrant consumption between t1 and t2 in the form of volume per time.
CQt(t1,t2)	Provides the mean titrant consumption between t1 and t2 in the form of substance quantity per time.

15.2 Result proposal lists

When the user selects a result proposal from the list, the parameters **Results**, **Result unit**, **Formula** and **Constant C=** are automatically filled and cannot be changed (depending on the titrator type).
The proposal lists are filtered by method type and entry type. **Results** and **Result unit** define the formula with the help of the entry type chosen in the method function **Samples**. If the entry type changes, the formula will be modified if the result type = **Predefined** (if this is possible for the unit in question). If no formula exists for the newly selected entry type, the system should detect this during method validation when the entry type is saved.

15.2.1 General titration (GT)

The table shows predefined results that can be used in general titration loop (GT loop). To reach the results proposal lists, go to **Add result** > **Result proposals**.

Result	Result unit	Formula	Constant C=
Content	%	Q*C/m	M/(10*z)
Content	g/100mL	Q*C*d/m	M/(10*z)
Content	mg/g	Q*C/(m)	M/z
Content	mL/g	VEQ/m	1
Content	mol/L	Q*C/m	1/z
Content	mmol/L	Q*C/m	1000/z
Content	ppm	Q*C/m	M*1000/z
Consumption	mmol	Q	1
Consumption	mL	VEQ	1
Consumption	mL/min	CVt(0, tCON(100))	1
Titer	--	m/(VEQ*c*C)	M/(10*p*z)
Titer	--	m/(VEQ*c*C)	1/(cst*z)
Back titration	%	(QENDDi-Q)*C/m	M/(10*z)
Blank-compensated	%	(Q-B[x])*C/m	M/(10*z)
Potential	mV	E	1
Stating	%	QStt(tCON(100))	M/(10*z)
EQP higher than x	mmol	Q(EEQ>10)	1
EQP lower than x	mmol	Q(EEQ<10)	1
EQP close to x	mmol	Q(EEQ~10)	1
EQP between x, y	mmol	Q(5<EEQ<10)	1
Ion conc.	mol/L	pw(-E)	1
Absorption	A	-lg(E/100)	1
Log (base e)	--	ln(1)	1
Exp (base e)	--	ex(1)	1
Square	--	sq(1)	1
Root	--	sr(1)	1

15.2.2 Standard addition (STD)

Different result proposals are available depending on the following factors:

- Analysis type
- Sample type
- Sampling method
- Entry type

15.2.2.1 Analysis type = Blank determination

Result	Unit	Formula R=	Constant C=
Blank	mg/L	cRawStd	1

15.2.2.2 Analysis type = Direct

Liquid samples

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **liquid**
- **Sampling** =**Direct**
- **Entry type** = **Volume** and **Fixed volume**

The total volume [ml] is defined as VTOT = VWATER + VISA + m.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	cRawStd	1
Content	mg/L	cRawStd*VTOT/m	1
	ppm	cRawStd*VTOT/m	1
	g/100mL	(cRawStd*VTOT/m)/10000	1
	%	(cRawStd*VTOT/m)/10000	1
	mg/100mL	(cRawStd*VTOT/m)/10	1
	g/L	(cRawStd*VTOT/m)/1000	1
	g/100g	(cRawStd*VTOT/(m*d))/10000	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **liquid**
- **Sampling** =**Direct**
- **Entry type** = **Weight** and **Fixed weight**

The total volume [ml] is defined as VTOT = VWATER + VISA + m/d.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	cRawStd	1
Content	mg/L	cRawStd*VTOT/(m/d)	1
	ppm	cRawStd*VTOT/(m/d)	1
	g/100mL	(cRawStd*VTOT/(m/d))/10000	1
	%	(cRawStd*VTOT/(m/d))/10000	1
	mg/100mL	(cRawStd*VTOT/(m/d))/10	1
	g/L	(cRawStd*VTOT/(m/d))/1000	1
	g/100g	(cRawStd*VTOT/m)/10000	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **liquid**
- **Sampling** = **Aliquot excl. ISA**
- **Entry type** = **Volume** and **Fixed volume**

The total volume [ml] is defined as VTOT = VALIQUOT + VISA.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	cRawStd	1

Result	Unit	Formula R=	Constant C=
Content	mg/L	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m)	1
	ppm	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m)	1
	g/100mL	((cRawStd*VTOT/VALIQUOT)*(VDILUTION/m))/10000	1
	%	((cRawStd*VTOT/VALIQUOT)*(VDILUTION/m))/10000	1
	mg/100mL	((cRawStd*VTOT/VALIQUOT)*(VDILUTION/m))/10	1
	g/L	((cRawStd*VTOT/VALIQUOT)*(VDILUTION/m))/1000	1
	g/100g	((cRawStd*VTOT/VALIQUOT)*(VDILUTION/m/d))/10000	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **liquid**
- **Sampling** = **Aliquot excl. ISA**
- **Entry type** = **Weight** and **Fixed weight**

The total volume [ml] is defined as VTOT = VALIQUOT + VISA.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	cRawStd	1
Content	mg/L	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/(m/d))	1
	ppm	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/(m/d))	1
	g/100mL	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/(m/d))/10000	1
	%	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/(m/d))/10000	1
	mg/100mL	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/(m/d))/10	1
	g/L	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/(m/d))/1000	1
	g/100g	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m)/10000	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **liquid**
- **Sampling** = **Aliquot incl. ISA**
- **Entry type** = **Volume** and **Fixed volume**

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	cRawStd	1
Content	mg/L	cRawStd*(VDILUTION/m)	1
	ppm	cRawStd*(VDILUTION/m)	1
	g/100mL	cRawStd*(VDILUTION/m)/10000	1
	%	cRawStd*(VDILUTION/m)/10000	1
	mg/100mL	cRawStd*(VDILUTION/m)/10	1
	g/L	cRawStd*(VDILUTION/m)/1000	1
	g/100g	cRawStd*(VDILUTION/(m*d))/1000	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **liquid**
- **Sampling** = **Aliquot incl. ISA**
- **Entry type** = **Weight** and **Fixed weight**

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	cRawStd	1
Content	mg/L	cRawStd*(VDILUTION/(m/d))	1
	ppm	cRawStd*(VDILUTION/(m/d))	1
	g/100mL	cRawStd*(VDILUTION/(m/d))/10000	1
	%	cRawStd*(VDILUTION/(m/d))/10000	1
	mg/100mL	cRawStd*(VDILUTION/(m/d))/10	1
	g/L	cRawStd*(VDILUTION/(m/d))/1000	1
	g/100g	cRawStd*(VDILUTION/m)/10000	1

Solid samples

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **solid**
- **Sampling** =**Direct**
- **Entry type** = **Weight** and **Fixed weight**

The total volume [ml] is defined as VTOT = VWATER + VISA.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	cRawStd	1
Content	mg/kg	cRawStd*VTOT/m	1
	ppm	cRawStd*VTOT/m	1
	g/100g	(cRawStd*VTOT/m)/10000	1
	%	(cRawStd*VTOT/m)/10000	1
	mg/100g	(cRawStd*VTOT/m)/10	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **solid**
- **Sampling** =**Direct**
- **Entry type** = **Pieces** and **Fixed pieces**

The total volume [ml] is defined as VTOT = VWATER + VISA.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	cRawStd	1
Content	mg/kg	cRawStd*VTOT/m*wp	1
	ppm	cRawStd*VTOT/m*wp	1
	g/100g	(cRawStd*VTOT/m*wp)/10000	1
	%	(cRawStd*VTOT/m*wp)/10000	1
	mg/100g	(cRawStd*VTOT/m*wp)/10	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **solid**
- **Sampling** = **Aliquot excl. ISA**
- **Entry type** = **Weight** and **Fixed weight**

The total volume [ml] is defined as VTOT = VALIQUOT + VISA.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	cRawStd	1
Content	mg/kg	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m)	1

Result	Unit	Formula R=	Constant C=
Content	ppm	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m)	1
Content	g/100g	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m)/10000	1
Content	%	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m)/10000	1
Content	mg/100g	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m)/10	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **solid**
- **Sampling** = **Aliquot excl. ISA**
- **Entry type** = **Pieces** and **Fixed pieces**

The total volume [ml] is defined as VTOT = VALIQUOT + VISA.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	cRawStd	1
Content	mg/kg	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m*wp)	1
Content	ppm	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m*wp)	1
Content	g/100g	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m*wp)/10000	1
Content	%	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m*wp)/10000	1
Content	mg/100g	(cRawStd*VTOT/VALIQUOT)*(VDILUTION/m*wp)/10	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **solid**
- **Sampling** = **Aliquot incl. ISA**
- **Entry type** = **Weight** and **Fixed weight**

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	cRawStd	1
Content	mg/kg	cRawStd*VDILUTION/m	1
Content	ppm	cRawStd*VDILUTION/m	1
Content	g/100g	(cRawStd*VDILUTION/m)/10000	1
Content	%	(cRawStd*VDILUTION/m)/10000	1
Content	mg/100g	(cRawStd*VDILUTION/m)/10	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **solid**
- **Sampling** = **Aliquot incl. ISA**
- **Entry type** = **Pieces** and **Fixed pieces**

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	cRawStd	1
Content	mg/kg	cRawStd*VDILUTION/m*wp	1
Content	ppm	cRawStd*VDILUTION/m*wp	1
Content	g/100g	(cRawStd*VDILUTION/m*wp)/10000	1
Content	%	(cRawStd*VDILUTION/m*wp)/10000	1
Content	mg/100g	(cRawStd*VDILUTION/m*wp)/10	1

15.2.2.3 Analysis type = Blank compensated

Liquid samples

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **liquid**
- **Sampling** =**Direct**
- **Entry type** = **Volume** and **Fixed volume**

The total volume [ml] is defined as VTOT = VWATER + VISA + m.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	(cRawStd-B[Blank Std])	1
Content	mg/L	(cRawStd-B[Blank Std])*VTOT/m	1
	ppm	(cRawStd-B[Blank Std])*VTOT/m	1
	g/100mL	((cRawStd-B[Blank Std])*VTOT/m)/10000	1
	%	((cRawStd-B[Blank Std])*VTOT/m)/10000	1
	mg/100mL	((cRawStd-B[Blank Std])*VTOT/m)/10	1
	g/L	((cRawStd-B[Blank Std])*VTOT/m)/1000	1
	g/100g	((cRawStd-B[Blank Std])*VTOT/(m*d))/10000	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **liquid**
- **Sampling** =**Direct**
- **Entry type** = **Weight** and **Fixed weight**

The total volume [ml] is defined as VTOT = VWATER + VISA + m/d.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	(cRawStd-B[Blank Std])	1
Content	mg/L	(cRawStd-B[Blank Std])*VTOT/(m/d)	1
	ppm	(cRawStd-B[Blank Std])*VTOT/(m/d)	1
	g/100mL	((cRawStd-B[Blank Std])*VTOT/(m/d))/10000	1
	%	((cRawStd-B[Blank Std])*VTOT/(m/d))/10000	1
	mg/100mL	((cRawStd-B[Blank Std])*VTOT/(m/d))/10	1
	g/L	((cRawStd-B[Blank Std])*VTOT/(m/d))/1000	1
	g/100g	((cRawStd-B[Blank Std])*VTOT/m)/10000	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **liquid**
- **Sampling** = **Aliquot excl. ISA**
- **Entry type** = **Volume** and **Fixed volume**

The total volume [ml] is defined as VTOT = VALIQUOT + VISA.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	(cRawStd-B[Blank Std])	1

Result	Unit	Formula R=	Constant C=
Content	mg/L	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m)	1
	ppm	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m)	1
	g/100mL	(((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m))/10000	1
	%	(((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m))/10000	1
	mg/100mL	(((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m))/10	1
	g/L	(((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m))/1000	1
	g/100g	(((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m/d))/10000	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **liquid**
- **Sampling** = **Aliquot excl. ISA**
- **Entry type** = **Weight** and **Fixed weight**

The total volume [ml] is defined as VTOT = VALIQUOT + VISA.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	(cRawStd-B[Blank Std])	1
Content	mg/L	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/(m/d))	1
	ppm	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/(m/d))	1
	g/100mL	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/(m/d))/10000	1
	%	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/(m/d))/10000	1
	mg/100mL	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/(m/d))/10	1
	g/L	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/(m/d))/1000	1
	g/100g	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m)/10000	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **liquid**
- **Sampling** = **Aliquot incl. ISA**
- **Entry type** = **Volume** and **Fixed volume**

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	(cRawStd-B[Blank Std])	1

Result	Unit	Formula R=	Constant C=
Content	mg/L	(cRawStd-B[Blank Std])*(VDILUTION/m)	1
	ppm	(cRawStd-B[Blank Std])*(VDILUTION/m)	1
	g/100mL	(cRawStd-B[Blank Std])*(VDILUTION/m)/10000	1
	%	(cRawStd-B[Blank Std])*(VDILUTION/m)/10000	1
	mg/100mL	(cRawStd-B[Blank Std])*(VDILUTION/m)/10	1
	g/L	(cRawStd-B[Blank Std])*(VDILUTION/m)/1000	1
	g/100g	(cRawStd-B[Blank Std])*(VDILUTION/(m*d))/1000	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **liquid**
- **Sampling** = **Aliquot incl. ISA**
- **Entry type** = **Weight** and **Fixed weight**

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	(cRawStd-B[Blank Std])	1
Content	mg/L	(cRawStd-B[Blank Std])*(VDILUTION/(m/d))	1
	ppm	(cRawStd-B[Blank Std])*(VDILUTION/(m/d))	1
	g/100mL	(cRawStd-B[Blank Std])*(VDILUTION/(m/d))/10000	1
	%	(cRawStd-B[Blank Std])*(VDILUTION/(m/d))/10000	1
	mg/100mL	(cRawStd-B[Blank Std])*(VDILUTION/(m/d))/10	1
	g/L	(cRawStd-B[Blank Std])*(VDILUTION/(m/d))/1000	1
	g/100g	(cRawStd-B[Blank Std])*(VDILUTION/m)/10000	1

Solid samples

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **solid**
- **Sampling** =**Direct**
- **Entry type** = **Weight** and **Fixed weight**

The total volume [ml] is defined as VTOT = VWATER + VISA.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	(cRawStd-B[Blank Std])	1
Content	mg/kg	(cRawStd-B[Blank Std])*VTOT/m	1
	ppm	(cRawStd-B[Blank Std])*VTOT/m	1
	g/100g	((cRawStd-B[Blank Std])*VTOT/m)/10000	1
	%	((cRawStd-B[Blank Std])*VTOT/m)/10000	1
	mg/100g	((cRawStd-B[Blank Std])*VTOT/m)/10	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **solid**
- **Sampling** =**Direct**
- **Entry type** = **Pieces** and **Fixed pieces**

The total volume [ml] is defined as VTOT = VWATER + VISA.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	(cRawStd-B[Blank Std])	1
Content	mg/kg	(cRawStd-B[Blank Std])*VTOT/m*wp	1
	ppm	(cRawStd-B[Blank Std])*VTOT/m*wp	1
	g/100g	((cRawStd-B[Blank Std])*VTOT/m*wp)/10000	1
	%	((cRawStd-B[Blank Std])*VTOT/m*wp)/10000	1
	mg/100g	((cRawStd-B[Blank Std])*VTOT/m*wp)/10	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **solid**
- **Sampling** = **Aliquot excl. ISA**
- **Entry type** = **Weight** and **Fixed weight**

The total volume [ml] is defined as VTOT = VALIQUOT + VISA.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	(cRawStd-B[Blank Std])	1
Content	mg/kg	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m)	1
Content	ppm	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m)	1
Content	g/100g	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m)/10000	1
Content	%	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m)/10000	1
Content	mg/100g	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m)/10	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **solid**
- **Sampling** = **Aliquot excl. ISA**
- **Entry type** = **Pieces** and **Fixed pieces**

The total volume [ml] is defined as VTOT = VALIQUOT + VISA.

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	(cRawStd-B[Blank Std])	1
Content	mg/kg	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m*wp)	1
Content	ppm	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m*wp)	1
Content	g/100g	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m*wp)/10000	1
Content	%	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m*wp)/10000	1
Content	mg/100g	((cRawStd-B[Blank Std])*VTOT/ VALIQUOT)*(VDILUTION/m*wp)/10	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **solid**
- **Sampling** = **Aliquot incl. ISA**
- **Entry type** = **Weight** and **Fixed weight**

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	(cRawStd-B[Blank Std])	1

Result	Unit	Formula R=	Constant C=
Content	mg/kg	(cRawStd-B[Blank Std])*VDILUTION/m	1
Content	ppm	(cRawStd-B[Blank Std])*VDILUTION/m	1
Content	g/100g	((cRawStd-B[Blank Std])*VDILUTION/m)/10000	1
Content	%	((cRawStd-B[Blank Std])*VDILUTION/m)/10000	1
Content	mg/100g	((cRawStd-B[Blank Std])*VDILUTION/m)/10	1

The following table shows the result proposals for the following settings in the **Sample (Standard Addition)** method function:

- **Sample type** = **solid**
- **Sampling** = **Aliquot incl. ISA**
- **Entry type** = **Pieces** and **Fixed pieces**

Result	Unit	Formula R=	Constant C=
Concentration	mg/L	(cRawStd-B[Blank Std])	1
Content	mg/kg	(cRawStd-B[Blank Std])*VDILUTION/m*wp	1
Content	ppm	(cRawStd-B[Blank Std])*VDILUTION/m*wp	1
Content	g/100g	((cRawStd-B[Blank Std])*VDILUTION/m*wp)/10000	1
Content	%	((cRawStd-B[Blank Std])*VDILUTION/m*wp)/10000	1
Content	mg/100g	((cRawStd-B[Blank Std])*VDILUTION/m*wp)/10	1

15.2.3 Volumetric Karl Fischer titration

Predefined results for volumetric Karl Fischer titration are described below. You use the **Results proposals** button in the **Add result** dialog to open the result proposal lists.

Navigation: **Results** > **Add result** > **Result proposals** or from the start screen of a method Calculation > **Result proposals**

If a results proposal is selected from the list, the parameters are set as follows: **Result**, **Result unit**, **Formula**, and **Constant C=** parameters are automatically filled. On some titrator types the parameters can be changed.
The proposal lists are filtered by method type and entry type. **Result** and **Result unit** define the formula with the help of the entry type chosen in the **Sample KF** method function. If the entry type changes and if the **Result type** is set to **Predefined**, the formula is modified (if this is possible for the unit in question). If no formula exists for the newly selected entry type, the system will detect this during method validation when the entry type is saved.
The blank value of the **Sample (KF)** method function - **Blank** subfunction - is used for the blank values of the external extraction/solution.

The formulas listed below are result proposals.

15.2.3.1 KF Vol method type

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample KF** method function.

Result	Unit	Formula R=	Constant C=
Consumption	mL	VEQ	1
Mean consumption	µL/min	VEQ*1000/TIME	1
Titration duration	min	TIME	1
Total water content	µg	CW	1
Concentration	mg/mL	CONC	1
Drift consumption	µL	DRIFTV*TIME	1

The result proposals for the calculation of the content depend on the setting of the **Entry type** parameter in the **Sample (KF)** method function.

Result proposals for Entry type = Weight or Fixed weight

Result	Unit	Formula R=	Constant C=
Content	mg	(VEQ*CONC-TIME*DRIFT/1000)*C	1
	µg		1000
	%	(VEQ*CONC-TIME*DRIFT/1000)*C/m	0.1
	ppm		1000
	g/kg		1
	mg/g		1
	mg/mL	(VEQ*CONC-TIME*DRIFT/1000)*C/(m/d)	1
	g/mL		0.001
	µg/L		1000000
	µg/mL		1000

Result proposals for Entry type = Volume or Fixed volume

Result	Unit	Formula R=	Constant C=
Content	mg	(VEQ*CONC-TIME*DRIFT/1000)*C	1
	µg		1000
	%	(VEQ*CONC-TIME*DRIFT/1000)*C/(m*d)	0.1
	ppm		1000
	g/kg		1
	mg/g		1
	mg/mL	(VEQ*CONC-TIME*DRIFT/1000)*C/m	1
	g/mL		0.001
	µg/L		1000000
	µg/mL		1000

Result proposals for Entry type = Pieces or Fixed pieces

Result	Unit	Formula R=	Constant C=
Content	mg	(VEQ*CONC-TIME*DRIFT/1000)*C	1
	µg		1000
	%	(VEQ*CONC-TIME*DRIFT/1000)*C/(m*wp)	0.1
	ppm		1000
	g/kg		1
	mg/g		1
	mg/pc	(VEQ*CONC-TIME*DRIFT/1000)*C/m	1

15.2.3.2 Ext. Extr. V. method type

The result proposals depend on the setting of the **Entry type** parameter in the **Sample (KF)** method function.

Result proposals for Entry type = Weight or Fixed weight

Result	Unit	Formula R=	Constant C=
External dissolution (B in %)	%	C*[(msol+mext)/mext]-B*msol/mext	(VEQ*CONC-TIME*DRIFT/1000)*0.1/m
External dissolution (B in ppm)	ppm	C*[(msol+mext)/mext]-B*msol/mext	(VEQ*CONC-TIME*DRIFT/1000)*1000/m
External extraction (B in %)	%	100/(100-C)*(C*msol/mext-B*msol/mext)	(VEQ*CONC-TIME*DRIFT/1000)*0.1/m
External extraction (B in ppm)	ppm	pw(6)/[pw(6)-C]*(C*msol/mext-B*msol/mext)	(VEQ*CONC-TIME*DRIFT/1000)*1000/m

Result proposals for Entry type = Volume or Fixed volume

Result	Unit	Formula R=	Constant C=
External dissolution (B in %)	%	C*[(msol+mext)/mext]-B*msol/mext	(VEQ*CONC-TIME*DRIFT/1000)*0.1/(m*d)
External dissolution (B in ppm)	ppm	C*[(msol+mext)/mext]-B*msol/mext	(VEQ*CONC-TIME*DRIFT/1000)*1000/(m*d)
External extraction (B in %)	%	100/(100-C)*(C*msol/mext-B*msol/mext)	(VEQ*CONC-TIME*DRIFT/1000)*0.1/(m*d)
External extraction (B in ppm)	ppm	pw(6)/[pw(6)-C]*(C*msol/mext-B*msol/mext)	(VEQ*CONC-TIME*DRIFT/1000)*1000/(m*d)

Result proposals for Entry type = Pieces or Fixed pieces

Result	Unit	Formula R=	Constant C=
External dissolution (B in %)	%	C*[(msol+mext)/mext]-B*msol/mext	(VEQ*CONC-TIME*DRIFT/1000)*0.1/(m*wp)
External dissolution (B in ppm)	ppm	C*[(msol+mext)/mext]-B*msol/mext	(VEQ*CONC-TIME*DRIFT/1000)*1000/(m*wp)
External extraction (B in %)	%	100/(100-C)*(C*msol/mext-B*msol/mext)	(VEQ*CONC-TIME*DRIFT/1000)*0.1/(m*wp)
External extraction (B in ppm)	ppm	pw(6)/[pw(6)-C]*(C*msol/mext-B*msol/mext)	(VEQ*CONC-TIME*DRIFT/1000)*1,000/(m*wp)

15.2.3.3 IM KF V. method type

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample KF** method function.

Result	Unit	Formula R=	Constant C=
Consumption	mL	VEQ	1
Mean consumption	µL/min	VEQ*1000/TIME	1
Titration duration	min	TIME	1
Total water content	µg	CW	1
InMotion KF blank value	µg	(VEQ*CONC-TIME*DRIFT/1,000)*C	1000

The result proposals for the calculation of the content depend on the setting of the **Entry type** parameter in the **Sample (KF)** method function.

Result proposals for Entry type = Weight or Fixed weight

<table>
<tr><th>Result</th><th>Unit</th><th>Formula R=</th><th>Constant C=</th></tr>
<tr><td rowspan="10">Content blank value compensated (B in µg)</td><td>mg</td><td rowspan="2">(VEQ*CONC-B[Blank IMKF Vol]/1000-TIME*DRIFT/1000)*C</td><td>1</td></tr>
<tr><td>µg</td><td>1000</td></tr>
<tr><td>%</td><td rowspan="4">(VEQ*CONC-B[Blank IMKF Vol]/1000-TIME*DRIFT/1000)*C/m</td><td>0.1</td></tr>
<tr><td>ppm</td><td>1000</td></tr>
<tr><td>g/kg</td><td>1</td></tr>
<tr><td>mg/g</td><td>1</td></tr>
<tr><td>mg/mL</td><td rowspan="4">(VEQ*CONC-B[Blank IMKF Vol]/1000-TIME*DRIFT/1000)*C/(m/d)</td><td>1</td></tr>
<tr><td>g/mL</td><td>0.001</td></tr>
<tr><td>µg/L</td><td>1000000</td></tr>
<tr><td>µg/mL</td><td>1000</td></tr>
</table>

Result proposals for Entry type = Volume or Fixed volume

Result	Unit	Formula R=	Constant C=
Content blank value compensated (B in µg)	mg	(VEQ*CONC-B[Blank IMKF Vol]/1000-TIME*DRIFT/1000)*C	1
	µg		1000
	%	(VEQ*CONC-B[Blank IMKF Vol]/1000-TIME*DRIFT/1000)*C/(m*d)	0.1
	ppm		1000
	g/kg		1
	mg/g		1
	mg/mL	(VEQ*CONC-B[Blank IMKF Vol]/1000-TIME*DRIFT/1000)*C/m	1
	g/mL		0.001
	µg/L		1000000
	µg/mL		1000

Result proposals for Entry type = Pieces or Fixed pieces

Result	Unit	Formula R=	Constant C=
Content blank value compensated (B in µg)	mg	(VEQ*CONC-B[Blank IMKF Vol]/1000-TIME*DRIFT/1000)*C	1
	µg		1000
	%	(VEQ*CONC-B[Blank IMKF Vol]/1000-TIME*DRIFT/1000)*C/(m*wp)	0.1
	ppm		1000
	g/kg		1
	mg/g		1
	mg/pc	(VEQ*CONC-B[Blank IMKF Vol]/1000-TIME*DRIFT/1000)*C/m	1

15.2.3.4 Scan KF V. method type

Result	Unit	Formula R=	Constant C=
Sample size	g mL pcs	m	1
Titration duration	min	TIME	1

15.2.3.5 Stromb. V. method type

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample KF** method function.

Result	Unit	Formula R=	Constant C=
Consumption	mL	VEQ	1
Mean consumption	µL/min	VEQ*1000/TIME	1
Titration duration	min	TIME	1
Total water content	µg	CW	1
Stromboli blank value	µg	VEQ*CONC-TIME*DRIFT/1000)*C	1000

The result proposals for the calculation of the content depend on the setting of the **Entry type** parameter in the **Sample (KF)** method function.

Result proposals for Entry type = Weight or Fixed weight

Result	Unit	Formula R=	Constant C=
Content blank value compensated (B in µg)	mg	(VEQ*CONC-B[Blank Stromboli]/1000-TIME*DRIFT/1000)*C	1
	µg		1000
	%	(VEQ*CONC-B[Blank Stromboli]/1000-TIME*DRIFT/1000)*C/m	0.1
	ppm		1000
	g/kg		1
	mg/g		1
	mg/mL	(VEQ*CONC-B[Blank Stromboli]/1000-TIME*DRIFT/1000)*C/(m/d)	1
	g/mL		0.001
	µg/L		1000000
	µg/mL		1000

Result proposals for Entry type = Volume or Fixed volume

Result	Unit	Formula R=	Constant C=
Content blank value compensated (B in µg)	mg	(VEQ*CONC-B[Blank Stromboli]/1000-TIME*DRIFT/1000)*C	1
	µg		1000
	%	(VEQ*CONC-B[Blank Stromboli]/1000-TIME*DRIFT/1000)*C/(m*d)	0.1
	ppm		1000
	g/kg		1
	mg/g		1
	mg/mL	(VEQ*CONC-B[Blank Stromboli]/1000-TIME*DRIFT/1000)*C/m	1
	g/mL		0.001
	µg/L		1000000
	µg/mL		1000

Result proposals for Entry type = Pieces or Fixed pieces

Result	Unit	Formula R=	Constant C=
Content blank value compensated (B in µg)	mg	(VEQ*CONC-B[Blank Stromboli]/1000-TIME*DRIFT/1000)*C	1
	µg		1000
	%	(VEQ*CONC-B[Blank Stromboli]/1000-TIME*DRIFT/1000)*C/(m*wp)	0.1
	ppm		1000
	g/kg		1
	mg/g		1
	mg/pc	(VEQ*CONC-B[Blank Stromboli]/1000-TIME*DRIFT/1000)*C/m	1

15.2.3.6 Internal calculations

Concentration determination

The result proposals depend on the setting of the **Entry type** parameter in the **Sample (KF)** method function.

Result proposals for Entry type = Weight or Fixed weight

Result	Unit	Formula R=	Constant C=
Concentration (Std. in mg/g)	mg/ml	CONC=CONT*m/(VEQ-(DRIFT/CONC(old))*TIME/1000) 1)	1
Concentration (Std. in mg/ml)	mg/ml	CONC=CONT*(m/d)/(VEQ-(DRIFT/CONC(old))*TIME/1000) 1)	1
Concentration (Std. in %)	mg/ml	CONC=CONT*m*10/(VEQ-(DRIFT/CONC(old))*TIME/1000) 1)	1
Concentration (Std. in ppm)	mg/ml	CONC=CONT*m/(1000*VEQ-(DRIFT/CONC(old))*TIME) 1)	1

1) CONC(old) refers to the Setup value current at the time of calculation.

Result proposals for Entry type = Volume or Fixed volume

Result	Unit	Formula R=	Constant C=
Concentration (Std. in mg/g)	mg/ml	CONC=CONT*(m*d)/(VEQ-(DRIFT/CONC(old))*TIME/1000) 1)	1
Concentration (Std. in mg/ml)	mg/ml	CONC=CONT*m/(VEQ-(DRIFT/CONC(old))*TIME/1000) 1)	1
Concentration (Std. in %)	mg/ml	CONC=CONT*(m*d)*10/(VEQ-(DRIFT/CONC(old))*TIME/1000) 1)	1
Concentration (Std. in ppm)	mg/ml	CONC=CONT*(m*d)/(1000*VEQ-(DRIFT/CONC(old))*TIME) 1)	1

1) CONC(old) refers to the Setup value current at the time of calculation.

Result proposals for Entry type = Weight or Fixed weight

Result	Unit	Formula R=	Constant C=
Concentration (Std. in mg/pc) 1)	mg/ml	CONC=CONT*m/(VEQ-(DRIFT/CONC(old))*TIME/1000) 2)	1

1) For standard Riedel de Haën FASTrate tablets (CONT in mg/pc , m=pieces)
2) CONC(old) refers to the Setup value current at the time of calculation.

Blank determination

The result proposals depend on the setting of the following parameters:

- **Entry type** in the **Sample (KF)** method function.
- **Source for drift** in the **Titration stand** method function

Result proposals for Entry type = Weight or Fixed weight and Source for drift = Request, Online or Fix value

Result	Unit	Formula R=	Constant C=
Blank	%	(VEQ*CONC-TIME*DRIFT/1,000)*C/m	0.1
	ppm		1,000

Result proposals for Entry type = Weight or Fixed weight and Source for drift = Determination

Result	Unit	Formula R=	Constant C=
Blank	%	(VEQ*CONC-TIME*DRIFTV*CONC/1,000)*C/m	0.1
	ppm		1,000

Result proposals for Entry type = Volume or Fixed volume and Source for drift = Request, Online or Fix value

Result	Unit	Formula R=	Constant C=
Blank	%	(VEQ*CONC-TIME*DRIFT/1,000)*C/(m*d)	0.1
	ppm		1,000

Result proposals for Entry type = Volume or Fixed volume and Source for drift = Determination

Result	Unit	Formula R=	Constant C=
Blank	%	(VEQ*CONC-TIME*DRIFTV*CONC/1,000)*C/(m*d)	0.1
	ppm		1,000

Miscellaneous internal calculations

Result	Unit	Formula R=	Constant C=
Drift	µg/min	DRIFT=DRIFTV*CONC	1
CW	µg	CW=VEQ*CONC*1,000	1

15.2.4 Coulometric Karl Fischer titration

Navigation: **Results** > **Add result** > **Result proposals** or from the start screen of a method Calculation > **Result proposals**

If a results proposal is selected from the list, the parameters are set as follows: **Result**, **Result unit**, **Formula**, and **Constant C=** parameters are automatically filled. On some titrator types the parameters can be changed.
The proposal lists are filtered by method type and entry type. **Result** and **Result unit** define the formula with the help of the entry type chosen in the **Sample KF** method function. If the entry type changes and if the **Result type** is set to **Predefined**, the formula is modified (if this is possible for the unit in question). If no formula exists for the newly selected entry type, the system will detect this during method validation when the entry type is saved.
The blank value of the **Sample (KF)** method function - **Blank** subfunction - is used for the blank values of the external extraction/solution.

The formulas listed below are result proposals.

15.2.4.1 KF Coul method type

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample KF** method function.

Result	Unit	Formula R=	Constant C=
Coulometric consumption	mC	ICEQ	1
Mean consumption	µg/min	(ICEQ/10.712)/TIME	1
Titration duration	min	TIME	1
Total water content	µg	CW	1

The result proposals for the calculation of the content depend on the setting of the **Entry type** parameter in the **Sample (KF)** method function.

Result proposals for Entry type = Weight or Fixed weight

Result	Result unit	Formula	Constant C=
Content	mg	(ICEQ/10.712-TIME*DRIFT)/C	1,00
	µg		1
	%	(ICEQ/10.712-TIME*DRIFT)/(C*m)	10,00
	ppm		1
	mg/g		1,00
	g/kg		1000
	µg/mL	(ICEQ/10.712-TIME*DRIFT)/(C*(m/d))	1
	mg/mL		1000
	µg/L		0.001
	g/mL		1000000

Result proposals for Entry type = Volume or Fixed volume

Result	Result unit	Formula	Constant C=
Content	mg	(ICEQ/10.712-TIME*DRIFT)/C	1000
	µg		1
	%	(ICEQ/10.712-TIME*DRIFT)/(C*(m*d))	10000
	ppm		1
	mg/g		1000
	g/kg		1000
	µg/mL	(ICEQ/10.712-TIME*DRIFT)/(C*m)	1
	mg/mL		1000
	µg/L		0.001
	g/mL		1000000

Result proposals for Entry type = Pieces or Fixed pieces

Result	Result unit	Formula	Constant C=
Content	mg	(ICEQ/10.712-TIME*DRIFT)/C	1000
	µg		1
	%	(ICEQ/10.712-TIME*DRIFT)/(C*(m*wp))	10000
	ppm		1
	mg/g		1000
	g/kg		1000
	mg/pc	(ICEQ/10.712-TIME*DRIFT)/(C*m)	1000

15.2.4.2 Ext. Extr. C method type

The result proposals depend on the setting of the **Entry type** parameter in the **Sample (KF)** method function.

Result proposals for Entry type = Weight or Fixed weight

Result	Unit	Formula R =	Constant
External dissolution (B in %)	%	C*[(msol+mext)/mext]-B*msol/mext	(ICEQ/10.712–TIME*DRIFT)/(10000*m)
External dissolution (B in ppm)	ppm	C*[(msol+mext)/mext]-B*msol/mext	(ICEQ/10.712–TIME*DRIFT)/m
External extraction (B in %)	%	100/(100-C)*(C*msol/mext-B*msol/mext)	(ICEQ/10.712-TIME*DRIFT)/(10000*m)
External extraction (B in ppm)	ppm	pw(6)/[pw(6)-C]*(C*msol/mext-B*msol/mext)	(ICEQ/10.712-TIME*DRIFT)/m

Result proposals for Entry type = Volume or Fixed volume

Result	Unit	Formula R =	Constant
External dissolution (B in %)	%	C*[(msol+mext)/mext]-B*msol/mext	(ICEQ/10.712–TIME*DRIFT)/(10000*(m*d))
External dissolution (B in ppm)	ppm	C*[(msol+mext)/mext]-B*msol/mext	(ICEQ/10.712–TIME*DRIFT)/(m*d)
External extraction (B in %)	%	100/(100-C)*(C*msol/mext-B*msol/mext)	(ICEQ/10.712-TIME*DRIFT)/(10000*(m*d))
External extraction (B in ppm)	ppm	pw(6)/[pw(6)-C]*(C*msol/mext-B*msol/mext)	(ICEQ/10.712-TIME*DRIFT)/(m*d)

Result proposals for Entry type = Pieces or Fixed pieces

Result	Unit	Formula R =	Constant
External dissolution (B in %)	%	C*[(msol+mext)/mext]-B*msol/mext	(ICEQ/10.712–TIME*DRIFT)/(10000*(m*wp))
External dissolution (B in ppm)	ppm	C*[(msol+mext)/mext]-B*msol/mext	(ICEQ/10.712–TIME*DRIFT)/(m*wp)
External extraction (B in %)	%	100/(100-C)*(C*msol/mext-B*msol/mext)	(ICEQ/10.712-TIME*DRIFT)/(10000*(m*wp))
External extraction (B in ppm)	ppm	pw(6)/[pw(6)-C]*(C*msol/mext-B*msol/mext)	(ICEQ/10.712-TIME*DRIFT)/(m*wp)

15.2.4.3 IM KF C. method type

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample KF** method function.

Result	Unit	Formula R=	Constant C=
Coulometric consumption	mC	ICEQ	1
Mean consumption	µg/min	(ICEQ/10.712)/TIME	1

Result	Unit	Formula R=	Constant C=
Titration duration	min	TIME	1
Total water content	µg	CW	1
InMotion KF blank value	µg	(ICEQ/10.712-TIME*DRIFT)/C	1

The result proposals for the calculation of the content depend on the setting of the **Entry type** parameter in the **Sample (KF)** method function.

Result proposals for Entry type = Weight or Fixed weight

Result	Unit	Formula R=	Constant C=
Content blank value compensated (B in µg)	mg	(ICEQ/10.712–TIME*DRIFT-B[Blank IMKF Coul])/C	1000
	µg		1
	%	(ICEQ/10.712–TIME*DRIFT-B[Blank IMKF Coul])/(C*m)	10000
	ppm		1
	mg/g		1000
	g/kg		1000
	µg/mL	(ICEQ/10.712–TIME*DRIFT-B[Blank IMKF Coul])/(C*(m/d))	1
	mg/mL		1000
	µg/L		0.001
	g/mL		1000000

Result proposals for Entry type = Volume or Fixed volume

Result	Unit	Formula R=	Constant C=
Content blank value compensated (B in µg)	mg	(ICEQ/10.712–TIME*DRIFT-B[Blank IMKF Coul])/C	1000
	µg		1
	%	(ICEQ/10.712–TIME*DRIFT-B[Blank IMKF Coul])/(C*(m*d))	10000
	ppm		1
	mg/g		1000
	g/kg		1000
	µg/mL	(ICEQ/10.712–TIME*DRIFT-B[Blank IMKF Coul])/(C*m)	1
	mg/mL		1000
	µg/L		0.001
	g/mL		1000000

Result proposals for Entry type = Pieces or Fixed pieces

Result	Unit	Formula R=	Constant C=
Content blank value compensated (B in µg)	mg	(ICEQ/10.712–TIME*DRIFT-B[Blank IMKF Coul])/C	1000
	µg		1
	%	(ICEQ/10.712–TIME*DRIFT-B[Blank IMKF Coul])/(C*(m*wp))	10000
	ppm		1
	mg/g		1000
	g/kg		1000
	µg/pc	(ICEQ/10.712–TIME*DRIFT-B[Blank IMKF Coul])/(C*m)	1000

15.2.4.4 Scan KF C. method type

Result	Unit	Formula R=	Constant C=
Sample size	gl mL pcs	m	1
Titration duration	min	TIME	1

15.2.4.5 Stromb. C. method type

The result proposals in the following table are independent of the **Entry type** parameter in the **Sample KF** method function.

Result	Unit	Formula R=	Constant C=
Coulometric consumption	mC	ICEQ	1
Mean consumption	µg/min	(ICEQ/10.712)/TIME	1
Titration duration	min	TIME	1
Total water content	µg	CW	1
Stromboli blank value	µg	(ICEQ/10.712-TIME*DRIFT)/C	1

The result proposals for the calculation of the content depend on the setting of the **Entry type** parameter in the **Sample (KF)** method function.

Result proposals for Entry type = Weight or Fixed weight

Result	Unit	Formula R=	Constant C=
Content blank value compensated (B in µg)	mg	(ICEQ/10.712–TIME*DRIFT-B[Blank Stromboli])/C	1000
	µg		1
	%	(ICEQ/10.712–TIME*DRIFT-B[Blank Stromboli])/(C*m)	10000
	ppm		1
	mg/g		1000
	g/kg		1000
	µg/mL	(ICEQ/10.712–TIME*DRIFT-B[Blank Stromboli])/(C*(m/d))	1
	mg/mL		1000
	µg/L		0.001
	g/mL		1000000

Result proposals for Entry type = Volume or Fixed volume

Result	Unit	Formula R=	Constant C=
Content blank value compensated (B in µg)	mg	(ICEQ/10.712–TIME*DRIFT-B[Blank Stromboli])/C	1000
	µg		1
	%	(ICEQ/10.712–TIME*DRIFT-B[Blank Stromboli])/(C*(m*d))	10000
	ppm		1
	mg/g		1000
	g/kg		1000
	µg/mL	(ICEQ/10.712–TIME*DRIFT-B[Blank Stromboli])/(C*m)	1
	mg/mL		1000
	µg/L		0.001
	g/mL		1000000

Result proposals for Entry type = Pieces or Fixed pieces

Result	Unit	Formula R=	Constant C=
Content blank value compensated (B in µg)	mg	(ICEQ/10.712–TIME*DRIFT-B[Blank Stromboli])/C	1000
	µg		1
	%	(ICEQ/10.712–TIME*DRIFT-B[Blank Stromboli])/(C*(m*wp))	10000
	ppm		1
	mg/g		1000
	g/kg		1000
	µg/pc	(ICEQ/10.712–TIME*DRIFT-B[Blank Stromboli])/(C*m)	1000

15.2.4.6 Internal calculations

Blank determination

Result proposals for Entry type = Weight or Fixed weight

Result	Unit	Formula R=	Constant C=
Blank	%	(ICEQ/10.712-TIME*DRIFT)/(C*m)	10000
	ppm		1

Result proposals for Entry type = Volume or Fixed volume

Result	Unit	Formula R=	Constant C=
Blank	%	(ICEQ/10.712-TIME*DRIFT)/(C*(m*d))	10000
	ppm		1

Miscellaneous internal calculations

Result	Unit	Formula R=	Constant C=
CW	µg	CW=ICEQ/10.712	1

15.2.5 Bromine index (BI)

The result proposals depend on the setting of the **Entry type** parameter in the **Sample** method function.

Result proposals for Entry type = Weight or Fixed weight

Result	Unit	Formula R=	Constant C=
Blank	mC	ICEQ	1
	mg	0.000828147*ICEQ	1
Bromine index	mg/100g	ICEQ*C/m	0.0828147
Bromine index (B in mC)	mg/100 g	(ICEQ-B[Bromine index])*C/m	0.0828147
Bromine index (B in mg)	mg/100 g	(0.000828147*ICEQ-B[Bromine index])*C/m	100

Result proposals for Entry type = Volume or Fixed volume

Result	Unit	Formula R=	Constant C=
Blank	mC	ICEQ	1
	mg	0.000828147*ICEQ	1
Bromine index	mg/100g	ICEQ*C/(m*d)	0.0828147
Bromine index (B in mC)	mg/100 g	(ICEQ-B[Bromine index])*C/(m*d)	0.0828147
Bromine index (B in mg)	mg/100 g	(0.000828147*ICEQ-B[Bromine index])*C/(m*d)	100

Result proposals for Entry type = Pieces or Fixed pieces

Result	Unit	Formula R=	Constant C=
Blank	mC	ICEQ	1
	mg	0.000828147*ICEQ	1
Bromine index	mg/100g	ICEQ*C/(m*wp)	0.0828147
Bromine index (B in mC)	mg/100 g	(ICEQ-B[Bromine index])*C/(m*wp)	0.0828147
Bromine index (B in mg)	mg/100 g	(0.000828147*ICEQ-B[Bromine index])*C/(m*wp)	100

15.3 Constants within a Content Calculation

The tables below provide an overview of how to select the constant C in content determinations, depending on the unit of the desired results and the data entered.

Desired indication of the result: content per gram of the sample **Input of the sample in [g]: R = QEQ*C/m** **Input of the sample in [mL]: R = QEQ*C/(m*d)** **Input of the sample in [St.]: R = QEQ*C/(m*wp)**		**Desired indication of the result: Content per milliliter of the sample** **Input of the sample in [mL]: R = QEQ*C/m** **Input of the sample in [g]: R = QEQ*C/(m/d)**		**Desired indication of the result: Content per item of the sample** **Input of the sample in [St.]: R = QEQ*C/m**	
Constant	**Unit**	**Constant**	**Unit**	**Constant**	**Unit**
C = 1/z	[mmol/g], [mol/kg]	C = 1/z	[mmol/mL], [mol/L]	C = 1/z	[mmol/pc.]
C = M/z	[mg/g], [g/kg]	C = M/z	[mg/mL], [g/L]	C = M/z	[mg/pc.]
C = 1	[meq/g], [eq/kg]	C = 1	[meq/mL], [eq/L]	C = 1	[meq/pc.]
C = 1000/z	[mmol/kg], [µmol/g]	C = 1000/z	[mmol/L], [µmol/mL]	C = 1000/z	[µmol/pc.]
C = 1000	[meq/kg], [µeq/g]	C = 1000	[meq/L], [µeq/mL]	C = 1000	[µeq/pc.]
C = M*1000/z	[ppm], [mg/kg], [µg/g]	C = M*1000/z	[mg/L], [µg/mL]	C = M*1000/z	[µg/pc.]
C = M	--	C = M	--	C = M	--
C = M*1000	--	C = M*1000	--	C = M*1000	--
C = M/(10*z)	[%] (w/w)	C = M/(10*z)	[g/100mL], [%] (w/v)	C = M/(10*z)	--
C = 56.1	[mgKOH/g] (TAN, TBN)	C = 56.1	--	C = 56.1	--

Calculation formulas for the titer determination

Standard type: fixed (input type = weight)

R = m/(VEQ*c*C) C = M/(10*p*z)

Standard type: liquid (entry type = volume)

R = m/(VEQ*c*C) C = 1/(cst*z)

Standard type: liquid (input type = weight)

R = m/(VEQ*c*C)
C = d/(cst*z)

The data shown above applies similarly for more complex content determinations as well:

Back titration content: R = (QENDDi-Q)*C/m

Content with blank: R = (QEQ-B[Name])*C/m

Stating content: R = QENDSt*C/m

15.4 Mathematical functions and operators

The following mathematical functions and operators can be used in formulas:

Functions	
Logarithm to the base 10	lg(x)
Logarithm to the base e	ln(x)
Exponential to base 10	pw(x) or scientific notation
Exponential to base e	ex(x)
Square	sq(x)
Square root	sr(x)

Comparison operators	
equal to	=
larger than	>
larger than or equal to	> =
smaller than	<
smaller than or equal to	<=
x in the range of	… < x < …
not equal to	< >
approximately	~

Mathematical operators	
Addition	+
Subtraction	-
Multiplication	*
Division	/

Logical operators	
and	AND
or	OR

Logical operators are only permitted within the formulas of "Condition" subfunctions (or parameters).

15.5 Naming Conventions for Using Analysis Data in Calculations

In calculations (**Calculation** method function), you can access analysis data (raw results, results, resource data, and sample data) using symbols or generate further results. The following chapters contain tables with the analysis data that is available for the different types of titrations.

The analysis data is represented by symbols. The symbols consist of basic symbols and symbol extensions. The basic symbols define the type of data (volume, substance quantity) and the corresponding unit. The symbol extensions specify the data more precisely. The symbol extensions are listed in the table below.

Note that the entry of symbols in formulas is case-sensitive.

Extension	Explanation
Cal	**Calibration** method function
Cc	**Conditioning (controlled)** method function
CON(x)	x percent of the titrant converted
Di	**Dispense (normal)** method function and **Dispense (controlled)** method function
E(x)	Potential x
END	End of a method function
EQ	Equivalence point
EX	Excess
ext	Extraction
HNV	Half neutralization value
Me	**Measure (normal)** method function and **Measure (MVT)** method function
Mean	Mean value
s	Sample
sol	Solvent
St	**Stating** method function
Std	**Standard Addition** method function
t(x)	Time x.
t(x,y)	Interval between the times x an y.

Extension	Explanation
Ti	Titration method function • **Titration (EP)** • **Titration (EQP)** • **Titration (2-phase)** • **Titration (LearnEQP)** • **Titration (Therm.)** • **Titration (KF Vol)** • **Scan (KF Vol)** • **Titration (KF Coul)** • **Scan (KF Coul)** • **Titration (EP Coul)**
USE	Use of the symbol in the **Calculation** method function.

15.5.1 General titrations

The tables below show the symbols that you can use in the following titration types:

- EP titration
- EQP titration
- 2-phase titration
- LearnEQP titration
- Thermometric titration
- Measure
- Titer
- Calibration
- Stating

All the symbols listed in the tables below can be used in calculations within a loop.

Sample data and series data

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
d	[g/mL]	--	--	--	**d**	The density of a sample or a standard.
f	--	--	--	--	**f**	A correction factor as defined in the sample method function.
m	[mL] [g] [pcs]	--	--	--	**m**	The sample size.
n	--	--	--	--	**n**	The sample number.
					nTOT	Total number of samples in the loop.
sf	--	--	--	--	**sf**	An additional sample factor as defined in the sample method function.
T	[°C], [K], [°F]	s	--	--	**Ts**	The temperature of the sample, standard or buffer solutions as defined in the sample method function.
wp	[g/pcs]	--	--	--	**wp**	The weight per item.

Resource data

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
B	[µg] [mmol]	--	--	--	**B[Name]**	A blank.
c	[mol/L]	--	--	--	**c**	Specifies the nominal concentration of a titrant used for a titration method function.
			St		**cSt**	Specifies the nominal concentration of a titrant used for a Stating method function.
			Di		**cDi**	Specifies the nominal concentration of a titrant used for a Dispense (normal) method function or a Dispense (controlled).

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
CELLC	[1/cm]	--	--	--	**CELLC**	Specifies the cell constant of a conductivity sensor used for a titration method function.
			Me		**CELLCMe**	Specifies the cell constant of a conductivity sensor used for Measure (normal) method function or a Measure (MVT) method function.
cst	[mol/L]	--	--	--	**cst**	The concentration of a liquid titer standard.
d	[g/mL]	--	--	--	**d**	The density of a sample or a standard.
H	--	--	--	--	**H[Name]**	An auxiliary value.
M	[g/mol]	--	--	--	**M**	The molar weight of a substance. As defined in the setup.
p	[%]	--	--	--	**p**	The purity of a solid titer standard.
SLOPE	Depends on the sensor	--	--		**SLOPE**	Specifies the slope of a pH or ISE sensor or a Phototrode for a titration method function.
			St		**SLOPESt**	Specifies the slope of a pH sensor for a Stating method function.
			Di		**SLOPEDi**	Specifies the slope of a pH sensor for a Dispense (controlled) method function .
			Me		**SLOPEMe**	Specifies the slope of a pH or ISE sensor or a Phototrode for a Measure (normal) method function or a Measure (MVT).
TITER	--	--	--	--	**TITER**	The titer value for a titrant used in a titration method function.
			St		**TITERSt**	The titer value for a titrant used in a Stating method function.
			Di		**TITERDi**	The titer value for a titrant used in a Dispense (normal) method function or a Dispense (controlled) method function.
z	--	--	--	--	**z**	The equivalent number of a substance. As defined in the setup.
ZERO	Depends on the sensor	--	--	--	**ZERO**	Specifies the zero point of a pH, ISE or temperature sensor or a Phototrode for a titration method function.
			St		**ZEROSt**	Specifies the zero point of a pH sensor for a Stating method function.
			Di		**ZERODi**	Specifies the zero point of a pH sensor for a Dispense (controlled) method function .
			Me		**ZEROMe**	Specifies the zero point of a pH, ISE or temperature sensor or a Phototrode for a Measure (normal) method function or a Measure (MVT) method function.

Raw results

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
AuxInst	--	--	--	--	**AuxInst**	Result of the Auxiliary instrument method function from the sequence of the external auxiliary instrument.
BETAHNV	[mmol/L*pH]	--	--	--	**BETAHNV**	Specifies the buffer capacity with half of the titrant volume used up to the equivalence point for a titration method function. Not possible forTitration (EP)andTitration (Therm.)
C	--	--	--	--	**C**	A constant that uniquely belongs to the result Rx. It cannot be used in this form for the calculations of other results.
CON	[%]	--	--	t(x)	**CONt(x)**	Specifies the reaction conversion at the time x in percent. Relative to 100% reaction conversion at the end of a Stating method function.
			Ti		**CONTit(x)**	Reaction conversion at the time x in percent for a titration method function with accompanying stating.

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
CORR	--	--	--	t(x,y)	**CORRt(x,y)**	CVt(x,y) and CQt(x,y) are determined using the linear regression of the measured values between x and y. CORR is the coefficient of correlation of this linear regression (volume versus time) and provides a standard for its quality.
CQ	[mmol/min]	--	--	t(x,y)	**CQt(x,y)**	Defines the mean consumption (substance quantity) per minute between the time points x and y during a Stating method function.
			Ti		**CQTit(x,y)**	Average consumption (substance quantity) per minute between the times x and y for titration method function with accompanying stating
CV	[mL/min]	--	--	t(x,y)	**CVt(x,y)**	Defines the mean consumption (volume) after pretitration per minute between the time points x and y during a Stating method function.
			Ti		**CVTit(x,y)**	Average consumption (volume) per minute between the times x and y for titration method function with accompanying stating
E	Depends on the sensor (No temperature sensor)	EQ	--	--	**EEQ**	The potential at the end point or equivalence point of a titration method function.
		HNV			**EHNV**	The potential at VEQ/2 of a titration method function. Not possible for Titration (EP)
		--			**E**	The measured potential of a method function Measure (normal). Without temperature or thermometric sensor.
EPD	Depends on the sensor	--	--	--	**EPD**	The measured potential after the waiting period for predispensing during a titration method function. Not possible for Titration (Therm.).
			St		**EPDSt**	The measured potential after the waiting period for predispensing during a Stating method function.
EPT	Depends on the sensor (No temperature sensor)	--	St	--	**EPTSt**	The measured potential after pretitration (before the waiting period) during a Stating method function.
EST	Depends on the sensor	--	--	--	**EST**	The measured potential at the start of a titration method function.
			St		**ESTSt**	The measured potential at the start of a Stating method function.
			Di		**ESTDi**	The measured potential at the start of a Dispense (controlled) method function.
			Me		**ESTMe**	The measured potential at the start of a Measure (normal) method function or a Measure (MVT) method function. Without temperature or thermometric sensor.
n	--	EQ	--	--	**nEQ**	The number of equivalent points for one of the following titration functions: • Titration (EQP) • Titration (LearnEQP) Titration (2-phase)

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
Q	[mmol]	EQ	--	--	**QEQ (=Q)**	Substance quantity used up to the end point or equivalence point of a titration method function.
		EX			**QEX**	Excess substance quantity titrated in after reaching the end point or equivalence point of a titration method function.
		END	--		**QEND**	The total substance quantity used up to the end of a titration method function.
			St		**QENDSt**	The total substance quantity used during a Stating method function.
			Di		**QENDDi**	The total substance quantity used during a Dispense (normal) or Dispense (controlled) method function.
		--	--	E(x)	**QE(x)**	The substance quantity used until the potential x is reached during a titration method function.
		--	--	t(x)	**Qt(x)**	The substance quantity used until the time x is reached during a titration method function.
			St		**QStt(x)**	The substance quantity used until the time x is reached during a Stating method function.
			Di		**QDit(x)**	The substance quantity used until the time x is reached during a Dispense (normal) method function or a Dispense (controlled) method function.
QTP	[mmol]	--	St	--	**QPTSt**	Substance quantity of titrant used for the pretitration.
SLOPE	Depends on the sensor	Cal	--	--	**SLOPECal**	Reports the slope of a sensor after a Calibration method function.
		--	--	E(x)	**SLOPEE(x)**	Specifies the slope of a pH or ISE sensor or a Phototrode at a potential of x for a titration method function.
			St		**SLOPEStE(x)**	Specifies the slope of a pH sensor at a potential of x for a Stating method function.
			Di		**SLOPEDiE(x)**	Specifies the slope of a pH sensor at a potential of x for a Dispense (controlled) method function .
			Me		**SLOPEMeE(x)**	Specifies the slope of a pH or ISE sensor or a Phototrode at a potential of x of a Measure (normal) method function or a Measure (MVT) method function.
		Mean	--		**SLOPEMean**	Specifies the mean slope of a pH or ISE sensor or a Phototrode for a titration method function.
			St		**SLOPEMeanSt**	Specifies the mean slope of a pH sensor for a Stating method function.
			Di		**SLOPEMeanDi**	Specifies the mean slope of a pH sensor for a Dispense (controlled) method function .
			Me		**SLOPEMeanMe**	Specifies the mean slope of a pH or ISE sensor or a Phototrode of a Measure (normal) method function or a Measure (MVT) method function.
T	[°C], [K], [°F]	--	--	--	**T**	The measured temperature in a Measure (normal) method function (direct measurement with temperature sensor or concomitant temperature acquisition).

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
t	[min]	--	--	--	**t**	Duration of a titration method function.
			St		**tSt**	Duration of a Stating method function.
			Di		**tDi**	Duration of a Dispense (normal) method function or a Dispense (controlled) method function.
			Me		**tMe**	Duration of a Measure (normal) method function or a Measure (MVT) method function.
		USE	--		**tUSE**	Duration of an analysis of a sample from the start of the loop to the usage of the symbol in the Calculation method function. The symbol cannot be used for conditions.
		--	--	CON(x)	**tCON(x)**	Duration of a Stating method function until x % of the titrant used for stating is converted. (Relative to 100% reaction conversion at the end of a Stating method function.)
			Ti		**tTiCON(x)**	Duration of a titration method function until x% of the titrant used for titration are converted. (Relative to 100% reaction conversion at the end of a titration method function.)
V	[mL]	EQ	--	--	**VEQ (=V)**	Titrant consumption up to the end point or equivalence point of a titration method function. For multiple equivalence points, the consumption is calculated from the previous equivalence point.
		EX			**VEX**	The excess of titrant added after reaching the end point or equivalence point of a titration method function.
		END	--		**VEND**	Titrant volume used up to the end of a titration method function.
			St		**VENDSt**	The total titrant volume used during a Stating method function, including the preti-tration.
			Di		**VENDDi**	The total titrant volume used during a Dispense (normal) method function or a Dispense (controlled) method function.
		--	--	E(x)	**VE(x)**	The titrant volume used until the potential x is reached during a titration method function.
		--	--	t(x)	**Vt(x)**	The titrant volume used until the time x is reached during a titration method function.
			St		**VStt(x)**	The titrant volume used until the time x is reached during a Stating method function.
			Di		**VDit(x)**	The titrant volume used until the time x is reached during a Dispense (normal) method function or a Dispense (controlled) method function.
VPT	[mL]	--	St	--	**VPTSt**	Volume of titrant used for the pretitration.

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
ZERO	Depends on the sensor	Cal	--	--	**ZEROCal**	Reports the zero point of a sensor after a Calibration method function .
		--	--	E(x)	**ZEROE(x)**	Specifies the zero point of a pH, ISE or temperature sensor or a Phototrode at a potential of x for a titration method function.
			St		**ZEROStE(x)**	Specifies the zero point of a pH sensor at a potential of x for a Stating method function.
			Di		**ZERODiE(x)**	Specifies the zero point of a pH sensor at a potential of x for a Dispense (controlled) method function .
			Me		**ZEROMeE(x)**	Specifies the zero point of a pH, ISE or temperature sensor or a Phototrode at a potential of x for a Measure (normal) method function or a Measure (MVT) method function.
		Mean	--	--	**ZEROMean**	Specifies the mean zero point of a pH or ISE sensor for a titration method function.
			St		**ZEROMeanSt**	Specifies the mean zero point of a pH sensor for a Stating method function.
			Di		**ZEROMeanDi**	Specifies the mean zero point of a pH sensor for a Dispense (controlled) method function .
			Me		**ZEROMeanMe**	Specifies the mean zero point of a pH or ISE sensor for a measurement Measure (MVT) method function.

Results

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
Mean	Unit of Rx	Rx	--	--	**Mean[Rx]**	The mean value of a result Rx.
		yRx			**Meany[Rx]**	The mean value of a result Rx over y samples
Rx	Arbitrary	--	--	--	**Rx**	A result x.
Rx[yy]	Arbitrary	--	--	--	**Rx[yy]**	Uses the value in the Result Buffer list for the corresponding sample for Result x from the method with ID yy.
s	Unit of Rx	Rx	--	--	**s[Rx]**	The standard deviation of a result Rx
		yRx			**sy[Rx]**	The standard deviation of a result Rx over y samples
srel	[%]	Rx	--	--	**srel[Rx]**	The relative standard deviation of the result Rx.
		yRx			**srely[Rx]**	The relative standard deviation of a result Rx over y samples

Symbols outside of loops

The following symbols can be used in calculations outside loops:

M	z	B[Name]	H[Name]
C	Titer	SLOPE	ZERO
CELLC	SLOPEE(x)	ZEROE(x)	SLOPEMean
ZEROMean	Mean[Rx]	s[Rx]	srel[Rx]
SLOPECal	ZEROCal		
VENDDi, QENDDi and tDi (within a method function **Dispense** outside a loop)			

Results (symbol "R") that are generated outside loops can also be used in calculations outside loops.

15.5.2 Standard addition

Sample data

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
d	[g/mL]	--	--	--	**d**	The density of a sample or a standard.
f	--	--	--	--	**f**	A correction factor as defined in the sample method function.

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
n	--	--	--	--	**n**	The sample number.
					nTOT	Total number of samples in the loop.
m	[mL] [g] [pcs]	--	--	--	**m**	The sample size.
sf	--	--	--	--	**sf**	An additional sample factor as defined in the sample method function.
T	[°C], [K], [°F]	s	--	--	**Ts**	The temperature of the sample, standard or buffer solutions as defined in the sample method function.
VALIQUOT	[mL]	--	--	--	**VALIQUOT**	Aliquot volume
VDILUTION	[mL]	--	--	--	**VDILUTION**	Dilution volume
VISA	[mL]	--	--	--	**VISA**	ISA volume
VTOT	[mL]	--	--	--	**VTOT**	Aqueous partition of the analyze mixture (i.e. only water soluble fraction are counted)
VWATER	[mL]	--	--	--	**VWATER**	Water volume
wp	[g/pcs]	--	--	--	**wp**	The weight per item.

Resource data

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
B	[µg] [mmol]	--	--	--	**B[Name]**	A blank.
c	mol/L, mg/L	--	Std	--	**cStd**	Nominal titrant concentration for a Standard Addition method function
d	[g/mL]	--	--	--	**d**	The density of a sample or a standard.
H	--	--	--	--	**H[Name]**	An auxiliary value.
M	[g/mol]	--	--	--	**M**	The molar weight of a substance. As defined in the setup.
SLOPE	Depends on the sensor	--	Std	--	**SLOPEStd**	Slope of a pH/ISE/Phototrode sensor for Standard Addition method function
			Cc		**SLOPECc**	Slope of a pH/ISE/Phototrode sensor for Conditioning (controlled) method function
TITER	--	--	Std	--	**TITERStd**	The titer value for a titrant used in a Standard Addition method function.
z	--	--	--	--	**z**	The equivalent number of a substance. As defined in the setup.
ZERO	Depends on the sensor	--	Std	--	**ZEROStd**	Zero point of a pH/ISE/Phototrode/ temperature sensor for a Standard Addition method function.
			Cc		**ZEROCc**	Zero point of a pH/ISE/Phototrode/ temperature sensor for a Conditioning (controlled) method function.

Raw results

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
AuxInst	--	--	--	--	**AuxInst**	Result of the Auxiliary instrument method function from the sequence of the external auxiliary instrument.
C	--	--	--	--	**C**	A constant that uniquely belongs to the result Rx. It cannot be used in this form for the calculations of other results.
cRawStd	mg/L	--	--	--	**cRawStd**	Concentration in the sample
DRIFT	Depends on the sensor	--	Cc	--	**DRIFTCc**	Sensor drift per minute
E	Depends on the sensor	--	Cc	--	**ECc**	Potential measured in a Conditioning (controlled) method function.
EST	mV	--	Std	--	**ESTStd**	Measured potential at the start of the Standard Addition method function
Intercept-StdAdd	mV	--	--	--	**InterceptStdAdd**	Intersection of the standard addition linear regression with the y-axis
$\mathbf{R^2}$	--	--	--	--	$\mathbf{R^2}$	Coefficient of the linear regression

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
SLOPE	Depends on the sensor	--	Std	E(x)	**SLOPEStdE(x)**	Specifies the slope of a pH or ISE sensor or a Phototrode at a potential of x for a Standard Addition method function.
			Cc		**SLOPECcE(x)**	Specifies the slope of a pH or ISE sensor or a Phototrode at a potential of x for a Conditioning (controlled) method function.
		Mean	Std	--	**SLOPEMeanStd**	Specifies the mean slope of a pH or ISE sensor or a Phototrode for a Standard Addition method function.
			Cc		**SLOPEMeanStd**	Specifies the mean slope of a pH or ISE sensor or a Phototrode for a Conditioning (controlled) method function.
SlopeStdAdd	mV/Log(c)	--	--	--	**SlopeStdAdd**	Standard addition linear regression of measured points
t	min, s	--	Std	--	**tStd**	Duration of a Standard Addition method function
			Cc		**tCc**	Duration of a Conditioning (controlled) method function
			USE		**tUSE**	Duration of an analysis of a sample from the start of the loop to the usage of the symbol in the Calculation method function. The symbol cannot be used for conditions.
VEND	mL	--	--	--	**VENDStd**	The total titrant volume used during a Standard Addition method function.
ZERO	Depends on the sensor	--	Std	E(x)	**ZEROStdE(x)**	Specifies the zero point of a pH, ISE or temperature sensor or a Phototrode at a potential of x for a Standard Addition method function.
			Cc		**ZEROCcE(x)**	Specifies the zero point of a pH, ISE or temperature sensor or a Phototrode at a potential of x for a Conditioning (controlled) method function.
		Mean	Std	--	**ZEROMeanStd**	Specifies the mean zero point of a pH or ISE sensor for a Standard Addition method function.
			Cc		**ZEROMeanStd**	Specifies the mean zero point of a pH or ISE sensor for a Conditioning (controlled) method function.

Results

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
Mean	Unit of Rx	Rx	--	--	**Mean[Rx]**	The mean value of a result Rx.
		yRx			**Meany[Rx]**	The mean value of a result Rx over y samples
Rx	Arbitrary	--	--	--	**Rx**	A result x.
Rx[yy]	Arbitrary	--	--	--	**Rx[yy]**	Uses the value in the Result Buffer list for the corresponding sample for Result x from the method with ID yy.
s	Unit of Rx	Rx	--	--	**s[Rx]**	The standard deviation of a result Rx
		yRx			**sy[Rx]**	The standard deviation of a result Rx over y samples
srel	[%]	Rx	--	--	**srel[Rx]**	The relative standard deviation of the result Rx.
		yRx			**srely[Rx]**	The relative standard deviation of a result Rx over y samples

15.5.3 Volumetric KF titration

Sample data

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
d	[g/mL]	--	--	--	**d**	The density of a sample or a standard.
f	--	--	--	--	**f**	A correction factor as defined in the sample method function.

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
m	[mL] [g] [pcs]	--	--	--	**m**	The sample size.
	[g]	--	--	sol	**msol**	Solvent weight for titrations of type Ext. Extr. (External extraction).
	[g]	--	--	ext	**mext**	Extracted sample quantity for titrations of type Ext. Extr. (External extraction)
n	--	--	--	--	**n**	The sample number.
					nTOT	Total number of samples in the loop.
T	[°C], [K], [°F]	s	--	--	**Ts**	The temperature of the sample, standard or buffer solutions as defined in the sample method function.
wp	[g/pcs]	--	--	--	**wp**	The weight per item.

Resource data

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
B	[µg] [mmol]	--	--	--	**B[Name]**	A blank.
c	[mol/L]	--	--	--	**c**	Specifies the nominal concentration of a titrant used for a titration method function.
CONC	[mg/mL]	--	--	--	**CONC**	Represents the actual titrant concentration.
CONT	[mg/g] [mg/mL] [mg/pc] [%] [ppm]	--	--	--	**CONT**	The concentration of a liquid KF standard.
d	[g/mL]	--	--	--	**d**	The density of a sample or a standard.
H	--	--	--	--	**H[Name]**	An auxiliary value.
M	[g/mol]	--	--	--	**M**	The molar weight of a substance. As defined in the setup.
z	--	--	--	--	**z**	The equivalent number of a substance. As defined in the setup.

Raw results

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
C	--	--	--	--	**C**	A constant that uniquely belongs to the result Rx. It cannot be used in this form for the calculations of other results.
CONC	[mg/mL]	--	--	--	**CONC**	Represents the actual titrant concentration.
CW	[µg]	--	--	--	**CW**	Volume of water titrated up to the end point (without drift or blank value correction).
DRIFT	[µg(H_2O)/min]	--	--	--	**DRIFT**	Consumption (mass) per minute for the titration method function (water quantity per time unit that penetrates the titration stand).
DRIFTV	[µL/min]	--	--	--	**DRIFTV**	Volume of titrant consumption per minute for the drift determination.
E	[mV]	EQ	--	--	**EEQ**	Potential at the end point of the titration method function.
EST	[mV]	--	--	--	**EST**	Measured potential at the start of the titration method function.
t	[min:s]	--	--	--	**t**	Duration of a sample analysis.
		USE			**tUSE**	Duration of an analysis of a sample from the start of the loop to the usage of the symbol in the Calculation method function. The symbol cannot be used for conditions.
T	[°C], [°F], [K]	EQ	--	--	**TEQ**	Temperature at the equivalence point of a Titration (KF Vol) method function.
TIME	[min:s]	--	--	--	**TIME**	Duration of a sample analysis from the end of Standby mode to the end of the titration method function or a scan method function (incl. waiting for sample addition)
V	[mL]	EQ	--	--	**VEQ (=V)**	Titrant consumed up to the end point of the titration method function.

Results

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
Mean	Unit of Rx	Rx	--	--	**Mean[Rx]**	The mean value of a result Rx.
		yRx			**Meany[Rx]**	The mean value of a result Rx over y samples
Rx	Arbitrary	--	--	--	**Rx**	A result x.
Rx[yy]	Arbitrary	--	--	--	**Rx[yy]**	Uses the value in the Result Buffer list for the corresponding sample for Result x from the method with ID yy.
s	Unit of Rx	Rx	--	--	**s[Rx]**	The standard deviation of a result Rx
		yRx			**sy[Rx]**	The standard deviation of a result Rx over y samples
srel	[%]	Rx	--	--	**srel[Rx]**	The relative standard deviation of the result Rx.
		yRx			**srely[Rx]**	The relative standard deviation of a result Rx over y samples

15.5.4 Coulometric KF titration and bromine index

Sample data

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
d	[g/mL]	--	--	--	**d**	The density of a sample or a standard.
f	--	--	--	--	**f**	A correction factor as defined in the sample method function.
m	[mL] [g] [pcs]	--	--	--	**m**	The sample size.
	[g]	--	--	sol	**msol**	Solvent weight for titrations of type Ext. Extr. (External extraction).
	[g]	--	--	ext	**mext**	Extracted sample quantity for titrations of type Ext. Extr. (External extraction)
n	--	--	--	--	**n**	The sample number.
					nTOT	Total number of samples in the loop.
T	[°C], [K], [°F]	s	--	--	**Ts**	The temperature of the sample, standard or buffer solutions as defined in the sample method function.
wp	[g/pcs]	--	--	--	**wp**	The weight per item.

Resource data

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
B	[µg] [mmol]	--	--	--	**B[Name]**	A blank.
CONT	[mg/g] [mg/mL] [mg/pc] [%] [ppm]	--	--	--	**CONT**	The concentration of a liquid KF standard.
d	[g/mL]	--	--	--	**d**	The density of a sample or a standard.
H	--	--	--	--	**H[Name]**	An auxiliary value.
M	[g/mol]	--	--	--	**M**	The molar weight of a substance. As defined in the setup.
z	--	--	--	--	**z**	The equivalent number of a substance. As defined in the setup.

Raw results

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
C	--	--	--	--	**C**	A constant that uniquely belongs to the result Rx. It cannot be used in this form for the calculations of other results.
CW	[µg]	--	--	--	**CW**	Volume of water titrated up to the end point (without drift or blank value correction).

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
DRIFT	[µg(H_2O)/min]	--	--	--	**DRIFT**	Consumption (mass) per minute for the titration method function (water quantity per time unit that penetrates the titration stand).
E	[mV]	EQ	--	--	**EEQ**	Potential at the end point of the titration method function.
EST	[mV]	--	--	--	**EST**	Measured potential at the start of the titration method function.
IC	[mC]	EQ	--	--	**ICEQ (=CEQ)**	Coulometric consumption to the end point of the titration method function.
t	[min:s]	--	--	--	**t**	Duration of a sample analysis.
		USE			**tUSE**	Duration of an analysis of a sample from the start of the loop to the usage of the symbol in the Calculation method function. The symbol cannot be used for conditions.
TIME	[min:s]	--	--	--	**TIME**	Duration of a sample analysis from the end of Standby mode to the end of the titration method function or a scan method function (incl. waiting for sample addition)

Results

Basic symbol	Unit	Possible symbol extensions			Symbol	Meaning
Mean	Unit of Rx	Rx	--	--	**Mean[Rx]**	The mean value of a result Rx.
		yRx			**Meany[Rx]**	The mean value of a result Rx over y samples
Rx	Arbitrary	--	--	--	**Rx**	A result x.
Rx[yy]	Arbitrary	--	--	--	**Rx[yy]**	Uses the value in the Result Buffer list for the corresponding sample for Result x from the method with ID yy.
s	Unit of Rx	Rx	--	--	**s[Rx]**	The standard deviation of a result Rx
		yRx			**sy[Rx]**	The standard deviation of a result Rx over y samples
srel	[%]	Rx	--	--	**srel[Rx]**	The relative standard deviation of the result Rx.
		yRx			**srely[Rx]**	The relative standard deviation of a result Rx over y samples

16 Transporting the titrator

If you transport the titrator over long distances, use the original packaging.

General titration and volumetric Karl Fischer titration

1. Empty all tubes.
2. Empty the titration vessel.
3. Shut down the titrator.
4. Unplug the titrator.
5. Remove all cable connections.
6. Remove the titration vessel from the titration stand.
7. Remove all tubes.
8. Remove all burettes.
9. Move the titrator to the new location.

Coulometric Karl Fischer titration

1. Empty all tubes.
2. Empty the measuring cell.
3. Shut down the titrator.
4. Unplug the titrator.
5. Remove all cable connections.
6. Remove the measuring cell from the titration stand.
7. Remove all tubes
8. Move the titrator to the new location.

17 Care and maintenance

17.1 Cleaning

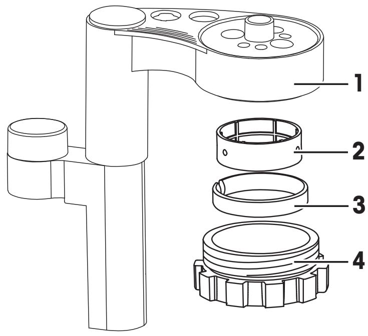
Housing of the titrator

1 Unplug the titrator.
2 Clean the housing of the titrator using a cloth moistened with alcohol.

17.1.1 General titration

Titration stand

1 Loosen the threaded ring (4) and remove it from the titration stand (1).
2 Remove the clamping ring (3) and the spacing ring (2) from the titration stand (1).
3 Clean the parts of the titration stand.
4 Place the clamping ring (3) and the spacing ring (2) in the threaded ring (4).
5 Screw the threaded ring (4) into the titration stand.



17.1.2 Volumetric Karl Fischer titration

Titration stand

1 Dismantle the titration stand.
2 Clean the parts of the titration stand.
3 Reassemble the titration stand.

17.1.3 Coulometric Karl Fischer titration

Titration stand

1 Remove the measuring cell.
2 If installed, remove the park sleeve and clean it.
3 Clean the titration stand.
4 Reinstall measuring cell and park sleeve.

Measuring cell

1 Empty the measuring cell.
2 Remove stopper, measuring electrode and generator electrode.
3 Rinse the measuring cell thoroughly with methanol.
4 If needed, remove remaining depositions with a laboratory washing liquid.
5 Dry the measuring cell with a lint-free cloth.
6 Leave the measuring cell to dry for several hours at 70...80 °C in a drying oven.
7 Lightly grease microsections with the silicone grease supplied.

Generator electrode

1 Empty the generator electrode.
2 Rinse the generator electrode thoroughly with methanol.
3 Dry the generator electrode with a lint-free cloth.
4 Leave the generator electrode to dry for several hours at 70...80 °C in a drying oven.

Dirty diaphragm

1 Place the generator electrode in a suitable solvent (ideally methanol) for several hours.
2 Dry the generator electrode with a lint-free cloth.
3 Leave the generator electrode to dry for several hours at 70...80 °C in a drying oven.

17.2 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 that has been qualified by METTLER TOLEDO.

Do not open the housing of the instrument; it does not contain any parts that can be maintained, repaired or replaced by the user. If you experience problems with your instrument, contact your authorized METTLER TOLEDO dealer or service representative.

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

▶ www.mt.com/contact

17.2.1 General titration and volumetric Karl Fischer titration

NOTICE

Danger of damage to the titrator through leaking burettes!

Substances leaking out of burettes can enter the housing and damage parts of the installed boards.

– Check the burettes for leaks and replace leaking burettes.

Daily

- Remove the burettes from the titrator.
- If you work with corrosive substances, rinse the burettes.
- If you work with corrosive substances, check the burettes for leaks and replace leaking burettes.

Weekly

- If you use the burettes daily, check the burettes for leaks and replace leaking burettes.

Before periods of inactivity

1 Rinse the burettes.
2 Empty all tubes.
3 Empty the titration vessel.
4 Shut down the titrator.
5 Unplug the titrator.
6 Remove the titration vessel from the titration stand.
7 Remove all tubes.
8 Remove all burettes.

17.2.2 Coulometric Karl Fischer titration

Weekly

- Check if the pins of the dual platinum pin electrode are bent. If the pins are bent, gently straighten them.
- Check if the pins of the dual platinum pin electrode are black. If the pins are black, clean them.

Before periods of inactivity

- Unplug the titrator.
- Empty the measuring cell.
- Empty all tubes.
- Remove the measuring cell from the titration stand.

18 Disposal

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 (for private or professional use), the content of this regulation must also be related.

Thank you for your contribution to environmental protection.

19 Technical data

19.1 Titrator

Power rating external power supply	Input values	100...240 V AC, 1.8 A ±10%
	Input frequency	50 - 60 Hz
	Output values	24 V DC, 5 A
Power rating instrument	Input values	24 V DC, 3.2 A
	Connector type	4-pin, power Mini-DIN female
CPU	Processor	Arm Cortex
	SDRAM	512 MB
	Flash memory	1 GB (industrial SD card)
Dimensions	Width	210 mm
	Depth	246 mm
	Height	250 mm
	Weight	4.3 kg (without plug-in cards)
Materials	Titrator housing	Crastin® PBT
	Titration arm	Crastin® PBT
	Spacing ring	Crastin® PBT
	Clamping ring	Crastin® PBT
	Threaded ring	Crastin® PBT
	Chassis	Stainless steel
Ambient conditions	Ambient temperature	+5 °C…+40 °C
	Relative humidity	Max. 80 % (non-condensing) at 31 °C, linear fall to 50 % at 40 °C
	Altitude	2000 m above sea level
	Use	In interior spaces
	Overvoltage category	II
	Pollution degree	2
COM1/COM2	Socket	9-pin male D-sub
	Configuration	Full-duplex
	Baud rate	1200…19200
	Handshake	X-On / X-Off
	Galvanic isolation	No
	EDS stability	Min. 1000 V
	Short-circuit protection	Yes
USB1/USB2	Host	USB full speed
	Max. power load	700 mA max. for each port
USB PC	Host	USB 2.0
Ethernet	Socket	RJ45
	Speed	10/100 MBits/s
TTL-I/O	Socket	D-Sub female, 9-pin
	Inputs	2
	Outputs	4
	Voltage	24 V⎓
	Current	Max. 25 mA
CAN_OUT	Socket	RJ12
	Speed	500 kBit/s

Pump 1/2 **Stirrer 1/2**	Socket	Stacked 6-pin mini-DIN
	Pump detection	Yes
	Stirrer detection	Yes
	Pump voltage range	0...24 V ⎓ ±1 %, 400 mA maximal current for normal operation
	Stirrer voltage range	0...18 V ⎓ ±10 %, 300 mA maximal current for normal operation
Terminal	Socket	19-pin Mettler-HDMI with non-standard pin assignment **Note** Not compatible with other HDMI interfaces like PC or beamer.
Burette drive	Drive	Stepper motor
	Resolution	1/20000 of the burette volume
	Limits of error	0.2% of the respective volume
	Filling time	Minimum 20 sec at 100% filling rate
	Discharge time	Minimum 20 sec
	Burette detection	Yes
	Thread length	50 mm
	Thread pitch	1 mm
	Resolver (magnetic)	32 pulse/360°
	Resolver resolution	0.0625% of burette volume
Interchangeable burettes	Volume	1, 5, 10 and 20 ml
	Drive and burette limits of error	According to ISO 8655-3
	Materials that come into contact with titrants	Fluoroplastic, borsilicate glass, ceramic
Magnetic stirrer (internal)	Drive	DC motor
	Max. speed	1050 rpm
Compact stirrer	Drive	DC motor
	Max. speed	3800 rpm
	Power consumption	6 W

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Power Management

The devices have a power management system which prevents the titrator from switching off unexpectedly in the event of a power overload. Tasks which would cause a power overload, because a number of pumps, stirrers and burette drives are already in use, cannot be started at all. A notification brings the start attempt to the attention of the user. It is advisable, if possible, to connect pumps and stirrers directly to sample changers or other devices which have their own power supply, such as a TBox, instead of to the titrator itself.

19.2 Terminal

Dimensions	Width	194 mm
	Depth	129.5 mm
	Height	56.7 mm
	Weight	638.4 g
Materials	Top housing	EN ZL-ZnAl4Cu1 (EN ZI-0410)
	Lower housing	Crastin SO653
	Cover glas	Gorilla glas

Display	Technology	Color TFT
	Size	7"
	Resolution	WVGA 800 x 480 pixels
	Backlighting	LED backlight
	Brightness control	Per software 50–100%
Input	Technology	Full-coverage capacitive touchscreen
Connections	Cables	1m (standard)
	Connector	19-pin Mettler-HDMI with non-standard pin assignment **Note** Not compatible with other HDMI interfaces like PC or beamer.
	USB	2.0
Angle adjustment	Mechanical	2-stage

19.3 Analog board (pH board)

Sensor 1

pH/mV sensor input	Socket	Triaxial
	Technology	Differential amplifier with reference input
	Input impedance	$>10^{12}$ Ω
	Offset current	<1 pA
	Measuring range	-2000...+2000 mV
	Resolution	0.1 mV
	Limits of error	0.2 mV
pH reference input	Socket	4 mm

Sensor 2

pH/mV sensor input	Socket	Triaxial
	Technology	Differential amplifier
	Input impedance	$>10^{12}$ Ω
	Offset current	<1 pA
	Measuring range	-2000...+2000 mV
	Resolution	0.1 mV
	Limits of error	0.2 mV
Polarized sensor input: Upol	Voltage source: Range	0...2000 mV AC
	Voltage source: Resolution	0.1 mV
	Voltage source: Limits of error	12 mV
	Measuring range	0...200 µA
	Resolution	0.1 µA
	Limits of error	0.2 µA
Polarized sensor input: Ipol	Power source: Current range	0...24 µA AC
	Power source: Resolution	0.1 µA
	Power source: Limits of error	1.2 µA
	Measuring range	0...2000 mV
	Resolution	0.1 mV
	Limits of error	2 mV

Common

Pt1000	Socket	4-pin LEMO
	Sensor	Pt1000
	Measuring range	–20…130 °C
	Resolution	0.1 °C
	Limits of error	0.2 °C
COM	Socket	9-pin male D-sub
	Configuration	Full-duplex
	Baud rate	1200…4800
	Handshake	X-On / X-Off
	Galvanic isolation	No
	ESD stability	Min. 1000 V
	Short-circuit protection	Yes
Pump / Stirrer	Socket	5-pin mini-DIN
	Pump detection	Yes
	Stirrer detection	Yes
	Pump voltage	24 V DC (max. 400 mA)
	Stirrer voltage range	0...18 V DC (max. 300 mA)

19.4 Conductivity board

Input		
CONDUCTIVITY (with integrated temperature input)	Socket	8-pin mini-DIN
	Measuring range	0…1000 mS (7 measuring ranges, automatic measuring range switching)
	Resolution in µS range	0.01 µS
	Resolution in mS range	0.001 mS
	Limits of error	0.5% of the value shown
	Temperature probe	NTC 30k
	Temperature range	–20…130 °C
	Resolution	0.1 °C
	Limits of error	0.2 °C
SENSOR	Socket	Triaxial
	Technology	Differential amplifier
	Input impedance	$>10^{12}$ Ω
	Offset current	<1 pA
	Measuring range	± 2000 mV
	Resolution	0.1 mV
	Limits of error	0.2 mV
Pt1000	Socket	4-pin LEMO
	Sensor	Pt1000
	Measuring range	–20…130 °C
	Resolution	0.1 °C
	Limits of error	0.2 °C

COM	Socket	9-pin male D-sub
	Configuration	Full-duplex
	Baud rate	1200…4800
	Handshake	X-On / X-Off
	Galvanic isolation	No
	ESD stability	Min. 1000 V
	Short-circuit protection	Yes

19.5 Coulometer board

Sensor 1

pH/mV sensor input	Socket	Triaxial, 9 mm
	Max. voltage range	-2000...+2000 mV
	Max. permissible error	0.2 mV
	Resolution	0.1 mV
	Input impedance	10^{12} Ω
	Galvanic seperation	Yes
Reference input	Socket	4 mm

Sensor 2

pH/mV sensor input	Socket	Triaxial, 9 mm
	Max. voltage range	-2000...+2000 mV
	Max. permissible error	0.2 mV
	Resolution	0.1 mV
	Input impedance	10^{12} Ω
	Galvanic seperation	Yes
Polarized sensor input: Upol	Voltage source: Range	0...2000 mV AC
	Voltage source: Resolution	0.1 mV
	Voltage source: Limits of error	12 mV
	Measuring range	0...200 µA
	Resolution	0.1 µA
	Max. permissible error	0.2 µA
	Galvanic separation	Yes
Polarized sensor input: Ipol	Power source: Current range	0...24 µA AC
	Power source: Resolution	0.1 µA
	Power source: Limits of error	1.2 µA
	Measuring range	0...2000 mV
	Resolution	0.1 mV
	Max. permissible error	2 mV
	Galvanic separation	Yes

Generator circuit

Voltage source	Socket	Lemo 5-pin
	Voltage source	+30 V
	Limits of error	±1 % of selected voltage step
	Voltage range	0...30 V
	Voltage resolution	1 mV
Current measurement	Current measuring range	0...450 mA
	Current resolution	18 bit

Current control	Controller mode	Pulsed
	Applied current range Karl Fischer Titration	100, 200, 300, 400 mA (pulsed)
	Applied current range Bromine Index	1, 5 mA (pulsed)

Common

PT1000	Socket	Lemo 4-pin
	Temperature range	-20...+130 °C
	Resolution	0.1 °C
	Max. error	0.2 °C

19.6 Dosing unit

Dimensions	Width	70 mm
	Depth	246 mm
	Height	250 mm
	Weight	2.1 kg
CAN_IN	Socket	RJ12
	Speed	500 kBit/s
Power supply	Via CAN	24 V
Burette drive	Drive	Stepper motor
	Resolution	1/20000 of the burette volume
	Limits of error	0.2% of the respective volume
	Filling time	Minimum 20 sec at 100% filling rate
	Discharge time	Minimum 20 sec
	Burette detection	Yes
	Thread length	50 mm
	Thread pitch	1 mm
	Resolver (magnetic)	32 pulse/360°
	Resolver resolution	0.0625% of burette volume
Interchangeable burettes	Volume	1, 5, 10 and 20 ml
	Drive and burette limits of error	According to ISO 8655-3
	Materials that come into contact with titrants	Fluoroplastic, borsilicate glass, ceramic
Materials	Housing	Crastin® PBT
	Chassis	Stainless steel

19.7 Supported devices (periphery)

Balances

Balances can connect to the COM interface of the titrator. METTLER TOLEDO balances must be equipped with an RS-232 interface or an appropriate adapter. For a list of connection cables, see Optional accessories.

Manufacturer	Type	RS	LocalCAN	Note

METTLER TOLEDO	AB / PB	•	•	COM ports
	AB-S / PB-S	•		COM ports
	AG / PG / PR		•	COM ports
	AT / MT / UMT	•		COM ports
	AX / MX / UMX	•	o	COM ports
	PG-S	•	o	COM ports
	XPE / XP	•	o	COM ports
	XSE / XS	•	o	COM ports
	MS-TS / MLT / MET	•	o	COM ports
	MS / MS-S / ML / ME	•	o	COM ports
Sartorius	Various	•		COM ports

• Standard o Option

Printer

Printers can be connected to the USB1 or USB2 interface of the titrator. Printers from METTLER TOLEDO or PCL-compatible printers from various manufacturers are supported. A current list of supported printers is available on the Internet at:
http://us.mt.com/us/en/home/supportive_content/product_information/titration_printers_1.html

Manufacturer	Type	Note
METTLER TOLEDO	USB-P25	Connection via USB1 or USB2
METTLER TOLEDO	RS-P25	Connection via COM1 or COM2
METTLER TOLEDO	RS-P26	Connection via COM1 or COM2
METTLER TOLEDO	P-56RUE	Connection via USB1 or USB2
METTLER TOLEDO	P-58RUE	Connection via USB1 or USB2
Various	Generic PCL printer	Connection via USB1 or USB2

A standard USB-hub can be used if more than one device is to be connected to the USB port of the titrator.

Sample changer

Manufacturer	Type	Note
METTLER TOLEDO	Rondolino TTL	Connection via TTL-I/O
METTLER TOLEDO	Rondo (as defined in the setup)	Connection via MB/COM1 or MB/COM2
METTLER TOLEDO	InMotion Flex, Pro and Max Autosamplers	Connection via USB1

Barcode reader

Sample data can be read in via an appropriate barcode. The barcode reader can also be used to enter text in open input fields. Barcode readers can be connected to the USB1 port of the titrator.

A standard USB-hub can be used if more than one device is to be connected to the USB port of the titrator.

20 Accessories

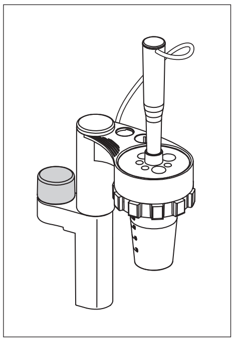
All parts are specified with their ordering code and quantity in cases where more than one part is included. When ordering, some parts are only available in a minimum order quantity. In such cases, the corresponding minimum order quantity is quoted.

The standard equipment and optional accessories for auxiliary equipment, are listed in the Operating Instructions of the auxiliary equipment.

If you have any questions, contact your authorized METTLER TOLEDO (Ref.) dealer.

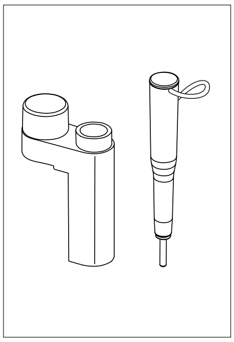
20.1 General titration

20.1.1 Titration kits



The manual titration kit contains: **51109220**

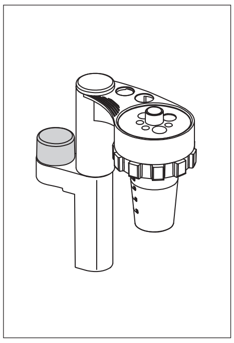
- Manual titration stand, complete
- Compact stirrer
- Propeller stirrer
- Magnetic stirrer bar



Auto titration kit, consisting of: **51109221**

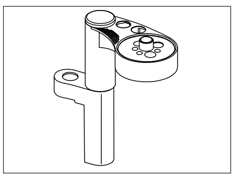
- Electrode holder assembly
- Compact stirrer
- Propeller stirrer

20.1.2 Titration stands

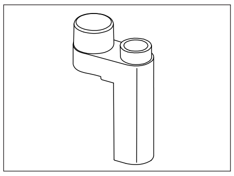
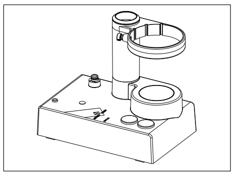
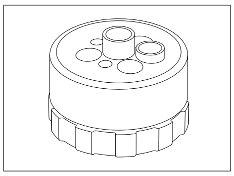
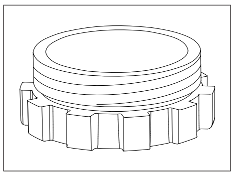
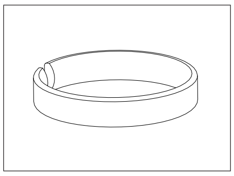
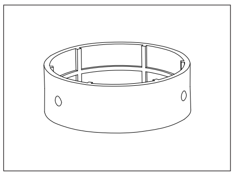
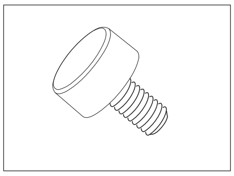
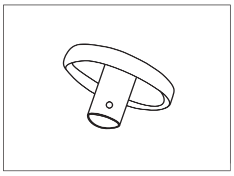
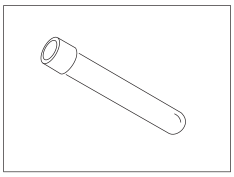


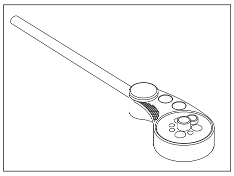
Manual titration stand, complete, set contains: **51109190**

- Titration stand
- Fastening screw
- Spacing ring
- Clamping ring
- Threaded ring
- Titration vessel
- Stopper
- Ground joint adapter
- Electrode sleeve

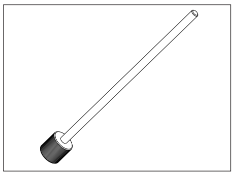


Titration stand without accessories **51109118**

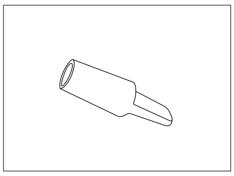
	Electrode holder set, consisting of: • Electrode holder • Fastening screw • Electrode sleeve	**51109195**
	DV704 External titration stand with magnetic stirrer	**51109259**
	Titration head	**51107458**
	Threaded ring	**25652**
	Clamping ring	**25653**
	Spacing ring	**23842**
	Clamping screw	**51109084**
	Cap (for titration stand)	**51107608**
	Electrode sleeve	**25654**



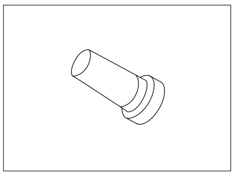
External Titration Stand with rod **51109270**



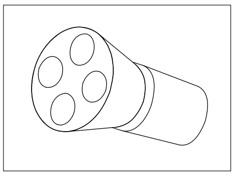
Stand rod **51107495**



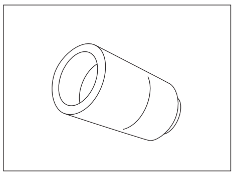
NS 14.5 stopper **23451**



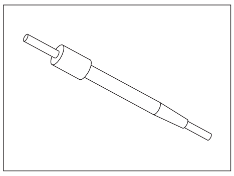
NS 7.5 stopper **23452**



4 in 1 dispensing tube adapter **51108356**

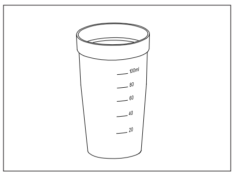


Adapter for dispensing tube **51109169**

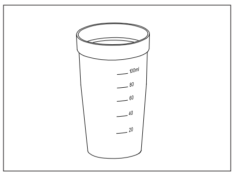


Gas inlet **23721**

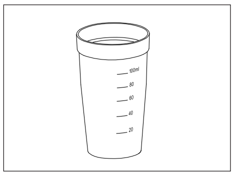
20.1.3 Titration vessels



Beakers PP (120 pcs.)
100 mL, polypropylene, standard **51109388**

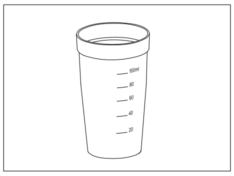


Beakers PP (480 pcs.)
100 mL, polypropylene, standard **51109389**



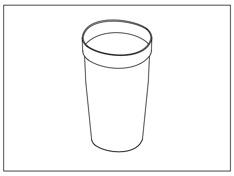
Beakers PP (1400 pcs.)
100 mL, polypropylene, standard

101974



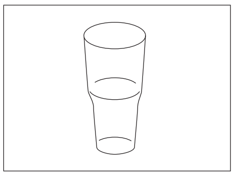
Beakers PP red (1400 pcs.)
100 mL, polypropylene

25777



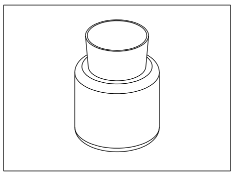
Glass beakers 100 mL
20 pcs.

101446



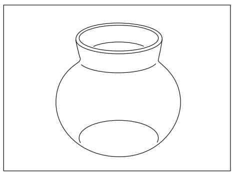
Glass titration vessels, 5 - 20 mL
(set of 20 pcs.)

51108125



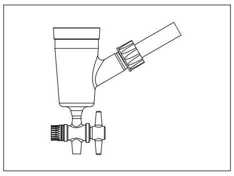
Thermostatable beaker 100 mL
1 pcs

23517



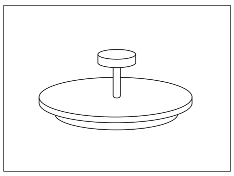
Glass titration vessels, 250 mL
(set of 10 pcs.)

23515



Titration vessel for two-phase titration

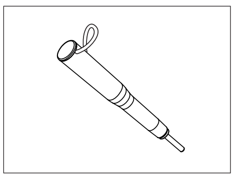
51107655



Plastic cap for titration vessels
(set of 16 pcs.)

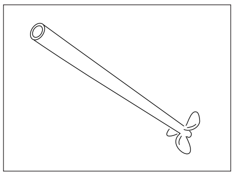
101448

20.1.4 Miscellaneous accessories



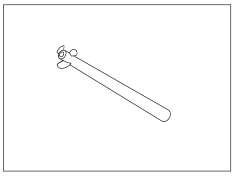
Compact stirrer
incl. 2 propeller stirrers

51109150



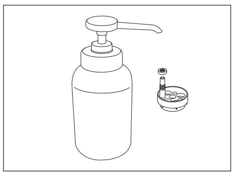
Propeller stirrer
(minimum ordering quantity: 3 pcs.)

101229



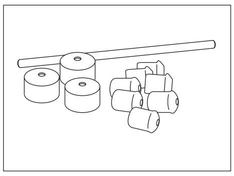
Micro-propeller stirrer

655073



Rinsing unit with titration head insert, stoppers and manual dispenser.

23821

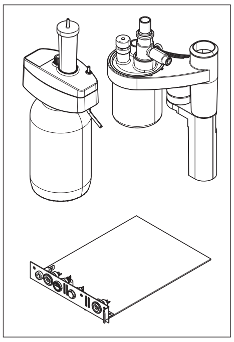


Set of stoppers for rinsing unit

101230

20.2 Coulometric Karl Fischer titration

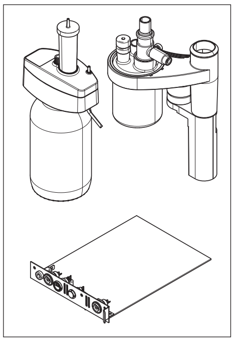
20.2.1 Titration kits



Coulometric Karl Fischer kit with diaphragm consists of:

30267112

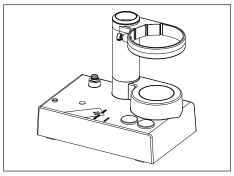
- Coulometer board
- Complete Solvent Manager set
- Complete Karl Fischer titration arm
- Complete titration vessel
- Reagent exchange set
- Clear glass bottle
- Extraction/dispensing tubes
- Connecting cable
- Generator electrode with diaphragm
- DM143-SC Dual platinum pin electrode
- Molecular sieve
- Installation instructions



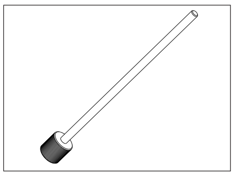
Coulometric Karl Fischer kit without diaphragm consists of: **30267113**

- Coulometer board
- Complete Solvent Manager set
- Complete Karl Fischer titration arm
- Complete titration vessel
- Reagent exchange set
- Clear glass bottle
- Extraction/dispensing tubes
- Connecting cable
- Generator electrode without diaphragm
- DM143-SC Dual platinum pin electrode
- Molecular sieve
- Installation instructions

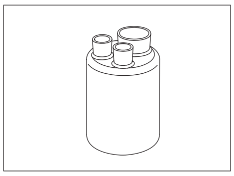
20.2.2 Titration stands



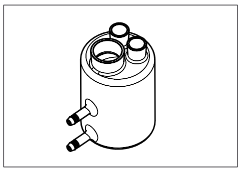
DV704 External titration stand with magnetic stirrer **51109259**



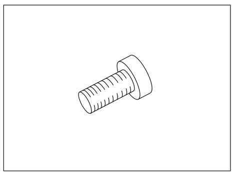
Stand rod **51107495**



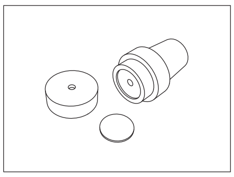
Coulometer measuring cell **51108732**



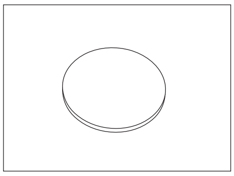
Tempering beaker **51109416**



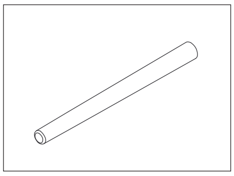
Mounting bolt (for titration beakers / measuring cell) **51108752**



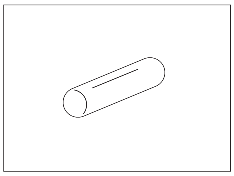
Stopper (PTFE) with septum **51108741**



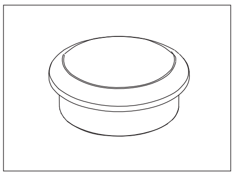
Septum (12 pcs) **51108740**



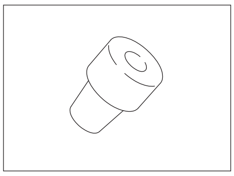
Holder **23960**



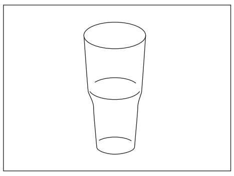
Magnetic stirrer bar **51191159**



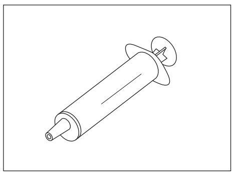
Seal (titration stand drying tube) **51107492**



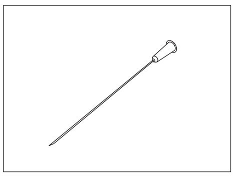
Gas inlet stopper for operation with DO308 **51108761**



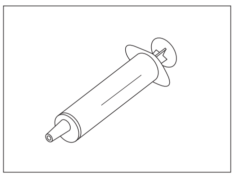
Glass titration vessels, 5 - 20 mL
(set of 20 pcs.) **51108125**



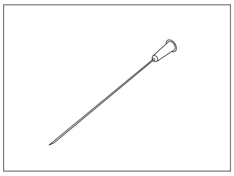
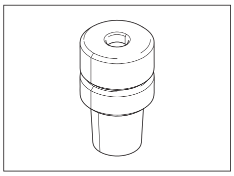
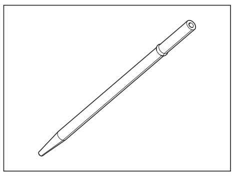
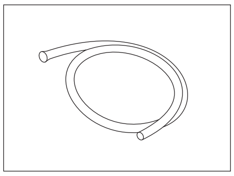
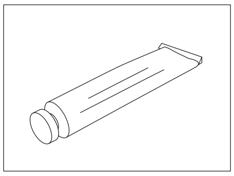
Syringes (100 pcs.)
10 mL **71482**



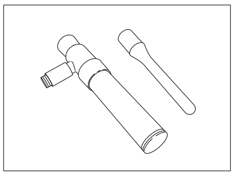
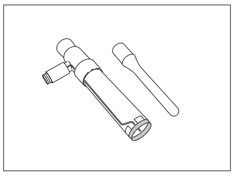
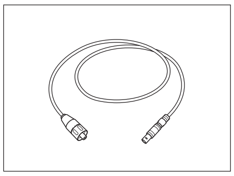
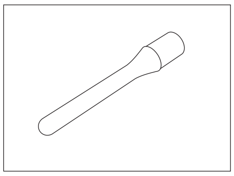
Injection needle (12 pcs)
80 × 1.2 mm **71483**

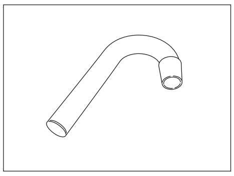


Syringe (120 pcs)
1 mL **30315987**

	Injection needle (100 pcs) 80 × 0.8 mm	**71484**
	Gas inlet adapter for KF titrators	**51108668**
	Gas inlet for Coulometric KF	**51108669**
	Draining tube	**23936**
	Silicone grease	**71300**

20.2.3 Generator electrodes

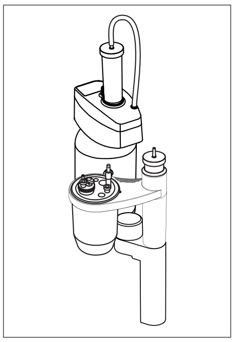
	Generator electrode with diaphragm incorporating a straight drying tube	**51108751**
	Generator electrode without diaphragm incorporating a straight drying tube	**51108753**
	Cable for generator electrode	**51107830**
	Drying tube, straight	**51108733**



Drying tube, bent, for operation with inMotion KF, DO308 or Stromboli **51108639**

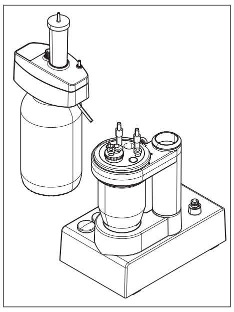
20.3 Volumetric Karl Fischer titration

20.3.1 Titration kits



Volumetric KF kit consists of: **51105605**

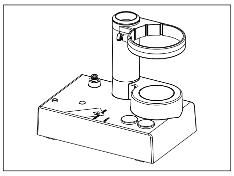
- Complete Solvent Manager set
- Complete Karl Fischer titration arm
- Complete titration vessel
- Clear glass bottle
- Extraction/dispensing tubes
- Connecting cable
- DM143-SC Double platinum pin electrode



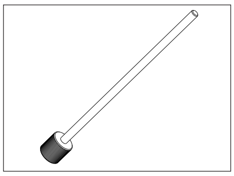
DV704 KF Vol kit **30378857**

- DV704 External titration stand with magnetic stirrer
- Complete titration vessel
- Complete Solvent Manager set
- Clear glass bottle
- Extraction/dispensing tubes
- Connecting cable
- DM143-SC Double platinum pin electrode

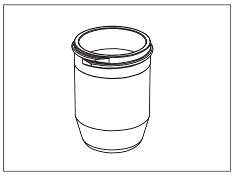
20.3.2 Titration stands



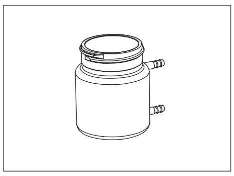
DV704 External titration stand with magnetic stirrer **51109259**



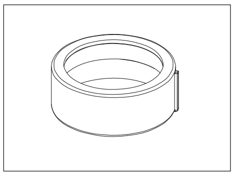
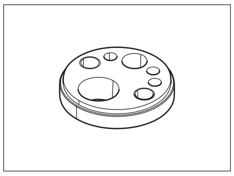
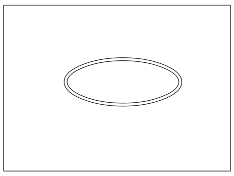
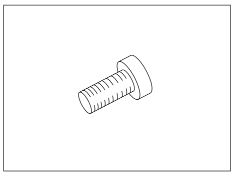
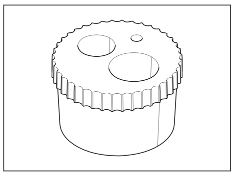
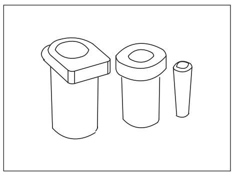
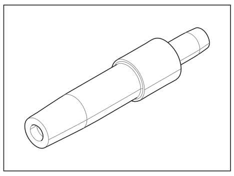
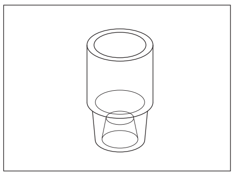
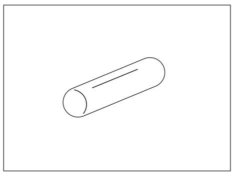
Stand rod **51107495**

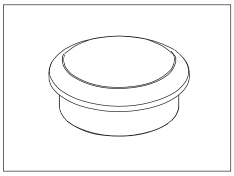
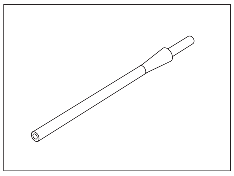
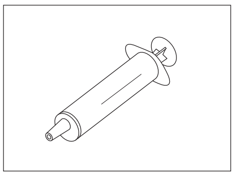
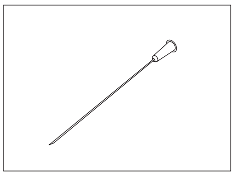
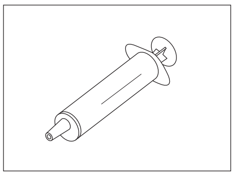
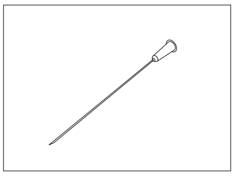
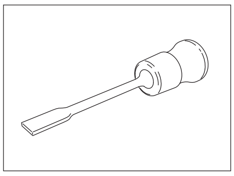
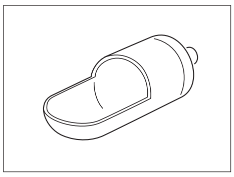


Titration vessel **51107463**

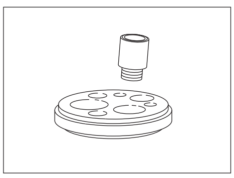


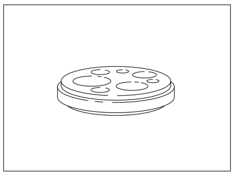
Tempering beaker **51107497**

	Threaded ring	**51107459**
	Cover plate for volumetric titration vessel	**51107462**
	O-ring	**51190366**
	Fastening screw (for measuring cell)	**51107474**
	Three-hole adapter	**23943**
	Stopper for three hole adapter (1 set: 1 NS 10, 1 NS 7.5, 6 pin hole stopper)	**25883**
	Connector KF Titrators	**23957**
	Septum stopper (10 pcs.) NS 10 NS 24	 **23949** **23950**
	Magnetic stirrer bar	**51191159**

	Seal (titration stand drying tube)	**51107492**
	Gas inlet for Volumetric KF	**25971**
	Syringe (120 pcs) 1 mL	**30315987**
	Injection needle (12 pcs) 80 × 1.2 mm	**71483**
	Syringes (100 pcs.) 10 mL	**71482**
	Injection needle (100 pcs) 80 × 0.8 mm	**71484**
	Visco-Spoon™	**51107668**
	Weighing boats (5 pieces.) Glass dia. 20 x 60 Glass dia. 30 x 80 PE dia. 38 x 100	 **23951** **23952** **23954**

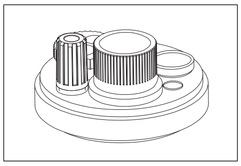
20.3.3 Homogenizer adapter sets

	Homogenizer adapter set 12 (for kinematica)	**51107534**



Homogenizer adapter set 18
(for IKA)

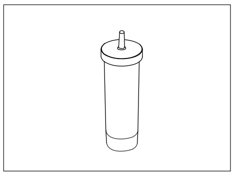
51107409



Homogenizer adapter set 19
(for IKA)

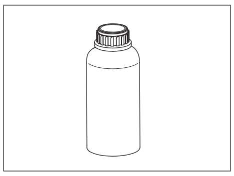
30030848

20.4 Drying tubes



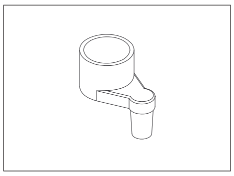
Drying tube with cover

23961



Molecular sieve
250 g

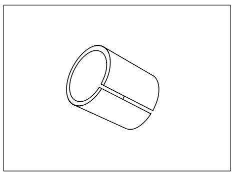
71478



Drying tube holder

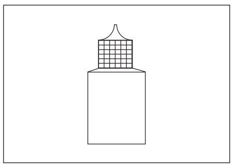
23915

20.5 Sensors



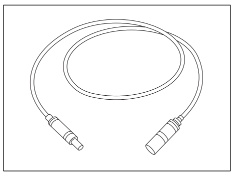
Adjustable cone for use with sensors

22986



3 Mol/L KCl (25mL)

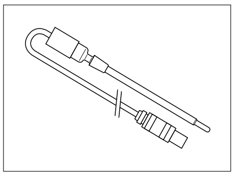
51343180



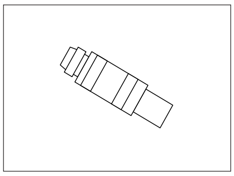
Sensor Extension Cable LEMO 120 cm

30259608

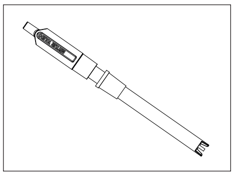
20.5.1 Temperature sensors



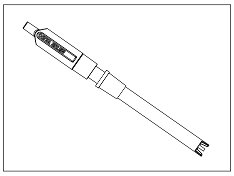
DT1000 temperature sensor
150 mm — **51109828**



LEMO (4-pin) cable connector for temperature sensors
(not from METTLER TOLEDO) — **88321**

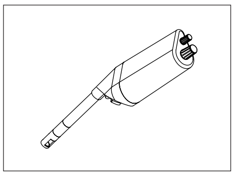


Thermotrode™, thermometric sensor
Cable length: 120 mm — **30322060**



Thermotrode™, thermometric sensor
Cable length: 200 mm — **30322061**

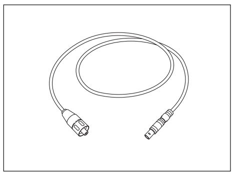
20.5.2 Photometric sensors



DP5 phototrode
(incl. power supply unit) for color indicated titrations, transmission measurement at 520, 555, 590, 620, 660 nm — **51109300**

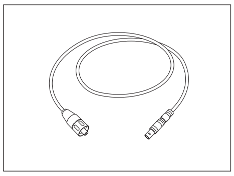
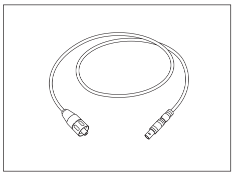
20.5.3 Plug & Play titration electrodes

DGi101-SC	PnP combined pH electrode (ceramic diaphragm) for small volumes in aqueous medium.	**51109507**
DGi102-Mini	PnP combined pH electrode (ceramic diaphragm) for small volumes in aqueous medium.	**51109508**
DGi112-Pro	PnP combined pH electrode (moving sleeve junction) for direct pH value measurements and acid/base titrations in complex, aqueous matrixes (for example, galvanic baths, condensation)	**51109501**
DGi113-SC	PnP combined pH electrode (moving sleeve junction) for titration in non-aqueous media.	**51109502**
DGi114-SC	PnP combined pH electrode (moving sleeve junction) for direct pH value measurements and titrations in complex, aqueous media	**51109503**
DGi115-SC	PnP combined pH electrode (with sleeve junction) for direct pH value measurements and acid/base titrations in aqueous media with low ion concentration.	**51109504**
DGi116-Solvent	PnP combined pH electrode (moving sleeve junction) for titration in non-aqueous media.	**51109505**

DGi117-Water	PnP combined pH electrode with sleeve junction and integrated temperature sensor for direct pH value measurements and acid/base titrations with simultaneous temperature acquisition in low-ion or weakly buffered aqueous media	**51109506**
DMi101-SC	PnP combined platinum ring electrode (ceramic diaphragm) for redox titration with small volumes	**51109523**
DMi102-SC	PnP combined silver ring electrode (ceramic diaphragm) for argentometric titration with small volumes	**51109533**
DMi140-SC	PnP combined platinum ring electrode (ceramic diaphragm) for redox titration	**51109520**
DMi141-SC	PnP combined silver ring electrode (ceramic diaphragm) for argentometric titrations	**51109530**
DMi144-SC	PnP combined platinum ring electrode (ceramic diaphragm) for redox titration, in particular for CSB titration using the Rondo sample changer	**51109521**
DMi145-SC	PnP combined silver ring electrode with moving sleeve junction for argentometric titrations in complex samples	**51109531**
DMi147-SC	PnP combined platinum ring electrode for redox titration at a constant pH value	**51109522**
DMi148-SC	PnP combined silver ring electrode for argentometric titrations at a constant pH value	**51109532**
	Triaxial SC LEMO cable Length: 72 cm Length: 100 cm Length: 160 cm (For Plug & Play – and traditional titration electrodes)	 **89601** **89602** **51108034**

20.5.4 Classical electrodes (not Plug & Play)

DG111-SC	Combined pH electrode for titrations in aqueous medium	**89596**
DG113-SC	Combined glass electrode with moveable sleeve junction for titrations in non-aqueous medium	**89632**
DG115-SC	Combined glass electrode with sleeve junction for titrations in aqueous medium	**89806**
DM140-SC	Combined platinum ring electrode for redox titrations	**89598**
DM141-SC	Combined silver ring electrodes for argentometric titration	**89599**
DM143-SC	Double platinum pin electrode	**51107699**
DX200	Reference electrode for ion selective electrodes	**89935**
DX202-SC	Reference electrode for solutions containing hydrofluoric acid	**51109295**
DX205-SC	Reference electrode for ion selective electrodes	**30066675**
Au805-S7/120	Half-cell with gold ring for RedOx titration of highly oxidizing samples	**59904381**
Sb850-S7/120	Half-cell with antimony for acid/base titration, plastic shaft	**59904405**

PT885-NS-S7/105	Double platinum ring electrode for measuring very low brom indexes.	**59904435**
InLab®718	Conductivity sensor for NTC 30k titrations, glass, 2 platinum rings	**51340266**
InLab®717	Conductivity sensor for NTC 30k titrations, glass, 4 platinum rings	**51302401**
	Triaxial SC Lemo (Classic) Length: 72 cm Length: 100 cm Length: 160 cm (For classic titration electrodes, especially for amperometric and voltammetric titrations with DM143-SC)	 **51109183** **51109184** **51109185**
	MultiPin - LEMO / Pt1000 Cable Length: 70 cm Length: 100 cm (For DGi117-Water pH electrode with built in temperature sensor)	 **51109544** **51109545**

20.5.5 Ion-selective and gas-sensitive electrodes (half cells)

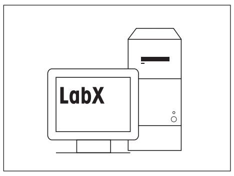
DX207	DX207-Li^+ lithium ISE	**51107673**
DX218	DX218-NH_4^+ ammonium ISE	**51340900**
DX219	DX219-F^- fluoride ISE	**51340500**
DX222	DX222-Na^+sodium ISE	**30079616**
DX224	DX224-Mg^{2+} magnesium ISE	**51340263**
DX226	DX226-CN^- cyanide ISE	**51107681**
DX232	DX232-S^{2-} sulfide ISE	**51107675**
DX235	DX235-Cl^- chloride ISE	**51340400**
DX239	DX239-K^+ potassium ISE	**51340700**
DX240	DX240-Ca^{2+} calcium ISE	**51340600**
DX258	DX258-SCN^- thiocyanate ISE	**51107870**
DX262	DX262-NO_3^- nitrate ISE	**51340800**
DX264	DX264-Cu^{2+} copper ISE	**51107678**
DX280	DX280-Br^- bromide ISE	**51340300**
DX287	DX287-BF_4^- tetrafluoroborate ISE	**51107676**
DX312	DX312-Cd^{2+} cadmium ISE	**51107672**
DX327	DX327-I^- iodide ISE	**51107680**
DX337	DX337-Ba^{2+} barium ISE	**51107674**
DX407	DX407-Pb^{2+} lead ISE	**51107873**
DS500	Tenside-sensitive electrode	**51107670**

DS800-TwoPhase	Tenside-sensitive electrode	**51109540**
GSE ammonia	GSE ammonia electrode	**51341000**
GSE nitrogen oxide	GSE nitrogen oxide electrode	**51341100**
GSE carbon dioxide	GSE carbon dioxide electrode	**51341200**

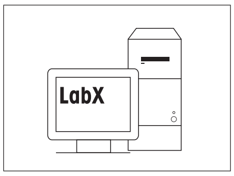
20.5.6 Combined ISE with integrated reference electrode

Ag^+/S^{2-}	perfectION™ comb Ag^+/S^{2-} Lemo	**51344800**
Ca^{2+}	perfectION™ comb Ca^{2+} Lemo	**51344803**
Cl^-	perfectION™ comb Cl^- Lemo	**51344806**
CN^-	perfectION™ comb CN^- Lemo	**51344809**
Cu^{2+}	perfectION™ comb Cu^{2+} Lemo	**51344812**
F^-	perfectION™ comb F^- Lemo	**51344815**
I^-	perfectION™ comb I^- Lemo	**51344818**
K^+	perfectION™ comb K^+ Lemo	**51344821**
Na^+	perfectION™ comb Na^+	**51344724**
NO^{3-}	perfectION™ comb NO^{3-} Lemo	**51344827**
Pb^{2+}	perfectION™ comb Pb^{2+} Lemo	**51344830**

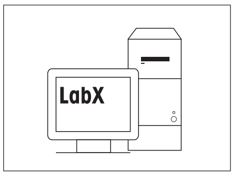
20.6 Software



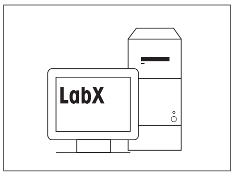
LabX Titration Server **30097755**
- Network installation for up to 30 total instrument licenses
- LabX Titration Server
- User Management and Auot Import/Export



LabX Titration Express **30097754**
- Single PC installation for up to 3 total instrument licenses
- One titrator and balance instrument license

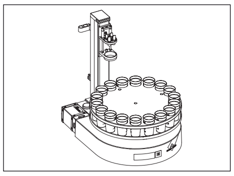


LabX Titration Instrument License (1 pc) **30097756**



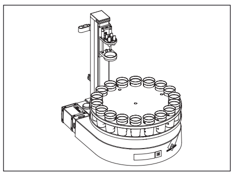
LabX Titration Instrument License (3 pcs) **30097757**

20.7 Sample changers and ovens



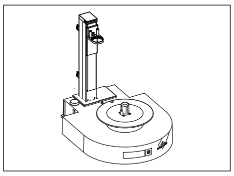
Autosampler InMotion Flex 100mL **30094120**

- Base InMotion Flex
- Rack Kit InMotion Flex 100mL

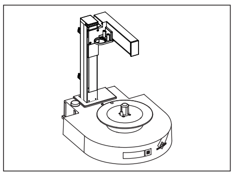


Autosampler InMotion Flex 80mL **30276336**

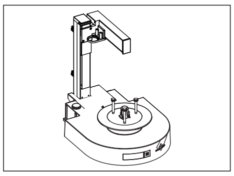
- Base InMotion Flex
- Rack Kit InMotion Flex 80mL



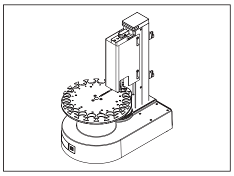
Base InMotion Flex **30094121**



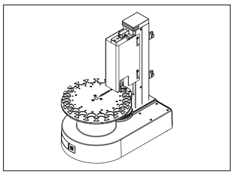
Base InMotion Pro **30094122**



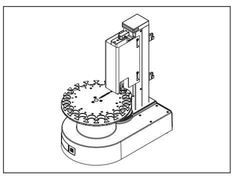
Base InMotion Max **30094123**



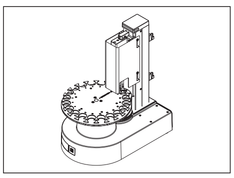
InMotion KF Flex **30407500**
Rack 10 mL, 23 sample positions, 1 drift position



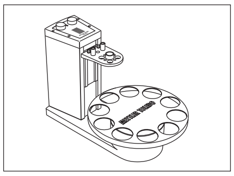
InMotion KF Pro **30407501**
Rack 20 mL, 19 sample positions, 1 drift position



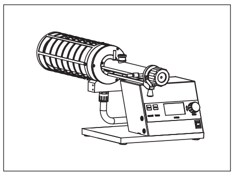
InMotion KF Pro **30407502**
Rack 10 mL, 23 sample positions, 1 drift position



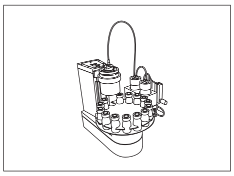
InMotion KF Pro **30407503**
Rack 5 mL, 25 sample positions, 1 drift position



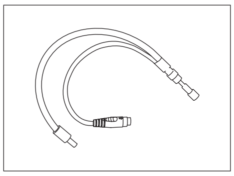
Sample changer **Rondolino** TTL — **51108500**



DO308 drying oven — **51371200**

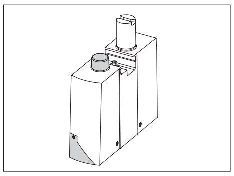


Stromboli oven sample changer — **51105200**

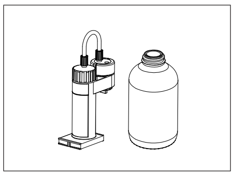


Tube (heatable) with cable — **51108836**

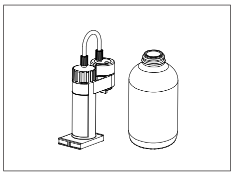
20.8 Dosing and pumps



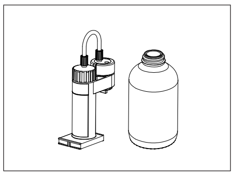
Dosing unit with CAN cable — **51109030**



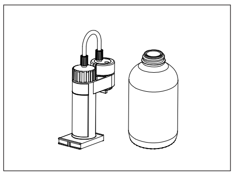
Interchangeable burette DV1005
5 ml — **51107500**



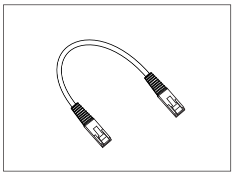
Interchangeable burette DV1010
10 mL — **51107501**



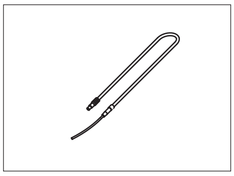
Interchangeable burette DV1020
20 mL — **51107502**



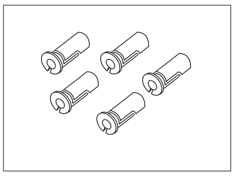
Interchangeable burette DV1001
1 ml — **51107503**



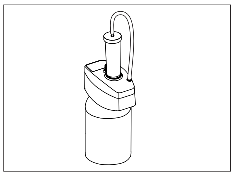
6-pole CAN cable
Length: 20 cm **51109874**
Length: 60 cm **51109886**



Dispensing tube with siphon tip 100 cm **25961**

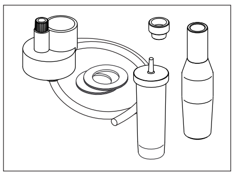


Siphon tips (5 pcs.) **23240**



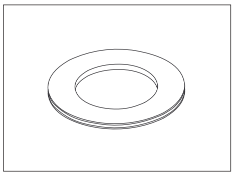
Solvent manager kit **51105652**

- Solvent manager set
- Clear glass bottle, 1L
- Pump tubing
- Y-cables

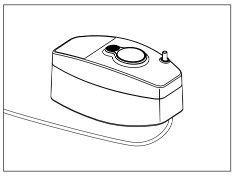


Reagent changing set with: **51105606**

- Extraction adapter for Coulometer cell
- Park sleeve
- PTFE extraction tube 800 mm (23936)
- Screw top (23937)
- Drying tube with cover (23961)
- 2 flat seals (23981) (minimum order quantity 5 pcs)

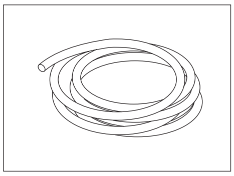


Flat seal (minimum order quantity 5 pcs.) **23981**

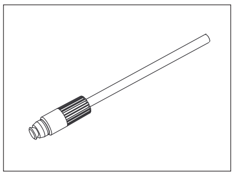


Solvent Manager set with: **51105600**

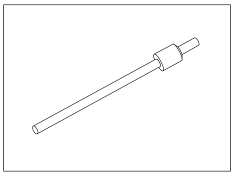
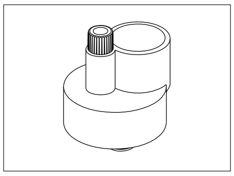
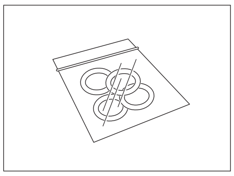
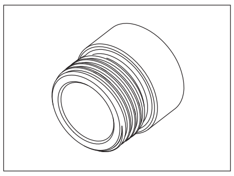
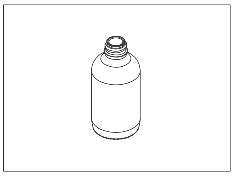
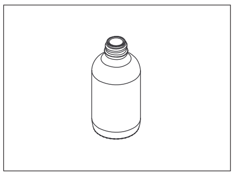
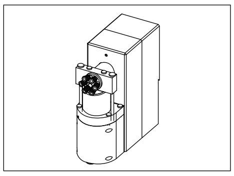
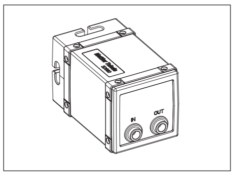
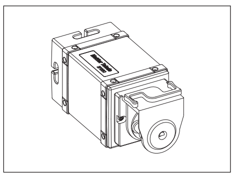
- Silicone tube 850 mm
- Silicone tube 170 mm
- Drying tube with cover
- 2 flat seals

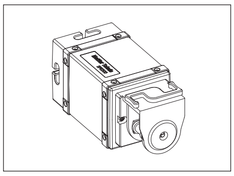
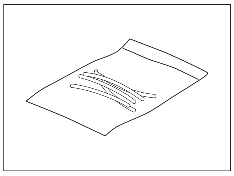
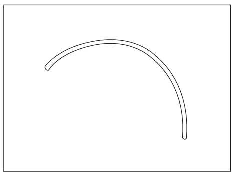
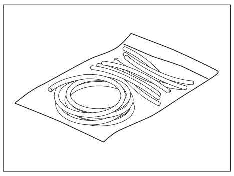
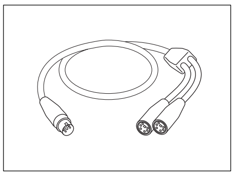


Silicone tube (pressure tube to solvent manager) 850 mm **51105581**

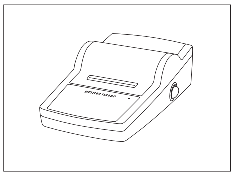
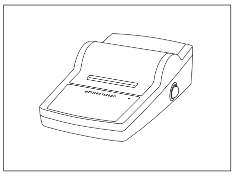
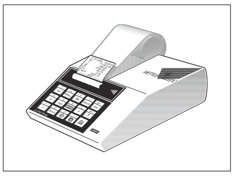
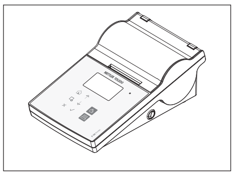


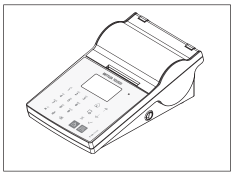
Draining tube / Dispensing tube **51107481**

	Adapter for immediate draining	**51105594**
	Screw top (for bottles)	**23937**
	O-ring (4 pcs.) for screw tops	**51107496**
	Bottle adapter Merck, Germany Fisher, USA	 **23774** **23787**
	Clear glass bottle 1 l	**30079610**
	Brown glass bottle 1 l	**71296**
	Liquid Handler	**51371500**
	Pump SD660 Diaphragm with Suction Tube	**30094165**
	Pump SP280 Peristaltic with novoprene tubing and connectors	**30094237**

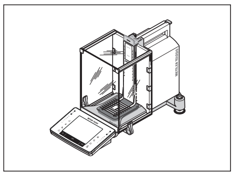
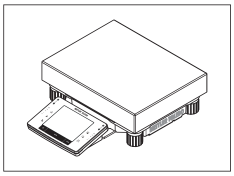
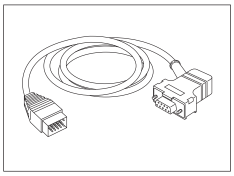
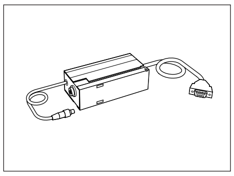
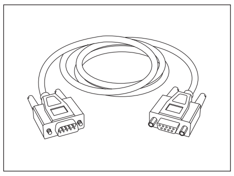
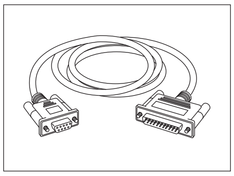
	Pump SPR200 Peristaltic Reversible with silicone tubing and connectors	**30094285**
	Silicone tubes (5x118 mm)	**51108149**
	ChemSure tube for pumps (1x120 mm)	**30094297**
	Novoprene tubes (1x1 m + 10x118 mm)	**51190969**
	Cable Y Titration Stirrer/Pump 6 pin	**30094247**

20.9 Printers

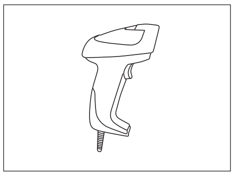
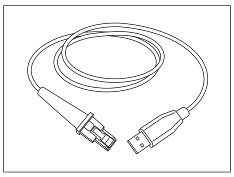
	Lab equip access. data writer USB-P25/01	**11124301**
	Lab equip access. data writer RS-P25/01	**11124300**
	Lab equip access. data writer RS-P26/01	**11124303**
	Lab equip access. data writer P-56RUE	**30094673**

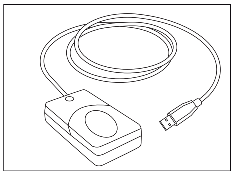
	Lab equip access. data writer P-58RUE	**30094674**

20.10 Balances

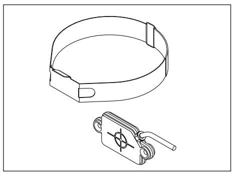
	Analytical balances • XPE, XSE, XS • MS, ML, ME-T, ME	–
	Precision balances • XPE, XS • MS, ML, ME-T, ME	–
	Connection cable for METTLER TOLEDO balance (MiniMettler)	**229029**
	Connection cable for METTLER TOLEDO balance (LC interface)	**229065**
	Connection cable for METTLER TOLEDO balance (RS9 interface)	**11101051**
	Connection cable for SARTORIUS balances (RS9-RS25)	**51190363**

20.11 Miscellaneous peripherals

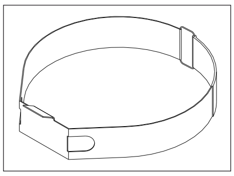
	Barcode reader with USB interface	**21901297**
	USB Cable 412	**21901309**



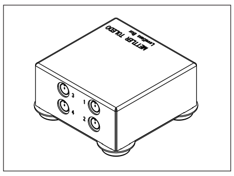
Fingerprint reader with USB interface **51192107**



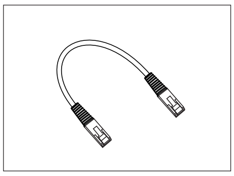
LevelSens (capacitive level sensor)
complete incl. sensor holder
- LevelSens Non-Aqueous **51109853**
- LevelSens Aqueous **51109854**



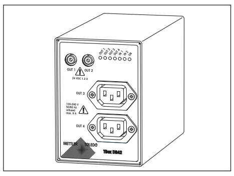
LevelSens holder **51109852**



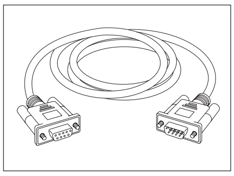
LevelSens box (connection option for four LevelSens) **51109210**



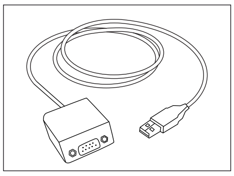
6-pole CAN cable (for LevelSens) **51109874**
(20cm)



DR42 TBox **51107420**
For activating external devices via TTL-I/O

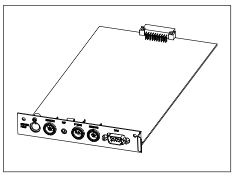


Connection cable for Rondolino **51190589**
(RS9-RS9)

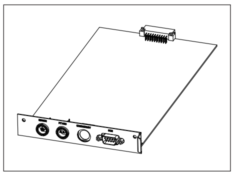
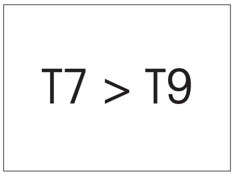
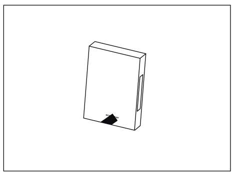
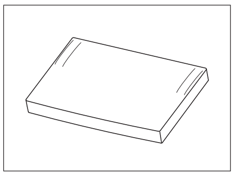
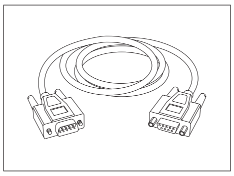
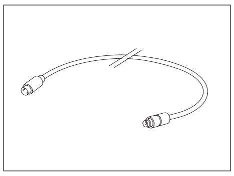
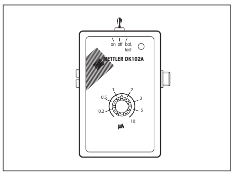
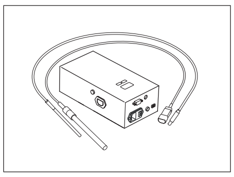
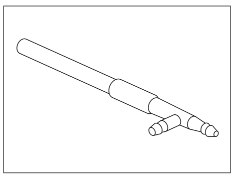


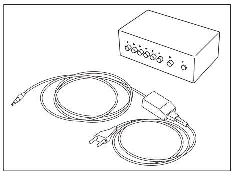
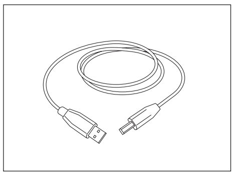
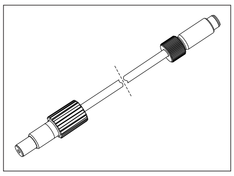
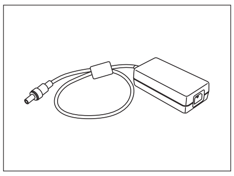
USB data export box **51105855**

20.12 Miscellaneous accessories



Analog board **51109818**

	Conductivity board	**51109840**
	T7 > T9 upgrade set Activation code and type label	**30267111**
	CD Titration User Documentation	**30297239**
	Terminal protection cover	**30125377**
	Connection cable for METTLER TOLEDO density meters / refractometers (RS9 interface)	**51192070**
	Extension cable (mini DIN female / mini DIN male) length 0,5 m length 1 m	 **51108351** **51108308**
	DK102A Polarization current source	**106013**
	DH100 heating system 110 Volt 230 Volt	 **51108779** **51108780**
	Heat exchanger for thermostatting (incl. ground joint adapter)	**23834**

	OE06 auxiliary output expander	**51108019**
	USB cable A-B (for PC or printer) 180 cm	**51191926**
	Connection tube for METTLER TOLEDO density meters / refraktometers 100 cm	**51337240**
	Extern. Power Supply 120W	**30298362**

21 Appendix

21.1 Predefined calibration standards for pH sensors

METTLER TOLEDO EU (Ref. 25°C)	METTLER TOLEDO USA (Ref. 25°C)	DIN (19266) /NIST (Ref. 25°C)	DIN (19267) (Ref. 25°C)	MERCK (Ref. 20°C)
2.00	1.68	1.680	1.09	1.00
4.01	4.01	3.557	3.06	2.00
4.60	7.00	3.775	4.65	3.00
7.00	10.01	4.008	6.79	4.00
9.21		6.865	9.23	4.66
10.00		7.416	12.75	5.00
11.00		9.184		6.00
		10.014		6.88
		12.454		7.00
				8.00
				9.00
				9.22
				10.00
				11.00
				12.00
				13.00

Fluka (Ref. 20°C)	Novartis (Fluka) (Ref. 20°C)	FISHER (Ref. 25°C)	JIS Z 8802 (Ref. 25°C)	JJG119 (Ref. 25°C)
1.00	4.00	1.00	1.679	1.680
2.00	7.00	2.00	4.008	3.559
3.00	9.00	3.00	6.865	4.003
4.00		4.00	7.413	6.864
5.00		5.00	9.180	7.409
6.00		6.00	10.01	9.182
7.00		7.00		12.460
8.00		8.00		
9.00		8.991		
10.00		10.00		
11.00		11.00		
12.00				
13.00				

21.1.1 Temperature related values

21.1.1.1 METTLER TOLEDO

METTLER TOLEDO EU (Ref. 25°C)

Temp. [°C]	pH						
0	2.03	4.01	4.66	7.12	9.52	10.65	11.90
5	2.02	4.01	4.65	7.09	9.45	10.52	11.72
10	2.01	4.00	4.64	7.06	9.38	10.39	11.54
15	2.00	4.00	4.63	7.04	9.32	10.26	11.36
20	2.00	4.00	4.62	7.02	9.26	10.13	11.18
25	**2.00**	**4.01**	**4.60**	**7.00**	**9.21**	**10.00**	**11.00**
30	1.99	4.01	4.61	6.99	9.16	9.87	10.82
35	1.99	4.02	4.62	6.98	9.11	9.74	10.64
40	1.98	4.03	4.63	6.97	9.06	9.61	10.46
45	1.98	4.04	4.64	6.97	9.03	9.48	10.28
50	1.98	4.06	4.66	6.97	8.99	9.35	10.10
55	1.98	4.08	4.67	6.98	8.96	9.22	9.92
60	1.98	4.10	4.69	6.98	8.93	9.09	9.74
70	1.99	4.16	4.71	7.00	8.88	8.96	9.56

Temp. [°C]	pH						
80	2.00	4.22	4.73	7.04	8.83	8.83	9.38
90	2.00	4.30	4.75	7.09	8.79	8.70	9.20
95	2.00	4.35	4.77	7.12	8.77	8.57	9.02

METTLER TOLEDO USA (Ref. 25°C)

Temp. [°C]	pH			
5	1.67	4.01	7.09	10.25
10	1.67	4.00	7.06	10.18
15	1.67	4.00	7.04	10.12
20	1.68	4.00	7.02	10.06
25	**1.68**	**4.01**	**7.00**	**10.01**
30	1.68	4.01	6.99	9.97
35	1.69	4.02	6.98	9.93
40	1.69	4.03	6.97	9.89
45	1.70	4.04	6.97	9.86
50	1.71	4.06	6.97	9.83

21.1.1.2 DIN / NIST

DIN (19266) / NIST (Ref. 25°C)

Temp. [°C]	pH								
0	1.666	3.577	3.863	4.010	6.984	7.534	9.464	10.317	13.423
5	1.668	3.573	3.837	4.004	6.950	7.502	9.392	10.248	13.207
10	1.670	3.569	3.819	4.001	6.922	7.474	9.331	10.180	13.003
15	1.672	3.565	3.801	4.001	6.900	7.451	9.277	10.121	12.810
20	1.676	3.561	3.787	4.003	6.880	7.432	9.228	10.066	12.627
25	**1.680**	**3.557**	**3.775**	**4.008**	**6.865**	**7.416**	**9.184**	**10.014**	**12.454**
30	1.685	3.553	3.766	4.015	6.853	7.405	9.144	9.970	12.289
35	1.691	3.549	3.759	4.026	6.845	7.396	9.110	9.928	12.133
40	1.697	3.549	3.754	4.036	6.837	7.389	9.076	9.892	11.984
45	1.704	3.544	3.751	4.049	6.834	7.386	9.046	9.856	11.841
50	1.712	3.548	3.748	4.064	6.833	7.384	9.018	9.830	11.705
55	1.715	3.554	3.750	4.075	6.834	7.382	8.985	9.804	11.574
60	1.723	3.560	3.753	4.091	6.836	7.380	8.962	9.778	11.449
70	1.743	3.580	3.763	4.126	6.845	7.378	8.921	9.752	11.324
80	1.766	3.609	3.780	4.164	6.859	7.376	8.885	9.726	11.199
90	1.792	3.650	3.802	4.205	6.877	7.374	8.850	9.700	11.074
95	1.806	3.674	3.815	4.227	6.886	7.372	8.833	9.674	10.949

DIN (19267) (Ref. 25°C)

Temp. [°C]	pH					
0	1.08	3.12	4.67	6.89	9.48	13.89
5	1.08	3.11	4.67	6.87	9.43	13.63
10	1.09	3.10	4.66	6.84	9.37	13.37
15	1.09	3.09	4.66	6.82	9.32	13.16
20	1.09	3.07	4.65	6.80	9.27	12.96
25	**1.09**	**3.06**	**4.65**	**6.79**	**9.23**	**12.75**
30	1.10	3.05	4.65	6.78	9.18	12.61
35	1.10	3.05	4.65	6.77	9.13	12.45
40	1.10	3.04	4.66	6.76	9.09	12.29
45	1.10	3.04	4.67	6.76	9.04	12.09
50	1.11	3.04	4.68	6.76	9.00	11.98
60	1.11	3.04	4.70	6.76	8.92	11.69
70	1.11	3.04	4.72	6.76	8.88	11.43
80	1.12	3.05	4.75	6.78	8.85	11.19
90	1.13	3.07	4.79	6.80	8.82	10.99

21.1.1.3 MERCK

MERCK (Ref. 20°C)

Temp. [°C]	pH						
0	0.96	2.01	3.05	4.05	4.68	5.06	6.04	6.98
5	0.99	2.01	3.05	4.04	4.68	5.05	6.02	6.95
10	0.99	2.01	3.03	4.02	4.67	5.02	6.01	6.92
15	0.99	2.00	3.01	4.01	4.67	5.01	6.00	6.90
20	**1.00**	**2.00**	**3.00**	**4.00**	**4.66**	**5.00**	**6.00**	**6.88**
25	1.01	2.00	3.00	4.01	4.66	5.00	6.02	6.86
30	1.01	2.00	3.00	4.01	4.66	5.00	6.03	6.86
35	1.01	2.00	3.00	4.01	4.66	5.00	6.03	6.85
40	1.01	2.00	2.98	4.01	4.67	5.00	6.04	6.84
45	1.01	2.00	2.98	4.01	4.67	5.01	6.05	6.84
50	1.01	2.00	2.97	4.00	4.68	5.01	6.06	6.84
60	1.02	2.00	2.97	4.00	4.69	5.04	6.10	6.84
70	1.02	2.01	2.97	4.00	4.70	5.05	6.12	6.84
80	1.02	2.01	2.97	4.00	4.71	5.10	6.17	6.86
90	1.02	2.01	2.96	4.00	4.72	5.14	6.24	6.88

MERCK (Ref. 20°C) (continued)

Temp. [°C]	pH							
0	7.13	8.15	9.24	9.46	10.26	11.45	12.58	13.80
5	7.07	8.10	9.16	9.40	10.17	11.32	12.41	13.59
10	7.05	8.07	9.11	9.33	10.11	11.20	12.26	13.37
15	7.02	8.04	9.05	9.28	10.05	11.10	12.10	13.18
20	**7.00**	**8.00**	**9.00**	**9.22**	**10.00**	**11.00**	**12.00**	**13.00**
25	6.98	7.96	8.95	9.18	9.94	10.90	11.88	12.83
30	6.98	7.94	8.91	9.14	9.89	10.81	11.72	12.67
35	6.96	7.92	8.88	9.10	9.84	10.72	11.67	12.59
40	6.95	7.90	8.85	9.07	9.83	10.64	11.54	12.41
45	6.95	7.88	8.82	9.04	9.79	10.56	11.44	12.28
50	6.95	7.85	8.79	9.01	9.74	10.48	11.33	12.15
60	6.96	7.83	8.73	8.96	9.67	10.33	11.04	11.75
70	6.96	7.80	8.70	8.93	9.62	10.19	10.90	11.61
80	6.97	7.78	8.66	8.89	9.55	10.06	10.70	11.39
90	7.00	7.75	8.64	8.85	9.49	9.93	10.48	11.15

21.1.1.4 FLUKA

FLUKA (Ref. 20°C)

Temp. [°C]	pH					
0	0.94	1.99	3.03	4.03	5.05	6.03
10	0.99	1.99	3.02	4.02	5.02	6.01
20	**1.00**	**2.00**	**3.00**	**4.00**	**5.00**	**6.00**
30	1.00	2.00	3.00	4.00	5.00	6.02
40	1.01	2.00	2.99	4.00	5.00	6.04
50	1.01	2.00	2.98	4.00	5.02	6.06
60	1.01	2.00	2.98	4.00	5.04	6.09
70	1.01	2.00	2.98	4.00	5.07	6.13
80	1.02	2.00	2.98	4.00	5.10	6.18
90	1.02	2.00	2.97	4.00	5.13	6.24

FLUKA (Ref. 20°C) (continued)

Temp. [°C]	pH						
0	7.13	8.18	9.24	10.24	11.45	12.58	13.71
10	7.05	8.09	9.11	10.10	11.20	12.26	13.35
20	**7.00**	**8.00**	**9.00**	**10.00**	**11.00**	**12.00**	**13.00**
30	6.98	7.94	8.93	9.90	10.81	11.75	12.66

Temp. [°C]	pH						
40	6.97	7.90	8.86	9.82	10.64	11.53	12.37
50	6.96	7.86	8.80	9.75	10.48	11.31	12.10
60	6.96	7.82	8.75	9.68	10.33	11.09	11.84
70	6.97	7.80	8.71	9.62	10.19	10.88	11.61
80	6.98	7.77	8.67	9.55	10.06	10.68	11.40
90	7.00	7.75	8.64	9.49	9.93	10.48	11.20

NOVARTIS (FLUKA) (Ref. 20°C)

Temp. [°C]	pH		
0	4.01	7.11	9.20
5	4.00	7.08	9.15
10	4.00	7.05	9.10
15	4.00	7.02	9.05
20	**4.00**	**7.00**	**9.00**
25	4.01	6.98	8.96
30	4.01	6.97	8.91
35	4.02	6.96	8.88
40	4.03	6.95	8.84
45	4.04	6.94	8.80
50	4.06	6.94	8.77
55	4.07	6.93	8.74
60	4.09	6.93	8.71
65	4.11	6.93	8.69
70	4.13	6.94	8.67
75	4.14	6.94	8.65
80	4.16	6.95	8.63
85	4.18	6.96	8.61
90	4.21	6.97	8.60
95	4.23	6.98	8.59

21.1.1.5 FISHER

FISHER (Ref. 25°C)

Temp. [°C]	pH										
0				4.01	5.05	6.07	7.13	8.15	9.166	10.34	11.80
5	0.95	1.98	2.98	3.99	5.04	6.05	7.10	8.13	9.126	10.26	11.69
10	0.98	1.98	2.97	4.00	5.03	6.06	7.07	8.08	9.089	10.19	11.46
15	1.01	2.02	3.00	3.99	4.99	6.05	7.05	8.01	9.055	10.12	11.31
20	1.01	2.00	3.00	4.00	5.00	6.00	7.02	8.00	9.022	10.06	11.17
25	**1.00**	**2.00**	**3.00**	**4.00**	**5.00**	**6.00**	**7.00**	**8.00**	**8.991**	**10.00**	**11.00**
30	1.02	2.00	3.02	4.01	5.01	5.99	6.99	8.00	8.961	9.94	10.88
35	1.03	2.02	3.03	4.02	5.01	5.98	6.98	7.95	8.930	9.90	10.76
40	1.02	2.01	3.03	4.03	5.04	5.97	6.97	7.94	8.902	9.85	10.62
45	1.03	2.01	3.04	4.04	5.06	5.97	6.97	7.94	8.874	9.81	10.52
50	1.03	2.01	3.04	4.06	5.08	5.96	6.97	7.93	8.845	9.78	10.41
55				4.07			6.97		8.815	9.74	
60				4.09			6.98		8.784	9.70	
65				4.11			6.99			9.68	
70				4.13			7.00			9.65	
75				4.14			7.02			9.63	
80				4.16			7.03			9.62	
85				4.18			7.06			9.61	
90				4.21			7.08			9.60	
95				4.23			7.11			9.60	

21.1.1.6 JIS / JJG

JIS Z 8802 (Ref. 25°C)

Temp. [°C]	pH					
0	1.666	4.003	6.984	7.534	9.464	10.32
5	1.668	3.999	6.951	7.500	9.395	10.24
10	1.670	3.998	6.923	7.472	9.332	10.18
15	1.672	3.999	6.900	7.448	9.276	10.12
20	1.675	4.002	6.881	7.429	9.225	10.06
25	**1.679**	**4.008**	**6.865**	**7.413**	**9.180**	**10.01**
30	1.683	4.015	6.853	7.400	9.139	9.97
35	1.688	4.024	6.844	7.389	9.102	9.92
40	1.694	4.035	6.838	7.380	9.068	9.89
45	1.700	4.047	6.834	7.373	9.038	9.86
50	1.707	4.060	6.833	7.367	9.011	9.83
55	1.715	4.075	6.834	7.361	8.985	9.80
60	1.723	4.091	6.836	7.355	8.962	9.77
70	1.743	4.126	6.845	7.349	8.921	9.74
80	1.766	4.164	6.859	7.343	8.885	9.71
90	1.792	4.205	6.877	7.337	8.850	9.68
95	1.806	4.227	6.886	7.331	8.833	9.65

JJG119 (Ref. 25°C)

Temp. [°C]	pH						
0	1.668	3.599	4.006	6.981	7.515	9.458	13.416
5	1.669	3.591	3.999	6.949	7.490	9.391	13.210
10	1.671	3.583	3.996	6.921	7.467	9.330	13.011
15	1.673	3.575	3.996	6.898	7.445	9.276	12.820
20	1.676	3.567	3.998	6.879	7.426	9.226	12.637
25	**1.680**	**3.559**	**4.003**	**6.864**	**7.409**	**9.182**	**12.460**
30	1.684	3.551	4.010	6.852	7.395	9.142	12.292
35	1.688	3.547	4.019	6.844	7.386	9.105	12.130
40	1.694	3.547	4.029	6.838	7.380	9.072	11.975
45	1.700	3.550	4.042	6.834	7.379	9.042	11.828
50	1.706	3.555	4.055	6.833	7.383	9.015	11.697
55	1.713	3.563	4.070	6.834	7.387	8.990	11.553
60	1.721	3.573	4.087	6.837	7.391	8.968	11.426
70	1.739	3.596	4.122	6.847	7.399	8.926	11.172
80	1.759	3.622	4.161	6.862	7.407	8.890	10.918
90	1.782	3.648	4.203	6.881	7.415	8.856	10.664
95	1.795	3.660	4.224	6.891	7.419	8.839	10.537

21.2 Predefined calibration standards for conductivity sensors

List name	REAGECON (Ref. 25°C)	METTLER TOLEDO (Ref. 25 °C)
Included Conductivity Standards	1.3 µS/cm	
	5 µS/cm	
	10 µS/cm	
	20 µS/cm	
	50 µS/cm	
	84 µS/cm	84 µS/cm
	100 µS/cm	
	147 µS/cm	
	200 µS/cm	
	500 µS/cm	
	1000 µS/cm	
	1413 µS/cm	1413 µS/cm
	5 mS/cm	
	10 mS/cm	
	12.88 mS/cm	12.88 mS/cm
	20 mS/cm	
	50 mS/cm	
	100 mS/cm	
	150 mS/cm	
	200 mS/cm	
	300 mS/cm	
	350 mS/cm	
	450 mS/cm	
	500 mS/cm	

21.2.1 Temperature related values

21.2.1.1 REAGECON

Ref. 25°C

Temp. °C	Conductivity [µS/cm]							
5	0.67	3.02	6.13	12.67	31.43	53.02	62.82	92.7
10	0.82	3.47	7.10	14.36	35.89	60.34	71.64	105.6
15	0.97	3.97	7.95	16.11	40.23	67.61	80.56	118.5
16	1.00	4.07	8.15	16.50	41.21	69.25	82.50	121.4
17	1.03	4.18	8.37	16.89	42.18	70.89	84.45	124.2
18	1.07	4.28	8.56	17.28	43.16	72.52	86.39	127.1
19	1.10	4.38	8.78	17.67	44.14	74.16	88.33	129.9
20	1.13	4.48	8.97	18.06	45.13	75.80	90.28	132.8
21	1.16	4.59	9.18	18.44	46.10	77.44	92.22	135.6
22	1.20	4.69	9.38	18.83	47.08	79.08	94.17	138.5
23	1.23	4.79	9.59	19.22	48.05	80.72	96.11	141.3
24	1.27	4.90	9.79	19.61	49.03	82.36	98.06	144.2
25	**1.30**	**5.00**	**10.00**	**20.00**	**50.00**	**84.00**	**100.00**	**147.0**
26	1.33	5.10	10.21	20.39	50.99	85.64	101.95	149.8
27	1.35	5.21	10.41	20.78	51.95	87.28	103.89	152.7
28	1.38	5.31	10.62	21.17	52.93	88.91	105.83	155.5
29	1.40	5.41	10.82	21.56	53.91	90.55	107.78	158.4
30	1.43	5.52	11.03	21.95	54.88	92.19	109.72	161.2
35	1.58	6.07	12.14	24.06	60.06	100.92	119.69	177.0
40	1.74	6.63	13.29	26.16	65.22	109.21	130.17	191.5
45	1.88	7.15	14.44	28.38	70.57	118.05	140.67	207.4
50	2.04	7.66	15.55	30.67	76.08	126.80	151.35	222.9

REAGECON (Ref. 25°C) (continued)

Temp. °C	Conductivity [µS/cm]							
5	127.3	315.3	633	894	3182	6367	8216	12810
10	144.8	359.6	718	1007	3616	7234	9326	14512
15	161.7	402.9	808	1139	4047	8104	10439	16239
16	165.5	412.6	827	1167	4142	8294	10684	16615
17	169.3	422.4	846	1194	4237	8484	10929	16991
18	173.2	432.1	865	1221	4333	8673	11174	17367
19	177.0	441.8	885	1249	4428	8863	11419	17743
20	180.8	451.5	904	1276	4523	9052	11664	18119
21	184.7	461.2	923	1304	4619	9242	11909	18496
22	188.5	470.9	942	1331	4714	9431	12153	18872
23	192.3	480.6	962	1358	4809	9621	12398	19248
24	196.2	490.3	981	1386	4905	9810	12643	19624
25	**200.0**	**500.0**	**1000**	**1413**	**5000**	**10000**	**12880**	**20000**
26	203.8	509.7	1019	1440	5095	10190	13133	20376
27	207.7	519.4	1038	1468	5191	10379	13378	20752
28	211.5	529.1	1058	1495	5286	10569	13623	21128
29	215.3	538.8	1077	1522	5381	10758	13867	21505
30	219.2	548.5	1096	1550	5477	10948	14112	21881
35	240.0	602.5	1200	1694	5985	11952	15392	23869
40	260.6	655.3	1301	1833	6501	12954	16678	25832
45	282.0	710.1	1406	1989	7013	14006	18024	27876
50	303.4	764.6	1517	2139	7515	15032	19338	29922

REAGECON (Ref. 25°C) (continued)

Temp. °C	Conductivity [µS/cm]							
5	32431	66141	100922	136689	210384	248247	321335	356804
10	36592	74301	112456	152103	232327	272909	353892	392874
15	40798	82458	124602	167414	254120	298010	385574	429033
16	41719	84212	127142	170673	258708	303209	392017	436130
17	42639	85967	129682	173931	263296	308408	398459	443227
18	43559	87721	132222	177190	267884	313607	404902	450323
19	44479	89475	134761	180448	272472	318806	411344	457420
20	45399	91229	137301	183707	277060	324005	417787	464517
21	46319	92983	139841	186966	281648	329204	424230	471613
22	47240	94737	142381	190224	286236	334403	430672	478710
23	48160	96492	144920	193483	290824	339602	437115	485807
24	49080	98246	147460	196741	295412	344801	443557	492903
25	**50000**	**100000**	**150000**	**200000**	**300000**	**350000**	**450000**	**500000**
26	50920	101754	152540	203259	304588	355199	456443	507097
27	51840	103508	155080	206517	309176	360398	462885	514193
28	52761	105263	157619	209776	313764	365597	469328	521290
29	53681	107017	160159	213034	318352	370796	475770	528387
30	54601	108771	162699	216293	322940	375995	482213	535483
35	59334	118005	175829	233217	346228	402200	512500	568468
40	64070	127035	188666	249976	369429	428442	543966	603131
45	69002	135799	202203	266899	393776	454931	573348	636054
50	74014	145808	215472	284025	417233	481705	601515	667245

21.2.1.2 METTLER TOLEDO

Ref. 25°C

Temp. °C	Conductivity [µS/cm]		
5	53.02	894	8216
10	60.34	1007	9326
15	67.61	1139	10439
16	69.25	1167	10684

Temp. °C	Conductivity [µS/cm]		
17	70.89	1194	10929
18	72.52	1221	11174
19	74.16	1249	11419
20	75.80	1276	11664
21	77.44	1304	11909
22	79.08	1331	12153
23	80.72	1358	12398
24	82.36	1386	12643
25	**84.00**	**1413**	**12880**
26	85.64	1440	13133
27	87.28	1468	13378
28	88.91	1495	13623
29	90.55	1522	13867
30	92.19	1550	14112
35	100.92	1694	15392
40	109.21	1833	16678
45	118.05	1989	18024
50	126.80	2139	19338

21.3 System validation

The products / systems were tested in respect of functionality and specification prior to shipment. In order to support GLP and validation requirements, we will make the following documents available to authorized persons for inspection:

- Performance specifications
- Market and technical requirements
- Quality plan
- Project management system
- Plan and Test results
- Review reports

METTLER TOLEDO, Analytical will retain possession of all documents and their reproductions and may wish to conclude a nondisclosure agreement with those requesting access to these documents.

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