Mira M-3

Product Manual

8.924.8010EN / 2019-04-18

Metrohm

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

Table of contents

1 Overview

1.1 Instrument description

Metrohm Instant Raman Analyzers (Mira) are handheld, high-power Raman spectrometers designed for the rapid, nondestructive identification and verification of chemical and pharmaceutical samples, both liquid and solid. Barely larger than a smartphone, the Mira spectrometers are the only handheld Raman spectrometers currently on the market with Orbital Raster Scan (ORS) technology.

1.2 Model versions

Mira M-3 instruments are available in the following versions:

Table 1 Model versions

2.924.0010	Mira M-3 Basic (1.924.0010) ▪ With vial holder and tablet holder	Laser class 1
2.924.0020	Mira M-3 Advanced (1.924.0020) ▪ With vial holder and tablet holder ▪ With SWD attachment lens and LWD attachment lens	Laser class 3B

NOTICE

You can find the accessories for your product version on the Internet at *http://partslists.metrohm.com*. There you can download the list of accessories as a PDF file.

1.3 Mira Cal Software

In order to configure a **Mira M-3** instrument, the following software is needed:

Table 2 Model versions

606071010	Mira Cal P

1.4 About the documentation

NOTICE

Please read through this documentation carefully before putting the product into operation.

The document contains important safety information and warnings which you must follow in order to ensure safe operation of the instrument. Metrohm is not responsible for damages and safety hazards that occur from using the instrument in a manner that is not specified in the user manual.

Symbols and conventions

The following icons 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 product part in the figure.
1	**Instruction step** Carry out these steps in the sequence shown.
Method	Designations for names of parameters, menu items, tabs and dialog windows in the software.
File ▶ New	Menu or menu item
Work area / Properties	Menu paths in order to arrive at a particular position in the software.
[Next]	**Button** or **key**

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use of or inability to use such product, even if Metrohm Raman, Inc. or its affiliates have been notified of the possibility of such damages.

1.5 Additional information - Software tutorials

Refer to following software tutorials for more information:

- Mira Cal P tutorial: 8.0105.8004EN

1.5.1 Accessories

Up-to-date information on the scope of delivery and optional accessories for your product can be found on the Internet. You can download this information using the article number as follows:

Downloading the accessories list

1 Enter *https://www.metrohm.com/* into your Internet browser.

2 Enter the article number of the product (e.g. **2.1001.0010**) into the search field.

The search result is displayed.

3 Click on the product.

Detailed information regarding the product is shown on various tabs.

4 On the **Included parts** tab, click **Download the PDF**.

The PDF file with the accessories data is created.

NOTICE

When you receive your new product, we recommend downloading the accessories list from the Internet, printing it out and keeping it for reference purposes.

2 Safety

2.1 Product safety

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

2.2 Hazard levels

The following warning messages indicate the severity of the danger and its possible effects.

DANGER

Immediate danger of life

Irreversible injuries that will result in death.

Warns of dangerous situations or unsafe actions that will most certainly cause severe injuries or death.

Lists measures to avoid hazard.

WARNING

Severe health hazards

Serious injuries that could result in death.

Warns of dangerous situations or unsafe actions that could result in serious injuries or death.

Lists measures to avoid hazard.

CAUTION

Health hazards or severe property damage

Warns of dangerous situations or unsafe actions that could result in moderate injuries or considerable property damage.

Lists measures to avoid hazard.

2.3 Intended use

Metrohm products are used for the analysis and handling of chemicals and other materials.

Usage therefore requires the user to have basic knowledge and experience in handling chemicals. Knowledge with respect to the application of the fire prevention measures prescribed for laboratories is also mandatory. Be sure to take proper safety precautions when working with chemicals

Adherence to this technical documentation and compliance with the maintenance specifications make up an important part of intended use.

Any utilization in excess of or deviating from the intended use is regarded as misuse.

Specifications regarding the operating values and limit values of individual products are contained in the "Technical specifications" section, if relevant.

Exceeding and/or not observing the mentioned limit values puts people and components at risk. The manufacturer assumes no liability for damage due to non-observance of these limit values.

The EU declaration of conformity loses its validity if modifications are carried out on the instruments and/or the components.

2.4 Residual risks

2.4.1 General dangers at the workplace

Generally, the regulations and provisions of the regulatory institutions and authorities in the field of work apply.

The instructions regarding the following areas have to be followed when using the products:

- Work safety
- Handling mechanical installations
- Handling electricity
- Handling hazardous and environmentally damaging substances
- Handling hazardous and environmentally damaging liquids
- Disposing hazardous and environmentally damaging substances

If they are not followed, this may result in:

- Disturbing, injuring and/or killing of people
- Malfunction and/or damage to instruments and infrastructure
- Damage and/or contamination of the environment

WARNING

General dangers at workplace

If the safety measures are not followed, working in a laboratory bears a high risk of injury, which can endanger your life and health.

- Only professionally trained and qualified specialist personnel may operate the products.
- Follow the applicable provisions concerning work safety and all regulations on wearing protective clothing.
- Use suitable tools to perform your work.
- Check the fill level of waste bottles or waste canisters and analysis vessels, and make sure they do not overflow.
- Use protective grounding when working with highly flammable substances and gases.

2.4.2 Danger from electrical potential

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.
- Protect live parts (e.g. power supply unit, power cord, connection sockets) against moisture.
- If you suspect that moisture has gotten into the instrument, disconnect the instrument from the energy supply. Then notify Metrohm Service.
- Only personnel who have been issued Metrohm qualification may perform service and repair work on electrical and electronic components.

2.4.3 Laser safety

NOTICE

NOHD

The information below refers to NOHD for Mira M-3 instruments in accordance with the international standard IEC 60825-1, "Safety of laser products".

The nominal ocular hazard distance (NOHD) is listed in technical specifications *Operating specifications (see chapter 10.5, page 37)*.

WARNING

Risk of injury by laser radiation

Serious eye injuries by laser radiation.

- Follow the safety measures and instructions.
- Instruments must be used by trained personnel only.
- Instruments of the laser class 3B must be used in protected and labeled rooms only.
- The protective glasses provided must be used when working with open laser beams (e.g. attachment lens).
- Observe the nominal ocular hazard distance (NOHD).
- Follow the provisions of the IEC 60825-1 standard "Safety of laser products" and the regulations for the use of laser systems in your country.

Laser Classification depending on Smart Tips

Attached Smart Tip	Laser Class 1	Laser Class 3B
Long distance attachment lens (LWD)		**X**
Short distance attachment lens (SWD)		**X**
Vial holder	**X**	
Tablet holder	**X**	
Calibration standard	**X**	

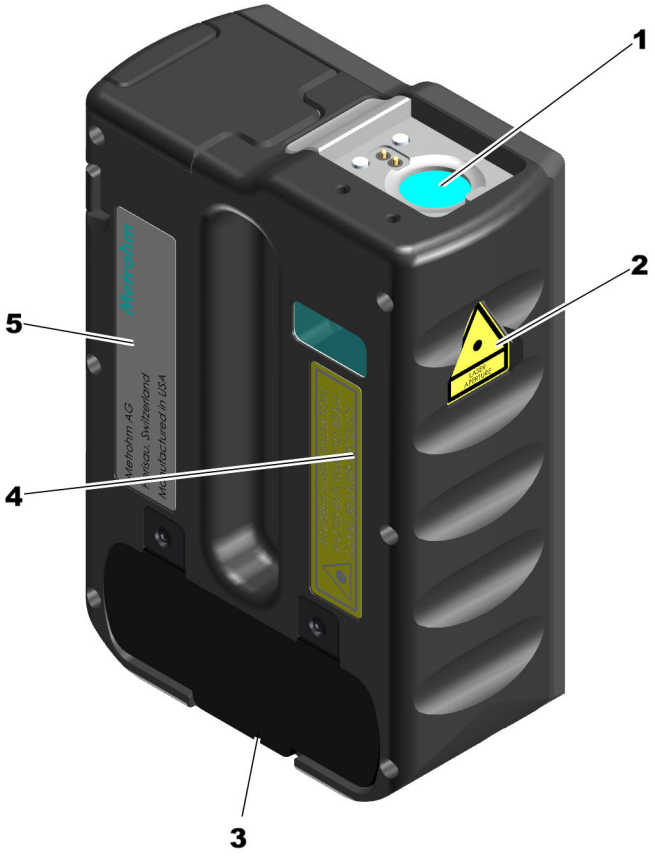
Vial holder, tablet holder and calibration standard have an interlock mechanism for measurement. This mechanism prevents laser radiation from emerging.

Laser stops immediately if:

- Lid of the smart tip is opened.
- Attached smart tip is disconnected from the instrument.

2.4.4 Warning stickers on the instrument

The instrument is equipped with stickers that warn of potential hazards. These warning stickers are listed and explained below.



1	**Laser aperture**	**2**	**Laser aperture sticker**
3	**Laser specification / serial number (bottom of instrument)**	**4**	**Laser class**
5	**Type plate**		

Laser aperture

Figure 1 Sticker - Emergence of laser

Laser specification / serial number

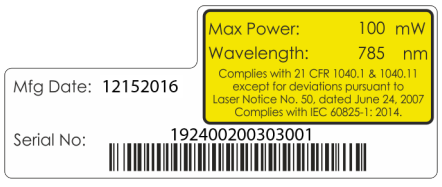


Figure 2 Sticker - laser data / serial number / standards

Laser class

The two stickers specify the laser class for the respective model version.

Figure 3 Sticker - Basic model version with vial holder/tablet holder

Figure 4 Sticker - Advanced model version with attachment lenses

2.5 Responsibility of the operator

- Eliminate defects or damage which impair operating safety without delay.
- Eliminate malfunctions which could impair safety without delay.
- The rules, regulations and instructions listed in the present document are not the only valid ones. Comply with the applicable statutory rules, government agency directives and regulations.
- Unauthorized modification of the products excludes any and all liability on the part of the manufacturer for any damage resulting from this as well as for any consequential damage. No modifications, attachments or conversions which could impair safety may be carried out on the products without the approval of the manufacturer.
- Spare parts must meet the technical requirements established by the manufacturer. Original spare parts always meet these requirements.
- Personnel must be familiar with this safety-relevant information and it must be available for consultation at all times.

2.6 Personnel requirement

Only qualified personnel may operate the present product.

Qualified personnel are people authorized by the safety responsible to carry out the necessary operations. They are capable of recognizing and avoiding possible dangers. These people are qualified due to their professional training, experience and/or instruction. They know the relevant standards, laws, provisions, accident prevention regulations and the company conditions.

3 Overview of the instrument

Front

Figure 5 Mira M-3 - front

1	**Magnetic smart tip fixture/ laser aperture**	**2**	**Touch screen**
3	**Battery compartment**	**4**	**Type B mini USB connector**
5	**On/off switch**		

Rear

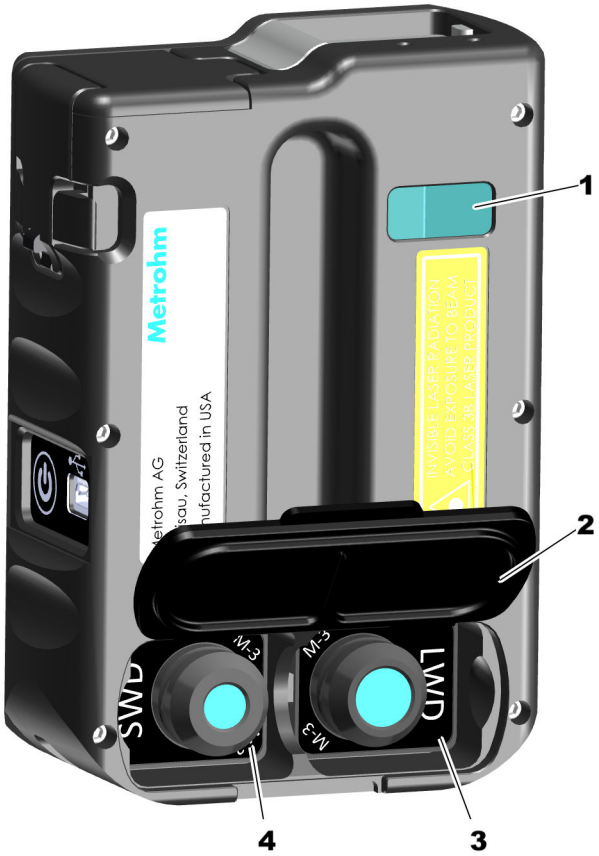


Figure 6 Mira M-3 - rear

1	**Barcode reader**	**2**	**Accessories covering**
3	**Long distance attachment lens (LWD)**	**4**	**Short distance attachment lens (SWD)**

4 Transport and storage

4.1 Checking the delivery

Immediately upon arrival of the merchandise, check the shipment against the delivery note to ensure completeness and absence of damage.

4.2 Storing the packaging

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

4.3 Storage

NOTICE

Always remove batteries if the instrument is not in use.

5 Installation

5.1 Safe shutdown

NOTICE

To prevent unexpected behavior in the instrument, always perform a safe shutdown.

A **safe shutdown** is performed in the following cases:

- The on/off switch is pressed.
- The battery is low.
- A battery-powered instrument is not in use for the duration specified in the shutdown delay.

An **unsafe shutdown** is performed in the following cases:

- The on/off switch is pressed and held for 3 seconds or longer.
- The battery door is opened while running on batteries only.
- The USB is unplugged while running on USB only.

5.2 Power supply with batteries

NOTICE

Always remove batteries if the instrument is not in use.

Changing batteries

The instrument uses exchangeable or rechargeable batteries of type AA 1.5Vdc x 2.

NOTICE

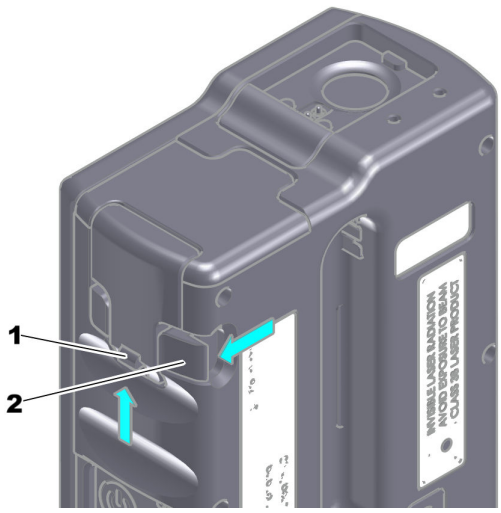
Battery type

We recommend to use AA Energizer® Ultimate Lithium™ batteries. We also support rechargeable NiMH Panasonic eneloop pro™ batteries.

NOTICE

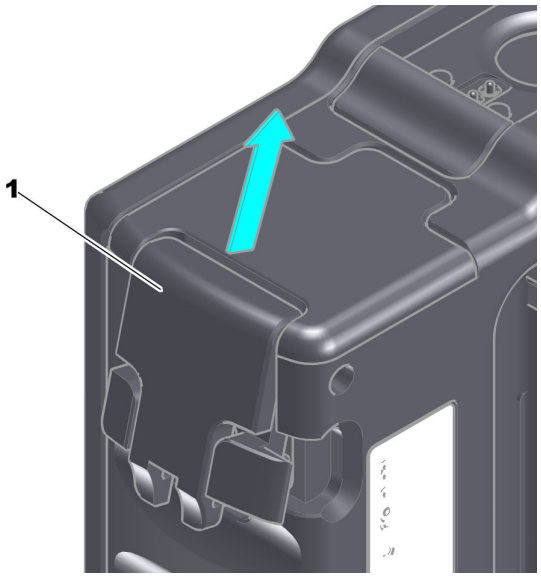
Power save mode

If used with batteries, a power save mode can be configured. *Configuration (see chapter 7.5, page 29)*.

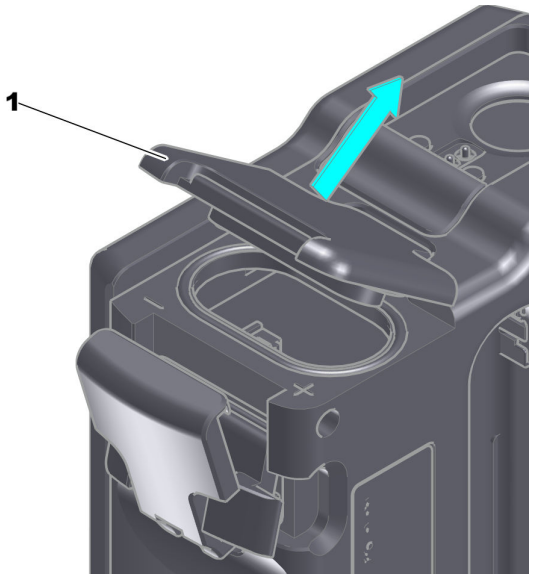


Press and hold lever **[1]**.

Push lever **[2]**.



Push part **[1]** upwards.



Rotate cover **[1]**.

Battery compartment is now opened.

5.3 USB connection

NOTICE

We do not recommend to use third party USB cables, only use the provided Metrohm USB Mini-B cable (order number 6.215.1110).

Power supply

For stationary use in the laboratory, you can operate the instrument with the USB interface which is connected to a powered USB hub. The USB hub also allows data transfer.

Use only certified power supply according to IEC/EN 60950-1, providing USB output of 5Vdc/1.5A and evaluated to the same environmental operating condition of MIRA-3 unit.

NOTICE

Battery charging function

The instrument has no charging function for rechargeable batteries.

You must replace drained batteries.

Synchronization

Connect the instrument to the computer that uses the USB Mini-B cable.

If the instrument is off, connecting the USB cable to a computer initiates an instrument start-up.

Refer to the Mira Cal Software Tutorial for further steps *Additional information - Software tutorials (see chapter 1.5, page 4)*.

6 Initial configuration

NOTICE

Configuration

Use **Mira Cal** software to change instrument settings or to install spectral libraries.

Refer to **Mira Cal** software tutorial for detailed information *Additional information - Software tutorials (see chapter 1.5, page 4)*.

7 Operation and control

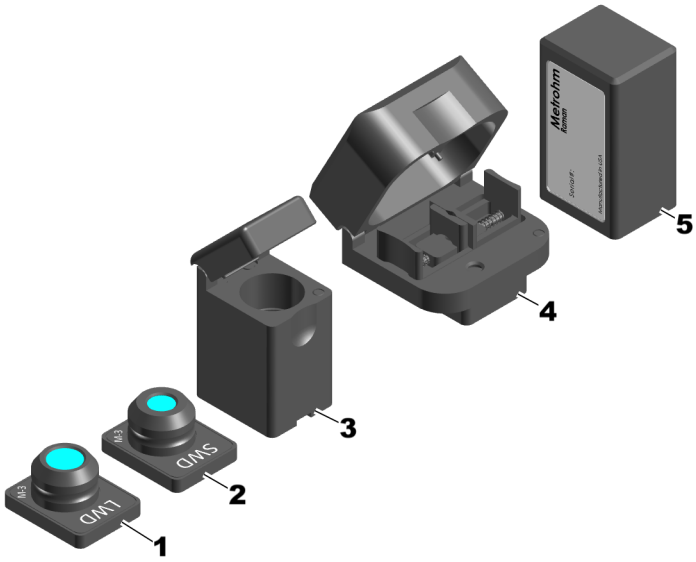
7.1 Smart tips for Mira instruments

The following smart tips are available.

Smart tips are attached to the instrument with magnetic connectors. The smart tips contain a memory chip so that they can be identified by the instrument. Due to its design, smart tips cannot be attached in a wrong position.

Laser Classification of smart tips is described here *Laser safety (see chapter 2.4.3, page 8)*.

The scope of delivery depends on your instrument version *Model versions (see chapter 1.2, page 1)*.



1 Long distance attachment lens (LWD)
A long distance lens for point and shoot measurement with laser class 3.

The focal point is approximately **8 mm** from the top of the lens.

The LWD lens is used for samples in thick-walled bottles.

2 Short distance attachment lens (SWD)
A short distance lens for point and shoot measurement with laser class 3.

The focal point is approximately **0.85 mm** from the top of the lens.

The SWD lens is used for samples with direct contact or in thin plastic bags.

3 **Vial holder**
The Vial holder is used for samples in glass vials.

Safety switch mechanism allows measurement with laser class 1. Laser stops if housing is opened.

4 **Tablet holder**
A spring-loaded holder helps to mount and position the sample. The tablet holder is designed such that different tablet or capsule shapes can be used.

Safety switch mechanism allows measurement with laser class 1. Laser stops if housing is opened.

5 **Calibration standard**
The calibration standard contains an ASTM 1840 reference sample and is needed for the calibration of the instrument.

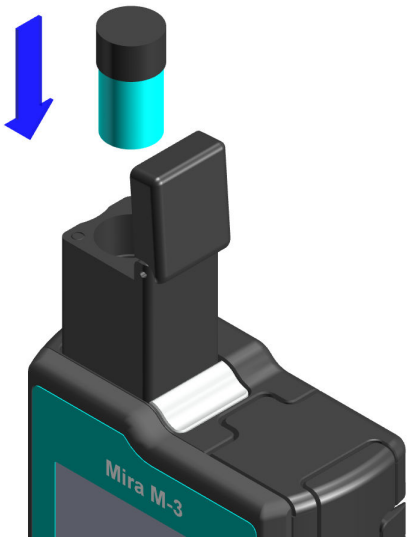
7.2 Attaching smart tips

Using vial holder

Closing the lid prevents laser radiation from emerging.

The lid contains a safety feature which cancels the measurement and stops the laser if the lid is opened.

Attach the smart tip as pictured.

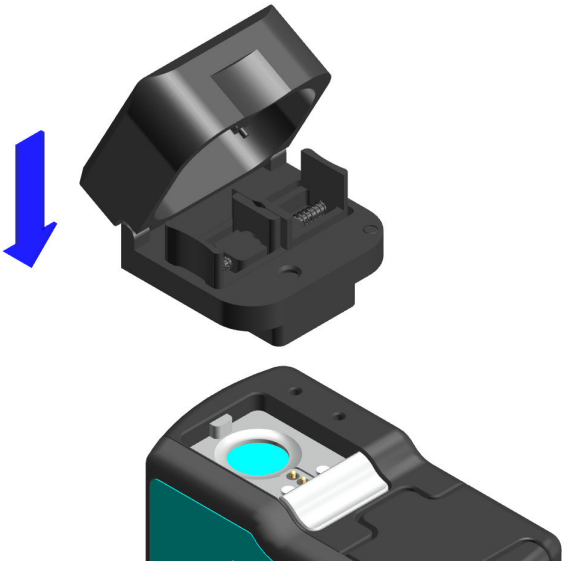


Open the vial holder and insert a vial to measure.

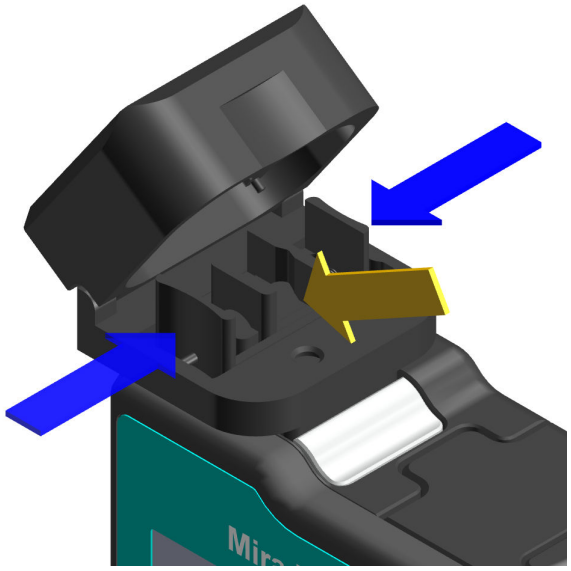
Using tablet holder

Closing the lid prevents laser radiation from emerging.

The lid contains a safety feature which cancels the measurement and stops the laser if the lid is opened.



Attach the smart tip.



Push the two levers and position the sample in the middle.

Release the levers, the sample is now fixed.

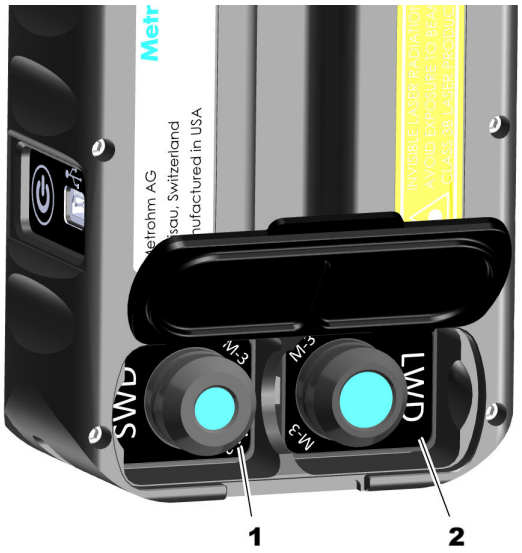
Using attachment lenses

WARNING

Risk of injury by laser radiation

Serious eye injuries by laser radiation.

- Follow the safety measures and instructions.
- Instruments must be used by trained personnel only.
- Instruments of the laser class 3B must be used in protected and labeled rooms only.
- The protective glasses provided must be used when working with open laser beams (e.g. attachment lens).
- Observe the nominal ocular hazard distance (NOHD).
- Follow the provisions of the IEC 60825-1 standard "Safety of laser products" and the regulations for the use of laser systems in your country.



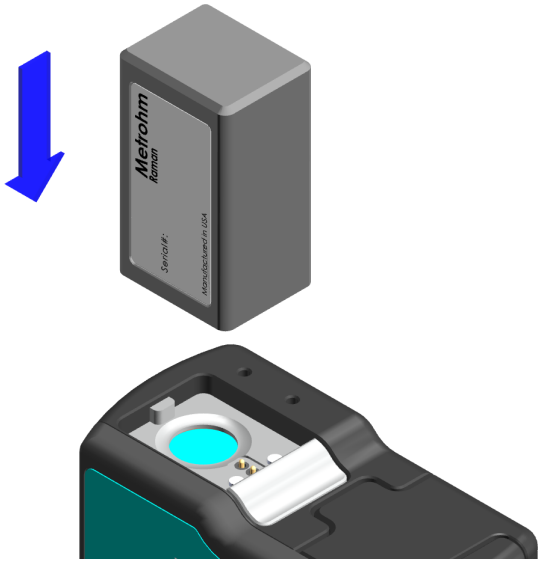
Select the correct attachment lens for your task:

- The **SWD** attachment lens is used for samples with direct contact or in thin plastic bags.
  The focal point is approximately **0.85 mm** from the end of the adapter.
- The **LWD** attachment lens is used for samples in thick-walled bottles.
  The bottles can be clear or amber. The focal point is approximately **8 mm** from the top of the attachment lens.

Attach the smart tip.

Using calibration standard

Attach the smart tip.



7.3 Data acquisition

The following steps show how samples can be acquired with the instrument.

NOTICE

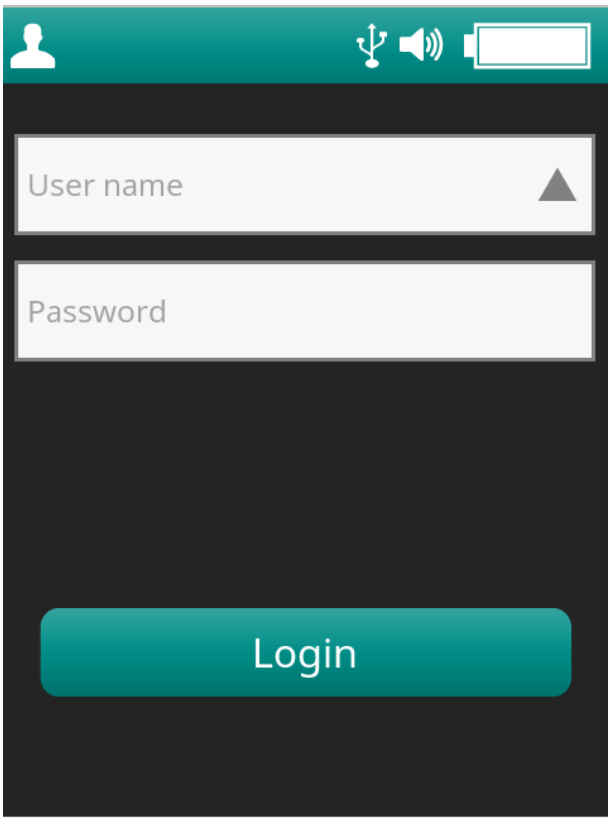
Operating procedures and users have to be defined and synchronized beforehand in Mira Cal software. Refer to Mira Cal software tutorial for more information *Additional information - Software tutorials (see chapter 1.5, page 4)*.

Make sure the instrument is connected to the power supply or has battery power.

1 Switching on the instrument

Switch on the instrument using the on/off switch.

2 Login



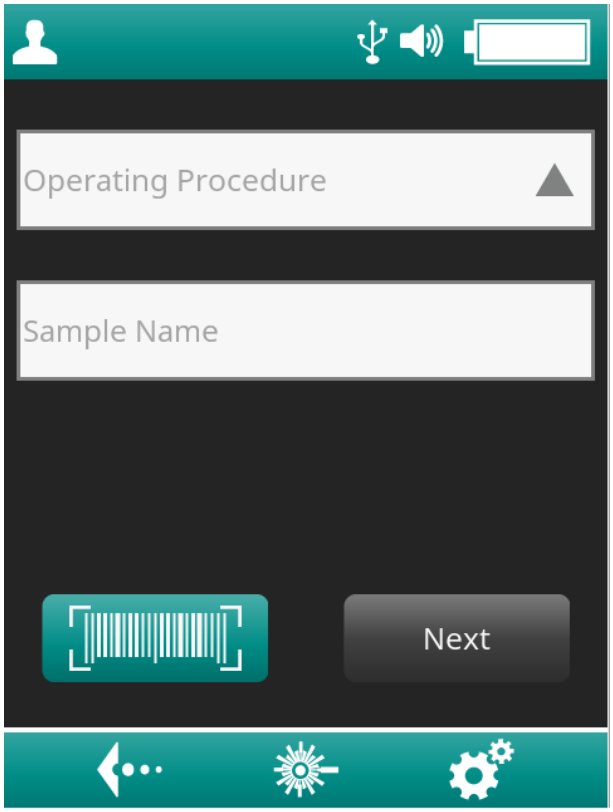
Select your user name from the dropdown list, enter your password and click on **[Login]**.

3 Attach smart tip

If not already done, attach the correct smart tip to the instrument *Attaching smart tips (see chapter 7.2, page 21)*.

Within an operating procedure a certain smart tip type may be required. A data acquisition will only be possible when the instrument recognizes the correct smart tip.

4 Selecting an operating procedure



Select an operating procedure from the dropdown list.

5 Read a barcode

Click on  to use the barcode reader instead of typing in by hand.

Barcode functionality and behavior is defined in the Operating Procedure.

6 **Use touch keyboard**

Use touch keyboard to enter or edit additional sample information fields.

Both fields are optional.

NOTICE

Entries may also be generated due to presets in the operating procedure.

7 **Arm laser**

Click on **[Arm laser]**.

Laser armed display is displayed.

8 **Measuring the sample**

- Click on **[Acquire]** to start the measurement.

When the measurement is finished, a spectrum is displayed with information according to definitions within the operating procedure.

9 **Measuring the next sample**

Click on **[Next]** to start the next measurement.

7.4 Calibrate an instrument

Calibration

1 Attach the Calibration Standard.

2 Click on button "Instrument settings"  .

3 Click on "Calibrate Instrument".

4 Click on "Calibrate".

NOTICE

Instrument Calibration can also be done in Mira Cal software with a connected instrument.

System Suitability Test (SST)

1. Attach the Calibration Standard.
2. Click on button "Instrument settings"  .
3. Click on "System Suitability Test".
4. Click on "Run SST".

7.5 Configuration

Open Settings

1. Go to settings section. Click on  .

Speaker

Enable or disable the internal speaker. This will activate an acoustic signal when the barcode reader is used.

Shutdown Delay

NOTICE

The shutdown delay will only affect battery-powered instruments.

For an instrument connected with a power supply or to a PC, the shutdown delay is disabled.

By default, no shutdown delay is configured.

Define a shutdown time to conserve battery charge.

For example if you enter value "3": A battery-powered instrument will automatically shutdown after 3 minutes not in use.

Battery Chemistry

There are many different types of AA batteries. For an accurate battery life indicator, it is important to choose the battery chemistry that is being used in the device. The two chemistries that are supported are Li and NiMH.

Set the battery chemistry:

1. In the Settings section, click on **[Battery Chemistry]**.
2. Select the battery type:
   - Lithium
   - NiMH

   The change will be reflected by the text in the battery indicator. This setting is persistent.

NOTICE

We recommend to change the batteries when the battery indicator changes color from white to yellow, orange or red.

8 Maintenance

8.1 Maintenance agreement

Maintenance of the product is best carried out as part of an annual service performed by specialist personnel from Metrohm. Shorter maintenance intervals may be necessary if you frequently work with caustic and corrosive chemicals. Metrohm Service personnel are properly trained in procedures for safely repairing the instrument.

Routine cleaning of the instrument can be done using non-corrosive cleansers such as water, ethanol, or acetone.

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

8.2 Checking and replacing product parts

To guarantee the flawless functioning and operation of the products as well as of their functional units, all parts must be regularly checked and replaced if needed.

NOTICE

The following points must always be observed:

- The product is switched off.
- The product is disconnected from the power grid.

In the following paragraphs you will find an explanation of how the product parts can be checked individually and what has to be taken into account. The procedure for replacing the parts is then described step-by-step where necessary.

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 product.
- Protect live parts (e.g. power supply unit, power cord, connection sockets) against moisture.
- If you suspect that moisture has gotten into the product, disconnect the product from the energy supply. Then notify Metrohm Service.
- Only personnel who have been issued Metrohm qualification may perform service and repair work on electrical and electronic components.

8.3 Cleaning the product

WARNING

Danger of poisoning and chemical burns from chemical hazardous substances

Poisoning and/or chemical burns by contact with aggressive chemical substances.

- Use only detergents that do not cause any unwanted side reactions with the materials to be cleaned.
- Clean contaminated surfaces.
- Wear protective equipment.
- Use exhaust equipment when working with vaporizing hazardous substances.
- Dispose of chemically contaminated materials (e.g. cleaning material) properly.

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 product.
- Protect live parts (e.g. power supply unit, power cord, connection sockets) against moisture.
- If you suspect that moisture has gotten into the product, disconnect the product from the energy supply. Then notify Metrohm Service.
- Only personnel who have been issued Metrohm qualification may perform service and repair work on electrical and electronic components.

Cleaning the surfaces of the product

Prerequisites

- The product is disconnected from the power grid.

1 Clean the surfaces with a damp cloth.

NOTICE

If the suspicion arises that liquids have found their way into the product, disconnect the product from the power grid and contact your Metrohm Service.

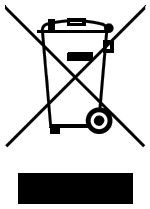
NOTICE

Water or ethanol can be used as a cleaning medium.

NOTICE

The connectors at the rear of the product must only be cleaned with a dry cloth.

9 Disposal



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

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

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

10 Technical specifications

10.1 Ambient conditions

Nominal function range	–20 - +40 °C (At a maximum of 93% humidity)
Storage	–20 - +70 °C (At a maximum of 93% humidity)
Transport	–20 - +70 °C (At a maximum of 93% humidity)
Altitude	Up to 2,500 m

10.2 Power supply

Aspect	Specification
Battery	2 x 1.5 V, size AA
Nominal input voltage	5 V DC
Power consumption	1,000 mA max.

Aspect	Specification
Power supply unit	Instrument connected to a powered USB HUB.
Nominal input voltage	100 - 240 V AC
Frequency	50 - 60 Hz
Output voltage	5 V DC
Nominal output current	1,500 mA max.

10.3 Interfaces

Aspect	Specification
USB connector	Type A/B mini USB connector (USB 2.0) with the following functions: ▪ Power supply ▪ Data transmission with USB cable (6.2151.110)

10.4 Dimensions and materials

Instrument

Aspect	Specification
Width	88 mm
Depth	44.8 mm
Height	126.2 mm
Display	3.7'' TFT LCD Display, glove compatible

Aspect	Specification
Weight	754 g

Aspect	Specification
Housing Material	Aluminum anodized
Accessories Covering	Thermoplastic elastomers (TPE-E)
IP Code (according to EN 60529)	IP67

Samples for Vial Holder or Tablet Holder

Aspect	Specification
Vial Holder	Vials 15mm x 26mm
Tablet Holder	Size for (coated) tablets: between 5x5 mm and 15x15 mm Size for capsules: between 4x4x7 mm and 10x10x25 mm

10.5 Operating specifications

Aspect	Specification
Laser wavelength	785 nm ± 0.5 nm
Laser output power	≤ 100 mW
Wavenumber range	400 - 2,300 cm^{-1}
Spectral resolution	12 - 14 cm^{-1} (FWHM) across the whole range
Collection optics	NA = 0.50, 1 mm and 7.6 mm working distance; 0.2 - 2.5 mm measuring spot size
Beam divergence	3.4 degrees
Detection technique	Orbital Raster Scan (ORS) to average over the sample
Laser class according to EN 60825-1	▪ Mira M-3 Basic Class 1 ▪ Mira M-3 Advanced Class 3B
Protection Level of goggles (according to EN 207)	D LB5 775 - 795 nm
NOHD - Nominal Ocular Hazard Distance	LWD attachment lens: 34 cm ± 5 cm SWD attachment lens: 32 cm ± 5 cm