OPERATING INSTRUCTIONS

OD7000

Displacement measurement sensor

SICK
Sensor Intelligence.

Described product

OD7000

Manufacturer

SICK AG
Erwin-Sick-Str. 1
79183 Waldkirch
Germany

Legal information

Original document

This document is an original document of SICK AG.

Contents

1 About this document

1.1 Information on the operating instructions

These operating instructions provide important information on how to use devices from SICK AG.

Prerequisites for safe work are:

- Compliance with all safety notes and handling instructions supplied.
- Compliance with local work safety regulations and general safety regulations for device applications

The operating instructions are intended to be used by qualified personnel and electrical specialists.

NOTE
Read these operating instructions carefully to familiarize yourself with the device and its functions before commencing any work.

The operating instructions are an integral part of the product. Store the instructions in the immediate vicinity of the device so they remain accessible to staff at all times. Should the device be passed on to a third party, these operating instructions should be handed over with it.

These operating instructions do not provide information on the handling and safe operation of the machine or system in which the device is integrated. Information on this can be found in the operating instructions for the machine or system.

1.2 Explanation of symbols

Warnings and important information in this document are labeled with symbols. Signal words introduce the instructions and indicate the extent of the hazard. To avoid accidents, damage, and personal injury, always comply with the instructions and act carefully.

DANGER
... indicates a situation of imminent danger, which will lead to a fatality or serious injuries if not prevented.

WARNING
... indicates a potentially dangerous situation, which may lead to a fatality or serious injuries if not prevented.

CAUTION
... indicates a potentially dangerous situation, which may lead to minor/slight injuries if not prevented.

NOTICE
... indicates a potentially harmful situation, which may lead to material damage if not prevented.

NOTE
... highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

1.3 Further information

More information can be found on the product page.

The page can be accessed via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

The following information is available depending on the product:

- Data sheets
- This document in all available language versions
- CAD files and dimensional drawings
- Certificates (e.g., declaration of conformity)
- Other publications
- Software
- Accessories

2 Safety information

2.1 Intended use

The OD7000 displacement measurement sensor is used for optical, non-contact distance determination and coating thickness measurement.

Applications

- Distance measurement
- Coating thickness measurement
- Surface measurement
- Position determination

The product can be integrated into measuring equipment or production plants via the interfaces. The product is used, for example, for autonomous monitoring and control of a production process.

The product is intended exclusively for indoor use in clean environments with stable light conditions and constant room temperature, e. g 20 °C. The measurement heads of the product are to be shielded against extraneous lighting that might influence the measurement result.

LabS compliance cannot be guaranteed for this product. So it is excluded from use in paint shops and other areas where LabS compliance is required.

SICK AG assumes no liability for losses or damage arising from the use of the product, either directly or indirectly. This applies in particular to use of the product that does not conform to its intended purpose and is not described in this documentation.

2.1.1 Use in medical technology or safety-relevant applications

The product is not intended for use in safety-related applications, nor shall it be used in any such system. If the product is used in medical technology application, ensure that the device is suitable for the application. Take into account the optical properties of the measuring object as well as temperature and vibration influences on the product itself. Check the product at regular intervals to determine if measurements are correct and if the specified measurement uncertainty is exceeded.

2.2 Improper use

Any use outside of the stated areas, in particular use outside of the technical specifications and the requirements for intended use, will be deemed to be incorrect use.

- The device does not constitute a safety component in accordance with the respective applicable safety standards for machines.
- The device must not be used in explosion-hazardous areas, in corrosive environments or under extreme environmental conditions.
- Any use of accessories not specifically approved by SICK AG is at your own risk.

WARNING
Danger due to improper use!

Any improper use can result in dangerous situations.

Therefore, observe the following information:

- Product should be used only in accordance with its intended use.
- All information in the documentation must be strictly observed.
- Shut down the product immediately in case of damage.

2.3 Cybersecurity

Overview

To protect against cybersecurity threats, it is necessary to continuously monitor and maintain a comprehensive cybersecurity concept. A suitable concept consists of organizational, technical, procedural, electronic, and physical levels of defense and considers suitable measures for different types of risks. The measures implemented in this product can only support protection against cybersecurity threats if the product is used as part of such a concept.

You will find further information at www.sick.com/psirt, e.g.:

- General information on cybersecurity
- Contact option for reporting vulnerabilities
- Information on known vulnerabilities (security advisories)

2.4 Limitation of liability

Relevant standards and regulations, the latest technological developments, and our many years of knowledge and experience have all been taken into account when compiling the data and information contained in these operating instructions. The manufacturer accepts no liability for damage caused by:

- Non-adherence to the product documentation (e.g., operating instructions)
- Incorrect use
- Use of untrained staff
- Unauthorized conversions or repair
- Technical modifications
- Use of unauthorized spare parts, consumables, and accessories

2.5 Modifications and conversions

NOTICE

Modifications and conversions to the device may result in unforeseeable dangers.

Interrupting or modifying the device or SICK software will invalidate any warranty claims against SICK AG. This applies in particular to opening the housing, even as part of mounting and electrical installation.

2.6 Requirements for skilled persons and operating personnel

WARNING

Risk of injury due to insufficient training.

Improper handling of the device may result in considerable personal injury and material damage.

- All work must only ever be carried out by the stipulated persons.

The following qualifications are required for various activities:

Table 1: Activities and technical requirements

Activities	Qualification
Mounting, maintenance	▪ Basic practical technical training ▪ Knowledge of the current safety regulations in the workplace

Activities	Qualification
Electrical installation, device replacement	■ Practical electrical training ■ Knowledge of current electrical safety regulations ■ Knowledge of the operation and control of the devices in their particular application
Commissioning, configuration	■ Basic knowledge of the computer operating system used ■ Basic knowledge of the design and setup of the described connections and interfaces ■ Basic knowledge of data transmission
Operation of the device for the particular application	■ Knowledge of the operation and control of the devices in their particular application ■ Knowledge of the software and hardware environment for the particular application

2.7 Operational safety and specific hazards

Please observe the safety notes and the warnings listed here and in other sections of this product documentation to reduce the possibility of risks to health and avoid dangerous situations.

Danger due to visible radiation is product-specific. See the technical data for more information.

CAUTION
Optical radiation: LED risk group 1, visible radiation, 400 nm to 780 nm

The LEDs may pose a danger to the eyes in the event of incorrect use.

- Do not look into the light source intentionally.
- Do not open the housing. Opening the housing will not switch off the light source. Opening the housing may increase the level of risk.
- Comply with the current national regulations on photobiological security of lamps and lamp systems.

WARNING
Electrical voltage!

Electrical voltage can cause severe injury or death.

- Work on electrical systems must only be performed by qualified electricians.
- The power supply must be disconnected when attaching and detaching electrical connections.
- The product must only be connected to a voltage supply as set out in the requirements in the operating instructions.
- National and regional regulations must be complied with.
- Safety requirements relating to work on electrical systems must be complied with.

WARNING

Risk of injury and damage caused by potential equalization currents!

Improper grounding can lead to dangerous equipotential bonding currents, which may in turn lead to dangerous voltages on metallic surfaces, such as the housing. Electrical voltage can cause severe injury or death.

- Work on electrical systems must only be performed by qualified electricians.
- Follow the notes in the operating instructions.
- Install the grounding for the product and the system in accordance with national and regional regulations.

3 Product description

3.1 Scope of delivery

Table 2: Scope of delivery

No. of units	Component	Note
1	Control unit in the type ordered	
1	Measuring head in the type ordered	The measuring range and resolution depend on the type.
1	Optical fiber	
1	Power supply unit	
1	Connection set	
1	Printed safety notes, multilingual	Brief information and general safety notes

The actual scope of delivery may differ for special designs, additional orders or due to the latest technical changes.

3.2 Product ID

3.2.1 Type label

Overview

The type labels contain information for identifying the product and control unit.

Type label of the product

The type label of the OD7000 product is located on the packaging.

Figure 1: Product type label (example)

① Manufacturer address
② Production site
③ Product identification number
④ Type designation
⑤ Test and approval marks
⑥ Serial number
⑦ Part number
⑧ Product identification number as QR code

Type label of the control unit

The type label of the control unit is located on the control unit.

Figure 2: Control unit type label (example)

① Manufacturer
② Production site
③ Product identification number
④ Type designation
⑤ Part number
⑥ Test and approval marks
⑦ MAC address
⑧ Serial number
⑨ Product identification number as QR code

3.2.2 Type code

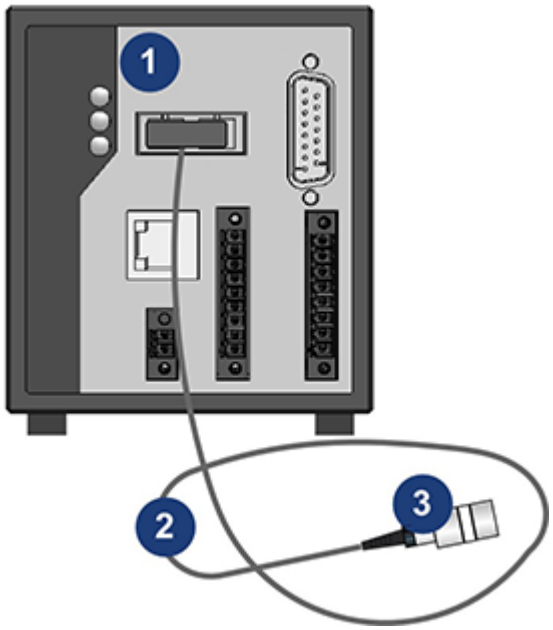
Type code structure

OD7000	–	a	bbb	ccc	d
1		2	3	4	5

Position	Description	Characteristic
1	Device family, type	OD7000: Optical distance sensor, measurement on natural objects, device family 7000
2	Optical head measurement principle	1: Chromatic
3	Measuring range	006: 600 µm, 6.2 mm ... 6.8 mm 040: 4 mm, 35.5 mm ... 39.5 mm 100: 10 mm, 64 mm ... 74 mm
4	Optical fiber	103: POF, length: 3 m
5	Interface	0: Special interface 1: Analog I/U, RS-422, encoder, Ethernet 2: RS-422, Ethernet

3.3 Product components

Overview



① Control unit
② Optical fiber
③ Measuring head

Control unit

The control unit contains the electronic and optical assemblies for evaluating the measured signals as well as the light source. The front panel contains the connection for the voltage supply, interfaces for signal transmission and device communication, status LEDs and the fiber female connector for connecting the measuring head.

Optical fiber

The control unit and the measuring head are connected with an optical fiber. This allows spatial separation of the measuring head and the control unit.

Measuring head

The measuring head does not contain any moving parts or electronic components. This prevents heat sources from affecting the accuracy and stability of the measurement.

3.4 Display and control elements

Overview

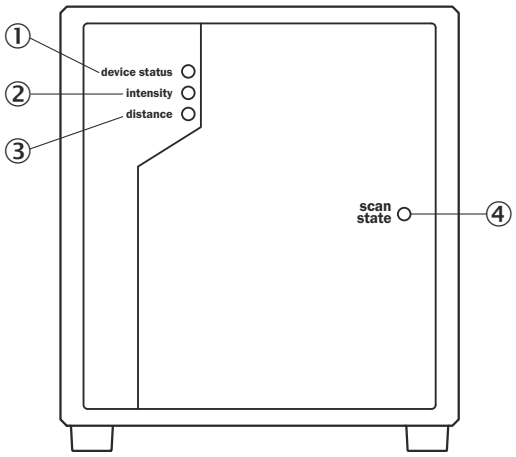


Figure 3: Status LEDs

① LED **device status**
② LED **intensity**
③ LED **distance**
④ LED **scan state** (OD7000-xxxxxxx1 only)

Status LEDs

Status LED		Color	Status
device status	○	-	Device switched off
	●	Red	Device switched on, firmware update failed
	●	Green	Device switched on, firmware configured, free-running measurement
	● ●	Blue Green	Device switched on, external trigger released When the device triggers with high frequency, the LED lights up green.
	●	Blue	Device switched on, device waiting for trigger
intensity	○	-	No signal
	✳	Red	Saturated intensity signal
	●	Red	High intensity signal
	●	Red Green (simultaneously)	Optimum intensity signal
	●	Green	Average intensity signal
	●	Blue	Weak intensity signal
distance	○	-	No signal
	✳	Red	Above the measuring range limit
	●	Red	Far range
	●	Green	Medium range
	●	Blue	Near range
	✳	Blue	Below the measuring range limit

Status LED		Color	Status
scan state [1]	●	Red	Power on, factory configuration not loaded Contact Service.
	✳	Red (fast flashing)	Factory configuration loaded To load the user configuration, wait 0.5 seconds.
	✳	Red (slowly flashing)	Factory configuration loaded, user configuration not available
	●	Blue	Factory configuration and user configuration loaded, device waiting for trigger
	●	Green	Device is measuring (free-running or triggered)
	●	Yellow	Device is waiting for forward scan (encoder trigger mode)
	●	Magenta	Device is waiting for reverse scan (encoder trigger mode)
	●	Red (flashing)	Analog output in current mode is outside the specified voltage range (e.g. open circuit).

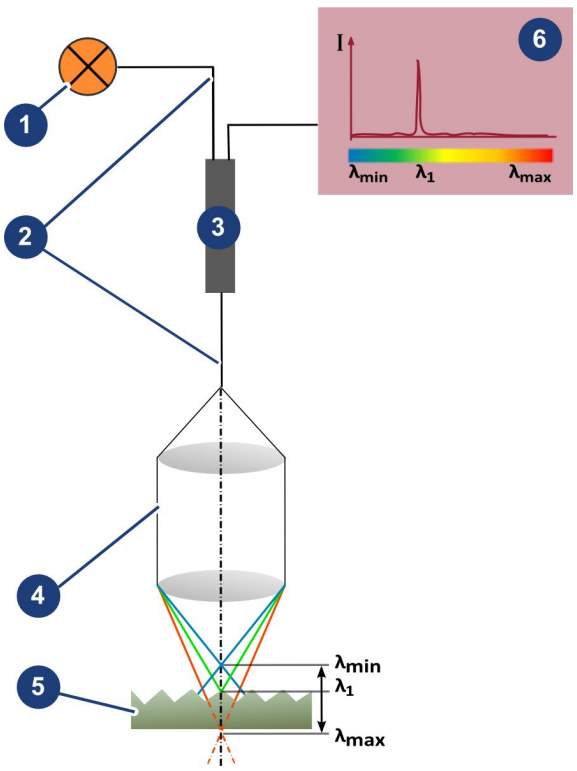
● = Lights up; ✳ = Flashes; ○ = Does not light up.

1) Only available for OD7000-xxxxxxx1.

3.5 Measurement principle

3.5.1 Chromatic confocal distance measurement

Explanation of the measurement principle



① Light source
② Optical fiber
③ Fiber coupler
④ Measuring head

⑤ Surface of the measuring object
⑥ Analysis by spectrometer

The light source emits light. The emitted light is guided through the optical fiber and a fiber coupler to the measuring head. The measuring head focuses light with a wide spectral range onto the surface of the measuring object. The light reflected from the measuring object is received by the measuring head on the reverse path and then analyzed by the spectrometer. The wavelength for which the surface is in focus is reflected to the maximum. The spectrum of the reflected light shows a distinct peak, from whose spectral position the distance to the surface is determined.

Example applications

- Topography, profile and roughness measurement (e.g. for tool surfaces)
- Position and dimension determination (e.g. for microelectronic components)
- Topography measurement on injection molded parts
- Non-contact 3D measurement technology for endoprostheses

3.5.2 Chromatic confocal coating thickness measurement

Explanation of the measurement principle

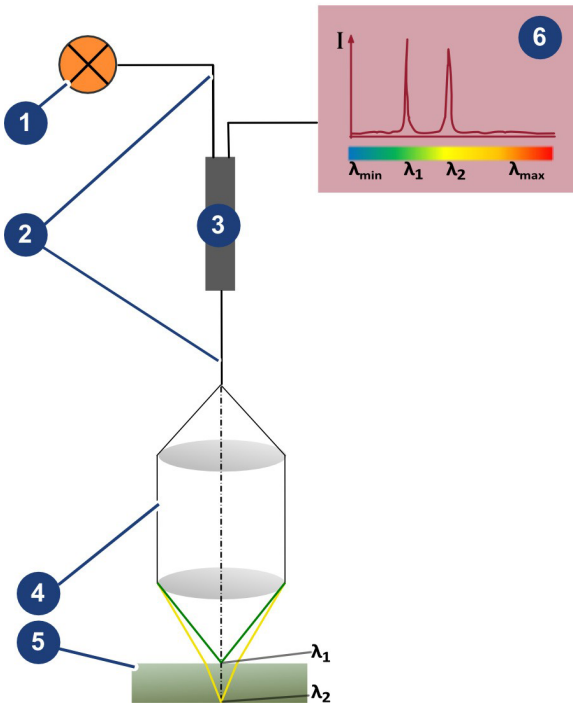


Figure 4: Measurement principle of chromatic confocal coating thickness measurement

① Light source
② Optical fiber
③ Fiber coupler
④ Measuring head
⑤ Transparent material
⑥ Analysis by spectrometer

The light source emits light. The emitted light is guided through the optical fiber and a fiber coupler to the measuring head. The measuring head focuses light with a wide spectral range onto the surface of the measuring object. The light reflected from the

measuring object is received by the measuring head on the reverse path and then analyzed by the spectrometer. If a transparent material is within the measuring range, two peaks appear in the spectrum of the reflected light. Each peak is due to reflection from one of the interfaces of the coating. The spectral distance and the refraction index of the coating material can be used to determine the coating thickness.

The coating thickness measurement of single coatings and the simultaneous measurement of different coatings in a coating system are possible.

Prerequisites for measurement

- The measured coating is transparent in the wavelength range used.
- In order for the two peaks to be distinguished in the spectrum, a minimum coating thickness is required. The minimum coating thickness depends on the measuring head used.
- Single coat: The two interfaces have a different refraction index.
- Coating system: The measured coatings have a different refraction index.

Example applications

- Coating thickness measurement of glass
- Coating thickness measurement of plastic coatings
- Coating thickness measurement of packaging films
- Measurement of transparent liquid coatings and liquid levels

3.6 Output of measured values

3.6.1 Free-running output of measured values

The device measures at regular intervals (free-running mode).

3.6.2 Triggered output of measured values

Trigger mode

In trigger mode, the measuring cycle is controlled externally. The device measures in response to external events (triggers). For example, a scan system and the device can be synchronized.

The external triggering is possible per measurement up to the measuring rate of 4000 Hz. Each of the trigger modes can be exited by a trigger command (`CTN`).

Trigger modes

- Trigger Once
- Trigger Each
- Window Trigger

Example

Triggers 1 to 6 are triggered externally. The result is returned after the exposure time.

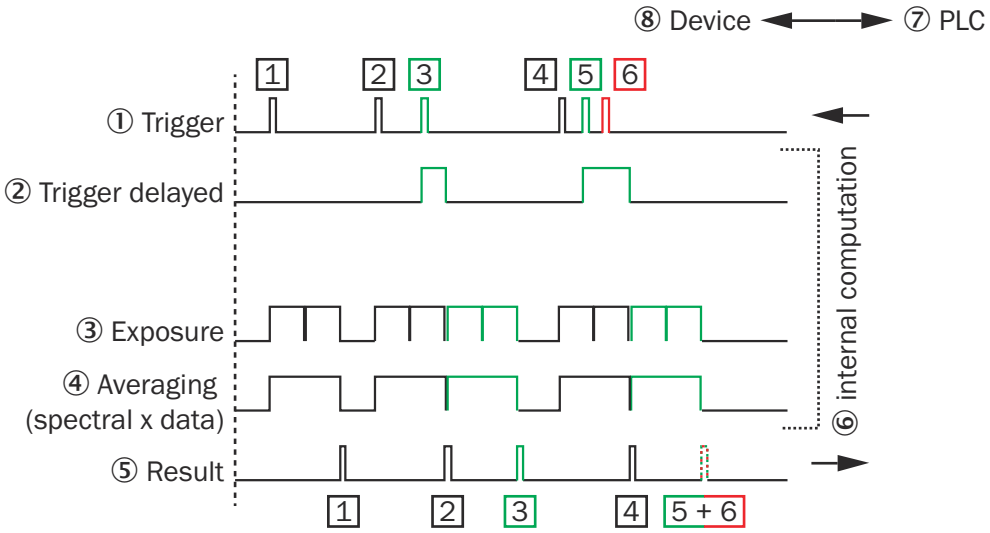


Figure 5: Digital signals over a time axis

① Trigger
② Trigger delayed
③ Exposure
④ Averaging (spectral x data)
⑤ Result
⑥ Internal data processing
⑦ PLC
⑧ Device

Table 3: Situation examples

Situation	Consequence
Trigger 3 is set while trigger 2 triggers the exposure.	After trigger 2 is processed, trigger 3 is stored and executed.
Trigger 5 is already stored, while trigger 6 is triggered.	Trigger 6 is recorded. The results of trigger 5 and 6 are output in the correct order (PLC = programmable logic controller).

3.7 Data transmission

During operation, the device continuously sends data packets via the data interfaces.

Interfaces for data transmission

- Ethernet interface
- RS422/RS232 (interface A)
- Analog output (interface B, OD7000-xxxxxx1 only)

The communication between the device and the computer is done using the dollar protocol or the binary packet protocol. The device supports up to two network connections simultaneously. Each network connection supports the dollar protocol or the packet protocol. The supported protocol can be defined by the port through which the connection is opened.

Table 4: Properties of the protocols

Dollar protocol	Packet protocol
• Available via Ethernet TCP/IP (port 7890) • Economical measured value transmission (2 bytes per measured value plus 2 byte telegram header) • Human-readable command format that allows setup and parameterization with a simple terminal program. • Optional ASCII output of measured values so that data output is readable for humans with a simple terminal program. • Real-time data output (via serial interface) • In ASCII format or binary format	• Available via Ethernet TCP/IP (port 7891) • Multi-client (2 clients per device) • Simple packet structure with reasonable packet overhead • Data packets, data format packets, command packets • Easily decodable • Easily expandable

3.8 Communication with the device

3.8.1 OD7000 Engineering Tool configuration software

OD7000 Engineering Tool

With the OD7000 Engineering Tool configuration software, you can, for example, configure the device, visualize measurements and save data via the Ethernet interface.

Further topics

- Starting the configuration software

3.8.2 DLL

The DLL can be used to connect the device to a user program. Sensor configuration, processing and transmission can be performed via the DLL. The DLL is written in C/C++ language and is intended for .NET compatible language.

3.8.3 Commands

Commands

The ASCII commands can be sent to the controller via the Ethernet interface. The device can be configured via commands. In addition, measurement data can be received and functions executed (e.g. changing the measuring rate). Configuration via commands is done with a terminal program (e.g. Tera Term, Putty). The device receives the commands via the Ethernet interface or the RS422 / RS232 interface (interface A).

Relevant commands for configuration

Command	Description
SODX	Select data for transmission
SHZ	Select measuring rate
AAL	Set exposure
LAI	Set lamp intensity
AVD, AVM ,AVS	Define averaging of the measurement data
SRI, ABE , SRT	Make material settings
THR	Define thresholds
DWD	Set detection window
IPCN , BDR	Make communication settings
SFD	Resetting to factory settings

Command	Description
DRK, FDK	Perform dark balance
SEN	Select calibration table (selection of the associated measuring head)

Complementary information

- Protocol and command reference with information on commands and communication protocols, available at www.sick.com/8027510

3.9 Encoder interface

Overview

The encoder interface is only available on the OD7000-xxxxxxx1 product type.

Encoder interface

The device communicates with encoders to detect position changes. Precise location coordinates are assigned to the measured values.

Further topics

- Connection diagram
- Setting up the encoder counter
- Integrating encoder signals

3.10 Connection example

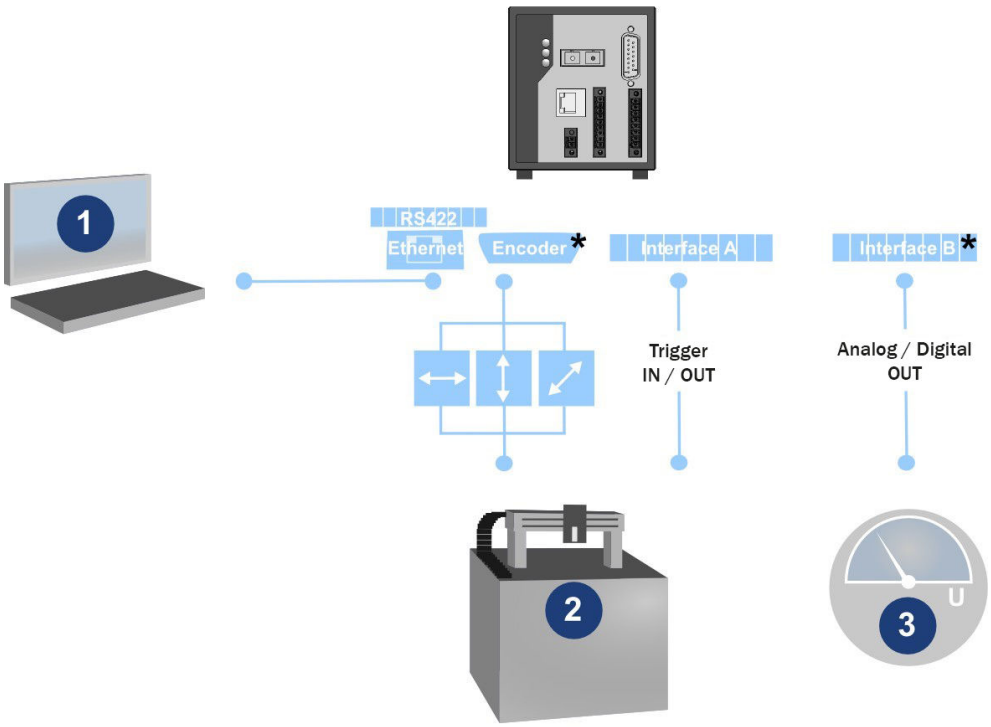


Figure 6: Connection example

* OD7000-xxxxxxx1 only
① Computer
② Shifting table
③ Analog output

A computer obtains the measurement data via the data interfaces (Ethernet, RS422/RS232). A DLL is used to communicate with the device. Encoder positions, e.g. from a shifting table, are read in via the encoder input. The encoder positions enable the precise assignment of measuring points to axis positions. Measured values are output as analog voltage via the analog output (interface B).

4 Transport and storage

4.1 Transport

NOTICE
Damage due to improper transport!

- The product must be packaged with protection against shock and damp.
- Recommendation: Use the original packaging.
- Note the symbols on the packaging.
- Do not remove packaging until immediately before you start mounting.

4.2 Unpacking

- To protect the device against condensation, allow it to equilibrate with the ambient temperature before unpacking if necessary.
- Handle the device with care and protect it from mechanical damage.
- To avoid ingress of dust and water, only remove the protective elements, e.g. protective caps of the electrical connections just before attaching the connecting cable.

4.3 Transport inspection

Immediately upon receipt in Goods-in, check the delivery for completeness and for any damage that may have occurred in transit. In the case of transit damage that is visible externally, proceed as follows:

- Do not accept the delivery or only do so conditionally.
- Note the scope of damage on the transport documents or on the transport company's delivery note.
- File a complaint.

NOTE
Complaints regarding defects should be filed as soon as these are detected. Damage claims are only valid before the applicable complaint deadlines.

4.4 Storage

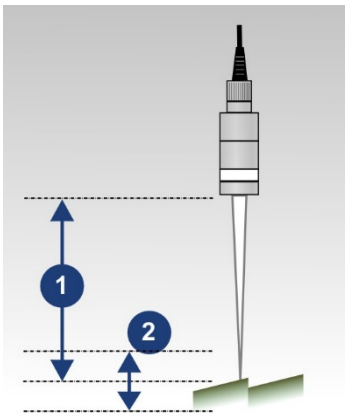
- Electrical connections are provided with a protective cap.
- Do not store outdoors.
- Store in a place protected from moisture and dust.
- Recommendation: Use the original packaging.
- To allow any residual dampness to evaporate, do not package in airtight containers.
- Do not expose to any aggressive substances.
- Do not store in or near strong magnet fields (e.g. permanent magnet or strong alternating field).
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: see "Technical data", page 55.
- Relative humidity: see "Technical data", page 55.
- For storage periods of longer than 3 months, check the general condition of all components and packaging on a regular basis.

5 Mounting

5.1 Mounting instructions

- Observe the technical data.
- Protect the sensor from extraneous light sources that may affect the measurement result.
- To prevent condensation, avoid exposing the device to rapid changes in temperature.
- The mounting site has to be designed for the weight of the device.
- Observe ambient temperature and air humidity, see "Technical data", page 55.
- Do not cover air holes on top and bottom of device.
- Do not stack devices on top of each other.
- Mount the device in a dry, dust-free location.
- To ensure air circulation, maintain minimum distances, see "Minimum distances during mounting", page 25.
- To prevent fluctuations in measured values, make sure that the device and the measured object are not exposed to vibrations when measuring distances. This effect is negligible for coating thickness measurements.

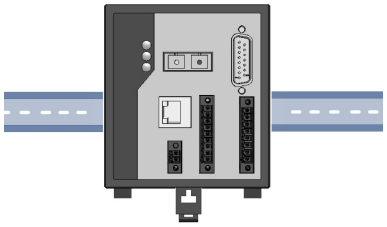
5.2 Working distance and measuring range



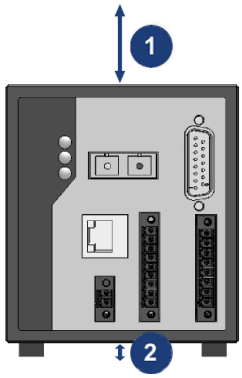
① Working distance
② Measuring range

5.3 Installation types

Installation type	Illustration	Note
Desktop device		The thread on the underside of the device is used for optional tightening.

Installation type	Illustration	Note
Mounting rail		The bracket for mounting rail installation can be ordered as an optional accessory, see "Accessories", page 61.

5.4 Minimum distances during mounting



① 50 mm

② 6 mm, corresponds to the height of the feet

5.5 Mounting device

Approach

1. Set up the device as a tabletop device or mount it on a mounting rail, taking into account the mounting instructions and dimensions.
2. Connect the measuring head.
3. Make the electrical connection.
4. Switch on the voltage supply.

✓ The status LED lights up after successful initialization. The device is ready for use.

Further topics

- Mounting instructions
- Installation types
- Connecting measuring head
- Connecting device electrically
- Connecting voltage supply

5.6 Connecting measuring head

Important information

NOTICE
Damage to the optical fiber

The optical fiber is sensitive to mechanical stress. A dirty fiber end produces increased stray light and impairs measurement capability.

- Handle the optical fiber with care.
- For transport and storage, screw the supplied protective caps onto the fiber ends.
- Observe minimum bend radius of 30 mm.
- Do not touch the fiber ends.
- Ensure that the exposed fiber end does not touch the thread of the measuring head when connecting.
- If the fiber end is contaminated or has been touched, follow the cleaning instructions, see "Cleaning", page 47.

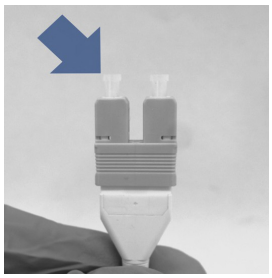
Prerequisites

- The device is set up or mounted.

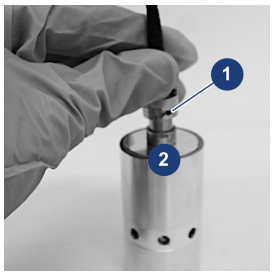
Approach

1. Remove the protective cap on the measuring head.

2. Remove the protective cap from both ends of the optical fiber.



3. Place the bayonet lock of the fiber male connector onto the fiber female connector on the measuring head.
4. Connect the parts by turning them in opposite directions.



① Bayonet coupling
② Fiber female connector

5. Close the bayonet lock as far as it will go.
6. Attach the measuring head to the desired location.
   - Ensure that the measuring object is within the working distance.
   - Align the measuring head perpendicular to the measuring object.
7. Connect the fiber female connector to the control unit.
   - Fold up the protective flap on the fiber female connector with one finger.
   - Connect the optical fiber.

✓ The male connector snaps into place with a clicking sound.
8. To remove the male connector, press the release on the connector. Carefully pull the male connector out of the female connector.

6 Electrical installation

6.1 Wiring instructions

NOTE

Pre-assembled cables can be found on the product page.

The page can be accessed via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

NOTICE

Faults during operation and defects in the device or the system

Incorrect wiring may result in operational faults and defects.

- Follow the wiring notes precisely.

Only use shielded cables with a length of < 30 m for data transmission.

The enclosure rating stated in the technical data is achieved only with a screwed plug connector or protective cap.

Connect the connecting cables in a de-energized state. Do not switch on the supply voltage until installation is complete and all connecting cables are connected to the device and control.

6.2 Prerequisites for safe operation of the device

WARNING

Risk of injury and damage caused by electrical current!

As a result of equipotential bonding currents between the device and other grounded devices in the system, faulty grounding of the device can give rise to the following dangers and faults:

- Dangerous voltages are applied to the metal housings.
- Devices will behave incorrectly or be destroyed.
- Cable shielding will be damaged by overheating and cause cable fires.

Remedial measures

- Only skilled electricians should be permitted to carry out work on the electrical system.
- If the cable insulation is damaged, disconnect the voltage supply immediately and have the damage repaired.
- Ensure that the ground potential is the same at all grounding points.
- Where local conditions do not meet the requirements for a safe earthing method, take appropriate measures. For example, ensure low-impedance and current-carrying equipotential bonding.

The device is connected to the peripheral devices (any local trigger sensor(s), system controller) via shielded cables. The cable shield – for the data cable, for example – rests against the metal housing of the device.

The device can be grounded through the cable shield or through a blind tapped hole in the housing, for example.

If the peripheral devices have metal housings and the cable shields are also in contact with their housings, it is assumed that all devices involved in the installation have the **same ground potential**.

This is achieved by complying with the following conditions:

- Mounting the devices on conductive metal surfaces
- Correctly grounding the devices and metal surfaces in the system
- If necessary: low-impedance and current-carrying equipotential bonding between areas with different ground potentials

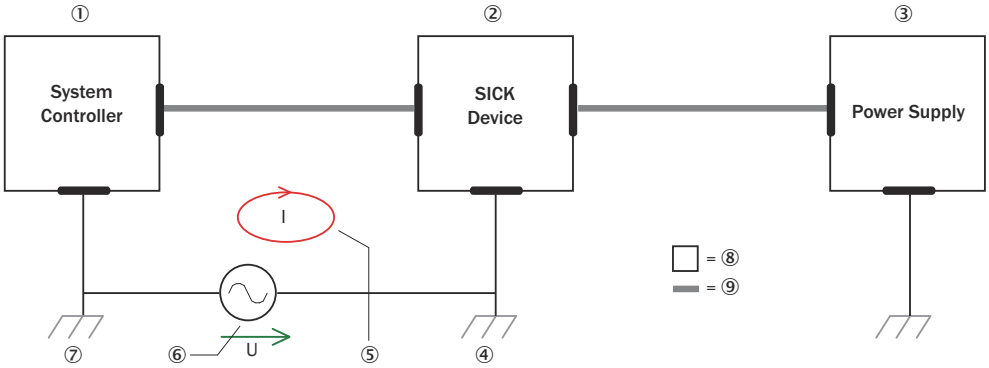


Figure 7: Example: Occurrence of equipotential bonding currents in the system configuration

① System controller
② Device
③ Voltage supply
④ Grounding point 2
⑤ Closed current loop with equalizing currents via cable shield
⑥ Ground potential difference
⑦ Grounding point 1
⑧ Metal housing
⑨ Shielded electrical cable

If these conditions are not fulfilled, equipotential bonding currents can flow along the cable shielding between the devices due to differing ground potentials and cause the hazards specified. This is, for example, possible in cases where there are devices within a widely distributed system covering several buildings.

Remedial measures

The most common solution to prevent equipotential bonding currents on cable shields is to ensure low-impedance and current-carrying equipotential bonding. If this equipotential bonding is not possible, the following solution approaches serve as a suggestion.

NOTICE

We expressly advise against opening up the cable shields. This would mean that the EMC limit values can no longer be complied with and that the safe operation of the device data interfaces can no longer be guaranteed.

Measures for widely distributed system installations

On widely distributed system installations with correspondingly large potential differences, the setting up of local islands and connecting them using commercially available **electro-optical signal isolators** is recommended. This measure achieves a high degree of resistance to electromagnetic interference.

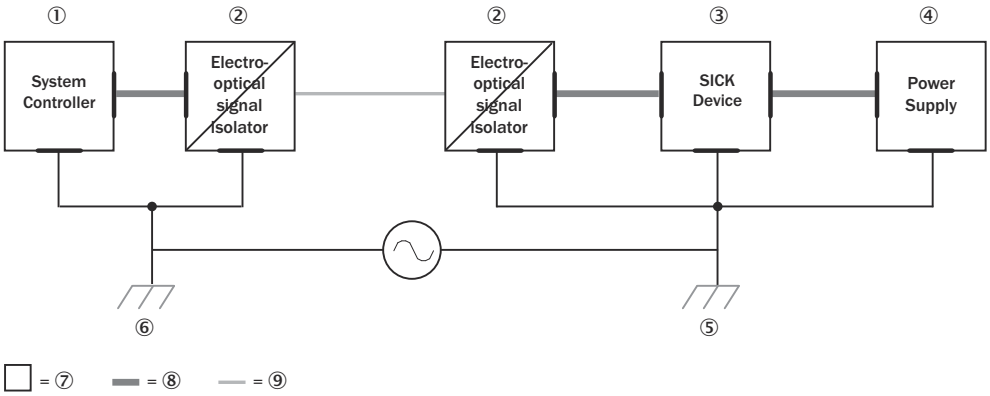


Figure 8: Example: Prevention of equipotential bonding currents in the system configuration by the use of electro-optical signal isolators

① System controller
② Electro-optical signal isolator
③ Device
④ Voltage supply
⑤ Grounding point 2
⑥ Grounding point 1
⑦ Metal housing
⑧ Shielded electrical cable
⑨ Optical fiber

The use of electro-optical signal isolators between the islands isolates the ground loop. Within the islands, a stable equipotential bonding prevents equalizing currents on the cable shields.

Measures for small system installations

For smaller installations with only slight potential differences, insulated mounting of the device and peripheral devices may be an adequate solution.

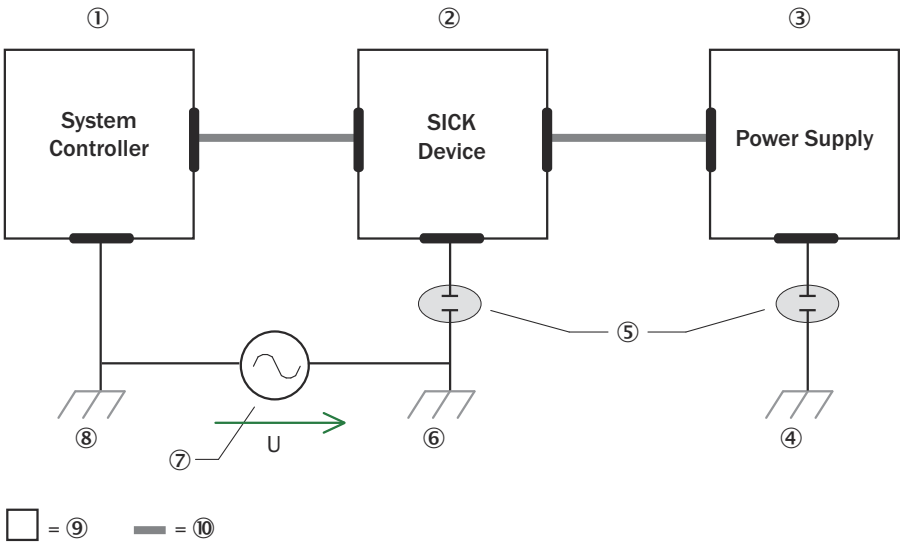


Figure 9: Example: Prevention of equipotential bonding currents in the system configuration by the insulated mounting of the device

① System controller
② Device
③ Voltage supply

④ Grounding point 3
⑤ Insulated mounting
⑥ Grounding point 2
⑦ Ground potential difference
⑧ Grounding point 1
⑨ Metal housing
⑩ Shielded electrical cable

Even in the event of large differences in the ground potential, ground loops are effectively prevented. As a result, equalizing currents can no longer flow via the cable shields and metal housing.

NOTICE
The voltage supply for the device and the connected peripheral devices must also guarantee the required level of insulation.
Under certain circumstances, a tangible potential can develop between the insulated metal housings and the local ground potential.

6.3 Connection diagram

NOTE
The recommended connecting cables and their associated technical data can be found on the online product page.
The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**
{P/N} corresponds to the part number of the product, see type label.
{S/N} corresponds to the serial number of the product, see type label (if indicated).

Interface A

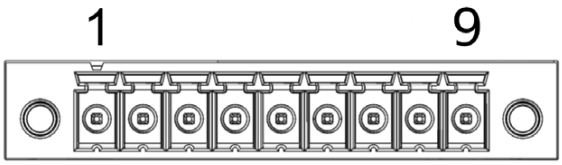


Figure 10: Terminal strip, 9-pin

Contact	Signal	Function
1	RS-232 TX/RS-422 TX-	Sender RS-232 / RS422 -
2	RS-232 RTS/RS-422 TX+	Sender RS-232 / RS422 +
3	RS-232 CTS/RS-422 RX-	Receiver RS-232 / RS422 -
4	RS-232 RX/RS-422 RX+	Receiver RS-232 / RS422 +
5	GND	Weight
6	SYNC-IN	Trigger input
7	SYNC-OUT	Trigger output
8	Spare	Spare
9	GND	Weight

Interface B

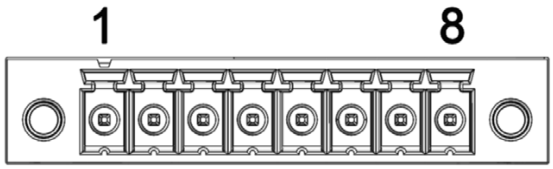


Figure 11: Terminal strip, 8-pin

Contact	Signal	Function
1	Digital IN 0 (reserve)	Digital input IN 0
2	Digital IN 1 (reserve)	Digital input IN 1
3	Digital OUT 0 (reserve)	Digital output OUT 0
4	Digital Out 1 (reserve)	Digital output OUT 1
5	GND (= voltage supply GND = housing GND)	Ground (= ground supply voltage = ground housing)
6	Analog GND (isolated)	Ground analog output (isolated)
7	Analog OUT 0	Analog output OUT 0
8	Analog OUT 1	Analog output OUT 1

Encoder

The device supports the operation of up to three encoder channels. The electrical encoder interface consists of three differential input pairs (An+, An- / Bn+, Bn-) with 120 Ohm termination. The voltage difference between positive and negative inputs must be greater than ± 0.2 V. This corresponds to the RS422 standard.

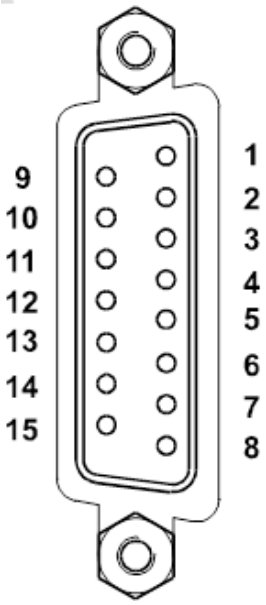


Figure 12: Male connector, 15-pin

Contact	Signal	Input (= I), Output (= O), Power (= P)
1	Axis 0; A+	I
2	Axis 0; B+	I
3	Axis 1; A+	I

Contact	Signal	Input (= I), Output (= O), Power (= P)
4	Axis 1; B+	I
5	Encoder GND (= voltage supply GND = housing GND)	-
6	Axis 2; A+	I
7	Axis 2; B+	I
8	AUX in; +	I
9	Axis 0; A-	I
10	Axis 0; B-	I
11	Axis 1; A-	I
12	Axis 1; B-	I
13	Axis 2; A-	I
14	Axis 2; B-	I
15	AUX in; -	-

6.4 Connecting device electrically

Important information

NOTICE
Observe the wiring instructions, see "Wiring instructions", page 28.

Approach

1. Ensure the voltage supply is not connected.
2. Connect the device according to the connection diagram.
3. To secure the male connectors, tighten the screws.
4. Connect the cable to the periphery.

Further topics

- Connection diagram

6.5 Connecting voltage supply

Prerequisites

- The device is set up or mounted.
- The device is electrically connected.
- If the device is brought from a cold to a warm environment, wait until the cold device has reached room temperature. Depending on air humidity and room temperature, this process can take up to three hours.
- Use a suitable separate power supply unit, see "Mechanics/Electronics", page 55.

Approach

1. To establish the voltage supply, connect the control unit to the power supply unit.
2. To secure the male connector, tighten the screws.

✓ The **device status** LED lights up green.

3. Before starting a measurement, check the device settings (e.g. measuring rate, averaging). Reconfigure the device if necessary.

7 Commissioning

7.1 Starting the configuration software

Prerequisites

- OD7000 Engineering Tool software
  The latest version of the OD7000 Engineering Tool software is available for download from the product page.
  The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**
  {P/N} corresponds to the part number of the product, see type label.
  {S/N} corresponds to the serial number of the product, see type label (if indicated).
- Computer with Windows 10 or higher operating system
- Computer with OD7000 Engineering Tool software installed
- Ethernet cable

Approach

1. Connect the communication interface of the device to the computer.
2. Switch on computer.
3. Supply the device with voltage.

✓ After successful initialization, the **device** status LED lights up green. The device is ready for use.

4. Start OD7000 Engineering Tool.
5. Search for the device by IP address (default: 192.168.170.4).
6. Select measuring head.
7. Select application.

✓ The user interface for configuring and operating the device opens.

7.2 Configuration steps

Overview

The following steps show an example of how the initial configuration of the device for a specific measuring task can look. Some parameters have to be optimized in the course of measurements.

Configuration steps

1. Set **measuring rate**.
2. Set **lamp intensity**.
3. Adjust **material settings** if necessary.
4. Adjust other **measurement settings**.
5. Set interface parameters.
6. Save the configuration.

7.3 Configuring the device

7.3.1 Measuring rate

Overview

The measuring rate defines how often measured values are acquired during a certain period of time. At a measuring rate of 4,000 Hz, for example, 4,000 measured values are acquired every second.

Setting the measuring rate

Preset measuring rates can be selected in 1 Hz steps. The measuring rate must be selected as an integer value in the range supported by the device.

The greater the measuring rate, the shorter the exposure time. The amount of light per measurement is lower.

The smaller the measuring rate, the longer the exposure time. The amount of light per measurement is higher. The detector is exposed for a longer time. Due to the longer exposure time, any stray light that may occur has a greater influence on the measurement result. If too much light is reflected, detector overdrive occurs. Increase the measuring rate in case of overdrive.

Setting	Application
Increase measuring rate	Perform many measurements per time unit, e.g. to measure highly reflective surfaces.
Reduce measuring rate	Even weakly reflective surfaces can be measured accurately.

Configuration with the OD7000 Engineering Tool

The measuring rate can be set in the **Measurement settings** window. To check the settings, open the spectrum in the **Alignment** menu.

Spectrum	Setting recommendation
The peak in the spectrum does not have a sharp peak, but is cut off at the top.	The detector is overdriven. Increase measuring rate.
The peak in the spectrum is too weak. The peak is difficult to distinguish from the noise.	Reduce measuring rate.

Configuration with commands

Command: `SHZ`

Example

Input	Action
`SHZ 40`	Sets the measuring rate of the device in Hz.
`SHZ ?`	Returns the current measuring rate.

7.3.2 Exposure settings

Exposure settings

Different exposure settings are available to account for surfaces with different reflective behavior.

The device can automatically adjust the amount of light during measurement.

Configuration with commands

Command: `AAL`(**Auto adapt light source**)

Example

Input	Action
`AAL 1 50`	Activates the automatic adjustment of the light source. Sets the target saturation level to 50%.
`AAL 0`	Deactivates automatic adjustment of the light source.

7.3.3 Lamp intensity

Overview

The effective brightness of the light source can be adjusted via the lamp intensity. Depending on the type of device, this is done by changing the intensity of the light source or the exposure time of the detector.

Setting the lamp intensity

Set the lamp intensity to less than 100% only if overdriving cannot be avoided by increasing the measuring rate. If a highly reflective surface is being measured where overdrive still occurs even at the highest measuring rate, reduce the exposure time.

The feedback of the device indicates the proportion of the exposure time in the measuring cycle time. A target value of 100% therefore cannot always be achieved.

Configuration with commands

Command `LAI`

Example

Input	Action
`LAI 80`	Sets the effective brightness of the light source to 80%.
`LAI ?`	Queries the lamp intensity.

7.3.4 Averaging

Overview

A freely selectable number of individual measurements can be summarized and the average value calculated from them. This averaged value is displayed and, if necessary, transmitted via the interfaces. Whether averaging is useful depends on the current measuring task and must be determined individually.

Examples: When does averaging make sense?

- Minimize noise.
- Reduce the influence of vibrations.
- Reduce measuring rate.

Setting the averaging

When averaging measured values, it is defined how many measured values are averaged before output. Averaging of measured values is recommended when the shape of the peak, but not its position, is stable.

A moving average of the measured values is used to smooth the data series.

Spectrum averaging specifies the number of spectra that are averaged. Averaging spectra is recommended when individual points of the peak are noisy or the shape of the peak varies. This can be caused by low light conditions.

If averaging of measured values and spectra are activated, then the averaging of spectra is performed first, then the averaging of measured values.

Averaging reduces the output rate according to the filter setting.

NOTE
Example

Measuring rate = 40 Hz, average value = 4, output rate = 10 Hz

To switch off averaging, select the value 1 (default setting). Invalid measured values, e.g. if the quality is too low, are not included in averaging.

Configuration with the OD7000 Engineering Tool

Averaging of measured values: In the **Measurement settings** window, define the **Data average** parameter.

Moving average of the measured values: In the **Measurement settings** window, specify the **Moving average** parameter.

Averaging of spectra: In the **Measurement settings** window, define the **Spectra averaging** parameter.

Configuration with commands

Commands

- `AVD` (averaging of measured values)
- `AVM` (Moving average of the measured values)
- `AVS` (averaging of spectra)

Example

Input	Comment
`AVD 5`	Averaging over 5 measuring objects
`AVM 10`	Moving average filter over 10 data samples
`AVS 5`	Averaging over 5 spectra
`AVS 7`	Returns the current number of averaged spectra.

7.3.5 Material settings

Overview

When measuring coating thicknesses, the optical properties of the material must be taken into account. Depending on the type of material measured, the light refracts differently at the interfaces.

Important information

NOTE
Only relevant for coating thickness measurements.

Material settings

Material settings for correction of the measurement result

- Refraction index
- Abbe number
- Refraction index table

The refraction index of transparent materials is not a constant in the visible wavelength range. The curve of the refraction index can be approximated well enough by specifying an average refraction index and the Abbe number.

The Abbe number describes the refraction of light depending on the wavelength (dispersion) of a transparent medium in relation to the refraction index. A small Abbe number represents a strong dispersion. A large Abbe number represents low dispersion. An Abbe number of 0 deactivates the dispersion model.

Alternatively, refraction index tables can be used to calculate the actual coating thickness.

Configuration with commands

Commands

- SRI (refraction index)
- ABE (Abbe number)
- SRT (refraction index table)

Example

Input	Action
SRI 1.2 1.3 2.1	Sets the refraction index for three coatings.
ABE 0 155 32.5	Sets the Abbe number for three coatings.

7.3.6 Detection threshold

Overview

The detection threshold sets the sensitivity of the peak detection algorithm.

Setting the detection threshold

The configured threshold value must be low enough to detect a peak. However, it must be high enough so that no noise signals are unintentionally evaluated as data.

Peaks that are below the set detection threshold are considered invalid and discarded. When the threshold is set high, noise and other weak peaks are not detected as peaks.

For a given measuring head, the intensity depends on the reflectivity of the examined surface, the slope of the surface, the exposure time of the detector, and the lamp intensity.

Configuration with commands

Command: THR (detection threshold)

Example

Input	Action
THR 30	Sets the detection threshold to 30.
THR ?	Returns the current value.

7.3.7 Detection window

Overview

Detection windows are used to select peaks to be included in the measurement. Detection windows are used to blank out unwanted signals.

Setting the detection window

The detection window function can be switched on and off. If the detection window function is switched off, the detection window extends over the entire measuring range.

Detection windows can be newly created. Up to 16 detection windows are possible within the measuring range. In addition, left and right edges of individual detection windows can be defined. The margins are specified in µm.

Configuration with commands

Commands

- LMA (activation and deactivation of the detection window function)
- DWD (creation of detection windows, definition of borders)

Example

Input	Action
`DWD 0 190.3 200.5 612.4 745 822.4`	Defines three detection windows.
`DWD ?`	Returns the currently active detection windows.
`LMA 1`	Activates detection window.
`LMA ?`	Returns the current status of the detection windows (0 = deactivated, 1 = active).

7.3.8 Analog output

Overview

The following information is only relevant for OD7000-xxxxxxx1.

The analog output converts the specified measured value limits into voltage values for a signal. The upper and lower measured value limits in µm are assigned to the corresponding voltage values. The analog output can be used, for example, to tap measured values as analog voltage.

Setting the analog output

The device has two analog outputs that can be configured individually. During configuration, the desired analog output, the measured value limits and the voltage range can be specified. If the limit values are set, the measured values between the limit values are output as voltage values. Thus, even a very small measuring span of e.g. 10 µm is output with high resolution.

A time span (error suppression time) can be set. The time span indicates how long the last valid measured value is held until a new valid measured value arrives. In addition, a voltage (substitute value) can be specified. If measured values of the source signal are invalid for longer than the specified time period, the voltage (substitute value) is output.

Configuration with commands

Command `ANAX`

Example

Input	Action
`ANAX 0 256 0 1000 0 10 -1 1000`	The distances 0 µm to 1,000 µm are transmitted as 0 V to 10 V at output 0. If no valid result is measured during 1,000 µs, the last valid voltage is replaced by -1 V.
`ANAX 0 ?`	Queries the settings of the first analog output channel.
`ANAX 1 ?`	Queries the settings of the second analog output channel.
`ANAX ?`	Provides a complete list of all settings for both channels.

Further topics

- Connection diagram

7.3.9 Communication via Ethernet

Setting the TCP/IP interface

The device is automatically detected via an Ethernet network (broadcast mode). To assign a fixed IP address to the device, set the IP address and subnet mask. In addition, the packet size can be set in a range of values from 1,500 to 9,000. If there is a DHCP server on the network, select DHCP-sClient. The device thus automatically receives the IP configuration.

Configuration with commands

Command `IPCN`

Example

Input	Action
`IPCN 0 192 168 170 2 255 255 255 0 1600`	Turns off the DHCP client. Sets IP address, subnet mask, and packet size.
`IPCN 1`	Selects DHCP-sClient. The device thus automatically receives the IP configuration.
`IPCN ?`	Returns the current communication settings.

7.3.10 Communication via RS-422 and RS-232

Configuring the RS422 and RS232 interface

For the RS-422 and RS-232 interfaces, the transmission rate and the hardware handshaking can be set.

Configuration with commands

Command `BDR`

Example

Input	Action
`BDR 115200 1`	Selects the baud rate (115200) and enables the hardware handshake.
`BDR ?`	Returns the current communication settings via the RS4222/RS232 interface.

7.3.11 Setting up the encoder counter

Setting the encoder counters

The encoder counters of the encoder channels can be set and queried.

Pulse counting mode

If a single encoder signal (**A_X**, **B_X** or **SYNC-IN**) is selected as the source of the counter signal, the counter is in pulse counting mode.

The counter increments with both the positive and negative pulse edges. Bit 0 of the counter value reflects the status of the input. If the input signal is logically LOW, the counter reading is always odd. If the signal is logically HIGH, the counter reading is always even. The status of the input can be monitored in this way.

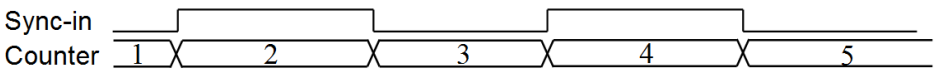


Figure 13: Example, SYNC-IN as source of counter signal for encoder counter 0 (ENC 0 1 10)

Quadrature counting mode

The quadrature counting mode is set by default. In quadrature counting mode, the phase shift between the square wave signals at A and B determines whether the counter is incremented or decremented.

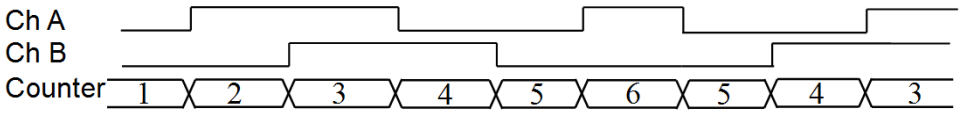


Figure 14: Example, quadrature signal at encoder channel 0 (ENC 0 1 15)

Configuration with commands

`ENC` (set up encoder counter)

7.3.12 Integrating encoder signals

Setting the encoder signals

Encoder count values can be monitored as signals included in the data telegram. Output data can be selected.

Table 5: Signal IDs of the encoder counters

ID	Signal	Data format	Description
65	Start_PositionX	int 32 bit	Encoder position X at start of exposure
66	Start_PositionY	int 32 bit	Encoder position Y at beginning of exposure
67	Start_PositionZ	int 32 bit	Encoder position Z at beginning of exposure

Configuration with commands

Command: `SODX` (selection of output data)

Example

Input	Action
`SODX 256 257 65 66`	Selects the peak 1 position (256) and the intensity (257) as well as the encoder count values of the X-axis and Y-axis at the beginning of the exposure. This means that, for each measurement, the axis position is transmitted at the time of the measurement.

7.3.13 Selection of data for transmission

Setting data transmission

During operation, the device continuously sends data packets with the measurement data. Transmissions can be selected. The selected data is included in the data telegram.

Example

Table 6: Example

Input	Comment
SODX 256 257	Selects distance 1 (=256) and intensity 1 (=257) included in the output.
SODX ?	Queries the currently active signal IDs.

Configuration with commands

Command SODX

Complementary information

- Protocol and command reference with information on the selection of the measured values and the underlying signal IDs, available at www.sick.com/8027510

Further topics

- Data transmission

7.3.14 Saving user-specific parameters

Important information

NOTICE
Loss of configuration data
Settings of the device are not saved automatically.

► Save settings made manually.

Approach

► Before ending the configuration, save changed settings in the non-volatile data memory of the device.
✓ When restarting, the last saved settings are loaded.

Configuration with commands

Command: SSU (saving the configuration in the non-volatile data memory)

Example

Input	Action
SSU	Saves the current settings in the non-volatile data memory (no argument supported).

7.3.15 Reset to factory settings

Configuration with commands

The command SFD resets all device parameters to the factory settings. The only exception is network settings. If no argument or "0" is specified together with the command SFD , the network settings are not reset. Only command SFD 1 also resets network settings.

Example

Input	Action
SFD	Resets the parameters except for the network settings to the factory settings.

Input	Action
SFD 0	Resets the parameters except for the network settings to the factory settings.
SFD 1	Resets the parameters including the network settings to the factory settings.

8 Operation

8.1 Positioning measuring head

Important information

NOTICE
Damage to the measuring head
The optical components in the measuring head can be damaged by incorrect handling.

- Do not twist the upper and lower halves of the measuring head against each other.
- To fasten the measuring head, only hand-tighten the clamping screw.

Prerequisites

- The device is connected.
- The measuring head is connected.

Approach

1. Align the measuring head perpendicular to the measuring object.
2. When using a clamping device: Clamp the measuring head.
3. Gradually change the distance from the measuring head to the measuring object until the intensity is maximum (coarse adjustment).
4. Find the point on the measuring object with the smallest distance to the measuring head.
5. Check the spectrum. Change the distance of the measuring head so that the peak is at the left end of the spectrum (fine adjustment).

✓ The measuring head is positioned at the correct working distance.
✓ If the measuring position is changed, valid distance values are measured.

Further topics

- Working distance and measuring range

8.2 Performing dark balance

Overview

Even if there is currently no sample within the measuring range, the detector of the device receives signals. These signals are generated by stray light in the fiber coupler, reflections from the fiber connectors, ambient light, and noise from the detector. The higher the intensity of these dark signals, the more the measuring capability of the device is limited.

The influence of the dark signals can be minimized by a dark balance. A dark calibration is performed at the factory for each device before delivery. However, the dark balance must also be performed by the user in certain situations.

When must a dark adjustment be performed by the user?

- Before new measuring tasks
- After changing the measuring head
- After changing the optical fiber
- In case of unusual measurement results, e.g. due to contaminated fiber ends

The dark balance value depends on different factors e.g. light source, spectrometer or condition of the optical fibers. Therefore, no guideline value can be given that must not be exceeded during dark calibration.

Prerequisites

- The device is connected.
- The operating temperature of the device has been reached. The warm-up time is approx. 30 minutes, depending on the ambient temperature.
- The measuring head is connected.
- The measuring head is positioned.

Approach

1. Make sure that the measuring head is not pointed at a light source.
2. Ensure that there are no objects within twice the working distance along the measuring beam.
3. Ensure that little stray light enters the measuring head. To do this, cover the measuring head with dark paper, for example. If this is not possible for constructive reasons, point the measuring head into the void.
4. Perform the dark balance using command `DRK` .

✓ Command `DRK` returns the current virtual measuring rate.

5. If the value obtained is very high, clean the fiber face.

Further topics

- Dark balance reports too much stray light, see "General faults, warnings, and errors", page 52.
- Cleaning

8.3 Performing chromatic confocal distance measurement

Important information

NOTE
The described procedure refers to point measurements. To perform surface measurements, move the measuring head over the surface with appropriate measuring equipment. In this way, a surface is assembled from individual measurements.

Prerequisites

- The device is configured correctly (e.g. measuring rate, lamp intensity).
- The correct chromatic measuring head is used.

Approach

1. Check whether the measuring head is positioned correctly.
2. In the OD7000 Engineering Tool: Select the desired signal. Track the measurement.
3. Adjust parameters if necessary.
   Typical parameter adjustments for chromatic confocal distance measurement:
   - Measuring rate
   - Lamp intensity
   - Detection threshold
   - Detection window

Further topics

- Positioning measuring head
- Chromatic confocal distance measurement

8.4 Performing chromatic confocal coating thickness measurement

Important information

NOTE
The described procedure refers to point measurements. To perform surface measurements, move the measuring head over the surface with appropriate measuring equipment. In this way, a surface is assembled from individual measurements.

Prerequisites

- The device is configured correctly (e.g. measuring rate, lamp intensity).
- The material settings are configured.
- The correct number of peaks is set. The peak count can be set e.g. with the command `NOP` .
- The correct chromatic measuring head is used.

Approach

1. Check whether the measuring head is positioned correctly.
2. In the OD7000 Engineering Tool: Select the desired signal. Track the measurement.
3. Adjust parameters if necessary.
   Typical parameter adjustments for chromatic confocal coating thickness measurement:
   - Measuring rate
   - Lamp intensity
   - Detection threshold
   - Detection window

Further topics

- Material settings
- Positioning measuring head
- Chromatic confocal coating thickness measurement
- Limits of chromatic confocal coating thickness measurement, see "General faults, warnings, and errors", page 52

9 Maintenance

9.1 Maintenance plan

During operation, the device works maintenance-free.

Depending on the assignment location, the following preventive maintenance tasks may be required for the device at regular intervals:

Table 7: Maintenance plan

Maintenance work	Interval	To be carried out by
Check device and connecting cables for damage at regular intervals.	Depends on ambient conditions and climate.	Specialist
Clean the optical fiber and measuring head.	Depends on ambient conditions and climate.	Specialist
Check the screw connections and plug connectors.	Depends on the place of use, ambient conditions or operating requirements. Recommended: At least every 6 months.	Specialist
Check that all unused connections are sealed with protective caps.	Depends on ambient conditions and climate. Recommended: At least every 6 months.	Specialist

9.2 Cleaning

NOTICE
Equipment damage due to improper cleaning.

Improper cleaning may result in equipment damage.

- Only use recommended cleaning agents and tools.
- Never use sharp objects for cleaning.

► If the usual measuring sensitivity is not achieved with known measuring objects or if incorrect measurements occur, check the front lens on the measuring head and the optical fiber ends and clean them if necessary.

9.2.1 Clean optical fiber with cleaning rod

Important information

NOTICE
Use only dry and unused cleaning rods.

NOTICE
There is an anti-reflective coating on the fiber end and on the front lens of the measuring head which is damaged by chemical reaction.

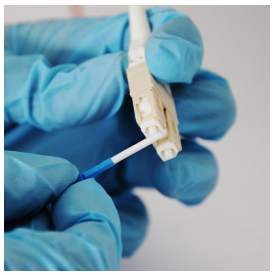
► Do not use aggressive solvents for cleaning.

Prerequisites

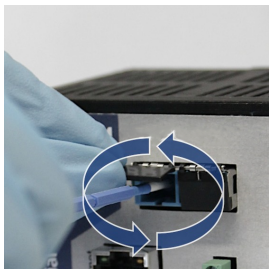
- The supply voltage is switched off.
- Required tools are available.
  Auxiliary equipment required
  - Cleaning sticks, see "Accessories", page 61
  - Soft, lint-free cloth
  - Ethanol
  - If necessary, pressurized can or bellows
  - Gloves if necessary

Approach

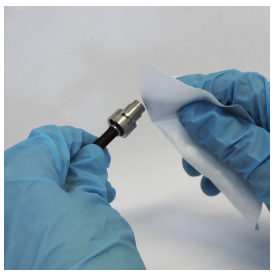
1. At the device end of the optical fiber: Remove the protective caps from the fiber ends.
2. At the device end of the optical fiber: Clean the fiber end with the cleaning rod.



3. Insert the white end of the cleaning rod into the fiber junction box on the control unit.
4. Rotate the cleaning rod once around its axis.



5. Remove the cleaning rod.
6. At the measuring head end of the optical fiber: Remove dust with a clean, grease-free and dry gas from a pressurized can or bellows.
7. At the measuring head end of the optical fiber: Clean grease from the fiber end with a lint-free cloth moistened with ethanol.



9.2.2 Clean optical fiber with cleaning pin

Important information

NOTICE
There is an anti-reflective coating on the fiber end and on the front lens of the measuring head which is damaged by chemical reaction.

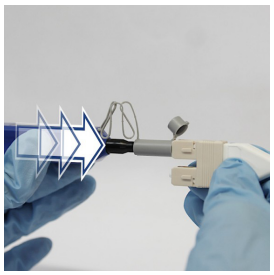
► Do not use aggressive solvents for cleaning.

Prerequisites

- The supply voltage is switched off.
- Required tools are available.
  Auxiliary equipment required
  - Cleaning sticks, see "Accessories", page 61
  - Soft, lint-free cloth
  - Ethanol
  - If necessary, pressurized can or bellows
  - Gloves if necessary

Approach

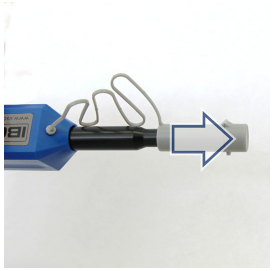
1. To clean the fiber ends, open the cover on the guide cap of the cleaning pin.
2. At the device end of the optical fiber: Remove the protective caps from the fiber ends.
3. At the device end of the optical fiber: Place the cleaning pin on the fiber connection.



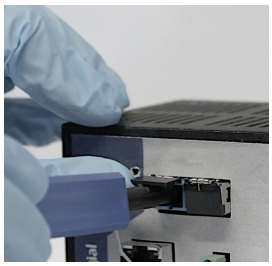
4. Press the cleaning pin in the direction of the fiber until firm resistance is felt.

✓ A clicking sound is audible.
✓ The optical fiber can be heard.

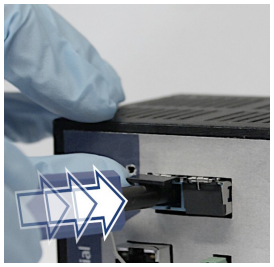
5. To clean the fiber junction box, remove the guide cap on the cleaning pin.



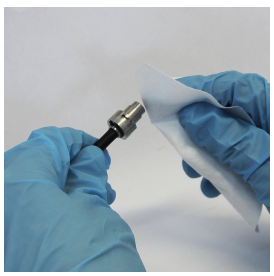
6. Fold up the protective flap of the fiber junction box.
7. Place the cleaning pin on the fiber junction box.



8. Press the cleaning pin in the direction of the control unit until firm resistance is felt.



✓ A clicking sound is audible.
✓ The fiber junction box is cleaned.
9. At the measuring head end of the optical fiber: Remove dust with a clean, grease-free and dry gas from a pressurized can or bellows.
10. Clean grease from the fiber end with a lint-free cloth moistened with ethanol.



9.2.3 Cleaning measuring head

Important information

NOTICE
There is an anti-reflective coating on the fiber end and on the front lens of the measuring head which is damaged by chemical reaction.

► Do not use aggressive solvents for cleaning.

Prerequisites

- Supply voltage is switched off.
- Required tools are available.
  Auxiliary equipment required
  - Soft, lint-free cloth
  - Ethanol
  - If necessary, pressurized can or bellows
  - Gloves if necessary

Approach

Removing dust

► Clean the measuring head with clean, grease-free and dry gas from a pressurized can or bellows. To avoid residues on the optical surface or accidental contact, keep the pressurized can or bellows at a distance from the measuring head.

Removing grease

1. Dampen a soft, lint-free cloth with ethanol.
2. Carefully wipe the optical surface with the moistened cloth. Do not press too hard.

10 Troubleshooting

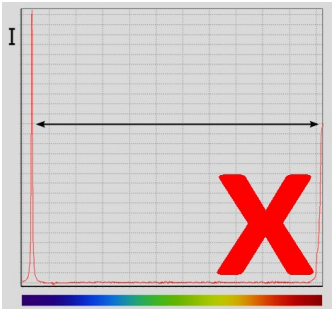
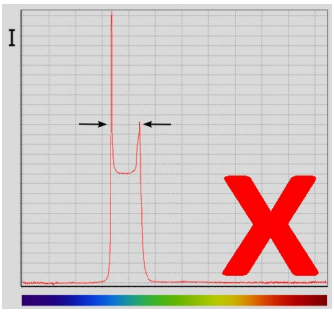
10.1 General faults, warnings, and errors

Possible faults and corrective actions are described in the table below for troubleshooting. In the case of faults that cannot be rectified using the information below, please contact the SICK Service department. To find your agency, see the final page of this document.

NOTE
To help us to resolve the matter quickly, please note down the details on the type label.

Table 8: Warning and error messages

Question or status	Possible cause	Troubleshooting
LEDs do not light up.	Supply voltage is switched off.	Check the supply voltage.
The **device status** LED lights up red.	A voltage of 10 V is exceeded at the analog output in current mode (e.g. due to an open circuit).	Check wiring to the controller, see "Electrical installation", page 28.
Dark balance reports too much stray light.	Measuring head or optical fiber is contaminated.	Check measuring head and optical fiber for contamination and clean if necessary, see "Cleaning", page 47.
	Measuring head or optical fiber is defective.	Check the measuring head and optical fiber for damage. Replace if necessary.
Device does not display a valid measurement.	Device is overdriven.	Increase measuring rate or decrease lamp intensity, see "Measuring rate", page 34 and "Lamp intensity", page 36.
	Detection window is set incorrectly.	Check detection window settings, see "Detection window", page 38.
	Measuring object is outside the focus range.	Position the measuring object in the measuring range, see "Positioning measuring head", page 44.
	Measuring head is too slanted in relation to the measuring surface.	Change angle between measuring object and measuring head, see "Positioning measuring head", page 44.
	Measuring head is not or improperly connected.	Check the connection of the measuring head, see "Connecting device electrically", page 33
	Threshold intensity is too high.	Reduce threshold.
	Measuring rate for measuring object is too high or lamp intensity is too low.	Reduce measuring rate or increase lamp intensity, see "Measuring rate", page 34 and "Lamp intensity", page 36.
	Quality of measurement results is too poor.	Perform dark balance, see "Performing dark balance", page 44.
	Sample is not transparent for the wavelength range used.	Check the transparency of the sample.

Question or status	Possible cause	Troubleshooting
Coating thickness measurement is not possible.	The coating thickness to be measured is greater than the measuring range of the measuring head used. A peak is outside the measuring range. 	Ensure that both peaks are within the measuring range. Reposition the measuring object in the measuring range if necessary, see "Positioning measuring head", page 44.
	The coating thickness to be measured is too small. The peaks are too close together. 	Ensure that the minimum distance between peaks is at least half the height of the smaller peak. Reposition the measuring object in the measuring range if necessary, see "Positioning measuring head", page 44.
Displayed measured values fluctuate strongly or more than usual.	Dark value is not current.	Perform dark balance, see "Performing dark balance", page 44.
	Vibrate the measuring object or measuring head.	Check the measuring system as well as the measuring head and measuring object holder for possible interference.
	There is another unexpected coating in the measuring range. The measured value of this coating is recognized as valid at the selected threshold and measuring window.	• Adjust measurement window. • Change thresholds. • Remove the interfering coating or change the working distance so that the interfering coating is no longer measured.
Device does not send any measured values via the interface.	Command `STO` is sent.	Send command `STA`. Then save the configuration with the command `SSU`.
Display of the measured coating thickness does not match the expected value.	Refraction index is set incorrectly.	Adjust refraction index, see "Material settings", page 37.
	Additional, unwanted coating is in the beam path.	Check if there are coats between the measuring object and other coatings that are measured.
Device settings are lost each time the device is switched off.	Configuration is not saved in the non-volatile data memory.	Save user-specific parameters, see "Saving user-specific parameters", page 42.

10.2 Repairs

Repair work on the device may only be performed by qualified and authorized personnel from SICK AG. Interruptions or modifications to the device by the customer will invalidate any warranty claims against SICK AG.

10.3 Returns

- ► Only send in devices after consulting with SICK Service.
- ► The device must be sent in the original packaging or an equivalent padded packaging.

NOTE

To enable efficient processing and allow us to determine the cause quickly, please include the following when making a return:

- Details of the contact person
- Description of the application
- Description of the fault that occurred

10.4 Disposal

CAUTION

Risk of injury due to hot device surface.

The surface of the device can become hot.

- Before performing work on the device (e.g. mounting, cleaning, disassembly), switch off the device and allow it to cool down.
- Ensure good dissipation of excess heat from the device to the surroundings.

If a device can no longer be used, dispose of it in an environmentally friendly manner in accordance with the applicable country-specific waste disposal regulations. Do not dispose of the product along with household waste.

NOTICE

Danger to the environment due to improper disposal of the device.

Disposing of devices improperly may cause damage to the environment.

Therefore, observe the following information:

- Always observe the national regulations on environmental protection.
- Separate the recyclable materials by type and place them in recycling containers.

11 Technical data

NOTE

The relevant online product page for your product, including technical data, dimensional drawing, and connection diagrams, can be downloaded, saved, and printed from the Internet.

The page can be accessed via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

Please note: This documentation may contain further technical data.

11.1 Mechanics/Electronics

Supply voltage V_S	DC 24 V ± 10% With separate power supply unit: AC 100 V ... 240 V, 50 Hz ... 60 Hz
Power consumption	4 W
Warm-up time [1]	30 minutes
Connection type	OD7000-xxxxxxx2: • 1 female connector, RJ-45 • 1 terminal strip, 9-pin
	OD7000-xxxxxxx1: • 1 female connector, RJ-45 • 1 multipoint connector, 9-pin • 1 multipoint connector, 8-pin • 1 multipoint connector, 15-pin
Display	OD7000-xxxxxxx**2**: 3 Status LEDs
	OD7000-xxxxxxx**1**: 4 Status LEDs
Weight	500 g
Dimensions of control unit (W x H x D)	95 mm x 106 mm x 95 mm
Optical fiber length	3 m
Enclosure rating	IP 20 (IEC 60529)
Protection class	III (IEC 61140)
Electrical safety	IEC 61010

1) Depending on the ambient temperature.

11.2 Dimensional drawing

11.2.1 OD7000-xxxxxxx2 control unit

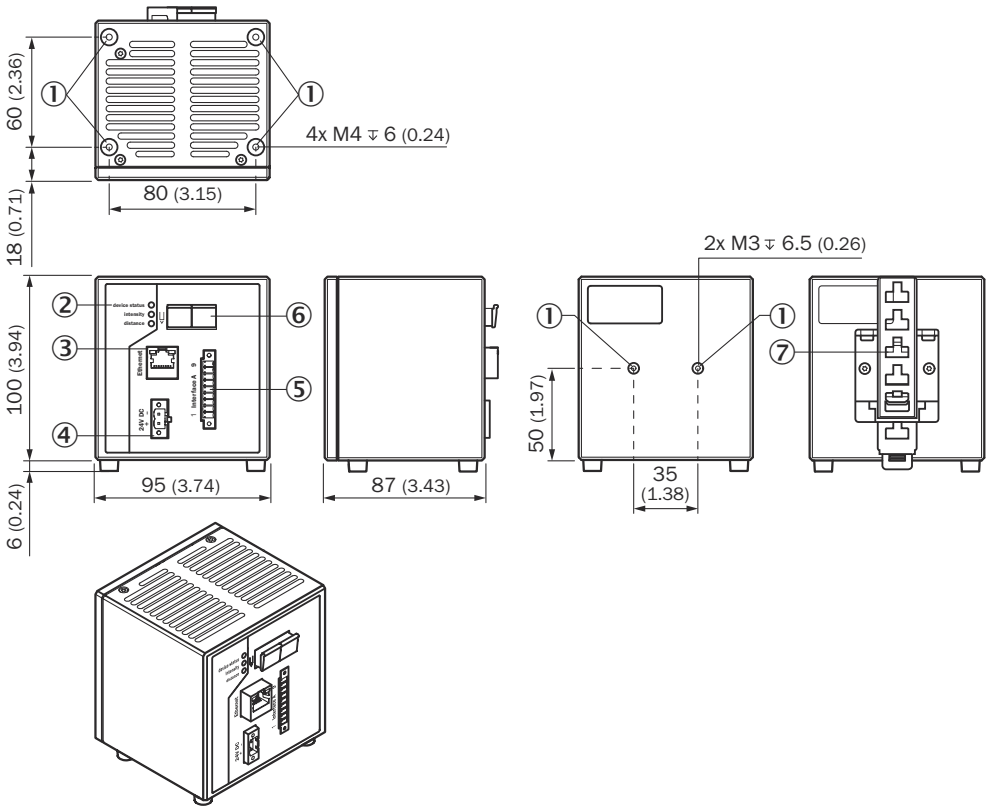


Figure 15: structure and device dimensions, unit: mm (inch), decimal separator: period

① M4 threaded mounting hole
② Status LEDs
③ Ethernet connection
④ Connecting the voltage supply
⑤ Terminal strip interface A (serial interface RS422/RS232, trigger)
⑥ Optical fiber connection
⑦ Mounting rail adapter

11.2.2 OD7000-xxxxxxx1 control unit

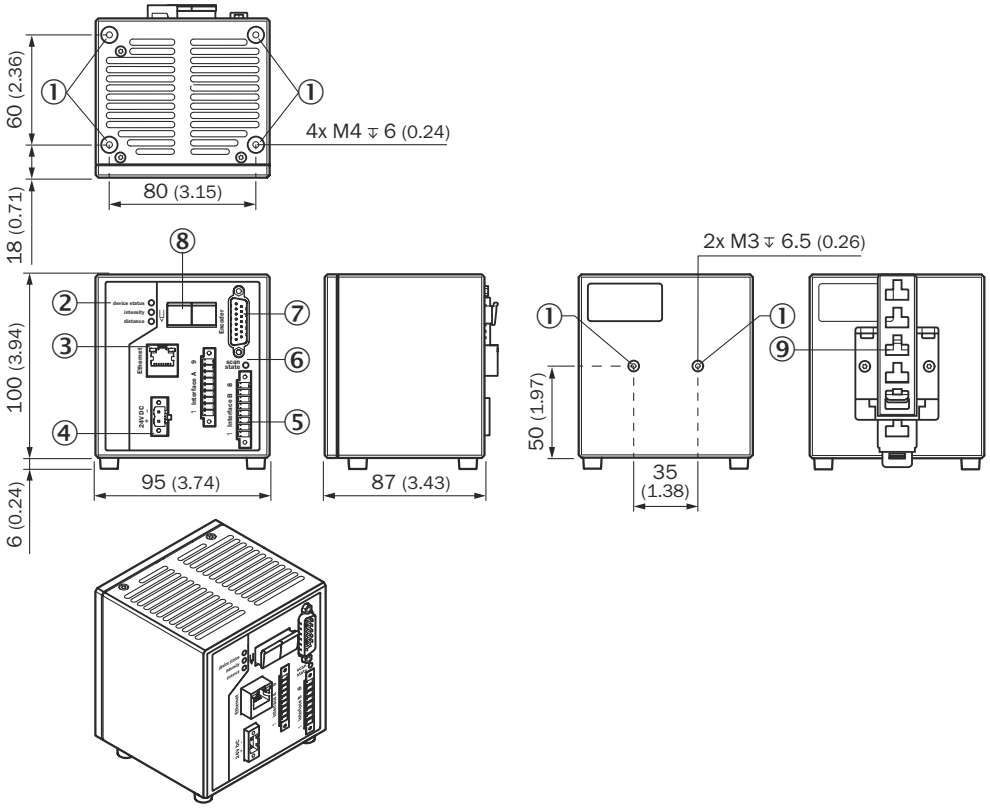


Figure 16: structure and device dimensions, unit: mm (inch), decimal separator: period

① M4 threaded mounting hole
② Status LEDs
③ Ethernet connection
④ Connecting the voltage supply
⑤ Connection strip interface B (analog outputs, digital inputs, digital outputs)
⑥ Terminal strip interface A (serial interface RS422/RS232, trigger)
⑦ Encoder connection
⑧ Optical fiber connection
⑨ Mounting rail adapter

11.2.3 Measuring head 600 µm

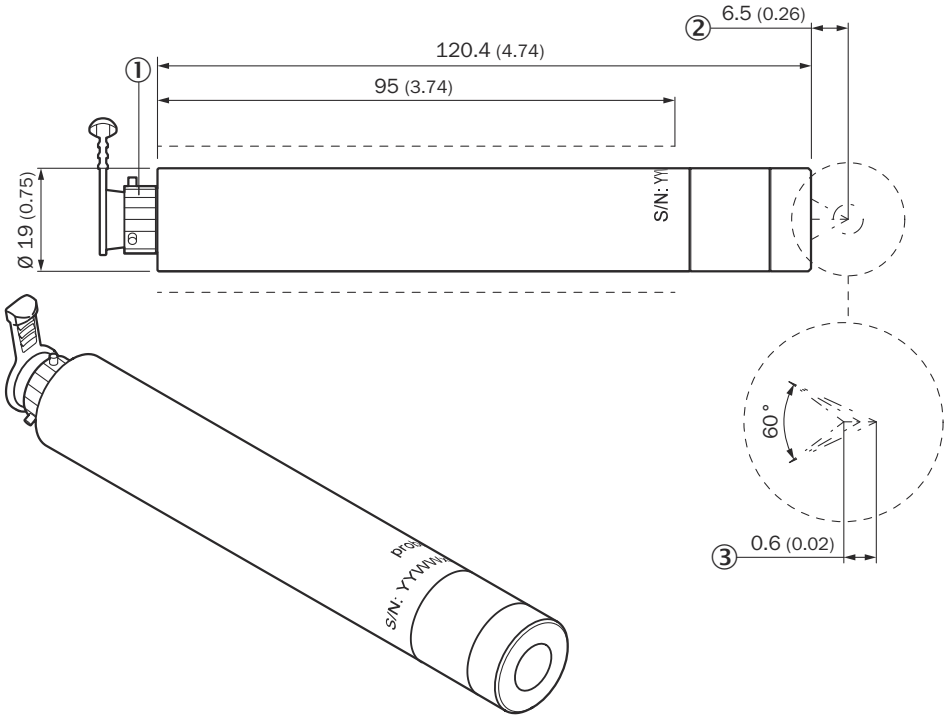


Figure 17: structure and device dimensions, unit: mm (inch), decimal separator: period

① Optical fiber connection
② Average measuring distance (typical)
③ Measuring range

11.2.4 Measuring head 4 mm

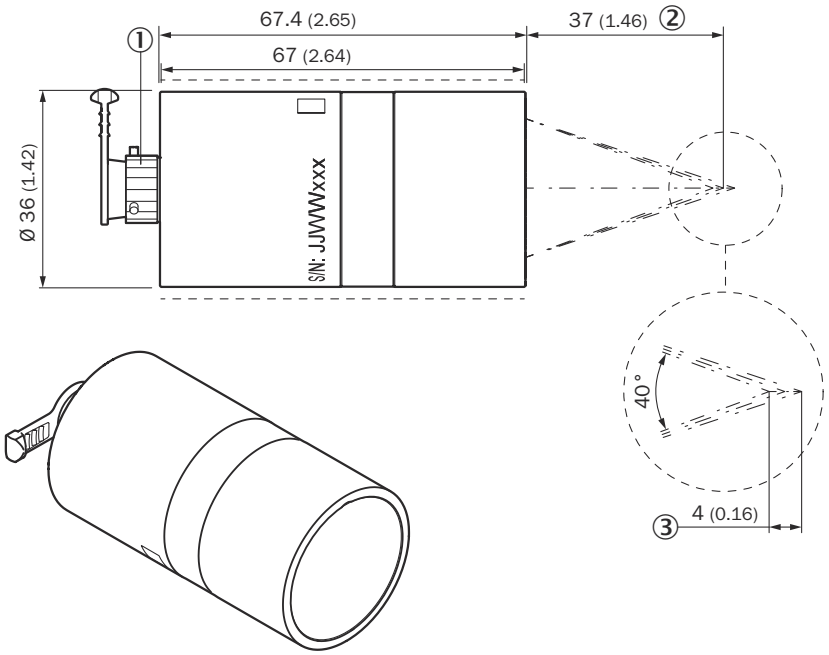


Figure 18: structure and device dimensions, unit: mm (inch), decimal separator: period

① Optical fiber connection
② Average measuring distance (typical)
③ Measuring range

11.2.5 Measuring head 10 mm

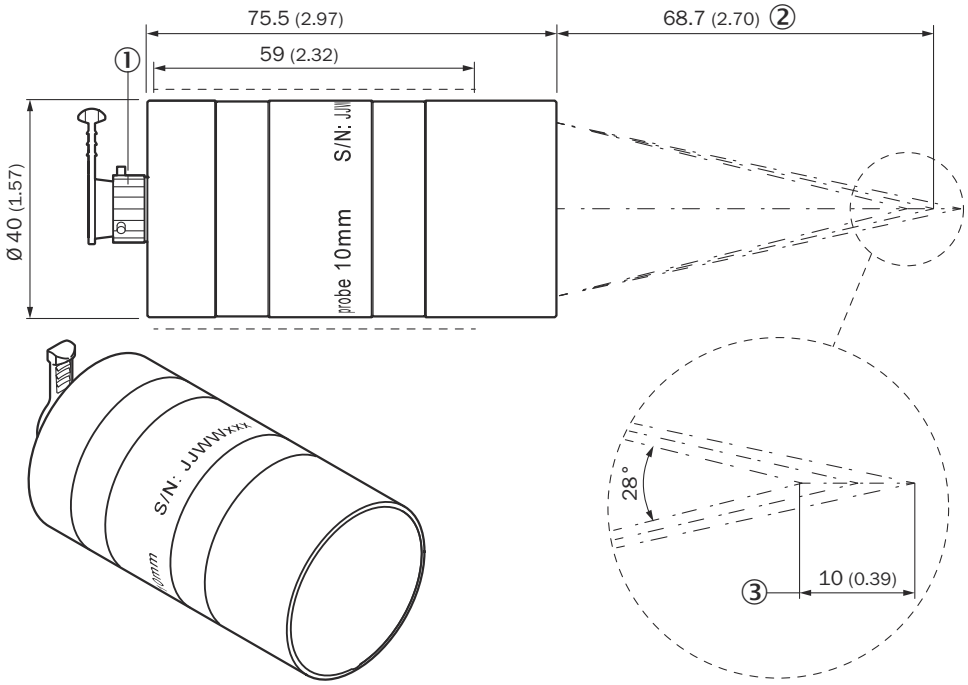


Figure 19: structure and device dimensions, unit: mm (inch), decimal separator: period

① Optical fiber connection
② Average measuring distance (typical)
③ Measuring range

11.3 Performance

Measurement procedure	Chromatic confocal
Measured values	• Distance measurement • Coating thickness measurement
Measuring rate	Max. 10 kHz
Chromatic confocal measuring range	Depending on the measuring head used
Gradient error [1)]	< 10^{-3}
Linearity deviation [1)]	< 3,3 x 10^{-4} x upper measuring range limit
Axial resolution	3 x 10^{-6} x upper measuring range limit
Number of measuring channels	1
Light sender	LED, visible white light
LED risk group	RG1 (IEC 62471)

1) Measurement accuracy = linearity deviation + (slope error x measured value). The specified accuracy is achieved at room temperature e. g +20 °C.

11.4 Interfaces

Ethernet	TCP/IP Data transmission rate: 100 Mbit/s 10BASE-T/ 100BASE-TX
Serial (RS-232)	Data transmission rate: max. 1.8 MBaud

Serial (RS-422)	Data transmission rate: max. 10 MBaud
Analog output	OD7000-xxxxxxx**2**: not available
	OD7000-xxxxxxx1: • Quantity: 2 • Type: Current output, voltage output • Current: -10 mA ... 10 mA • Voltage: -10 V ... 10 V • Latency: 270 µs
Digital input	OD7000-xxxxxxx**2**: not available
	OD7000-xxxxxxx**1**: 2 digital inputs
Digital output	OD7000-xxxxxxx**2**: not available
	OD7000-xxxxxxx**1**: 2 digital outputs
Trigger input	OD7000-xxxxxxx**2**: not available
	OD7000-xxxxxxx**1**: 1 trigger input
Trigger output	OD7000-xxxxxxx**2**: not available
	OD7000-xxxxxxx**1**: 1 trigger output
Encoder input	OD7000-xxxxxxx**2**: not available
	OD7000-xxxxxxx**1**: 1 encoder input

11.5 Ambient data

Electromagnetic compatibility (EMC)	Radiated emissions: EN 61326-1 The device is classified in device class B and group 1 according to EN 55011. With regard to emitted interference, the device is classified as class A according to DIN EN 55011.
Ambient operating temperature	0 °C ... +50 °C
Storage temperature	-20 °C ... +70 °C
Relative humidity (non-condensing)	Operation: 30% ... 75% Storage: 10% ... 90%

12 Accessories

NOTE

On the product page you will find accessories and, if applicable, related installation information for your product.

The page can be accessed via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

13 Annex

13.1 Declarations of conformity and certificates

You can download declarations of conformity and certificates via the product page.

The page can be accessed via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

13.2 Licenses

SICK uses open source software which is published by the rights holders under a free license. Among others, the following license types are used: GNU General Public License (GPL version 2, GPL version 3), GNU Lesser General Public License (LGPL), MIT license, zlib license and licenses derived from the BSD license.

This program is provided for general use without warranty of any kind. This warranty disclaimer also extends to the implicit assurance of marketability or suitability of the program for a particular purpose.

More details can be found in the GNU General Public License.

For license texts see www.sick.com/licensetexts.

Printed copies of the license texts are also available on request.

8027188/ 1JL2/2023-04-25/en

Australia
Phone +61 (3) 9457 0600
1800 33 48 02 – tollfree
E-Mail sales@sick.com.au

Austria
Phone +43 (0) 2236 62288-0
E-Mail office@sick.at

Belgium/Luxembourg
Phone +32 (0) 2 466 55 66
E-Mail info@sick.be

Brazil
Phone +55 11 3215-4900
E-Mail comercial@sick.com.br

Canada
Phone +1 905.771.1444
E-Mail cs.canada@sick.com

Czech Republic
Phone +420 234 719 500
E-Mail sick@sick.cz

Chile
Phone +56 (2) 2274 7430
E-Mail chile@sick.com

China
Phone +86 20 2882 3600
E-Mail info.china@sick.net.cn

Denmark
Phone +45 45 82 64 00
E-Mail sick@sick.dk

Finland
Phone +358-9-25 15 800
E-Mail sick@sick.fi

France
Phone +33 1 64 62 35 00
E-Mail info@sick.fr

Germany
Phone +49 (0) 2 11 53 010
E-Mail info@sick.de

Greece
Phone +30 210 6825100
E-Mail office@sick.com.gr

Hong Kong
Phone +852 2153 6300
E-Mail ghk@sick.com.hk

Hungary
Phone +36 1 371 2680
E-Mail ertekesites@sick.hu

India
Phone +91-22-6119 8900
E-Mail info@sick-india.com

Israel
Phone +972 97110 11
E-Mail info@sick-sensors.com

Italy
Phone +39 02 27 43 41
E-Mail info@sick.it

Japan
Phone +81 3 5309 2112
E-Mail support@sick.jp

Malaysia
Phone +603-8080 7425
E-Mail enquiry.my@sick.com

Mexico
Phone +52 (472) 748 9451
E-Mail mexico@sick.com

Netherlands
Phone +31 (0) 30 204 40 00
E-Mail info@sick.nl

New Zealand
Phone +64 9 415 0459
0800 222 278 – tollfree
E-Mail sales@sick.co.nz

Norway
Phone +47 67 81 50 00
E-Mail sick@sick.no

Poland
Phone +48 22 539 41 00
E-Mail info@sick.pl

Romania
Phone +40 356-17 11 20
E-Mail office@sick.ro

Singapore
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Slovakia
Phone +421 482 901 201
E-Mail mail@sick-sk.sk

Slovenia
Phone +386 591 78849
E-Mail office@sick.si

South Africa
Phone +27 10 060 0550
E-Mail info@sickautomation.co.za

South Korea
Phone +82 2 786 6321/4
E-Mail infokorea@sick.com

Spain
Phone +34 93 480 31 00
E-Mail info@sick.es

Sweden
Phone +46 10 110 10 00
E-Mail info@sick.se

Switzerland
Phone +41 41 619 29 39
E-Mail contact@sick.ch

Taiwan
Phone +886-2-2375-6288
E-Mail sales@sick.com.tw

Thailand
Phone +66 2 645 0009
E-Mail marcom.th@sick.com

Turkey
Phone +90 (216) 528 50 00
E-Mail info@sick.com.tr

United Arab Emirates
Phone +971 (0) 4 88 65 878
E-Mail contact@sick.ae

United Kingdom
Phone +44 (0)17278 31121
E-Mail info@sick.co.uk

USA
Phone +1 800.325.7425
E-Mail info@sick.com

Vietnam
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Detailed addresses and further locations at **www.sick.com**

SICK AG | Waldkirch | Germany | www.sick.com

SICK
Sensor Intelligence.