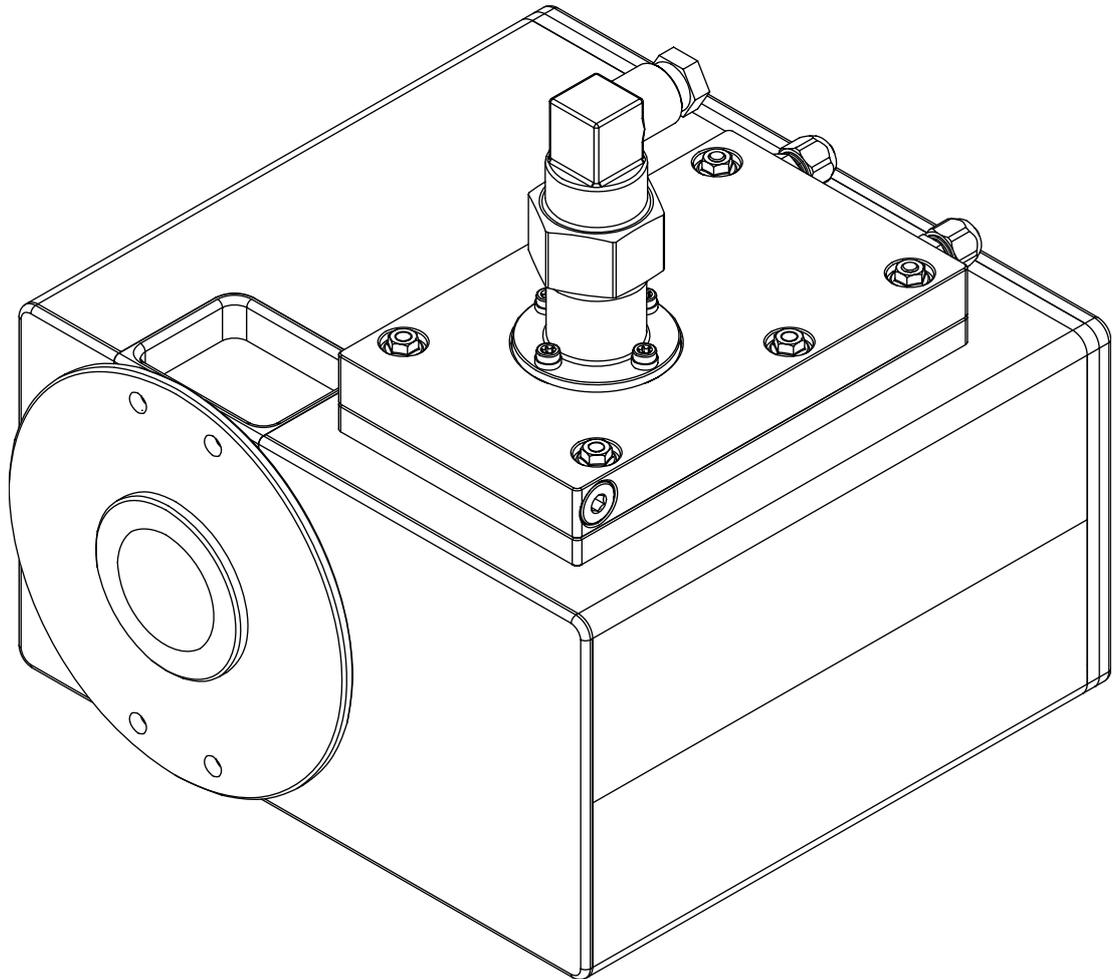




Process Analyser PA2

Operation Manual



Imprint

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1 About this document

This operation manual is applicable for all variants of the instrument. Read this operation manual before operating the instrument and follow the instructions to ensure safe and trouble-free operation.

Keep this operation manual for later use and pass it on to any subsequent user or owner.

NIR-Online GmbH accepts no liability for damage, faults and malfunctions resulting from not following this operation manual.

If you have any questions after reading this operation manual:

► Contact NIR-Online GmbH Customer Service.

service.nir-online@buchi.com

1.1 Warning notices in this document

Warning notices warn you of dangers that can occur when handling the instrument. There are four danger levels, each identifiable by the signal word used.

Signal word	Meaning
DANGER	Indicates a danger with a high level of risk which could result in death or serious injury if not prevented.
WARNING	Indicates a danger with a medium level of risk which could result in death or serious injury if not prevented.
CAUTION	Indicates a danger with a low level of risk which could result in minor or medium-severity injury if not prevented.
NOTICE	Indicates a danger that could result in damage to property.

1.2 Symbols

The following symbols are displayed in this operation manual or on the device:

1.2.1 Warning symbols

Symbol	Meaning
	General warning
	Dangerous electrical voltage
	Explosive substances

1.2.2 Mandatory directive symbols

Mandatory signs	Meaning
	Read manual

1.3 Mark-ups and symbols



NOTE

This symbol draws attention to useful and important information.

- ☑ This character draws attention to a requirement that must be met before the instructions below are carried out.
- ▶ This character indicates an instruction that must be carried out by the user.
- ⇒ This character indicates the result of a correctly carried out instruction.

Mark-up	Explanation
<i>Window</i>	Software Windows are marked-up like this.
<i>Tab</i>	Tabs are marked-up like this.
<i>Dialog</i>	Dialogs are marked-up like this.
<i>[Button]</i>	Buttons are marked-up like this.
<i>[Field names]</i>	Field names are marked-up like this.
<i>[Menu / Menu item]</i>	Menus or menu items are marked-up like this.
Status	Status is marked-up like this.
Signal	Signals are marked-up like this.

2 Safety

2.1 Proper use

The sensor is used to analyze substances and samples in production and in the laboratory. The sensor is intended exclusively for that purpose.

The sensor can be used in laboratories and production facilities for the following operations:

- Quality control
- Process optimization
- Reference measurements

2.2 Use other than that intended

Use of any other kind than that described in the section Chapter 2.1 "Proper use", page 7 and any application that does not comply with the technical specifications (see Chapter 3.6 "Technical data", page 14) constitutes use other than that intended.

In particular, the following applications are not permissible:

- Using the sensor in areas for which the sensors are not certified. For certification details see Chapter 3.4 "ATEX rating", page 13
- Use of the sensor in a potentially explosive atmosphere without an overall assessment by the responsibility holder.
- Use of a sensor of which the screw sealing cap is damaged.

Damage or hazards attributable to use of the product other than as intended are entirely at the risk of the operator alone.

2.3 Location of safety notices and warning signs on the product

The following safety signs and warning symbols are present on the sensor.

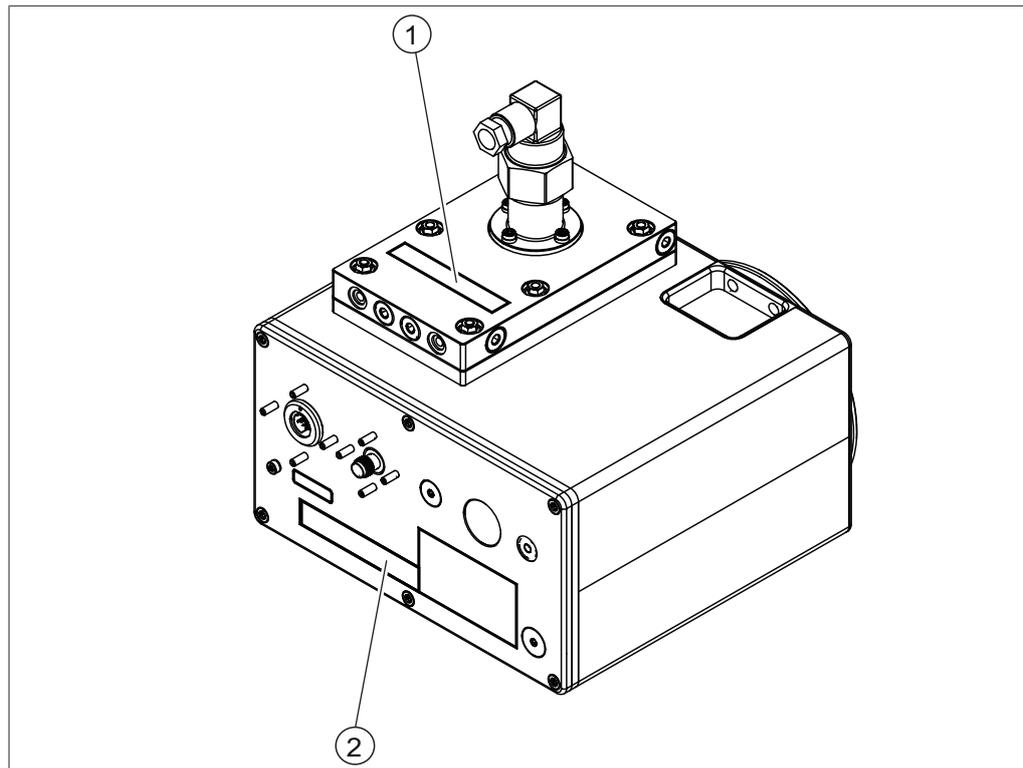


Fig. 1: Location of safety notices and warning signs on the product

1



General warning

**ONLY OPERATE INSTRUMENT
WHEN TEMPERATURE
SWITCH IS IN USE**

2



General warning

**DO NOT SEPARATE WHEN EN-
ERGIZED DO NOT OPEN IN A
HAZARDOUS AREA**

2.4 Safety features

2.4.1 Thermostat

A thermostat in the device switches off the internal power supply if the temperature exceeds 60 °C +/- 5 °C.

2.5 Residual risks

The instrument has been developed and manufactured using the latest technological advances. Nevertheless, risks to persons, property or the environment can arise if the instrument is used incorrectly.

Appropriate warnings in this manual serve to alert the user to these residual dangers.

2.5.1 Risk of explosion from opening up the sensor

Opening up the sensor in potentially explosive atmospheres can cause an explosion.

- ▶ Do not open up the sensor housing.

2.5.2 Risk of explosion from unplugging the device power plug

Risk of explosion from unplugging the device power plug when the power is switched on.

- ▶ Do not unplug the sensor when the power is switched on.

2.6 Staff qualification

Unqualified persons are unable to identify risks and are therefore exposed to greater dangers.

The device may only be operated by suitably qualified persons.

These operating instructions are aimed at the following target groups:

Users

Users are persons that meet the following criteria:

- They have been instructed in the use of the device.
- They are familiar with the contents of these operating instructions and the applicable safety regulations and apply them.
- They are able on the basis of their training or professional experience to assess the risks associated with the use of the device.

Operator

The operator is responsible for the following aspects:

- The instrument must be correctly installed, commissioned, operated and serviced.
- Only suitably qualified staff may be assigned the task of performing the operations described in these operating instructions.
- The staff must comply with the locally applicable requirements and regulations for safe and hazard-conscious working practices.
- Safety-related incidents that occur while operating the instrument are to be reported to the manufacturer.

service.nir-online@buchi.com

NIR-Online service technicians

Service technicians authorized by NIR-Online have attended special training courses and are authorized by NIR-Online GmbH to carry out special servicing and repair measures.

2.7 Personal protective equipment (laboratory)

Depending on the application, hazards due to heat and/or corrosive chemicals may arise.

- ▶ Always wear appropriate personal protective equipment such as safety goggles, protective clothing and gloves.
- ▶ Make sure that the personal protective equipment meets the requirements of the safety data sheets for all chemicals used.

2.8 Personal protective equipment (production)

Follow the rules regarding personal protective equipment that are applicable at the installation site.

The operation of the sensor does not require additional protective equipment.

2.9 Modifications

Unauthorized modifications may impair safety and lead to accidents.

- ▶ Use only genuine NIR-Online accessories, spare parts and consumables.
- ▶ Technical modifications to the instrument or accessories should only be carried out with the prior written approval of NIR-Online GmbH and only by authorized NIR-Online service technicians.

NIR-Online GmbH accepts no liability whatsoever for damage arising as a result of unauthorized modifications.

3 Product description

3.1 Description of function

The sensor is an optical instrument for nondestructive determination of substances and concentrations in a sample.

A sample absorbs and reflects light across the entire wavelength spectrum according to its color and chemical composition. The signal reflected by the sample is recorded and analyzed by a spectrometer.

- The sensor uses a lamp to produce near-infrared radiation that interacts with the molecules of the sample. The interaction between sample and light produces a characteristic spectrum.
- The light reflected from the sample is collected through two sets of fiber optics that direct the light to the NIR and visible spectrophotometers, respectively. The visible spectrophotometer consists of a diffraction grating to spatially disperse the light according to wavelength and a silicon photodiode array containing multiple elements which measure the light intensity for specific wavelength intervals. The NIR spectrophotometer consists of a diffraction grating to spatially disperse the light according to wavelength and an indium-gallium-arsenide photodiode array containing multiple elements.
- The produced measurement results are converted to data sequences.
- The data sequences are transferred to a computer via an interface.
- A computer program compares the data sequence curve with a calibration model and in that way determines the chemical composition of the sample.

3.2 Configuration

3.2.1 Front view

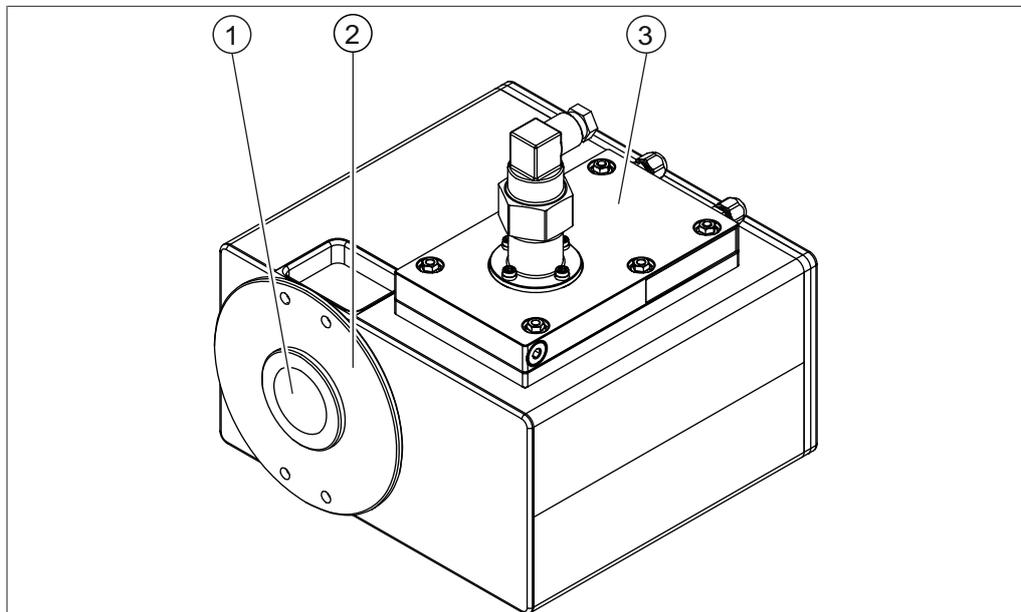


Fig. 2: Front View

1 Measurement window
3 Heat sink

2 Flange

3.2.2 Rear view

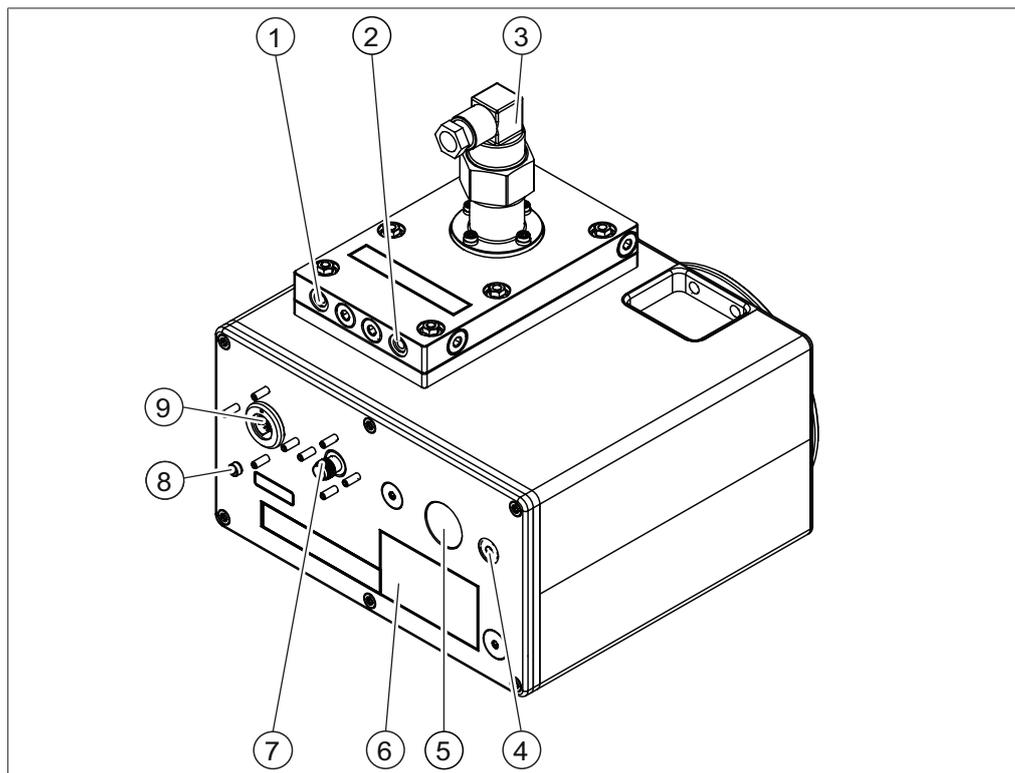


Fig. 3: Rear view

- | | | | |
|---|-----------------------------|---|--|
| 1 | Coolant connection | 2 | Coolant connection |
| 3 | Thermostat
(make-switch) | 4 | Beacon |
| 5 | Button | 6 | Type plate |
| 7 | Video connection | 8 | Ground connection
(Equipotential bonding) |
| 9 | Device cable connection | | |

3.3 Type plate

The type plate identifies the instrument. The type plate is attached to the rear panel. See Chapter 3.2.2 "Rear view", page 11

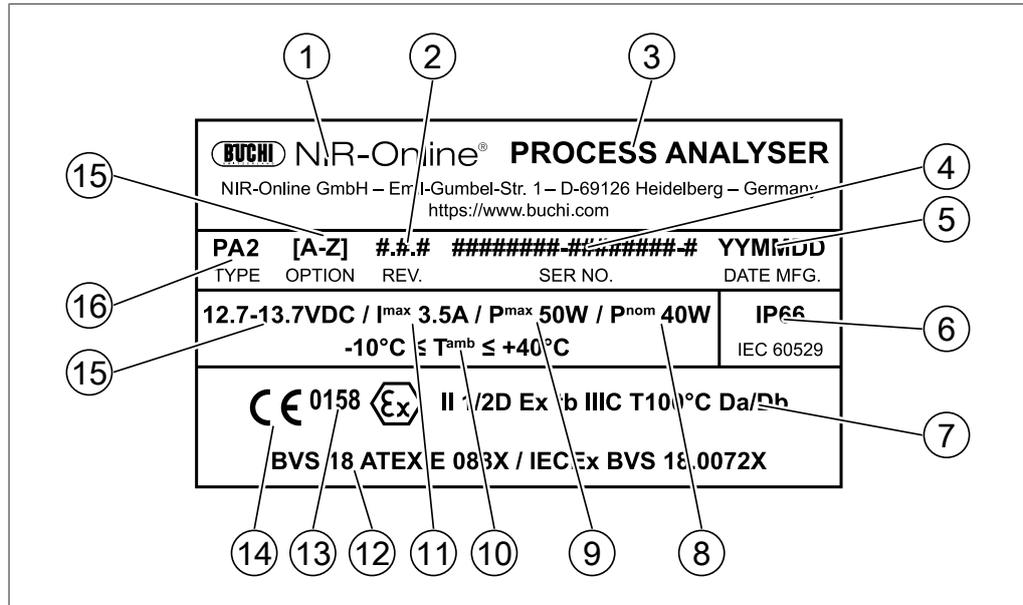


Fig. 4: Type plate

- | | |
|--------------------------------|-------------------------------|
| 1 Company name and address | 2 Revision number |
| 3 Product name | 4 Serial number |
| 5 Production date | 6 IP class |
| 7 ATEX rating | 8 Power consumption (nominal) |
| 9 Power consumption (maximum) | 10 Ambient temperature |
| 11 Current draw (maximum) | 12 ATEX certification number |
| 13 Certification center number | 14 Certificates |
| 15 Operating voltage | 16 Product type |
| 17 Product option | |

The following product options are possible:

Letter	Option
A	NIR
B	FEEDER/X-ROT (without ATEX certification)
C	CAMERA
D	VIS
E	Gold reflector (X-One)
F	Silver reflector (X-Two/X-Four (diffusion lamps), X-Three)
G	Lamp position rev. 1.3.2
H	Lamp position rev. 1.3.6 (X-Two/X-Four/X-View (diffusion lamps))
I	Camera setting flange (0 mm)

Letter	Option
K	Camera setting X-ROT (15 mm)
L	Camera setting (20 mm (X-Cell+X-Cool))
N	System temperature 0 - 80 °C
O	Humidity sensor 0-100% RH
S	X-Quvette (Fiber lens (approx. 0 - 2 cm))
T	Bluetooth® (without ATEX certification)
U	Camera setting special flange ZB-0103
V	External button
X	= X-Beam (without ATEX certification) (approx. 40 cm measurement distance)
X2	X-Beam 002 (approx. 15 cm measurement distance)

3.4 ATEX rating

The sensor is certified according to the following European Union ATEX Directive ratings:

II 1/2D Ex tb IIIC T100°C Da/Db

Meaning of the rating marks:

Rating	Meaning according to Directive 2014/34/EU
II	Device group approved for all Ex zones except mining
1/2D	Device category approved for dust zone 20/21/22 (1D); dust zone 21/22 (2D)
Ex	Explosion-safe
tb	Protection class protected by enclosure
IIIC	Dust group conductive dusts
T100 °C	Temperature classification max. surface temperature = 100° C
Da/Db	Device safety level. Da - zone 20, adequate safety in event of rare faults; D -: zone 21,adequate safety in event of foreseeable faults

3.5 Scope of delivery



NOTE

The scope of delivery depends on the configuration of the purchase order.

Accessories are delivered as per the purchase order, order confirmation, and delivery note.

3.6 Technical data

3.6.1 Sensor

Specifications	PA2
Dimensions (W x D x H)	235 x 230 x 180 mm
Weight	14 kg
Max. operating pressure	30 bar at flange
Coolant inlet temperature	+10 °C to +30 °C
Coolant flow rate	10 L/h
Coolant pressure	max. 0.5 bar
Product temperature (temperature at flange with water cooling)	-10 °C to +130 °C
Product temperature (temperature at flange without water cooling)	-10 °C to +70 °C
Vibrations	0.2 G at 0.1 - 150 Hz
Wavelength spectrum NIR range	1100 - 2200 nm; 9090 - 4545 cm ⁻¹
Detector	Diode array
Average measurement time	20 spectra/s
IP code	IP66 (IEC 60529)
Type of lamp	Tungsten-halogen dual lamp
Number of lamps	2
Lifetime lamp	18000 h (2 x 9000 h)

3.6.2 Installation box

Specifications	Installation box
Dimensions (W x D x H)	300 x 300 x 167 mm
Weight (excluding cables)	6 kg
Weight (inc. cables, 2 x 10 m)	7.4 kg
Frequency	50/60 Hz
Power consumption	30 W
Power supply	85 - 264 VAC

3.6.3 Ambient conditions

Max. altitude above sea level	2500 m
Ambient temperature	-10 °C ≤ Tamb ≤ + 40 °C
Max. relative air humidity	< 90 % non-condensing
Storage temperature	max. 45 °C

3.6.4 Materials

Component	Materials of construction
Casing	Stainless steel (1.4301 high-gloss polished)
Heat sink	Nickel and zinc-coated aluminum
Seals	FFKM (standard)

3.6.5 Computer system requirements

The system requirements for the computer are as follows:

Operating system	Windows 10 Pro
Central processing unit	Intel Core i5 generation 6600 or later
RAM	At least 4 GB
Hard disk space	At least 80 GB free disk space Use a hard disk suitable for continuous operation.
Data backup	At least 0.5 GB free disk space
Network or external hard disk	Additional 20 MB per day and sensor
Screen resolution	At least 1280x1024
LAN	At least 1 x 100 Mbit/s LAN
USB 2.0/3.0	At least 1 USB connection per sensor and 1x USB per DataLab I/O box
PCI/PCIe	1 slot for Profibus card (for Profibus connection)
Software	Word and Microsoft Excel 2003 or later

3.6.6 Software

The sensor is controlled via the SX-Suite software package. It consists of the following components:

Name	Description	Typical usage	User	Occurrence
SX-Server	Instrument driver / usage of special functions	Read out instrument status	Operator	As required
		Setup of instrument hardware	NIR admin	For installation and maintenance

Name	Special function	Description	User	Occurrence
SX-Server	Conveyor belt	Optimized for measurement of moving objects on a conveyor belt	NIR admin	As required
	Mix	Control end-point of mixing processes	NIR admin	As required
	Sample movement detection	Verify sample flow	NIR admin	As required

Name	Description	Typical usage	User	Occurrence
SX-Center	User interface (online/lab mode)	Recipe/product and calibration management View results (table, trend, charts, reports) Reference data management	Operator	Daily workflow (if not fully automated)
SX-Backup	Data backup scheduler	Automated backup of measurement data, results and calibrations	NIR admin	During installation

4 Transport and storage

4.1 Transport



NOTICE

Risk of breakage due to incorrect transportation

- ▶ Make sure that all parts of the instrument are safely packed in such a way as to prevent breakage, ideally in the original box.
 - ▶ Avoid sharp movements during transit.
-
- ▶ After transportation, check the instrument for damage.
 - ▶ Damage that has occurred in transit should be reported to the carrier.
 - ▶ Keep packing for future transportation.

4.2 Storage

- ▶ Make sure that the ambient conditions are complied with (see Chapter 3.6 "Technical data", page 14).
- ▶ Wherever possible, store the device in its original packaging.
- ▶ After storage, check the device for damage and replace if necessary.

5 Installation

5.1 Installation site (production)

Make sure that the installation site meets the following requirements:

- Minimum space requirements: 250 mm x 300 mm x 270 mm (W x D x H).
- At least 300 mm clearance on all sides. The clearance ensures air circulation and prevents the instrument from overheating.
- The installation point meets the specifications. See Chapter 5.5 "Establishing installation point", page 20.
- The sensor is not exposed to any external sources of heat such as direct sunlight.
- The layer thickness of the product to be measured is at least 30 mm.
- A constant product flow is ensured.
- The product flow can be directly measured.
- There is a sample removal point at a distance of < 1 m.

5.2 Installation site (laboratory)

Make sure that the installation site meets the following requirements:

- Firm, level surface.
- Minimum space requirements: 250 mm x 300 mm x 270 mm (W x D x H).
- Take into account the maximum product dimensions and weight.
- At least 300 mm clearance on all sides. The clearance ensures air circulation and prevents the sensor from overheating.
- The sensor is not exposed to any external sources of heat such as direct sunlight



NOTE

Make sure that the power supply can be disconnected at any time in an emergency.

5.3 Installation point in piping system (example)

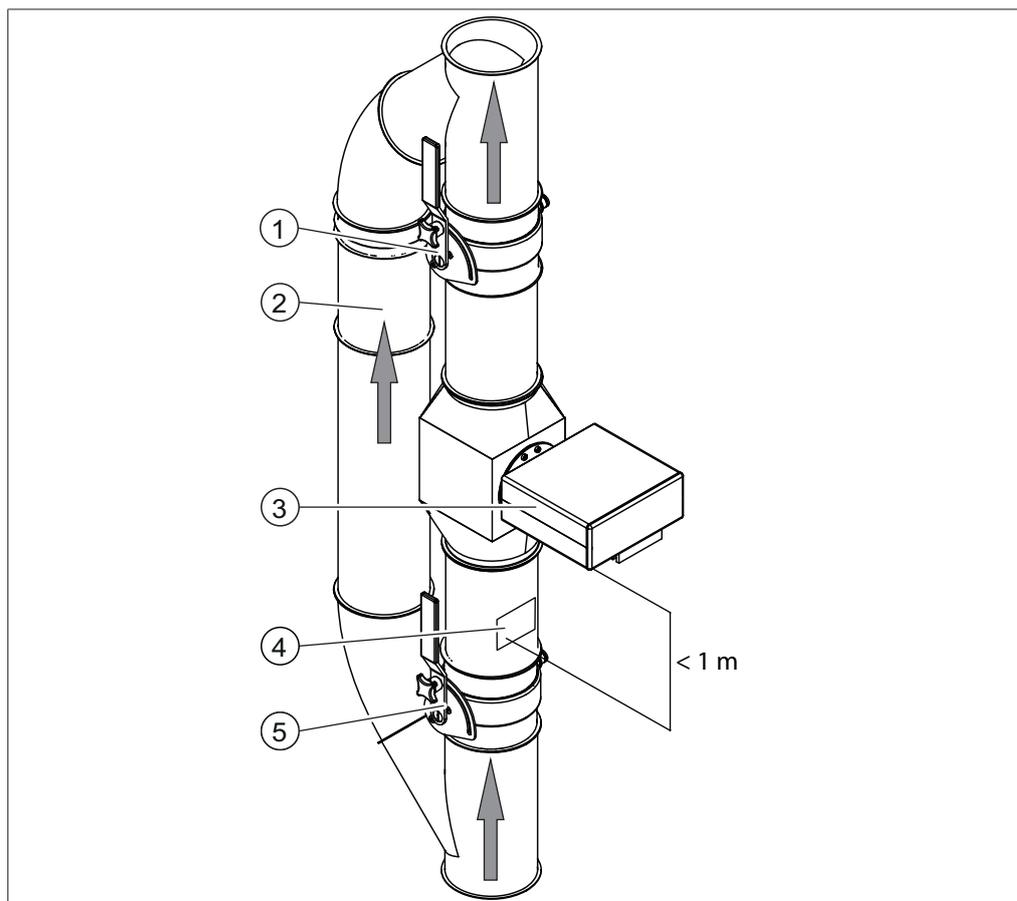
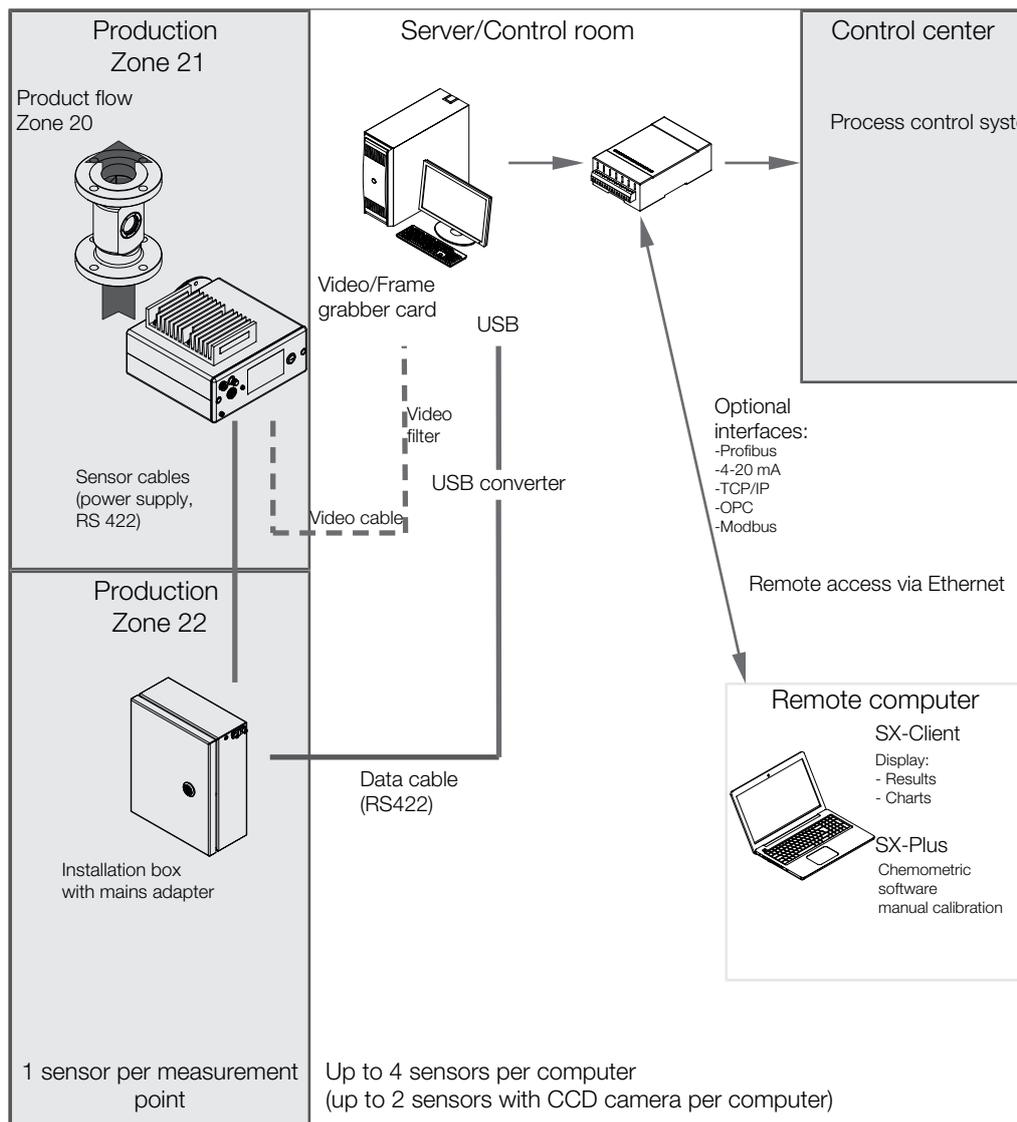


Fig. 5: Configuration

- | | | | |
|---|-----------------|---|----------------------|
| 1 | Flow restrictor | 2 | Bypass |
| 3 | Analyser | 4 | Sample removal point |
| 5 | Flow restrictor | | |

5.4 Installation (example)



5.5 Establishing installation point

The fixing points or bolts conform to M6 A2-70/7.3 Nm.

Establish the installation point according to the specified data of the flange.

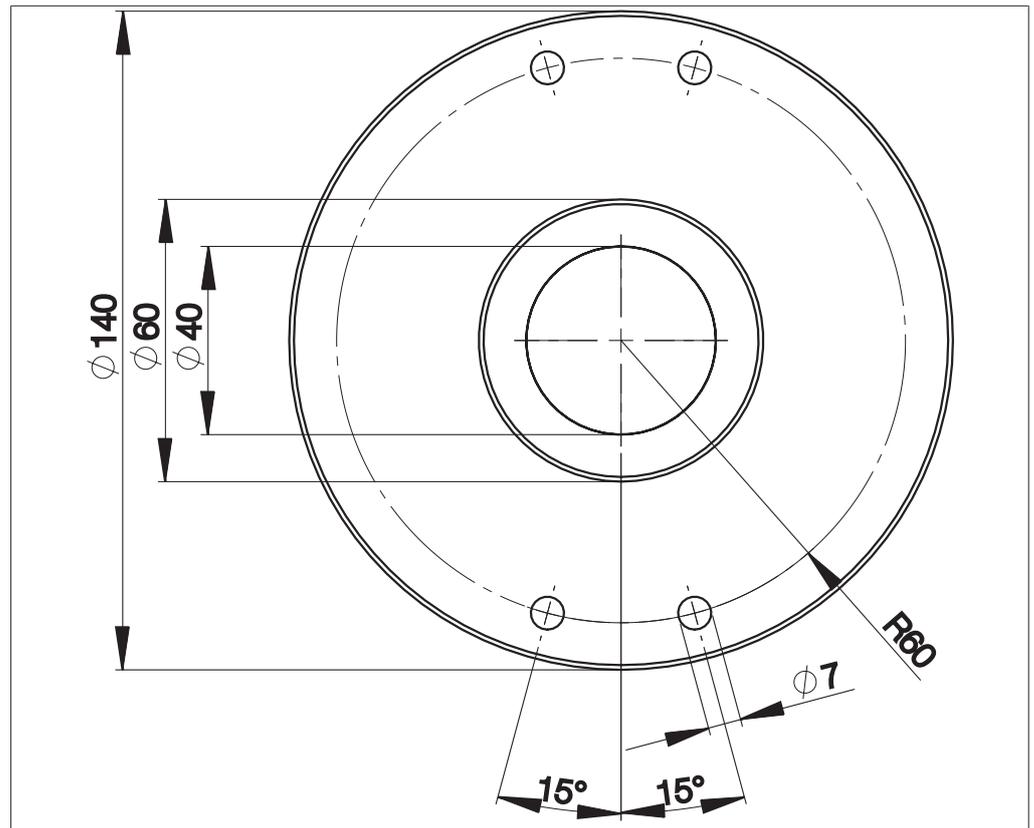


Fig. 6: Dimensions of flange

5.6 Sensor installation



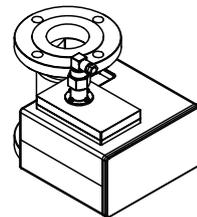
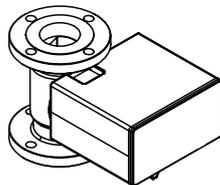
! DANGER

Use of an unsuitable flange in potentially explosive atmospheres.

The use of an unsuitable flange may cause an explosion.

- In potentially explosive atmospheres use a double flange.

The following installation positions are possible:



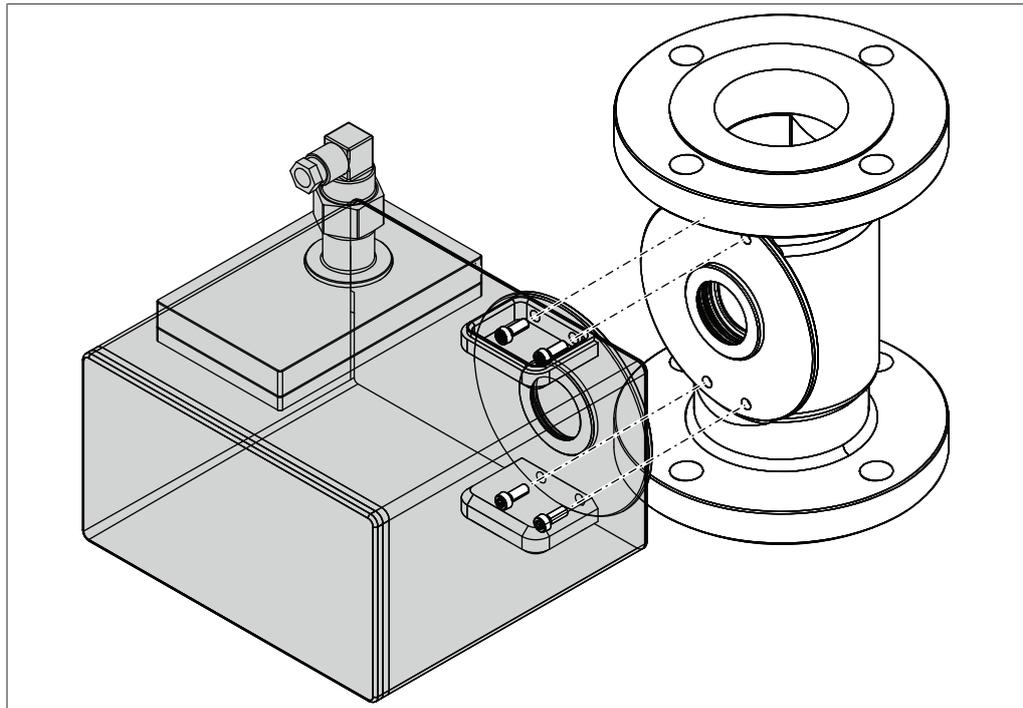


Fig. 7: Fixing sensor with screws

Tools required:

- Torque wrench, size Torx T30

Tightening torque: 8.4 Nm +-1

Precondition:

- Installation point has been established. See Chapter 5.5 "Establishing installation point", page 20.
- The fixing points or bolts conform to M6 A2-70 15 mm
- ▶ Fix the sensor to the installation point using the bolts.

5.7 Connecting the sensor

Tools required:

- Torque wrench, size 7 mm AF
- Torque wrench, size Torx T20



NOTE

Make sure that the power is not switched on when connecting the sensor.

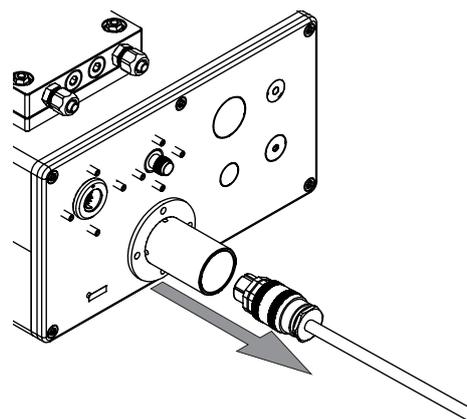


NOTE

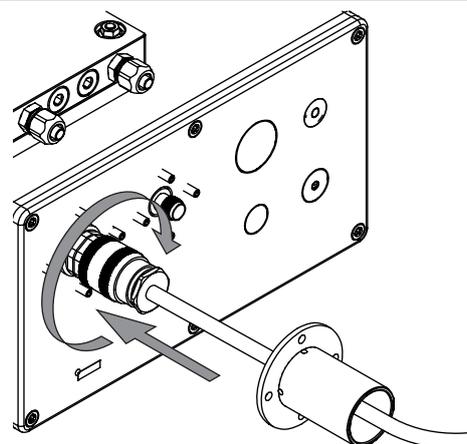
Loss of performance due to use of unsuitable device cables

Max. cable length between installation box and sensor 10 m.

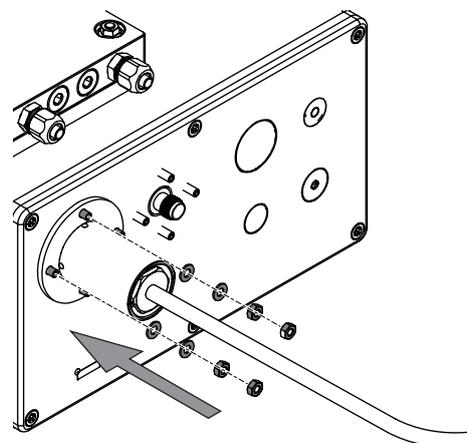
- ▶ Slide the cable guard over the connector.



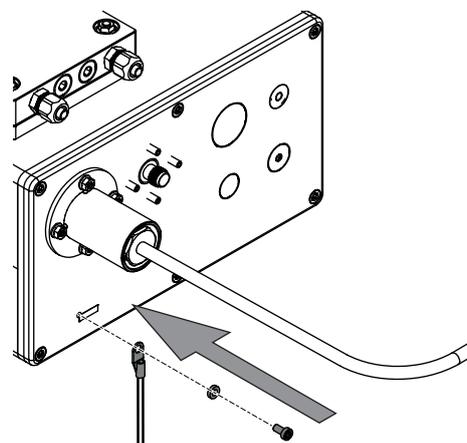
- ▶ Plug the connector into the sensor.
- ▶ Secure the connector.



- Tightening torque: $2.5 \text{ Nm} \pm 0.5$
- ▶ Fix the cable guard to the sensor.

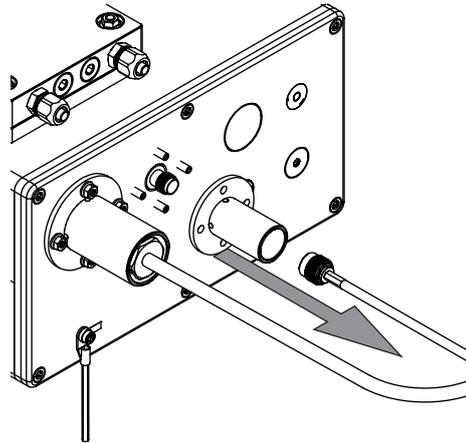


- Tightening torque: $2 \text{ Nm} \pm 0.5$
- ▶ Fix the ground cable to the sensor.

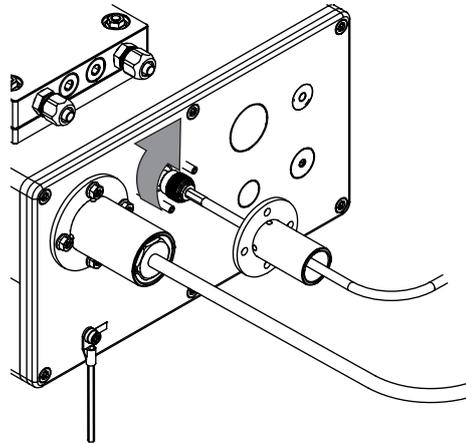


5.8 Connecting the video cable (optional accessory)

- Socket, 7 mm
- ▶ Slide the cable guard over the video cable connector.

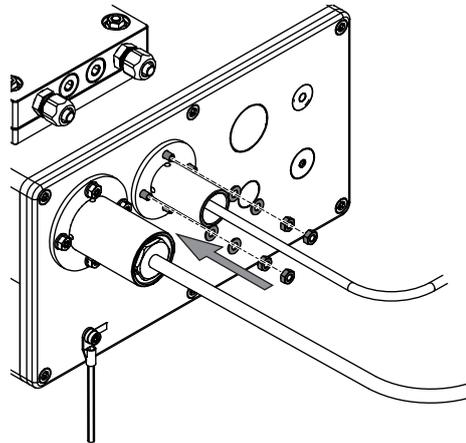


- ▶ Plug the connector into the sensor.



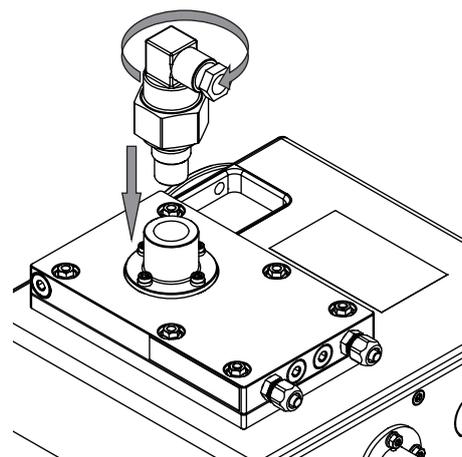
Tightening torque: $2.5 \text{ Nm} \pm 0.5$

- ▶ Fix the cable guard to the sensor.



5.9 Connecting the thermostat

- ▶ Screw the thermostat onto the bracket.



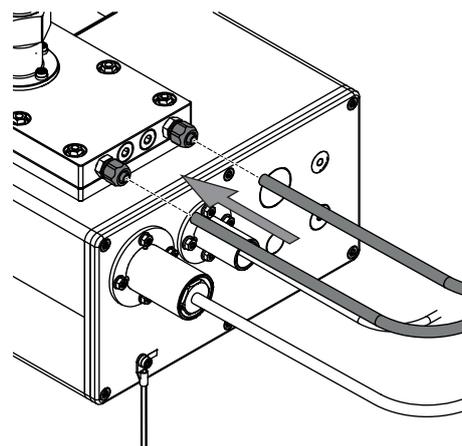
5.10 Connecting the coolant



NOTE

The coolant supply is within the specified parameters. See Chapter 3.6 "Technical data", page 14

- ▶ Connect the coolant supply to the condenser.



5.11 Establishing the electrical connection to the installation box



⚠ WARNING

Death or serious burns by electric current.

- ▶ Have the installation carried out by an electrician or a person with similar expert knowledge.
- ▶ After installation, check electrical safety.



NOTE

Observe the legal requirements when connecting the instrument to the power supply.

- ▶ Use additional electrical safety features (e.g., residual-current circuit breakers) to comply with local laws and regulations.
- ▶ Perform installation in accordance with IEC/EN 60079-14.

The power supply must fulfil the following conditions:

1. Provide the specified mains voltage and frequency.
2. Be designed for the load imposed by the instruments connected.
3. Be equipped with suitable fuses and electrical safety devices.
4. Be equipped with proper grounding.



NOTICE

Risk of property damage and diminished performance due to use of unsuitable power cables.

The power supply cables supplied with the product precisely match the requirements of the instrument. If other power cables that do not meet those requirements are used, the product may be damaged and/or its performance diminished.

- ▶ Use only the power supply cables supplied with the product or ordered separately from the manufacturer.
- ▶ If using any other power supply cables, make sure that they match the specifications on the type plate.

6 Operation

The instrument is operated via the SX-Suite software on a computer. See *SX-Suite User Manual* and *SX-Plus User Manual*.

6.1 Journal button

Pressing the button generates a journal entry.

6.2 Entering reference data in the journal

To perform a calibration and continuously check the calibration, reference data is required.

Continuous checking of the calibration is performed according to the requirements of the production process.



NOTE

The journal entry is identified by date and time.

- ▶ Press and hold the journal button for one second.
 - ⇒ The connected software creates a journal entry.
- ▶ Remove the sample at the sample removal point.
- ▶ Mark sample with date, time and sensor number.
- ▶ Carry out a laboratory analysis.
- ▶ Insert the reference data in the journal for creating the calibration model. See *SX-Suite User Manual* and *SX-Plus User Manual*

7 Cleaning and servicing



NOTE

Users may only carry out the servicing and cleaning operations described in this section.

Any servicing and repair work which involves opening up the casing may only be carried out by NIR-Online service technicians.

- ▶ Use only genuine NIR-Online consumables and spare parts in order to ensure correct operation of the device and preserve the warranty.

7.1 Regular maintenance work

Component	Action	Interval
Casing	▶ Wipe down the casing with a damp cloth.	Weekly
Warning symbols	<ul style="list-style-type: none"> ▶ Check that the warning symbols on the sensor are legible. ▶ If they are dirty, clean them. ▶ Replace damaged warning symbols. 	Weekly
Optics	<p>NOTICE! Have operation carried out by NIR-Online service technician</p> <ul style="list-style-type: none"> ▶ Replace lamps. 	Annually
Casing	<p>NOTICE! Have operation carried out by NIR-Online service technician</p> <ul style="list-style-type: none"> ▶ Check and replace seals 	Annually

8 Taking out of service and disposal

8.1 Disposal

The operator is responsible for proper disposal of the instrument.

- ▶ When disposing the equipment observe the local regulations and statutory requirements regarding waste disposal.
- ▶ When disposing, observe the disposal regulations of the materials used. Materials used see Chapter 3.6 "Technical data", page 14.

8.2 Returning the instrument

Before returning the instrument, contact the NIR-Online GmbH Service Department. service.nir-online@buchi.com and ask for an RMA number.

9 Appendix

9.1 Spare parts and accessories



NOTE

Any modifications of spare parts or assemblies are only allowed with the prior written permission of NIR-Online GmbH.

9.1.1 Accessories

	Order no.
USB-RS422 interface	11060741
Analog interface (DataLabIO)	11060742
PC video card (Frame-grabber)	11060746
PCI express, High Profile	
PC video card (Frame-grabber)	11062588
PCI express, Low Profile	
Profibus card	11063000
PCI Express, High Profile	
Profibus card	11063001
PCI Express, Low Profile	
Siemens LOGO!Power Power Supply 12,7 V	11063076

9.1.2 Spare parts specifications

Power supply



NOTICE

Risk of property damage due to incorrectly connected mains adapter

An incorrectly connected mains adapter may cause the sensor to fail.

- ▶ Make sure that the current limiter is set to more than 4.5 A.
- ▶ Make sure that the voltage is 12.7 VDC.

Specification

Power supply voltage: 100 - 240 ± 10% VAC

Rated voltage: 12.7 VDC

Rated current: ≥ 4.5A

Typical peak-to-peak residual ripple: 50 mV

Max. peak-to-peak residual ripple: 200 mV

Device cables



NOTE

Loss of performance due to use of unsuitable device cables

Max. cable length between installation box and sensor 10 m.

Sensor Cable

Pin assignment on device connector viewed from rear of instrument:

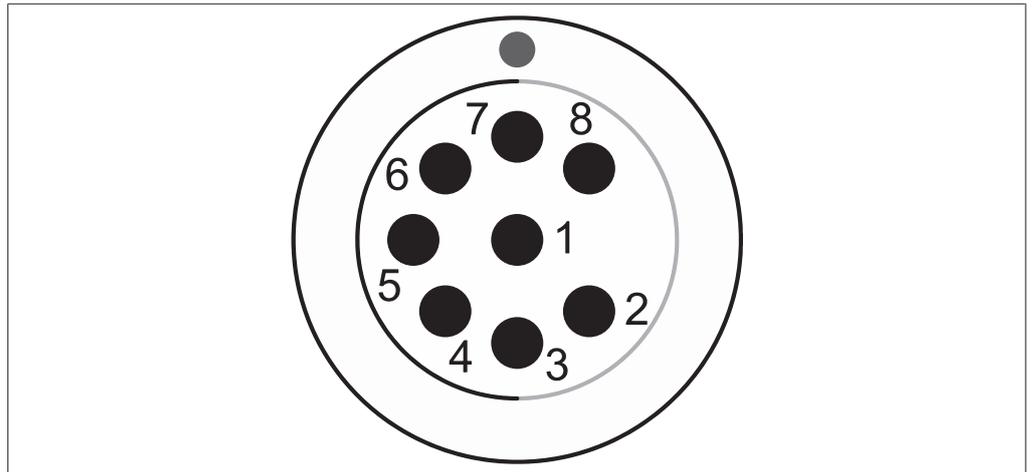


Fig. 8: Pin assignment

1	PIN 1- blue, ground	2	PIN 2- red, 12.7 VDC
3	PIN 3- green, RxD-	4	PIN 4- yellow, TxD+
5	PIN 5- white, TxD-	6	PIN 6- brown, RxD+
7	PIN 7- not connected	8	PIN 8- not connected

RS422 Data Cable

Pin assignment on the Moxa viewed from rear of the Moxa:

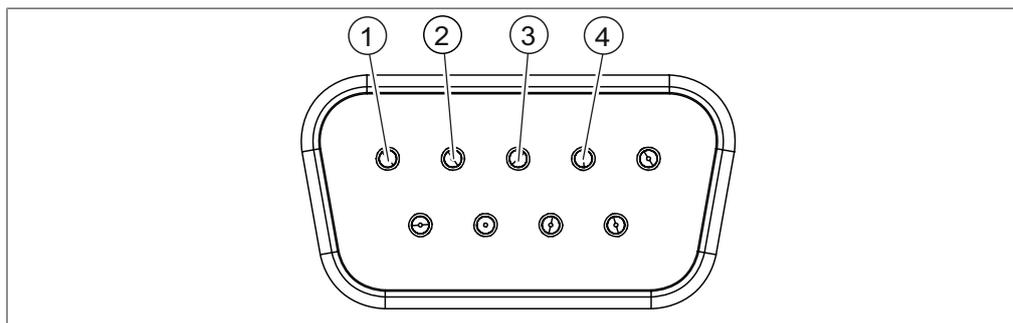


Fig. 9: Pin assignment

1	PIN 1 green, TxD- (A)	2	Pin 2 white (from green), TxD+ (B)
3	Pin 3 orange, RxD+ (B)	4	Pin 4 white (from orange). RxD- (A)

When using the supplied Moxa D-Sub 9-pole connector, swap the cables on pin 1 and 2.

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