905 Titrando

Manual

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Manual

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Table of contents

Table of figures

1 Introduction

1.1 The Titrando system

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

A Titrando system can contain numerous kinds of a variety of instruments. The following figure provides an overview of the peripheral devices you can connect to the 905 Titrando.
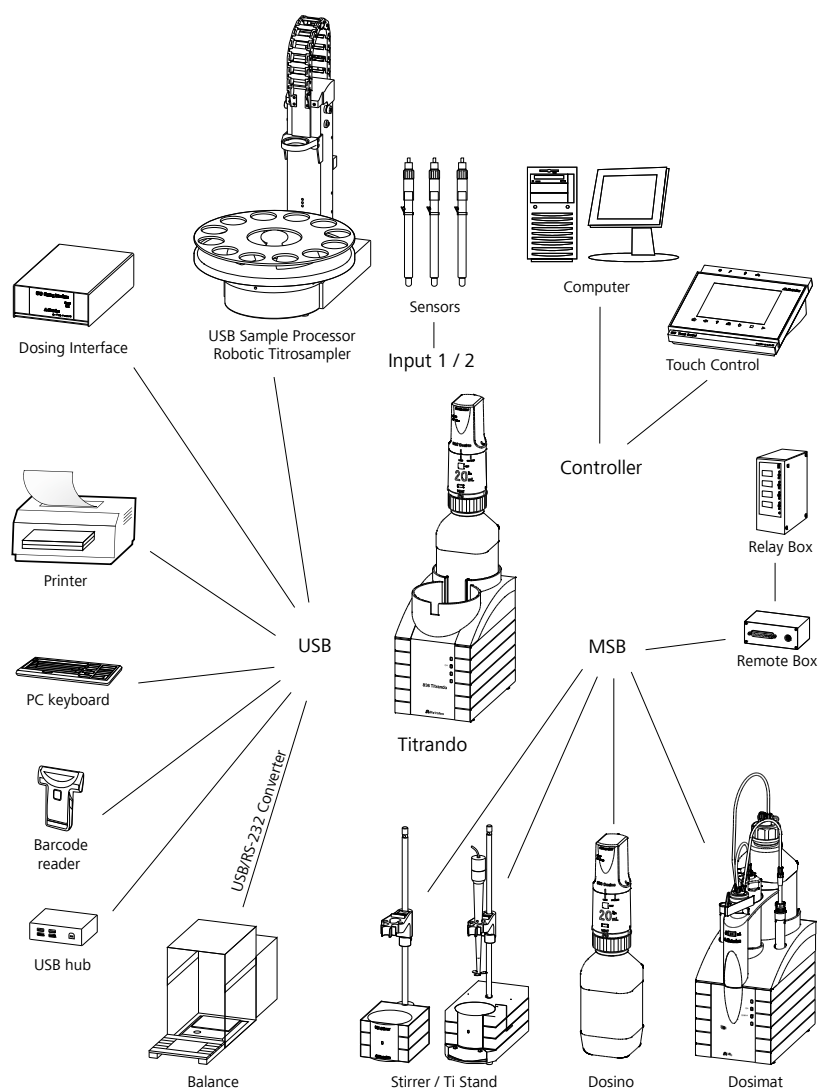
Figure 1   The Titrando system

Up to three control instruments (Titrando, 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 through the responsible Metrohm representative. Various monographs on the subjects of titration techniques and electrodes are also available.

Updating the device software is described in the Help for the corresponding PC software.

1.2 Instrument description

The 905 Titrando has the following characteristics:

- **Operation**
  Operation is carried out by means of a touch-sensitive Touch Control or with high-performance PC software.
- **MSB connectors**
  Four MSB connectors (Metrohm Serial Bus) for connecting dosing devices (Dosimat with exchange unit or Dosino with dosing unit), stirrers, titration stands and Remote Boxes.
- **USB connectors**
  Two USB connectors, through which devices such as printers, PC keyboards, barcode readers or additional control instruments (USB Sample Processor, Titrando, Dosing Interface, etc.) can be connected.
- **Measuring interface**
  Depending on the model version, one or two measuring interface(s). Each measuring interface has one measuring input each for:
    - a potentiometric electrode (pH, metal or ion-selective electrode)
    - a separate reference electrode
    - a temperature sensor (Pt1000 or NTC)
    - a polarizable electrode
    - an iConnect (measuring interface for electrodes with integrated data chip, so-called iTrodes)

1.3 Titration modes – Measuring modes – Dosing commands

The 905 Titrando supports the following titration modes, measuring modes and dosing commands:

- **DET**
  Dynamic equivalence point titration. The reagent addition is carried out 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 addition is carried out 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)

- **MEAS**
  The following measuring modes can be selected for measurements:
  - **pH** (pH measurement)
  - **U** (potentiometric voltage measurement)
  - **Ipol** (voltametric measurement with selectable polarization current)
  - **Upol** (amperometric measurement with selectable polarization voltage)
  - **Conc** (concentration measurement with or without standard addition)
  - **T** (temperature measurement)
- **STDADD**
  The measuring modes for standard addition are listed separately only in *tiamo™*. In Touch Control they are integrated in the measuring mode MEAS Conc.
  The following measuring modes can be selected for measurements:
  - **auto** (automatic addition of the standard addition solution by specifying a potential difference)
  - **dos** (automatic addition of the standard addition solution by specifying the individual volume increments)
  - **man** (manual addition of the standard addition solution)
- **CAL**
  Electrode calibration.
  Measuring mode:
  - **pH** (calibration of pH electrodes)
  - **Conc** (calibration of ion-selective electrodes)
- **ELT**
  Electrode test for pH electrodes.
  This mode is listed separately only in *tiamo™*. In Touch Control, the electrode test is a component part of the CAL calibration mode.
- **Dosing commands**
  The following commands for dosing can be selected:
  - **PREP** (rinsing the cylinder and tubings of an exchange unit or dosing unit)
  - **EMPTY** (emptying the cylinder and tubings of a dosing unit)
  - **ADD** (dosing a specified volume)
  - **LQH** (carrying out complex dosing tasks with a Dosino)

1.4 About the documentation

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

1.4.1 Symbols and conventions

The following symbols and formatting may appear in this documentation:

*(5-**12**)*	**Cross-reference to figure legend** The first number refers to the figure number, the second to the instrument part in the figure.
1	**Instruction step** Carry out these steps in the sequence shown.
Method	**Dialog text**, **parameter** in the software
File ▸ New	Menu or menu item
[Next]	**Button** or **key**
⚠	**WARNING** This symbol draws attention to a possible life-threatening hazard or risk of injury.
⚡	**WARNING** This symbol draws attention to a possible hazard due to electrical current.
🔥	**WARNING** This symbol draws attention to a possible hazard due to heat or hot instrument parts.
☣	**WARNING** This symbol draws attention to a possible biological hazard.
❗	**CAUTION** This symbol draws attention to possible damage to instruments or instrument parts.

NOTE

This symbol highlights additional information and tips.

1.5 Safety instructions

1.5.1 General notes on safety

WARNING

This instrument may only be operated in accordance with the specifications in this documentation.

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

1.5.2 Electrical safety

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

WARNING

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

WARNING

Never open the housing of the instrument. The instrument could be damaged by this. There is also a risk of serious injury if live components are touched.

There are no parts inside the housing which can be serviced or replaced by the user.

Mains voltage

WARNING

An incorrect mains voltage can damage the instrument.

Only operate this instrument with a mains voltage specified for it (see rear panel of the instrument).

Protection against electrostatic charges

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

1.5.3   Working with liquids

> ❗ **CAUTION**
>
> Periodically check all system connections for leaks. Observe the relevant regulations in respect to working with flammable and/or toxic fluids and their disposal.

1.5.4   Flammable solvents and chemicals

> ⚠ **WARNING**
>
> All relevant safety measures are to be observed when working with flammable solvents and chemicals.
>
> - Set up the instrument in a well-ventilated location (e.g. fume cupboard).
> - Keep all sources of flame far from the workplace.
> - Clean up spilled liquids and solids immediately.
> - Follow the safety instructions of the chemical manufacturer.

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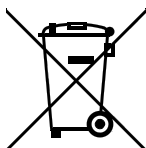
This product is covered by European Directive 2002/96/EC, WEEE – Waste from Electrical and Electronic Equipment.

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

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

2   Overview of the instrument

Figure 2   Front 905 Titrando

1	**Bottle holder**	**2**	**"On" LED**
	With holding clamps, for two reagent bottles.		Lights up when the Titrando is ready for operation.
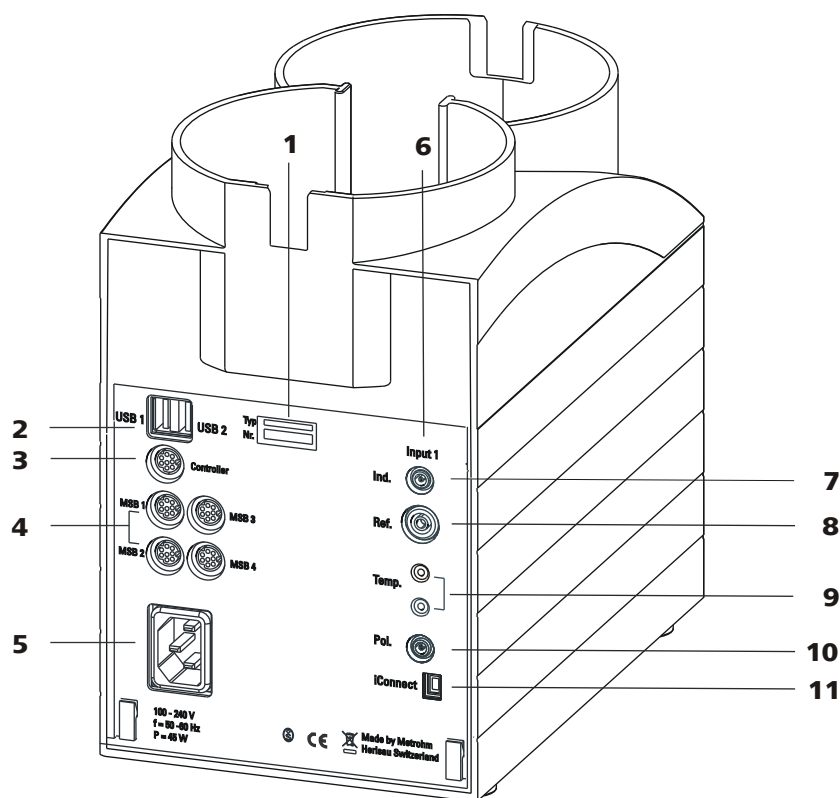
Figure 3   Rear 905 Titrando

1	**Type plate** Contains specifications concerning supply voltage, instrument type and serial number.	2	**USB connector (USB 1 and USB 2)** USB ports (type A) for connecting printer, keyboard, barcode reader, additional Titrandos, USB Sample Processor, etc.
3	**Connector (Controller)** For connecting a Touch Control or a PC with installed PC software. Mini DIN, 9-pin.	4	**MSB connector (MSB 1 to MSB 4)** Metrohm Serial Bus. For connecting external dosing devices, stirrers or Remote Boxes. Mini DIN, 9-pin.
5	**Power socket**	6	**Measuring interface 1 (Input 1)**
7	**Electrode connector (Ind.)** For connecting pH, metal or ion-selective electrodes with integrated or separated reference electrode. Socket F.	8	**Electrode connector (Ref.)** For connecting reference electrodes, e.g. Ag/AgCl reference electrode. Socket B, 4 mm.
9	**Temperature sensor connector (Temp.)** For connecting temperature sensors (Pt1000 or NTC). Two B sockets, 2 mm.	10	**Electrode connector (Pol.)** For connecting polarizable electrodes, e.g. double Pt wire electrodes. Socket F.
11	**Electrode connector (iConnect)** For connecting electrodes with integrated data chip (iTrodes).		

3 Installation

3.1 Setting up the instrument

3.1.1 Packaging

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

3.1.2 Checks

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

3.1.3 Location

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

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

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

3.2 Connecting a controller

3.2.1 Operation

Two different versions are available for operating the 905 Titrando:

- A Touch Control with touch-sensitive screen. It forms a "stand-alone instrument" together with the 905 Titrando.
- A computer enables operation of the 905 Titrando with the help of a PC software, e.g. *tiamo*.

> **CAUTION**
>
> Take care to ensure that the power supply cable is pulled out of the power socket before either setting up or disconnecting connections between the instruments.

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 will first need to pull back the outer plug sleeve marked with arrows.

Connect the Touch Control as follows:

1 ▪ Insert the plug of the Touch Control connection cable into the **Controller** socket.
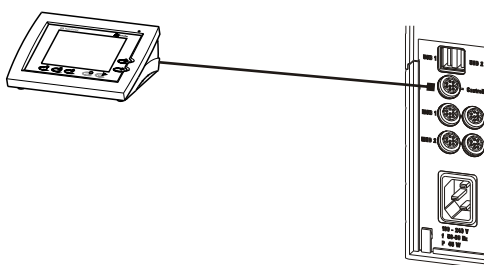
Figure 4   Connecting the Touch Control

2 ▪ Connect the MSB devices *(see Chapter 3.3, page 14)*.
   ▪ Connect the USB devices *(see Chapter 3.4, page 18)*.

3 ▪ Connect the Titrando to the power supply.

4 ▪ Switch on the Touch Control.

The Touch Control power supply is supplied through the Titrando. Automatic system tests are performed on both instruments at the time of activation. The **On** LED on the front of the Titrando lights up when the system test has been completed and the instrument is ready for operation.

> ⓘ **CAUTION**
>
> The Touch Control must be shut down properly by deactivation with the power switch on the rear of the instrument before the power supply is interrupted. If this is not done, then there is a danger of data loss. Because of the fact that the power supply for the Touch Control is provided through the Titrando, you must never disconnect the Titrando from the power supply (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 a computer

The 905 Titrando requires a USB connection to a computer in order to be able to be controlled by a PC software. Using a 6.2151.000 controller cable, the instrument can be connected directly, either to a USB socket on a computer, to a connected USB hub or to a different Metrohm control device.

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 905 Titrando is recognized by the PC software. To accomplish this, you must comply with the procedures specified. The following steps are necessary:

1 Installing the software

- Insert the PC software installation CD and carry out the installation program directions.
- 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 14* and *see Chapter 3.4, page 18*.
- Connect the instrument to the power supply if you have not already done this.
  The "On" LED on the 905 Titrando 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.
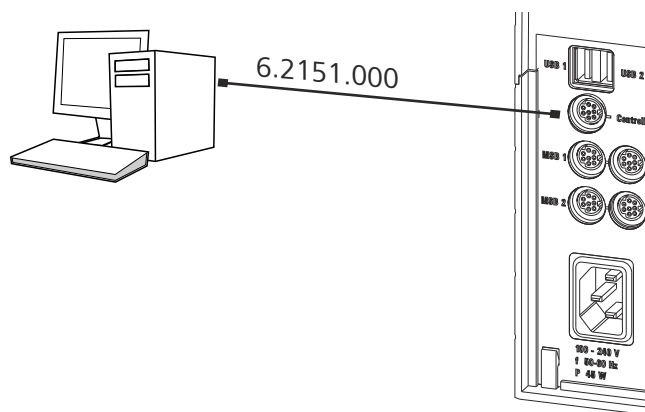
Figure 5   Connecting the computer

The instrument is recognized. Depending on the version of the Windows operating system used, the driver installation proceeds differently afterwards. Either the necessary driver software is installed automatically or an installation wizard is started.

3 Follow the instructions of the installation wizard.

The "On" LED on the 905 Titrando lights up when the driver installation has been completed and the instrument is ready for operation.

If problems should occur during installation, contact your company's IT support team.

NOTE

The plug on the instrument end of the 6.2151.000 controller cable is protected against accidental disconnection by means of a pull-out protection feature. If you wish to pull out the plug, you will first need to pull back the outer plug sleeve marked with arrows.
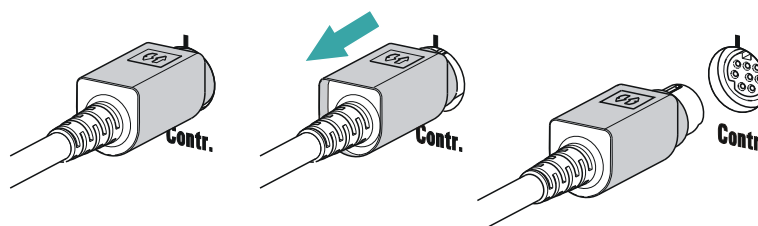
Registering and configuring the instrument in the PC software

The instrument must be registered in the configuration of your PC software. Once that has been done, you can then configure it according to your requirements. Proceed as follows:

1 Setting up the instrument

- Start the PC software.
  The instrument is automatically recognized. The configuration dialog for the instrument is displayed.
- Make configuration settings for the instrument and its connectors.

More detailed information concerning the configuration of the instrument can be found in the documentation for the respective PC software.

3.3 Connecting MSB devices

In order to connect MSB devices, e.g. stirrers or dosing devices, Metrohm instruments are equipped with up to a maximum of four 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 device. 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.
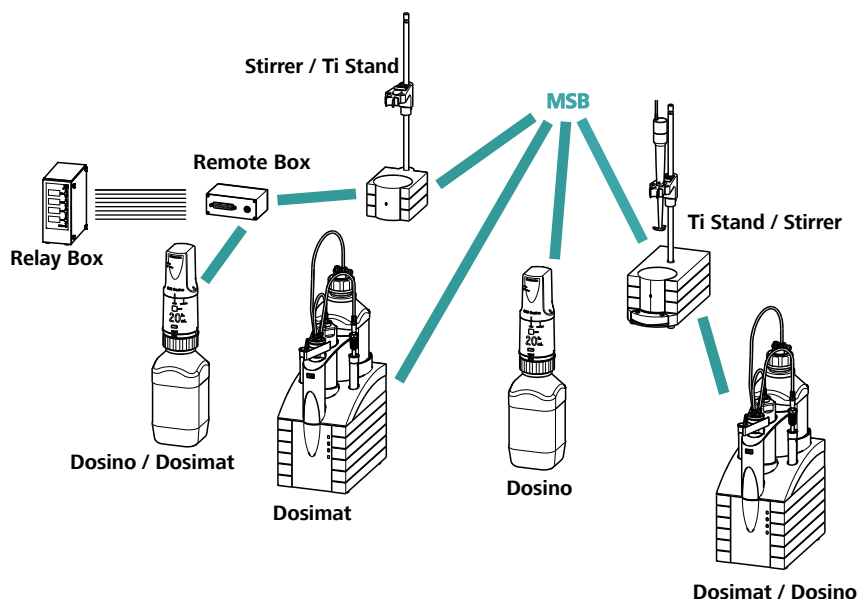
Figure 6   MSB connections

The control device 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.
> - Type 700 Dosino and 685 Dosimat dosing devices cannot be connected together with other MSB instruments on a shared connector. These dosing devices must be connected separately.

> **CAUTION**
>
> Exit the control software before you plug in MSB instruments. When it is switched on, the control device 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 connections 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

Proceed as follows:

1 Connecting a dosing device

- Exit the control software.
- Connect the connection cable of the dosing device to one of the sockets marked with **MSB** on the rear of the control device.
- Start the control software.
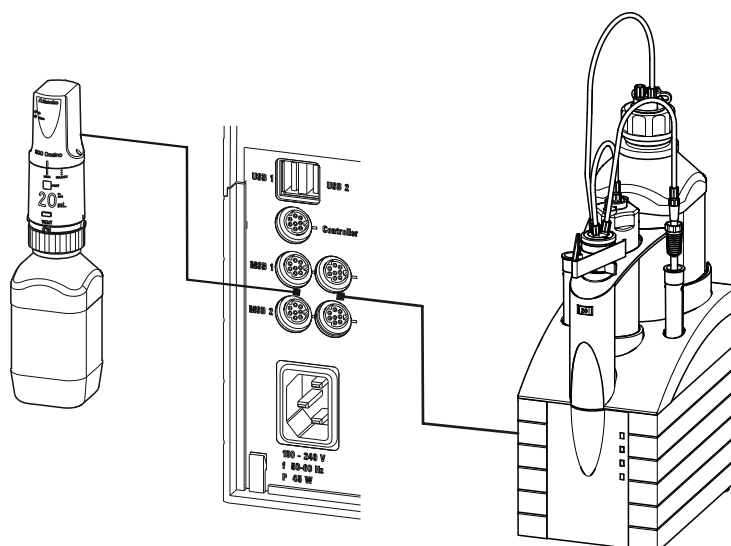
Figure 7   Connecting a dosing device

3.3.2   Connecting a stirrer or titration stand

You can use the following instruments:

- With built-in magnetic stirrer (stirring "from below"):
  - 801 Stirrer
  - 803 Ti Stand
- Without built-in magnetic stirrer (stirring "from above"):
  - 804 Ti Stand with propeller stirrer 802 Stirrer

Connect a stirrer or a titration stand as follows:

1   Connecting the stirrer or titration stand

- Exit the control software.
- Connect the connection cable of the magnetic stirrer or of the titration stand to one of the sockets marked with **MSB** on the rear of the control device.
- 804 Ti Stand only: Connect the propeller stirrer to the stirrer connector (socket with stirrer symbol) of the titration stand.
- Start the control software.
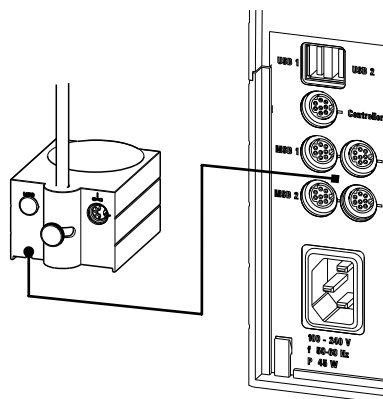
Figure 8   Connecting an MSB stirrer
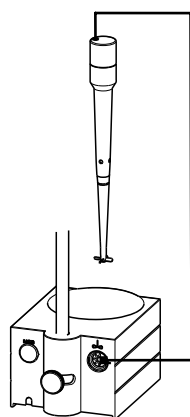
Figure 9   Connecting the propeller stirrer to the titration stand

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 generally have a signal level of 5 volts.

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. Sequences on a variety of instruments can thus be coordinated in a single complex automation system. No exchange of data is possible, however.

Proceed as follows:

1   Connecting the Remote Box
- Exit the control software.

- Connect the Remote Box connection cable to one of the sockets marked with **MSB** on the rear of the control device.
- Start the control software.
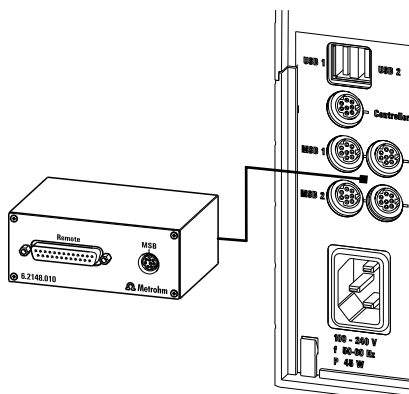
Figure 10   Connecting the Remote Box

You can, for example, connect an 849 Level Control (fill level monitoring in a canister) or a 731 Relay Box (switch box for 230/110 volt alternating current sockets and low-voltage direct current outlets). 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 precise information concerning the pin assignment of the interface on the Remote Box in the appendix.

3.4 **Connecting USB devices**

3.4.1 **General**

The 905 Titrando has two 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 two devices to the USB, you can also use an additional, commercially available USB hub.

> **CAUTION**
>
> If you operate the 905 Titrando with the aid of the Touch Control, take care to ensure that the Touch Control is switched off when you set up or disconnect connections between the various instruments. If you use a PC software to control the 905 Titrando, 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 two devices to the USB connector of the 905 Titrando, you can also use an additional commercially available USB hub (distributor). If you operate the 905 Titrando with the help of the Touch Control, then you should use a USB hub with its own power supply.

Connect the USB hub as follows:

1 Switch off the Touch Control and/or exit the PC software.

2 With the aid of the 6.2151.020 cable, connect the USB connector of the 905 Titrando (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 905 Titrando with Touch Control must meet the following requirements:

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

Connect the printer as follows:

1 Switch off the Touch Control.

2 With the aid of the 6.2151.020 cable, connect the USB connector of the 905 Titrando (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).
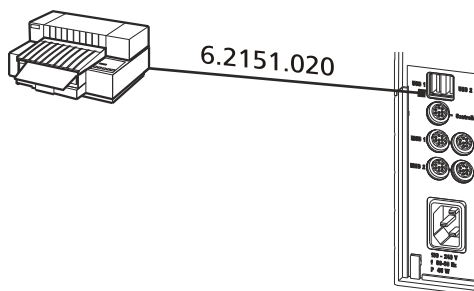
Figure 11   Connecting a printer

3.4.4   Connecting a balance

- Operation with a PC 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 905 Titrando and of which cable you will need for connection to the RS-232 interface:

Balance	Cable
AND ER, FR, FX with RS-232 inter-face (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	Cable
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

Connect the balance as follows:

1 Plug in the USB plug of the USB/RS-232 adapter at the USB connector of the 905 Titrando.

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 PC keyboard (only for operation with Touch Control)

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

Connect the PC keyboard as follows:

1 Insert the USB plug of the keyboard into one of the USB sockets of the 905 Titrando.

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

Connect the barcode reader as follows:

1 Insert the USB plug of the barcode reader into one of the USB sockets of the 905 Titrando.

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:

Program the barcode reader as follows (see also the manual for 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 Connecting sensors

The measuring interface contains the following measuring inputs:

- **Ind.** for a potentiometric electrode (pH, metal or ion-selective electrode)
- **Ref.** for a separate reference electrode
- **Temp.** for a temperature sensor (Pt1000 or NTC)
- **Pol.** for a polarizable electrode
- **iConnect** for an iConnect (measuring interface for electrodes with integrated data chip, so-called iTrodes)

3.5.1 Connecting a pH, metal or ion-selective electrode

Connect the pH, metal or ion-selective electrode as follows:

1 Plug the electrode plug into the **Ind.** socket of the 905 Titrando.

Figure 12   Connecting a pH, metal or ion-selective electrode

> **i** | **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 will first need to pull back the outer plug sleeve.

3.5.2 Connecting a reference electrode

Connect the reference electrode as follows:

1 Plug the electrode plug into the **Ref.** socket of the 905 Titrando.

Figure 13   Connecting a reference electrode

3.5.3 Connecting a polarizable electrode

Connect the polarizable electrode as follows:

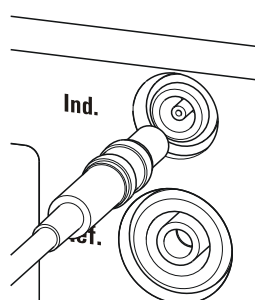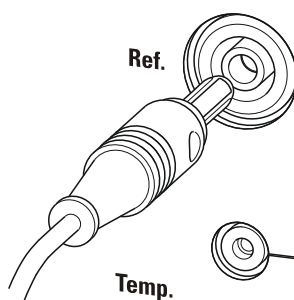**1** Plug the electrode plug into the **Pol.** socket of the 905 Titrando.
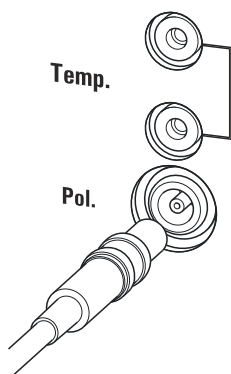
Figure 14   Connecting a polarizable electrode

> **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 will first need to pull back the outer plug sleeve.

3.5.4 Connecting a temperature sensor or an electrode with integrated temperature sensor

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

Connect the temperature sensor or the electrode with integrated temperature sensor as follows:

1 Insert the plugs of the temperature sensor into the **Temp.** sockets of the Titrando.
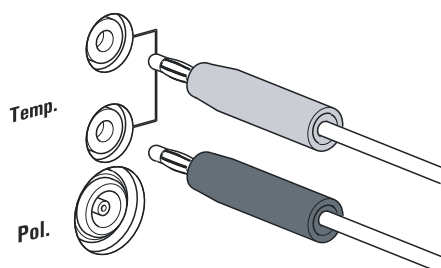
Figure 15   Connecting a temperature sensor or an electrode with integrated temperature sensor

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

3.5.5 Connecting an iConnect

An external 854 iConnect measuring interface can be connected to the 905 Titrando.

Connect the iConnect as follows:

1 Plug the iConnect plug into the **iConnect** socket of the 905 Titrando.

Take care to ensure that the marking on the plug matches the marking on the Titrando as shown in the figure.
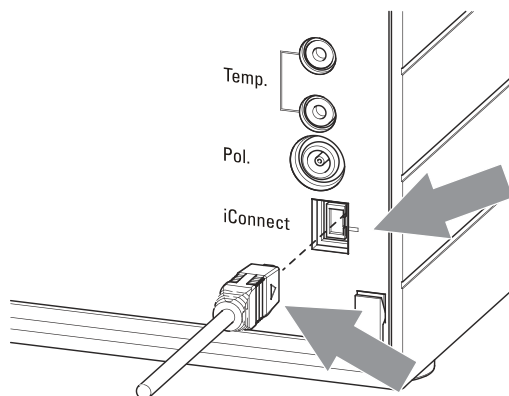
Figure 16   Connecting the iConnect

The iConnect is detected automatically and entered as measuring input into the device properties of the Titrando. If an electrode is connected to the iConnect that is not yet included in the list of sensors for the control software, then a corresponding message will be displayed.

The iConnect can be plugged in and unplugged while the Titrando is switched on.

An electrode with integrated data chip, referred to as iTrode, is connected to the iConnect.

Connect the electrode as follows:

1 Remove the protective caps on the iConnect and the electrode.

2 Plug in the electrode on the iConnect as illustrated below.
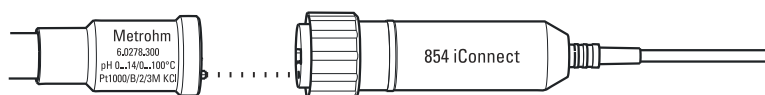
Figure 17   Connecting an electrode to the iConnect

The guide pin guarantees correct connection in such a way that the contact pins cannot be damaged.

3 Screw the iConnect tightly.

3.5.6 Differential potentiometry

Potentiometric measurements with high-ohm measuring chains can be disrupted by electrostatic and electromagnetic fields in media with low conductivity. Use our 6.0229.100 Solvotrode or other special electrodes for pH measurements in organic solvents. If no reliable measurements are possible with these, then a 6.5104.030 (230 V) or 6.5104.040 (115 V) differential amplifier can be used. The differential amplifier is connected to the high-ohm measuring input (**Ind.**).

4 Setting up the titration vessel

4.1 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 18   Schematic configuration of magnetic stirrer, electrode and buret tip during a titration. a) stirring direction clockwise, b) stirring direction counterclockwise.

1	Magnetic stirrer	2	Electrode
3	Buret tip		

5 Operation and maintenance

5.1 General notes

5.1.1 Care

The 905 Titrando requires appropriate care. Excess contamination of the instrument may result in functional disruptions and a reduction in the lifetime 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 905 Titrando is best carried out as part of an annual service, which is performed by specialist personnel of the Metrohm company. If working frequently with caustic and corrosive chemicals, a shorter maintenance interval could be necessary.

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

5.2 Quality Management and qualification with Metrohm

Quality management

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

Qualification

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

Maintenance

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

6 Troubleshooting

6.1 General

Problem	Cause	Remedy
The "On" LED is not illuminated, even though the instrument is connected to the power supply.	*The Touch Control or the computer has not been switched on yet or the plugs are not correctly plugged in.*	1. Check the plug connections. 2. Switch on the Touch Control or the computer.

6.2 SET titration

Problem	Cause	Remedy
The titration will not be finished.	*The minimum dosing rate is too low.*	Select the user-defined titration rate and increase the minimum rate (see manual/help of the software used).
	The stop criterion is unsuitable.	Adjust the control parameters (see manual/ help of the software used): ■ Increase the stop drift. ■ Select a short delay time.
The sample is over-titrated.	*The control parameters are unsuitable.*	Adjust the control parameters (see manual/ help of the software used): ■ Select Titration rate = **slow**. ■ Select the user-defined titration rate and increase the control range. ■ Select the user-defined titration rate and reduce the maximum rate. ■ Select the user-defined titration rate and reduce the minimum 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 manual/ help of the software used): ■ Select Titration rate = **optimal** or **fast**.

Problem	Cause	Remedy
		■ Select the user-defined titration rate and decrease the control range.
		■ Select the user-defined titration rate and increase the maximum rate.
		■ Select the user-defined titration rate and increase the minimum rate.
The results are spread widely.	*The minimum dosing rate is too high.*	Select user-defined titration rate and decrease the minimum rate (see manual/help of the software used).
	The electrode responds too slowly.	Replace the electrode.

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.
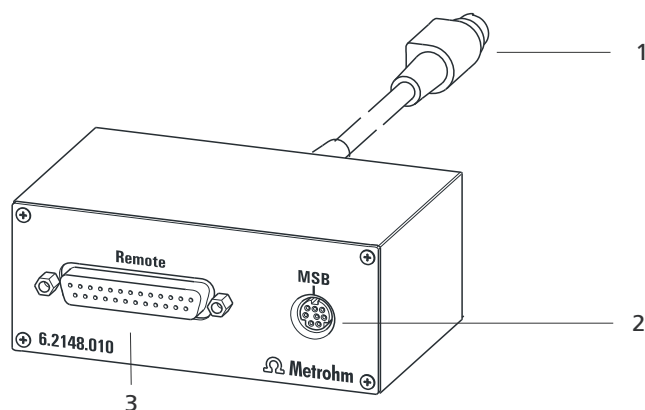

Figure 19   Connectors of the Remote Box

1	**Cable**	**2**	**MSB connector**
	For connecting to the Titrando.		Metrohm Serial Bus. For connecting external dosing devices or stirrers.

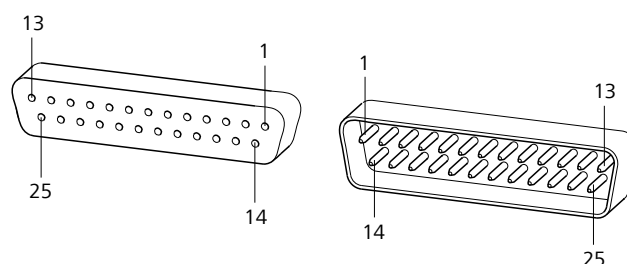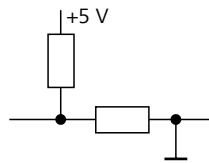| **3**	**Remote connector**
	For connecting instruments with a remote interface.

7.1.1 Pin assignment of the remote interface

Figure 20   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.
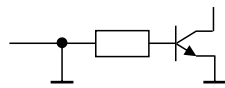
Inputs

+5 V

approx. 50 kΩ 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, $V_{CEO} = 40$ V

+5 V: maximum load = 20 mA

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

Table 1   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 2   Explanation of the individual functions

Function	Explanation
Start	The current method is started at the time of activation. $t_{pulse} > 100$ ms
Stop	The current method is canceled (Stop) at the time of activation. $t_{pulse} > 100$ ms
Quit	The current command in the determination run will be canceled at the time of activation. $t_{pulse} > 100$ 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	**E**nd **o**f **D**etermination. Pulse ($t_{pulse} = 200$ 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 Technical specifications

8.1 Measuring interface

Depending on the version, the 905 Titrando has one (version 2.905.0010) or two (version 2.905.0020) galvanically isolated measuring interface(s).

The measuring cycle is 100 ms for all measuring modes.

8.1.1 Potentiometry

One high-ohm measuring input (**Ind.**) for pH, metal or ion-selective electrodes and one measuring input (**Ref.**) for separate reference electrodes.

Input resistance	$> 1 \cdot 10^{12}\ \Omega$
Offset current	$< 1 \cdot 10^{-12}$ A (under reference conditions)
Measuring mode pH	
Measuring range	-13 - $+20$ pH
Resolution	0.001 pH
Measuring accuracy	± 0.003 pH (± 1 digit, without sensor error, under reference conditions)
Measuring mode U	
Measuring range	$-1{,}200$ - $+1{,}200$ mV
Resolution	0.1 mV
Measuring accuracy	± 0.2 mV (± 1 digit, without sensor error, under reference conditions)

8.1.2 Temperature

A measuring input (**Temp.**) for temperature sensors of the Pt1000 or NTC type with automatic temperature compensation.

R (25 °C) and B value can be configured for NTC sensors.

Measuring range	
Pt1000	-150 - $+250$ °C
NTC	-5 - $+250$ °C (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; ±1 digit; without sensor error, under reference conditions)
NTC	±0.6 °C
	(Applies for measuring range +10 - +40 °C; ±1 digit; without sensor error, under reference conditions)

8.1.3   Polarizer

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

Measuring mode Ipol	Determination with adjustable polarization current
Polarization current	−122.5 - +122.5 µA (increment: 0.5 µA)
	−125.0 - +125.0 µA: non-guaranteed values, dependent on reference voltage +2.5 V
Measuring range	−1,200 - +1,200 mV
Resolution	0.1 mV
Measuring accuracy	±0.2 mV
	(±1 digit, without sensor error, under reference conditions)
Measuring mode Upol	Determination with adjustable polarization voltage
Polarization voltage	−1,225 - +1,225 mV (increment: 25 mV)
	−1,250 - +1,250 mV: non-guaranteed values, dependent on reference voltage +2.5 V
Measuring range	−120 - +120 µA
Resolution	0.1 µA

8.2 Power connection

Supply voltage	100 - 240 V
Frequency	50 - 60 Hz
Power consump-tion	Maximum 45 W
Fuse	Electronic overload protection

8.3 Safety specifications

Design and testing	- EN/IEC 61010-1 - UL 61010-1 - CSA-C22.2 No. 61010-1 - Protection class I
Safety instructions	The documentation contains safety instructions which have to be followed by the user in order to ensure safe operation of the instrument.

8.4 Electromagnetic compatibility (EMC)

Emission	Standards fulfilled: - EN/IEC 61326-1 - EN/IEC 61000-6-3 - EN 55022 / CISPR 22
Immunity	Standards fulfilled: - EN/IEC 61326-1 - EN/IEC 61000-6-2 - EN/IEC 61000-4-2 - EN/IEC 61000-4-3 - EN/IEC 61000-4-4 - EN/IEC 61000-4-5 - EN/IEC 61000-4-6 - EN/IEC 61000-4-11 - EN/IEC 61000-4-14 - NAMUR

8.5 Ambient temperature

Nominal function range	+5 - +45 °C
Storage	−20 - +60 °C
Transport	−40 - +60 °C

8.6 Reference conditions

Ambient temperature	+25 °C (± 3 °C)
Relative humidity	≤ 60%
Instrument status	Instrument in operation at least 30 min
Adjusting interval	annual

8.7 Dimensions

Width	142 mm
Height	227 mm
Depth	231 mm
Weight	2,817 g
Material (housing)	Poly(butylene terephthalate) (PBT)

8.8 Interfaces

USB connectors

USB ports	2 USB downstream ports (type A sockets), 500 mA each, for connecting peripheral devices such as printers, keyboards, barcode readers or RS-232/USB boxes (Metrohm order no. 6.2148.020).

Connector "Controller"

Controller port	USB upstream port with auxiliary power supply (Mini DIN socket) for connecting Touch Control or computer for controlling the 905 Titrando.
Touch Control	With integrated Touch Control cable.
Computer	With 6.2151.000 cable.

MSB connectors (Metrohm Serial Bus)

Dosing device   Connection for a maximum of 4 external dosing devices, models Dosimat or Dosino (MSB 1 to MSB 4).

Stirrer   Connection for a maximum 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.

Remote Box   Connection for a maximum of four Remote Boxes. Remote Boxes can be used to actuate and monitor external devices.

9   Warranty (guarantee)

Metrohm guarantees that the deliveries and services it provides are free of defects in materials, design or manufacturing.

The general warranty period is 36 months (exclusions below) from the date of delivery or 18 months in the event of continuous operation. The warranty remains valid on the condition that the servicing is provided by a service organization authorized by Metrohm at defined intervals and with a defined scope.

The warranty period for anion suppressors of the type "MSM" is 120 months from the date of delivery or 60 months in the case of continuous operation.

The warranty period for IC separation columns is 90 days after start-up.

For third-party components that are recognizable as such, the manufacturer's warranty regulations apply.

Consumables and materials with limited storage life and glass breakage in the case of electrodes or other glass parts are excluded from the warranty.

Warranty claims cannot be asserted if the ordering party has failed to meet its payment obligations according to schedule.

During the warranty period, Metrohm undertakes either to replace free of charge or to credit the purchaser for any modules or components that can be shown to be faulty. Any transport or customs fees that may apply are the ordering party's responsibility.

The precondition for this is that the ordering party has to specify the article number, the article designation, an adequate error description, the delivery date and (if applicable) the serial number or chip data in the Support Tracker. Metrohm then decides whether a replacement or a credit note is to be issued or whether the faulty part has to be returned using the Return Material Authorization (RMA). If a replacement or credit note is issued, the ordering party undertakes to store the faulty part for at least 24 months in accordance with the current storage directives (in compliance with ESD guidelines) and to hold it in readiness for onsite inspection or for return shipment to Metrohm. Metrohm reserves the right to invoice the ordering party for these articles, including retroactively, in the event of noncompliance with these preconditions.

The same warranty periods that are specified for a corresponding new part apply to parts that are replaced or repaired within the above-mentioned warranty periods. However, replacement or repair of a part does not extend the warranty period of the entire system.

Deficiencies arising from circumstances that are not the responsibility of Metrohm, such as improper storage or improper use, etc., are expressly excluded from the warranty.

Metrohm also offers a 120 month spare parts availability guarantee and a 60 month PC software support warranty, calculated from the date on which the product is withdrawn from the market. The content of this warranty is the ability of the customer to obtain functioning spare parts or appropriate software support at market prices during the time of the warranty period.

If Metrohm AG is unable to meet this obligation due to circumstances beyond the control of Metrohm AG, then the ordering party shall be offered alternative solutions at preferential conditions.

10 Accessories

> **NOTE**
>
> Subject to change without notice.

10.1 Scope of delivery

10.1.1 2.905.0010

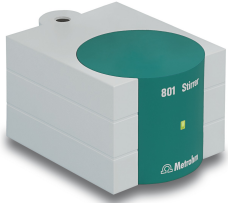| Qty.	Order no.	Description
1	1.905.0010	**Titrando**
		High-end titrator for use of intelligent electrodes "iTrodes". Up to four 800 Dosino dosing systems. Dynamic (DET), monotonic (MET) and endpoint titration (SET). Measurements with ion-sensitive electrodes (MEAS CONC). Dosing functions (DOS), Liquid Handling. Four MSB connections. One galvanically separated measuring interface. USB connection.
2	6.2043.005	**Holding clip for bottles**
		Holding spring for reagent bottles in exchange units.
1	6.2103.130	**Adapter red 2 mm plug / 4 mm socket**
		For connecting plug B (4 mm) to 2 mm socket.

Qty.	Order no.	Description
1	6.2103.140	**Adapter black 2 mm plug / B socket 4 mm**

For connecting plug B (4 mm) to 2 mm socket.

Qty.	Order no.	Description
1	6.2122.0x0	**Power supply cable with IEC 60320 line socket, type C13**

Cable plug according to customer requirements.

Switzerland:	SEV 1011, Type 12
	6.2122.020
Germany, …:	CEE 7, Type VII
	6.2122.040
USA, …:	NEMA 5-15, Type 498
	6.2122.070
Length:	1.5 m

Qty.	Order no.	Description
1	8.905.8003EN	**905 Titrando Manual**

10.1.2   2.905.0020

Qty.	Order no.	Description
1	1.905.0020	**Titrando**

High-end titrator for use of intelligent electrodes "iTrodes". Up to four 800 Dosino dosing systems. Dynamic (DET), monotonic (MET) and endpoint titration (SET). Measurements with ion-sensitive electrodes (MEAS CONC). Dosing functions (DOS), Liquid Handling. Four MSB connections. Two galvanically separated measuring interfaces. USB connection.

Qty.	Order no.	Description
2	6.2043.005	**Holding clip for bottles**

Holding spring for reagent bottles in exchange units.

| 2 | 6.2103.130 | **Adapter red 2 mm plug / 4 mm socket** |

For connecting plug B (4 mm) to 2 mm socket.

| 2 | 6.2103.140 | **Adapter black 2 mm plug / B socket 4 mm** |

For connecting plug B (4 mm) to 2 mm socket.

| 1 | 6.2122.0x0 | **Power supply cable with IEC 60320 line socket, type C13** |

Cable plug according to customer requirements.

Switzerland:	SEV 1011, Type 12
	6.2122.020
Germany, …:	CEE 7, Type VII
	6.2122.040
USA, …:	NEMA 5-15, Type 498
	6.2122.070
Length:	1.5 m

| 1 | 8.905.8003EN | **905 Titrando Manual** |

10.2 Optional accessories

10.2.1 2.905.0010 and 2.905.0020

Order no.	Description

2.800.0010   800 Dosino

Drive with write/read hardware for intelligent Dosing Units. With fixed cable (length 150 cm).

2.801.0040   801 Stirrer with stand

Magnetic stirrer including base plate, support rod and electrode holder for supplementing the Titrino plus, Dosimat plus, Titrandos, Sample Processors, 805 Dosimat and 780/781 pH meters as well as the 856 and 867 measuring modules. With permanently attached cable for MSB (Metrohm Serial Bus).

2.802.0040   802 Stirrer (propeller stirrer) for 804 Ti Stand

Rod stirrer with 6.1909.010 Propeller stirrer.

Order no.	Description

2.804.0040   804 Ti Stand with stand

Titration stand and controller for 802 Rod Stirrer. The 804 Ti Stand together with the optional 802 Rod Stirrer provides an alternative to the magnetic stirrer. Ti Stand with base plate, support rod and electrode holder.

2.805.0010   805 Dosimat

Dosing device for the Titrando and Sample Processors with read/write hardware for intelligent Exchange Units. With permanently attached cable. Without Exchange Unit.

Order no.	Description

2.846.0010   **846 Dosing Interface**

USB controller for up to four 700/800 Dosino dosing systems or 685/805 Dosi-mats for dosing or liquid handling tasks. A Touch Control control unit or the connection to a PC with tiamo™, MagIC Net™ or 797 VA Computrace is required.

6.2104.020   **Electrode cable / 1 m / F**

For connecting electrodes with Metrohm plug-in head G to Metrohm instruments (socket F).

Length (m):   1

6.2104.600   **Electrode cable for plug in head U/plug F, 2x2 mm B, 1m**

For connecting electrodes with Metrohm plug-in head U to Metrohm instruments (socket F).
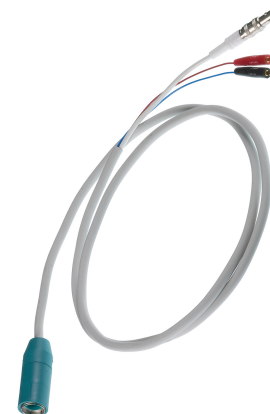
Order no.	Description

6.2148.010   **Remote Box MSB**

Additional remote interface for the connection of devices that can be controlled via remote lines. With permanently attached cable.

6.2148.020   **RS-232/USB box**

Extends the Titrando, USB Sample Processors, Dosing Interface, Titrosampler by two RS-232 interfaces for connecting e.g. balances, PC, LIMS. Requires 6.2151.030 cable.

6.3026.110   **Exchange Unit 1 mL**

Exchange Unit with integrated data chip with 1 mL glass cylinder and light protection. PCTFE/PTFE flat stopcock, FEP tubing connection, antidiffusion buret tip and standard amber glass reagent bottle.

    Volume (mL):   1

6.3026.150   **Exchange Unit 5 mL**

Exchange Unit with integrated data chip with 5 mL glass cylinder and light protection. PCTFE/PTFE flat stopcock, FEP tubing connection, anti-diffusion buret tip and standard amber glass reagent bottle.

    Volume (mL):   5

Order no.	Description

6.3026.210   Exchange Unit 10 mL

Exchange unit with integrated data chip with 10 mL glass cylinder and light protection. PCTFE/PTFE flat stopcock, FEP tubing connection, anti-diffusion buret tip and standard amber glass reagent bottle.

    Volume (mL):   10

6.3026.220   Exchange Unit 20 mL

Exchange unit with integrated data chip with 20 mL glass cylinder and light protection. PCTFE/PTFE flat stopcock, FEP tubing connection, anti-diffusion buret tip and standard amber glass reagent bottle.
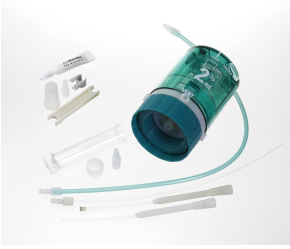
    Volume (mL):   20

6.3026.250   Exchange Unit 50 mL

Exchange unit with integrated data chip with 50 mL glass cylinder and light protection. PCTFE/PTFE flat stopcock, FEP tubing connection, anti-diffusion buret tip and standard amber glass reagent bottle.

    Volume (mL):   50

Order no.	Description

6.3032.120   **Dosing Unit 2 mL**

Dosing unit with integrated data chip with 2 mL glass cylinder and light protection, mountable on reagent bottle with ISO/DIN GL45 glass thread. FEP tubing connection, anti-diffusion buret tip.

   Volume (mL):   2

6.3032.150   **Dosing Unit 5 mL**

Dosing unit with integrated data chip with 5 mL glass cylinder and light protection, mountable on reagent bottle with ISO/DIN GL45 thread. FEP tubing connection, anti-diffusion buret tip.

   Volume (mL):   5

6.3032.210   **Dosing Unit 10 mL**

Dosing unit with integrated data chip with 10 mL glass cylinder and light protection, mountable on reagent bottle with ISO/DIN GL45 thread. FEP tubing connection, anti-diffusion buret tip.

   Volume (mL):   10

6.3032.220   **Dosing Unit 20 mL**

Dosing unit with integrated data chip with 20 mL glass cylinder and light protection, mountable on reagent bottle with ISO/DIN GL45 thread. FEP tubing connection, anti-diffusion buret tip.

   Volume (mL):   20

6.3032.250   **Dosing Unit 50 mL**

Dosing unit with integrated data chip with 50 mL glass cylinder and light protection, mountable on reagent bottle with ISO/DIN GL45 thread. FEP tubing connection, anti-diffusion buret tip.

   Volume (mL):   50

Order no.	Description

2.900.0010   900 Touch Control

Operating unit for the Titrandos, USB Sample Processors, 856 Conductivity Module, 867 pH Module and 846 Dosing Interface. Touch-sensitive, high-resolution color display, simple and intuitive operation, thanks to favorites for direct method access. With integrated Ethernet interface for direct connection to the Internet and USB interface for connecting USB printers or a USB memory stick.
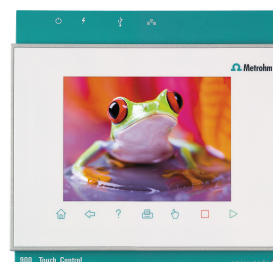
2.854.0010   854 iConnect

854 iConnect - electrode cable and measuring amplifier for intelligent electrodes "iTrodes".

6.6056.231   tiamo ™ 2.3 Light CD: 1 license

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Index