Manual

8.862.8002EN / 2023-09-04 / v7

Metrohm

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

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Technical Communication
Metrohm AG
CH-9100 Herisau

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

Disclaimer

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

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1 Introduction

1.1 Instrument description

The 862 Compact Titrosampler is a versatile analysis instrument which combines a titrator and a compact sample changer in a single unit. It is the central control instrument in an automation system that can also include, in addition to a Dosimat (for adding auxiliary solutions), a pump for rinsing and aspirating the sample vessels.

Specified automation runs and titration modes can be individually parameterized and saved as sample-specific methods. The methods can be exported to a connected USB flash drive. This function enables you to copy methods quickly and easily from one instrument to another.

1.1.1 Instrument components

The 862 Compact Titrosampler has the following components:

- **Turntable**
  Permanently mounted sample rack with 11 positions for sample beakers and 1 position for a rinsing beaker.
- **Lift with titration head**
  For two electrodes, one rod stirrer, two dosing tips, one aspiration tip and three rinsing nozzles.
- **Sensor connectors**
  Four connectors for the following sensor types:
  - pH or redox electrodes
  - reference electrodes
  - Polarizable electrodes
  - Temperature sensor (Pt1000 or NTC)
- **Stirrer connector**
  For one rod stirrer with propeller stirrer.
- **MSB connector (Metrohm Serial Bus)**
  For connecting one Dosino.
- **USB (OTG) connector**
  The 6.2151.100 adapter can be used to connect, for example, one USB hub, one printer or one USB flash drive (for system backup or method export).
- **Remote connector**
  For connecting a Dosimat and/or an 843 Pump Station as well as other instruments with a remote interface.

1.1.2 Titration and measuring modes

The following titration and measuring modes are supported:

- **DET**
  Dynamic equivalence point titration. The reagent is added in variable 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)
- **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)

1.2 Displaying accessories

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

1 Searching for a product on the website

- Go to *https://www.metrohm.com*.
- Click on 🔍.
- Enter the article number of the product (e.g. **2.1001.0010**) into the search field and press **[Enter]**.

The search result is displayed.

2 Displaying product information

- To display the products matching the search term, click on **Product models**.
- Click on the desired product.

Detailed information regarding the product is displayed.

3 Displaying accessories and downloading the accessories list

- To display the accessories, scroll down to **Accessories and more**.
  - The **scope of delivery** is displayed.
  - Click on **[Optional parts]** for the optional accessories.
- To download the accessories list, click on **[Download accessories PDF]** under **Accessories and more**.

NOTE

Metrohm recommends keeping the accessories list for reference purposes.

1.3 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** Perform the steps one after the other.
Method	**Dialog text**, **parameter** in the software
File ▶ New	Menu or menu item
[Continue]	**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.
	**WARNING** Warning of optical radiation
	**CAUTION** This symbol draws attention to possible damage to instruments or instrument parts.
	**NOTICE** This symbol highlights additional information and tips.

2 Safety

WARNING

Operate this instrument only according to the information contained in this documentation.

This instrument exhibited no flaws in terms of technical safety at the time it left the factory. To maintain this state and ensure non-hazardous operation of the instrument, the following instructions must be observed carefully.

2.1 Intended use

The 862 Compact Titrosampler is designed for usage as an automation system in analytical laboratories. It is **not** suitable for usage in biochemical, biological or medical environments in its basic equipment version.

This instrument is suitable for dosing chemicals and flammable solvents. Therefore, the use of the 862 Compact Titrosampler requires the user to have basic knowledge and experience in handling toxic and caustic substances. Knowledge with respect to the application of the fire prevention measures prescribed for laboratories or production plants is also mandatory.

2.2 Responsibility of the operator

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

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

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

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

- Maintain and clean the product regularly.

2.3 Requirements for operating personnel

Only qualified personnel may operate the product. Qualified personnel are persons who meet the following requirements:

- Basic regulations on occupational safety and accident prevention for chemical laboratories are known and complied with.
- Knowledge of handling hazardous chemicals is present. Personnel have the ability to recognize and avoid potential dangers.
- Knowledge regarding the application of fire prevention measures for laboratories is available.
- Safety-relevant information is communicated and understood. The personnel can operate the product safely.
- The user documentation has been read and understood. The personnel operate the product according to the instructions in the user documentation.

2.4 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.

Supply voltage

WARNING

An incorrect supply voltage can damage the instrument.

Only operate this instrument with a supply 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 power cord out of the power socket before you set up or disconnect electrical plug connections at the rear of the instrument.

2.5 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.

2.6 Personnel safety

WARNING

Wear protective goggles and working clothes suitable for laboratory work while operating the 862 Compact Titrosampler. It is also advisable to wear gloves when caustic liquids are used or in situations where glass vessels could break.

WARNING

Always install the safety shield supplied with the equipment before using the instrument for the first time. Pre-installed safety shields are not allowed to be removed.

The 862 Compact Titrosampler may not be operated without a safety shield!

WARNING

Personnel are not permitted to reach into the working area of the instrument while operations are running!

A **considerable risk of injury** exists for the user.

WARNING

In the event of a possible blockage of a drive, the power plug must be pulled out of the socket immediately. Do not attempt to free jammed sample vessels or other parts while the device is switched on. Blockages can only be cleared when the instrument is in a voltage-free status; this action generally involves a **considerable risk of injury**.

WARNING

The 862 Compact Titrosampler is **not** suitable for utilization in bio-chemical, biological or medical environments in its basic equipment version.

Appropriate protective measures must be implemented in the event that potentially infectious samples or reagents are being processed.

2.7 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.

2.8 Danger from biological substances

If the instrument is used for biological hazardous substances, it must be marked in accordance with regulations.

In case of a return shipment to Metrohm or a Metrohm Service partner, the instrument or component has to be decontaminated and the hazard symbol for biological hazardous substances must be removed. A declaration of decontamination must be enclosed.

WARNING

Danger of infection and poisoning from biological hazardous substances

Poisoning from toxins and/or infections from samples contaminated with microorganisms.

- Wear protective equipment.
- Use exhaust equipment when working with vaporizing hazardous substances.
- Dispose of biologically contaminated substances properly.

3 Overview of the instrument

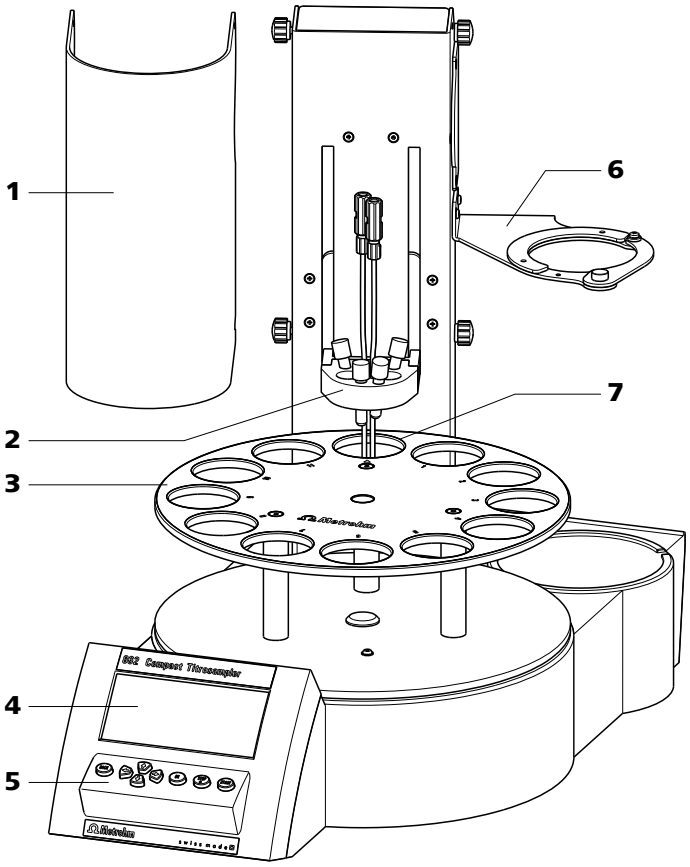


Figure 1 Front 862 Compact Titrosampler

1 **Safety shield (6.2751.130)** With knurled screws for mounting. The safety shield can be folded up.	**2** **Titration head** With two retracted dosing tips and four stoppers.
3 **Sample rack** For 11 sample beakers and one rinsing beaker (6.1459.300, 120 mL)	**4** **Display**
5 **Keypad**	**6** **Dosino holder (6.2057.110)** For fixing the dosing drive and the titrant bottle (1 L).
7 **Special position** For a rinsing beaker	

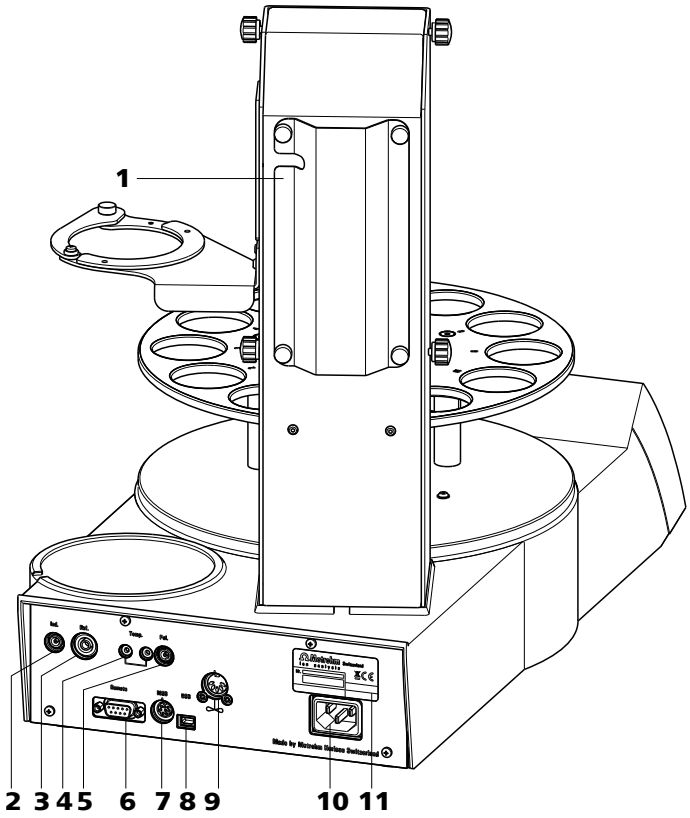


Figure 2 862 Compact Titrosampler rear

1 **Tubing and cable guide**	**2** **Electrode connector (Ind.)** For connecting pH or redox electrodes with integrated or separate reference electrode. Socket F.
3 **Electrode connector (Ref.)** For connecting reference electrodes. Socket B, 4 mm.	**4** **Temperature sensor connector** For connecting temperature sensors of the Pt1000 or NTC type. Two B sockets, 2 mm .
5 **Electrode connector (Pol.)** For connecting polarizable electrodes, e.g. double Pt electrodes. Socket F.	**6** **Remote connector** For connecting instruments with a remote interface. D-sub, 9-pin.
7 **MSB connector** Metrohm Serial Bus. For connecting the 800 Dosino. Mini DIN, 9-pin.	**8** **USB (OTG) connector** For connecting printers, USB flash drives, USB hubs, etc.
9 **Stirrer connector** For 802 Stirrer (rod stirrer).	**10** **Power socket**
11 **Type plate** Contains specifications concerning supply voltage and serial number.	

4 Installation

4.1 Setting up the instrument

4.1.1 Packaging

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

4.1.2 Checks

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

4.1.3 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 and free of vibrations and which provides protection against corrosive atmosphere and contamination by chemicals.

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

4.2 Removing the safety shield and cable guide

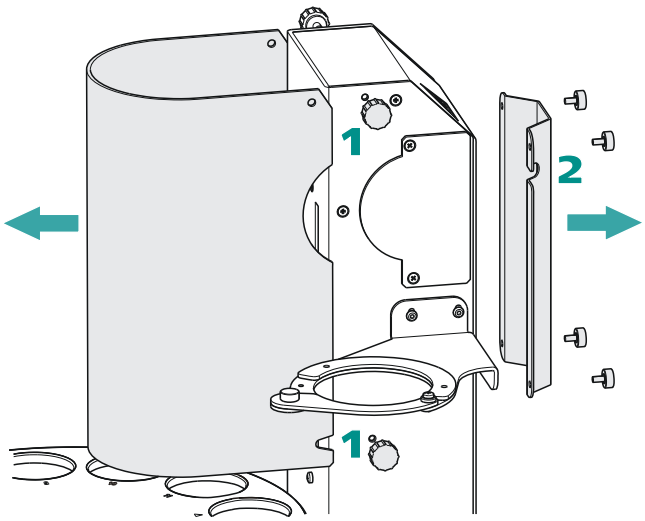


Figure 3 Removing shields

The installation of the accessories is easier to carry out if you remove the safety shield and the cable guide beforehand. Proceed as follows:

1 Loosen the knurled screws on the sides of the tower and remove the safety shield.

2 Loosen the knurled screws on the rear of the tower and remove the cable guide.

Do not forget to refasten these two shields after the installation of the accessories.

4.3 Installing the Dosino

The 800 Dosino is used for the addition of titrant. The titrant bottle can be placed next to the tower of the 862 Compact Titrosampler .

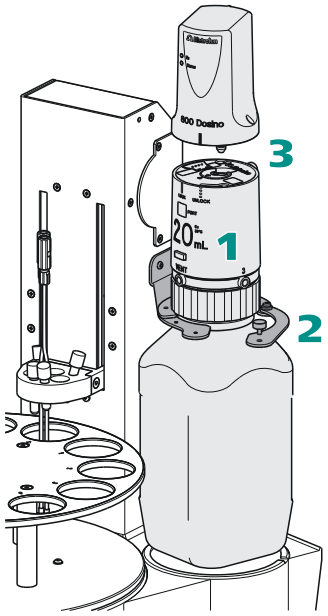


Figure 4 Installing the Dosino

1 Attaching the dosing unit

Connect the filling tubing to port 2 on the underside of the dosing unit and screw the dosing unit onto the titrant bottle.

2 Placing the titrant bottle

Open the bracket on the right-hand side of the tower with the aid of the knurled screw. Place the titrant bottle with the dosing unit on the support surface. Fix the bottle with the bracket and tighten the knurled screw.

3 Attaching the dosing drive

Insert the 800 Dosino with the guide bolts into the openings on the upper side of the dosing unit. Fix the 800 Dosino with a rotation to the left. Note the markings.

4.4 Connecting the Dosino

Connect the Dosino to the **MSB** socket on the rear of the device. The Dosino is automatically recognized when switching on the instrument.

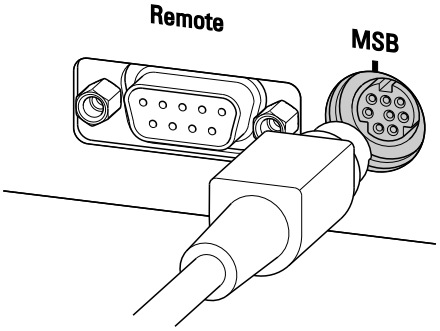


Figure 5 Connecting the Dosino

CAUTION

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

4.5 Setting up the titration head

Equipping the titration head without rinsing equipment

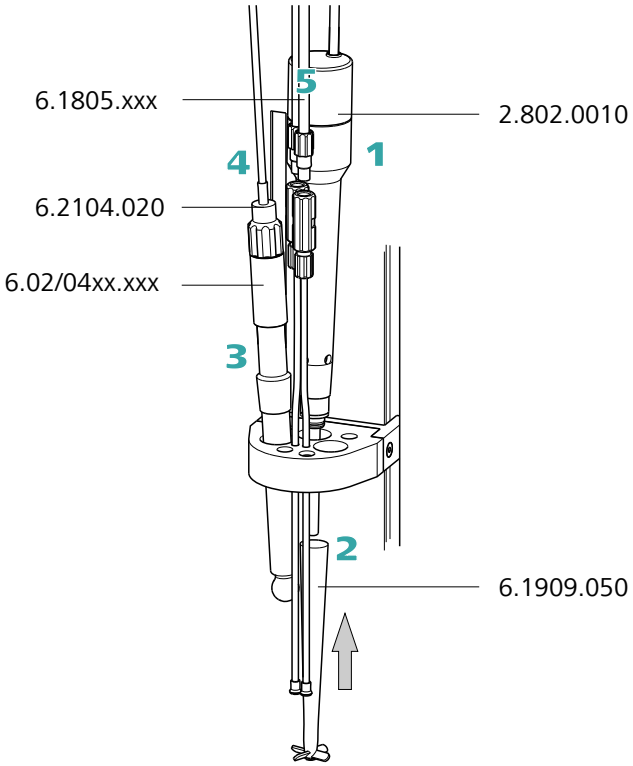


Figure 6 Equip the titration head

1 Insert the rod stirrer (802 Stirrer) from above into the rear opening of the titration head.

2 Guide the 6.1909.050 stirring propeller over the drive shaft of the rod stirrer from below and press firmly.

3 Insert an electrode into the left-hand opening of the titration head.

4 Connect a 6.2104.020 electrode cable to the electrode. Connect the other end to the electrode connector **Ind.** *(see "Connecting pH or redox electrodes", page 22)*.

5 Manually screw the enclosed 6.1805.100 FEP tubing to the dosing tip mounted on the titration head. Connect the other end of the tubing to the dosing unit on the Dosino.

The remaining openings of the titration head can be sealed with the enclosed stoppers provided.

Equipping the titration head with rinsing equipment

An 843 Pump Station (with two pumps) can be used when the sample processing requires the rinsing of the electrodes and the aspiration of the processed sample solution. The 843 Pump Station is available as model version with complete rinsing and aspiration equipment. The rinsing and aspiration equipment is installed as follows:

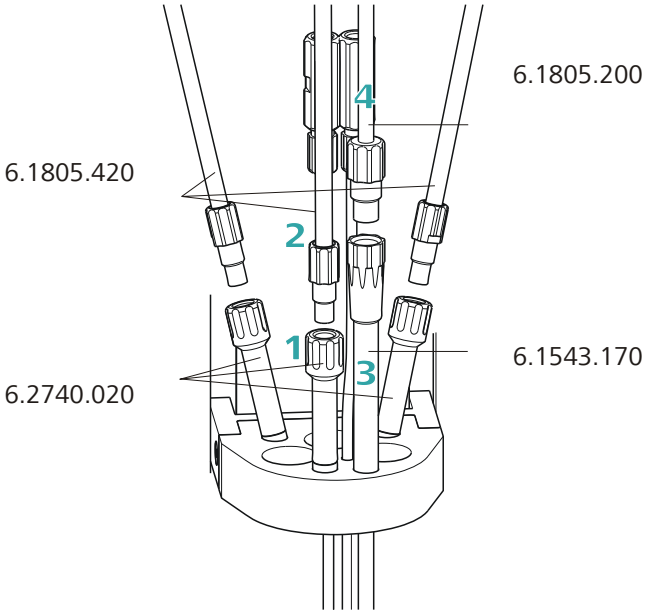


Figure 7 Installing rinsing nozzles and aspiration tip

1 Insert the three 6.2740.020 spray nozzles into the titration head according to the illustration. The position of the individual spray nozzles can also be adjusted as required in terms of height.

2 Manually screw the three 6.1805.420 FEP tubings (with M6 thread) firmly to the spray nozzles.

3 Insert the 6.1543.120 aspiration tip into the front opening of the titration head. It can be adjusted in terms of height and its tip can be cut as required to the necessary length.

4 Manually screw the 6.1805.200 aspiration tubing (with M8 thread) firmly to the aspiration tip.

Setting up the distributor

The 6.1818.240 distributor must be mounted on the rear side of the tower for complete installation of the rinsing and aspiration equipment. It is supplied with the 843 Pump Station.

First loosen the knurled screws of the cable and tubing cover and then remove it. Proceed as follows:

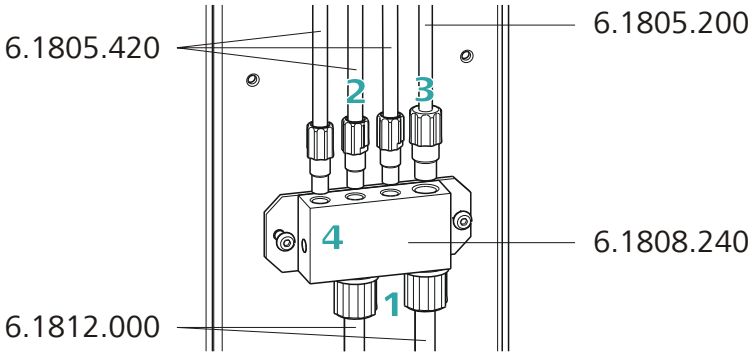


Figure 8 Setting up the distributor

1
- Loosen both union nuts on the distributor and guide each of them over the end of one 6.1812.000 PTFE tubing.
- Fasten the tubing ends to the distributor and fix in place with the union nuts.
- Connect the free tubing ends with a disposal or rinsing canister.

2 Manually screw the 6.1805.420 rinsing tubings already mounted on the titration head firmly into the openings with M6 threaded bores on the distributor.

3 Manually screw the 6.1805.200 aspiration tubing with M8 thread firmly into the remaining opening on the distributor.

4 Loosen the two screws on the rear panel of the instrument with a hexagon key and use it to screw the distributor firmly.

NOTE

Enclosed with the 862 Compact Titrosampler is the 6.1815.010 spiral band. You can wrap cables and tubings with it. This will ensure that the cables and tubings are arranged in an organized manner.

5 Use the four knurled screws to remount the cable and tubing cover.

CAUTION

Close the safety shield again after the titration head has been equipped. The 862 Compact Titrosampler is not permitted to be operated unless the safety shield is correctly mounted.

4.6 Connecting the stirrer

A DIN socket for connecting an **802 Stirrer** rod stirrer is located on the rear of the instrument.

Figure 9 Rod stirrer 802 Stirrer

Take care to observe correct orientation of the contact pins when plugging in the connection cable. The rib on the outside of the plug must match the reference mark (above) on the socket.

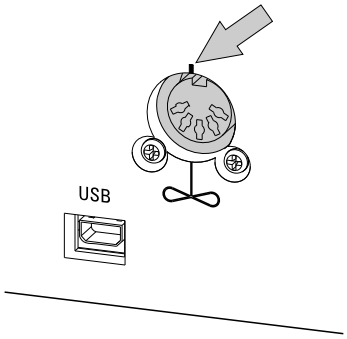


Figure 10 Connecting a stirrer

4.7 Connecting a keyboard, printer and other USB devices

The 862 Compact Titrosampler 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.

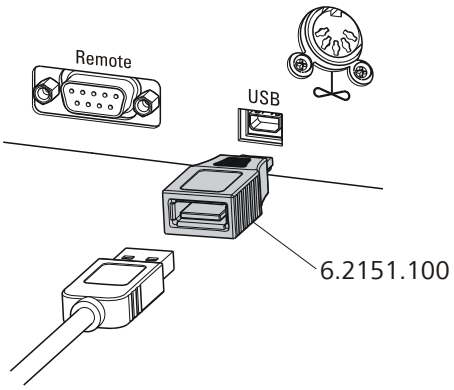


Figure 11 Connecting USB devices

CAUTION

Switch the instrument off before connecting or disconnecting a USB device or a USB stick.

The 862 Compact Titrosampler 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
- 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 862 Compact Titrosampler 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 862 Compact Titrosampler is not designed for supplying power to several devices with elevated electricity requirements.

Examples:

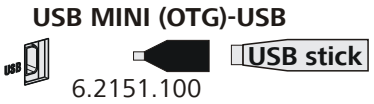


Figure 12 Connecting the USB stick

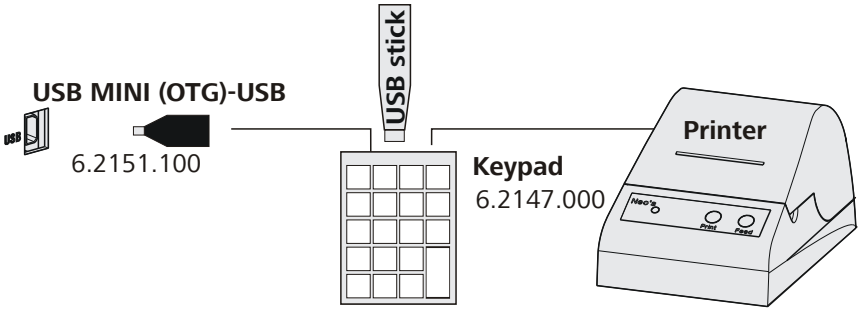


Figure 13 Connecting the 6.2147.000 USB keyboard with USB stick and printer

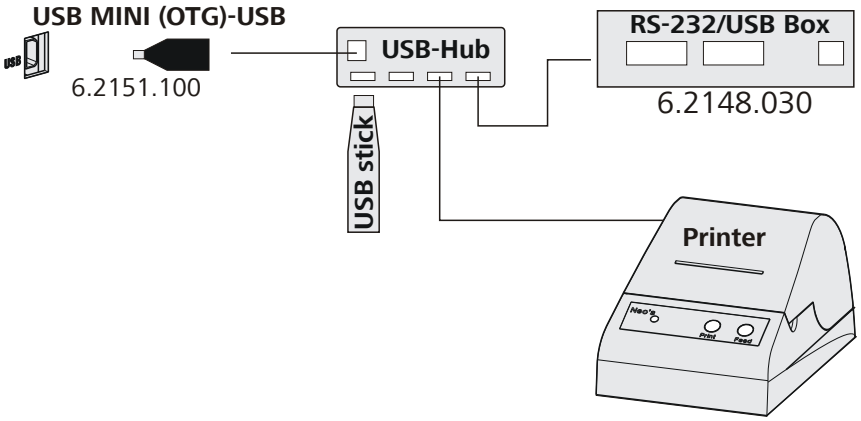


Figure 14 Connecting the USB hub with USB stick, printer and the 6.2148.030 RS-232/USB Box (for connecting balances).

4.8 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.

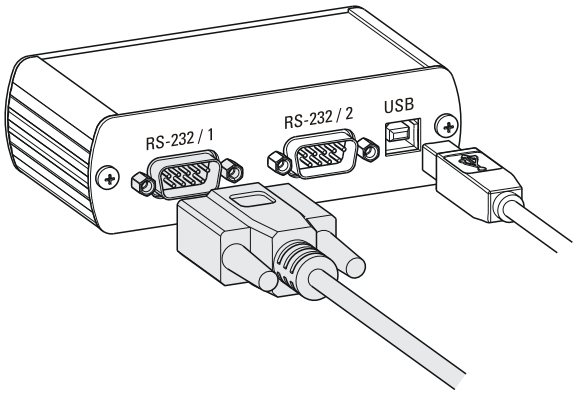


Figure 15 Connecting a balance

When a 6.2151.020 USB cable is used, then the 6.2148.030 RS-232/USB Box can be connected to the 862 Compact Titrosampler by means of a USB hub or a 6.2151.100 adapter *(see chapter 4.7, page 19)*.

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 84)*. Additionally consult the user manual of the balance.

4.9 Connecting a sensor

Connecting pH or redox electrodes

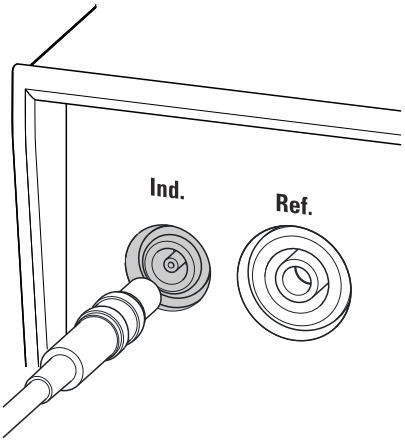


Figure 16 Connecting pH or redox electrodes

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

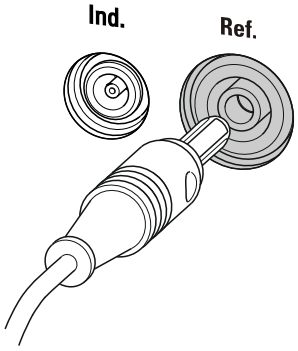


Figure 17 Connecting a reference electrode

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.

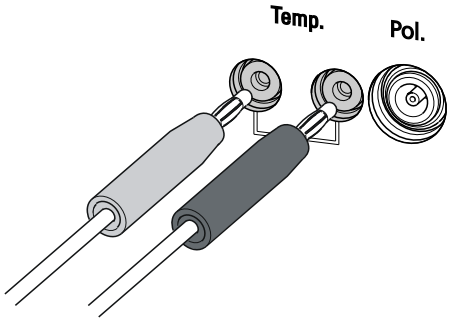


Figure 18 Connecting a temperature sensor

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

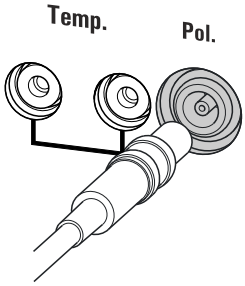


Figure 19 Connecting a polarizable electrode

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.

4.10 Remote connections

The 862 Compact Titrosampler can be used as a control instrument for a simple automation system with a large variety of different instruments. Even older Metrohm instruments can thus be integrated into an automated analysis system.

4.10.1 Miscellaneous remote cables

The following connecting cables can be used with the 862 Compact Titrosampler:

6.2136.010

- For connections with a Dosimat with dosing contact (banana plug socket).

The cable only transmits a starting pulse from the 862 Compact Titrosampler to the connected Dosimat.

6.2141.230

- For connections to an 843 Pump Station.

The cable transmits the control signals of the 862 Compact Titrosampler to the pump 1 and 2 of the 843 Pump Station.

6.2141.240

- For connections with a Dosimat plus.

The cable transmits start and stop pulses from the 862 Compact Titrosampler to the connected Dosimat plus.

In case of an error at the connected Dosimat plus, the cable transmits a stop signal to the 862 Compact Titrosampler.

CAUTION

Some of these cables have asymmetrical wiring. You must connect the correct plug to a particular instrument in each case. Observe the lettering on the ends of the cables. The designation of the instrument is explicitly printed on the end of the cable wherever necessary.

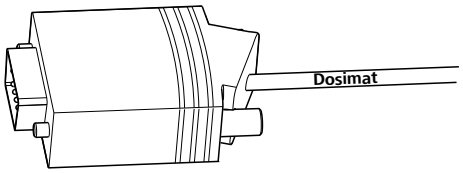


Figure 20 Remote cable with lettering

4.10.2 Example systems

The following figures show typical automation systems with different instrument combinations.

862 — 843 Pump Station — Dosimat plus

The default combination for titrations, with the addition of auxiliary solution by a Dosimat plus, with rinsing and aspiration.

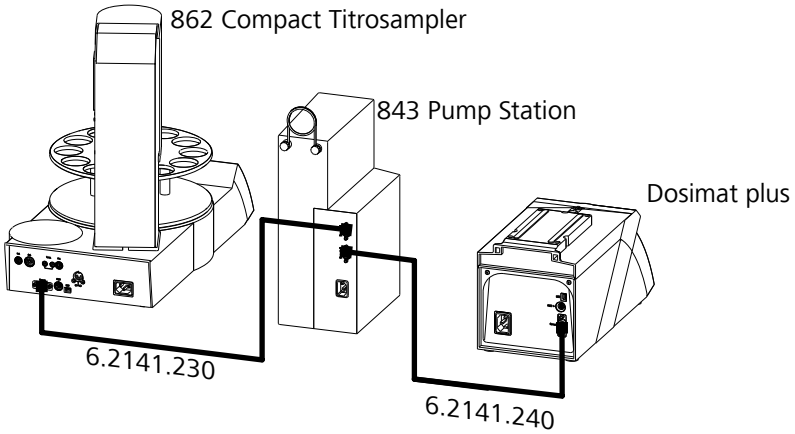


Figure 21 Remote connection 862 Compact Titrosampler - 843 Pump Station - Dosimat plus

The Dosimat is operated in XDOS mode. The volume of the auxiliary solution is defined on the Dosimat plus. On the 843 Pump Station the 862 is connected to **Remote 1**, the Dosimat plus to **Remote 2**. Pump 1 is used for rinsing the electrode, pump 2 for aspirating the sample solution. The sample series is started on the 862 Compact Titrosampler.

862 — Dosimat

The small combination for titrations, with the addition of auxiliary solution by a Dosimat of the 6xx/7xx series. If no 843 Pump Station is used, a Dosimat can be connected directly to the 862 Compact Titrosampler.

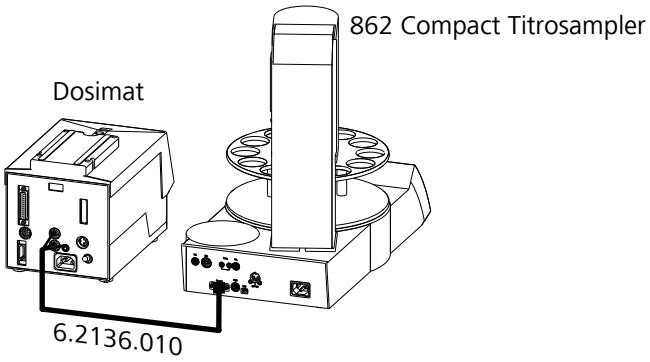


Figure 22 Remote connection 862 Compact Titrosampler - Dosimat

The Dosimat plus is operated in DIS mode. The volume of the auxiliary solution is defined at the Dosimat.

4.11 Mounting the cable guide and the safety shield

After having installed all accessories you can remount the shields. Proceed as follows:

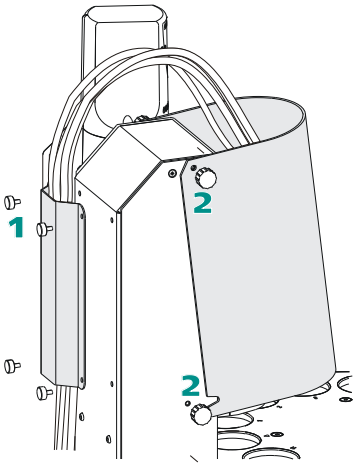


Figure 23 Mounting shields

1 Mounting the cable guide

Fasten the cable guide with the four red knurled screws to the rear of the tower. Ensure that all cables and tubing are routed in order.

2 Mounting the safety shield

Fasten the safety shield with the four black knurled screws to the sides of the tower. The safety shield can be folded up if needed once each of the lower knurled screws has been slightly loosened.

WARNING

The 862 Compact Titrosampler may not be operated without a safety shield!

4.12 Connecting the instrument to the power grid

WARNING

Electric shock from electrical potential

Risk of injury by touching live components or through moisture on live parts.

- Never open the housing of the instrument while the power cord is still connected.
- Protect live parts (e.g. power supply unit, power cord, connection sockets) against moisture.
- Unplug the power plug immediately if you suspect that moisture has gotten inside the instrument.
- Only personnel who have been issued Metrohm qualifications may perform service and repair work on electrical and electronic parts.

Connecting the power cord

Accessories

Power cord with the following specifications:

- Length: max. 2 m
- Number of cores: 3, with protective conductor
- Instrument plug: IEC 60320 type C13
- Conductor cross-section 3x min. 1.0 mm^2 / 18 AWG
- Power plug:
  - according to customer requirement (6.2122.XX0)
  - min. 10 A

NOTE

Do not use a not permitted power cord!

1 Plugging in the power cord

- Plug the power cord into the instrument's power socket.
- Connect the power cord to the power grid.

5 Titrations and automation runs

5.1 Dynamic equivalence point titration (DET)

Dynamic equivalence point titration is a titration mode for all standard titrations with an s-shaped curve progression. The reagent is added in variable volume steps. The volume steps vary as a function of the slope of the curve. An attempt is made to reach constant measured value changes with each dosing. The optimal volume for dosing is determined from the measured value changes of the previous dosings. Measured value acceptance is measured value drift-controlled (equilibrium titration) or after a waiting time. Equivalence points are evaluated automatically.

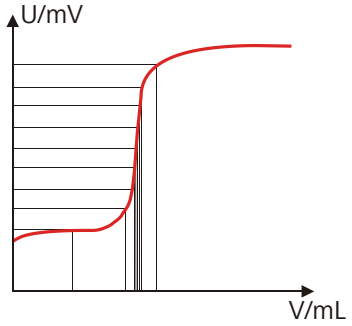


Figure 24 Reagent dosing for DET

5.2 Monotonic equivalence point titration (MET)

Monotonic equivalence point titration is a robust titration mode for titrations with any curve shape and for slow titrations or slow-response electrodes. The reagent is added in constant volume steps. Measured value acceptance is measured value drift-controlled (equilibrium titration) or after a waiting time. Equivalence points are evaluated automatically.

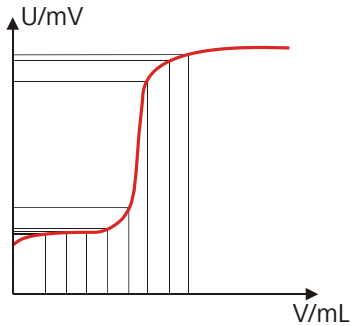


Figure 25 Reagent dosing for MET

5.3 Endpoint titration (SET)

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

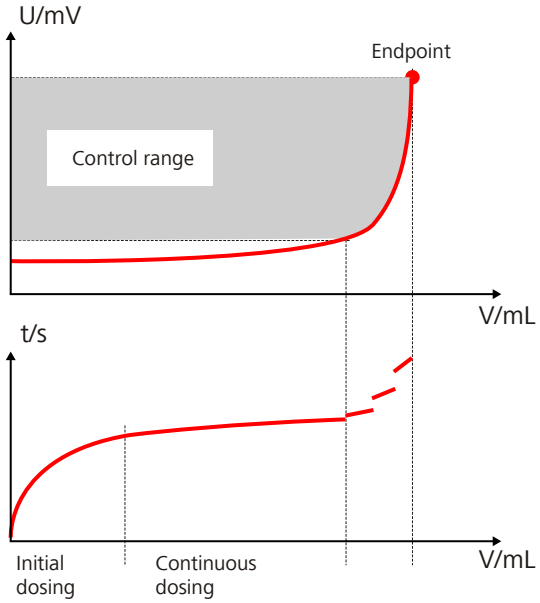


Figure 26 Reagent dosing for SET

5.4 Automation runs

5.4.1 Dipping in special

This automation run is suitable for simple determinations.

No pump is required for rinsing or for aspiration of the sample vessels. The titration head with electrode and buret tips is immersed in the filled rinsing beaker on the special beaker position after each determination. At the same time, the rinsing solution is stirred.

If required, auxiliary solution can be added prior to the beginning of a determination with a Dosimat/Dosimat plus.

NOTE

A beaker full of rinsing solution needs to be placed in the **special beaker position**.

The individual steps:

- Move to sample
- Lower the lift to the work position
- Start the determination
- If necessary, initiate dosing (**Activation pulse**) and switch on the stirrer
- Wait for **Start delay time** if necessary
- Wait for end of determination
- Switch off the stirrer and move the lift upward
- Wait for **Dripping time**
- Move to special beaker position
- Lower the lift to work position and switch on the stirrer
- Wait for **Rinsing time**
- Switch off the stirrer and move the lift upward
- Wait for **Dripping time**

After the last sample:

- Lower the lift in special beaker to work position.

5.4.2 Dipping in special 2

This automation run is suitable for simple determinations.

No pump is required for rinsing or for aspiration of the sample vessels. The titration head with electrode and buret tips is immersed in the filled beaker on rack position 11 at the beginning of the sample series and after each determination. At the same time, the rinsing solution is stirred. The electrode is immersed on the special beaker position after the sample series.

If required, auxiliary solution can be added prior to the beginning of a determination with a Dosimat/Dosimat plus.

NOTE

A beaker filled with rinsing solution needs to be placed in **rack position 11**.

A beaker filled with storage solution needs to be placed in the **special beaker position**.

The individual steps:

Before the first sample:

- Move to rack position 11
- Lower the lift to work position and switch on the stirrer
- Wait for **Rinsing time**

- Switch off the stirrer and move the lift upward
- Wait for **Dripping time**

For each sample:

- Move to sample
- Lower the lift to the work position
- Start the determination
- If necessary, initiate dosing (**Activation pulse**) and switch on the stirrer
- Wait for **Start delay time** if necessary
- Wait for end of determination
- Switch off the stirrer and move the lift upward
- Wait for **Dripping time**
- Move to rack position 11
- Lower the lift to work position and switch on the stirrer
- Wait for **Rinsing time**
- Switch off the stirrer and move the lift upward
- Wait for **Dripping time**

After the last sample:

- Move to special beaker position
- Lower the lift in special beaker to work position

5.4.3 Double dipping

This automation run is suitable for simple determinations.

No pump is required for rinsing or for aspiration of the sample vessels. The titration head with electrode and buret tips is immersed in the filled rinsing beaker on rack position 11 and on the special beaker position after each determination. At the same time, the rinsing solution is stirred.

If required, auxiliary solution can be added prior to the beginning of a determination with a Dosimat/Dosimat plus.

NOTE

A filled rinsing beaker must be placed in **rack position 11** and in the **special beaker position**.

The individual steps:

- Move to sample
- Lower the lift to the work position
- Start the determination
- If necessary, initiate dosing (**Activation pulse**) and switch on the stirrer
- Wait for **Start delay time** if necessary
- Wait for end of determination

- Switch off the stirrer and move the lift upward
- Wait for **Dripping time**
- Move to rack position 11
- Lower the lift to work position and switch on the stirrer
- Wait for **Rinsing time**
- Switch off the stirrer and move the lift upward
- Wait for **Dripping time**
- Move to special beaker position
- Lower the lift to work position and switch on the stirrer
- Wait for **Rinsing time**
- Switch off the stirrer and move the lift upward
- Wait for **Dripping time**

After the last sample:

- Lower the lift in special beaker to work position

5.4.4 Rinsing in sample

This automation run requires an 843 Pump Station for rinsing and aspirating. The sample solution is aspirated after each determination. The titration head with electrode and buret tips is subsequently rinsed in the sample vessel. The rinsing solution is also aspirated.

If required, auxiliary solution can be added prior to the determination with a Dosimat/Dosimat plus.

NOTE

A beaker full of rinsing solution needs to be placed in the **special beaker position**.

The individual steps:

- Move to sample
- Lower the lift to the work position
- Start the determination
- If necessary, initiate dosing (**Activation pulse**) and switch on the stirrer
- Wait for **Start delay time** if necessary
- Wait for end of determination
- Switch off the stirrer and switch on the aspiration pump
- Wait for **Aspiration time**, the aspiration pump remains switched on
- Switch on the rinsing pump and wait for **Rinsing time**
- Switch off the rinsing pump and wait for **Aspiration time** again
- Switch off the aspiration pump and move the lift upward
- Wait for **Dripping time**

After the last sample:

- Move to special beaker position
- Lower the lift to work position

5.4.5 Rinsing in special

This automation run requires an 843 Pump Station for rinsing and aspirating. The titration head with electrode and buret tips is rinsed in the rinsing beaker after each determination. The rinsing solution is aspirated at the same time.

If required, auxiliary solution can be added prior to the determination with a Dosimat/Dosimat plus.

NOTE

An empty beaker should be placed in the **special beaker position**.

The individual steps:

- Move to sample
- Lower the lift to the work position
- Start the determination
- If necessary, initiate dosing (**Activation pulse**) and switch on the stirrer
- Wait for **Start delay time** if necessary
- Wait for end of determination
- Switch off the stirrer and move the lift upward
- Wait for **Dripping time**
- Move to special beaker position
- Lower the lift to work position
- Switch on the rinsing pump and the aspiration pump
- Wait for **Rinsing time**, the aspiration pump remains switched on
- Switch off the rinsing pump and wait for **Aspiration time**
- Switch off the aspiration pump and move the lift upward
- Wait for **Dripping time**

After the last sample:

- Lower the lift in special beaker to work position
- Switch on the rinsing pump and wait for **Rinsing time**
- Switch off the rinsing pump

5.4.6 Pump control

Rinsing the electrode and aspirating the sample vessels is carried out with the aid of an 843 Pump Station with two membrane or peristaltic pumps. These are connected to the 862 Compact Titrosampler by means of a remote cable *(see chapter 4.10.2, page 25)*. The pumps can be operated manually by push-button or controlled by means of remote lines.

The method runs of the 862 Compact Titrosampler automatically switch the pumps on or off at a predefined moment. The runs cannot be modified.

You can define the duration of the rinsing and aspiration procedures under **Menu ► Parameters ► Automation**, see *page 136*ff.

NOTE

The pumps of the 843 Pump Station **cannot be stopped manually** on the 862 Compact Titrosampler. In the event of an **Emergency stop**, switch off the 843 Pump Station with the red **power switch**.

5.4.7 Dosing auxiliary solutions

The addition of an auxiliary solution can be carried out with a 6xx/7xx Dosimat or a Dosimat plus. This is connected via remote cable to the 862 Compact Titrosampler .

Triggering dosing is accomplished by switching on the **Activation pulse** which is issued at the beginning of a titration. Dosing proceeds automatically and is not monitored by the 862 Compact Titrosampler. A waiting time must be observed in each case for the duration of the dosing. Define a sufficiently long **Start delay time**. You will find both settings under **Menu ► Parameters ► Start conditions**, see *page 133ff*. Select a start delay time that is sufficiently large so that the entire volume is dosed before the titration begins.

NOTE

The dosing of an auxiliary solution is parameterized on the Dosimat. An **8xx Dosimat plus** must be operated in **XDOS** mode, a **6xx** or **7xx Dosimat** in **DIS** mode. Enter the dosing volume on the Dosimat and activate a dosing rate as high as possible.

6 Operation

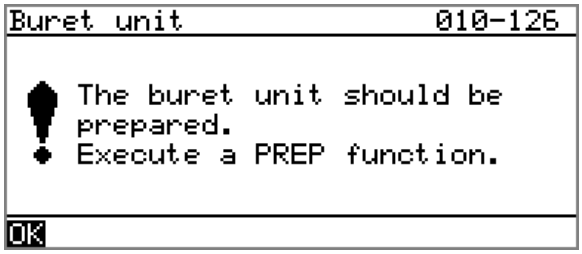
6.1 Switching the instrument on and off

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.

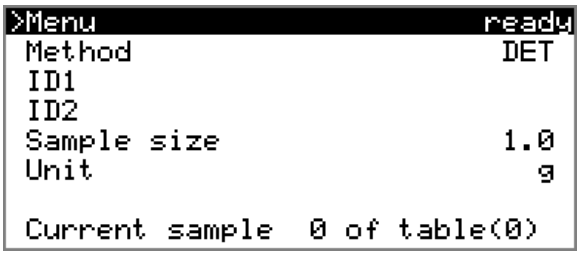
▪ If a buret unit has been attached, then a request appears to carry out the **PREP** function:



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 64*.

▪ Confirm the message with **[OK]**.
The display of this message can be deactivated in the system settings *(see "PREP warning", page 73)*.

The main dialog is displayed:



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.

6.2 Fundamentals of operation

6.2.1 The keypad

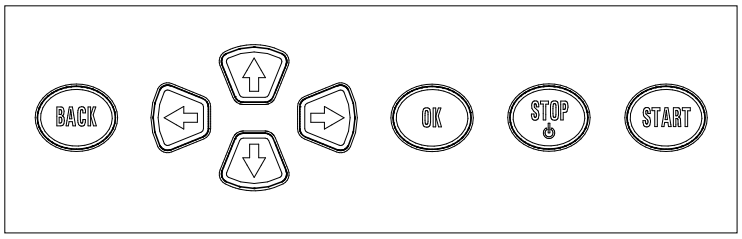
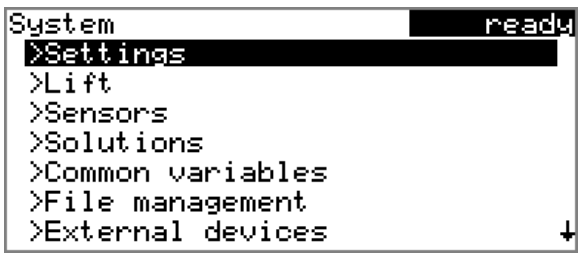


Figure 27 Keypad 862 Compact Titrosampler

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.

6.2.2 Structure of the dialog windows



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.

busy A method has been started.

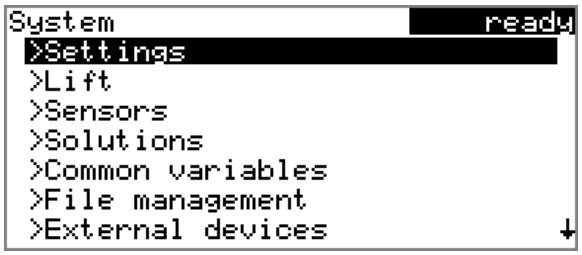
hold A method has been paused.

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]**.

6.2.3 Navigating in the dialog

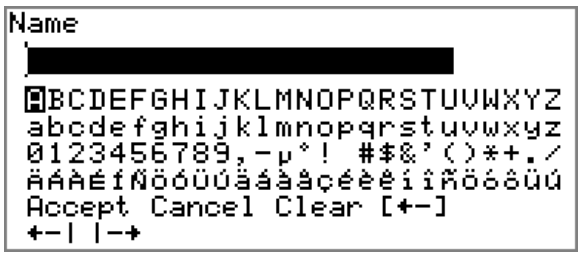
The selection bar is displayed in inverted style. Use the arrow keys **[⇧]** and **[⇩]** to move the selection bar upward or downward one line at a time. If a dialog text is marked with ">", then additional settings are available in a subordinate dialog. Use **[OK]** to access this dialog.

Example: System settings



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

6.2.4 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**.

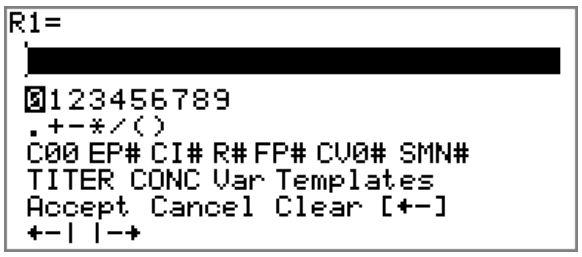
A commercially available USB keyboard can be connected to make it easier to enter text and numbers. The assignment of the keys on the PC keyboard is described in *chapter 12.6.2, page 147*.

6.2.5 Selecting from a selection list

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

6.3 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.



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 40)*
Templates	List of predefined calculation formulas *(see "Calculation templates", page 41)*

"#" 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 6.2.4, page 38*.

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]**.

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

Template	Description
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

6.4 Methods

6.4.1 Creating a new method

Proceed as follows to create a new method:

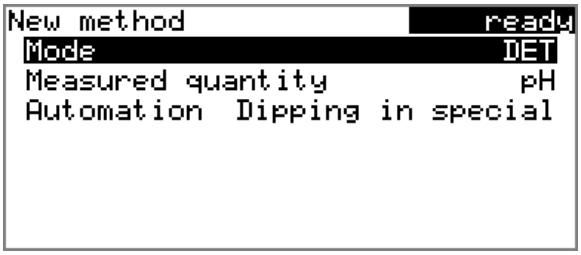
1 Open the method table

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

The method table opens:

2 Select a titration and measuring mode

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



- 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]**.

3 Select an automation sequence

- Select **Automation** and press **[OK]**.
- Select the desired sequence 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**.

6.4.2 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:

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:

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.

6.4.3 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:

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**.

6.4.4 Exporting a method

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

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:

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 7.6, page 81*.

The method is being exported. The directory structure on the USB flash drive is described in the more detailed manual.

6.5 Sample data

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

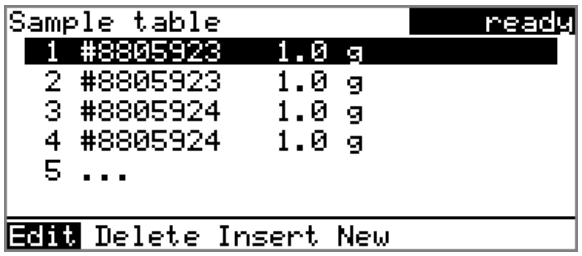
- Using the sample table. This is particularly useful with sample series.
- Directly in the main dialog, if the same sample data is to be used for an entire sample series.
- Automatic request immediately after the start of the determination. This is useful only with single determinations.

You can also send the sample size and the unit from a connected balance in any case. With some balances, the sample identification and the method can be sent in addition to the sample size.

6.5.1 Sample table

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 6.7.2, page 55)*.

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



Edit

Editing data of the selected line

Delete

Delete the selected line from the sample table.

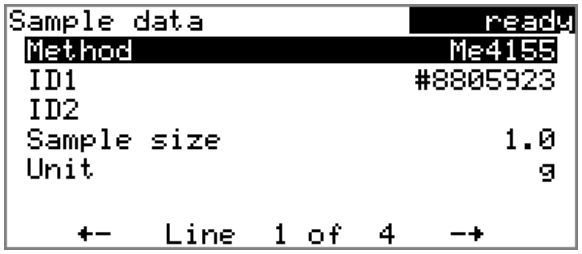
Insert

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.

Editing sample data



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 **[⇨]**.

Insert 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 to 9999999999**
Default value	**1.0**

Unit

Unit of the sample size.

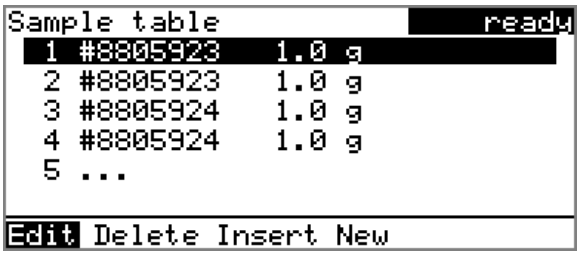
Selection	**g** | **mg** | **µg** | **mL** | **µL** | **pieces** | **User-defined**
Default value	**g**

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.

Sending the sample size from a balance

NOTE

In order for a balance to be able to send a sample size to the sample table, the sample table has to be switched on in the sample series dialog *(see chapter 6.6.1, page 50)*.



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 highlighted or whether the sample table is even opened. In the above example, the sample size is entered in line 5.

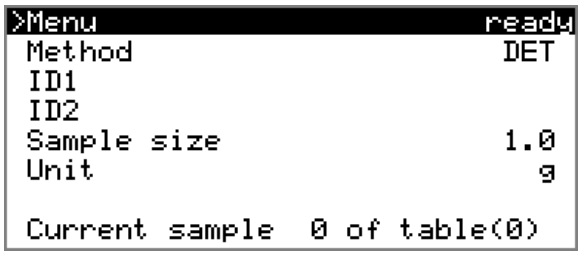
NOTE

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.

6.5.2 Entering sample data in the main dialog

In the main dialog you can enter the sample data even while a determination is running *(see chapter 6.7, page 54)*. It will be used for the ongoing determination.



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 to 999999999**
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.

6.6 Performing a sample series

Samples can be placed anywhere on the rack. They are processed according to ascending rack position.

The following is to be observed:

- In addition to the sample vessels, a rinsing beaker has to be placed on the last rack position, marked with the sign ▲. This vessel must be either empty or filled with a rinsing solution, depending on the automation sequence, *see chapter 5.4, page 30ff*.

6.6.1 Starting the sample series

Starting a sample series

A suitable method must be loaded before a sample series is started *(see chapter 6.4.3, page 44)*. The necessary parameters *(see chapter 8.1, page 88ff)* can then be modified.

If the sample table is used and if it contains methods defined, these methods will be used. In this case, previously loading a certain method is not necessary.

1 Define the sample series

Press the **[START]** key.

You can now select the quantity and the first rack position of the samples to be processed as well as the location of the sample data.

2 Enter the number of samples

- Select **Number of samples** and press **[OK]**.
- Enter the number of samples. **table** means that all samples in the sample table will be processed until it will be empty.
- Close the input dialog with **[BACK]** or **Accept**.

3 Enter the rack position of the first sample

- Select **Next sample pos.** and press **[OK]**.

- Enter the starting position of the sample series.
- Close the input dialog with **[BACK]** or **Accept**.

The value for the number of samples remains saved for the next sample series. The position of the first sample is increased with each method run.

You can still cancel the start of the sample series at this time with **[BACK]** or **[STOP]**.

4 Activate or deactivate the sample table

If the sample table is activated, the sample data of the sample table is used. If the sample table is deactivated then the sample data of the main dialog is used.

5 Close the sample series dialog

Close the dialog with the **[BACK]** key.

6 Start the sample series

Press the **[START]** key.

Stopping a sample series

A sample series can be canceled at any time.

A sample series can be canceled at any time. When this is done, instruments connected via remote connections, such as a Dosimat plus or an 843 Pump Station will also be stopped.

1 Press the **[STOP]** key.

The method run is stopped. The sample series cannot be resumed.

6.6.2 Pausing a sample series and continuing

Pausing a sample series

A method run of the 862 Compact Titrosampler can be paused and then continued again. The connected instruments are however **not** paused.

NOTE

Interruption of the method run is not possible during the execution of commands during which the 862 Compact Titrosampler waits for a signal from the connected titrator. This is the case during the conditioning of the titration cell and the execution of the KF titration.

A function bar with the entry "**Hold**" is displayed during the run of a sample series in the so-called "Live" dialog.

1 Press the **[OK]** key.

The method run is paused. However, currently running movements of the sample rack or the lift will be finished.

Instead of the "**Hold**" function, "**Continue**" is displayed in the function bar.

Continuing sample series

If a method run is paused, then the "**Hold**" status is displayed in the title bar, see previous figure. The sequence can be continued with the "**Continue**" function.

In the "**Hold**" status, a method run can be stopped completely, and with it the entire sample series, by pressing the **[STOP]** key.

1 Press the **[OK]** key.

As is also the case at the start of a sample series, a request dialog appears here in which the number of samples to be processed can

still be changed. It is thus possible to shorten a sample series or to extend it, without stopping it.

2 Press the **[OK]** key and enter the number of samples that still need to be processed. The current sample must be taken into account.

3 Press the **[START]** key.

The sample series continues.

6.6.3 Status of the sample series

The status of the sample series is continuously displayed in the main dialog. In addition to the name of the method loaded and the sample data of the current sample, information concerning the running or the previous sample series will be displayed on the lowest line. This includes:

- Number of samples already processed (including the current sample)
- Total number of samples in the sample series
- Number of assigned lines in the sample table (only when sample table is switched on)

Examples:

Current sample 2 of 5(3)

The second sample in a sample series with a total of 5 samples is currently being processed. 3 unprocessed samples remain in the sample table.

Current sample 1 from table(10)

The first sample in a sample series which contains all of the samples in the sample table is currently being processed. 10 unprocessed samples remain in the sample table.

One can use the key **[BACK]** to switch back and forth between live display and main dialog while a sample series is running. This makes it possible to check the current status of the sample series at any time. If changes are made in the sample table, then this status bar is updated without delay in the main dialog.

6.6.4 Special case: Calibrations

The electrodes must be calibrated in advance for a correct SET titration. This can be accomplished in the same sample series.

- Create a calibration method (CAL mode) in which you define the number of buffer solutions to be processed. Save the method.
- Add a line to the sample table which calls up the calibration method. It should be positioned immediately ahead of the lines with the data for the samples to be titrated.
- Place the required buffer solutions on the rack positions ahead of the sample solutions on the sample rack.

The calibration method is run first when the sample series is being executed. The buffer solutions are moved to automatically.

NOTE

At the start of the sample series, enter the rack position of the first buffer solution as the **Next sample pos.**.

When specifying the **Number of samples**, enter (for the calibration) one sample more than is to be titrated. The calibration is considered to be one single sample processing, even if several buffer solutions are being processed. The number of lines in the sample table is the determining factor. You can also select **table** as the **Number of samples**.

6.7 Live modifications

6.7.1 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]**.

- 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.

6.7.2 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]**.

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]**.

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 6.7.1, page 54*. 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 55)* menu item in the main menu.

6.7.3 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:

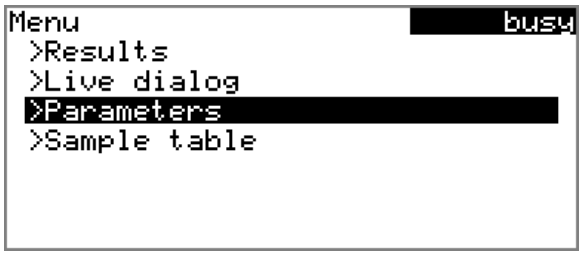
1 Displaying the main dialog

- 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]**.



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.

6.8 Results

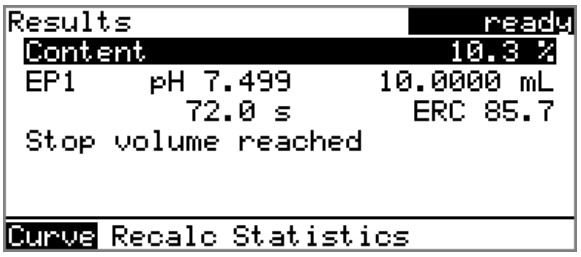
Menu ▶ Results

After the completion of the sample series, the results dialog is displayed.

NOTE

It is also possible to display the results dialog during a running sample series. The statistics results of the previous determinations are also available. However, the results of the current determination can only be displayed between the end of one titration and the beginning of the next titration. The method run can be interrupted with the **Hold** function in the live dialog.

Recalculations and the display of the titration curves in the results window are not possible during a sample series.



The calculated result of the last determination and details concerning the endpoint are shown in the overview.

Curve

Display the curve of the current determination.

Recalculate

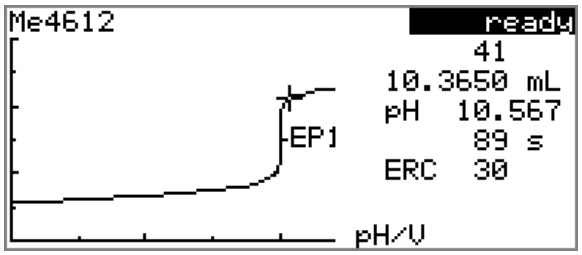
Recalculate the current determination. The procedure will be executed immediately.

Statistics

Display the statistical overview of a determination series *(see chapter 6.9, page 59)*.

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

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.

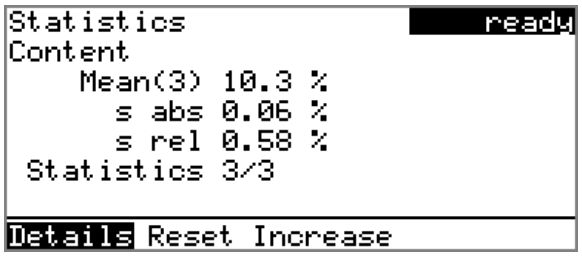
6.9 Statistics

Menu ▶ Results ▶ Statistics

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

NOTE

This function is visible only if statistics has been activated.



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 deter-

minations are to be carried out in total. All three determinations were carried out in this example.

Details

Display additional data.

Reset

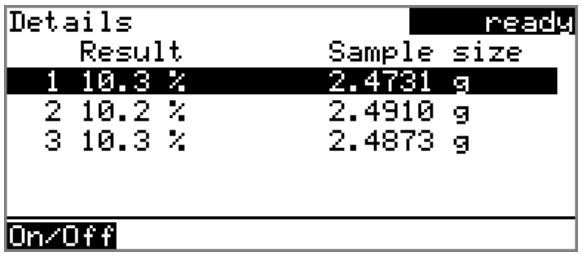
Delete all statistics data.

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.



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.

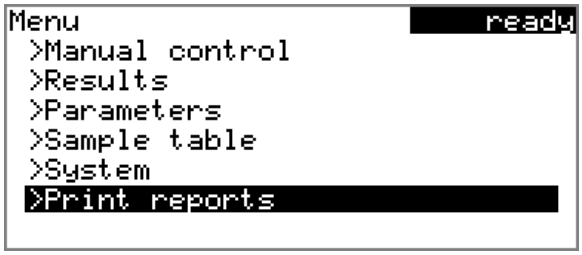
6.10 Printing a report manually

Menu ► Print reports

Proceed as follows to print a report manually:

1 Opening the main menu

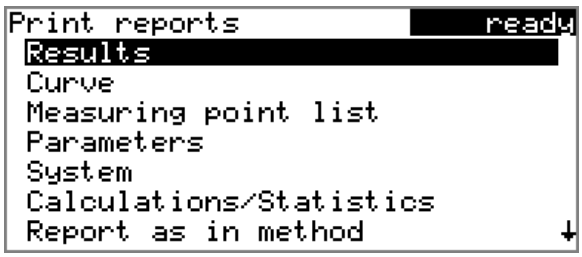
- In the main dialog, select **Menu** and press **[OK]**.



2 Opening the print dialog

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

The dialog window with the available reports opens:



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 83)*.
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 82)*.
Report as in method	The reports that are defined in the method will be printed out.

6.11 Manual control

Menu ► Manual control

The following functions are available in the manual control:

- Rotating the sample rack (**Rack position**)
- Moving the lift (**Lift position**)
- Dosing (**Dosing**)
- Measuring (**Measure**)
- Stirring (**Stirrer**)

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

6.11.1 Rotating the sample rack

If the **Rack position** line is selected, then the arrow keys **[⇨]** and **[⇦]** can be used to select one of the following functions, which can then be run by pressing **[OK]**:

Next	The lift is moved upward and the next highest rack position is placed in front of the lift. If the **[OK]** key remains pressed, the rack automatically moves to the next position.
Previous	The lift is moved upward and the next lowest rack position is placed in front of the lift. If the **[OK]** key remains pressed, the rack automatically moves to the next position.
Reset	The rack is being initialized. The lift is moved upward and the sample rack is rotated to the starting position. At the same time, the starting position is reset (**Next sample pos.**) to **1** for the start of the next sample series.

The rack position display is always updated as soon as the rack is in the new position.

6.11.2 Moving the lift

If the **Lift position** line is selected, then the lift can be moved to the position suggested in the function bar by pressing **[OK]**. Only two positions are possible:

Work pos.	The working height. It can be set under **Menu ► System ► Lift** *(see page 74)*.
Shift pos.	The rotation height. The lift moves all the way to the top.

The current lift position is displayed. Each other possible position is provided in the function bar.

6.11.3 Dosing

The following dosing functions are available in the manual control:

Prepare the buret unit (PREP)	Rinse the cylinder and tubings of the buret unit *(see chapter 12.1.2, page 142)*.
Continuous dosing (DOS)	Dose while the **[START]** key is pressed.
Dose a fixed volume (ADD)	Dose a specified volume.

Empty the dosing device (EMPTY) Empty the cylinder and tubings of the buret unit *(see chapter 12.1.2, page 142)*.

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]**.

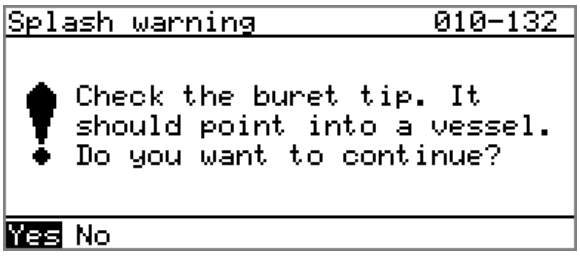
Manual control opens.

2 Select the dosing function

- Select the **Dosing** item.

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

The following message is displayed:



3 Start the preparing

CAUTION

Make sure that the buret tip is directed into a vessel that can accommodate the cylinder 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.

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

3 Configure the dosing function

NOTE

- The dosing and filling rates should be decreased for viscous liquids.
- The maximum dosing and filling rates depend on the cylinder volume *(see chapter 12.1.1, page 142)*.

- Enter the dosing rate.
- Enter the filling rate.

4 Start dosing

- Press **[START]**.

The status changes to **busy**, the dosed volume is displayed. When the volume of one cylinder has been dosed, 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

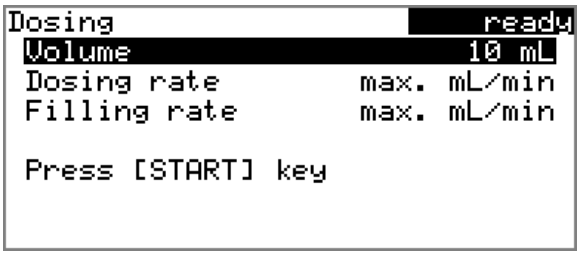
- In the main dialog, select **Menu** and press **[OK]**.
  The main menu opens.
- Select the menu item **Manual control** and press **[OK]**.

Manual control opens.

2 Select the dosing function

- Select the **Dosing** item.

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



3 Configure the dosing function

NOTE

- The dosing and filling rates should be decreased for viscous liquids.
- The maximum dosing and filling rates depend on the cylinder volume *(see chapter 12.1.1, page 142)*.

- 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 the volume of one cylinder has been dosed, 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.

Emptying the buret unit (EMPTY)

The **EMPTY** function is used to empty the cylinder and tubings of the buret unit. You should carry out this function before a reagent exchange.

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]**.

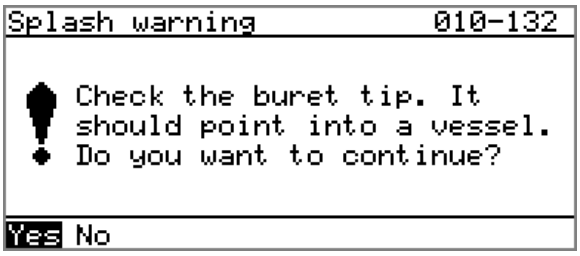
Manual control opens.

2 Select the dosing function

- Select the **Dosing** item.

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

The following message is displayed:



3 Start the emptying

CAUTION

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

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

Emptying is carried out.

6.11.4 Measuring

Open the dialog for manual measurement as follows:

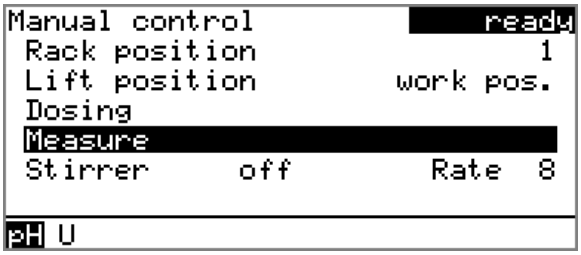
1 Open the manual control

- 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.



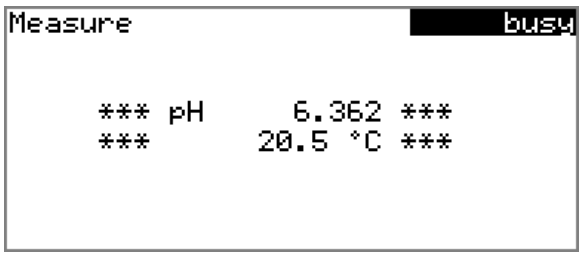
- In the function bar, select the measuring mode and press **[OK]**.

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 connected. If a temperature sensor is connected, then the temperature will be measured automatically.
  This temperature is used for automatic temperature compensation with pH measurements.

4 Start the measurement

- Press **[START]**.



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.

6.11.5 Stirring

You can control a connected stirrer manually.

Proceed as follows:

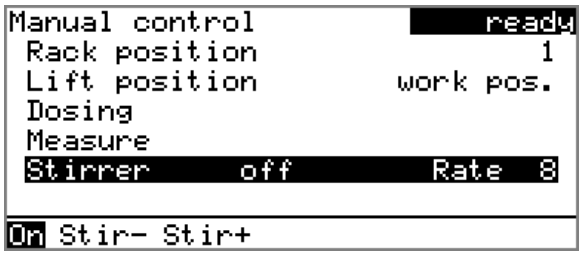
1 Opening the manual control

- 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 Setting the stirring rate

- Select the **Stirrer** item.



- 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 viewing the stirrer from above, this means:
  - "+": counterclockwise rotation
  - "–": clockwise rotation

3 Switching 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 Switching off the stirrer

- In the function bar, select **Off** and confirm with **[OK]**.

The stirrer is stopped.

7 System settings

7.1 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.

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 [Link target not found in publication context!], 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** and **Parameters** are not shown in the main menu.
- Methods can only be loaded, but not deleted, exported or created.

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 862 Compact Titrosampler 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 to 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.

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 12.1.2, page 142)*.

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 to 99999 ohm**
Default value	**30000 ohm**

B value

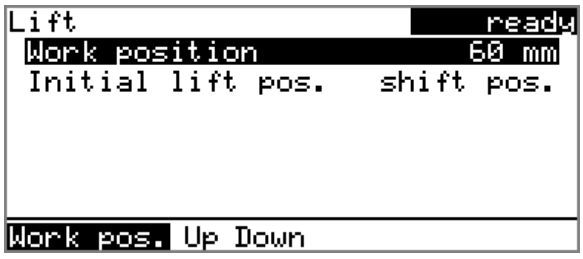
This parameter is visible only when **Temperature sensor** = **NTC**.

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 to 9999 K**
Default value	**4100 K**

7.2 Lift settings (Lift)

Menu ► System ► Lift



Work position

The working height of the lift can be set to the desired value. This is accomplished by means of the direct operation of the lift.

Three functions can be selected from the function bar with **[⇦]** and **[⇨]** and then run by pressing **[OK]**:

- **Work pos.** moves the lift to the current working height.
- **Up** moves the lift 6 mm upward.
- **Down** moves the lift 6 mm downward.

When this dialog page is exited, the respective current lift position will be applied as **Work pos.**.

Input range	**0 to 132 mm** (Increment: **6**)
Default value	**60 mm**

Initial lift pos.

After the 862 Compact Titrosampler has been switched on, the lift moves all the way to the top to the home position for the initialization of the drive. It can then be moved back down to the working height if desired.

Selection	**shift pos.** | **work pos.**
Default value	**shift pos.**

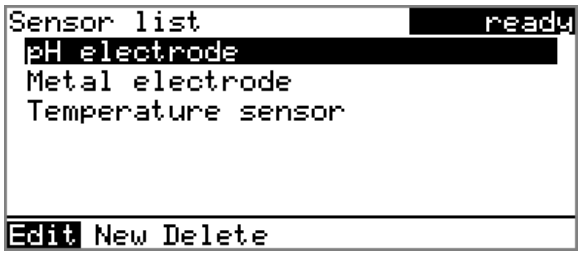
shift pos.
Resting position (0 mm) all the way up

work pos.
The set working height

7.3 Managing sensors

7.3.1 General

Menu ► System ► Sensors



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 a unique 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.

7.3.2 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 is only visible with 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 to 999.9 %**
Default value	**100.0 %**

pH(0)

This parameter is only visible with 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 to 20.000**
Default value	**7.000**

Calibration temp.

This parameter is only visible with pH electrodes.

Temperature at which the last calibration was carried out.

Input range	**–20.0 to 150.0 °C**
Default value	**25.0 °C**

Calibration date

This parameter is only visible with pH electrodes.

Date of the last calibration.

Monitoring

This parameter is only visible with 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 to 999 d**
Default value	**999 d**

7.4 Managing solutions

7.4.1 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.

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:

- **DU**: dosing unit without data chip

- **IDU**: dosing 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.

7.4.2 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	**2** | **5** | **10** | **20** | **50**
Default value	**20**

Concentration

Concentration of the solution.

Input range	**–999999999 to 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 to 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 to 999 d**
Default value	**999 d**

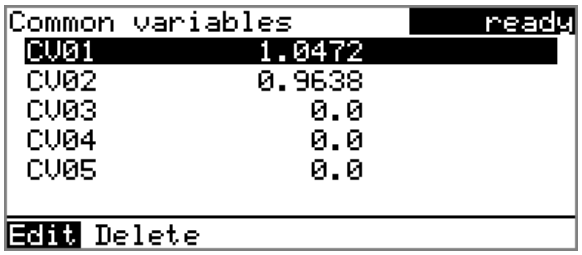
7.5 Managing common variables

7.5.1 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.



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**.

7.5.2 Editing common variables

The common variables can be modified as follows:

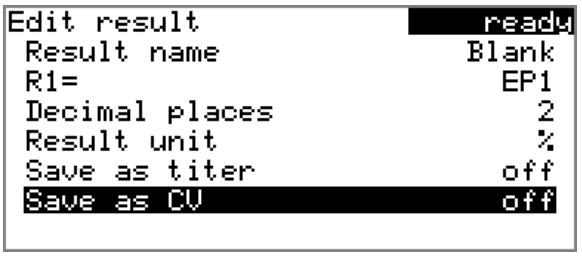
- Manually in this dialog.
- Automatic assignment from the determination run. A calculation result must be configured accordingly for this purpose (see below).

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]**.



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.

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.

7.6 File management

Menu ▶ System ▶ File management

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 82)*.

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.

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 28 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.

7.7 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 85)*.

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 to 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**

Balance	Balance type
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**

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.

7.8 Instrument diagnosis

7.8.1 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

These are device-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]**.

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.

7.8.2 Diagnosis functions

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

8 Parameters

8.1 Dynamic equivalence point titrations (DET)

8.1.1 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 is started. During this period, substances such auxiliary solution can be added with a Dosimat (parameterization on the Dosimat). However, this requires that the **Activation pulse** be enabled.

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

Start volume

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

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

Dosing rate

Rate at which the start volume is dosed. The maximum dosing rate depends on the cylinder volume *(see chapter 12.1.1, page 142)*.

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

Pause

Waiting time, e.g. for the electrode to settle down after the start or a reaction time after the dosing of a start volume.

Input range	**0 to 999,999 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 activated, then the value for the sample size will be requested.

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

Request sample unit

If this parameter is activated, then the unit for the sample size will be requested.

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

Hold at request

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

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

8.1.2 Titration parameters

Menu ► Parameters ► Titration parameters

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

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 **optimal** as 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 92*.

Meas. point density

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

A small value means small volume increments, i.e. a high measuring point density. The curve then shows all the finest details which also include noise; this could cause unwanted equivalence points to be found. A larger value, i.e. a smaller measuring point density, permits quicker titrations. If you are using a dosing device with a small cylinder volume then a smaller measuring point density value may be beneficial. However, you should also set a smaller signal drift and a higher EP criterion at the same time.

Input range	**0 to 9**
Default value	**4**

Min. increment

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

This smallest permitted volume increment is added at the start of the titration and with steep curves in the region of the equivalence point. Very small values should only be used if a low titrant consumption is expected; otherwise unwanted equivalence points could be evaluated.

Input range	**0.05 to 999.90 µL**
Default value	**10.00 µL**

Max. increment

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

A maximum volume increment should be selected in the following cases:

- when titration consumption is very low up until the equivalence point is reached.
- when a start volume is dosed up until shortly before the equivalence point is reached.

- when the change of direction in the jumping range is very abrupt, because otherwise it is easily possible that an excessively large volume could be dosed in the region of the equivalence point.

The value should not be less than 1/100 cylinder volume.

Input range	**0.1 to 9,999.9 µL**
Selection	**off**
Default value	**off**

NOTE

It is not advisable to select similar volumes for the minimum and the maximum increment. Monotonic equivalence point titration (MET) is appropriate for these applications.

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 12.1.1, page 142)*.

Input range	**0.01 to 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 reached 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 reached.

Measuring mode pH, U and Ipol:

Input range	**0.1 to 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 to 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 to 999,999 s**
Default value	**0 s**

Max. waiting time

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

If the 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 to 999,999 s**
Default value	**26 s**

Table 1 Default values of the predefined titration rates for DET

	Titration rate		
	slow	**optimal**	**fast**
Meas. point density	2	4	6
Min. increment	10.00 µL	10.00 µL	30.00 µL
Max. increment	off	off	off
Dosing rate	max.	max.	max.

	Titration rate		
	slow	**optimal**	**fast**
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 to 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 solutions** | **not defined**
Default value	**not defined**

not defined
No check takes place.

I(pol)

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

Input range	**–125 to 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	**–1,250 to 1,250 mV** (Increment: **10**)
Default value	**400 mV**

Electrode test

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

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

Stirrer

The stirrer is switched on at the start of the determination when this parameter is activated.

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 1,000 rpm. The formula for calculating the rotational speed is specified in *chapter 12.2, page 143*. The optimum stirring rate can be tested in the manual control.

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

- "+": counterclockwise rotation
- "–": clockwise rotation

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

8.1.3 Stop conditions

Menu ▶ Parameters ▶ Stop conditions

The conditions for canceling the titration are defined under **Stop conditions**.

Stop volume

The titration is canceled 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 to 9,999.99 mL**
Default value	**100.000 mL**
Selection	**off**

Stop meas. value

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

Measuring mode pH:

Input range	**–20.000 to 20.000**
Selection	**off**
Default value	**off**

Measuring mode U, Ipol:

Input range	**–1,250.0 to 1,250.0 mV**
Selection	**off**
Default value	**off**

Measuring mode Upol:

Input range	**–125.0 to 125.0 µA**
Selection	**off**
Default value	**off**

Stop EP

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

Input range	**1 to 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 to 9,999.99 mL**
Selection	**off**
Default value	**off**

Stop time

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

Input range	**0 to 999,999 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 12.1.1, page 142)*.

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

8.1.4 Evaluation

Menu ► Parameters ► Evaluation

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

Window

Activate this parameter if equivalence points are to be recognized only in a specific measured value range (window). 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 to 20.000**
Default value	**–20.000**

Measuring mode U, Ipol:

Input range	**–1,250.0 to 1,250.0 mV**
Default value	**–1,250.0 mV**

Measuring mode Upol:

Input range	**–125.00 to 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 to 20.000**
Default value	**20.000**

Measuring mode U, Ipol:

Input range	**–1,250.0 to 1,250.0 mV**
Default value	**1,250.0 mV**

Measuring mode Upol:

Input range	**–125.00 to 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.

Input range	**0 to 200**
Default value	**5**

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 to 20.000**
Selection	**off**
Default value	**off**

Measuring mode U, Ipol:

Input range	**–1,250.0 to 1,250.0 mV**
Selection	**off**
Default value	**off**

Measuring mode Upol:

Input range	**–125.00 to 125.00 µA**
Selection	**off**
Default value	**off**

Fixed EP2 at

See **Fixed EP1 at**.

Evaluation and equivalence point criterion with DET

The equivalence points (EP) are localized in a way similar to the Tubbs method [1][2]. The volume value of the equivalence point (V_E) is shifted from the inflection point (see arrow) towards the smaller circle of curvature for real asymmetric titration curves.

[1] C. F. Tubbs, *Anal. Chem.* **1954**, *26*, 1670–1671.

[2] E. Bartholomé, E. Biekert, H. Hellmann, H. Ley, M. Weigert, E. Weise, *Ullmanns Encyklopädie der technischen Chemie*, Vol. 5, Verlag Chemie, Weinheim, 1980, p. 659.

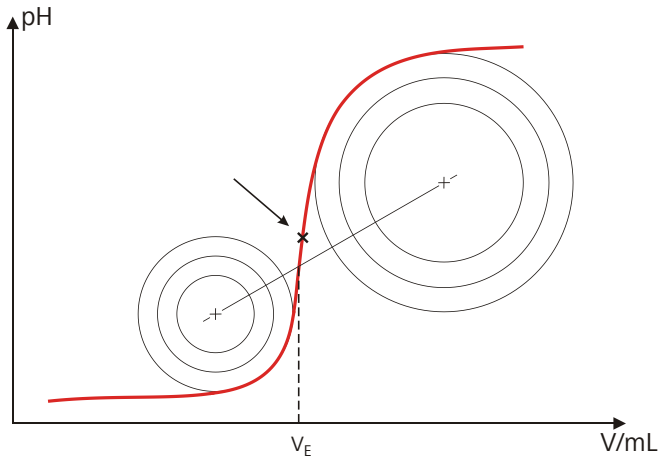


Figure 29 Tubbs method for determining the equivalence point

The figure shows that the evaluation still requires measured values from the measuring point list also after the equivalence point.

For the recognition of the EPs found, the set EP criterion is compared to the ERC (Equivalence point Recognition Criterion) found. The ERC is the first derivative of the titration curve combined with a mathematical function which is more sensitive for flat jumps than for steeper ones. 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 **[Recalculate]** key.

8.1.5 Calculation

8.1.5.1 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. A definition can be made for each calculation as to whether the result is to be saved as a titer or as a common variable.

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

Edit

See the following chapter for editing the data of the selected calculation.

Delete

Delete the selected calculation.

8.1.5.2 Editing a calculation

Menu ► Parameters ► Calculation ► Edit

Result name

The result name is the text which will be shown in the results display 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 6.3, page 40)*.

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

Decimal places

Number of decimal places used to display the result.

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

Result unit

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

Selection	**%** | **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 the 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, called a 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**

8.1.6 Statistics

Menu ► Parameters ► Statistics

The statistics calculation of a multiple determination is activated under **Statistics** and definition is made as to how many determinations the series contains.

Statistics

If this function is activated, then statistics calculations will be carried out for all of the defined results.

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

Number of determinations

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

If an additional determination has to be added to the determination series, because one determination has been incorrect, for example, then this can be accomplished in the statistical overview *(see chapter 6.9, page 59)*.

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

8.1.7 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 83)*.

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

Calculations/Statistics

Output of the calculation formulas for the individual results. Results are specified with full accuracy. This makes recalculation with an external program possible. If Statistics has been activated, then the following data will be printed out as well:

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

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

Measuring point list

Output of the measuring point list.

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

Parameters

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

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

PC/LIMS

The PC/LIMS report is a machine-readable report with all of the 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 82)*.

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

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

8.2 Monotonic equivalence point titrations (MET)

8.2.1 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 is started. During this period, substances such auxiliary solution can be added with a Dosimat (parameterization on the Dosimat). However, this requires that the **Activation pulse** be enabled.

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

Start volume

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

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

Dosing rate

Rate at which the start volume is dosed. The maximum dosing rate depends on the cylinder volume *(see chapter 12.1.1, page 142)*.

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

Pause

Waiting time, e.g. for the electrode to settle down after the start or a reaction time after the dosing of a start volume.

Input range	**0 to 999,999 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 activated, then the value for the sample size will be requested.

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

Request sample unit

If this parameter is activated, then the unit for the sample size will be requested.

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

Hold at request

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

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

8.2.2 Titration parameters

Menu ▶ Parameters ▶ Titration parameters

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

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 **optimal** as 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 2, page 107*.

Volume increment

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

Volume dosed at each dosing increment. High accuracy requires using the correct volume increment. A good guideline is 1/20 of the expected endpoint volume. The volume increment should be closer to 1/100 of the endpoint volume for steep jumps and closer to 1/10 for flat jumps.

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 changes between two measuring points are then of the same order of magnitude as the noise.

Input range	**0.00005 to 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 12.1.1, page 142)*.

Input range	**0.01 to 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 reached 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 reached.

Measuring mode pH, U and Ipol:

Input range	**0.1 to 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 to 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 to 999,999 s**
Default value	**0 s**

Max. waiting time

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

If the 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 to 999,999 s**
Default value	**26 s**

Table 2 Default values of the predefined titration rates for MET

	Titration rate		
	slow	**optimal**	**fast**
Volume increment	0.05000 mL	0.10000 mL	0.20000 mL
Dosing rate	max.	max.	max.
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 to 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 solutions | not defined**
Default value	**not defined**

not defined
No check takes place.

I(pol)

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

Input range	**–125 to 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	**–1,250 to 1,250 mV** (Increment: **10**)
Default value	**400 mV**

Electrode test

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

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

Stirrer

The stirrer is switched on at the start of the determination when this parameter is activated.

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 1,000 rpm. The formula for calculating the rotational speed is specified in *chapter 12.2, page 143*. The optimum stirring rate can be tested in the manual control.

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

- "+": counterclockwise rotation
- "–": clockwise rotation

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

8.2.3 Stop conditions

Menu ▶ Parameters ▶ Stop conditions

The conditions for canceling the titration are defined under **Stop conditions**.

Stop volume

The titration is canceled 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 to 9,999.99 mL**
Default value	**100.000 mL**
Selection	**off**

Stop meas. value

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

Measuring mode pH:

Input range	**–20.000 to 20.000**
Selection	**off**
Default value	**off**

Measuring mode U, Ipol:

Input range	**–1,250.0 to 1,250.0 mV**
Selection	**off**
Default value	**off**

Measuring mode Upol:

Input range	**–125.0 to 125.0 µA**
Selection	**off**
Default value	**off**

Stop EP

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

Input range	**1 to 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 to 9,999.99 mL**
Selection	**off**
Default value	**off**

Stop time

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

Input range	**0 to 999,999 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 12.1.1, page 142)*.

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

8.2.4 Evaluation

Menu ► Parameters ► Evaluation

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

Window

Activate this parameter if equivalence points are to be recognized only in a specific measured value range (window). 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 to 20.000**
Default value	**–20.000**

Measuring mode U, Ipol:

Input range	**–1,250.0 to 1,250.0 mV**
Default value	**–1,250.0 mV**

Measuring mode Upol:

Input range	**–125.00 to 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 to 20.000**
Default value	**20.000**

Measuring mode U, Ipol:

Input range	**–1,250.0 to 1,250.0 mV**
Default value	**1,250.0 mV**

Measuring mode Upol:

Input range	**–125.00 to 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 to 9.99**
Default value	**0.50**

Measuring mode U, Ipol:

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

Measuring mode Upol:

Input range	**0.1 to 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 to 20.000**
Selection	**off**
Default value	**off**

Measuring mode U, Ipol:

Input range	**–1,250.0 to 1,250.0 mV**
Selection	**off**
Default value	**off**

Measuring mode Upol:

Input range	**–125.00 to 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 change (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 to the ERC (Equivalence point Recognition Criterion) found. The ERC is the sum of the measured value changes before and after the jump:

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

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 **[Recalculate]** key.

8.2.5 Calculation

8.2.5.1 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. A definition can be made for each calculation as to whether the result is to be saved as a titer or as a common variable.

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

Edit

See the following chapter for editing the data of the selected calculation.

Delete

Delete the selected calculation.

8.2.5.2 Editing a calculation

Menu ▶ Parameters ▶ Calculation ▶ Edit

Result name

The result name is the text which will be shown in the results display 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 6.3, page 40)*.

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

Decimal places

Number of decimal places used to display the result.

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

Result unit

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

Selection	**%** | **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 the 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, called a 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**

8.2.6 Statistics

Menu ► Parameters ► Statistics

The statistics calculation of a multiple determination is activated under **Statistics** and definition is made as to how many determinations the series contains.

Statistics

If this function is activated, then statistics calculations will be carried out for all of the defined results.

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

Number of determinations

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

If an additional determination has to be added to the determination series, because one determination has been incorrect, for example, then this can be accomplished in the statistical overview *(see chapter 6.9, page 59)*.

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

8.2.7 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 83)*.

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

Calculations/Statistics

Output of the calculation formulas for the individual results. Results are specified with full accuracy. This makes recalculation with an external program possible. If Statistics has been activated, then the following data will be printed out as well:

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

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

Measuring point list

Output of the measuring point list.

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

Parameters

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

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

PC/LIMS

The PC/LIMS report is a machine-readable report with all of the 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 82)*.

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

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

8.3 Endpoint titrations (SET)

8.3.1 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 to 999 µL/min**
Default value	**20 µL/min**

Drift correction

The endpoint volume can be corrected for drift. This involves multiplying the volume drift by the drift correction time and then subtracting the resulting value from the endpoint volume. The drift correction time is the time interval between the end of the conditioning process and the end of the determination.

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

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

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

off
No drift correction takes place.

Drift value

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

Volume drift for manual drift correction.

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

Cond. stop volume

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

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

Cond. stop time

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

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

8.3.2 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 is started. During this period, substances such auxiliary solution can be added with a Dosimat (parameterization on the Dosimat). However, this requires that the **Activation pulse** be enabled.

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

Start volume

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

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

Dosing rate

Rate at which the start volume is dosed. The maximum dosing rate depends on the cylinder volume *(see chapter 12.1.1, page 142)*.

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

Pause

Waiting time, e.g. for the electrode to settle down after the start or a reaction time after the dosing of a start volume.

Input range	**0 to 999,999 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 activated, then the value for the sample size will be requested.

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

Request sample unit

If this parameter is activated, then the unit for the sample size will be requested.

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

Hold at request

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

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

8.3.3 Titration parameters

Menu ▶ Parameters ▶ Titration parameters

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

Solution

Selection of the solution from the solution list. We 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 solutions** | **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 to a polarizable electrode during voltametric measurement. This parameter is available only with I(pol) determinations.

Input range	**–125 to 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	**–1,250 to 1,250 mV** (Increment: **10**)
Default value	**400 mV**

Electrode test

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

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

Stirrer

The stirrer is switched on at the start of the determination when this parameter is activated.

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 1,000 rpm. The formula for calculating the rotational speed is specified in *chapter 12.2, page 143*. The optimum stirring rate can be tested in the manual control.

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

- "+": counterclockwise rotation
- "–": clockwise rotation

Input range	**–15 to 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 to 150.0 °C**
Default value	**25.0 °C**

Titration direction

The titration direction is normally determined automatically from the initial measured value and the set endpoint. It is recommended that you specify whenever possible whether the change of the measured value is positive or negative. 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 change, i.e. in the direction of a higher pH value, greater voltage or greater current.

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

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

Extraction time

Minimum duration of the titration. The titration will not be canceled during the extraction time, even if the endpoint has already been reached. The titration is, however, canceled if a stop condition is fulfilled during this time *(see chapter 8.3.6, page 125)*. The entry of an extraction time may be advisable, for instance, for the titration of sparingly soluble samples.

Input range	**0 to 999,999 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 to 999,999.0 s**
Default value	**2.0 s**

8.3.4 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 to 20.000**
Selection	**off**
Default value	**off**

Measuring mode U and Ipol:

Input range	**–1,250.0 to 1,250.0 mV**
Selection	**off**
Default value	**off**

Measuring mode Upol:

Input range	**–125.00 to 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 3, page 124*.

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 the control range, dosing is carried out continuously, and the dosing rate is defined under **Max. rate**.

Measuring mode pH:

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

Measuring mode U and Ipol:

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

Measuring mode Upol:

Input range	**0.01 to 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 12.1.1, page 142)*.

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

Table 3 Default values of the 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 canceled when the endpoint has been reached and this stop criterion has been fulfilled. If no stop criterion has been selected then the titration will not be canceled. The stop conditions *(see chapter 8.3.6, page 125)* 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 canceled when the stop drift has been reached.

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

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

Stop drift

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

The titration is canceled when the endpoint and the stop drift have been reached.

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

Delay time

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

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

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

8.3.5 Control parameters EP2

Menu ► Parameters ► Control parameters EP2

The control parameters for the second endpoint are defined under **Control parameters EP2**. The parameters and input ranges are identical with those for the first endpoint.

8.3.6 Stop conditions

Menu ► Parameters ► Stop conditions

The conditions for canceling the titration are defined under **Stop conditions**, if this does not occur automatically. This could be the case when the endpoint set is not reached or if the stop criterion *(see "Stop criterion", page 124)* is not fulfilled.

Stop volume

The titration is canceled 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 to 9,999.99 mL**
Default value	**100.000 mL**
Selection	**off**

Stop time

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

Input range	**0 to 999,999 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 12.1.1, page 142)*.

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

8.3.7 Calculation

8.3.7.1 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. A definition can be made for each calculation as to whether the result is to be saved as a titer or as a common variable.

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

Edit

See the following chapter for editing the data of the selected calculation.

Delete

Delete the selected calculation.

8.3.7.2 Editing a calculation

Menu ▶ Parameters ▶ Calculation ▶ Edit

Result name

The result name is the text which will be shown in the results display 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 6.3, page 40)*.

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

Decimal places

Number of decimal places used to display the result.

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

Result unit

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

Selection	**%** | **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 the 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, called a 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**

8.3.8 Statistics

Menu ► Parameters ► Statistics

The statistics calculation of a multiple determination is activated under **Statistics** and definition is made as to how many determinations the series contains.

Statistics

If this function is activated, then statistics calculations will be carried out for all of the defined results.

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

Number of determinations

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

If an additional determination has to be added to the determination series, because one determination has been incorrect, for example, then this can be accomplished in the statistical overview *(see chapter 6.9, page 59)*.

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

8.3.9 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 83)*.

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

Calculations/Statistics

Output of the calculation formulas for the individual results. Results are specified with full accuracy. This makes recalculation with an external program possible. If Statistics has been activated, then the following data will be printed out as well:

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

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

Measuring point list

Output of the measuring point list.

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

Parameters

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

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

PC/LIMS

The PC/LIMS report is a machine-readable report with all of the 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 82)*.

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

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

8.4 pH calibration (CAL)

8.4.1 Calibration parameters

Menu ► Parameters ► Calibration parameters

Under **Calibration parameters**, the parameters influencing the run of the entire calibration are defined.

Signal drift

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

Input range	**0.1 to 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 to 999,999 s**
Default value	**10 s**

Max. waiting time

If the 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 to 999,999 s**
Default value	**110 s**

Temperature

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

Input range	**–20.0 to 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

The stirrer is switched on at the start of the determination when this parameter is activated.

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 1,000 rpm. The formula for calculating the rotational speed is specified in *chapter 12.2, page 143*. The optimum stirring rate can be tested in the manual control.

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

- "+": counterclockwise rotation
- "–": clockwise rotation

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

8.4.2 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. When using Merck CertiPUR buffers (20 °C) the buffer type **Merck Titrisol** must be selected.

Special
Up to five calibration buffers can be defined in the method. The automatic buffer recognition 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 in order to 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 to 20.000**
Default value	**7.000**

Buffer 2 pH

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

Input range	**–20.000 to 20.000**
Default value	**4.000**
Selection	**off**

Buffer 3 pH

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

Input range	**–20.000 to 20.000**
Selection	**off**
Default value	**off**

Buffer 4 pH

See **Buffer 3 pH**.

Buffer 5 pH

See **Buffer 3 pH**.

8.4.3 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 in the parameter report.

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

PC/LIMS

The PC/LIMS report is a machine-readable report with all of the 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 82)*.

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

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

8.5 Automation: Dipping in special

Menu ► Parameters ► Automation

Automation

Display of the template used for the automation sequence.

Dripping time

Waiting time after the titration head moves out of the sample beaker and out of the rinsing beaker.

Input range	**0 to 999 s**
Default value	**3 s**

Rinsing time

Waiting time during which the electrode remains immersed in the rinsing beaker.

Input range	**0 to 999 s**
Default value	**5 s**

Stirring rate

Setting the stirring rate. It can be set in steps of –15 to +15. The default setting **8** corresponds to 1,000 rpm. The formula for calculating the rotational speed is specified in *chapter 12.2, page 143*. The optimum stirring rate can be tested in the manual control.

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

- "+": counterclockwise rotation
- "–": clockwise rotation

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

NOTE

The setting of the stirring rate under **Menu ► Parameters ► Automation** applies only to stirring while the electrode is immersed in the rinsing beaker. The stirring rate during the determination is set under **Menu ► Parameters ► Titration parameters**.

8.6 Automation: Dipping in special 2

Menu ► Parameters ► Automation

Automation

Display of the template used for the automation sequence.

Dripping time

Waiting time after the titration head moves out of the sample beaker and out of the rinsing beaker.

Input range	**0 to 999 s**
Default value	**3 s**

Rinsing time

Waiting time during which the electrode remains immersed in the rinsing beaker.

Input range	**0 to 999 s**
Default value	**5 s**

Stirring rate

Setting the stirring rate. It can be set in steps of –15 to +15. The default setting **8** corresponds to 1,000 rpm. The formula for calculating the rotational speed is specified in *chapter 12.2, page 143*. The optimum stirring rate can be tested in the manual control.

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

- "+": counterclockwise rotation

- "–": clockwise rotation

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

NOTE

The setting of the stirring rate under **Menu ► Parameters ► Automation** applies only to stirring while the electrode is immersed in the rinsing beaker. The stirring rate during the determination is set under **Menu ► Parameters ► Titration parameters**.

8.7 Automation: Double dipping

Menu ► Parameters ► Automation

Automation

Display of the template used for the automation sequence.

Dripping time

Waiting time after the titration head moves out of the sample beaker and out of the rinsing beaker.

Input range	**0 to 999 s**
Default value	**3 s**

Rinsing time

Waiting time during which the electrode remains immersed in the rinsing beaker.

Input range	**0 to 999 s**
Default value	**5 s**

Stirring rate

Setting the stirring rate. It can be set in steps of –15 to +15. The default setting **8** corresponds to 1,000 rpm. The formula for calculating the rotational speed is specified in *chapter 12.2, page 143*. The optimum stirring rate can be tested in the manual control.

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

- "+": counterclockwise rotation
- "–": clockwise rotation

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

NOTE

The setting of the stirring rate under **Menu ► Parameters ► Automation** applies only to stirring while the electrode is immersed in the rinsing beaker. The stirring rate during the determination is set under **Menu ► Parameters ► Titration parameters**.

8.8 Automation: Rinsing in sample

Menu ► Parameters ► Automation

Automation

Display of the template used for the automation sequence.

Dripping time

Waiting time after the titration head moves out of the sample beaker.

Input range	**0 to 999 s**
Default value	**3 s**

Aspiration time

Aspiration time of Pump 2, in case an 843 Pump Station is connected. It is applied before the rinsing and after the rinsing.

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

Rinsing time

Rinsing time of Pump 1, in case an 843 Pump Station is connected. Rinsing pump **and** aspiration pump run during the rinsing time.

Input range	**0 to 999 s**
Default value	**5 s**

8.9 Automation: Rinsing in special

Menu ► Parameters ► Automation

Automation

Display of the template used for the automation sequence.

Dripping time

Waiting time after the titration head moves out of the sample beaker and out of the rinsing beaker.

Input range	**0 to 999 s**
Default value	**3 s**

Aspiration time

Aspiration time of Pump 2, in case an 843 Pump Station is connected. It runs after the rinsing time.

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

Rinsing time

Rinsing time of Pump 1, in case an 843 Pump Station is connected. It runs before the aspiration time. Rinsing pump **and** aspiration pump run during the rinsing time.

At the end of a sample series, the rinsing time determines how long rinsing solution will be filled into the rinsing beaker.

Input range	**0 to 999 s**
Default value	**5 s**

9 Operation and maintenance

The 862 Compact Titrosampler requires appropriate care. Excess contamination of the instrument may result in functional disruptions and a reduction in the service life of the sturdy mechanics and electronics of the instrument.

Severe contamination can also have an influence on the measured results. Regular cleaning of exposed parts can prevent this to a large extent.

Spilled chemicals and solvents must be removed immediately. In particular, the plug connections (particularly the power plug) must be protected against contamination.

Check all tubing connections regularly for leaks.

10 Troubleshooting

10.1 SET titration

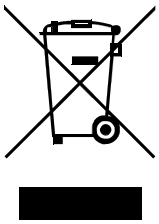
Problem	Cause	Remedy
The titration will not be finished.	*The minimum dosing rate is too low.*	Define **Titration rate** = **user** and increase the minimum rate (**Min. rate**) *(see chapter 8.3.4, page 122)*.
	The stop criterion is unsuitable.	Adjust the control parameters *(see chapter 8.3.4, page 122)*: ▪ 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 8.3.4, page 122)*: ▪ Select **Titration rate** = **slow**. ▪ Define **Titration rate** = **user** and increase the control range. ▪ Define **Titration rate** = **user** and reduce the maximum rate (**Max. rate**). ▪ Define **Titration rate** = **user** and reduce the 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 8.3.4, page 122)*: ▪ Select **Titration rate** = **optimal** or **fast**. ▪ Define **Titration rate** = **user** and reduce the control range. ▪ Define **Titration rate** = **user** and increase the maximum rate (**Max. rate**). ▪ Define **Titration rate** = **user** and increase the minimum rate (**Min. rate**).
The results are spread widely.	*The minimum dosing rate is too high.*	Define **Titration rate** = **user** and reduce the minimum rate (**Min. rate**) *(see chapter 8.3.4, page 122)*.

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

10.2 Miscellaneous

Problem	Cause	Remedy
No report is printed.	*The printer is not recognized by the instrument.*	▪ Switch the 862 Compact Titrosampler off and then back on again. ▪ Use a USB hub and connect the printer to the USB hub.
	The printer model is not compatible.	Use a printer which fulfills the required specifications *(see chapter 12.6.4, page 149)*.
The USB keyboard or the PC mouse does not function.	*The keyboard or mouse is not recognized by the instrument.*	▪ Switch the 862 Compact Titrosampler off and then back on again. ▪ Use a USB hub and connect the keyboard and mouse to the USB hub.
	The keyboard or the mouse is not compatible.	Use a model which fulfills the required specifications *(see chapter 12.6, page 147)*.
The display is no longer readable.	*The contrast is set incorrectly.*	Adjust the contrast correctly *(see chapter 7.1, page 71)*.
Mettler XP balances send "R" or "O ----" as ID1.	*The automatic calibration of the balance is activated.*	Deactivate the automatic calibration.
Message 020-511 "Action not possible" is displayed.	*The USB flash drive is no longer connected.*	1. Connect the USB flash drive. 2. Switch the instrument off and then back on again.
	The USB flash drive is full.	▪ Use a different USB flash drive. ▪ Delete files with the aid of a PC.

11 Recycling and disposal



This product is covered by European Directive 2012/19/EU, WEEE – Waste Electrical and Electronic Equipment.

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

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

12 Appendix

12.1 Dosing unit

12.1.1 Maximum dosing and filling rate

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

Cylinder volume	Maximum rate
2 mL	6.67 mL/min
5 mL	16.67 mL/min
10 mL	33.33 mL/min
20 mL	66.67 mL/min
50 mL	166.00 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.

12.1.2 Parameters for preparing (PREP) and emptying (EMPTY)

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

The **EMPTY** function empties the cylinder and the tubings of the dosing unit.

With these functions you can easily change the reagent in the dosing unit without coming into contact with chemicals.

Preparing and emptying are carried out with the following, non-alterable settings:

- The entire cylinder volume is dosed via port 1.
- For filling/emptying the tubings the following configuration is assumed:
  - Tubing on port 1: length = 70 cm, diameter = 2 mm
  - Tubing on port 2: length = 25 cm, diameter = 2 mm
- Dosing and filling are both carried out with the same maximum rate.

12.2 Stirring rate

The stirring rate can be adjusted in steps from –15 to +15.

The approximate rotational speed for the internal magnetic stirrer (depends on the product version) can be calculated with the following formula:

Rotational speed/min (r/min) = 125 · Stirring rate

Example:

Configured stirring rate: 8

Rotational speed in revolutions per minutes = 125 · 8 = 1,000

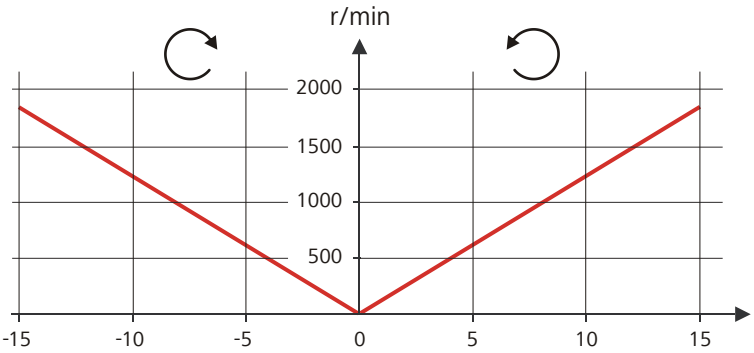


Figure 30 Rotational speed depending on the stirring rate

The information on the separately connectable 802 propeller stirrer can be found in the "802 Stirrer" manual.

12.3 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**

12.4 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.

12.5 Remote interface

12.5.1 Pin assignment of the remote interface

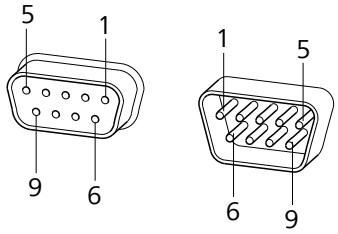


Figure 31 Pin assignment of remote socket and remote plug

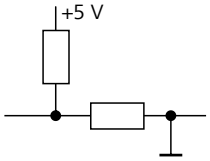
The above figure of the pin assignment applies for all Metrohm instruments with 9-pin D-Sub remote connector.

Table 4 Inputs and outputs of the remote interface

Pin No.	Assignment	Function
1	Output 0	Sample ready
2	Output 1	Dosimat
3	Output 2	Pump 1

Pin No.	Assignment	Function
4	Output 3	Pump 2
5	Output 4	Error
6	0 volt (GND)	
7	+5 volts	
8	Input 0	Start
9	Input 1	Stop

Inputs

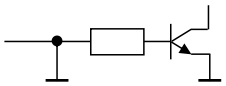


approx. 5 kΩ Pull-up

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

12.5.2 Status diagram of the remote interface

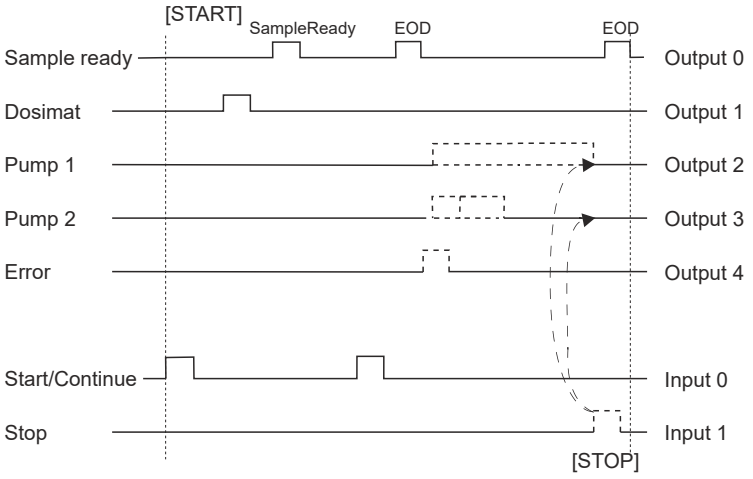


Figure 32 Remote status diagram

12.6 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.

12.6.1 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 5 Key assignment

Key of the 862 Compact Titrosampler or function in the editing dialog	Key on the numerical USB keypad
[BACK]	**[Home]**
[⇧] [⇩]	**[↑] [↓]**
[⇦] [⇨]	**[←] [→]**
[OK]	**[Enter]**
[+−]	**[BS]** (backspace)
Clear	**[Del]**
Accept	**[Home]**

12.6.2 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 6 Key assignment

Key of the 862 Compact Titrosampler 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]**

NOTE

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

12.6.3 PC mouse

In order to make navigating in the dialog of the 862 Compact Titrosampler easier, a PC mouse can be connected.

Table 7 Mouse functions

Key of the 862 Compact Titrosampler	Mouse function
[OK]	Left mouse button
[BACK]	Right mouse button
[⇧] [⇩] [⇦] [⇨]	Mouse movement vertical/horizontal
[⇧] [⇩]	Scroll wheel vertical

12.6.4 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

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.

13 Technical specifications

13.1 Measuring inputs

13.1.1 Potentiometry

A high-ohm measuring input (**Ind.**) for pH electrodes 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 to +20
Resolution	0.001
Measuring accuracy	±0.003 (±1 digit, without sensor error, under reference conditions)
Measuring mode U	
Measuring range	–1200 - +1200 mV
Resolution	0.1 mV
Measuring accuracy	±0.2 mV (±1 digit, without sensor error, under reference conditions)

13.1.2 Polarizer

One 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	–1200 - +1200 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	–1200 - +1200 mV (increment: 10 mV) –1250 - –1210 mV / +1210 - +1250 mV: non-guaranteed values, dependent on reference voltage +2.5 V
Measuring range	–120 - +120 µA
Resolution	0.01 µA
Measuring accuracy	–

13.1.3 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 to +250 °C
NTC	–5 to +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)

13.2 Dosing drive

Resolution	10,000 steps per cylinder volume
Dosing unit	
Cylinder volume	▪ 2 mL ▪ 5 mL ▪ 10 mL ▪ 20 mL ▪ 50 mL
Accuracy	Fulfills ISO/DIN standard 8655-3

13.3 Lift

Stroke path	132 mm
Maximum load	5 N
Lift rate	15 mm/s (typical)

13.4 Turntable

Rack positions	12
Maximum load	17 N
Turntable speed	13 degrees/s (typical)

13.5 Interfaces and connectors

Stirrer connector	DIN socket
Stirring rate	722/802 rod stirrer: 180–3000 rpm Adjustable in 15 steps each in both shift directions.
USB (OTG) connector	For connecting USB devices.
Remote connector	For connecting instruments with a remote interface.

13.6 Power connection

Supply voltage	100–240 V ± 10%
Frequency	50–60 Hz ± 3%
Power consumption	45 W
Fuse	1.0 ATH

13.7 Ambient conditions

Nominal function range	+5 to +45 °C at max. 80% relative humidity, non-condensing
Storage	+5 to +45 °C at max. 80% relative humidity, non-condensing
Altitude / Pressure range	Max. 2,000 m.a.s.l. sea level / min. 800 mbar
Overvoltage category	II
Pollution degree	2

13.8 Reference conditions

Ambient temperature	+25 °C (±3 °C)
Relative moisture	≤ 60%

13.9 Dimensions

Width	0.26 m
Height	0.47 m
Depth	0.43 m
Weight	9.09 kg (without accessories)
Material	
Housing	Lower part: Crastin PBT Lift: Metal, surface-treated
Rack	PVC

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