877 Titrino plus

c(NaOH) = 0.1 mol/L

10 mL

877 Titrino plus

802 Stirrer

804 Ti Stand

Manual
8.877.8003EN

Ω Metrohm

877 Titrino plus

Manual

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Although all the information given in this documentation has been checked with great care, errors cannot be entirely excluded. Should you notice any mistakes please send us your comments using the address given above.

Documentation in additional languages can be found on *http://documents.metrohm.com*.

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1 Introduction

1.1 Instrument description

The 877 Titrino plus is a titrator for volumetric titrations for universal applications. Methods can be created and stored under a new name. The methods can be exported to a connected USB flash drive. This function makes it possible for you to copy methods quickly and easily from one instrument to another. The remote connector enables the integration of the instrument in a Metrohm automation system.

1.1.1 Titration and measuring modes

The following titration and measuring modes are supported:

- **MET**
  Monotonic equivalence point titration. The reagent is added in constant volume steps.
  Measuring modes:
  - **pH** (pH measurement)
  - **U** (potentiometric voltage measurement)
  - **Ipol** (voltametric measurement with selectable polarization current)
  - **Upol** (amperometric measurement with selectable polarization voltage)

- **SET**
  Endpoint titration at one or two specified endpoints.
  Measuring modes:
  - **pH** (pH measurement)
  - **U** (potentiometric voltage measurement)
  - **Ipol** (voltametric measurement with selectable polarization current)
  - **Upol** (amperometric measurement with selectable polarization voltage)

- **CAL**
  Electrode calibration.
  Measuring mode:
  - **pH** (calibration of pH electrodes)

1.1.2 Connectors

The instrument is equipped with the following connectors:

- **MSB connector (Metrohm Serial Bus)**
  For connecting a stirrer.
- **USB (OTG) connector**
  The 6.2151.100 adapter can be used to connect, for example, a printer, a USB flash drive or a USB keyboard.
- **Sensor connectors**
  Four connectors for the following sensor types:
  - pH or redox electrodes
  - reference electrodes
  - polarizable electrodes
  - temperature sensors (Pt1000 or NTC)
- **Remote connector**
  For connecting a Dosimat or sample changer. The Dosimat enables automatic addition of an auxiliary solution.

1.1.3 Intended use

The 877 Titrino plus is designed for usage as a titrator in analytical laboratories. Its main application field is volumetric titration.

This instrument is suitable for processing chemicals and flammable samples. The usage of the 877 Titrino plus therefore requires that the user have basic knowledge and experience in the handling of toxic and caustic substances. Knowledge with respect to the application of the fire prevention measures prescribed for laboratories is also mandatory.

1.2 About the documentation

> **CAUTION**
>
> Please read through this documentation carefully before putting the instrument into operation. The documentation contains information and warnings which the user must follow in order to ensure safe operation of the instrument.

1.2.1 Symbols and conventions

The following symbols and formatting may appear in this documentation:

*(5-**12**)*	**Cross-reference to figure legend**
	The first number refers to the figure number, the second to the instrument part in the figure.

1	**Instruction step**
	Carry out these steps in the sequence shown.
Method	**Dialog text**, **parameter** in the software
File ▶ New	Menu or menu item
[Next]	**Button** or **key**
⚠️	**WARNING**
	This symbol draws attention to a possible life-threatening hazard or risk of injury.
⚠️	**WARNING**
	This symbol draws attention to a possible hazard due to electrical current.
⚠️	**WARNING**
	This symbol draws attention to a possible hazard due to heat or hot instrument parts.
⚠️	**WARNING**
	This symbol draws attention to a possible biological hazard.
❗	**CAUTION**
	This symbol draws attention to possible damage to instruments or instrument parts.
ℹ️	**NOTE**
	This symbol highlights additional information and tips.

1.3   Safety instructions

1.3.1   General notes on safety

> ⚠️ **WARNING**
>
> This instrument may only be operated in accordance with the specifications in this documentation.

This instrument has left the factory in a flawless state in terms of technical safety. To maintain this state and ensure non-hazardous operation of the instrument, the following instructions must be observed carefully.

1.3.2 Electrical safety

The electrical safety when working with the instrument is ensured as part of the international standard IEC 61010.

> **WARNING**
>
> Only personnel qualified by Metrohm are authorized to carry out service work on electronic components.

> **WARNING**
>
> Never open the housing of the instrument. The instrument could be damaged by this. There is also a risk of serious injury if live components are touched.
>
> There are no parts inside the housing which can be serviced or replaced by the user.

Mains voltage

> **WARNING**
>
> An incorrect mains voltage can damage the instrument.
>
> Only operate this instrument with a mains voltage specified for it (see rear panel of the instrument).

Protection against electrostatic charges

> **WARNING**
>
> Electronic components are sensitive to electrostatic charges and can be destroyed by discharges.
>
> Do not fail to pull the mains cable out of the mains connection socket before you set up or disconnect electrical plug connections at the rear of the instrument.

1.3.3 Tubing and capillary connections

CAUTION

Leaks in tubing and capillary connections are a safety risk. Tighten all connections well by hand. Avoid applying excessive force to tubing connections. Damaged tubing ends lead to leakage. Appropriate tools can be used to loosen connections.

Check the connections regularly for leakage. If the instrument is used mainly in unattended operation, then weekly inspections are mandatory.

1.3.4 Flammable solvents and chemicals

WARNING

All relevant safety measures are to be observed when working with flammable solvents and chemicals.

- Set up the instrument in a well-ventilated location (e.g. fume cupboard).
- Keep all sources of flame far from the workplace.
- Clean up spilled liquids and solids immediately.
- Follow the safety instructions of the chemical manufacturer.

1.3.5 Recycling and disposal
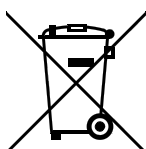
This product is covered by European Directive 2002/96/EC, WEEE – Waste from Electrical and Electronic Equipment.

The correct disposal of your old equipment will help to prevent negative effects on the environment and public health.

More details about the disposal of your old equipment can be obtained from your local authorities, from waste disposal companies or from your local dealer.

2 Overview of the instrument
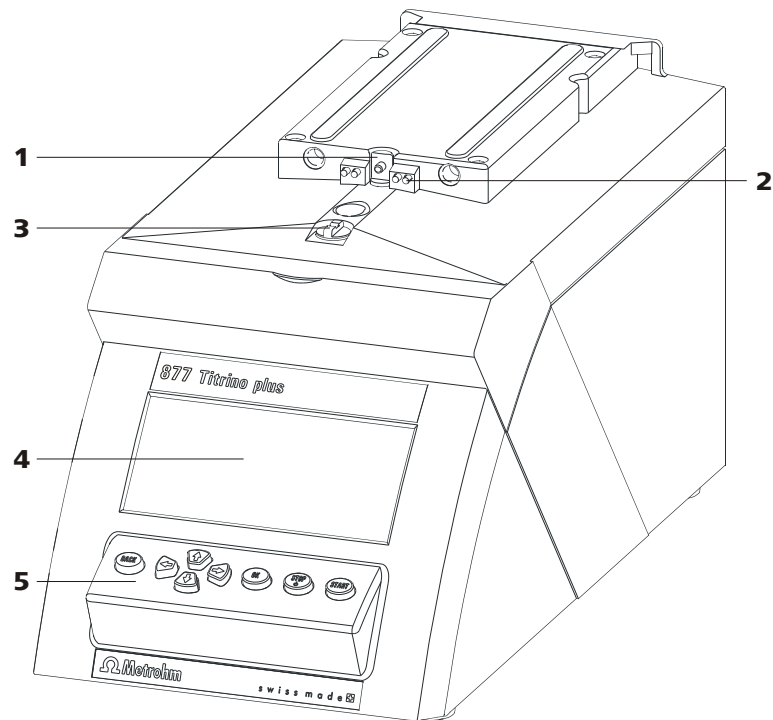
Figure 1   Front 877 Titrino plus

1	**Piston rod** Of the dosing drive.	**2**	**Contact pins** For the data chip.
3	**Coupling** For switching the flat stopcock.	**4**	**Display**
5	**Keypad**		
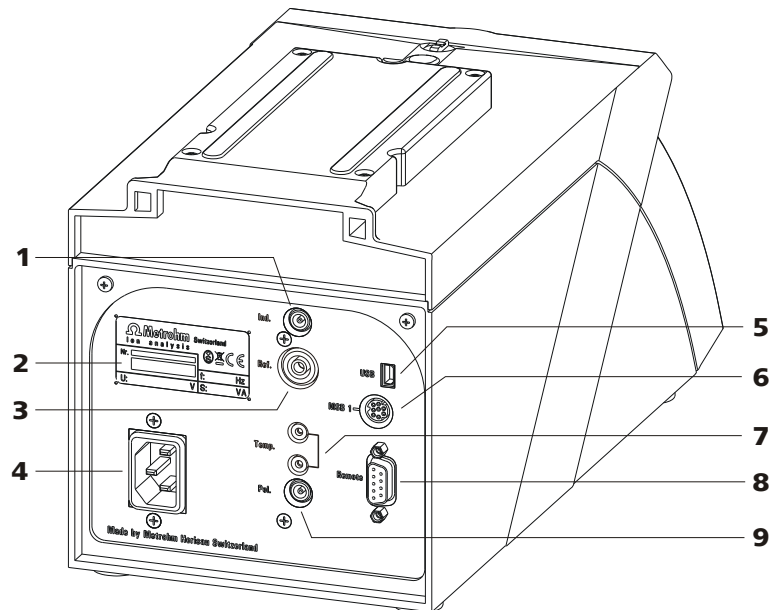
Figure 2   Rear 877 Titrino plus

1	**Electrode connector (Ind.)** For connecting pH or redox electrodes with integrated or separate reference electrode. Socket F.	**2**	**Type plate** Contains specifications concerning mains voltage and serial number.
3	**Electrode connector (Ref.)** For connecting reference electrodes. Socket B, 4 mm.	**4**	**Mains connection socket**
5	**USB (OTG) connector** For connecting printers, USB sticks, USB hubs, etc.	**6**	**MSB connector** Metrohm Serial Bus. For connecting a stirrer. Mini DIN, 9-pin.
7	**Temperature sensor connector (Temp.)** For connecting temperature sensors of the Pt1000 or NTC types. Two B sockets, 2 mm.	**8**	**Remote connector** For connecting instruments with a remote interface. D-Sub, 9-pin.
9	**Electrode connector (Pol.)** For connecting polarizable electrodes, e.g. double Pt electrodes. Socket F.		

3 Installation

3.1 Setting up the instrument

3.1.1 Packaging

The instrument is supplied in highly protective special packaging together with the separately packed accessories. Keep this packaging, as only this ensures safe transportation of the instrument.

3.1.2 Checks

Immediately after receipt, check whether the shipment has arrived complete and without damage by comparing it with the delivery note.

3.1.3 Location

The instrument has been developed for operation indoors and may not be used in explosive environments.

Place the instrument in a location of the laboratory which is suitable for operation, free of vibrations, protected from corrosive atmosphere, and contamination by chemicals.

The instrument should be protected against excessive temperature fluctuations and direct sunlight.

3.2 Connecting a sensor

Connecting pH or redox electrodes
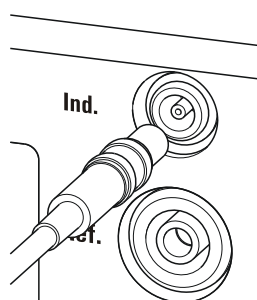
Figure 3   Connecting pH or redox electrodes

> **NOTE**
>
> The electrode cable is protected against accidental disconnection of the cable by means of a pull-out protection feature. If you wish to remove the plug, then you must first retract the outer plug sleeve.

Connecting a reference electrode
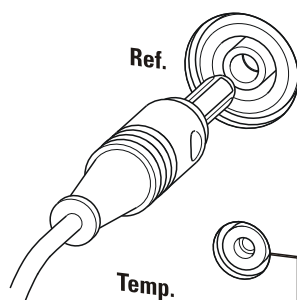
Figure 4   Connecting a reference electrode

Connecting a temperature sensor or an electrode with integrated temperature sensor

Temperature sensors of the Pt1000 or NTC type can be connected to the **Temp.** connector.
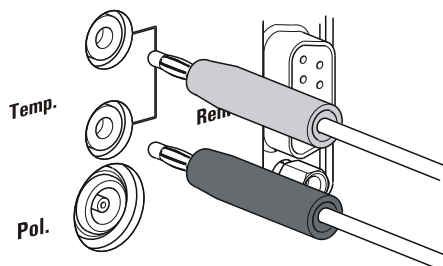
Figure 5   Connecting a temperature sensor

> **NOTE**
>
> The red plug must always be plugged into the red socket at the temperature sensor for the purpose of shielding against disruptions.
>
> If you use an electrode with an integrated NTC probe, then you must plug the red plug into the red socket.

Connecting a polarizable electrode
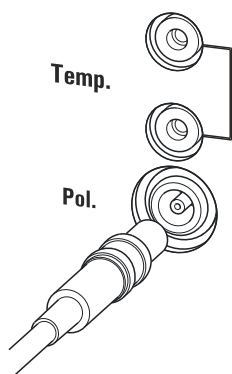
Figure 6   Connecting a polarizable electrode

> ### NOTE
>
> The electrode cable is protected against accidental disconnection of the cable by means of a pull-out protection feature. If you wish to remove the plug, then you must first retract the outer plug sleeve.

3.3   Connecting a stirrer

You can connect the following stirrers:

- 801 Stirrer
- 803 Ti Stand
- 804 Ti Stand (requires rod stirrer)
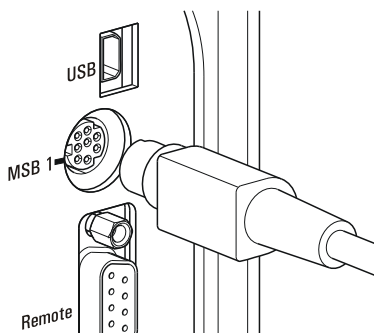
Figure 7   Connecting a stirrer

> ### CAUTION
>
> Make sure that the flat side of the plug matches the marking on the socket.

3.4 Connecting a balance

Balances are equipped with a serial RS-232 interface as a rule. To connect a balance, you require a 6.2148.030 RS-232/USB Box.
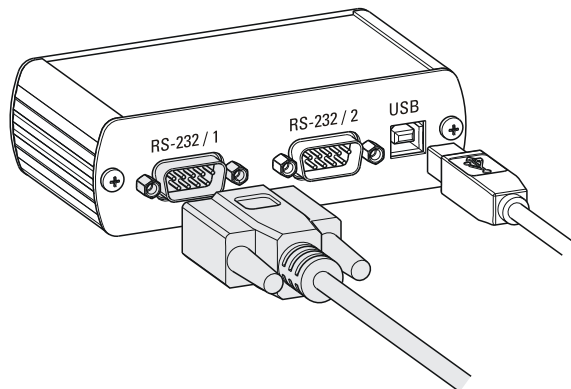
Figure 8   Connecting a balance

When a 6.2151.020 USB cable is used, then the 6.2148.030 RS-232/USB Box can be connected to the 877 Titrino plus by means of a USB hub or a 6.2151.100 adapter *(see Chapter 3.5, page 11)*.

Connect the 9-pin plug of the respective balance connecting cable to the **RS 232/1** connector. Consult the user manual of the balance in order to select the correct connecting cable.

The parameters for the RS-232 interface on the instrument must match those on the balance *(see "Editing the COM1 settings", page 63)*. Additionally consult the user manual of the balance.

3.5 Connecting a keyboard, printer and other USB devices

The 877 Titrino plus has a USB (OTG) connector. Use the provided 6.2151.100 adapter USB MINI (OTG) - USB A for connecting USB devices as e.g. printers, keyboards or USB sticks, see the following figure.
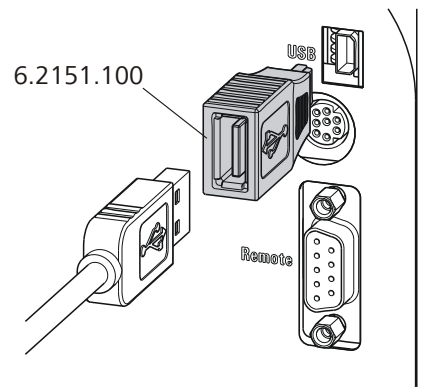
Figure 9   Connecting USB devices

> **CAUTION**
>
> Switch the instrument off before connecting or disconnecting a USB device or a USB stick.
>
> The 877 Titrino plus can only recognize the device immediately after switching on.

The following devices can be operated **directly on the USB connector with the 6.2151.100 adapter**:

- USB sticks (for the backup or storing of methods)
- 6.2147.000 numerical USB keypad
- 6.2148.030 RS-232/USB Box (for connecting balances or for the RS-232 remote control)
- USB hub (with or without an own power supply)

The **6.2147.000 numerical USB keypad** serves for comfortable numerical input and for navigating in the dialog. In addition, it provides two USB connectors. Connect additional USB devices to the keypad.

> **NOTE**
>
> Most of the USB devices need a so-called hub in order to work correctly.
>
> A USB hub is a distributor to which several USB devices can be connected. USB hubs are available in specialty stores in a number of different models.
>
> The USB (OTG) connector of the 877 Titrino plus has no such hub. The 6.2147.000 numerical USB keypad has a USB hub and two USB connectors.

The following devices can **only be connected to a 6.2147.000 numerical keypad or to a USB hub**:

- Printer (with USB connector, use the 6.2151.020 connecting cable)
- Barcode reader (with USB cable)
- Mouse (PC mouse with USB cable, for navigating in the dialog)

The following devices can **only be connected to a USB hub**:

- PC keyboard (with USB cable, for the comfortable input of letters and numbers)
- Keypad with numerical keypad (with USB cable)

If you wish to connect **several different instruments without own power supply**, then you must possibly use a USB hub with own power supply (*self powered*). The USB (OTG) connector of the 877 Titrino plus is not designed for supplying power to several devices with elevated electricity requirements.

Also observe the instructions in *chapter 10.4, page 103*.

Examples:

USB MINI (OTG)-USB
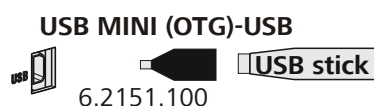
Figure 10   Connecting the USB stick
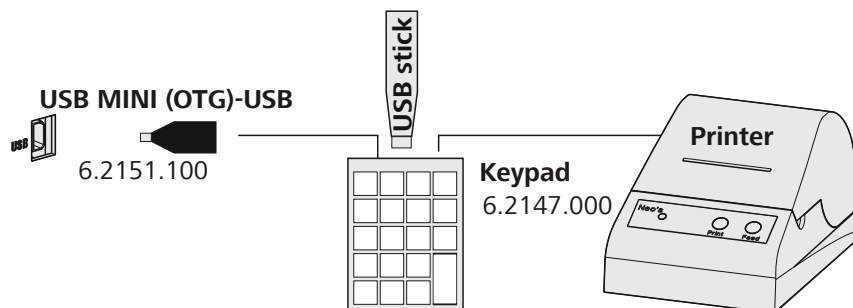
Figure 11   Connecting the 6.2147.000 USB keyboard with USB stick and printer
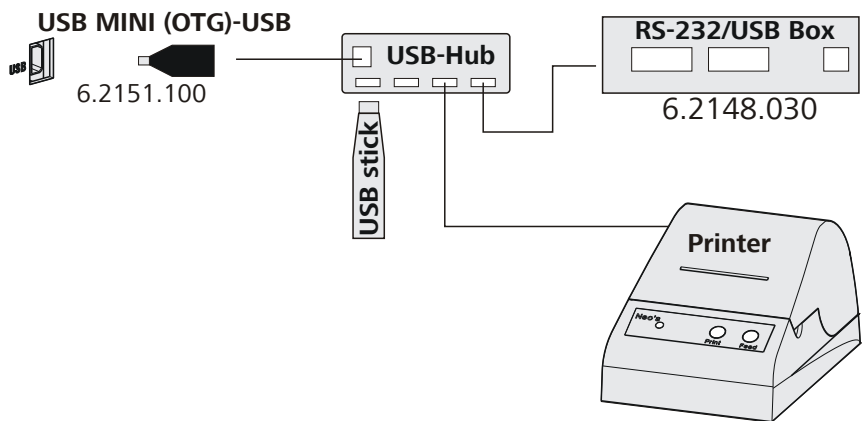
Figure 12   Connecting the USB hub with USB stick, printer and the 6.2148.030 RS-232/USB Box (for connecting balances).

3.6   Connecting instruments to the remote connector

The 877 Titrino plus can be integrated in an automation system with the aid of a remote cable.
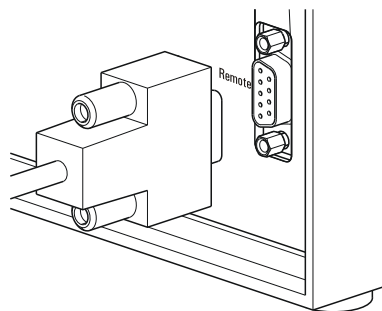
Figure 13   Connecting a remote cable

A variety of different connecting cables are available for connecting Metrohm instruments (e.g. sample changers) *(see Optional Accessories chapter)*.

3.7   Attaching the exchange unit
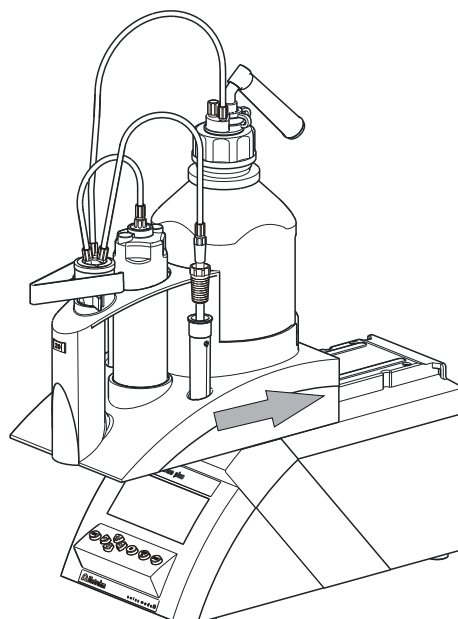
Figure 14   Attaching the exchange unit

To attach the exchange unit, proceed as follows:

1 Slide the exchange unit from the front onto the 877 Titrino plus and push all the way to the rear.

It must snap in audibly.

4 Titrations

4.1 Monotonic equivalence point titration (MET)

Monotonic equivalence point titration is a titration mode for titrations with relatively high signal fluctuations or suddenly occurring potential jumps and for slow titrations or slow-response electrodes. The reagent is added in constant volume steps. Measured value acceptance is drift-controlled (equilibrium titration) or after a waiting time. Equivalence points are evaluated automatically.

Figure 15   Reagent dosing for MET

4.2 Endpoint titration (SET)

Endpoint titration is a titration mode for rapid routine determinations to a preset endpoint (e.g. titrations in accordance with special norms) and titrations for which reagent overflow must be avoided. The titration termination at the endpoint takes place either drift-controlled or after a waiting period. The volume dosed until the endpoint is used for calculating the content of the sample.

Figure 16   Reagent dosing for SET

5 Operation

5.1 Switching the instrument on and off

Switching on the instrument

Proceed as follows:

1 ▪ Press the red **[STOP]** key.
The instrument is initialized and a system test performed. This process takes some time.
▪ If a buret unit has been attached, then a request appears to carry out the **PREP** function:

```
Buret unit              010-126

     The buret unit should be
     prepared.
     Execute a PREP function.


OK
```
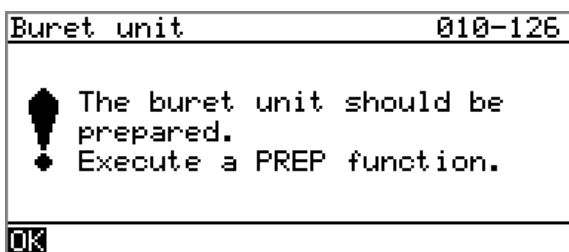
All tubings and the cylinder are rinsed with the **PREP** (Preparing) function. The preparing of the buret unit is described in chapter *"Preparing the buret unit (PREP)", page 44*.
▪ Confirm the message with **[OK]**.
The display of this message can be deactivated in the system settings *(see "PREP warning", page 53)*.

The main dialog is displayed:

```
>Menu                      ready
 Method                      MET
 ID1
 ID2
 Sample size                 1.0
 Unit                          g

```
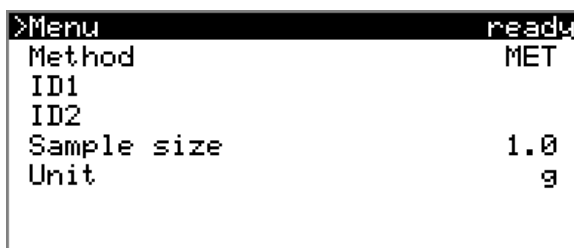
Switching off the instrument

The instrument is switched off with the **[STOP]** key. The fact that the key needs to be pressed down for an extended time prevents accidental switch off.

Proceed as follows:

1 ▪ Keep the red **[STOP]** key pressed down for at least 3 s.

A progress bar is displayed. If the key is released during this time, then the instrument will not be switched off.

5.2 Fundamentals of operation

5.2.1 The keypad
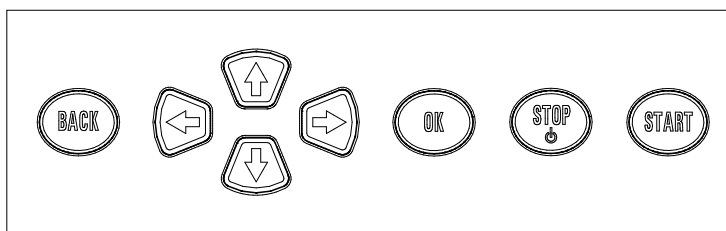
Figure 17   Keypad 877 Titrino plus

BACK	Apply the input and exit the dialog.
⇑ ⇓	Move the selection bar either up or down by one line at a time. Select the character to be entered in the text editor.
⇐ ⇒	Select the character to be entered in the text and number editor. Select the individual functions in the function bar.
OK	Confirm the selection.
STOP	Stop an ongoing method run or a manual function. Switch the instrument on or off.
START	Start a method run or a manual function.

5.2.2 Structure of the dialog windows

```
System                    ready
>Settings
>Sensors
>Solutions
>Common variables
>File management
>External devices
>Diagnosis
```

The current dialog title is displayed on the left-hand side of the title bar. The current status of the system is displayed in the upper right-hand corner:

ready   The instrument is in normal status.

cond.busy   The working medium is being conditioned.

cond.ok   The working medium is conditioned.

busy   A method has been started.

hold   A method has been paused.

Some dialogs have a so-called function bar on the bottom line. The functions contained therein can be selected with the arrow keys **[⇦]** or **[⇨]** and executed with **[OK]**.

```
Solution list             ready
Reagent 1                 *IEU
Reagent 2                 EU



Edit New Delete
```

5.2.3 Navigating in the dialog

The selection bar is displayed in inverted style. Use the arrow keys **[⇧]** and **[⇩]** to move the selection bar upward or downward one line at a time. If a dialog text is marked with " **>** ", then additional settings are available in a subordinate dialog. Use **[OK]** to access this dialog.

Example: System settings

```
System                    ready
>Settings
>Sensors
>Solutions
>Common variables
>File management
>External devices
>Diagnosis
```

Use the **[BACK]** key to return to the next higher level.

5.2.4   Entering text and numbers
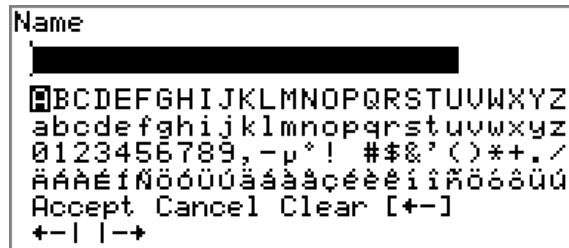
In the editing dialog for text input or numerical input, select the individual characters with the arrow keys. Use **[OK]** to apply the character in the input field. The following functions are available:

Editing function	Description
Accept	The modification is applied and the editing dialog is exited.
Cancel	The editing dialog is exited without applying the modification.
Clear	The content of the input field is deleted completely.
[←]	The character left of the cursor is deleted (backspace).
←|	Text editor only The cursor within the input field is shifted to the left by one character each time that **[OK]** is pressed.
|→	Text editor only The cursor within the input field is shifted to the right by one character each time that **[OK]** is pressed.
[BACK]	The modification is applied and the editing dialog is exited.

The **[BACK]** key has the same function as **Accept**.

A commercially available USB keyboard can be connected to make it easier to enter text and numbers. The assignment of the keys on the PC keyboard is described in *chapter 10.4.2, page 104*.

5.2.5   Selecting from a selection list

```
Unit
 g
 mg
 µg
 mL
 µL
 pieces
 >User-defined
```

In a selection list, select the individual entries with the arrow keys **[⇧]** and **[⇩]**. Accept the selection with **[OK]** or **[BACK]**.

5.3   Formula editor

The formulas for the calculations are entered with the formula editor. The formula editor is equipped with an automatic syntax check. This is triggered as soon as a formula is applied. The generally valid rules of priority apply for the calculation operations.

```
R1=

▮
⊠123456789
.+-*/()
C00 EP# CI# R# FP# CV0# SMN#
TITER CONC Var Templates
Accept Cancel Clear [←]
←| |→
```

Variable	Description
C00	Sample size
EP#	Volume of endpoint EP# (# = 1…9)
CI#	Sample identification (# = 1…2)
R#	Result (# = 1…5)
FP#	Volume of fixed endpoint FP# (# = 1…9)
CV0#	Common variable (# = 1…5)
SMN#	Mean value of result R# (# = 1…5)
TITER	Titer of selected solution
CONC	Concentration of selected solution
Var	List of additional variables *(see "Variables", page 23)*
Templates	List of predefined calculation formulas *(see "Calculation templates", page 23)*

"#" stands for a sequential number that you must enter manually. Example: if you apply the variable **EP#** in the formula, only **EP** is entered. You will still need to enter the number yourself.

The meanings of the editing functions are explained in *chapter 5.2.4, page 21*.

Variables

Pressing **Var** displays a list with additional variables. You can enter these variables either directly into the formula or also by selecting them from the list and applying them with **[OK]**.

Variable	Description
MIM	Initial measured value, i.e. measured value prior to the processing of the start conditions
MSM	Start measured value, i.e. measured value after the processing of the start conditions
MCV	End volume, i.e. total dosed volume at the end of the titration
ET#	Temperature at endpoint EP# (# = 1…9)
EM#	Measured value of endpoint EP# (# = 1…9)
ED#	Time at endpoint EP# (# = 1…9)
MSV	Start volume
MEN	Electrode zero point pH(0)
MSL	Electrode slope
DD	Duration of the entire determination
MST	Start temperature
MCT	End temperature
FT#	Temperature at fixed endpoint FP# (# = 1…9)
FM#	Measured value of fixed endpoint FP# (# = 1…9)
FD#	Time at fixed endpoint FP# (# = 1…9)

For **Molw**, see the following section.

Calculation templates

Pressing **Templates** displays a list with calculation templates. You can apply these templates directly with **[OK]**.

> **ℹ NOTE**
>
> Some templates contain the wildcard **Molw**, which stands for the molar mass of the sample. You must replace this wildcard with the correct value in the calculation formula.

The templates available:

Template	Description
Content %	Content in %
	Unit of the sample size = g
Content mmol/L	Content in mmol/L
	Unit of the sample size = mL
Content mol/L	Content in mol/L
	Unit of the sample size = mL
Content g/L	Content in g/L
	Unit of the sample size = mL
Content ppm	Content in ppm
	Unit of the sample size = g
Titer	Titer calculation
	Unit of the sample size = g
Blank mean value	Blank value as mean value of single results
Blank single value	Blank value as single value

5.4   Methods

5.4.1   Creating a new method

Proceed as follows to create a new method:

1   Open the method table

- ▪ In the main dialog, select **Method** and press **[OK]**.

The method table opens:

```
Method table              ready



Load New Store Delete Export
```

2 Select a titration and measuring mode

- In the function bar, select **New** and press **[OK]**.

```
New method                ready
Mode                        MET
Measured quantity            pH



```
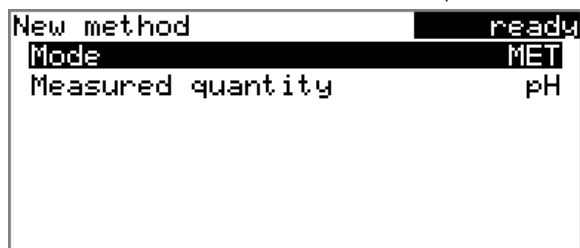
- Select **Mode** and press **[OK]**.
- Select the desired titration mode in the selection list and apply with **[OK]**.
- Select **Measured quantity** and press **[OK]**.
- Select the desired measuring mode in the selection list and apply with **[OK]**.
- Press **[BACK]**.

The method is now loaded and is displayed in the main dialog under **Method**.

If a new method has been created, then the individual parameters can be modified under **Menu ▸ Parameters**.

5.4.2 Saving a method

If you modify method parameters, then you can save these as your own method. A maximum of 100 methods can be saved.

To save a method, proceed as follows:

1 Opening the method table

- In the main dialog, select **Method** and press **[OK]**.

The method table opens:

```
Method table            ready




Load New Store Delete Export
```

2 **Modifying/applying the method name**

- In the function bar, select **Store** and press **[OK]**.
  A method name will be suggested for new methods. If the
  method has already been saved once, then the method name will
  be displayed:

```
Store method            ready
Name                   Me2115




```
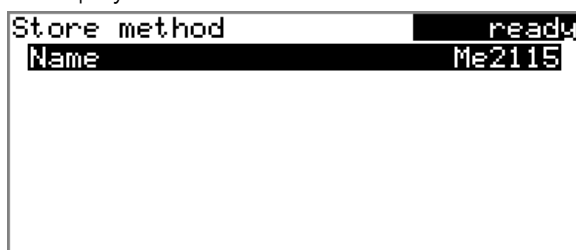
Applying the name:

- Press **[BACK]**.

The method will be saved and the method table is displayed.

Entering a new name:

- Press **[OK]**.
  The text editor opens.
- Enter a method name (max. 12 characters) and apply with
  Accept or **[BACK]**.
- Press **[BACK]**.

The method will be saved and the method table is displayed.

5.4.3   Loading a method

To load a method, proceed as follows:

1 **Open the method table**

- In the main dialog, select **Method** and press **[OK]**.

The method table with the stored methods opens:

```
Method table              ready
 Me2115
 Me3901
 Me4155
 Me4612


Load New Store Delete Export
```

2 Select a method

- Select the desired method.

3 Load the method

- In the function bar, select **Load** and press **[OK]**.

The method is now loaded and is displayed in the main dialog under **Method**.

5.4.4   Exporting a method

The methods can be exported to a connected USB flash drive.

```
┌─────┐
│  i  │      NOTE
└─────┘    ─────────────────────────────────────────

This function is possible only if a USB flash drive is connected as an
external storage medium.
```

To export a method, proceed as follows:

1 Opening the method table

- In the main dialog, select **Method** and press **[OK]**.

The method table with the stored methods opens:

```
Method table              ready
 Me2115
 Me3901
 Me4155
 Me4612


Load New Store Delete Export
```

2 Selecting the method

- Select the desired method.

3 Exporting the method

- In the function bar, select **Export** and press **[OK]**.

The method is being exported. The directory structure on the USB flash drive is listed in *chapter 6.5, page 61*.

5.5   Control

Menu ▶ Control

In the dialog **Control**, the settings for the execution of a single determination or of one sample series are defined.

Sample table

If this parameter is activated, the sample data for a sample series can be entered in a table *(see Chapter 5.7, page 31)*.

Selection	**on**	**off**
Default value	**off**

Autostart

If this parameter is activated, a new determination is started automatically at the end of a determination. This continues until the number specified has been reached (see **Number of autostarts**).

Selection	**on**	**off**
Default value	**off**

Number of autostarts

This parameter is visible only when **Autostart** = **on**.

Number of automatic starts.

Input range	**1 - 50**
Selection	**table**
Default value	**table**

table
The number of automatic starts corresponds to the number of samples in the sample table.

> **NOTE**
>
> It may be necessary to reset the autostart counter manually before the quantity defined above has been reached. Proceed as follows:
>
> - Deactivate autostart.
> - Exit the **Control** dialog.
> - Activate autostart again.

5.6 Sample data

You can enter the sample data (identification, sample size, etc.) in a variety of ways:

- Directly in the main dialog.
- Using the sample table. This is particularly useful with sample series. The sample table is a table in which the sample data for up to 99 samples can be entered *(see Chapter 5.7, page 31)*.
- Automatic request immediately after the start of the determination *(see Chapter 5.6.2, page 30)*.

You can also send the sample size and the unit from a connected balance in any case. With some balances, the sample identification and method can be also sent *(see Chapter 10.3, page 102)*.

5.6.1 Entering sample data in the main dialog

For a sample, you can enter the sample data directly in the main dialog, even while the determination is running *(see Chapter 5.9, page 36)*.

```
>Menu              ready
 Method             MET
 ID1
 ID2
 Sample size        1.0
 Unit                 g
```

ID1

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

Entry	**max. 10 characters**
Default value	**empty**

ID2

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

Entry	**max. 10 characters**
Default value	**empty**

Sample size

Sample size. The value of the sample size can be used in calculations as the variable **C00**.

Input range	**−999999999 - 9999999999**
Default value	**1.0**

Unit

Unit of the sample size.

Selection	**g** | **mg** | **µg** | **mL** | **µL** | **pieces** | **User-defined**
Default value	**g**

User-defined

A user-defined unit can be created. This will be added to the selection list. The previous entry will be overwritten as soon as the new unit has been defined.

5.6.2 Requesting sample data at the start of the determination

The sample data can be requested immediately after the start of the determination in order to ensure that the sample data entry is not forgotten. This automatic request is indispensable when you reweigh your samples.

```
Me4155                    hold
 ID1
Sample size              1.0
Unit                       g

Press [START] key to continue
```

The corresponding parameters must be activated under **Start conditions** for this purpose. If the parameter **Hold at request** is activated, then the run will be paused and must be continued with **[START]** after the input of the sample data. If **Hold at request** is deactivated, then the titration will be started in the background. This dialog will be displayed until the entering of the sample data is confirmed with **[START]**, even if the the titration is already completed. This ensures that the sample data is available for calculations.

5.7 Sample table

5.7.1 General

The sample table is a table in which the sample data for up to 99 samples can be entered. The sample data can also be entered while a determination is running *(see Chapter 5.9.2, page 37)*.

Activating the sample table

Proceed as follows to activate the sample table (parameter **Sample table** = **on**).

1 Opening the main menu

- In the main dialog, select **Menu** and press **[OK]**.

```
Menu                    ready
 >Manual control
 >Results
 >Parameters
 >System
 >Control
 >Print reports
```

2 Opening the control dialog

- Select the menu item **Control** and press **[OK]**.

```
Control                 ready
 Sample table            off
 Autostart               off
```

3 Activating the sample table

- Select **Sample table** and press **[OK]**.
- Select the entry **on** in the selection list and apply with **[OK]**.
- Press **[BACK]**.

The menu item **Sample table** is displayed in the main menu:

```
Menu                        ready
 >Manual control
 >Results
 >Parameters
 ▶Sample table
 >System
 >Control
 >Print reports
```

The sample table contains numbered lines. The identification (**ID1**) and the sample size of each sample are displayed.

```
Sample table                ready
 1 #8805923    1.0 g
 2 #8805923    1.0 g
 3 #8805924    1.0 g
 4 #8805924    1.0 g
 5 ...

Edit Delete Insert New
```

Edit

Edit the data of the selected line, see following chapter.

Delete

Delete the selected line from the sample table.

Insert

Insert a new line above the line selected.

New

Delete the sample table completely. This function is visible only if the instrument is in **ready** status.

5.7.2   Editing the sample data

```
Sample data                 ready
 Method              Me4155
 ID1               #8805923
 ID2
 Sample size            1.0
 Unit                     g

    +-    Line  1 of  4   -+
```

You will see at the very bottom the line number of the selected line and the line number of the last line containing data. In this example, the first line is opened and the sample table contains four lines.

One can scroll between the individual data sets with the keys **[⇦]** and **[⇨]**.

Inserting a new line

If you find yourself on the last line (i.e. **Line 4 of 4** in the above example), you can add a new line to the sample table by pressing **[⇨]** again. The sample data of the previous sample will be applied thereby.

Method

Method used for processing the sample.

Selection	**Selection of stored methods | empty**
Default value	**empty**

> **empty**
> The currently loaded method is used.

ID1

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

Entry	**max. 10 characters**
Default value	**empty**

ID2

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

Entry	**max. 10 characters**
Default value	**empty**

Sample size

Sample size. The value of the sample size can be used in calculations as the variable **C00**.

Input range	**–999999999 - 9999999999**
Default value	**1.0**

Unit

Unit of the sample size.

Selection	**g | mg | μg | mL | μL | pieces | User-defined**
Default value	**g**

> **User-defined**
> A user-defined unit can be created. This will be added to the selection list. The previous entry will be overwritten as soon as the new unit has been defined.

5.7.3 Sending the sample size from a balance

```
Sample table              ready
  1 #8805923     1.0 g
  2 #8805923     1.0 g
  3 #8805924     1.0 g
  4 #8805924     1.0 g
  5 ...

 Edit Delete Insert New
```

If the sample size is sent directly from the balance, then it will always be entered in a new line at the end of the sample table. It does not matter which line is selected or whether the sample table is even opened. In the above example, the sample size is entered in line 5.

> **NOTE**
>
> If you would like to enter the sample size in a particular line, then you must open the corresponding editing dialog (i.e. the **Sample data** dialog is displayed).
>
> If the editing dialog for the sample size is opened, then the sent value will be ignored.

5.8 Carrying out a determination

The sample size can be entered in the following ways when a determination is carried out:

- Enter manually on the instrument
- Send automatically from a connected balance. Consult the user manual for the balance for this purpose.

The following instructions describe how to enter the sample size on the 877 Titrino plus.

1 Load the method

- *See Chapter Loading a method, Page 26.*

2 Prepare the sample

> **NOTE**
>
> Calculate the amount of the sample in such a way that a titrant consumption of 10...90 % of the cylinder volume will result.

- Weigh in or measure the sample in a sample vessel.
- Add solvent.
- Place the sample vessel on the stirrer.
- Immerse electrode and buret tip in solution.

3 | **Enter the sample size**

- In the main dialog, select **Sample size** and press **[OK]**.
  The editing dialog opens.
- Enter the sample size and apply with **Accept** or **[BACK]**.

4 | **Start the titration**

- Press **[START]**.

The titration starts and the curve is displayed:
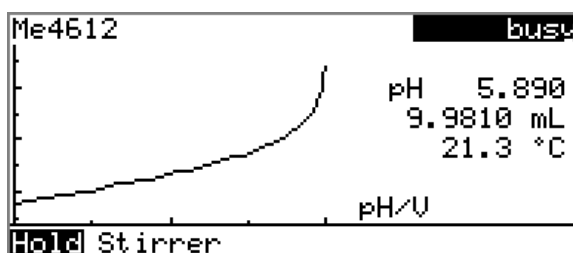
The axes are scaled automatically. The run is paused with **Hold**.
Continue is now displayed instead. This can be used to continue the
run.

The stirring rate can be modified during titration with the **Stirrer**
function. The following dialog is opened by pressing **[OK]**:
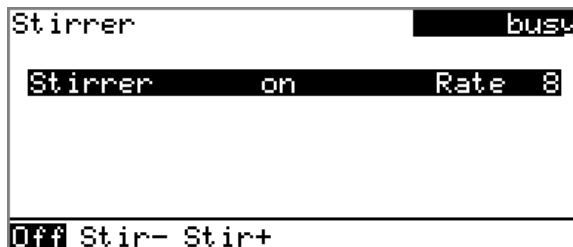
The stirring rate can be reduced with **Stir−** and increased with **Stir+**.
Off switches the stirrer off. **On** is displayed now instead. This can be
used to switch the stirrer back on. This dialog is exited with **[BACK]**.

After the completion of the titration, the results dialog is displayed:

```
Results                        ready
Content                       10.3 %
EP1      pH 7.499        10.0000 mL
         72.0 s             ERC 85.7
Stop volume reached


Curve Recalc Statistics
```

Canceling a determination manually

A determination can be canceled at any time with the **[STOP]** key.

5.9 Live modifications

5.9.1 Editing the sample data of the running determination

The sample data can be entered or modified in the main dialog while a determination is running. In calculations always the sample data entered at the end of the titration in the main dialog is used.

Proceed as follows to edit the sample data:

1 Displaying the main dialog

- Press **[BACK]**.

The main dialog is displayed. The determination continues to run in the background.

2 Editing the sample data

- Edit the sample data and apply with **Accept** or **[BACK]**.

3 Displaying the live dialog

- Press **[BACK]**.

or

- Select **Menu** and press **[OK]**.

```
Menu                           busy
 >Results
 >Live dialog
 >Parameters



```

- Select the menu item **Live dialog** and press **[OK]**.

The live dialog is displayed once again.

NOTE

If the determination is finished while an editing dialog is opened (e.g. of the sample size), then this will be closed automatically and the results dialog will be displayed. The value entered must be entered once more and the determination must be recalculated.

Make sure that the editing dialogs are closed before the determination is finished.

5.9.2 Editing the sample table while a determination is running

You can insert new lines or delete existing ones or edit sample data while a determination is running.

NOTE

We recommend that the editing dialogs always be closed in order to ensure that no problems occur during the run and that the current data is always available for calculation purposes.

Editing the sample table

Proceed as follows to edit the sample table:

1 Displaying the main dialog

- Press **[BACK]**.

The main dialog is displayed. The determination continues to run in the background.

2 Opening the main menu

- Select **Menu** and press **[OK]**.

```
Menu                    busy
 >Results
 >Live dialog
 >Parameters
 >Sample table
```

3 Selecting the sample data

- Select the menu item **Sample table** and press **[OK]**.
- Select the desired line.

- In the function bar, select **Edit** and press **[OK]**.

4 **Editing the sample data**

- Edit the sample data and apply with **Accept** or **[BACK]**.

> **ℹ** **NOTE**
>
> In addition to the sample data, the method can also be modified, except in cases where the determination is running.

5 **Displaying the live dialog**

- Select the menu item **Live dialog** in the main menu and press **[OK]**.

or

- Press **[BACK]** in the main dialog.

The live dialog is displayed once again.

Editing the sample data of the running determination

When you use the sample table, the editing of the sample data of the running determination proceeds as described in *chapter 5.9.1, page 36*. In addition, you have the option of editing these in the sample table. The first line always contains the sample data of the running determination. Simply select for this purpose the **Sample table***(see "Editing the sample table", page 37)* menu item in the main menu.

5.9.3 Editing the live parameters

Certain method parameters can be edited while a determination is being carried out. The only parameters that can be modified are those that can be selected. Nevertheless, all of the parameters are visible. The modified parameters are taken into account at once. If you modify, for instance, the start conditions after the start volume has been dosed, then these modifications will not be taken into account until the next determination.

Proceed as follows to edit the parameters:

1 **Displaying the main dialog**

- Press **[BACK]**.

The main dialog is displayed. The determination continues to run in the background.

2 **Opening the main menu**

- Select **Menu** and press **[OK]**.

```
Menu                    busy
 >Results
 >Live dialog
 >Parameters
```
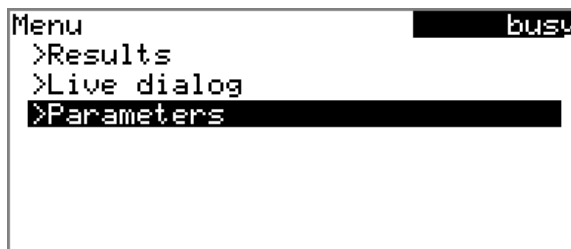
3 **Editing the method parameters**

- Select the menu item **Parameters** and press **[OK]**.
- Change the desired parameters accordingly.

4 **Displaying the live dialog**

- Select the menu item **Live dialog** in the main menu and press **[OK]**.

or

- Press **[BACK]** in the main dialog.

The live dialog is displayed once again.

5.10 Results

Menu ▶ Results

After the completion of the titration, the results dialog is displayed:

```
Results                 ready
 Content               10.3 %
 EP1    pH 7.499   10.0000 mL
            72.0 s      ERC 85.7
 Stop volume reached

 Curve Recalc Statistics
```
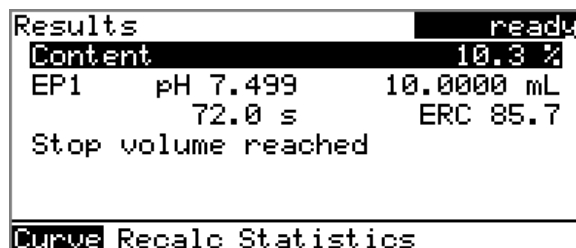
The calculated result and details concerning the endpoint are shown in the overview.

Curve

Display the curve of the current determination.

Recalculate

Recalculate the current determination. The procedure will be executed immediately.

Statistics

Display the statistical overview of a determination series *(see Chapter 5.11, page 40)*.

Displaying the curve

The curve of the current determination can be displayed with the **Curve** function.
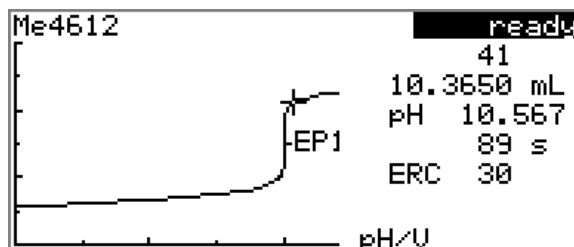
The arrow keys **[⇦]** and **[⇨]** can be used to move to the individual measuring points. A cross hair is used to show the current position on the curve. The data (volume, measured value, time, etc.) for the respective measuring point is indicated on the right-hand side.

Recalculating

> **ℹ NOTE**
>
> Recalculation cannot be undone.

All of the results are recalculated with the **Recalculate** function. This is necessary if, for example, the calculation, the titer or the sample size has been modified.

5.11   Statistics

Menu ▶ Results ▶ Statistics

The statistical overview of a determination series can be displayed in the **Results** dialog with the **Statistics** function.

> **ℹ NOTE**
>
> This function is visible only if statistics has been activated.

```
Statistics                    ready
Content
    Mean(3) 10.3 %
        s abs 0.06 %
        s rel 0.58 %
  Statistics 3/3

Details Reset Increase
```

The mean value (**Mean**), the absolute and the relative standard deviation (**s abs** and **s rel**) are displayed in the overview. For the mean value, the number of individual results from which it has been calculated is displayed in parentheses. In this example, it is 3. The **Statistics** line shows how many determinations have already been carried out and how many determinations are to be carried out in total. All three determinations were carried out in this example.

Details

Display additional data.

Reset

Delete all statistics data.

Increase

Add a further determination to the determination series.

Displaying statistical details

Additional data from the determination series can be displayed with the **Details** function.

```
Details                       ready
    Result          Sample size
  1 10.3 %          2.4731 g
  2 10.2 %          2.4910 g
  3 10.3 %          2.4873 g


On/Off
```

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

On/Off

Remove the selected determination from the statistics. The line will then be marked with an asterisk (*), the statistics will be recalculated automatically. If several calculations are defined in the method, then all the results will be removed from the statistics.

Deleting statistical data

All statistical data is deleted with the **Reset** function. The statistics data is deleted automatically in the following cases:

- When all of the determinations of the determination series have been carried out and a new determination has been started afterwards.
- When a new method is loaded.

Adding a determination to a determination series

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

5.12 Printing a report manually

Menu ▸ Print reports

Proceed as follows to print a report manually:

1 Opening the main menu

- In the main dialog, select **Menu** and press **[OK]**.

```
Menu                    ready
 >Manual control
 >Results
 >Parameters
 >System
 >Control
 >Print reports
```

2 Opening the print dialog

- Select the menu item **Print reports** and press **[OK]**.

The dialog window with the available reports opens:

```
Print reports           ready
 Results
 Curve
 Measuring point list
 Parameters
 System
 Calculations/Statistics
 Report as in method      ↓
```

3 Selecting the report

- Select the desired report and press **[OK]**.

The report is printed out.

The following reports can be printed out manually:

Results	Result report with determination properties, sample data, calculated results, etc.
Curve	Curve report. The width of the curve is defined in the system settings *(see "Graphics width", page 63)*.
Measuring point list	Measuring point list report.
Parameters	Report with all method parameters of the loaded method.
System	System report with system settings, solution list, external devices, etc.
Calculations/Statistics	Calculation report. The statistics are also printed out in the case of multiple determinations. The individual determinations with the respective sample size, the mean value, the absolute and the relative standard deviation are printed out for each result.
PC/LIMS	Machine-readable report with all of the data for a determination. This report can be saved as a TXT file to a connected USB flash drive or sent to a terminal program or a LIMS via an RS-232 interface. The definition is made in the system settings *(see "PC/LIMS report", page 62)*.
Report as in method	The reports that are defined in the method will be printed out.

5.13 Manual Control

Menu ▶ Manual control

The following functions are available in the manual control:

- Dosing
- Measuring
- Stirring

The available subfunctions are listed for each function in the function bar.

> **NOTE**
>
> The **Stirrer** function can only be selected if a stirrer is connected.

5.13.1   Dosing

The following dosing functions are available in the manual control:

Prepare buret unit (PREP)	Rinse the cylinder and tubings of the buret unit *(see Chapter 10.1.2, page 101)*.
Continuous dosing (DOS)	Dose while the **[START]** key is pressed.
Dose fixed volume (ADD)	Dose a specified volume.

Preparing the buret unit (PREP)

The **PREP** function is used to rinse the cylinder and tubings of the buret unit and fill them air bubble-free. You should carry out this function before the first determination or once per day.

Proceed as follows:

1 Open the manual control

■ In the main dialog, select **Menu** and press **[OK]**.
The main menu opens.
■ Select the menu item **Manual control** and press **[OK]**.

Manual control opens.

2 Select the dosing function

■ Select the **Dosing** item.

```
Manual control          ready
Dosing
Measure
Stirrer      off       Rate  8


PREP DOS ADD
```

■ In the function bar, select **PREP** and press **[OK]**.

The following message is displayed:

```
Splash warning          010-132

  ╻  Check the buret tip. It
  ┃  should point into a vessel.
  ╹  Do you want to continue?

 Yes  No
```

3 Start the preparing

> **ⓘ CAUTION**
>
> Make sure that the buret tip is directed into a vessel that can accommodate the volume of your buret unit several times over.

- Select **Yes** and confirm the message with **[OK]**.

Preparing is carried out.

Continuous dosing (DOS)

Continuous dosing will be carried out with the **DOS** function for as long as you keep the **[START]** key pressed down.

Proceed as follows:

1 Open the manual control

- In the main dialog, select **Menu** and press **[OK]**.
  The main menu opens.
- Select the menu item **Manual control** and press **[OK]**.

Manual control opens.

2 Select the dosing function

- Select the **Dosing** item.

```
Manual control          ready
 Dosing
 Measure
 Stirrer      off      Rate  8



 PREP  DOS  ADD
```

- In the function bar, select **DOS** and press **[OK]**.

```
Dosing                  ready
Dosing rate      max. mL/min
Filling rate     max. mL/min


Press [START] key
```

3 Configure the dosing function

> **ℹ NOTE**
>
> ■ The dosing and filling rate should be decreased for viscous liquids.
> ■ The maximum dosing and filling rate depends on the cylinder volume *(see Chapter 10.1.1, page 101)* .

■ Enter the dosing rate.
■ Enter the filling rate.

4 Start dosing

■ Press **[START]**.

The status changes to **busy**, the dosed volume is displayed. When a cylinder volume has been added, the dosing cylinder will be refilled automatically.

5 Fill the cylinder

■ Press **[STOP]** or **[BACK]**.

The dosing cylinder is filled. If you start the filling with **[BACK]**, then the dialog will also be exited.

Dosing a particular volume (ADD)

You can dose a particular volume with the **ADD** function.

Proceed as follows:

1 Open the manual control

■ In the main dialog, select **Menu** and press **[OK]**.
 The main menu opens.
■ Select the menu item **Manual control** and press **[OK]**.

Manual control opens.

2 **Select the dosing function**

- Select the **Dosing** item.

```
Manual control          ready
 Dosing
 Measure
 Stirrer      off       Rate  8



PREP DOS ADD
```

- In the function bar, select **ADD** and press **[OK]**.

```
Dosing                  ready
 Volume               10 mL
 Dosing rate    max.  mL/min
 Filling rate   max.  mL/min

 Press [START] key


```

3 **Configure the dosing function**

> ℹ **NOTE**
> ─────────────────────────────────
>
> - The dosing and filling rate should be decreased for viscous liq-
>   uids.
> - The maximum dosing and filling rate depends on the cylinder
>   volume *(see Chapter 10.1.1, page 101)* .

- Enter the desired volume.
- Enter the dosing rate.
- Enter the filling rate.

4 **Start dosing**

- Press **[START]**.

The status changes to **busy**, the dosed volume is displayed. When a
cylinder volume has been added, the dosing cylinder will be refilled
automatically.

5 **Fill the cylinder**

- Press **[STOP]** or **[BACK]**.

The dosing cylinder is filled. If you start the filling with **[BACK]**, then
the dialog will also be exited.

5.13.2   Measuring

Open the dialog for manual measurement as follows:

1   Open the manual control

- In the main dialog, select **Menu** and press **[OK]**.
  The main menu opens.
- Select the menu item **Manual control** and press **[OK]**.
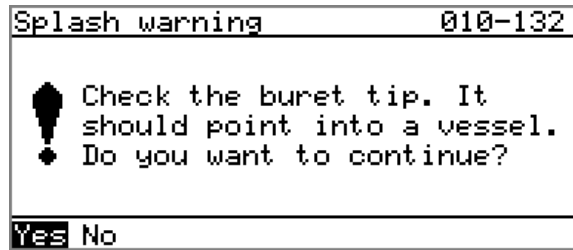
Manual control opens.

2   Select a measuring mode

- Select the **Measure** item.

```
Manual control              ready
 Dosing
 Measure
 Stirrer      off       Rate  8


pH U
```
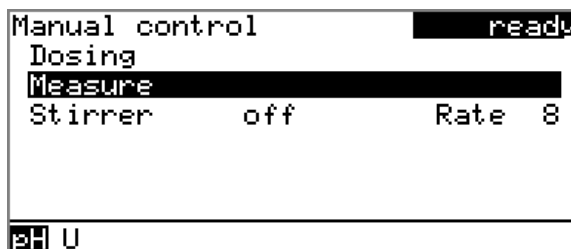
- In the function bar, select the measuring mode and press **[OK]**.

```
Measure                     ready
 Electrode          pH electrode
 Temperature          25.0 °C


 Press [START] key

```
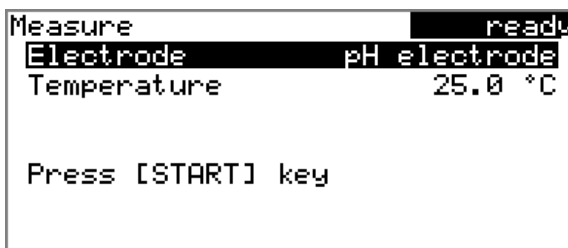
3   Configure the measuring mode

- Select the desired electrode from the sensor list.
  The selection depends on the measuring mode. Sensors are
  defined under **System ▸ Sensors**.
- Enter the measuring temperature if no temperature sensor is con-
  nected. If a temperature sensor is connected then the tempera-
  ture will be measured automatically.
  This temperature is used for automatic temperature compensation
  with pH measurements.

4   Start the measurement

- Press **[START]**.

```
┌─────────────────────────────────────────┐
│ Measure                          busy    │
│                                          │
│                                          │
│      *** pH        6.362 ***             │
│      ***          20.5 °C ***            │
│                                          │
│                                          │
│                                          │
└─────────────────────────────────────────┘
```

The status changes to **busy**. The current measured value and the measuring temperature are displayed.

5 Stop the measurement

- Press **[STOP]** or **[BACK]**.

The measurement is stopped. The status changes back again to **ready**. If you stop the measurement with **[BACK]**, then the dialog will also be exited.

5.13.3   Stirring

You can control a connected stirrer manually.

Proceed as follows:

1 Open the manual control

- In the main dialog, select **Menu** and press **[OK]**.
  The main menu opens.
- Select the menu item **Manual control** and press **[OK]**.

Manual control opens.

2 Set the stirring rate

- Select the **Stirrer** item.

```
┌─────────────────────────────────────────┐
│ Manual control                  ready    │
│  Dosing                                  │
│  Measure                                 │
│  Stirrer       off         Rate  8       │
│                                          │
│                                          │
│                                          │
│ On Stir- Stir+                           │
└─────────────────────────────────────────┘
```

- In the function bar, select **Stir–** or **Stir+**.
  The stirring rate will be increased or decreased by one step each time the **[OK]** key is pressed.
  The algebraic sign changes the direction in which the stirring is done. When the stirrer is viewed from above, this means:
    - "+": counterclockwise rotation
    - "–": clockwise rotation

3 **Switch on the stirrer**

■ In the function bar, select **On** and press **[OK]**.

The stirrer is started and stirs at the rate which has been set. **Off** is now displayed in the function bar.

4 **Switch off the stirrer**

■ In the function bar, select **Off** and press **[OK]**.

The stirrer is stopped.

6 System settings

6.1 Basic settings

Menu ▸ System ▸ Settings

This chapter contains a description of general instrument settings.

User name

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

Entry	**max. 12 characters**
Default value	**empty**

Instrument name

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

Entry	**max. 10 characters**
Default value	**empty**

Serial number

Serial number of the instrument. This is printed as a part of the instrument identification in the report header.

Program version

Version number of the instrument software. This is printed as a part of the instrument identification in the report header.

Time

Current time. Only valid numbers can be entered.

Format: hh:mm:ss

Date

Current date. Only valid numbers can be entered.

Format: YYYY:MM:DD

Language

Setting the dialog language. An additional language can be selected besides English.

> **ℹ NOTE**
>
> In order to ensure that a second language can be selected, it must first be installed. This installation must be carried out by specialist personnel. In chapter *Language files, page 65*, you will find details regarding the installation of a second language.

Dialog type

The user dialog can be limited for routine operations. One can operate normally with methods in the limited dialog. However, no settings can be made or methods deleted.

The resetting of the dialog will take effect as soon as you exit the main menu.

The limitation of the dialog results in the following:

- The menu items **System**, **Parameters** and **Control** are not shown in the main menu.
- Methods can only be loaded, but not deleted, exported or created.

> **ℹ NOTE**
>
> If the limited dialog for routine operation is activated, then the expert dialog cannot be activated during ongoing operation. To change the dialog type, the 877 Titrino plus must be switched off and then back on again. The expert dialog can be forced as soon as the instrument is started up again. Then it is possible to enter whatever settings one wishes, e.g. the changing of the dialog type. If the instrument is switched off again without changing the dialog type, then the routine dialog will remain activated.

Forcing the expert dialog:

- Switch on the instrument.
- Wait for the display of the instrument logo with the lettering **easy, safe, precise**.
- Press the **[STOP]** key once again and hold it down while also briefly pressing the **[BACK]** key.
- Release both keys once again.

Selection	**Expert** | **Routine**
Default value	**Expert**

Expert
Complete dialog.

Routine

Limited dialog for routine operations.

Contrast

The contrast of the display can be adjusted with the arrow keys [⇦] and [⇨].

- [⇦]: the contrast will be decreased by one step each time the key is pressed.
- [⇨]: the contrast will be increased by one step each time the key is pressed.

Input range	**150 - 240**
Default value	**212**

> **NOTE**
>
> Alternatively, the contrast can also be modified in the following manner:
>
> Keep the red **[STOP]** key pressed down. As soon as the progress bar appears, also press the arrow key **[⇩]** or **[⇧]** repeatedly.
>
> This method will, however, cause the contrast to be modified by several steps.

Beep

If this parameter is activated, then a short beep will sound in the following cases:

- When a key is pressed.
- At the end of the determination.
- When the system remains conditioned without interruption for 10 seconds.

Selection	**on**	**off**
Default value	**on**	

PREP warning

If this parameter is activated, then the recommendation will be made to carry out the function **PREP** (Preparing):

- After the instrument is switched on.
- Each time a buret unit is attached.

All tubing and the cylinder are rinsed with this function *(see Chapter 10.1.2, page 101)*.

Selection	**on** | **off**
Default value	**on**

Temperature sensor

The instrument supports the use of two different temperature measurement techniques:

- NTC (Negative Temperature Coefficient)
- Pt1000 (platinum resistance)

Select the type here that has been connected to the instrument. If you use an NTC sensor, it is required that two characteristics for the sensor be entered in addition. These characteristics are listed in the specifications of the sensor.

Selection	**Pt1000** | **NTC**
Default value	**Pt1000**

R (25 °C)

This parameter is visible only when **Temperature sensor** = **NTC**.

Nominal resistance of the NTC sensor at 25 °C.

Input range	**1000 - 99999 ohm**
Default value	**30000 ohm**

B value

This parameter is visible only when **Temperature sensor** = **NTC**.

Material constant of the NTC sensor. B values of NTC sensors are frequently based on different reference temperatures (usually 25 °C and 50…100 °C).

Input range	**1000 - 9999 K**
Default value	**4100 K**

6.2 Managing sensors

6.2.1 General

Menu ▸ System ▸ Sensors

```
Sensor list              ready
pH electrode
Metal electrode
Temperature sensor


Edit New Delete
```

Three standard sensors are defined in the sensor list: **pH electrode**, **Metal electrode** and **Temperature sensor**. These sensors cannot be deleted or renamed. The sensor list can contain a maximum of 10 sensors.

Every sensor is identified with an unambiguous name. This means that it is not possible to use the same name twice, e.g. for a pH electrode and for a metal electrode.

Edit

Edit the data of the selected sensor, see following chapter.

New

Add a new sensor to the list, see following chapter.

The following sensor types can be selected:

- pH electrode
- Metal electrode
- Temperature sensor
- Other sensor, e.g. Spectrosense

Delete

Delete the selected sensor from the list.

6.2.2 Editing the sensor data

Name

The designation of the sensor is used for unambiguous identification.

Entry	**max. 24 characters**
Default value	**empty**

Type

The sensor type is displayed.

Slope

This parameter only appears for pH electrodes.

Slope of the pH electrode. With a 1-point calibration, only pH(0) can be calculated, 100.0 % is used as the slope.

Input range	**−999.9 - 999.9 %**
Default value	**100.0 %**

pH(0)

This parameter only appears for pH electrodes.

pH value of the pH electrode at 0 mV. Apart from the slope, pH (0) is the second characteristic of the calibration curve.

Input range	**−20.000 - 20.000**
Default value	**7.000**

Calibration temp.

This parameter only appears for pH electrodes.

Temperature at which the last calibration was carried out.

Input range	**−20.0 - 150.0 °C**
Default value	**25.0 °C**

Calibration date

This parameter only appears for pH electrodes.

Date of the last calibration.

Monitoring

This parameter only appears for pH electrodes.

Activating and deactivating the calibration monitoring.

Selection	**on	off**
Default value	**off**

Time interval

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

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

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

6.3 Managing solutions

6.3.1 General

Menu ▸ System ▸ Solutions

Solutions can be used in intelligent buret units or in non-intelligent buret units. Intelligent buret units have a built-in data chip on which the data for the reagent is stored. This data is automatically read out during attachment and entered in the solution list.

```
Solution list        ready
Reagent 1           *IEU
Reagent 2            EU



Edit New Delete
```

The name and the type are specified for each solution in the solution list. The asterisk (*****) on the right-hand side indicates that this buret unit is attached (only for intelligent buret units). An unlimited number of solutions in buret units with data chip can be added to the solution list. The number of solutions in buret units without data chip is limited to 10 items.

Meaning of the type:

- **EU**: exchange unit without data chip
- **IEU**: exchange unit with integrated data chip

Edit

Edit the data of the selected solution, see following chapter.

New

Add a new solution to the list, see following chapter.

Delete

Delete the selected solution from the list.

6.3.2 Editing the solution data

Name

The designation of the solution is used for unambiguous identification.

Entry	**max. 24 characters**
Default value	**empty**

Type

The model of the buret unit is displayed.

Cylinder volume

Cylinder volume of the buret unit in mL. The cylinder volume is automatically read out with intelligent buret units.

Selection	**1	5	10	20	50**
Default value	**20**

Concentration

Concentration of the solution.

Input range	**–999999999 - 9999999999**
Default value	**1.000**

Concentration unit

Unit of the concentration.

Selection	**µmol/mL	mmol/L	mol/L	g/L	mg/L	mg/mL	µg/L	ppm	%	mEq/L	User-defined**
Default value	**mol/L**

User-defined
A user-defined unit can be created. This will be added to the selection list. The previous entry will be overwritten as soon as the new unit has been defined. A blank entry can be generated this way as well.

Titer

Titer of the solution.

Input range	**–999999999 - 9999999999**
Default value	**1.000**

Titer unit

Unit of the titer.

Selection	**µmol/mL	mmol/L	mol/L	g/L	mg/L	mg/mL	µg/L	ppm	%	mEq/L	empty	User-defined**
Default value	**empty**

User-defined
A user-defined unit can be created. This will be added to the selection list. The previous entry will be overwritten as soon as the new unit has been defined. A blank entry can be generated this way as well.

Date titer det.

Date of the last titer determination.

Monitoring

Activating and deactivating the titer monitoring.

Selection	**on** | **off**
Default value	**off**

Time interval

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

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

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

6.4 Managing common variables

6.4.1 General

Menu ▸ System ▸ Common variables

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

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

```
Common variables          ready
CV01              1.0472
CV02              0.9638
CV03                 0.0
CV04                 0.0
CV05                 0.0

Edit Delete
```

The common variables have the non-changeable designation **CV01…CV05**. The value is displayed for every variable. No unit can be assigned to the common variables.

Edit

See the following chapter for editing the data of the selected common variable.

Delete

Set the selected common variable to **invalid**.

6.4.2 Editing common variables

The common variables can be modified as follows:

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

Assigning a result automatically to a common variable

Proceed as follows:

1 Opening the editing dialog of the result

- Select the menu item **Parameters ▸ Calculation** and press **[OK]**.
- Select the result whose value is to be assigned to a common variable.
- In the function bar, select **Edit** and press **[OK]**.

```
Edit result              ready
 Result name             Blank
 R1=                       EP1
 Decimal places             2
 Result unit                %
 Save as titer            off
 Save as CV               off
```
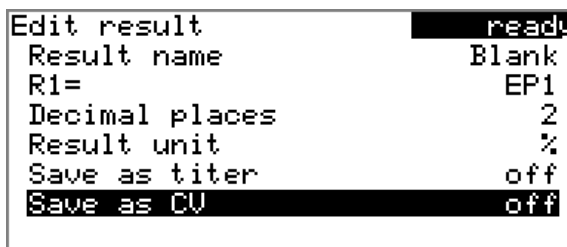
2 Adjusting the result properties

- Select the parameter **Save as CV** and press **[OK]**.
- Select the entry **on** in the selection list and apply with **[OK]**.

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

- Result **R1** ⇨ Common Variable **CV01**
- Result **R2** ⇨ Common Variable **CV02**
- etc.

> **ℹ NOTE**
>
> If you have set the parameter **Statistics** to **on**, then the mean value of the results will be assigned to the respective common variable.

6.5   File management

Menu ▶ System ▶ File management

> **ℹ NOTE**
>
> This menu item is visible only if a USB flash drive has been connected as an external storage medium.

Methods can be imported and deleted from a USB flash drive in this dialog. Only methods located in the **Files** directory are displayed in the list *(see "Directory structure on the USB flash drive", page 61)*.

A backup of the system can be created (all data and settings). Similarly, an existing backup can be reloaded.

Import

Import the selected method.

Delete

Delete the selected method.

Backup

Create a backup of all data and settings on the USB flash drive.

> **ℹ NOTE**
>
> Only **one** backup can be created on the same USB flash drive.
>
> If a backup is already stored on the flash drive, then this will be overwritten as soon as the function is performed once again.

Restore

Load the backup from a connected USB flash drive.

Directory structure on the USB flash drive

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

Figure 18   Directory structure on the USB flash drive

Backup	All of the files of the backup are stored in this directory. The directory is created as soon as a backup is created for the first time.
Files	Exported methods are stored in this directory. The directory is created as soon as a backup is exported for the first time.
	Only methods located in this directory can be imported.
pc_lims_report	PC/LIMS reports are stored in this directory as TXT files. The directory is created as soon as a PC/LIMS report is printed for the first time.

6.6 Configuring external devices

Menu ▶ System ▶ External devices

PC/LIMS report

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

- as a TXT file on a USB flash drive.
- to a LIMS via an RS-232 interface. The 6.2148.030 RS-232/USB Box is required for this purpose.

Selection	**COM2	USB Stick**
Default value	**USB Stick**

COM2
The report is sent via the serial COM2 interface. The interface parameters set in the dialog **COM2 settings** are used *(see "Editing the COM2 settings", page 64)*.

USB Stick
The report will be saved as a TXT file on the USB flash drive in the folder **pc_lims_report**.

Printer

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

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

Selection	**Citizen (ESC-POS)	Custom (ESC-POS)	Epson	Epson (ESC-POS)	HP DeskJet	HP LaserJet	Seiko (ESC-POS)**
Default value	**HP DeskJet**

Graphics width

Adjust the width of the curve to be printed out to the paper width of the printer to be used. The default value depends on the selected printer. The height of the curve is 2/3 of the width.

Input range	**100 - 3000 Pixels**

Keyboard layout

A commercially available USB keyboard can be connected to make it easier to enter text and numbers. Specify the country-specific keyboard layout.

Selection	**English US │ French FR │ German CH │ German DE │ Spanish ES**
Default value	**English US**

Balance

If you have connected a balance, then you must define the balance type here.

Selection	**AND │ Mettler │ Mettler AT │ Mettler AX │ Ohaus │ Precisa │ Sartorius │ Shimadzu**
Default value	**Sartorius**

The following table indicates the balance type that needs to be selected for the balance model:

Balance	Balance type
AND	**AND**
Mettler AB, AE, AG, AM, AJ, PE, PM, PJ, PR, XP, XS	**Mettler**
Mettler AT	**Mettler AT**
Mettler AX, MX, UMX, PG, AB-S, PB-S	**Mettler AX**
Ohaus Voyager, Explorer, Analytical Plus	**Ohaus**
Precisa	**Precisa**
Sartorius	**Sartorius**
Shimadzu BX, BW	**Shimadzu**

Editing the COM1 settings

Menu ▶ System ▶ External devices ▶ COM1 settings

The interface parameters for the connected balance are set under **COM1 settings**.

Baud rate

Transfer rate in characters per second.

Selection	**1200**	**2400**	**4800**	**9600**	**19200**	**38400**	**57600**	**115200**
Default value	**9600**

Data bits

Number of data bits.

Selection	**7**	**8**
Default value	**8**

Stop bits

Number of stop bits.

Selection	**1**	**2**
Default value	**1**

Parity

Type of parity testing.

Selection	**even**	**none**	**odd**
Default value	**none**

Handshake

Type of the data transfer protocol.

Selection	**hardware**	**software**	**none**
Default value	**hardware**

ℹ️ **NOTE**

If communications problems occur, set the parameter **Handshake** to **software**, and make another attempt.

Editing the COM2 settings

Menu ▶ System ▶ External devices ▶ COM2 settings

The interface parameters for instruments connected to the **RS-232/2** connector of the RS-232/USB Box (e.g. PC) are set under **COM2 settings**. The parameters and input ranges are identical to those for the COM1 interface.

6.7 Instrument diagnosis

6.7.1 Loading program versions and language files

Menu ▸ System ▸ Diagnosis

New program versions or language files can be loaded from a USB flash drive. The corresponding file must be saved on the USB flash drive in a directory with the instrument number (e.g. 848 or 863).

You can distinguish between language files and program files by noting how the file name is constructed.

Program files

They are instrument-specific. The file name has the following structure:

5XXXyyyy.bin where

XXX = Instrument type (e.g. 848 for the 848 Titrino plus)

yyyy = Program version

Language files

They can be recognized by means of the two-digit language code in the file name. A language file contains the dialog texts for various instrument types. It is not instrument-specific. The file name has the following structure:

5848xxxxYY.bin where

xxxx = Version number

YY = Language, e.g. DE (German), FR (French), ES (Spanish)

Loading a file

Proceed as follows:

1 Connecting the USB flash drive

■ Plug in the USB flash drive with the 6.2151.100 adapter (USB MINI (OTG) - USB A) at the instrument's USB port.
■ Switch on the instrument.

2 Opening the update dialog

■ Under **Menu ▸ System ▸ Diagnosis**, select the menu item **Software update**.
■ Press **[OK]**.

```
┌─────────────────────────────────┐
│Software update        ▐  ready▌ │
│Program version        ▐58480011▌│
│                                 │
│ Press [START] key to continue   │
│                                 │
│                                 │
│                                 │
└─────────────────────────────────┘
```

3 Opening the file selection

- Press **[OK]**.

The selection list with the program and language files present on the USB flash drive opens.

4 Selecting the file

- Use the arrow keys to select the required file.
- Press **[OK]**.

5 Starting the update

- Press **[START]**.

The update process is started, it runs automatically. At the end of the process, the instrument will be switched off automatically and switched back on again. No user intervention is required.

6.7.2   Diagnosis functions

Electronic and mechanical functional groups in Metrohm instruments can and should be checked as part of regular maintenance by specialist personnel from Metrohm. Please ask your local Metrohm representative regarding the precise terms and conditions involved in concluding a corresponding maintenance agreement.

7 Parameters

7.1 Monotonic equivalence point titrations (MET)

7.1.1 Start conditions

Menu ▶ Parameters ▶ Start conditions

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

Activation pulse

Output of an activation pulse on a remote line. This activation pulse starts a connected Dosimat.

Selection	**on | off**
Default value	**off**

Start delay time

Waiting time after the start of the determination, before titration takes place. An auxiliary solution can, e.g. be added with a Dosimat during this time (parameterization at the Dosimat). The **Activation pulse** parameter must however be switched on for this purpose.

Input range	**0 - 999999 s**
Default value	**0 s**

Start volume

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

Input range	**0.00000 - 9999.99 mL**
Default value	**0.00000 mL**

Dosing rate

Rate at which the start volume is dosed. The maximum dosing rate depends on the cylinder volume *(see Chapter 10.1.1, page 101)*.

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

Pause

Waiting time, e.g. in case of a slow response of the electrode after the start or reaction time after the dosing of a start volume.

Input range	**0 - 999999 s**
Default value	**0 s**

Request sample ID

Selection of the sample identification that is queried in the method run.

Selection	**off** | **ID1** | **ID2** | **ID1&ID2**
Default value	**off**

Request sample size

If this parameter is switched on, then the value for the sample size will be queried.

Selection	**on** | **off**
Default value	**off**

Request sample unit

If this parameter is switched on, then the unit for the sample size will be queried.

Selection	**on** | **off**
Default value	**off**

Hold at request

If this parameter is switched on, then the method run will be paused during the query. If the parameter is switched off, the titration will be started in the background.

Selection	**on** | **off**
Default value	**on**

7.1.2   Titration parameters

Menu ▶ Parameters ▶ Titration parameters

The parameters that influence the sequence of the entire titration are defined under **Titration parameters**.

Titration rate

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

Selection	**slow** | **optimal** | **fast** | **user**
Default value	**optimal**

slow
For titrations in which the finest details are also to be visible. This could however also lead to an increase in noise, which could result in unwanted equivalence points.

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

fast

For fast and less critical titrations.

user

The individual titration parameters can be modified.

> **NOTE**
>
> Select the **optimal** titration rate when you are developing a new titration method. This parameter is suitable for virtually all titrations and only needs adaptation in special cases.

The settings of the individual titration rates are listed in *table 1, page 71*.

Volume increment

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

Volume that is dosed in each dosing step. The choice of the correct volume increment is a basic requirement for achieving high accuracy. A good guideline is 1/20 of the expected EP volume. For steep jumps the volume increment should tend toward 1/100 and for flat jumps toward 1/10 of the EP volume.

Small volume increments are used for determining blank values or with very asymmetrical curves. The accuracy of the evaluation cannot be increased by using smaller increments as the measured value alterations between two measuring points are then of the same order of magnitude as the noise.

Input range	**0.00005 - 999.900 mL**
Default value	**0.10000 mL**

Dosing rate

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

Rate at which the volume increments are dosed. The maximum dosing rate depends on the cylinder volume *(see Chapter 10.1.1, page 101)*.

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

Signal drift

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

Maximum permissible drift for the measured value acceptance, i.e. maximum change of the measured value per minute. This type of titration is often referred to as equilibrium titration.

> **NOTE**
>
> A constant measured value is often only achieved after a certain time, as mixing and the reaction itself require a certain time. The response time of an electrode can also increase with time, i.e. reaching a constant measured value takes longer and longer. Drift-controlled measured value acceptance is particularly advisable in such cases, as the measured values are only accepted when equilibrium has almost been achieved.

Measuring mode pH, U and Ipol:

Input range	**0.1 - 999.0 mV/min**
Default value	**50.0 mV/min**
Selection	**off**

off
Measured value acceptance will take place after the maximum waiting time has elapsed. This can be useful when the titration reaction proceeds slowly or the electrode is slow to respond.

Measuring mode Upol:

Input range	**0.01 - 99.90 µA/min**
Default value	**50.00 µA/min**
Selection	**off**

off
Measured value acceptance will take place after the maximum waiting time has elapsed. This can be useful when the titration reaction proceeds slowly or the electrode is slow to respond.

Min. waiting time

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

The measured value is not accepted until the minimum waiting time has elapsed, even if the signal drift has already been reached. The minimum waiting time is only important for drift-controlled measurements.

Input range	**0 - 999999 s**
Default value	**0 s**

Max. waiting time

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

If signal drift has been switched off or has not yet been reached, then the measured value will be accepted when the maximum waiting time has elapsed.

Input range	**0 - 999999 s**
Default value	**26 s**

Table 1   Standard values for predefined titration rates for MET

	Titration rate		
	slow	**optimal**	**fast**
Volume increment	0.05000 mL	0.10000 mL	0.20000 mL
Dosing rate	maximum	maximum	maximum
Signal drift – pH, U and Ipol – Upol	 20.0 mV/min 20.0 µA/min	 50.0 mV/min 50.0 µA/min	 80.0 mV/min 80.0 µA/min
Min. waiting time	0 s	0 s	0 s
Max. waiting time	38 s	26 s	21 s

Temperature

Manually entered titration temperature. If a temperature sensor is connected then the temperature will be measured continuously. This value is used for temperature correction in pH measurements.

Input range	**−20.0 - 150.0 °C**
Default value	**25.0 °C**

Sensor

Selection of the sensor from the sensor list. The selection depends on the measuring mode. Sensors are defined under **System ▶ Sensors**.

Selection	**Selection of configured sensors**

Solution

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

For buret units with integrated data chip, a check is made in the method run to verify whether the correct solution has been attached and whether the type of dosing drive matches. For buret units without integrated data chip, the cylinder volume and the type of dosing drive are checked. The validity of the titer is checked for the selected solution at the start of the determination.

Selection	**Selection of configured solution	not defined**
Default value	**not defined**

not defined

No check takes place.

I(pol)

The polarization current is the current that is applied at a polarizable electrode during the voltametric measurement. This parameter is available only with I(pol) determinations.

Input range	**−125 - 125 µA** (Increment: **1**)
Default value	**5 µA**

U(pol)

The polarization voltage is the voltage applied to the polarizable electrode during an amperometric measurement. This parameter is available only with U(pol) determinations.

Input range	**−1250 - 1250 mV** (Increment: **10**)
Default value	**400 mV**

Electrode test

For polarizable electrodes, an electrode test can be carried out. A check is made that the electrode is properly connected and that no short-circuit is present. The electrode test is carried out when the determination is started. This parameter is available only with I(pol) and U(pol) determinations.

Selection	**on	off**
Default value	**off**

Stirrer

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

Selection	**on	off**
Default value	**on**

Stirring rate

Setting the stirring rate. It can be set in steps of −15 to +15. The default setting **8** corresponds to 1000 U/min. The formula for calculating the rotational speed is specified in *chapter 10.2, page 102*. The optimum stirring rate can be tested in the manual control.

The algebraic sign of the stirring rate changes the direction in which the stirring is done. When the stirrer is viewed from above, this means:

- "+": counterclockwise rotation
- "−": clockwise rotation

Input range	**−15 - 15**
Default value	**8**

7.1.3 Stop conditions

Menu ▶ Parameters ▶ Stop conditions

The conditions for stopping a titration are defined under **Stop conditions**.

Stop volume

The titration is stopped when the specified volume has been dosed since the start of the titration. This volume should be adjusted to the size of the titration vessel in order to prevent the contents from running over.

Input range	**0.00000 - 9999.99 mL**
Default value	**100.000 mL**
Selection	**off**

Stop meas. value

The titration is stopped when the specified measured value has been reached since the start of the titration.

Measuring mode pH:

Input range	**−20.000 - 20.000**
Selection	**off**
Default value	**off**

Measuring mode U, Ipol:

Input range	**−1250.0 - 1250.0 mV**
Selection	**off**
Default value	**off**

Measuring mode Upol:

Input range	**−125.0 - 125.0 µA**
Selection	**off**
Default value	**off**

Stop EP

The titration is stopped when the specified number of equivalence points has been found.

Input range	**1 - 9**
Default value	**9**
Selection	**off**

Volume after EP

This volume will be added when the number of equivalence points defined under **Stop EP** has been found. The curve shape after the equivalence point can also be seen this way.

Input range	**0.01000 - 9999.99 mL**
Selection	**off**
Default value	**off**

Stop time

The titration is stopped when the specified time has elapsed since the start of the titration.

Input range	**0 - 999999 s**
Selection	**off**
Default value	**off**

Filling rate

Rate at which the dosing cylinder is filled after the titration. The maximum filling rate depends on the cylinder volume *(see Chapter 10.1.1, page 101)*.

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

7.1.4 Evaluation

Menu ▶ Parameters ▶ Evaluation

The parameters for the evaluation of the titration curve are defined under **Evaluation**.

Window

Switch this parameter on when equivalence points are to be recognized only in one particular measured value range (window) of the curve. Only one window can be defined.

Selection	**on	off**
Default value	**off**

Lower limit

This parameter is visible only when **Window** = **on**.

Measured value for the lower limit.

Measuring mode pH:

Input range	**−20.000 - 20.000**
Default value	**−20.000**

Measuring mode U, Ipol:

Input range	**−1250.0 - 1250.0 mV**
Default value	**−1250.0 mV**

Measuring mode Upol:

Input range	**−125.00 - 125.00 µA**
Default value	**−125.00 µA**

Upper limit

This parameter is visible only when **Window** = **on**.

Measured value for the upper limit.

Measuring mode pH:

Input range	**−20.000 - 20.000**
Default value	**20.000**

Measuring mode U, Ipol:

Input range	**−1250.0 - 1250.0 mV**
Default value	**1250.0 mV**

Measuring mode Upol:

Input range	**−125.00 - 125.00 µA**
Default value	**125.00 µA**

EP criterion

The equivalence point criterion found (ERC = Equivalence point Recognition Criterion) is compared with this value. Equivalence points whose ERC is less than the value defined here will be ignored.

Measuring mode pH:

Input range	**0.10 - 9.99**
Default value	**0.50**

Measuring mode U, Ipol:

Input range	**1 - 999 mV**
Default value	**30 mV**

Measuring mode Upol:

Input range	**0.1 - 99.9 µA**
Default value	**2.0 µA**

EP recognition

This parameter allows you to filter out only the equivalence points that are being sought.

for Window = off

Selection	**all** | **greatest** | **last** | **off**
Default value	**all**

all

All equivalence points will be recognized.

greatest

Only the equivalence point with the greatest ERC value, i.e. the steepest jump, will be recognized.

last

Only the last equivalence point will be recognized.

off

No evaluation takes place.

for Window = on

Selection	**first	greatest	last**
Default value	**first**

first

Only the first equivalence point will be recognized.

greatest

Only the equivalence point with the greatest ERC value, i.e. the steepest jump, will be recognized.

last

Only the last equivalence point will be recognized.

Fixed EP1 at

The associated volume will be interpolated from the measuring point list for the measured value entered. The fixed endpoint must lie between the first and the final entry in the measuring point list.

Measuring mode pH:

Input range	**−20.000 - 20.000**
Selection	**off**
Default value	**off**

Measuring mode U, Ipol:

Input range	**−1250.0 - 1250.0 mV**
Selection	**off**
Default value	**off**

Measuring mode Upol:

Input range	**−125.00 - 125.00 µA**
Selection	**off**
Default value	**off**

Fixed EP2 at

See **Fixed EP1 at**.

Evaluation and equivalence point criterion with MET

The equivalence points (EPs) are localized by a method based on the Fortuin method which has been adapted by Metrohm for numerical methods. A search is made for the largest measured value alteration (Δ_n). The exact EP is determined by using an interpolation factor ρ which depends on the Δ values before and after Δ_n.

$$V_{EP} = V_0 + \rho \cdot \Delta V$$

V_{EP}:   EP volume

V_0:   Dosed total volume before Δ_n

ΔV: Volume increment

ρ: Interpolation factor according to Fortuin

For the recognition of the EPs found the set EP criterion is compared with the ERC (Equivalence point Recognition Criterion) found. The ERC is the sum of the measured value alterations before and after the jump:

$$\left|\Delta_{n-2}\right| + \left|\Delta_{n-1}\right| + \left|\Delta_n\right| + \left|\Delta_{n+1}\right| + \left|\Delta_{n+2}\right|$$

In certain cases only three or only a single summand are taken into account.

EPs whose ERC is smaller than the defined EP criterion will not be recognized. The ERC is displayed in the results dialog for each discovered and recognized EP. If you adjust the EP criterion after the fact in order to recognize more or fewer EPs, then you can initiate the reevaluation in the results dialog with the **[Recalc]** key.

7.1.5   Calculation

7.1.5.1   General

Menu ▶ Parameters ▶ Calculation

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

```
Calculation              ready
 R1: Content
 R2:
 R3:
 R4:
 R5:

Edit Delete
```

The result name is specified in the list for each calculation.

Edit

Edit the data of the selected calculation, see following chapter.

Delete

Delete the selected calculation.

7.1.5.2   Editing a calculation

Result name

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

Entry	**12 characters**
Default value	**empty**

R1=…R5=

Shows the calculation formula. A special editor is opened for the definition *(see Chapter 5.3, page 22)*.

Entry	**44 characters**
Default value	**empty**

Decimal places

Number of decimal places used to display the result.

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

Result unit

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

Selection	**% | mol/L | mmol/L | g/L | mg/L | mg/mL | ppm | g | mg | mL | mg/piece | °C | µL | mL/min | User-defined**
Default value	**%**

User-defined
A user-defined unit can be created. This will be added to the selection list. The previous entry will be overwritten as soon as the new unit has been defined. A blank entry can be generated this way as well.

Save as titer

The result can be saved as titer for this selected solution. If statistics has been switched on, then the current mean value of the determination series will be saved.

Selection	**on | off**
Default value	**off**

Save as CV

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

Selection	**on	off**
Default value	**off**

7.1.6   Statistics

Menu ▸ Parameters ▸ Statistics

The statistics calculation of a multiple determination is switched on under **Statistics** and it is defined how many determinations the series contains.

Statistics

If this funtion is switched on, then statistics calculations will be carried out for all of the defined results.

Selection	**on	off**
Default value	**off**

Number of samples

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

If an additional determination must be added to the determination series, because one determination was incorrect, for example, then this can be accomplished in the statistical overview *(see Chapter 5.11, page 40)*.

Input range	**2 - 20**
Default value	**3**

7.1.7   Reports

Menu ▸ Parameters ▸ Reports

The reports that will be printed out automatically in connection with a determination are defined under **Reports**.

Results

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

Selection	**on	off**
Default value	**off**

Curve

Curve report. The width of the curve is defined in the system settings *(see "Graphics width", page 63)*.

Selection	**on**	**off**
Default value	**off**	

Calculations/Statistics

Output of the calculation formulas for the individual results. The results are printed with the maximum resolution. This makes recalculation with an external program possible. The following data is printed out in addition when statistics is switched on:

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

Selection	**on**	**off**
Default value	**off**	

Measuring point list

Output of the measuring point list.

Selection	**on**	**off**
Default value	**off**	

Parameters

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

Selection	**on**	**off**
Default value	**off**	

PC/LIMS

The PC/LIMS report is a machine-readable report with all of the data important for a determination. The PC/LIMS report can be saved as a TXT file on a USB storage medium or sent via an RS-232 interface to a LIMS. The output location is defined in the system settings *(see "PC/LIMS report", page 62)*.

The file name of the TXT file is constructed as follows: *PC_LIMS_Report-ID1-YYYYMMDD-hhmmss.txt*.

Selection	**on**	**off**
Default value	**off**	

7.2 Endpoint titrations (SET)

7.2.1 Conditioning

Menu ▶ Parameters ▶ Conditioning

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

Conditioning

If this parameter is switched on, then the first time the titration is started the working medium will be titrated to the endpoint with the specified control parameters. The status is kept stable. The actual method run does not begin until **[START]** has been pressed once more. Conditioning will be carried out again automatically after the titration.

Selection	**on**	**off**
Default value	**off**

Start drift

Conditioning OK will be displayed as soon as this volume drift has been reached and the titration can be started.

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

Drift correction

The endpoint volume can be corrected by taking the drift value into account. For this, the volume drift is multiplied with the drift correction time and this value is then subtracted from the endpoint volume. The drift correction time is the time interval between the end of conditioning and the end of the determination.

Selection	**auto**	**manual**	**off**
Default value	**off**

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

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

off
No drift correction takes place.

Drift value

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

Volume drift for manual drift correction.

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

Cond. stop volume

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

Input range	**0.00000 - 9999.99 mL**
Default value	**20.0000 mL**
Selection	**off**

Cond. stop time

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

Input range	**0 - 999999 s**
Selection	**off**
Default value	**off**

7.2.2 Start conditions

Menu ▶ Parameters ▶ Start conditions

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

Activation pulse

Output of an activation pulse on a remote line. This activation pulse starts a connected Dosimat.

Selection	**on	off**
Default value	**off**

Start delay time

Waiting time after the start of the determination, before titration takes place. An auxiliary solution can, e.g. be added with a Dosimat during this time (parameterization at the Dosimat). The **Activation pulse** parameter must however be switched on for this purpose.

Input range	**0 - 999999 s**
Default value	**0 s**

Start volume

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

Input range	**0.00000 - 9999.99 mL**
Default value	**0.00000 mL**

Dosing rate

Rate at which the start volume is dosed. The maximum dosing rate depends on the cylinder volume *(see Chapter 10.1.1, page 101)*.

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

Pause

Waiting time, e.g. in case of a slow response of the electrode after the start or reaction time after the dosing of a start volume.

Input range	**0 - 999999 s**
Default value	**0 s**

Request sample ID

Selection of the sample identification that is queried in the method run.

Selection	**off** | **ID1** | **ID2** | **ID1&ID2**
Default value	**off**

Request sample size

If this parameter is switched on, then the value for the sample size will be queried.

Selection	**on** | **off**
Default value	**off**

Request sample unit

If this parameter is switched on, then the unit for the sample size will be queried.

Selection	**on** | **off**
Default value	**off**

Hold at request

If this parameter is switched on, then the method run will be paused during the query. If the parameter is switched off, the titration will be started in the background.

Selection	**on** | **off**
Default value	**on**

7.2.3   Titration parameters

Menu ▸ Parameters ▸ Titration parameters

The parameters that influence the sequence of the entire titration are defined under **Titration parameters**.

Solution

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

For buret units with integrated data chip, a check is made in the method run to verify whether the correct solution has been attached and whether the type of dosing drive matches. For buret units without integrated data chip, the cylinder volume and the type of dosing drive are checked. The validity of the titer is checked for the selected solution at the start of the determination.

Selection	**Selection of configured solution | not defined**
Default value	**not defined**

> **not defined**
> No check takes place.

Sensor

Selection of the sensor from the sensor list. The selection depends on the measuring mode. Sensors are defined under **System ▸ Sensors**.

Selection	**Selection of configured sensors**

I(pol)

The polarization current is the current that is applied at a polarizable electrode during the voltametric measurement. This parameter is available only with I(pol) determinations.

Input range	**−125 - 125 µA** (Increment: **1**)
Default value	**5 µA**

U(pol)

The polarization voltage is the voltage applied to the polarizable electrode during an amperometric measurement. This parameter is available only with U(pol) determinations.

Input range	**−1250 - 1250 mV** (Increment: **10**)
Default value	**400 mV**

Electrode test

For polarizable electrodes, an electrode test can be carried out. A check is made that the electrode is properly connected and that no short-circuit is present. The electrode test is carried out when the determination is started. This parameter is available only with I(pol) and U(pol) determinations.

Selection	**on | off**
Default value	**off**

Stirrer

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

Selection	**on | off**
Default value	**on**

Stirring rate

Setting the stirring rate. It can be set in steps of −15 to +15. The default setting **8** corresponds to 1000 U/min. The formula for calculating the rotational speed is specified in *chapter 10.2, page 102*. The optimum stirring rate can be tested in the manual control.

The algebraic sign of the stirring rate changes the direction in which the stirring is done. When the stirrer is viewed from above, this means:

- "+": counterclockwise rotation
- "−": clockwise rotation

Input range	**−15 - 15**
Default value	**8**

Temperature

Manually entered titration temperature. If a temperature sensor is connected then the temperature will be measured continuously. This value is used for temperature correction in pH measurements.

Input range	**−20.0 - 150.0 °C**
Default value	**25.0 °C**

Titration direction

The titration direction is normally determined automatically from the start measured value and the set endpoint. It is recommended that, whenever possible, a positive or negative alteration of the measured value is entered. If two endpoints have been set then the titration direction will be defined automatically. In this case the setting will be ignored.

Selection	**+ | − | auto**
Default value	**auto**

+

Positive measured value alteration, i.e. in the direction of a higher pH value, greater voltage or greater current.

−

Negative measured value alteration, i.e. in the direction of a lower pH value, lesser voltage or lesser current.

auto

The titration direction is determined automatically from the start measured value and the set endpoint.

Extraction time

Minimum duration of the titration. Titration will not be stopped during the extraction time, even if the endpoint has already been reached. Titration is however stopped if a stop condition is fulfilled during this time *(see Chapter 7.2.6, page 89)*. The entry of an extraction time may be advisable, e.g. for the titration of sparingly soluble samples.

Input range	**0 - 999999 s**
Default value	**0 s**

Time interval MP

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

Input range	**0.1 - 999999.0 s**
Default value	**2.0 s**

7.2.4   Control parameters EP1

Menu ▸ Parameters ▸ Control parameters EP1

The control parameters for the first endpoint are defined under **Control parameters EP1**.

Endpoint 1 at

Measured value for the first endpoint.

Measuring mode pH:

Input range	**−20.000 - 20.000**
Selection	**off**
Default value	**off**

Measuring mode U and Ipol:

Input range	**−1250.0 - 1250.0 mV**
Selection	**off**
Default value	**off**

Measuring mode Upol:

Input range	**−125.00 - 125.00 μA**
Selection	**off**
Default value	**off**

Titration rate

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

Selection	**slow** | **optimal** | **fast** | **user**
Default value	**optimal**

slow

For steep titration curves for which dosing must be carried out in small steps at the endpoint.

optimal

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

fast

For flat titration curves for which the endpoint is reached only slowly.

user

The individual titration parameters can be modified.

The settings of the individual titration rates are listed in *table 2, page 88*.

Dynamics

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

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

Measuring mode pH:

Input range	**0.001 - 20.000**
Default value	**2.000**
Selection	**off**

Measuring mode U and Ipol:

Input range	**0.1 - 1250.0 mV**
Default value	**100.0 mV**
Selection	**off**

Measuring mode Upol:

Input range	**0.01 - 125.00 µA**
Default value	**10.00 µA**
Selection	**off**

Max. rate

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

Rate at which dosing is carried out outside of the control range. The maximum dosing rate depends on the cylinder volume *(see Chapter 10.1.1, page 101)*.

Input range	**0.01 - 166.00 mL/min**
Default value	**10.00 mL/min**
Selection	**max.**

Min. rate

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

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

Input range	**0.01 - 9999.00 µL/min**
Default value	**25.00 µL/min**

Table 2   Standard values for predefined titration rates for SET

	Titration rate		
	slow	**optimal**	**fast**
Dynamics			
– pH	5.000	2.000	0.500
– U und Ipol	300.0 mV	100.0 mV	30.0 mV
– Upol	40.00 µA	10.00 µA	5.00 µA
Max. rate	1.00 mL/min	10.00 mL/min	maximum
Min. rate	5.00 µL/min	25.00 µL/min	50.00 µL/min

Stop criterion

The titration is stopped when the endpoint has been reached and this stop criterion has been fulfilled. If no stop criterion has been selected then the titration will not be stopped. The stop conditions *(see Chapter 7.2.6, page 89)* always lead to a stop, even if the stop criterion has not been reached.

Selection	**drift**	**time**	**off**
Default value	**drift**

drift

The titration is stopped when the stop drift has been reached.

time

The titration is stopped if the endpoint has been exceeded during a certain time period (**Delay time**).

off

The titration will not be stopped until the stop conditions have been fulfilled.

Stop drift

This parameter is visible only when **Stop criterion** = **drift**.

Titration is stopped when the endpoint and the stop drift have been reached.

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

Delay time

This parameter is visible only when **Stop criterion** = **time**.

When the endpoint is reached, the specified time is allowed to elapse after the last dosing and the titration is then stopped.

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

7.2.5 Control parameters EP2

Menu ▸ Parameters ▸ Control parameters EP2

The control parameters for the second endpoint are defined under **Control parameters EP2**. The parameters and the input ranges are the same as for the first endpoint.

7.2.6 Stop conditions

Menu ▸ Parameters ▸ Stop conditions

The conditions for stopping a titration are defined under **Stop conditions**, if this does not occur automatically. This could be the case when the set endpoint is not reached or if the stop criterion *(see "Stop criterion", page 88)* is not fulfilled.

Stop volume

The titration is stopped when the specified volume has been dosed since the start of the titration. This volume should be adjusted to the size of the titration vessel in order to prevent the contents from running over.

Input range	**0.00000 - 9999.99 mL**
Default value	**100.000 mL**
Selection	**off**

Stop time

The titration is stopped when the specified time has elapsed following the termination of the start conditions.

Input range	**0 - 999999 s**
Selection	**off**
Default value	**off**

Filling rate

Rate at which the dosing cylinder is filled after the titration. The maximum filling rate depends on the cylinder volume *(see Chapter 10.1.1, page 101)*.

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

7.2.7 Calculation

7.2.7.1 General

Menu ▶ Parameters ▶ Calculation

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

```
Calculation              ready
 R1: Content
 R2:
 R3:
 R4:
 R5:

 Edit Delete
```

The result name is specified in the list for each calculation.

Edit

Edit the data of the selected calculation, see following chapter.

Delete

Delete the selected calculation.

7.2.7.2   Editing a calculation

Result name

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

Entry	**12 characters**
Default value	**empty**

R1=…R5=

Shows the calculation formula. A special editor is opened for the definition *(see Chapter 5.3, page 22)*.

Entry	**44 characters**
Default value	**empty**

Decimal places

Number of decimal places used to display the result.

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

Result unit

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

Selection	**% | mol/L | mmol/L | g/L | mg/L | mg/mL | ppm | g | mg | mL | mg/piece | °C | µL | mL/min | User-defined**
Default value	**%**

User-defined
A user-defined unit can be created. This will be added to the selection list. The previous entry will be overwritten as soon as the new unit has been defined. A blank entry can be generated this way as well.

Save as titer

The result can be saved as titer for this selected solution. If statistics has been switched on, then the current mean value of the determination series will be saved.

Selection	**on | off**
Default value	**off**

Save as CV

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

Selection	**on	off**
Default value	**off**

7.2.8   Statistics

Menu ▸ Parameters ▸ Statistics

The statistics calculation of a multiple determination is switched on under **Statistics** and it is defined how many determinations the series contains.

Statistics

If this funtion is switched on, then statistics calculations will be carried out for all of the defined results.

Selection	**on	off**
Default value	**off**

Number of samples

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

If an additional determination must be added to the determination series, because one determination was incorrect, for example, then this can be accomplished in the statistical overview *(see Chapter 5.11, page 40)*.

Input range	**2 - 20**
Default value	**3**

7.2.9   Reports

Menu ▸ Parameters ▸ Reports

The reports that will be printed out automatically in connection with a determination are defined under **Reports**.

Results

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

Selection	**on	off**
Default value	**off**

Curve

Curve report. The width of the curve is defined in the system settings *(see "Graphics width", page 63)*.

Selection	**on	off**
Default value	**off**

Calculations/Statistics

Output of the calculation formulas for the individual results. The results are printed with the maximum resolution. This makes recalculation with an external program possible. The following data is printed out in addition when statistics is switched on:

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

Selection	**on**	**off**
Default value	**off**	

Measuring point list

Output of the measuring point list.

Selection	**on**	**off**
Default value	**off**	

Parameters

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

Selection	**on**	**off**
Default value	**off**	

PC/LIMS

The PC/LIMS report is a machine-readable report with all of the data important for a determination. The PC/LIMS report can be saved as a TXT file on a USB storage medium or sent via an RS-232 interface to a LIMS. The output location is defined in the system settings *(see "PC/LIMS report", page 62)*.

The file name of the TXT file is constructed as follows: *PC_LIMS_Report-ID1-YYYYMMDD-hhmmss.txt*.

Selection	**on**	**off**
Default value	**off**	

7.3   pH calibration (CAL)

7.3.1   Calibration parameters

Menu ▸ Parameters ▸ Calibration parameters

The parameters that influence the sequence of the entire calibration are defined under **Calibration parameters**.

Signal drift

Maximum permissible drift for the measured value acceptance, i.e. maximum change of the measured value per minute.

Input range	**0.1 - 999.0 mV/min**
Default value	**2.0 mV/min**
Selection	**off**

off
Measured value acceptance will take place after the maximum waiting time has elapsed. This can be useful when the electrode is slow to respond.

Min. waiting time

The measured value is not accepted until the minimum waiting time has elapsed, even if the signal drift has already been reached. The minimum waiting time is only important for drift-controlled measurements.

Input range	**0 - 999999 s**
Default value	**10 s**

Max. waiting time

If signal drift has been switched off or has not yet been reached, then the measured value will be accepted when the maximum waiting time has elapsed.

Input range	**0 - 999999 s**
Default value	**110 s**

Temperature

Manually entered calibration temperature. If a temperature sensor is connected then the temperature will be measured continuously.

The temperature can also be entered during the run.

Input range	**−20.0 - 150.0 °C**
Default value	**25.0 °C**

Sensor

Selection of the sensor from the sensor list. The selection depends on the measuring mode. Sensors are defined under **System ▸ Sensors**.

Selection	**Selection of configured sensors**

Stirrer

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

Selection	**on | off**
Default value	**on**

Stirring rate

Setting the stirring rate. It can be set in steps of −15 to +15. The default setting **8** corresponds to 1000 U/min. The formula for calculating the rotational speed is specified in *chapter 10.2, page 102*. The optimum stirring rate can be tested in the manual control.

The algebraic sign of the stirring rate changes the direction in which the stirring is done. When the stirrer is viewed from above, this means:

- "+": counterclockwise rotation
- "−": clockwise rotation

Input range	**−15 - 15**
Default value	**8**

Sample changer

This parameter must be switched on for automatic calibrations with sample changers (e.g. 869 Compact Sample Changer). Because the buffers are changed by the sample changer, the run is not paused in order to request values). The 877 Titrino plus sends a signal (EOD) to the sample changer via the remote connection as soon as the measurement of one buffer has been completed *(see Figure 23, page 109)*. The sample changer switches to the next buffer at that time.

The parameterization of the sample changer is described in the corresponding manual.

> **ℹ NOTE**
>
> We recommend that the stirrer be connected to the sample changer when calibrating with a sample changer. The **Stirrer** parameter must however be switched off in such cases.

Selection	**on | off**
Default value	**off**

7.3.2 Buffers

Menu ▶ Parameters ▶ Buffers

The buffer type and the number of buffers is defined under **Buffers**.

Buffer type

Selection of a predefined buffer series or definition of special buffers. In the case of predefined buffer series, the instrument automatically recognizes which buffer is involved.

Selection	**Baker** | **Beckman** | **DIN** | **Fisher** | **Fluka Basel** | **Hamilton** | **Merck CertiPUR** | **Merck Titrisol** | **Metrohm** | **Mettler** | **NIST** | **Precisa** | **Radiometer** | **Special**

Merck CertiPUR
Reference temperature = 25 °C. The buffer type **Merck Titrisol** must be selected when using Merck CertiPUR buffers (20 °C).

Special
Up to five calibration buffers can be defined in the method. The automatic buffer detection is not activated in this case. The buffers must be measured precisely in the specified sequence.

Number of buffers

Number of buffers that are used for calibration. If calibration is accomplished with more than two buffers, then they can be used repeatedly give them more statistical weight. The first two buffers must however always be different from one another.

Selection	**1** | **2** | **3** | **4** | **5**
Default value	**2**

Buffer 1 pH

This parameter is visible only when **Buffer type** = **Special**.

Input range	**−20.000 - 20.000**
Default value	**7.000**

Buffer 2 pH

This parameter is visible only when **Buffer type** = **Special**.

Input range	**−20.000 - 20.000**
Default value	**4.000**
Selection	**off**

Buffer 3 pH

This parameter is visible only when **Buffer type** = **Special**.

Input range	**−20.000 - 20.000**
Selection	**off**
Default value	**off**

Buffer 4 pH

See **Buffer 3 pH**.

Buffer 5 pH

See **Buffer 3 pH**.

7.3.3 Reports

Menu ▶ Parameters ▶ Reports

The reports that will be printed out automatically in connection with a calibration are defined under **Reports**.

Results

The result report contains the specifications for the calibration (slope, pH(0), etc.).

Selection	**on │ off**
Default value	**off**

Parameters

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

Selection	**on │ off**
Default value	**off**

PC/LIMS

The PC/LIMS report is a machine-readable report with all of the data important for a determination. The PC/LIMS report can be saved as a TXT file on a USB storage medium or sent via an RS-232 interface to a LIMS. The output location is defined in the system settings *(see "PC/LIMS report", page 62)*.

The file name of the TXT file is constructed as follows: *PC_LIMS_Report-ID1-YYYYMMDD-hhmmss.txt*.

Selection	**on │ off**
Default value	**off**

8 Operation and maintenance

8.1 Quality Management and qualification with Metrohm

Quality management

Metrohm offers you comprehensive support in implementing quality management measures for instruments and software. Further information on this can be found in the brochure **"Metrohm Quality Management"** available from your local Metrohm representative.

Qualification

Please contact your local Metrohm representative for support in qualification of instruments and software. The **Installation Qualification** (IQ) and **Operational Qualification** (OQ) are offered by Metrohm representatives as a service. They are carried out by trained employees using standardized qualification documents and in accordance with the currently applicable requirements of the regulated industry. Further information on this can be found in the brochure **"Analytical Instrument Qualification – Confidence in quality with IQ/OQ"**.

Maintenance

The electronic and mechanical functional groups of Metrohm instruments can and should be checked by specialist personnel from Metrohm as part of a regular preventive maintenance schedule. Please ask your local Metrohm representative regarding the precise terms and conditions involved in concluding a corresponding maintenance agreement. Further information on this can be found in the brochure **"Metrohm Care Contracts – Protect your investment the smart way"** available from your local Metrohm representative.

9 Troubleshooting

9.1 SET titration

Problem	Cause	Remedy
The titration will not be finished.	*The minimum dosing rate is too low.*	Define **Titration rate** = **user** and increase minimum rate (**Min. rate**) *(see Chapter 7.2.4, page 86)*.
	The stop criterion is unsuitable.	Adjust the control parameters *(see Chapter 7.2.4, page 86)*: ▪ Increase the stop drift. ▪ Select a short delay time.
The sample is over-titrated.	*The control parameters are unsuitable.*	Adjust the control parameters *(see Chapter 7.2.4, page 86)*: ▪ Select **Titration rate** = **slow**. ▪ Define **Titration rate** = **user** and increase the control range. ▪ Define **Titration rate** = **user** and reduce maximum rate (**Max. rate**). ▪ Define **Titration rate** = **user** and reduce minimum rate (**Min. rate**). ▪ Stir faster. ▪ Arrange the electrode and buret tip to an optimum.
	The electrode responds too slowly.	Replace the electrode.
The titration time is too long.	*The control parameters are unsuitable.*	Adjust the control parameters *(see Chapter 7.2.4, page 86)*: ▪ Select **Titration rate** = **optimal** or **fast**. ▪ Define **Titration rate** = **user** and reduce the control range. ▪ Define **Titration rate** = **user** and increase maximum rate (**Max. rate**). ▪ Define **Titration rate** = **user** and increase minimum rate (**Min. rate**).
The results are spread widely.	*The minimum dosing rate is too high.*	Define **Titration rate** = **user** and reduce minimum rate (**Min. rate**) *(see Chapter 7.2.4, page 86)*.

Problem	Cause	Remedy
	The electrode responds too slowly.	Replace the electrode.

9.2 Miscellaneous

Problem	Cause	Remedy
No report is printed.	*The printer is not recognized by the instrument.*	▪ Switch the 877 Titrino plus off and on again. ▪ Use a hub on the USB connector and connect the printer to the hub.
	The printer model is not compatible.	Use a printer which fulfills the required specifications *(see Chapter 10.4.4, page 105).*
The USB keyboard or the PC mouse does not function.	*The keyboard or mouse is not recognized by the instrument.*	▪ Switch the 877 Titrino plus off and on again. ▪ Use a hub on the USB connector and connect the keyboard or mouse to the hub.
	The keyboard or the mouse is not compatible.	Use a model which fulfills the required specifications *(see Chapter 10.4, page 103).*
The display is no longer readable.	*The contrast is set incorrectly.*	Adjust the contrast correctly *(see Chapter 6.1, page 51).*
Mettler XP balances send "R" or "O ----" as ID1.	*The automatic calibration of the balance is switched on.*	Switch off the automatic calibration.
Message 020-511 "Action not possible" is displayed.	*The USB stick is no longer connected.*	1. Connect the USB stick. 2. Switch the instrument off and on again.
	The USB stick is full.	▪ Use a different USB stick. ▪ Delete files with the aid of a PC.

10 Appendix

10.1 Exchange unit

10.1.1 Maximum dosing and filling rate

The maximum dosing rate and maximum filling rate for the exchange unit depend on the cylinder volume:

Cylinder volume	Maximum rate
1 mL	3.00 mL/min
5 mL	15.00 mL/min
10 mL	30.00 mL/min
20 mL	60.00 mL/min
50 mL	150.00 mL/min

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

10.1.2 Parameters for the preparing (PREP)

The **PREP** function (Preparing) is used to rinse the cylinder and tubings of the exchange unit and fill them air bubble-free. You should carry out this function before the first determination or once per day.

Preparing is carried out with the following, non-alterable settings:

- The entire cylinder volume is dosed twice with the maximum dosing rate.

10.2 Stirring rate

The stirring rate can be adjusted in steps of −15 to +15.

The approximate rotational speed can be calculated with the following formula:

$$\text{Rotational speed/min (r/min)} = 125 \cdot \text{stirring rate}$$

Example:

Stirring rate set: 8

Rotational speed in rpm = 125 · 8 = 1000
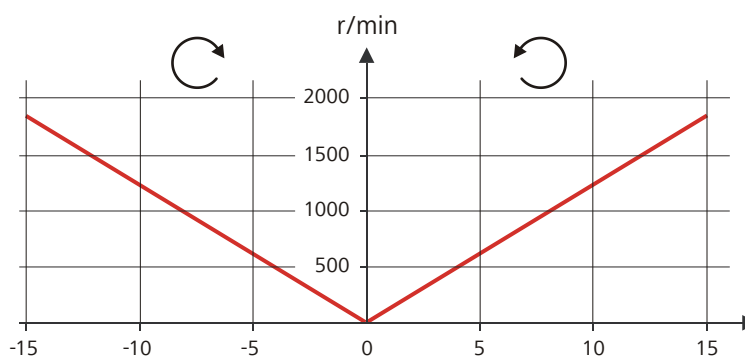
Figure 19   Rotational speed depending on stirring rate

10.3 Balance

The sample size and the associated unit can be sent from a connected balance. The sample size is transmitted as a number with up to ten characters (including algebraic sign and decimal point).

Sample size and unit are sent as a single character string. They are separated by a space character. The string is terminated with the ASCII characters **CR** and **LF**.

If the balance sends a negative sample size (e.g. when you are reweighing a sample), then the algebraic sign is adopted. The algebraic sign is, however, ignored for the calculations.

> **NOTE**
>
> With some balances, the sample identification and the method can be sent in addition to the sample size.
>
> Make sure that the balance does not send the sample size until the end.

Mettler AX

For the Mettler AX balance, the fields that contain the sample identification or the method must be designated as follows:

- Designation for the field with the method name: **METHOD**
- Designation for the field with sample identification 1: **ID1**
- Designation for the field with sample identification 2: **ID2**

10.4 USB devices

	NOTE

USB peripheral devices that are to be connected must support either the *USB 1.0/1.1 (Full Speed)* or the *USB 2.0 (High Speed)* standard. The maximum data transfer rate is however in any case 12 MBit/s.

Keyboards, PC mice and barcode readers are so-called HID devices (**H**uman **I**nterface **D**evice) and can be connected via a USB hub only.

Printers should also be connected via a USB hub. Depending on the manufacturer or printer type a direct connection is however possible.

10.4.1 6.2147.000 numerical USB keypad

The **[Num Lock]** key must be pressed for navigating in the dialog. The arrow keys are effective in conjunction with it.

The respective editing dialog must be opened for the numerical input.

Table 3   Key assignment

Key of the 877 Titrino plus or function in the editing dialog	Key on the numerical USB keypad
[BACK]	**[Home]**
[⇧] [⇩]	**[↑] [↓]**
[⇦] [⇨]	**[←] [→]**
[OK]	**[Enter]**
[+−]	**[BS]** (backspace)
Clear	**[Del]**
Accept	**[Home]**

10.4.2 Key assignment of a USB keyboard

A commercially available USB keyboard can be connected to make it easier to enter text and numbers.

The respective editing dialog must be opened for the text input and numerical input.

Table 4   Key assignment

Key of the 877 Titrino plus or function in the editing dialog	Key on the USB keyboard
[BACK]	**[Esc]**
[⇧] [⇩]	**[↑] [↓]**
[⇦] [⇨]	**[←] [→]**
[OK]	**[↵]** (enter key) *or* **[Enter]** on the numerical keypad
[STOP]	**[Ctrl]** + **[S]**
[START]	**[Ctrl]** + **[G]**
[＋−]	**[←]** (backspace)
Clear	**[Delete]**
Cancel	**[Ctrl]** + **[Q]**
Accept	**[Esc]**

> **i**   **NOTE**
>
> The lettering of the USB keyboard may differ from above lettering, depending on the country-specific keyboard used.

10.4.3 PC mouse

In order to make navigating in the dialog of the 877 Titrino plus easier, a PC mouse can be connected.

Table 5   Mouse functions

Key of the 877 Titrino plus	Mouse function
[OK]	Left mouse button
[BACK]	Right mouse button

Key of the 877 Titrino plus	Mouse function
[⇧] [⇩] [⇦] [⇨]	Mouse movement vertical/horizontal
[⇧] [⇩]	Scroll wheel vertical

10.4.4 Printer

The range of USB printers available is extremely varied and constantly changing. The following points must be taken into account when selecting a printer:

- USB interface necessary
- Printer language: HP-PCL, Canon BJL Commands, Epson ESC P/2 or ESC/POS

> **i** **NOTE**
>
> Inexpensive printers are often designed solely for use with a PC and may not be equipped with one of the printer languages listed above. Such models are not suitable for this reason.

10.5 System initialization

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

> **(!)** **CAUTION**
>
> All user data (methods, solutions, etc.) are deleted if a system initialization is carried out. Afterwards, the instrument will have the factory settings again.
>
> We recommend creating a backup of the system at regular intervals in order to avoid data losses.

After a system initialization the program versions and language files do not have to be reloaded. Only the selection of the dialog language may have to be reset in the system settings.

Proceed as follows for the system initialization:

1 Switching off the instrument
- Keep the red **[STOP]** key pressed down for at least 3 s.

A progress bar is displayed. If the key is released during this time, then the instrument will not be switched off.

2 **Switching on the instrument**

- Keep the red **[STOP]** key pressed down for approx. 10 s.

The dialog for confirmation of the initialization is displayed for 8 s. The initialization must be confirmed during this time.

```
System reset request detected.
>> Press [BACK] key twice
   to confirm !
>> Time remaining: 8 sec
```

3 **Confirming the initialization**

> **NOTE**
>
> If the request is not confirmed within 8 s, then the procedure will be canceled.

- Press **[BACK]** twice.

Initialization is started. The process takes approximately 80 s. The instrument will be automatically restarted after successful initialization.

10.6   Remote interface

10.6.1   Pin assignment of the remote interface
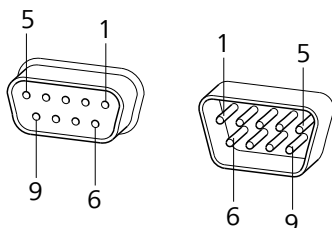
Figure 20   Pin assignment of remote socket and remote plug

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

Table 6   Inputs and outputs of the remote interface

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

Inputs
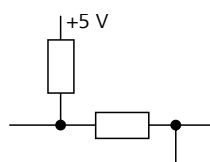
approx. 5 kΩ Pull-up

$t_p > 100$ ms

active = low, inactive = high

Outputs
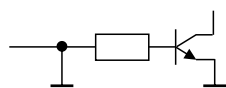
Open Collector

$t_p > 200$ ms

active = low, inactive = high

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

+5 V: maximum load = 20 mA

10.6.2   Status diagram of the remote interface

Titration mode MET
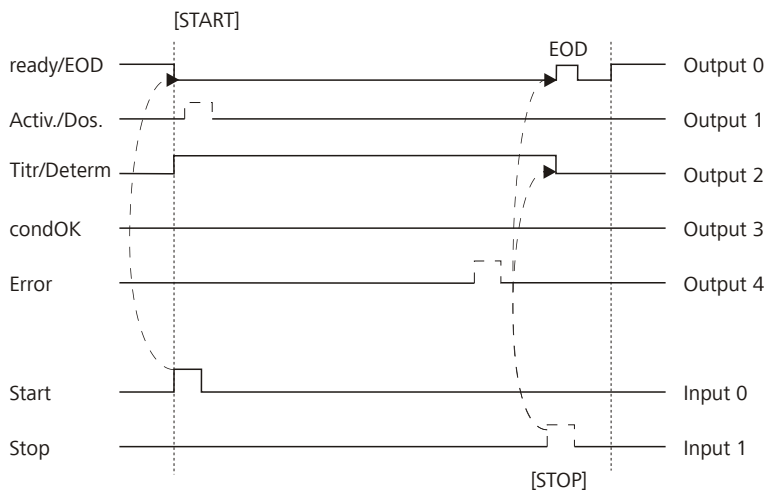
Figure 21   Remote status diagram MET

Titration mode SET
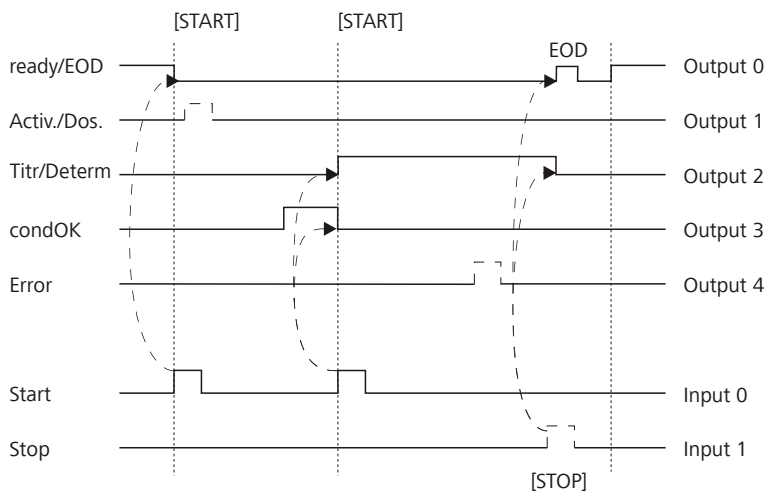
Figure 22   Remote status diagram SET

Measuring mode CAL
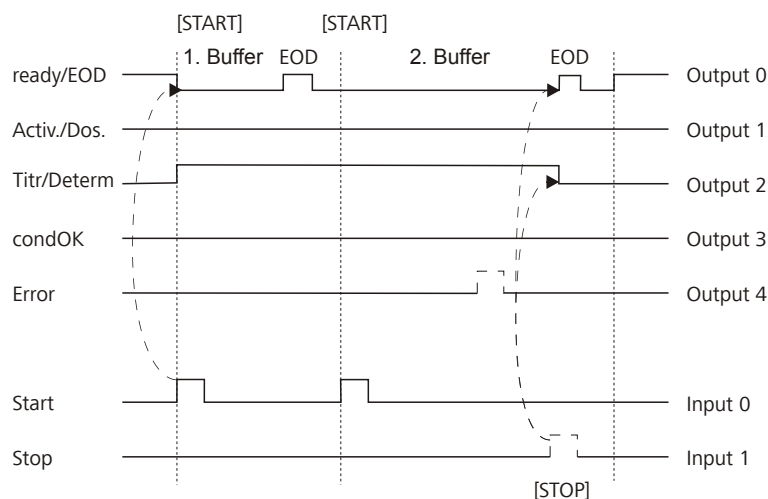
Figure 23   Remote status diagram CAL

EOD = End of Determination

10.7   Remote control via an RS-232 connection

The 877 Titrino plus can be remote controlled via an RS-232 connection. For this, a **6.2148.030 RS-232/USB Box** is necessary. Connect the RS-232/USB Box to the USB interface of the instrument.

The RS-232/USB Box has two connectors for RS-232 instruments. The RS-232 remote control functions only through the connector **RS-232/2**. The connector RS-232/1 is designed for connection with a balance. Connect the **RS-232/2** connector of the RS-232/USB Box to a serial interface (COM interface marked with the symbol **IOIOI**) of a PC. Use a **6.2134.040 connection cable**.

6.2134.040
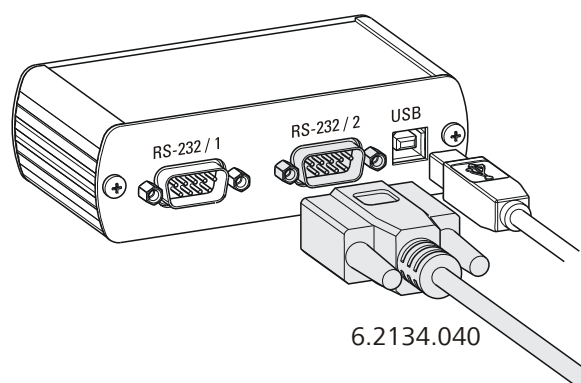
Figure 24   Connecting the RS-232/USB Box to the PC

Interface parameters

We recommend the following parameters for the RS-232 interface **COM2**:

- Baud rate: **19200**
- Data bits: **8**
- Stop bits: **1**
- Parity: **none**
- Handshake: **software**

On the 877 Titrino plus, adjust the interface parameters under **Menu ▸ System ▸ External devices ▸ COM2 settings**.

Transfer protocol

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

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

The instrument does not send spontaneous messages.

10.7.1 Commands and variables

Command	Function	Comment
$G	Start/Continue	Corresponds to the key **[START]** or **[Continue]**
$S	Stop	Corresponds to the key **[STOP]**
$H	Hold	Hold the method run
$D	Scan instrument status	Acknowledgements: *Ready;0*, *Busy;0* or *Hold;0* (0 = no message)
		If a message on the instrument requires the interaction of the user, the acknowledgement of the status scan displays the corresponding message number. Example:
		Busy;010-119
		= "Check buret unit"
		The message can be confirmed with **[OK]** or **[Cancel]**, see below.

Command	Function	Comment
$A	Confirm message	Confirm the message on the instrument with **[OK]**
		A mandatory status scan providing the message number must take place immediately before confirming the message, see above.
$A(OK), **$A(CANCEL)**	Confirm message	Confirm the message with **[OK]** or **[Cancel]**
$A(YES), **$A(NO)**	Confirm message	Confirm the message with **[Yes]** or **[No]**
$L(*method name*)	Load method	The method name has to be known and unique.
$Q(*variable*)	Request variable value	Examples for variables: *EP1*, *R1*, *C00*.
		Complete list of the variables, *see page 22*.

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

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

10.8 Arithmetic algorithms in the 877 Titrino plus

Numerical format

The software of the 877 Titrino plus calculates in accordance with the widespread standard IEEE 754 (IEEE Standard for Binary Floating-Point Arithmetic for Microprocessor Systems). This means that the numbers are used in calculations in "double precision" (64 bit). Decimal numbers are converted into binary numbers in the computer and used in this form for calculations. The output on the display and in reports once again contains decimal numbers; the binary numbers are thus converted back into decimal numbers. In order to be able to check the internal calculations performed by the computer yourself in accordance with IEEE 754, the numbers are reproduced in the calculation report in complete accuracy. A min-

imal difference may arise between an originally entered decimal number and the internal computer representation in complete accuracy in the range of the rear decimal places. This difference results from the fact that an exact binary equivalent does not exist for every decimal number. If, for example, you enter the sample size 50.3 mg, this will be depicted in the calculation report in "double precision" with 5.02999999999999E+01.

Rounding-off process

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

Examples:

2.33 yields **2.3**

2.35 yields **2.4**

2.47 yields **2.5**

−2.38 yields **−2.4**

−2.45 yields **−2.5**

Statistics

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

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

The following convention applies to the subsequent formulas:

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

Mean value:

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

Absolute standard deviation:

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

Relative standard deviation (in %):

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

Explanations

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

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

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

Example:

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

- **1234.568 mg/L**.

If the same result is expressed in "**g/L**" (**1.23456789158763 g/L**), and is also rounded off to three decimal place, this yields

- **1.235 g/L**.

I.e. you obtain the lowest losses in accuracy with rounding when you select the application and the numerical format in such a way that the numbers displayed have as many places before the decimal point as possible.

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

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

11 Technical specifications

11.1   Measuring inputs

The measuring cycle is 100 ms for all measuring modes.

11.1.1   Potentiometry

A high-ohm measuring input (**Ind.**) for pH and redox electrodes and a measuring input for separate reference electrodes (**Ref.**).

Input resistance	$> 1 \cdot 10^{12} \, \Omega$
Offset current	$< 1 \cdot 10^{-12} \, A$
Measuring mode pH	
Measuring range	−13 - +20
Resolution	0.001
Measuring accuracy	±0.003 (±1 digit, without sensor error, under reference conditions)
Measuring mode U	
Measuring range	−1,200 - +1,200 mV
Resolution	0.1 mV
Measuring accuracy	±0.2 mV (±1 digit, without sensor error, under reference conditions)

11.1.2   Polarizer

A measuring input (**Pol.**) for polarizable electrodes.

Measuring mode Ipol	Determination with adjustable polarization current.
Polarization current	−120 - +120 µA (increment: 1 µA) −125 - −121 µA / +121 - +125 µA: non-guaranteed values, dependent on reference voltage +2.5 V
Measuring range	−1,200 - +1,200 mV
Resolution	0.1 mV
Measuring accuracy	±0.2 mV (±1 digit, without sensor error, under reference conditions)

Measuring mode Upol	Determination with adjustable polarization voltage.
Polarization voltage	−1,200 - +1,200 mV (increment: 10 mV) −1,250 - −1,210 mV / +1,210 - +1,250 mV: non-guaranteed values, dependent on reference voltage +2.5 V
Measuring range	−120 - +120 µA
Resolution	0.01 µA
Measuring accuracy	−

11.1.3   Temperature

A measuring input (**Temp.**) for temperature sensors of the Pt1000 or NTC type with automatic temperature compensation.

R (25 °C) and B value can be configured for NTC sensors.

Measuring range	
Pt1000	−150 - +250 °C
NTC	−5 - +250 °C (For an NTC sensor with R (25 °C) = 30,000 Ω and B (25/50) = 4,100 K)
Resolution	
Pt1000	0.1 °C
NTC	0.1 °C
Measuring accuracy	
Pt1000	±0.2 °C (applies for measuring range −20 - +150 °C)
NTC	±0.6 °C (applies for measuring range +10 - +40 °C)

11.2   Dosing drive

Resolution	10,000 steps per cylinder volume
Exchange unit	
Cylinder volume	▪ 1 mL ▪ 5 mL ▪ 10 mL ▪ 20 mL ▪ 50 mL
Accuracy	Fulfills ISO/DIN standard 8655-3

11.3   Interfaces

USB (OTG) connector	For connecting USB devices.
MSB connector	For connecting a stirrer.
Remote connector	For connecting instruments with a remote interface.

11.4   Mains connection

Voltage	100 - 240 V (± 10%)
Frequency	50 - 60 Hz
Power consumption	45 W
Fuse	2 × 2.0 ATH, electronic overload protection

11.5   Safety specifications

This instrument fulfills the following electrical safety requirements:

CE designation in accordance with the EU directives:
- 2006/95/EC (Low Voltage Directive, LVD)
- 2004/108/EC (EMC Directive, EMC)

Federal Inspectorate for Heavy Current Installations ESTI (Accreditation Number SCESp 033)
- Safety mark for certification type 2 in accordance with NEV (type testing with market monitoring, EMC conformity)

ETL Listed Mark:
- Control number 3144965
- UL 61010-1
- CSA-C22.2 No. 61010-1

Design and testing   According to EN/IEC/UL 61010-1, CSA-C22.2 No. 61010-1, protection class I, EN/IEC 60529, degree of protection IP40.

Safety instructions   This document contains safety instructions which have to be followed by the user in order to ensure safe operation of the instrument.

11.6   Electromagnetic compatibility (EMC)

Emission

Standards fulfil-
led
- EN/IEC 61326-1
- EN/IEC 61000-6-3
- EN 55022 / CISPR 22

Immunity

Standards fulfil-
led
- EN/IEC 61326-1
- EN/IEC 61000-6-2
- EN/IEC 61000-4-2
- EN/IEC 61000-4-3
- EN/IEC 61000-4-4
- EN/IEC 61000-4-5
- EN/IEC 61000-4-6
- EN/IEC 61000-4-11
- EN/IEC 61000-4-14

11.7   Ambient temperature

Nominal function   +5 - +45 °C
range   (at a maximum of 85% humidity)

Storage   −20 - +60 °C

Transport   −40 - +60 °C

11.8   Reference conditions

Ambient temperature	+25 °C (±3 °C)
Relative humidity	≤ 60%
Operating temperature status	Instrument in operation at least 30 min
Validity of the data	After adjustment

11.9   Dimensions

Material of housing	Polybutylene terephthalate (PBT)
Material of display cover	Glass
Width	142 mm
Height	164 mm
Depth	310 mm
Weight	2,950 g

12 Warranty (guarantee)

Metrohm guarantees that the deliveries and services it provides are free of defects in materials, design or manufacturing.

The general warranty period is 36 months (exclusions below) from the date of delivery or 18 months in the event of continuous operation. The warranty remains valid on the condition that the servicing is provided by a service organization authorized by Metrohm at defined intervals and with a defined scope.

The warranty period for anion suppressors of the type "MSM" is 120 months from the date of delivery or 60 months in the case of continuous operation.

The warranty period for IC separation columns is 90 days after start-up.

For third-party components that are recognizable as such, the manufacturer's warranty regulations apply.

Consumables and materials with limited storage life and glass breakage in the case of electrodes or other glass parts are excluded from the warranty.

Warranty claims cannot be asserted if the ordering party has failed to meet its payment obligations according to schedule.

During the warranty period, Metrohm undertakes either to replace free of charge or to credit the purchaser for any modules or components that can be shown to be faulty. Any transport or customs fees that may apply are the ordering party's responsibility.

The precondition for this is that the ordering party has to specify the article number, the article designation, an adequate error description, the delivery date and (if applicable) the serial number or chip data in the Support Tracker. Metrohm then decides whether a replacement or a credit note is to be issued or whether the faulty part has to be returned using the Return Material Authorization (RMA). If a replacement or credit note is issued, the ordering party undertakes to store the faulty part for at least 24 months in accordance with the current storage directives (in compliance with ESD guidelines) and to hold it in readiness for onsite inspection or for return shipment to Metrohm. Metrohm reserves the right to invoice the ordering party for these articles, including retroactively, in the event of noncompliance with these preconditions.

The same warranty periods that are specified for a corresponding new part apply to parts that are replaced or repaired within the above-mentioned warranty periods. However, replacement or repair of a part does not extend the warranty period of the entire system.

Deficiencies arising from circumstances that are not the responsibility of Metrohm, such as improper storage or improper use, etc., are expressly excluded from the warranty.

Metrohm also offers a 120 month spare parts availability guarantee and a 60 month PC software support warranty, calculated from the date on which the product is withdrawn from the market. The content of this warranty is the ability of the customer to obtain functioning spare parts or appropriate software support at market prices during the time of the warranty period.

If Metrohm AG is unable to meet this obligation due to circumstances beyond the control of Metrohm AG, then the ordering party shall be offered alternative solutions at preferential conditions.

13 Accessories

> ℹ️ **NOTE**
>
> Subject to change without notice.

13.1   Scope of delivery

2.877.0010 877 Titrino plus

Qty.	Order no.	Description
1	**1.877.0010**	**877 Titrino plus**
1	**6.2147.000**	**Numerical USB keypad**

Numerical USB keypad for Titrino plus, Dosimat plus, 862 Compact Titrosampler, 869 Compact Sample Changer, 863 Compact Autosampler and 899 Coulometer. Including USB hub with two connectors.

1	**6.2151.100**	**Adapter USB MINI (OTG) - USB A**

For connecting USB instruments.

Qty.	Order no.	Description
1	**6.2739.010**	**Wrench**

For exchange units.

Length (mm):	190

1	**6.6063.901**	**Demo CD for tiBase 1.1**

Demo CD for tiBase. Test version for 30 days.

1	**6.2122.0x0**	**Power supply cable with IEC 60320 line socket, type C13**

Cable plug according to customer requirements.

Switzerland:	SEV 1011, Type 12
	6.2122.020
Germany, …:	CEE 7, Type VII
	6.2122.040
USA, …:	NEMA 5-15, Type 498
	6.2122.070
Length:	1.5 m

1	**8.877.8003EN**	**877 Titrino plus Manual**
1	**8.848.8004EN**	**877 Titrino plus Tutorial**

13.2 Optional accessories

Order no.	Description
2.141.0100	**USB Thermal printer Neo's**

Compact printer with USB interface for the Titrino plus and Dosimat plus. Paper width 60 mm (40 characters). Including 6.2151.120 USB cable.

Order no.	Description

2.801.0040   801 Stirrer with stand

Magnetic stirrer including base plate, support rod and electrode holder for supplementing the Titrino plus, Dosimat plus, Titrandos, Sample Processors, 805 Dosimat and 780/781 pH meters as well as the 856 and 867 measuring modules. With permanently attached cable for MSB (Metrohm Serial Bus).
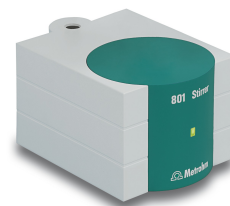
2.802.0040   802 Stirrer (propeller stirrer) for 804 Ti Stand

Rod stirrer with 6.1909.010 Propeller stirrer.

2.804.0040   804 Ti Stand with stand

Titration stand and controller for 802 Rod Stirrer. The 804 Ti Stand together with the optional 802 Rod Stirrer provides an alternative to the magnetic stirrer. Ti Stand with base plate, support rod and electrode holder.

2.865.0010   865 Dosimat plus

Universal dispenser for titration and dosing tasks in the laboratory. Including push-button cable for manual dispensing control and 6.3026.220 exchange unit (20 mL).

Order no.	Description

2.869.0010   **869 Compact Sample Changer**

The 869 Compact Sample Changer provides automation on a minimum footprint.

   Dimensions in mm (W/H/D):   260/470/430

2.876.0010   **876 Dosimat plus**

876 Dosimat plus for hand titrations and dosing. Including push-button cable for manual dispensing control and 20 mL exchange unit.

6.2104.020   **Electrode cable / 1 m / F**

For connecting electrodes with Metrohm plug-in head G to Metrohm instruments (socket F).

   Length (m):   1

6.2104.030   **Electrode Cable 2 m / F**

For connecting electrodes with Metrohm plug-in head G to Metrohm instruments (socket F).

   Length (m):   2

6.2141.230   **Remote cable Compact Sample Changer/Compact Autosampler - Titrino plus/Pump Station**

Cable for the remote connection between Compact Sample Changer/Compact Autosampler and Titrino plus and/or Pump Station.

Order no.	Description
6.2141.240	**Remote cable Dosimat plus - Compact Sample Changer/Titrino plus**

Cable for the remote connection between Dosimat plus and Compact Sample Changer and/or Titrino plus using 6.2141.260 Cable.

6.2141.250	**Remote cable Compact Sample Changer - Titrino**

Cable for the remote connection between Compact Sample Changer and Titrinos with 25-pin remote socket.

6.2141.260	**Remote cable Compact Sample Changer - Dosimat plus and Titrino plus**

Cable for remote connection between Compact Sample Changer and Dosimat plus and further devices (e.g. Titrino plus or Pump Station).

6.2148.030	**RS-232/USB Box**

Extends the Titrino plus by two RS 232 interfaces for the connection of e.g. balance, PC, LIMS. Requires 6.2151.030 Cable.

6.2151.120	**Cable USB MINI (OTG) - USB B, 1.8 m**

For connecting USB instruments.

Order no.	Description

6.2723.310   Protective cover for Titrino plus

Protective cover for display and keypad for all instruments of the Titrino plus family. Suitable for: 848 Titrino plus, 862 Compact Titrosampler, 863 Compact Autosampler, 865 Dosimat plus, 869 Compact Sample Changer, 870 KF Titrino plus, 876 Dosimat plus, 877 Titrino plus, 899 Coulometer.

Material:	PVC

6.3026.110   Exchange Unit 1 mL

Exchange Unit with integrated data chip with 1 mL glass cylinder and light protection. PCTFE/PTFE flat stopcock, FEP tubing connection, antidiffusion buret tip and standard amber glass reagent bottle.

Volume (mL):	1

6.3026.150   Exchange Unit 5 mL

Exchange Unit with integrated data chip with 5 mL glass cylinder and light protection. PCTFE/PTFE flat stopcock, FEP tubing connection, anti-diffusion buret tip and standard amber glass reagent bottle.

Volume (mL):	5

6.3026.210   Exchange Unit 10 mL

Exchange unit with integrated data chip with 10 mL glass cylinder and light protection. PCTFE/PTFE flat stopcock, FEP tubing connection, anti-diffusion buret tip and standard amber glass reagent bottle.

Volume (mL):	10

Order no.	Description

6.3026.220   **Exchange Unit 20 mL**

Exchange unit with integrated data chip with 20 mL glass cylinder and light pro-
tection. PCTFE/PTFE flat stopcock, FEP tubing connection, anti-diffusion buret tip
and standard amber glass reagent bottle.

Volume (mL):   20

6.3026.250   **Exchange unit 50 mL**

Exchange unit with integrated data chip with 50 mL glass cylinder and light pro-
tection. PCTFE/PTFE flat stopcock, FEP tubing connection, antidiffusion tip and
standard amber glass reagent bottle.

Volume (mL):   50

6.1115.000   **Optrode**

Sensor for titration with photometric endpoint recognition.

Shaft material: Glass
SGJ sleeve: Flexible SGJ sleeve
Shaft diameter top (mm):   12
Shaft diameter bottom (mm):   12
Min. immersion depth (mm):   30
Electrode plug-in head: Fixed cable (l = 1 m) with plug F
Height (housing) (mm):   177
Temperature (housing) (°C):   0 ... 40

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