

852 Titrande



Manual

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852 Titrande

Manual

Technical Communication
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1 Introduction

1.1 The Titrando system

The Titrando is the heart of the modular Titrando system. Operation is carried out either by a Touch Control with a touch-sensitive screen ("stand-alone titrator") or by a computer with a corresponding software.

A Titrando system can contain numerous, various kinds of devices. The following figure provides an overview of the peripheral devices you can connect to the 852 Titrando.

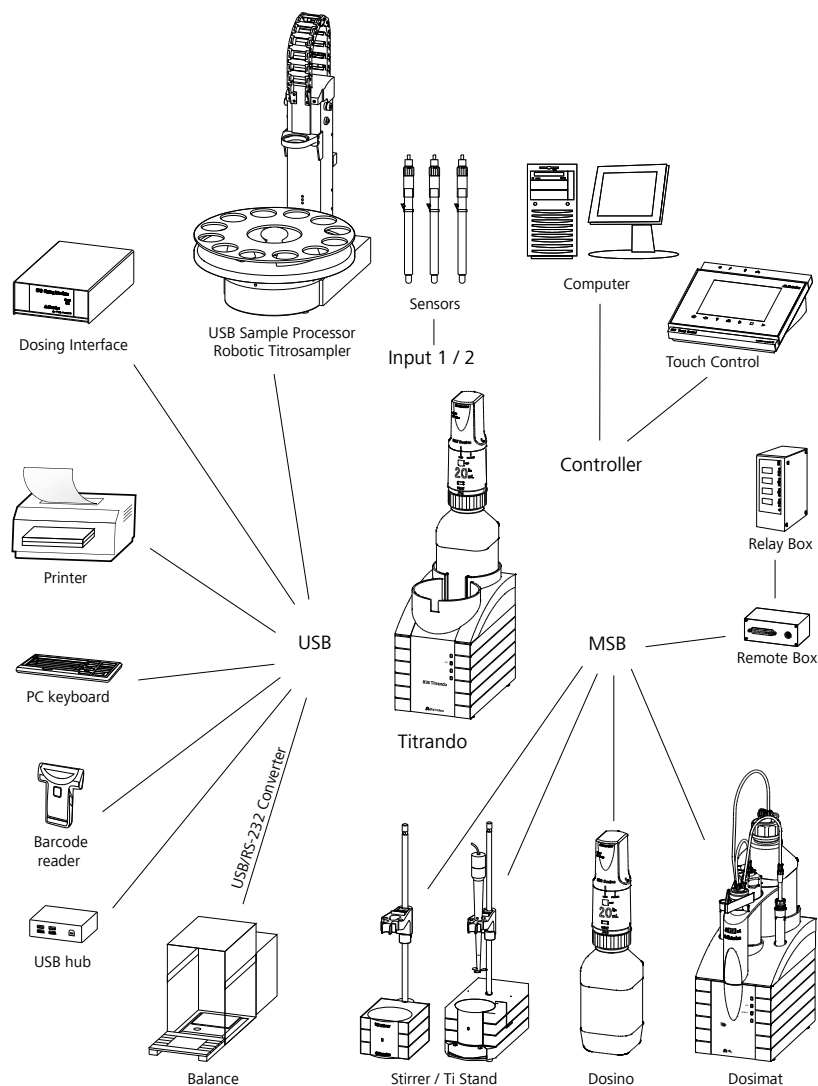


Figure 1 The Titrando system



Up to 3 control instruments (Titrandos, Dosing Interface, USB Sample Processor, etc.) can be controlled via USB connection during operation with the 900 Touch Control.

You can request information on special applications in the "Application Bulletins" and "Application Notes", available free of charge via the regional Metrohm representative. Various monographs on the subjects of titration techniques and electrodes are also available.

Updating the device software is described in the help of the corresponding PC software.

1.2 Device description

The 852 Titrandos has the following characteristics:

- **Operation**

Operation is carried out by means of a touch-sensitive Touch Control or with a high-performance PC software.

- **MSB connectors**

4 MSB connectors (Metrohm Serial Bus) for connecting dosing devices (Dosimat or Dosino), stirrers, titration stands, and Remote Boxes.

- **USB connectors**

Two USB connectors, through which devices such as printers, PC keyboards, barcode readers or additional control devices (USB Sample Processor, Titrandos, Dosing Interface, etc.) can be connected.

- **Measuring interface**

Two measuring interfaces. Measuring interface 1 has one measuring input each for:

- a generator electrode
- a temperature sensor (Pt1000 or NTC)
- a double Pt electrode

Measuring interface 2 has one measuring input each for:

- a temperature sensor (Pt1000 or NTC)
- a polarizable electrode

1.3 Titration modes – Measuring modes – Dosing commands

The 852 Titrande supports the following titration modes, measuring modes and dosing commands:

- **MET**
Monotonic equivalence point titration. The reagent is added in constant volume steps.
Measuring modes:
 - **Ipol** (voltametric measurement with selectable polarization current)
 - **Upol** (amperometric measurement with selectable polarization voltage)
- **SET**
Endpoint titration at one or two specified endpoints, for volumetric bromine index determination.
 - **Ipol** (voltametric measurement with selectable polarization current)
 - **Upol** (amperometric measurement with selectable polarization voltage)
- **KFT**
Volumetric water content determination according to Karl Fischer.
Measuring modes:
 - **Ipol** (voltametric measurement with selectable polarization current)
 - **Upol** (amperometric measurement with selectable polarization voltage)
- **KFC**
Coulometric water content determination according to Karl Fischer.
Measuring mode:
 - **Ipol** (voltametric measurement with selectable polarization current)
- **BRC**
Coulometric bromine index determination. Determining the amount of double bonds in e.g. mineral oils.
Measuring mode:
 - **Ipol** (voltametric measurement with selectable polarization current)



- **MEAS**

The following measuring modes can be selected for measurements:

- **Ipol** (voltametric measurement with selectable polarization current)
- **Upol** (amperometric measurement with selectable polarization voltage)
- **T** (temperature measurement)

- **Dosing commands**

The following commands for dosing can be selected:


- **PREP** (rinse the cylinder and tubings)
- **EMPTY** (empty the cylinder and tubings)
- **ADD** (dosing a specified volume)
- **LQH** (carrying out complex dosing tasks with a Dosino)

Parallel determinations by coulometric (KFC or BRC) and volumetric titration (KFT or SET/MET) are not possible with the Touch Control.

1.4 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.

1.5 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 device 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 devices or device parts. |



NOTICE

This symbol highlights additional information and tips.

2 Safety



WARNING

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

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

2.1 Intended use

2.2 Responsibility of the operator

The operator is responsible for the following tasks to ensure the safe operation of the product:

- Check the condition of the product before use
- Ensure that the operating values and limit values specified in the technical specifications are observed.
- Maintain and clean the product regularly
- Remedy defects and malfunctions immediately



NOTE

The product may be used only when its status is perfect.

- Train staff on basic occupational safety and accident prevention regulations for chemical laboratories and ensure that these regulations are complied with.
- Train personnel in the use of the product according to the user documentation (e.g., install, operate, eliminate faults).
- Provide personal protective equipment (e.g., protective glasses, gloves).
- Provide suitable tools and equipment to execute the work safely.

Supply voltage



WARNING

An incorrect supply voltage can damage the device.

Operate this device only with a supply voltage specified for it (refer to the rear of the device).

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 setting up or disconnecting electrical plug connections at the rear of the device.

2.4.2 Tubing and capillary connections



CAUTION

Leaks in tubing connections 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. Suitable tools can be used for disconnecting connections.

The leak-tightness of the connections must be checked regularly. If the device is used mainly in unattended operation, then weekly inspections are mandatory.

2.4.3 Flammable solvents and chemicals



WARNING

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

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

3.2.1.1 Connecting a Touch Control



NOTE

The plug is protected against accidental disconnection of the cable by means of a pull-out protection feature. If you wish to pull out the plug, you first need to pull back the outer plug sleeve marked with arrows.

- 1 ▪ Insert the plug of the Touch Control connection cable into the **Controller** socket.

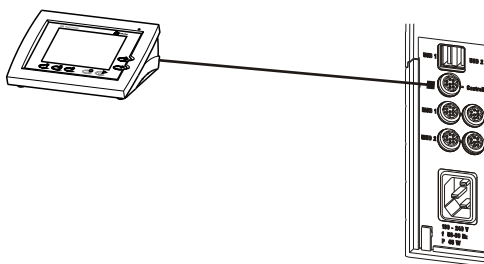


Figure 2 Connecting the Touch Control

- 2 ▪ Connect the MSB devices (*see chapter 3.3, page 15*).
 - Connect the USB devices (*see chapter 3.4, page 19*).
- 3 ▪ Connect the Titrande to the power grid (*see chapter 3.2.1.2, page 12*).
- 4 ▪ Switch on the Touch Control.

The Touch Control power supply is supplied through the Titrande. Automatic system tests are performed on both devices at the time of switch-on. The **On** LED on the front of the Titrande lights up when the system test has been completed and the device is ready for operation.



CAUTION

The Touch Control must be shut down properly by deactivation with the power switch on the rear of the device before the power supply is interrupted. If this is not done, then there will be a danger of data loss. Because of the fact that the power supply for the Touch Control is provided through the Titrande, you must never disconnect the Titrande from the power grid (e.g. by deactivating with a connector strip) before you have deactivated the Touch Control.



If you would prefer not to position the Touch Control directly next to the Titrando, then you can lengthen the connection with the 6.2151.010 cable. The maximum connection length permitted is 5 m.

3.2.1.2 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. 0.75 mm² / 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.

3.2.1.3 Connecting a computer

The 852 Titrande requires a USB connection to a computer in order to be able to be controlled by a computer software. Using a 6.2151.000 controller cable, the instrument can be connected directly, either to a USB port on a computer, to a connected USB hub or to a different Metrohm control instrument.

You need administrator rights for the installation of driver software and control software on your computer.

Cable connection and driver installation

A driver installation is required in order to ensure that the 852 Titrande is recognized by the computer software. To accomplish this, you must comply with the procedures specified. The following steps are necessary:

1 Installing the software

- Insert the installation CD of the computer software and carry out the instructions of the installation program.
- Exit the program if you have started it after the installation.

2 Establishing the cable connections

- Connect all peripheral devices to the instrument, *see Chapter 3.3, page 15* and *see Chapter 3.4, page 19*.
- Connect the instrument to the power grid if you have not already done this (*see chapter 3.2.1.2, page 12*).
The "On" LED on the 852 Titrande is not yet illuminated!
- Connect the instrument to a USB connector (type A) of your computer (*see manual of your computer*). The 6.2151.000 cable is used for this purpose.

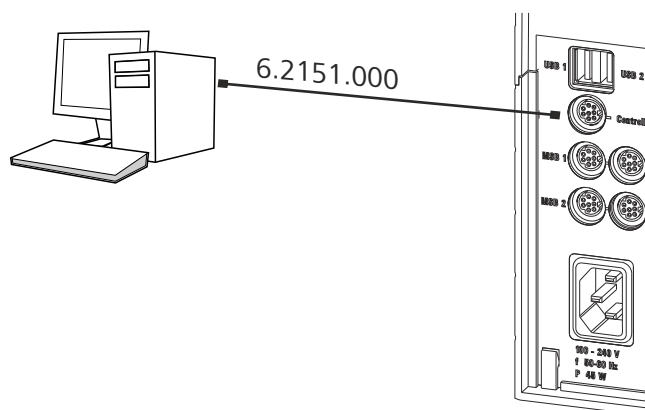


Figure 3 Connecting the computer

The instrument is recognized. Depending on the version of the Windows operating system used, the driver installation proceeds dif-

3.3 Connecting MSB devices

In order to connect MSB devices, e.g., stirrers or dosing devices, Metrohm devices are equipped with up to a maximum of 4 connectors on what is referred to as the *Metrohm Serial Bus (MSB)*. Various kinds of peripheral devices can be connected in sequence (in series, as a "daisy chain") at a single MSB connector (8-pin Mini DIN socket) and controlled simultaneously by the respective control instrument. In addition to the connection cable, stirrers and the Remote Box are each equipped with their own MSB socket for this purpose.

The following figure provides an overview of the instruments that can be connected to an MSB socket, along with a number of different cabling variations.

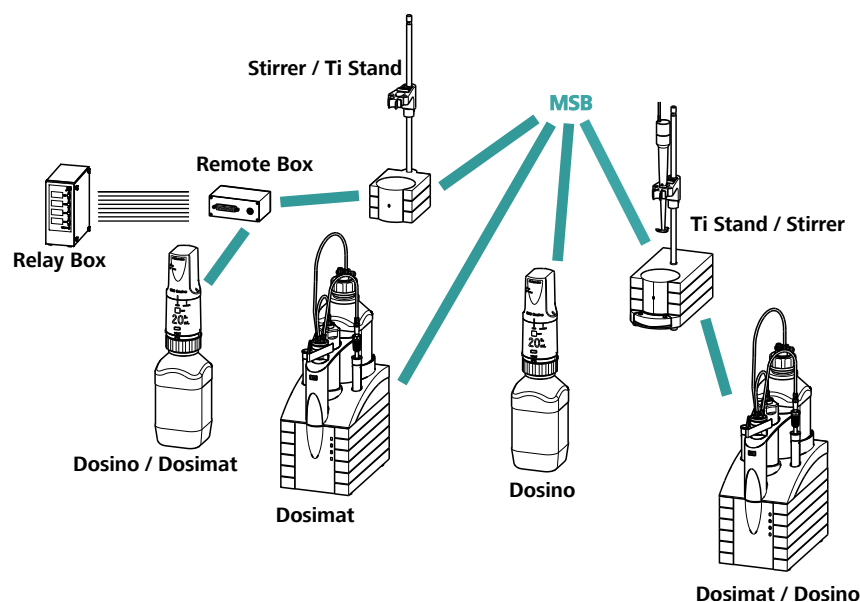


Figure 4 MSB connections

The control instrument determines which peripheral devices are supported.



NOTE

When connecting MSB devices together, the following must be observed:

- Only one device of the same type can be used at a single MSB connector at one time.
- Dosing devices of the 700 Dosino and 685 Dosimat plus type cannot be connected together with other MSB devices on a shared connector. These dosing devices must be connected separately.



CAUTION

Exit the control software before you plug in MSB devices. When it is switched on, the control instrument automatically recognizes which device is connected to which MSB connector. The operating unit or the control software enters the connected MSB devices into the system configuration (device manager).

MSB connectors can be extended with the 6.2151.010 cable. The maximum connection length permitted is 15 m.

3.3.1 Connecting a dosing device

Four dosing devices can be connected to the instrument (**MSB 1 to MSB 4**).

The types of dosing devices that are supported are:

- 800 Dosino
- 700 Dosino
- 805 Dosimat
- 685 Dosimat plus

Connecting a dosing device

1 Connecting a dosing device

- Exit the control software.
- Connect the connection cable of the dosing device to 1 of **MSB** sockets on the rear of the control instrument.
- Start the control software.

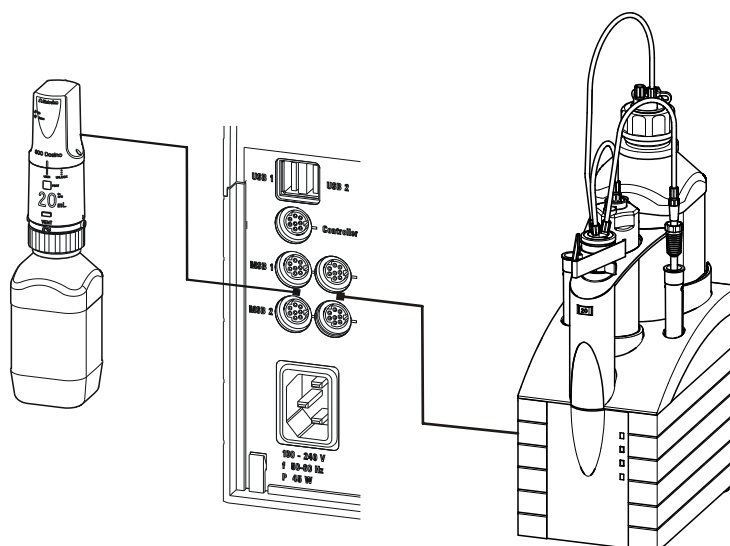


Figure 5 Connecting a dosing device

3.3.2 Connecting a stirrer or titration stand

You can use the following devices:

These devices have a built-in magnetic stirrer (stirring "from below"):

- 801 Stirrer
- 803 Ti Stand

This device has no built-in magnetic stirrer (stirring "from above"):

- 804 Ti Stand with propeller stirrer 802 Stirrer

Connecting the stirrer or titration stand

- 1 Exit the control software.
- 2 Connect the connection cable of the magnetic stirrer or titration stand to an **MSB** socket on the rear of the control instrument.
804 Ti Stand only: Connect the propeller stirrer to the stirrer connector (socket with stirrer symbol) of the titration stand.
- 3 Start the control software.

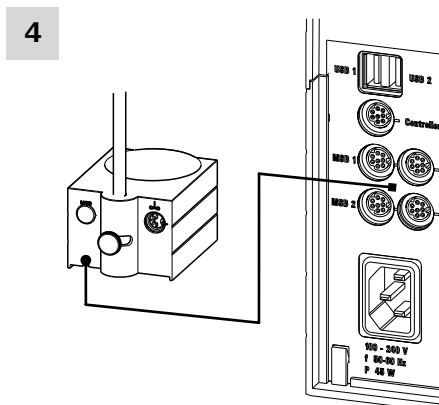


Figure 6 Connecting an MSB stirrer

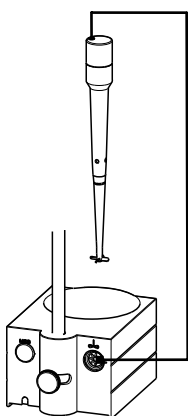


Figure 7 Connecting the propeller stirrer to the titration stand

3.3.3 Connecting a Remote Box

Instruments that are controlled via remote lines and/or that send control signals via remote lines can be connected via the 6.2148.010 Remote Box. In addition to Metrohm, other instrument manufacturers also use similar connectors that make it possible to connect different instruments together. These interfaces are also frequently given the designations "TTL Logic", "I/O Control" or "Relay Control" and they generally have a signal level of 5 volts.

You can connect the following devices to the remote connector, among others:

- 849 Level Control (fill level monitoring in a canister)
- 731 Relay Box (switch box for 230/110 volt alternating current sockets and low-voltage direct current outlets)
- 843 Pump Station (for complex sample preparations or for rinsing external titration vessels)

The Remote Box also has an MSB socket at which a further MSB device, e.g., a dosing device or a stirrer, can be connected. You will find pre-

cise information concerning the pin assignment of the interface on the Remote Box in the *Appendix*.

Control signals are understood to be electrical line statuses or electrical pulses (> 200 ms) which display the operating status of an instrument or which trigger or report an event. Runs on a variety of instruments and can thus be coordinated in a single complex automation system. However, no data exchange is possible.

Connecting the Remote Box

- 1 Exit the control software.
- 2 Connect the connection cable of the Remote Box to an **MSB** socket on the rear of the control instrument.
- 3 Start the control software.

4

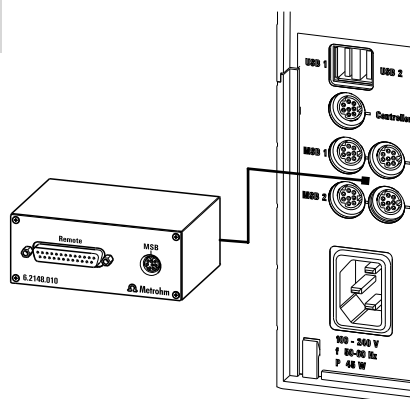


Figure 8 Connecting the Remote Box

3.4 Connecting USB devices

3.4.1 General

The 852 Titrando has 2 USB connectors (type A sockets) for peripheral devices with USB interfaces. The Titrando functions as a USB hub (distributor), no matter how it is operated. If you wish to connect more than 2 devices to the USB, you can also use an additional, commercially available USB hub.

**CAUTION**

If you operate the 852 Titrandò with the aid of the Touch Control, then take care to ensure that the Touch Control is switched off when you set up or disconnect connections between the various devices. If you use a computer software to control the 852 Titrandò, then you should exit the program before you set up or disconnect the USB connections.

3.4.2 Connecting a USB hub

If you wish to connect more than 2 devices to the USB connector of the 852 Titrandò, then you can also use an additional commercially available USB hub (distributor). If you operate the 852 Titrandò with the help of the Touch Control, then you should use a USB hub with its own energy supply.

- 1 Switch off the Touch Control and/or exit the computer software.
- 2 With the aid of the 6.2151.020 cable, connect the USB connector of the 852 Titrandò (type A) with the USB connector of the hub (type B, see manual for the hub).

- 3 Switch on the Touch Control.

The USB hub is recognized automatically.

3.4.3 Connecting a printer

Printers that are connected to the 852 Titrandò with Touch Control must meet the following requirements:

- Printer languages: HP-PCL (PCL 3 to 5, PCL 3GUI), Canon BJI Commands or Epson ESC P/2
- Printer resolution: 300 dots/inch or 360 dots/inch (Epson)
- Paper size: A4 or Letter, single-sheet feed.

- 1 Switch off the Touch Control.

- 2 With the aid of the 6.2151.020 cable, connect the USB connector of the 852 Titrandò (type A) with the USB connector of the printer (type B, see manual for the printer).

- 3 Switch on the printer first, then the Touch Control.

- 4** Configure the printer in the device manager of the Touch Control (see Touch Control manual).

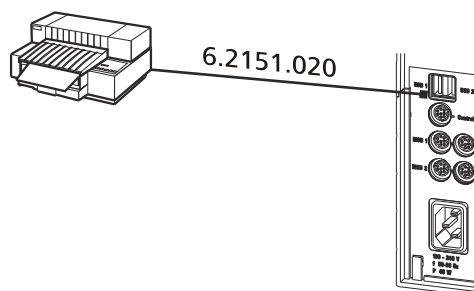


Figure 9 Connecting a printer

3.4.4 Connecting a balance

- Operation with a computer software:
 - Connect the balance directly to the serial connector (COM) of the computer. This is usually 9-pin and marked with the symbol **IOIOI**.
- Operation with Touch Control:
 - You will need the 6.2148.050 USB/RS-232 adapter to connect a balance.

The following table offers an overview of the balances that you can use together with the 852 Titrando and of which cable you will need for connection to the RS-232 interface:

| Balance | Cables |
|--|--|
| AND ER, FR, FX with RS-232 interface (OP-03) | 6.2125.020 + 6.2125.010 |
| Mettler AB, AG, PR (LC-RS9) | In the scope of delivery for the balance |
| Mettler AM, PM, PE with interface option 016 or Mettler AJ, PJ with interface option 018 | 6.2146.020 + 6.2125.010 Also from Mettler: ME 47473 adapter and either ME 42500 hand switch or ME 46278 foot switch |
| Mettler AT | 6.2146.020 + 6.2125.010 Also from Mettler: ME 42500 hand switch or ME 46278 foot switch |
| Mettler AX, MX, UMX, PG, AB-S, PB-S, XP, XS | 6.2134.120 |



| Balance | Cables |
|---|--|
| Mettler AE with interface option 011 or 012 | 6.2125.020 + 6.2125.010 Also from Mettler: ME 42500 hand switch or ME 46278 foot switch |
| Ohaus Voyager, Explorer, Analytical Plus | Cable AS017-09 from Ohaus |
| Precisa balances with RS-232-C interface | 6.2125.080 + 6.2125.010 |
| Sartorius MP8, MC, LA, Genius, Cubis | 6.2134.060 |
| Shimadzu BX, BW | 6.2125.080 + 6.2125.010 |

Operation with Touch Control

- 1** Plug in the USB plug of the USB/RS-232 adapter at the USB connector of the 852 Titrande.
- 2** Connect the RS-232 interface of the USB/RS-232 adapter with the RS-232 interface of the balance (see table for cable).
- 3** Switch on the Touch Control.
- 4** Switch on the balance.
- 5** Activate the RS-232 interface of the balance if necessary.
- 6** Configure the RS-232 interface of the USB/RS-232 adapter in the device manager of the Touch Control (see Touch Control manual).

3.4.5 Connecting a keyboard (only for operation with Touch Control)

The computer keyboard is used as an aid for text and numerical input.

- 1** Insert the USB plug of the keyboard into 1 of the USB port of the 852 Titrande.
- 2** Switch on the Touch Control.

The keyboard is recognized automatically and entered in the device manager.

- 3 Configure the keyboard in the device manager of the Touch Control (see Touch Control manual).

3.4.6 Connecting a barcode reader

The barcode reader is used as an aid for text and numerical input. You can connect a barcode reader with USB interface.

Operation with Touch Control

- 1 Insert the USB plug of the barcode reader into 1 of the USB ports of the 852 Titrande.
- 2 Switch on the Touch Control.
The barcode reader is recognized automatically and entered in the device manager.
- 3 Configure the barcode reader in the device manager of the Touch Control (see Touch Control manual).

Settings on the barcode reader:

- 1 Switch the barcode reader to programming mode.
- 2 Specify the desired layout for the keyboard (USA, Germany, France, Spain, German-speaking Switzerland).
This setting must match the setting in the device manager (see the Touch Control manual).
- 3 Make sure that the barcode reader is set in such a way that Ctrl characters (ASCII 00 to 31) can be sent.
- 4 Program the barcode reader in such a way that the ASCII character 02 (STX or Ctrl B) is sent as the first character. This first character is normally referred to as the "Preamble" or "Prefix Code".
- 5 Program the barcode reader in such a way that the ASCII character 04 (EOT or Ctrl D) is sent as the last character. This last character is normally referred to as the "Postamble", "Record Suffix" or "Postfix Code".
- 6 Exit the programming mode.

3.5 Setting up the titration vessel

3.5.1 General

During the titration, it is important that the solution be well-mixed. The stirring rate should be high enough for a small "vortex" to appear. If the stirring rate is too high, then air bubbles will be aspirated. This results in incorrect measured values. If the stirring rate is too low, then the solution at the electrode will not be correctly mixed. In order to ensure that measurement is carried out in a well-mixed solution following addition of the titrant, the buret tip should be placed in a position where the turbulence is high. In addition, the distance between the addition of the titrant and the electrode should be as large as possible. Also take into account the stirring direction (counterclockwise or clockwise) when positioning electrode and buret tip (see figure below).

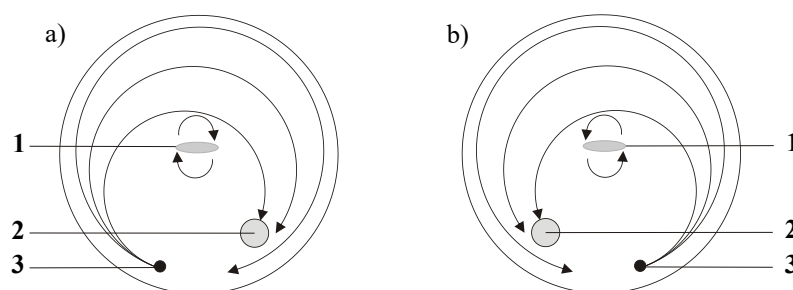


Figure 10 Schematic configuration of magnetic stirrer, indicator electrode and buret tip (Volumetry) / Generator electrode (Coulometry) during a titration. a) stirring direction clockwise, b) stirring direction counterclockwise.

1 Magnetic stirrer

3 Buret tip (Volumetry) / Generator electrode (Coulometry)

2 Indicator electrode

3.5.2 Titration vessel for coulometric KF titration

3.5.2.1 Mounting the titration cell (coulometry)

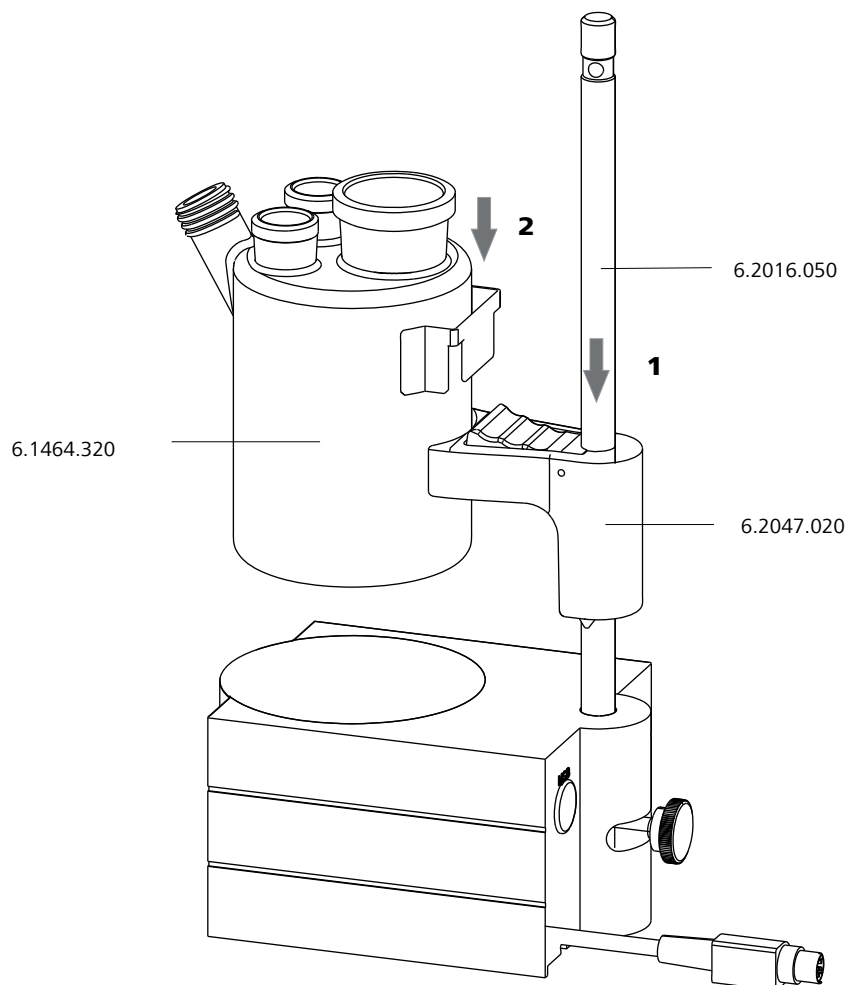


Figure 11 Mounting the titration cell (coulometry)

- 1** Fasten the 6.2047.020 titration vessel holder to the 6.2016.050 support rod.
- 2** Insert the 6.1464.320 titration vessel from above into the titration vessel holder.

3.5.2.2 Titration cell (coulometry) – standard configuration

Filling the adsorber tube

Required accessories:

- 6.1403.030 adsorber tube



- 6.2811.000/6.2811.010 molecular sieve

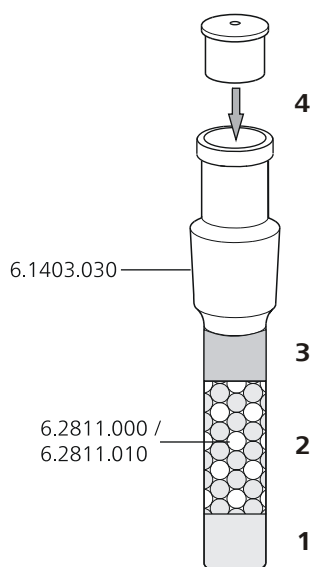


Figure 12 Filling the adsorber tube

- 1** Insert a small cotton plug into the bottom of the adsorber tube. Do not pack the cotton too tightly.
- 2** Fill the molecular sieve up to $\frac{3}{4}$ of the height.
- 3** Place a small cotton plug on the molecular sieve. Do not pack the cotton too tightly.
- 4** Seal the adsorber tube with the associated lid.



NOTE

The molecular sieve must be replaced at regular intervals. Each time the adsorber tube is filled, write the date directly on the adsorber tube, for example.

Equipping the titration cell (coulometry)

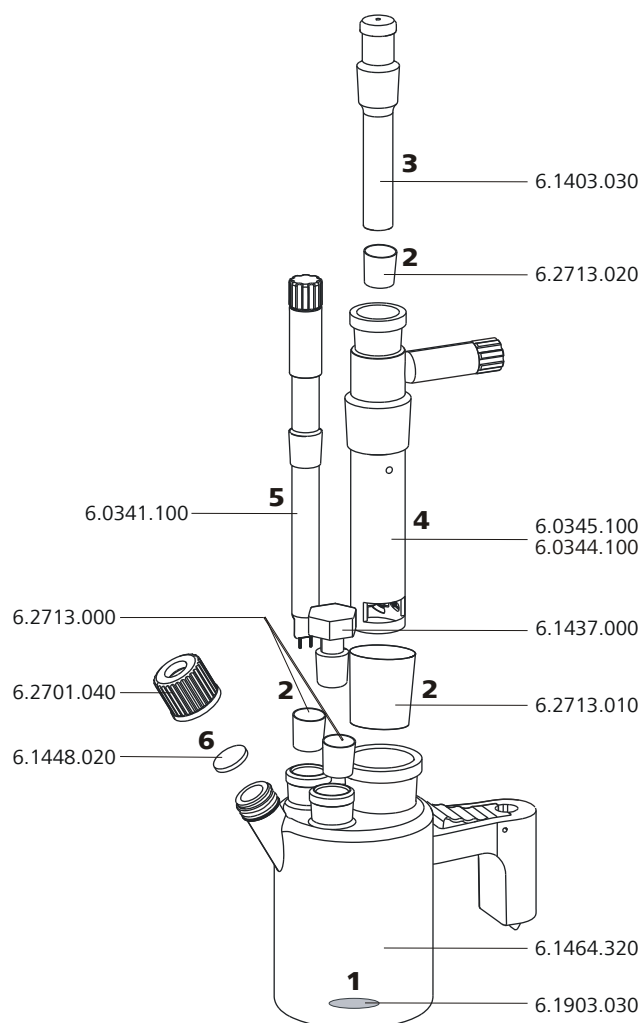


Figure 13 Equipping the titration cell (coulometry)

- 1** Place the 6.1903.030 stirring bar in the titration cell.
- 2** Cut the 6.2713.0x0 ground-joint sleeves to the correct length and attach them to the ground joints of the inserts (electrodes, adsorber tube, etc.).

Take care to ensure that the edges of the ground-joint sleeves are cut to size cleanly and that there are no fringes. The ground-joint sleeves must not protrude at the lower edge of the ground-joint opening.

- 3** Insert the 6.1403.030 adsorber tube into the generator electrode.



- 4 Insert the 6.0345.100 generator electrode without diaphragm or the 6.0344.100 generator electrode with diaphragm together with the adsorber tube into the large ground-joint opening at the rear.
- 5 Insert the 6.0341.100 indicator electrode into the left ground-joint opening.
- 6 Place the 6.1448.020 septum on the front opening of the titration cell and screw it shut with the 6.2701.040 screw cap.
Tighten the screw cap only enough for it to seal. The septum must not bend.

Filling the titration cell (coulometry) – Generator electrode with diaphragm

- 1 Fill approximately 5 mL of catholyte into the generator electrode.
- 2 Fill approximately 100 mL of anolyte into the titration cell using the 6.2738.000 funnel. The level of the anolyte should be roughly 1 to 2 mm above the level of the catholyte.
- 3 Close the remaining ground-joint opening on the right with the 6.1437.000 ground-joint stopper (with ground-joint sleeve attached).

Filling the titration cell (coulometry) – Generator electrode without diaphragm

- 1 Fill approximately 100 mL of reagent into the titration cell using the 6.2738.000 funnel.
- 2 Close the remaining ground-joint opening on the right with the 6.1437.000 ground-joint stopper (with ground-joint sleeve attached).

Screwing on the electrode cable

- 1 Unscrew the lid of the indicator electrode.

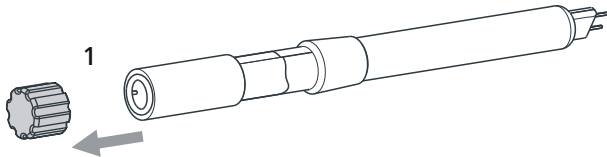


Figure 14 Unscrewing the lid from the indicator electrode

2 Unscrew the lid of the generator electrode.

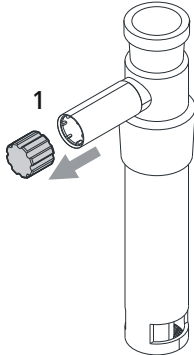


Figure 15 Unscrewing the lid from the generator electrode

3 Tighten the 6.2104.020 electrode cable to the indicator electrode.

4 Tighten the 6.2104.120 electrode cable to the generator electrode.

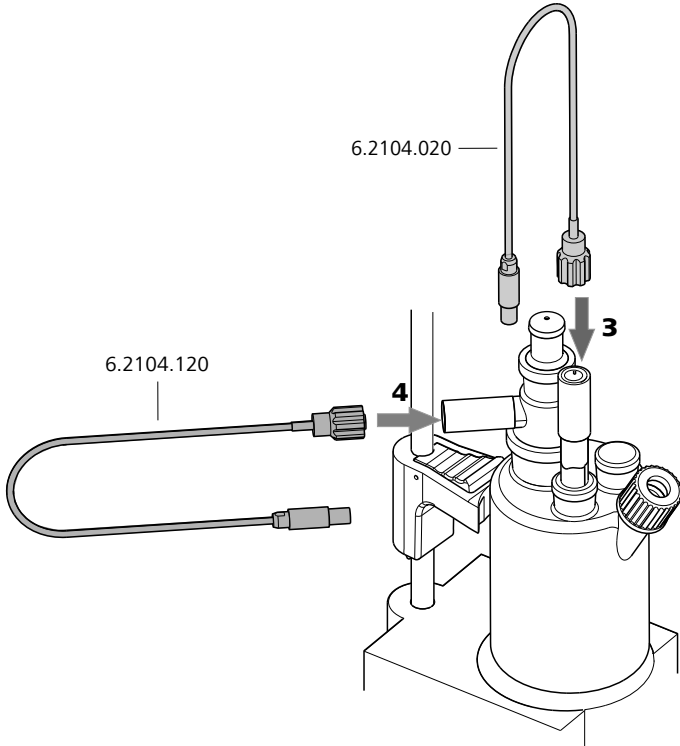


Figure 16 Screwing the electrode cable to the electrodes

**NOTE**

Mark the screw head of the electrode cable. This prevents you from mixing up the indicator and generator electrodes.

3.5.2.3 Titration cell (coulometry) with addition and aspiration tube – Utilization with Ti Stand

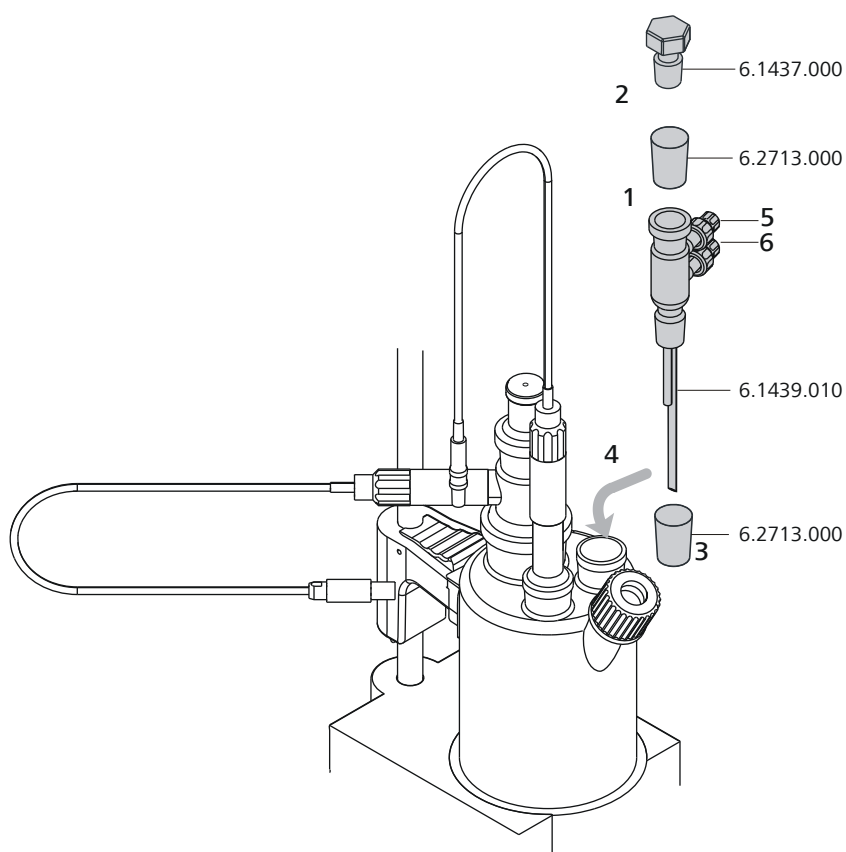


Figure 17 Mounting the addition and aspiration tube

- 1** Attach the 6.2713.000 ground-joint sleeve that has been cut to size to the ground joint of the 6.1437.000 stopper.
- 2** Insert the stopper into the 6.1439.010 addition and aspiration tube.
- 3** Attach the 6.2713.000 ground-joint sleeve that has been cut to size to the ground joint of the addition and aspiration tube.
- 4** Insert this assembly into the ground-joint opening.

- 5 Connect the tubing for the reagent addition at the upper connector of the addition and aspiration tube (5).
- 6 Connect the tubing for the aspiration of the titration cell at the lower connector of the addition and aspiration tube (6).

3.5.2.4 Titration cell (coulometry) with equipment for reagent replacement – Utilization with Dosino

A Dosino allows the automatic replacement of reagents.

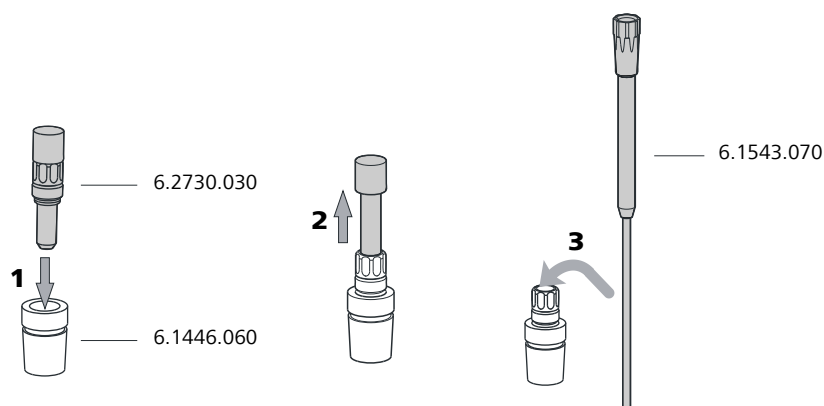
Required accessories:

- Equipment for reagent replacement (6.5617.000)
- 807 Dosing Unit

Metrohm recommends the following cylinder volumes for the 807 Dosing Unit:

| Use case | Cylinder volume |
|---|-----------------|
| General | 50 mL |
| Aspirating greasy samples when only the sample and not the whole reagent is aspirated | 20 mL |
| High-viscosity samples | 10 mL |

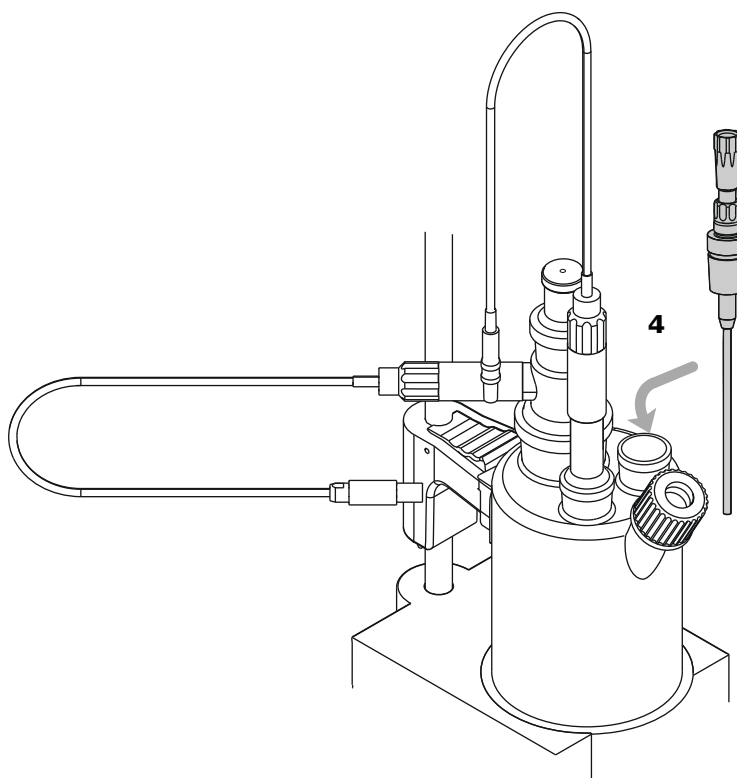
Mounting the aspiration tip



- 1 Screw the 6.2730.030 nipple, with stopper and O-ring, onto the 6.1446.060 stopper.
- 2 Pull out the stopper.



- 3** Slide the 6.1543.070 aspiration tip through the stopper.



- 4** Place the stopper with the attached aspiration tip into the ground-joint opening with the ground-joint sleeve.

Insert the aspiration tip into the titration cell until it touches the vessel base.

3.5.2.5 Titration cell (coulometry) with Karl Fischer oven

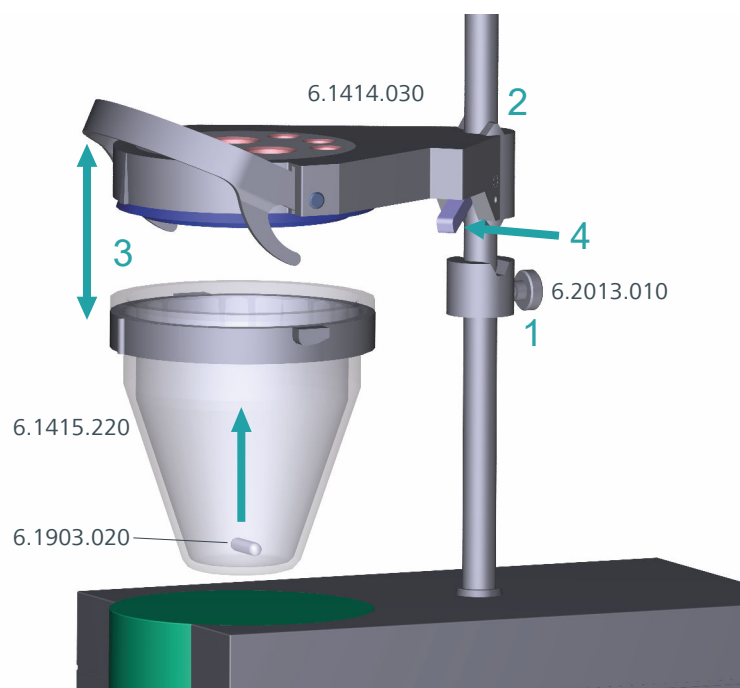
If samples release their water only slowly or only at higher temperatures, then the oven method is used. The sample is heated in a KF oven (e.g., *860 KF Thermoprep*) and the water that is released is transferred to the titration cell (coulometry) with a carrier gas. A detailed description can be found in the respective manual.

3.5.2.6 Titration cell (coulometry) with sample changer

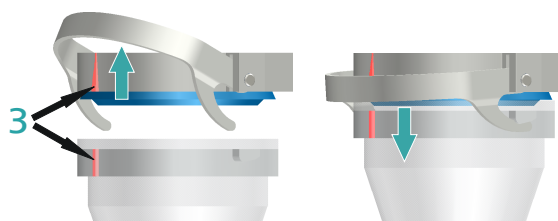
If a large number of samples need to be processed, then the determination of the water content can be automated with the aid of a sample changer with oven module (e.g., *874 Oven Sample Processor*). A detailed description can be found in the respective manual.

3.5.3 Titration vessel for volumetric KF titration

Mounting the KF titration cell



- 1** Screw the 6.2013.010 clamping ring tightly to the support rod.
- 2** Fix the 6.1414.030 vessel lid of the KF titration cell (with correctly inserted sealing ring from the 6.1244.040 sealing set) to the support rod. Keep the locking lever pressed down until it can be released at the desired position.
- 3** Fasten the 6.1415.220 (or 6.1415.250) titration vessel with a 6.1903.020 (or 6.1903.030) stirring bar inside on the vessel lid. Fold back the support bracket upwards while doing so. The markings on the vessel lid and on the plastic ring must be aligned above one another. Afterwards, press the support bracket downwards in order to fasten the titration vessel in place. The levers of the support bracket must enclose the pins of the plastic ring on the titration vessel in order to ensure a secure hold.

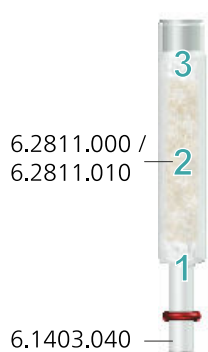


- 4** Adjust the height of the KF titration cell by pressing the locking lever. It should almost touch the surface of the stirrer. The position can now be fixed by readjusting the clamping ring.

If the height of the KF titration cell has been adjusted correctly, then the entire cell can now be raised and swiveled as required by pressing the locking lever.

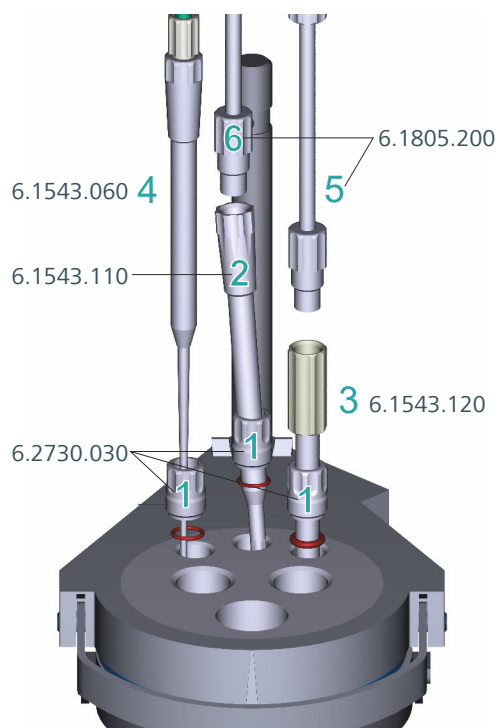
Filling the adsorber tube

Before insertion, the 6.1403.040 adsorber tube must be filled with the 6.2811.000 / 6.2811.010 molecular sieve.



- 1** Insert a small cotton plug into the bottom of the adsorber tube. Do not pack the cotton too tightly.
- 2** Fill the molecular sieve up to $\frac{3}{4}$ of the height.
- 3** Place a small cotton plug on the molecular sieve. Do not pack the cotton too tightly.
- 4** Seal the adsorber tube with the associated lid.

Inserting the tips



- 1** Place the 3 screw nipples from 6.2730.030 (including O-rings, but without stoppers) in the rear openings of the vessel lid.
- 2** Insert the 6.1543.110 dosing tip through the screw nipple in the middle rear opening.
- 3** Insert the 6.1543.120 aspiration tip through the screw nipple in the right rear opening.
If solvent is aspirated, then the end of the aspiration tip must touch the vessel base, but it must not inhibit the action of the stirring bar.
The aspiration tip can, if needed, be pulled out of the solvent.
- 4** Insert the 6.1543.060 tip through the screw nipple in the left rear opening.
- 5** Screw the 6.1805.200 PTFE M8 tubing of the aspiration bottle onto the aspiration tip.
- 6** Screw the 6.1805.200 PTFE M8 tubing of the solvent bottle onto the dosing tip.

3.6 Connecting sensors

The measuring interface contains the following measuring inputs:

- Measuring interface 1:
 - **Gen.** for a generator electrode
 - **Ind.** for a double Pt electrode
 - **Temp.** for a temperature sensor (Pt1000 or NTC)
- Measuring interface 2:
 - **Temp.** for a temperature sensor (Pt1000 or NTC)
 - **Pol.** for a polarizable electrode

3.6.1 Connecting a generator electrode (coulometric Karl Fischer titration)

- 1 Plug the electrode plug into the **Gen.** socket of the 852 Titrand.

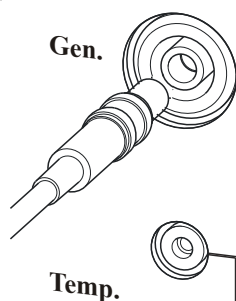


Figure 18 Connect generator electrode



NOTE

The electrode cable is protected against accidental disconnection of the cable by means of a pull-out protection. If you wish to pull out the plug again, you first need to pull back the outer plug sleeve.

3.6.2 Connecting an indicator electrode (coulometric Karl Fischer titration)

- 1 Plug the electrode plug into the **Ind.** socket of the 852 Titrand.

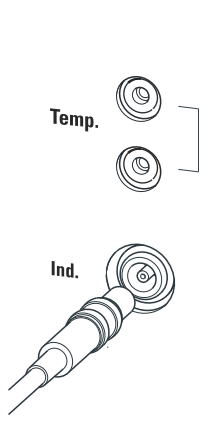


Figure 19 Connect indicator electrode



NOTE

The electrode cable is protected against accidental disconnection of the cable by means of a pull-out protection. If you wish to pull out the plug again, you first need to pull back the outer plug sleeve.

3.6.3 Connecting a polarizable electrode (Karl Fischer titration)

- 1 Plug the electrode plug into the **Pol.** socket of the 852 Titrande.

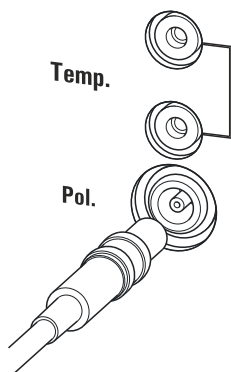


Figure 20 Connecting a polarizable electrode



NOTE

The electrode cable is protected against accidental disconnection of the cable by means of a pull-out protection. If you wish to pull out the plug again, you first need to pull back the outer plug sleeve.

3.6.4 Connecting a temperature sensor

A temperature sensor of the Pt1000 or NTC type can be connected to the **Temp.** connector.

- 1 Plug the temperature sensor plug into the **Temp.** sockets of the 852 Titrande.

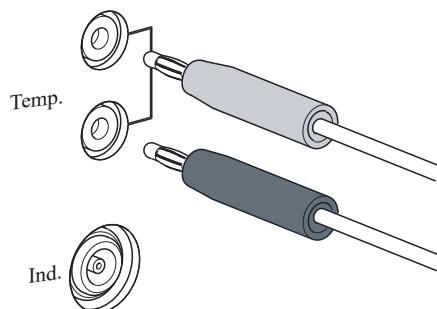


Figure 21 Connecting a temperature sensor



NOTE

Always insert the red plug into the red socket. This is the only way that shielding against electrical interference can be ensured.

**NOTE**

The 1.0 mg/g water standard is easier to handle and is therefore preferred.

Table 1 Recommended weighing ranges

| | |
|-------------------------|-----------|
| 1.0 mg/g water standard | 0.2–2.0 g |
| 0.1 mg/g water standard | 0.5–5.0 g |

4.1.2.2 Practical recommendations

For validation, it is essential to work very accurately. In order to minimize any measurement inaccuracies that could occur, the sample preparation and the sample processing should proceed in accordance with a defined scheme:

- 1 Put on gloves (always for Karl Fischer titration).
- 2 Use a clean syringe.

**NOTE**

If you are working with the 0.1 mg/g water standard, then you must use a glass syringe. If you are working with the 1.0 mg/g water standard, then you may use either a plastic syringe or a glass syringe.

- 3 Take a new ampoule of water standard and shake it briefly.
- 4 With a folded paper towel held between thumb and index finger, break open the ampoule at the marking.
- 5 Draw approx. 1 mL of the water standard into the syringe.
- 6 Pull the plunger of the syringe up to the end and shake the syringe back and forth somewhat.
The inside of the syringe is rinsed by water standard and freed of water contamination.
- 7 Dispose of the used water standard in a waste bottle.



- 8** Draw the rest of the water standard into the syringe, aspirating as little air as possible.
- 9** Push out any air bubbles that may be present in the syringe.
- 10** Wipe off the needle with a lint-free paper towel and cover it with the appropriate cap.
- 11** Place the syringe on the balance and press **[TARA]**.
- 12** As soon as the drift on the 852 Titrande is stable, take the syringe in your hand, press **[START]** and inject approx. 1 mL of the water standard through the septum.
There are 2 possibilities:
 - Version 1:
Inject the water standard without immersing the needle in the reagent liquid. If a little drop remains on the end of the needle, it must be aspirated back before pulling the needle out of the septum.
The water standard should not be sprayed from the syringe onto the electrode nor onto the wall of the titration cell.
 - Version 2:
Inject the water standard directly under the surface of the reagent liquid.
Take care to ensure that you do not aspirate any liquid when you withdraw the syringe from the reagent liquid.
- 13** Close the syringe with the same cap and place it back on the balance.
- 14** If you have connected a balance to the Titrande, you may transmit the sample size directly from the balance.
- 15** The next determination can be started as soon as the determination has been finished and the titration cell has been conditioned (drift stable) again.

4.1.3 Sample addition

This chapter contains a few notes concerning sample addition. An exhaustive discussion of this topic is not possible here. Further notes can be found in the literature from the reagent manufacturers and in the following **Metrohm Application Bulletins**:

| <i>Bulletin No.</i> | Title |
|---------------------|---|
| No. 142 | Karl Fischer water content determination in non-explosive gases |
| No. 145 | Determination of low water contents in plastics using the KF oven method |
| No. 209 | Coulometric water content determinations according to the the Karl Fischer method in insulating oils, hydrocarbons and their products |

4.1.3.1 Size of the sample size

The sample weight should be small in order to be able to titrate as many samples as possible in the same electrolyte solution and to keep the titration time short. However, ensure that the sample contains at least 50 µg of H₂O. The following table helps you determine the appropriate sample size.

Table 2 Recommended sample sizes

| Water content of the sample | Sample size | Resulting water content |
|-----------------------------|-------------|-------------------------|
| 10,000 ppm = 1% | 10–100 mg | 100–1,000 µg |
| 1,000 ppm = 0.1% | 100 mg–1 g | 100–1,000 µg |
| 100 ppm = 0.01% | 1 g | 100 µg |
| 10 ppm = 0.001% | 5 g | 50 µg |

4.1.3.2 Working with liquid samples

Liquid samples are added with a syringe. The samples can be injected 2 different ways:

- One uses a syringe with a long needle, which one immerses in the reagent during the injection.
- One uses a syringe with a short needle and aspirates the last drops back into the needle.

The best way for you to determine the injected sample amount is to reweigh the sample.

Glass syringes should be used for the **determination of traces and validations**. We recommend obtaining these from a specialized syringe manufacturer.

For generator electrodes with diaphragms, you should expect a preparation time of approx. 2 hours.

To obtain precise determinations of amounts of water less than 100 µg, it may also be of advantage to condition the titration cell overnight before using it.

4.1.4.2 Drift

A constant drift in the range of ≤ 4 µg/min is all right. Lower values are, however, quite possible. Higher but stable values will still produce good results because it is possible to compensate for the drift.

A constantly high drift can be caused by water-containing deposits in inaccessible parts of the titration cell. In these cases, shaking the cell can reduce the value. Ensure that there are no drops above the liquid level in the titration cell.

If you are working with a generator electrode with diaphragm, do not shake the cell so hard that the catholyte and anolyte mix with one another. If the drift remains too high for a prolonged time, even after shaking the cell, then the electrolyte solutions should be replaced. The catholyte should be replaced once per week.

A wet catholyte can be another reason for the excessively high drift. The wet catholyte can be dried with a KF one-component reagent.

When you work with a Karl Fischer oven, a drift \leq of 10 µg/min is all right. The drift depends on the gas flow (the smaller the gas flow, the lower the drift) and on the humidity of the surroundings.

4.1.4.3 Reagent replacement

The electrolyte solutions must be replaced in the following cases:

- The titration cell is too full.
- The KF reagent has reached its capacity limit.
- The drift is too high, and cannot be reduced by shaking the titration cell.
- A two-phase-mixture is being formed in the titration cell; in this case it is also only possible to aspirate the sample phase.

Exhausted electrolyte solution is best disposed of by aspiration. To do this, you can use, for example, an *803 Ti Stand* with built-in membrane pump. An advantage is that the titration cell does not have to be disassembled.

In the event of severe contamination, the titration cell can be rinsed with a suitable solvent which is also aspirated.

In the case of a generator electrode with diaphragm, the catholyte should be replaced once per week. Longer use can cause blackening and yellow precipitates in the cathode chamber. An unpleasant smell is also a sign of having used the catholyte for too long.

4.2.3 Karl Fischer reagents

1-component reagents

They contain all the reactive parts in a single solution – iodine, sulfur dioxide, and a base, dissolved in a suitable alcohol.

Two-component reagents

The reactive parts are distributed among 2 separated solutions. The titration reagent contains iodine in methanol. The KF solvent is a solution of sulfur dioxide and a base in methanol. It is used as a working medium in the KF titration cell.

4.2.4 Application of the Karl Fischer titration

The volumetric Karl Fischer titration is preferably used for the determination of an amount of water between 0.1 and 100%. It has the advantage, that even solid and pasty samples can directly be added to the titration vessel. In addition, various organic solvents can be used which fit the corresponding samples.

4.2.5 Working with water standards

4.2.5.1 Certified water standards

Commercially available, certified water standards with a water content of 10.0 ± 0.1 mg/g should be used for validating the instrument as a whole, integrated system.

4.2.5.2 Practical recommendations

(see chapter 4.1.2.2, page 41)

4.2.6 Sample addition

This chapter contains a few notes concerning sample addition. Further notes can be found in the publications of the reagent manufacturers and in the Karl Fischer monograph published by Metrohm.

4.2.6.1 Size of the sample size

The sample weight should be small in order to be able to titrate as many samples as possible in the same electrolyte solution and thus to keep the titration time short. However, ensure that the sample contains at least 50 μg of H_2O . The following tables provide clues for the sample size.

Table 3 Approximate sample size in grams (5 mL cylinder volume)

| Water content of the sample | KF reagent 1 | KF reagent 2 | KF reagent 5 |
|-----------------------------|--------------|--------------|--------------|
| 0.5% | 0.1–0.9 | 0.2–1.8 | 0.5–4.5 |



| Water content of the sample | KF reagent 1 | KF reagent 2 | KF reagent 5 |
|-----------------------------|--------------|--------------|--------------|
| 1.0% | 0.05–0.45 | 0.1–0.9 | 0.25–2.25 |
| 5.0% | | 0.02–0.18 | 0.05–0.45 |
| 10.0% | | | 0.03–0.22 |
| 25.0% | | | |
| 50.0% | | | |

Table 4 Approximate sample size in grams (10 mL cylinder volume)

| Water content of the sample | KF reagent 1 | KF reagent 2 | KF reagent 5 |
|-----------------------------|--------------|--------------|--------------|
| 0.5% | 0.2–1.8 | 0.4–3.6 | |
| 1.0% | 0.1–0.9 | 0.2–1.8 | 0.5–4.5 |
| 5.0% | 0.02–0.18 | 0.04–0.36 | 0.1–0.9 |
| 10.0% | | 0.02–0.18 | 0.05–0.45 |
| 25.0% | | | 0.02–0.18 |
| 50.0% | | | 0.02–0.09 |

Table 5 Approximate sample size in grams (20 mL cylinder volume)

| Water content of the sample | KF reagent 1 | KF reagent 2 | KF reagent 5 |
|-----------------------------|--------------|--------------|--------------|
| 0.5% | 0.4–3.6 | | |
| 1.0% | 0.2–1.8 | 0.4–3.6 | |
| 5.0% | 0.04–0.36 | 0.08–0.72 | 0.2–1.8 |
| 10.0% | 0.02–0.18 | 0.04–0.36 | 0.1–0.9 |
| 25.0% | | 0.02–0.14 | 0.04–0.36 |
| 50.0% | | | 0.02–0.18 |

KF reagent 1: 1 mL KF reagent reacts with around 1 mg H₂O

KF reagent 2: 1 mL KF reagent reacts with around 2 mg H₂O

KF reagent 5: 1 mL KF reagent reacts with around 5 mg H₂O

4.2.6.2 Working with liquid samples

Liquid samples are added with a syringe. The samples can be injected two different ways:

- Use a syringe with a long needle that you immerse in the reagent during the injection.
- Use a syringe with a short needle and aspirate the last drop back into the needle.

The best way for you to determine the injected sample amount is to weigh the sample by difference.

Glass syringes should be used for the **determination of traces and validations**. We recommend obtaining these from a specialized syringe manufacturer.

Highly volatile samples and samples of low viscosity should be cooled before sampling. Doing so avoids losses while working. The syringe must, however, not be cooled directly, as condensation could be formed. For the same reason, no air may be aspirated into a syringe into which a cooled sample has been aspirated beforehand.

Samples of high viscosity can be thinned by heating. The syringe must be heated as well. The same target can be reached by diluting with a suitable solvent. In this case, the water content of the solvent has to be determined and subtracted as a blank value.

Viscous samples can be added to the measuring cell with a syringe without needle. You can use the ground-joint opening for this. The best way for you to determine the added sample amount is by weighing by difference the sample.

4.2.6.3 Working with solid samples

If possible, solid samples are to be extracted or dissolved in a suitable solvent. The resulting solution is injected, during which a blank-value correction for the solvent must be carried out.

If no suitable solvent can be found for a solid sample, or if the sample reacts with the Karl Fischer reagent, then a Karl Fischer oven should be used.

If solid samples have to be directly added to the titration cell, then they can be inserted through the ground-joint opening. While doing so, take care to ensure that

- the sample releases its moisture completely.
- no side reaction with the Karl Fischer reagent takes place.
- the surface of the electrode is not covered by the sample substance (incomplete KF reaction!).
- the Pt wires of the indicator electrode do not become damaged.

5 Operation and maintenance

5.1 General notes

5.1.1 Care

The 852 Titrande requires appropriate care. Excess contamination of the instrument may result in functional disruptions and a reduction in the service life of the otherwise sturdy mechanics and electronics.

Spilled chemicals and solvents should be removed immediately. Above all, the plug connections on the rear of the instrument (in particular the power socket) should be protected from contamination.



CAUTION

Although this is extensively prevented by design measures, the power plug should be unplugged immediately if aggressive media have penetrated the inside of the instrument, so as to avoid serious damage to the instrument electronics. In such cases, Metrohm Service must be informed.

5.1.2 Maintenance by Metrohm Service

Maintenance of the 852 Titrande is best carried out as part of an annual service, which is performed by specialist personnel of the Metrohm company. A shorter maintenance interval may be necessary if you frequently work with caustic and corrosive chemicals.

Metrohm Service offers every form of technical advice for maintenance and service of all Metrohm instruments.

5.2.2.2 Cleaning

As a rule, the electrolyte solution can be exchanged without special cleaning of the parts. If cleaning is necessary anyway, ensure that the Pt grid of the generator electrode is not damaged.

- **Resinous residues on the diaphragm**

Hang the generator electrode vertically on a support rod, fill with concentrated HNO_3 and leave overnight. First rinse with water, then with ethanol.

- **Contaminations containing oil**

First clean with a solvent (e.g. hexane), then rinse with ethanol.

- **Saline depositions**

First clean with water, then rinse with ethanol.

- **Cleaning (rinsing) the diaphragm**

Fill the cathode chamber of the generator electrode with methanol and let the contents flow out. Repeat this procedure two or three times.

This procedure should also be carried out after the cleaning described above.

Thoroughly dry all parts after cleaning. A hair dryer can be used for this. If the parts are dried in the drying oven the temperature must not exceed 70 °C (plastic parts!).

6 Troubleshooting

6.1 General

| Problem | Cause | Remedy |
|--|--|---|
| The "On" LED is not illuminated, even though the instrument is connected to the power supply. | <i>The Touch Control or the computer has not been switched on yet or the plugs are not correctly plugged in.</i> | <ol style="list-style-type: none"> 1. Check the plug connections. 2. Switch on the Touch Control or the computer. |

6.2 Karl Fischer titration

| Problem | Cause | Remedy |
|--|--|---|
| The drift is very high during conditioning. | <i>The titration cell is leaking.</i> | <ul style="list-style-type: none"> ▪ Check the seals and the septum. Replace if necessary. ▪ Replace the molecular sieve. |
| The drift becomes greater after each titration. | <i>The sample releases water very slowly.</i> | <ul style="list-style-type: none"> ▪ Adjust the method. ▪ Add solubility promoter. ▪ Increase the temperature (possibly using a KF oven). ▪ See technical literature. |
| | <i>A side reaction is taking place.</i> | <ul style="list-style-type: none"> ▪ Use special reagents. ▪ Adjust the method (increase/decrease the temperature, external extraction). ▪ See technical literature. |
| | <i>The pH value is no longer in the optimum range.</i> | Add buffer (see technical literature). |
| The titration will not be finished. | <i>The titration cell is leaking.</i> | <ul style="list-style-type: none"> ▪ Check the seals and the septum. Replace if necessary. ▪ Replace the molecular sieve. |
| | <i>The minimum increment is too low.</i> | Select the user-defined titration rate and increase the minimum volume increment (see manual/help of the software used). |
| | <i>The stop criterion is unsuitable.</i> | Adjust the control parameters (see manual/help of the software used): <ul style="list-style-type: none"> ▪ Increase the stop drift. |

| Problem | Cause | Remedy |
|---|---|--|
| | | <ul style="list-style-type: none"> Select a short delay time. |
| | <i>See also: The drift becomes greater after each titration.</i> | |
| The sample is over-titrated. | <i>The increments at the end of the titration are too high.</i> | <ul style="list-style-type: none"> Select the user-defined titration rate and reduce the dosing rate (see manual/help of the software used). The following experiment provides a clue for the optimum dosing rate: During conditioning, display the drift and add sample without starting the titration. Select a value below the highest drift as dosing rate. Stir faster. |
| | <i>The amount of methanol in the working medium is too low.</i> | <ul style="list-style-type: none"> Replace the working medium. Reduce the amount of solubility promoter, if working with solvent mixtures, see technical literature. |
| | <i>The electrode may be covered.</i> | Wipe off the electrode with ethanol or a suitable solvent. |
| The solution becomes darker after each titration. | | Replace the working medium. |
| | <i>The electrode may be covered.</i> | Wipe off the electrode with ethanol or a suitable solvent. |
| | <i>The electrode has a short circuit.</i> | <ol style="list-style-type: none"> Check the Pt wires. Activate the electrode check. |
| The endpoint is reached too quickly. | <i>The dosing rate outside the control range is too high.</i> | Select the user-defined titration rate and reduce the dosing rate (see manual/help of the software used). |
| The titration times with volumetric titration are constantly longer. | <i>The buffer capacity of the solvent may be exhausted with two-component reagents.</i> | Replace the working medium. |

7 Appendix

7.1 Remote interface

The 6.2148.010 Remote Box allows devices to be controlled which cannot be connected directly to the MSB interface of the Titrando.

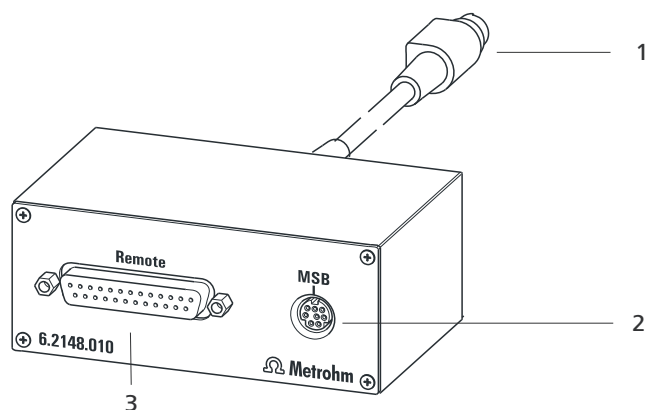


Figure 22 Connectors of the Remote Box

1 Cable

For connecting to the Titrando.

2 MSB connector

Metrohm Serial Bus. For connecting external dosing devices or stirrers.

3 Remote connector

For connecting instruments with a remote interface.

7.1.1 Pin assignment of the remote interface

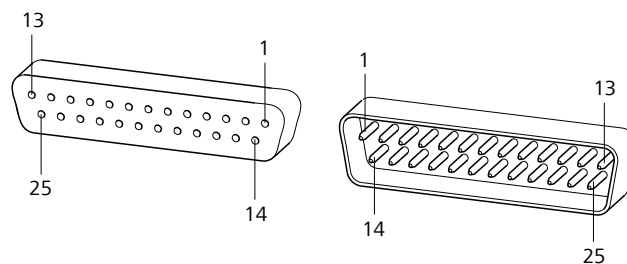
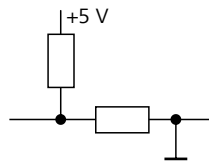


Figure 23 Pin assignment of remote socket and remote plug

The above figure of the pin assignment applies for all Metrohm instruments with 25-pin D-Sub remote connector.

Inputs

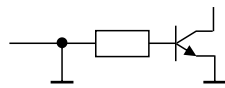


approx. 50 k Ω Pull-up

$t_p > 20$ ms

active = low, inactive = high

Outputs



Open Collector

$t_p > 200$ ms

active = low, inactive = high

$I_C = 20$ mA, $V_{CE0} = 40$ V

+5 V: maximum load = 20 mA

The following tables offer information concerning the assignment of the individual pins and their function:

Table 6 Inputs and outputs of the remote interface

| Assignment | Pin No. | Function* |
|------------|---------|------------------------|
| Input 0 | 21 | Start |
| Input 1 | 9 | Stop |
| Input 2 | 22 | |
| Input 3 | 10 | Quit |
| Input 4 | 23 | – |
| Input 5 | 11 | |
| Input 6 | 24 | |
| Input 7 | 12 | |
| Output 0 | 5 | Ready |
| Output 1 | 18 | Conditioning OK |
| Output 2 | 4 | Determination |
| Output 3 | 17 | EOD |
| Output 4 | 3 | |
| Output 5 | 16 | Error |
| Output 6 | 1 | |
| Output 7 | 2 | Warning |

| Assignment | Pin No. | Function* |
|---------------|---------|-----------|
| Output 8 | 6 | |
| Output 9 | 7 | |
| Output 10 | 8 | |
| Output 11 | 13 | |
| Output 12 | 19 | |
| Output 13 | 20 | |
| 0 volts / GND | 14 | |
| +5 volts | 15 | |
| 0 volts / GND | 25 | |

* Signal activated only for operation with Touch Control.

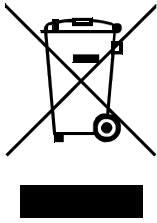
Table 7 Explanation of the individual functions

| Function | Explanation |
|------------------------|--|
| Start | The current method is started at the time of activation. $t_{\text{pulse}} > 100 \text{ ms}$ |
| Stop | The current method is canceled (Stop) at the time of activation. $t_{\text{pulse}} > 100 \text{ ms}$ |
| Quit | The current command in the determination run will be canceled at the time of activation. $t_{\text{pulse}} > 100 \text{ ms}$ |
| Ready | The instrument is ready to receive a start signal. |
| Conditioning OK | The line is set when Conditioning with SET titration and KFT titration is at OK. The line remains set until the determination is started with [START] . |
| Determination | The instrument performs a data-generating determination. |
| EOD | End of Determination. Pulse ($t_{\text{pulse}} = 200 \text{ ms}$) after a determination or after a buffer/standard solution during calibration using a Sample Processor. |
| Error | The line is set for error message display. |



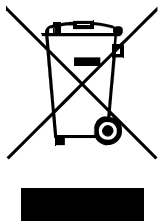
| Function | Explanation |
|----------------|--|
| Warning | The line is set for warning message display. |

8 Recycling and disposal



Properly dispose of chemicals and of the product to reduce negative effects on the environment and public health. Local authorities, waste disposal companies or dealers provide more detailed information on disposal. Observe the WEEE EU directive (WEEE = Waste Electrical and Electronic Equipment) for the proper disposal of waste electronic equipment within the European Union.

9 Recycling and disposal



Properly dispose of chemicals and of the product to reduce negative effects on the environment and public health. Local authorities, waste disposal companies or dealers provide more detailed information on disposal. Observe the WEEE EU directive (WEEE = Waste Electrical and Electronic Equipment) for the proper disposal of waste electronic equipment within the European Union.

10 Technical specifications

10.1 Measuring interface

The measuring cycle is 100 ms for all measuring modes.

10.1.1 Generator electrode

One measuring input (**Gen.**) for a generator electrode.

I_{max} 400 mA
Continuous current and pulsed

10.1.2 Indicator electrode

One measuring input (**Ind.**) for an indicator electrode.

Measuring mode Determination with adjustable polarization current
I_{pol}
AC 5, 10, 20, and 30 μ A
DC -125 to +125 μ A

10.1.3 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
(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 to +150 °C; ± 1 digit; without sensor error, under reference conditions)
NTC ± 0.6 °C
(Applies for measuring range +10 to +40 °C; ± 1 digit; without sensor error, under reference conditions)



10.1.4 Polarizer

One measuring input (**Pol.**) for polarizable electrodes.

| | |
|---|---|
| <i>Measuring mode</i> <i>I_{pol}</i> | Determination with adjustable polarization current |
| <i>Polarization current</i> | –122.5 to +122.5 μA (increment: 0.5 μA) –125.0 to +125.0 μA : non-guaranteed values, dependent on reference voltage +2.5 V |
| <i>Measuring range</i> | –1,200 to +1,200 mV |
| <i>Resolution</i> | 0.1 mV |
| <i>Measuring accuracy</i> | ± 0.2 mV (± 1 digit, without sensor error, under reference conditions) |
| <i>Measuring mode</i> <i>U_{pol}</i> | Determination with adjustable polarization voltage |
| <i>Polarization voltage</i> | –1,225 to +1,225 mV (increment: 25 mV) –1,250 to +1,250 mV: non-guaranteed values, dependent on reference voltage +2.5 V |
| <i>Measuring range</i> | –120 to +120 μA |
| <i>Resolution</i> | 0.1 μA |

10.2 Power connection

| | |
|--------------------------|--------------------------------|
| <i>Supply voltage</i> | 100–240 V ($\pm 10\%$) |
| <i>Frequency</i> | 50–60 Hz ($\pm 3\%$) |
| <i>Power consumption</i> | max. 45 W |
| <i>Fuse</i> | Electronic overload protection |

10.3 Ambient conditions

Automatic interior temperature monitoring

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. above sea level / min. 780 mbar

Overvoltage category II

Pollution degree 2

10.4 Dimensions

Width 142 mm

Height 227 mm

Depth 231 mm

Weight 3.1 kg (without accessories)

Material (housing) Polybutylene terephthalate (PBT)

10.5 Interfaces

USB connectors

USB ports 2 USB downstream ports (type A sockets), 500 mA, for connecting peripheral devices such as printers, keyboards, barcode readers or RS-232/USB boxes (6.2148.020).

"Controller" connector

Controller port USB upstream port with auxiliary power supply (Mini DIN socket) for connecting Touch Control or computer for controlling the 852 Titrande.

Touch Control With integrated Touch Control cable.

Computer With 6.2151.000 cable

**MSB connectors (Metrohm Serial Bus)**

| | |
|----------------------|---|
| <i>Dosing device</i> | Connection of a max. of 4 external dosing devices of the Dosimat or Dosino (MSB 1 to MSB 4) types. |
| <i>Stirrer</i> | Connection of a max. of 4 stirrers. Stirrer control: Switching on/off manually or coordinated with the titration sequence. Speed in 15 steps and shift direction can be selected. |
| <i>Remote Box</i> | Connection of a max. of 4 Remote Boxes. Remote Boxes can be used to actuate and monitor external devices. |

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