# NIRS XDS SmartProbe Analyzer


Manual

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# NIRS XDS SmartProbe Analyzer

## Manual

8.921.8004EN / 2020-04-30

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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.

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# 1 Introduction

This manual gives you a comprehensive overview of the installation and maintenance of the NIRS XDS SmartProbe Analyzer. The NIRS XDS SmartProbe Analyzer is operated with the control software. You can find information on operating the instrument in the tutorial and in the manual for the control software.

**NOTICE**

You can request application descriptions in the form of **Application Notes** and **Application Bulletins** from your Metrohm representative or download them from *http://www.metrohm.com*.

## 1.1 Instrument description

The NIRS XDS SmartProbe Analyzer is a measuring instrument for reflection measurement or transflection measurement in the visible to near-infrared wavelength range.

The complete NIRS XDS SmartProbe Analyzer measuring instrument consists of two modules, monochromator and measuring module.

The monochromator operates in the range from 400 to 2,500 nm.

The measuring module to the NIRS XDS SmartProbe Analyzer is equipped with the corresponding accessories for specific samples and can be replaced with other measuring modules during ongoing operation (hot-swappable).

The NIRS XDS SmartProbe Analyzer is designed for quality monitoring in production processes and can be applied for the following purposes:

- Quick and non-destructive incoming goods inspection of raw materials
- Production process monitoring
- Final inspection of finished products

The NIRS XDS SmartProbe Analyzer can be used to measure the following sample types:

- Powders
- Coarse solids/granulates
- Turbid liquids
- Pastes/creams
- Viscous liquids/gels

- Clear liquids

The NIRS XDS SmartProbe Analyzer is operated with the control software via an external computer.

## 1.2 Intended use

The NIRS XDS SmartProbe Analyzer is designed for use in production facilities. It can be used for incoming goods inspection or for production process monitoring.

This instrument is suitable for measuring chemicals and flammable samples. Usage of the NIRS XDS SmartProbe Analyzer therefore requires the user to have basic knowledge and experience in handling toxic and caustic substances. Knowledge with respect to the application of the fire prevention measures prescribed for laboratories is also mandatory.

## 1.3 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.

### 1.3.1 Symbols and conventions

The following symbols and formatting may appear in this documentation:

| | |
|---|---|
| *(5-**12**)* | **Cross-reference to figure legend**<br>The first number refers to the figure number, the second to the instrument part in the figure. |
| **1** | **Instruction step**<br>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**<br>This symbol draws attention to a possible life-threatening hazard or risk of injury. |

| | |
|---|---|
|  | **WARNING**<br>This symbol draws attention to a possible hazard due to electrical current. |
|  | **WARNING**<br>This symbol draws attention to a possible hazard due to heat or hot instrument parts. |
|  | **WARNING**<br>This symbol draws attention to a possible biological hazard. |
|  | **CAUTION**<br>This symbol draws attention to possible damage to instruments or instrument parts. |
|  | **NOTE**<br>This symbol highlights additional information and tips. |

## 1.4 Safety instructions

### 1.4.1 General notes on safety

**WARNING**

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

This instrument 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.

### 1.4.2 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.

**Supply voltage**

**WARNING**

An incorrect supply voltage can damage the instrument.

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

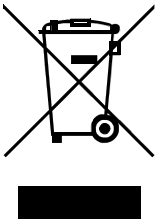
### 1.4.3 Flammable solvents and chemicals

**WARNING**

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

- Set up the 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.

### 1.4.4 Recycling and disposal



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

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

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

# 2 Overview of the instrument

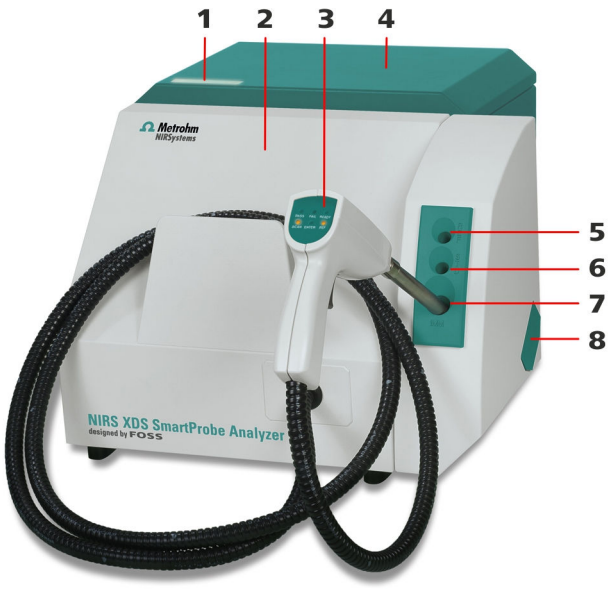



*Figure 1 Front - measuring instrument*

| | | | |
|---|---|---|---|
| **1** | **Status display** | **2** | **Measuring module** |
| **3** | **Measuring probe** | **4** | **Monochromator** |
| **5** | **Position "REF"** | **6** | **Position "STD"** |
| **7** | **Position "IMM"** | **8** | **Slot for calibration standard** |

# 2.1 Monochromator

## 2.1.1 Connectors/rear

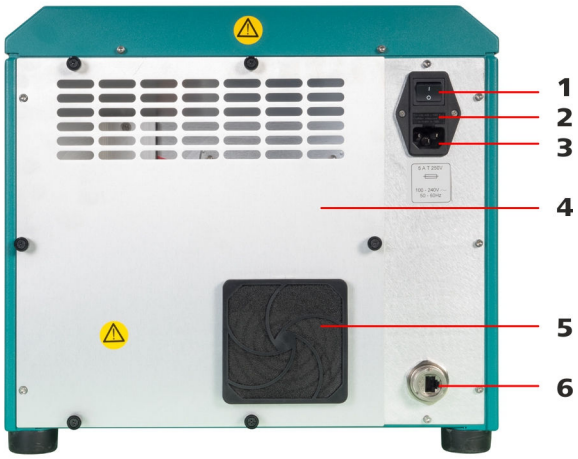



*Figure 2 Rear - monochromator*

| | | | |
|---|---|---|---|
| **1** | **On/off switch** | **2** | **Fuse holder** |
| **3** | **Power socket** | **4** | **Covering** |
| **5** | **Fan** | **6** | **Network connection socket** |

## 2.1.2 Status display

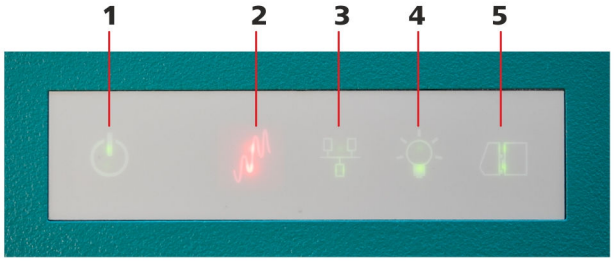



*Figure 3 Status display*

| | | | |
|---|---|---|---|
| **1** | **Instrument on** | **2** | **Measurement ongoing** |
| **3** | **Connected to network** | **4** | **Lamp on** |
| **5** | **Monochromator connected to measuring module** | | |

### 2.1.3 Instrument connection

The two modules are connected via mechanical, optical and electrical interfaces, combining monochromator and measuring module to one measuring instrument.

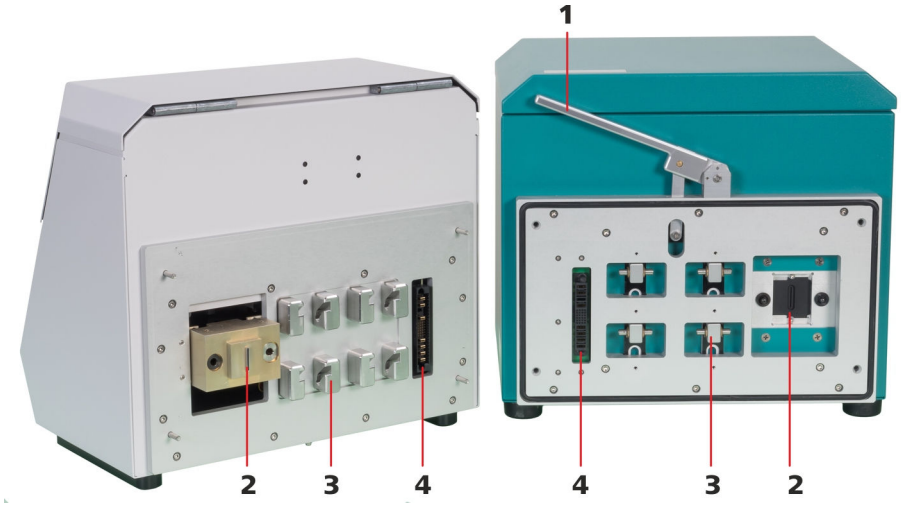



*Figure 4 Instrument connection*

| | | | |
|---|---|---|---|
| **1** | **Locking lever** | **2** | **Optical interface** |
| **3** | **Mechanical interface** | **4** | **Electrical interface** |

# 3 Installation

## 3.1 Unpacking and inspecting the instrument

### 3.1.1 Packaging

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

### 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 Scope of application

The NIRS XDS SmartProbe Analyzer is designed for offline use in the laboratory or for monitoring production processes.

## 3.2 Setting up the instrument

Like most high-precision instruments, the NIRS XDS SmartProbe Analyzer is sensitive to ambient conditions, which may negatively influence its performance and shorten its service life. The following guidelines have to be observed when the instrument is set up and put into operation:

### 3.2.1 Lifting and transporting instruments

**WARNING**

**Heavy modular instruments**

Incorrect handling when lifting and transporting can lead to injuries and damages.

- Instrument modules must be disconnected for moving and lifting *(see chapter 3.3, page 10)*.
- Only lift or move heavy instruments with caution and/or the appropriate auxiliary tools.
- Only transport heavy instruments on a trolley.
- Put instruments down carefully to avoid damage to the optical-mechanical elements.

**NOTICE**

**Dimensions and weights**

The dimensions and weights are listed in the technical specifications *(see chapter 7.7, page 37)*.

### 3.2.2 Handling fiber

**CAUTION**

**Damage to the fiber**

Rough and incorrect handling can damage the fibre so that it cannot be used for further measurements.

- Do not bend fiber heavily (bending radius > 150 mm).
- Do not pull fiber lengthwise (no linear expansion).
- Do not subject fiber to sudden shocks.

### 3.2.3 Ambient conditions

The ambient conditions are decisive for a proper functioning and to ensure accurate measured values. These conditions are listed in the technical specifications *(see chapter 7.3, page 35)*.

High humidity and climatic fluctuations caused by unstable ambient conditions hamper the instrument's stability in respect to calibration and measuring accuracy.

**NOTICE**

**Problems during calibration/measurement**

If the expected values are not obtained during calibration and the test runs, then you should check the ambient conditions.

Draft (air conditioning, open windows, etc.) and exposure to direct sunlight should be prevented.

Make sure to allow enough free space (on the sides and the back at least 75 mm) around the instrument to prevent heat accumulation.

### 3.2.4 General conditions

Dust and dirt may compromise the instrument's cooling and should therefore be prevented as far as possible.

The maintenance procedures for the fan filter are described as follows *(see chapter 5.2.2, page 17)*.

### 3.2.5 Vibrations and/or shocks

Vibrations and shocks interfere with the sensitive optical and mechanical components and can compromise calibration and measuring accuracy.

Do not set up other instruments that cause vibrations and shocks (mills, mixers, stirrers, etc.) on the same workplace as the NIRS XDS SmartProbe Analyzer.

Set the instrument up on a stable workplace that does not pass on vibrations (e.g. typing on keyboard).

## 3.3 Connecting monochromator to measuring module

**CAUTION**

**Mechanical damage**

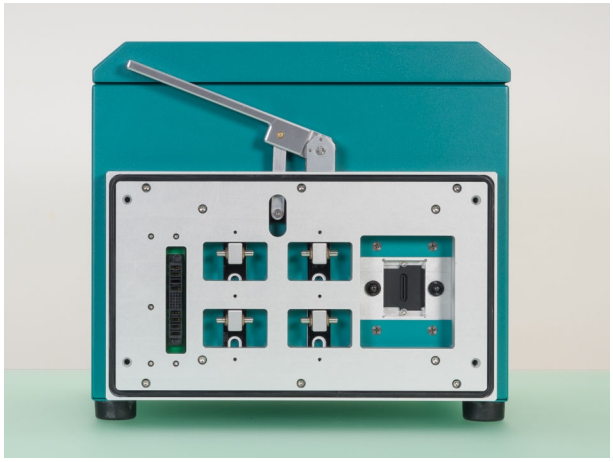
Rough and careless handling may damage the connection elements.

- Set the instrument up on a level workplace.
- Align the instrument parts correctly before pushing them together.
- Do not use excessive force.

**Connecting monochromator to measuring module**

**1 Positioning the monochromator**

- Position the monochromator on the laboratory table in the shown position.



## 2 Positioning measuring module and pushing together

- Align the measuring module with the monochromator and push together.

## 3 Locking monochromator and measuring module

- Push the locking lever down to connect the two instrument parts.

## 3.4 Connecting the power supply cable

The NIRS XDS SmartProbe Analyzer instrument contains a permanently installed power supply unit and can be directly connected to the power supply with a power supply cable.

The power supply unit automatically supports operating voltages between 100 and 240 VAC at 50 / 60 Hz. The maximum power consumption is 750 watt.

## 3.5 Connecting the network cable

In order to control the NIRS XDS SmartProbe Analyzer, it is connected to a computer either directly or via a local network (LAN). Use the supplied **crossover** network cable for connecting the instrument directly to a computer's network card.

For a connection via your local network, you need a network cable.

As network configurations vary considerably across different companies, a full discussion is not possible in this manual. We recommend that you have your network specialist establish the connection between the instrument and the company network.

**NOTICE**

**Direct connection to computer**

When directly connecting the measuring instrument to a computer, no other network card for connection to a local network may be installed at the same time.

This leads to communication errors and disruptions.

- In network operation, connect the measuring instrument via the network as well.

## 3.6 Switching on the instrument

Use the switch at the rear to switch on the instrument.


*Figure 5 On/off switch*

## 3.7 Initial start-up

The initial start-up of the instrument is always carried out with the control software.

You can find detailed information on the procedure in the tutorial for the control software.

## 3.8 Setting up accessories

Metrohm offers a wide range of accessories for the NIRS XDS SmartProbe Analyzer instrument.

A detailed description of how to use the accessories can be found in the appendix *(see chapter 6, page 31)*.

# 4 Operation

Apart from the main switch for switching on and off, the NIRS XDS SmartProbe Analyzer instrument does not have any other controls.

The complete instrument configuration, calibration and measurement is set up and operated via the control software.

# 5 Operation and maintenance

## 5.1 General notes

### 5.1.1 Care

The NIRS XDS SmartProbe Analyzer 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. In particular, the plug connections on the rear of the instrument should be protected from contamination.

**CAUTION**

Although this is largely prevented by design measures, Metrohm Service should immediately be notified if aggressive substances have found their way into the instrument.

### 5.1.2 Maintenance by Metrohm Service

Maintenance of the NIRS XDS SmartProbe Analyzer instrument is best carried out as part of annual service, which is performed by specialist personnel from Metrohm. 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 Maintenance

The instrument maintenance for the NIRS XDS SmartProbe Analyzer is designed to be easy to carry out.

The optical housing of the monochromator is sealed to prevent contamination of critical parts and minimize maintenance.

**NOTICE**

Do not attempt to open the optical housing of the monochromator.

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

Damages resulting from opening the instrument are not covered by the warranty.

### 5.2.1 Overview

**NOTICE**

**Maintenance log**

The control software features a maintenance log in the diagnosis database to keep track of maintenance activities. It can be used to record information on tests and maintenance work and to store comments.

**NOTICE**

**Instrument environment**

Check regularly that no other instruments producing vibrations or other immissions that could be transmitted to the NIRS XDS SmartProbe Analyzer are in proximity. Such immissions can cause spectral interferences which compromise the calibration and the measuring accuracy.

### 5.2.2 Replacing the fan filter

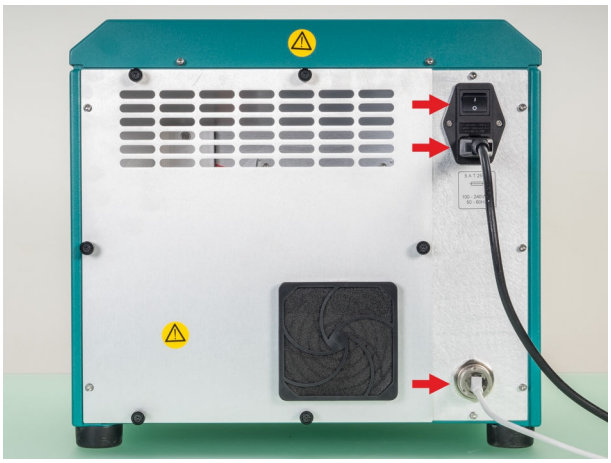
The fan filter should be checked at least once a month. If the instrument is operated in a dusty or otherwise dirty environment, then a check is required once or even twice a week.

**Replacing the fan filter**

The fan is located on the rear of the instrument. The filter cover is attached to the fan filter by means of four plastic latches.

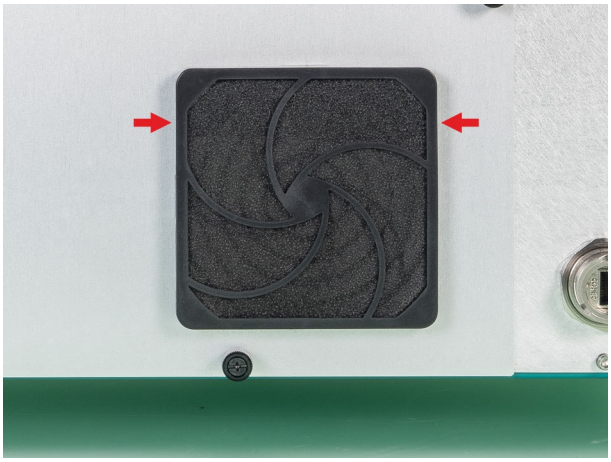
**1 Disconnecting the instrument from the power supply**

- Turn the on/off switch to the position **O**.
- Pull out the power supply cable.
- Remove the network cable (optional).



**2 Removing the filter cover**

- Grab the filter cover with both hands and gently take it off starting on top.



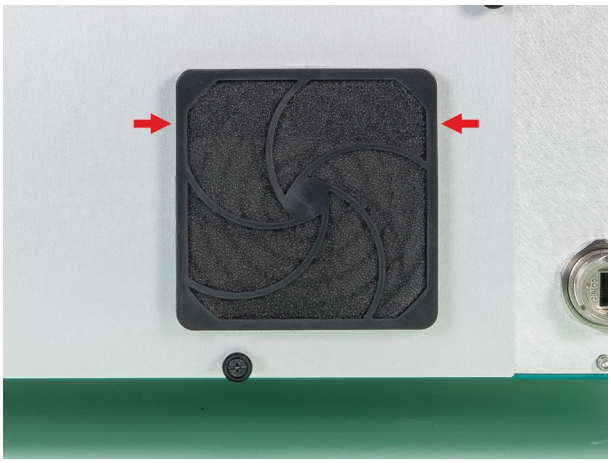
**3 Cleaning/replacing the filter**

- Remove the filter from the cover and examine it.
- If the filter shows no damage, then it can be cleaned and used again.
- If the filter is damaged, then a spare filter of the same type has to be used.

- Place the cleaned or new filter symmetrically into the filter cover. Make sure the filter material is correctly positioned and is not wrinkled or folded. The edges should form a good seal.

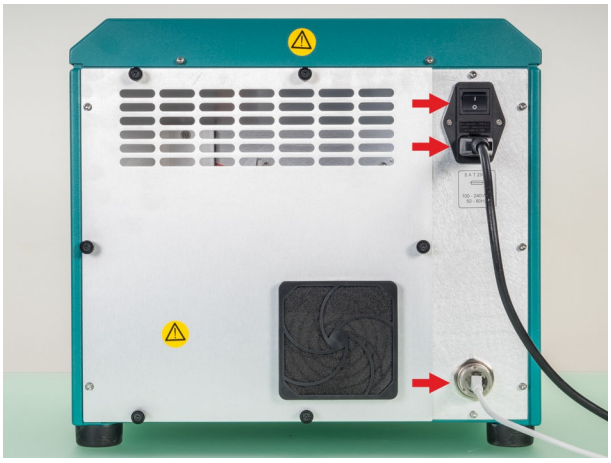
### 4 Mounting the filter cover

- Mount the filter cover to the frame starting on the top and push it in place until all latches snap in.



**5 Connecting the instrument**

- Plug in the network cable.
- Plug in the power supply cable.
- Switch on the instrument.



### 5.2.3 Replacing the lamp

**Replacing the lamp**

The lamp must be replaced if it is defective or when its performance is insufficient. Signs of an insufficient lamp performance include:

- Measurements are impaired by noise.
- The repeatability of the wavelengths is deteriorating.
- The performance test is no longer completed successfully.

**WARNING**

**Electric shock**

There is a danger of life-threatening electric shock if an instrument connected to the power supply is opened.

- Remove the power supply cable before starting with the according maintenance procedure.

**WARNING**

**Hot surface**

Immediately after use, the lamp is extremely hot and can cause burns.

- Allow the lamp to cool down for approx. 10 to 15 minutes.
- Remove the lamp with appropriate care.

**NOTICE**

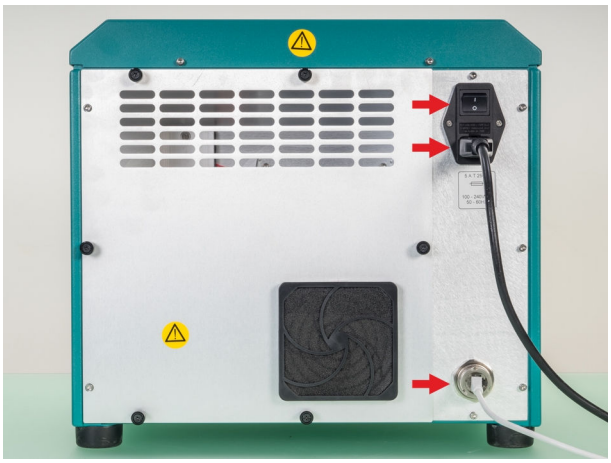
**Spare part**

A new spare lamp is available from your Metrohm distributor under the article number 6.7430.000.

- It is advisable to keep spare lamps in stock.
- Only original lamps must be used in the instrument.

**1 Disconnecting the instrument from the power supply**

- Turn the on/off switch to the position **O**.
- Pull out the power supply cable.
- Remove the network cable (optional).
- Wait 10 to 15 minutes until the lamp has cooled down.



**2 Removing the lamp covering**

- Loosen the six knurled screws until they are free.
- If the screws are too tight, loosen them with a screwdriver.
- Carefully remove the back panel and put it aside.

**NOTICE**

The built-in lamp is the only part subject to maintenance work.

All other construction elements are maintenance-free and must not be opened or removed.

This overview shows the area inside the rear covering.

The lamp box is located in the lower left corner.

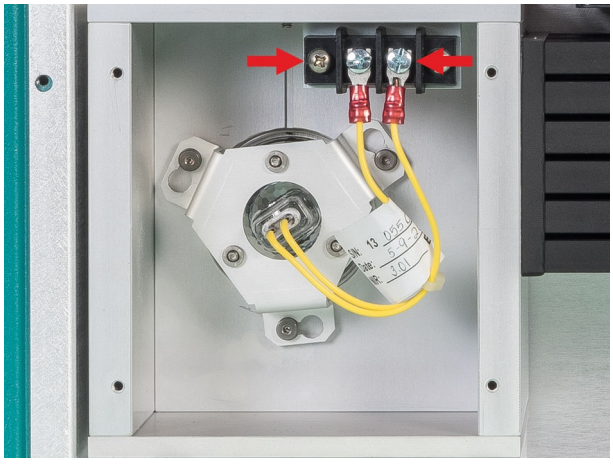
### 3 Loosening the lamp cables

The cable clips for connecting the lamp are in the upper right corner of the lamp box.

The lamp itself is secured with a quick-opening clamping fixture. On the lamp is a black arrow, which has to be aligned with the milled groove at the top of the mounting area.

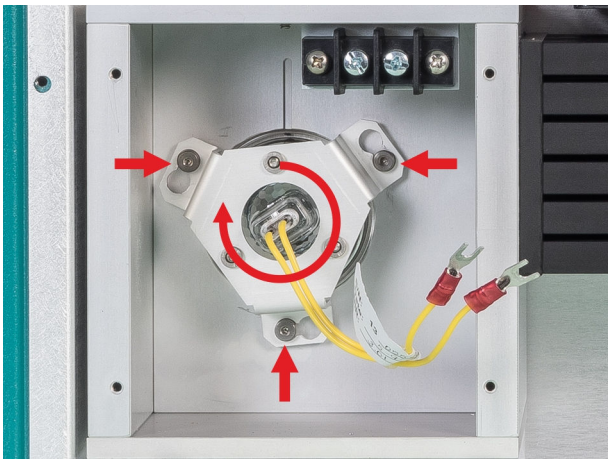
Loosen the screw terminals using a screwdriver and pull out the spade terminals.

Do not remove the terminal screws.



### 4 Removing the lamp holder

- Push the lamp holder to the inside and then rotate it clockwise (to the right) until it is completely unlocked.
- Remove the lamp holder with the lamp from the lamp box.



## 5 Replacing the lamp

**CAUTION**

**Damage to the lamp**

Fingerprints and greasy deposits may damage the lamp.

Do not touch the glass part of the lamp or the inner side of the reflector.

- Remove the lamp from the lamp holder and replace it with a new lamp.

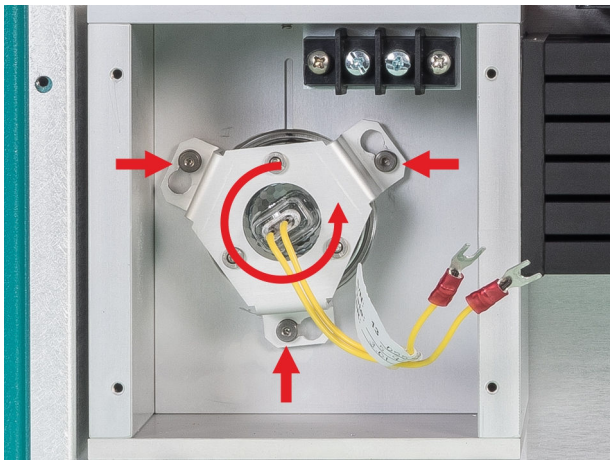
**NOTICE**

**Disposal**

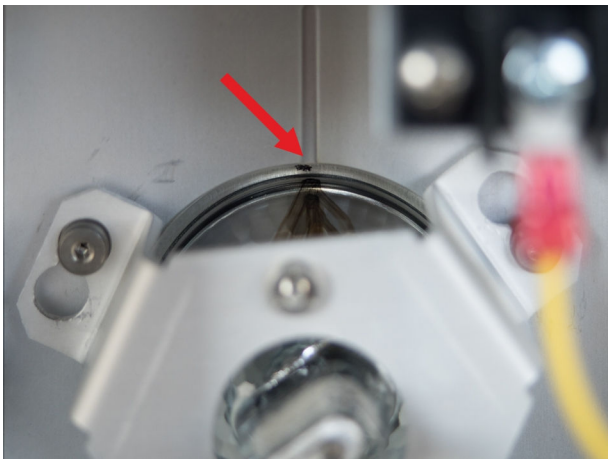
Follow the country-specific regulations and guidelines to dispose of the old lamp.

## 6 Inserting the lamp holder

- Place the lamp into the opening and align the black arrow with the milled groove (on top).
- Position the lamp holder over the lamp and the locking bolts.
- Carefully push the lamp holder down, rotate anti-clockwise (to the left) and lock.



The following image shows the lamp in the correct position with the black arrow facing the top groove.



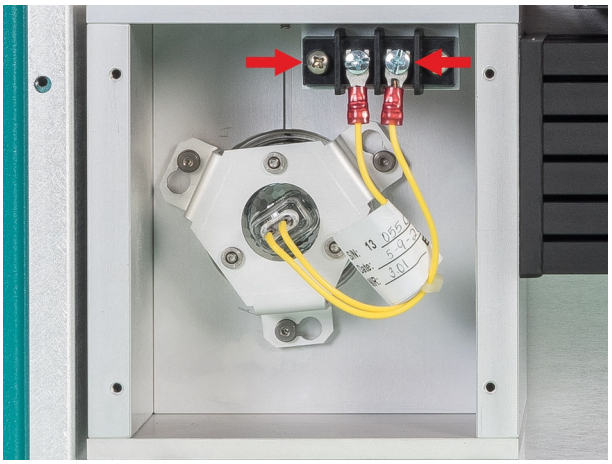
## 7 Connecting the lamp cables

- Place the two spade terminals into their according screw terminal and tighten with a screwdriver.

**NOTICE**

**Polarity**

The polarity is irrelevant.

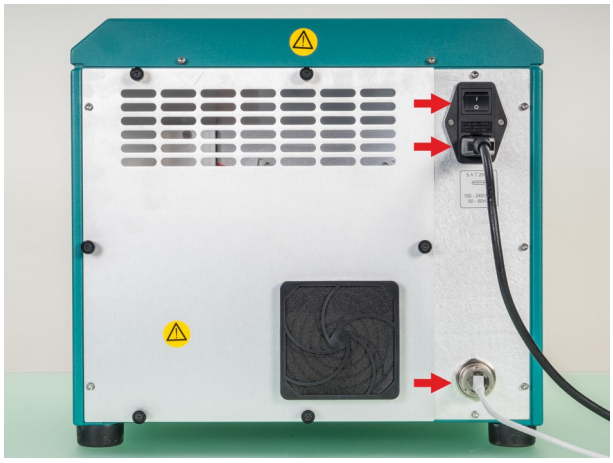


## 8 Attaching the lamp covering

- Position the covering with the screws over the thread bore holes.
- Fasten the screws by hand.

## 9 Connecting the instrument

- Plug in the network cable.
- Plug in the power supply cable.
- Switch on the instrument.



## 10 Connecting the instrument to the control software

- Start the control software and connect to the instrument.
- Connect the instrument according to the specific procedure (see tutorial) to the control software.
- The lamp symbol of the status display on the monochromator lights up.
- The instrument warms up and a message is shown in the control software until the instrument is stable enough for further use.

**NOTICE**

**Stabilizing time**

The instrument features a monitoring function for stabilizing which can be deactivated in the control software. If the monitoring is deactivated, the instrument takes about 20 to 30 minutes for correct stabilizing.

**11 Calibrate the instrument**

The instrument has to be recalibrated every time a lamp is replaced.

- Calibrate the instrument according to the specific procedure (see tutorial for the control software).

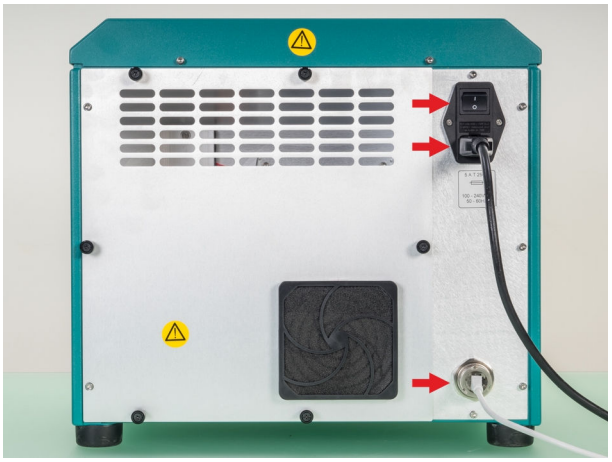
The instrument is ready for operation again once the calibration and the according tests have been carried out successfully.

## 5.2.4 Replacing the fuse

**Replacing the fuse**

**1 Disconnecting the instrument from the power supply**

- Turn the on/off switch to the position **O**.
- Pull out the power supply cable.
- Remove the network cable (optional).

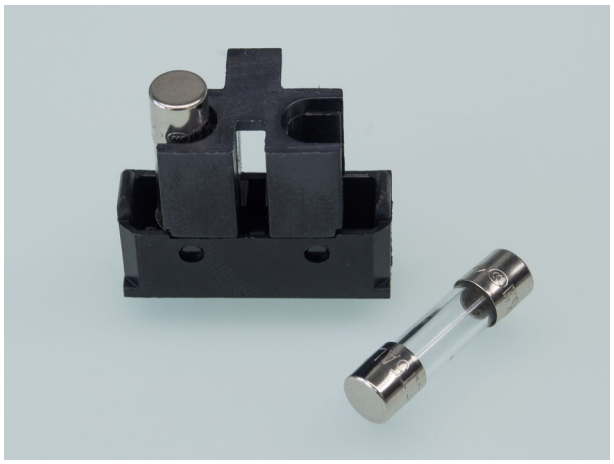


**2 Removing the fuse holder**

- Pull out the fuse holder with a screwdriver.

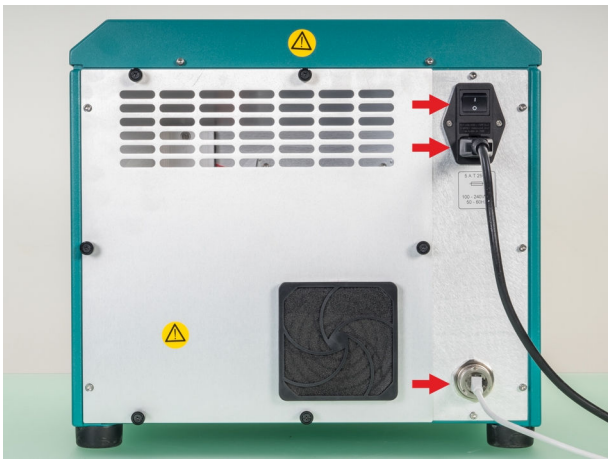

### 3 Replacing the fuse

- Remove the old fuses from the fuse holder and replace with new fuses *(see chapter 7.2, page 35)*.
- Insert the fuse holder with the new fuses into the opening until it latches.



### 4 Connecting the instrument

- Plug in the network cable.
- Plug in the power supply cable.
- Switch on the instrument.



# 6 Appendix

**CAUTION**

**Sample preparation**

Spilled sample material can enter the instrument and cause damages.

- Prepare samples outside of the instrument.
- Use appropriate sample cups.
- After filling, the sample cup must be clean on the outside.

**NOTICE**

**Cleanliness of sample cups**

Only clean and flawless sample cups ensure correct measurements.

Use only clean sample cups and replace them if there is any doubt.

**NOTICE**

**Cleaning validation**

Pharmaceutical applications require validation of the cleaning process to ensure cleanliness requirements regarding sample handling are met.

**NOTICE**

**Control software**

The operation of the control software with the required settings and operating steps is described in the **tutorial**.

# 6.1 Accessories for measuring probes

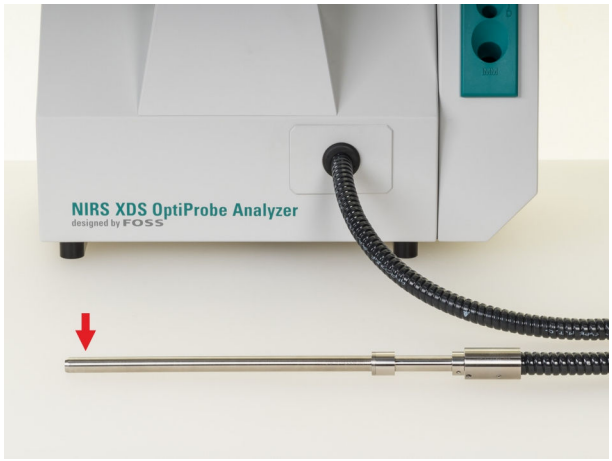
The optical fiber can be adapted to the specific measurements using probe attachments. In addition, the optical fiber can be furnished with a protective sleeve to prevent storage and transportation damage.


*Figure 6 Measuring probes / protective sleeve*

| | | | |
|---|---|---|---|
| **1** | **Optical fiber** | **2** | **Protective sleeve** |
| **3** | **Reflection probe** | **4** | **Immersion probe** |

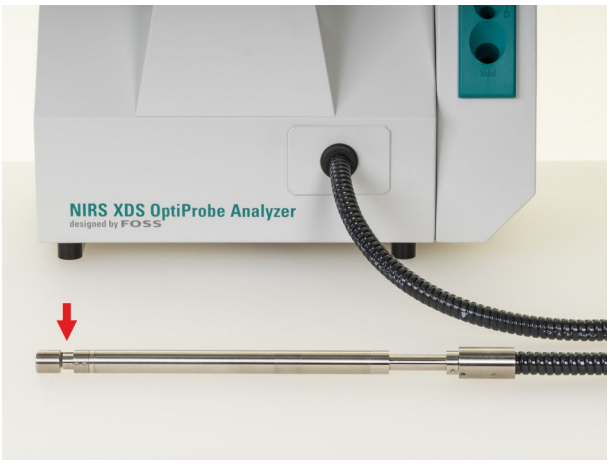
## 6.1.1 Reflection probe

The reflection probe allows the measurement of samples in powder and granular form.



### 6.1.2 Immersion probe

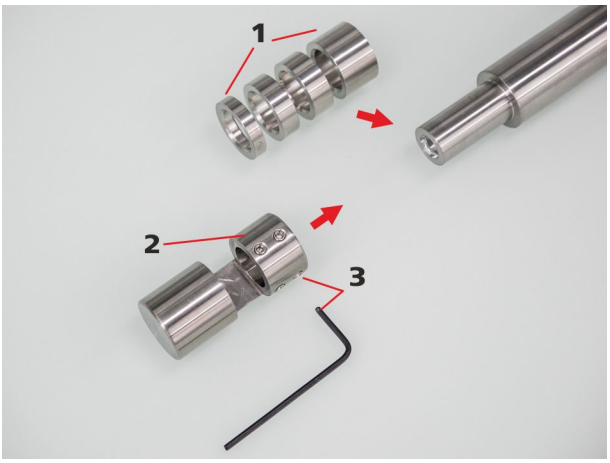
The immersion probe allows the measurement of liquid samples.




#### Setting the measuring distance

The measuring distance of the immersion probe can be modified depending on the water content of the samples.

Four different spacer rings **1** (for measuring distance 2, 4, 5 and 10 mm) are included in the scope of delivery.




**1 Fitting the spacer ring**

- Choose the appropriate spacer ring **1**.
  The measuring distance is engraved on the outside of the ring.
- Slide the spacer ring **1** onto the optical fiber.

**2 Fitting the transflection attachment**

- Slide the transflection attachment **2** onto the optical fiber.

**3** **Fixating the transflection head**

- Tighten the four studs on the transflection attachment with the hex key **3**.

## 6.2 Calibration standards

**NOTICE**

**Choosing the calibration standard**

The necessary calibration standards for the calibration of the measuring instrument are listed in the tutorial for the control software under the respective measuring modules.

# 7 Technical specifications

## 7.1 LAN interface

| | |
|---|---|
| *RJ-45* | Ethernet connection socket for the data transfer to the PC with the control software via direct connection or via the network. |

## 7.2 Power connection

| | |
|---|---|
| *Nominal voltage range* | 100–120 V and 220–240 V (±10%, autosensing) |
| *Frequency* | 50 and 60 Hz (autosensing) |
| *Power consumption* | 750 $VA_{max}$ |
| *Protection* | Diameter 5 mm, length 20 mm<br>5.0 ATH (slow-acting)<br>2 pieces per instrument |

## 7.3 Ambient conditions

| | |
|---|---|
| *Nominal function range* | 5–35 °C<br>at max. 60% humidity, non-condensing |
| *Storage* | –20 to 70 °C<br>at max. 93% humidity, non-condensing |

## 7.4 Operation

| | |
|---|---|
| *Measuring mode* | Reflection<br>Transflection |
| *Wavelength range* | 400–2500 nm |
| *Detectors* | Silicon (400–1100 nm),<br>Lead sulfide (1100–2500 nm) |
| *Optical bandwidth* | 8.75 nm (±0.10 nm) |
| *Spectral data interval* | 0.5 nm |
| *Number of data points per spectrum* | 4,200 |

| | |
|---|---|
| *Scan rate* | 2 scans/second |
| *Wavelength accuracy* | < 0.08 nm (NIST SRM 1920) |
| *Wavelength precision* | |
| *Based on one instrument* | < 0.008 nm |
| *Based on an instrument group* | < 0.025 nm |
| *Photometric noise* | |
| *400–700 nm* | < 80 µAU |
| *700–2200 nm* | < 30 µAU |
| *700–2500 nm* | N/A |
| *850–1100 nm* | N/A |
| *1100–1600 nm* | N/A |

## 7.5 Reference conditions

| | |
|---|---|
| *Ambient temperature* | +25 °C (±3 °C) |
| *Relative humidity* | ≤ 60% |
| *Instrument status* | > 30 minutes in operation |
| *Validity of the data* | After adjustment |

## 7.6 Dimensions

| | **Monochromator** |
|---|---|
| *Measurements* | |
| *Width* | 380 mm |
| *Height* | 348 mm |
| *Depth* | 335 mm |
| *Weight* | 21.0 kg |
| | **NIRS XDS SmartProbe Analyzer module** |
| *Measurements* | |
| *Width* | 457 mm |
| *Height* | 381 mm |

| | |
|---|---|
| *Depth* | 275 mm |
| *Weight* | 11.5 kg |

## 7.7 Housing

**Monochromator**

| | |
|---|---|
| *Material* | Steel sheet |
| *IP degree of protection* | IP 52 |

**NIRS XDS SmartProbe Analyzer module**

| | |
|---|---|
| *Material* | Aluminum |
| *IP degree of protection* | IP 52 |

# 8 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 (e.g. **Variable Produktnummer**) 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 on **Download the PDF**.

   The PDF file with the accessories data is created.

**NOTICE**

Once you have received your new product, we recommend downloading the accessories list from the Internet, printing it out and keeping it together with the manual for reference purposes.

# Glossary

**AU**

*Absorbance Units*; unit of the (actually dimensionless) absorbance.

**Data interval**

Distance of nearby data points on the wavelength axis; depends on the angle between nearby grid positions. Not to be confused with the optical bandwidth; the spectral data interval does not show the optical resolution of the spectrometer.

**Optical bandwidth**

The optical bandwidth is the spectral broadening of an ideal monochromatic light source with a spectrometer. It is determined by the spectral dispersion of the monochromator, among other things.

**Optical pathlength**

Distance a light beam covers in a sample from entry point to exit point. In transmission measurements of clear samples, the optical pathlength is the same as the thickness of the sample, in reflection measurements it depends on different factors (particle size, packing density, and others).

**Photometric noise**

Statistical fluctuations of the measured absorbance.

**Reflection measurement**

Reflection measurements are performed on diffuse scattering or opaque materials. Hereby the light that is remitted out of the sample by the scattering angle is detected.

**Transflection measurement**

Transflection measurements enable the measurement of absorption spectra of transparent samples in reflection geometry. Hereby the light going through the sample is reflected with a mirror in the direction of the incoming light beam and collected, for example with a fiber.

**Transmission measurement**

Transmission measurements are performed on transparent samples. Hereby the light that directly goes through the sample (along the optical axis) is detected.

**Wavelength accuracy**

Absolute deviation of measured and actual wavelength.

**Wavelength precision**

Variance of the measured wavelength at repeated measurements with a single instrument or a group of instruments.

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