TiM8xxP

2D LiDAR sensors

SICK
Sensor Intelligence.

Product described

TiM8xxP

Manufacturer

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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 instructions constitute an integral part of the product and are to be stored 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 operating the machine or system in which the device is integrated. For information about this, refer to the operating instructions of the specific machine.

1.2   Explanation of symbols

Warnings and important information in this document are labeled with symbols. The warnings are introduced by signal words that indicate the extent of the danger. These warnings must be observed at all times and care must be taken to avoid accidents, personal injury, and material damage.

> **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.

2 Safety information

2.1 Intended use

The TiM8xxP is a programmable 2D LiDAR sensor. It features one scan plane and is suitable for applications which demand precise, non-contact optical contour measurement and environment perception.

The device is programmed on a PC by using the **SICK AppSpace** development environment software and the **SICK AppStudio** software program.

Depending on the application, a browser-based, graphical user interface (HMI) can be created, which provides opportunities defined by the application developer to influence an application at operator level.

The device offers various interfaces and operating elements for controlling, programming, and operating purposes, which can be activated as necessary via development environments, control systems (programmable logic controllers), or applications. However, configuration, programming, and control requires various technical skills, depending on how the device is connected and used.

The devices are primarily designed for use in industrial and logistics areas, and they meet the requirements for industrial ruggedness, interfaces and data processing.

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.

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:

- Device should be used only in accordance with its intended use.
- All information in these operating instructions must be strictly observed.

2.3 Internet protocol (IP) technology

ℹ️ **NOTE**
SICK uses standard IP technology in its products. The emphasis is placed on availability of products and services.

SICK always assumes the following prerequisites:

- The customer ensures the integrity and confidentiality of the data and rights affected by its own use of the aforementioned products.
- In all cases, the customer implements the appropriate security measures, such as network separation, firewalls, virus protection, and patch management.

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
- Technical modifications
- Use of unauthorized spare parts, consumables, and accessories

With special variants, where optional extras have been ordered, or owing to the latest technical changes, the actual scope of delivery may vary from the features and illustrations shown here.

2.4.1 Programmable device

The TiM8xxP is a programmable device.

Therefore, the respective programmer is responsible for his/her programming performance and the resulting operating principle of the device.

The liability and warranty of SICK AG is limited to the device specification (hardware functionality and any programming interfaces) according to the agreed conditions.

Therefore, SICK AG is not liable, among other things, for damages that are caused by programming of the customer or third parties.

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.

This product documentation refers to the following qualification requirements for the various activities associated with the device:

- **Instructed personnel** have been briefed by the operator about the tasks assigned to them and about potential dangers arising from improper action.
- **Skilled personnel** have the specialist training, skills, and experience, as well as knowledge of the relevant regulations, to be able to perform tasks delegated to them and to detect and avoid any potential dangers independently.
- **Electricians** have the specialist training, skills, and experience, as well as knowledge of the relevant standards and provisions to be able to carry out work on electrical systems and to detect and avoid any potential dangers independently. In Germany, electricians must meet the specifications of the BGV A3 Work Safety Regulations (e.g. Master Electrician). Other relevant regulations applicable in other countries must be observed.

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
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, programming	- Basic knowledge of the Windows™ operating system in use - Basic knowledge of the design and setup of the described connections and interfaces - Basic knowledge of data transmission - Knowledge of the programming of systems and network components
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 particular hazards

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

⚠ **CAUTION**
Optical radiation: Laser class 1

The accessible radiation does not pose a danger when viewed directly for up to 100 seconds. It may pose a danger to the eyes and skin in the event of incorrect use.

- Do not open the housing. Opening the housing may increase the level of risk.

- Current national regulations regarding laser protection must be observed.

⚠️ **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.

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3 Product description

3.1 Scope of delivery

The delivery of the device includes the following components:

Table 2: Scope of delivery

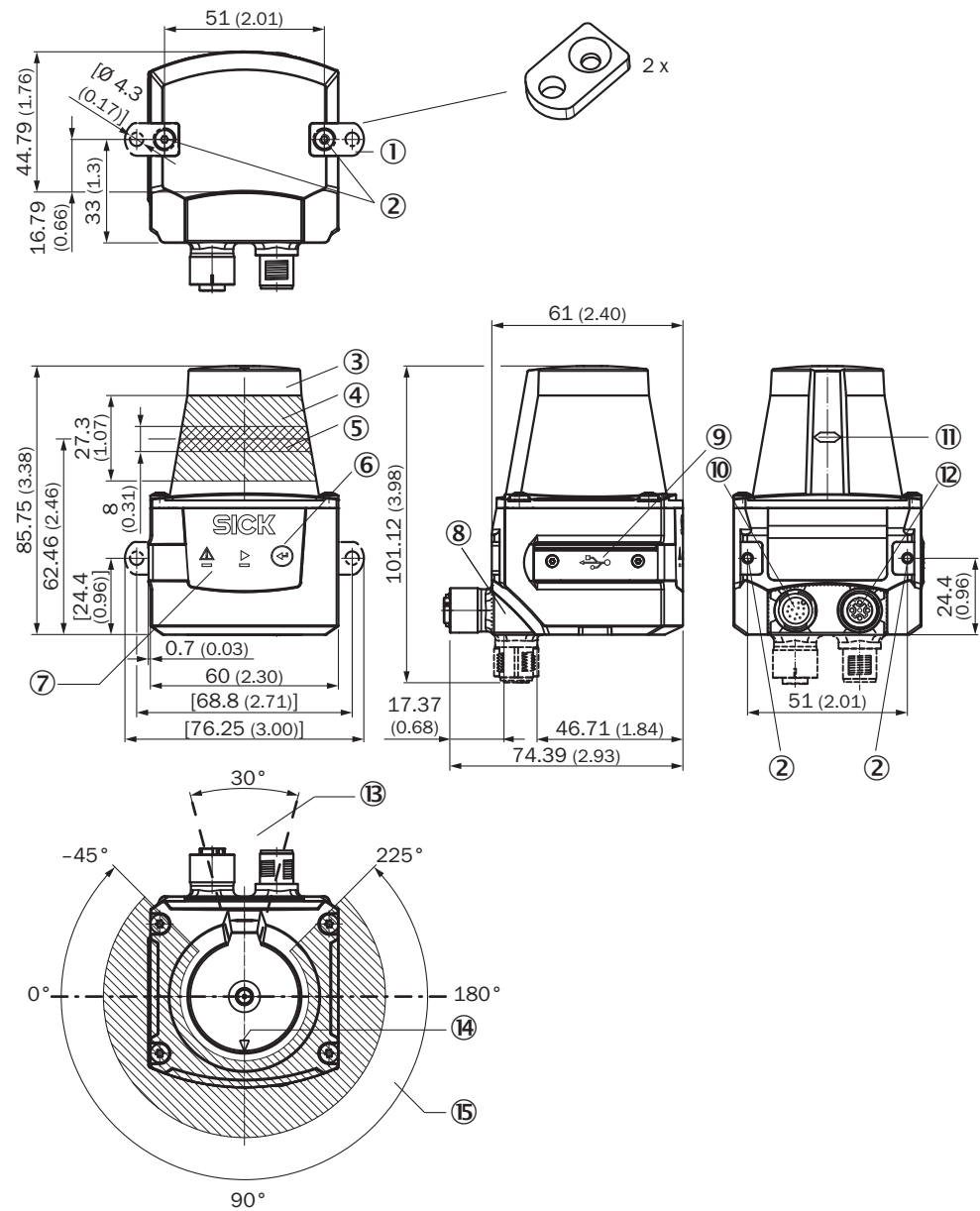| No. of units	Component	Notes
1	Device in the version ordered, 2 mounting straps, 2 screws M3 x 4 mm	Without connecting cables.
1	Printed safety notes, multilingual (no. 8021393)	Quick guide and safety notes for 2D-/3D-LiDAR sensors

3.2   Setup and dimensions

Figure 1: Structure and dimensions, unit: mm (inch), decimal separator: period

①   2 x fastening clip with M3 x 4 mm screw (included in scope of delivery)

②   M3 threaded mounting hole, 2.8 mm deep (blind hole thread)

③   Optics cover

④   Receiving range (light inlet)

⑤   Transmission range (light emission)

⑥   Pushbutton

⑦   Red and green LED (status indicators)

⑧   Swivel connector unit with electrical connections

⑨   Micro USB port behind black plastic cover

⑩   Voltage supply connection, digital in/outputs, 12-pin. M12 female connector

⑪   Marking for the position of the light emission level

⑫   Ethernet connection, 4-pin M12 female connector

⑬   Area in which no reflective surfaces are permitted when the device is mounted

⑭   Bearing marking to support alignment (90° axis)

⑮   270° aperture angle (visual range)
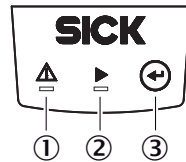
3.3   Display and operating elements

Figure 2: TiM8xxP display and operating elements

①   Red LED

②   Green LED

③   Pushbutton

Status indicators

The LEDs can display the off, flashing or permanently illuminated status depending on the programming of the device. Which functions are triggered when the pushbutton is actuated can also be programmed.

3.4   Type code

The devices of the product family are arranged according to the following type code:

TIM	x	y	z		–	aa	bb	c	dd
1	2	3	4	5		6	7	8	9

Table 3: Type code

Position	Description	Characteristic
1	Device name	TIM: Short range 2D-LiDAR sensor
2	Device type	8. AppSpace device
3	Output	8: HDDM+, 25 m measuring range, 0.33° angular resolution, performance professional
4	Housing	1: Housing IP67 without heating
5		P: Programmable
6	Connection	21: Rotating connection unit, 1 x M12 male connector, 12-pin, D-coded (Power + I/O); 1x M12 female connector, 4-pin, A-coded (Ethernet)
7	Application	00: AppSpace standard
8	Laser type	1: Pulse power up to 880 mW, pulse width up to 5 ns, pulse rate 1,500 kHz
9	Color	01: Gray

3.5   Product identification

The type label gives information for identification of the product variant.

3.6   SICK AppSpace

The SICK AppSpace eco-system reveals new paths leading to solutions for customer-specific applications and consists of software tools and programmable sensors or devices. The SICK AppStudio SDK is used for developing sensor apps on programmable SICK devices. Its user interface for machine operators can be created individually as a web GUI. The SICK AppManager software tool supports the service in the field in the simple distribution and management of sensor apps.
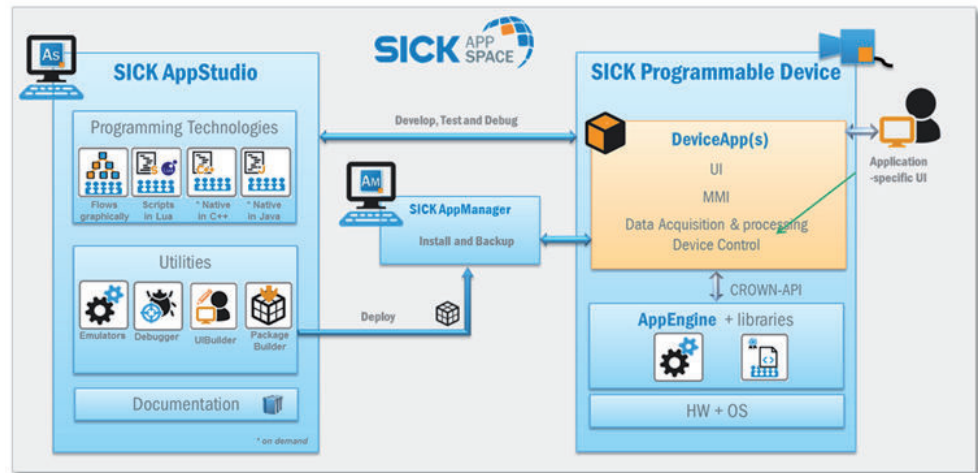

Figure 3: SICK AppSpace

Detailed instructions on the SICK AppStudio as well as programming the device can be found at **supportportal.sick.com**.

3.7   Principle of operation

3.7.1   Measurement principle

The device is an opto-electronic LiDAR sensor (laser scanner) that uses laser beams for non-contact scanning of the outline of its surroundings on a plane. The device measures its surroundings in two-dimensional polar coordinates, relative to its measurement origin. Its measurement origin is marked by a circular indentation in the center of the optics cover. If a laser beam strikes an object, the position of that object is determined in terms of distance and direction.
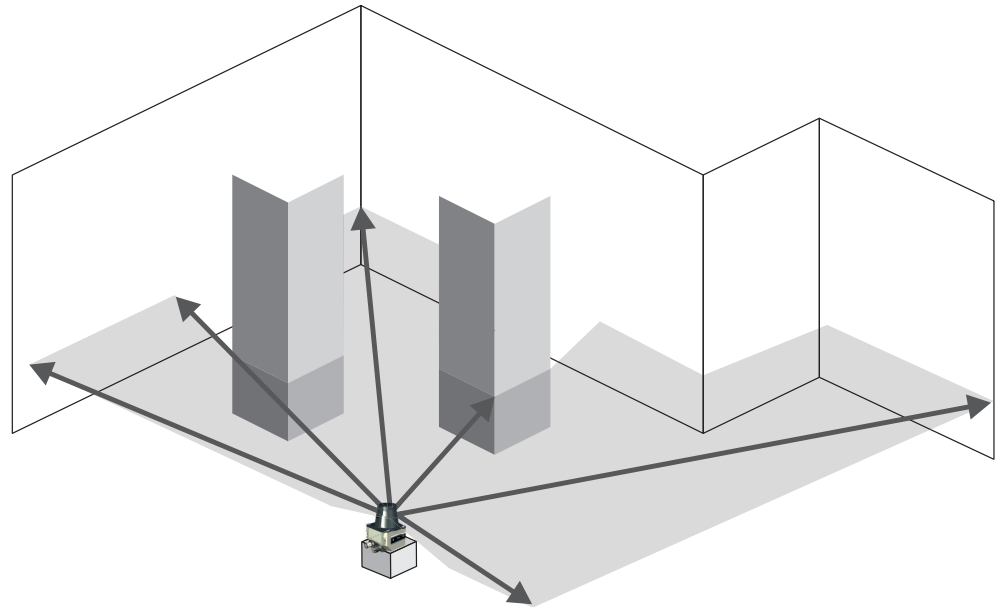
*Figure 4: Measurement principle of the 2D laser scanner*

3.7.2 Range finding

The device emits beams pulsed by a laser diode. If a laser pulse hits an object or person, it is reflected on the surface of the object or person in question. The reflection is registered by a photosensitive element in the device receiver. The device uses SICK's own HDDM+ (high definition distance measurement) technology. With this measurement process, a measured value is formed by adding together multiple single pulses. The device calculates the distance from the object based on the elapsed time that the light requires between emitting the beam and receiving the reflection. Radar systems apply this "pulse time-of-flight measurement" principle in a similar way.

3.7.3 Direction measurement

The device uses a rotating mirror to deflect the emitted laser beams, thereby scanning its surroundings in a circular pattern. The measurements are triggered internally by an encoder in regular angle increments.

The measuring procedure uses the averaging from multiple pulses to determine individual measured values. A measuring point is the average value of several measurements combined.

① Device
② Laser pulse
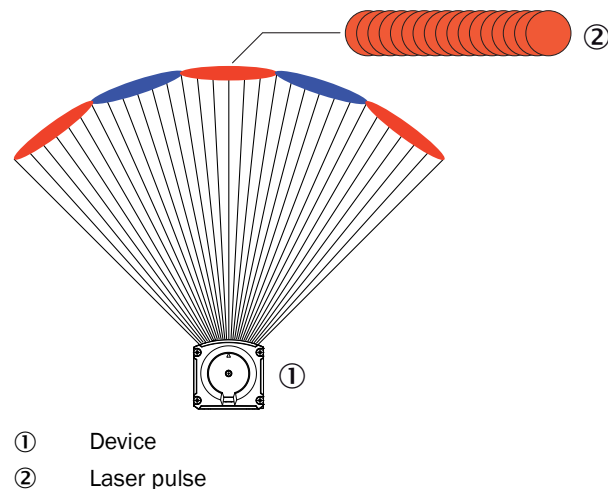
3.7.4   Object sizes

As the distance from the device increases, the laser beam expands. As a result, the diameter of the light spot on the surface of the object increases.

Figure 5: Beam expansion

①   Expanded laser beam

②   Optical axis

Values required to calculate the light spot size:
- Light spot size on the device cover: 7 mm (rounded up)
- Divergence of 1 light spot: 0.49 deg (8.6 mrad)
- HDDM+ supplement (1 spot comprises several superimposed individual pulses): 0.33 deg (5.8 mrad)

Formula for calculating the light spot width:

(Light spot divergence [mrad] + HDDM+ supplement [mrad]) x distance [mm] + light spot size on the device cover [mm] = light spot width [mm]

Example calculation of the light spot width at a distance of 25 m (25,000 mm):

(8.6 mrad +5.8 mrad) * 25,000 mm +7 mm = 367 mm

Formula for calculating the height of the light spot:

Light spot divergence [mrad] x Distance [mm] + Light spot height at the n device cover [mm] = Light spot width [mm]

Example calculation of the light spot height at a distance of 25 m (25,000 mm):

8.6 mrad * 25,000 mm +7 mm = 222.0 mm

NOTE

For reliable measurement, in particular when using the device to output measured values, the laser needs to hit the object several times. Therefore, the object either needs to be larger than the minimum object size, or both the LiDAR sensor and the object must not be moving.
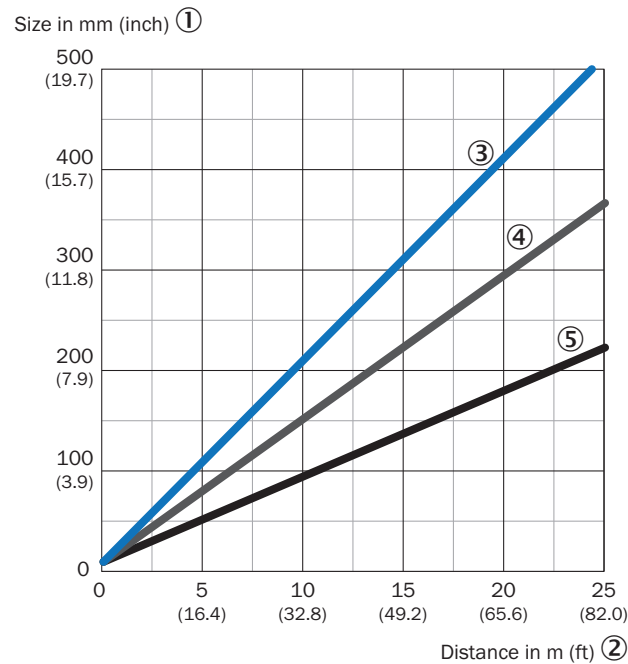

Figure 6: Minimum object size

①	Size in millimeters (inc)
②	Distance in meters (feet)
③	Minimum object size
④	Light spot width
⑤	Light spot height

3.7.5 Impact of object surfaces on the measurement

Reflection

Most surfaces produce a diffuse reflection of the laser beam in all directions. The structure (smooth or rough), shape (flat or curved), and color (light or dark) of the surface determine how well the laser beam is reflected.

On very rough surfaces, part of the energy is lost due to shadowing. Curved surfaces produce a higher diffusion. Dark surfaces reflect the laser beam worse than light ones (brilliant white plaster reflects approx. 100% of the light, while black foam rubber reflects approx. 2.4%). The aforementioned surface characteristics can reduce the scanning range of the device, in particular for surfaces with low remission values.
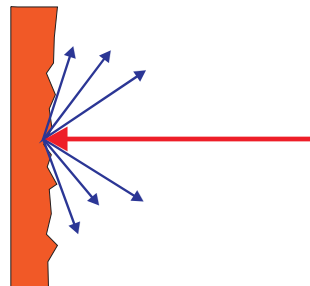

Figure 7: Reflection of light on the surface of the object

Angle of reflection

The angle of reflection corresponds to the angle of incidence. If the laser beam hits a surface at right angles, the energy is optimally reflected. If the laser beam hits a surface at an oblique angle, energy and range are lost accordingly.
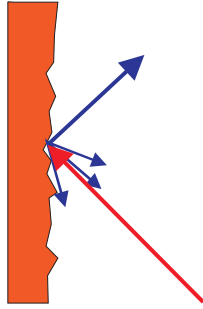
Figure 8: Angle of reflection

Retroreflection

If the reflective energy is greater than 100%, the beam is not reflected diffusely in all directions; instead it is reflected in a targeted way (retroreflection). Thus a large part of the emitted energy can be received by the laser distance measurer. Plastic reflectors (cat's eyes), reflective tape, and triple prisms have these properties.
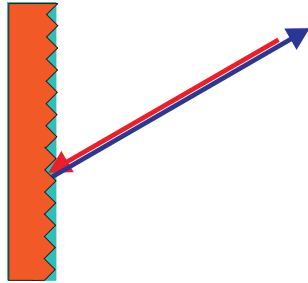

Figure 9: Retroreflection

Reflective surfaces

The laser beam is almost completely deflected on reflective surfaces. This means that an object hit by the deflected beam may be detected instead of the reflective surface.
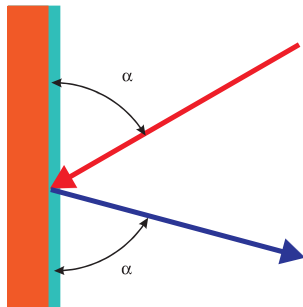

Figure 10: Specular surfaces

Small objects

Objects that are smaller than the diameter of the laser beam cannot reflect the laser light's full energy. The portion of the light beam that does not reach the object is lost. If all of the light reflected to the sensor is insufficient, the object may not be detected.

The portion of the light that does not reach the front object can be reflected by a larger object in the background. If all of the light reflected to the sensor is sufficient, this object is detected.
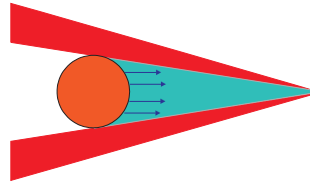
Figure 11: Object smaller than the laser beam diameter

3.7.6 Scanning range

The scanning range of the device depends on the remission of the object to be detected. The better a surface reflects the incident beam back to the device, the greater the scanning range of the device.
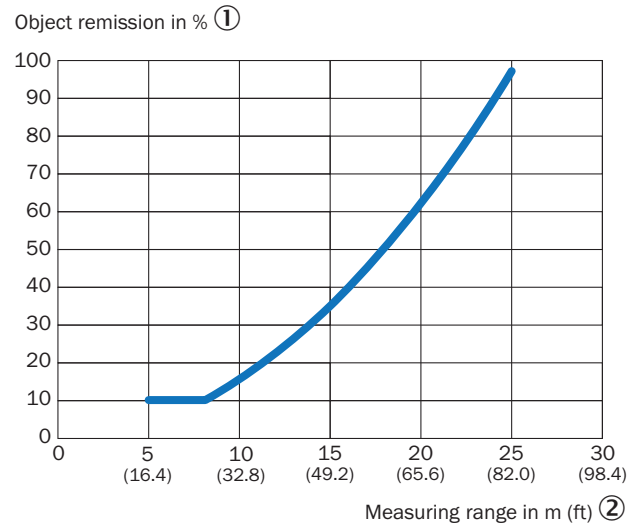

Figure 12: Scanning range rate as a function of object remission

① Object remission in percent

② Measuring range in meters (feet)

3.7.7 Switching inputs/outputs

Switching inputs

The device has four digital switching inputs.

The inputs are decoupled from the supply voltage of the device. They have a common reference point (INGND), meaning they are not decoupled from one another.

Switching behavior	Current to the input starts the assigned function in the device.
Properties	Opto-decoupled Switchable with an electronic switch (PNP output) or mechanical switch
Electrical values	Low: Ue ≤ 2 V; Ie ≤ 0.3 mA High: 8 V ≤ U_e ≤ 32 V; 0.7 mA ≤ I_e ≤ 5 mA

Switching outputs

The device has four digital switching outputs.

Switching behavior	PNP switching against supply voltage UV
Properties	Short-circuit protected and temperature protected Not electrically isolated from supply voltage U_v

Electrical values	$0 \text{ V} \leq U_a \leq U_V$
	$(U_V - 1.5 \text{ V}) \leq U_a \leq U_V \text{ at } I_a \leq 100 \text{ mA}$

Longer connecting cables at the switching outputs of the device should be avoided due to the resulting fall in voltage. This is calculated as follows:

$\Delta U = (2 \times \text{length} \times \text{current}) : (\text{conductance value} \times \text{cross-section})$

Conductance value for copper: 56 m/Ω mm².

4 Transport and storage

4.1 Transport

For your own safety, please read and observe the following notes:

> **!** **NOTICE**
> **Damage to the product due to improper transport.**
>
> - The device must be packaged for transport with protection against shock and damp.
> - Recommendation: Use the original packaging as it provides the best protection.
> - Transport should be performed by trained specialist staff only.
> - The utmost care and attention is required at all times during unloading and transportation on company premises.
> - Note the symbols on the packaging.
> - Do not remove packaging until immediately before you start mounting.

4.2 Unpacking

- Before unpacking, it may be necessary to equalize the temperature to protect the device from condensation.
- Handle the device with care and protect it from mechanical damage.

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.

> **(i)** **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

Store the device under the following conditions:

- Recommendation: Use the original packaging.
- Do not store outdoors.
- Store in a dry area that is protected from dust.
- So that any residual damp can evaporate, do not package in airtight containers.
- Do not expose to any aggressive substances.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: see "Technical data".
- Relative humidity: see "Technical data".
- 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 direct and indirect sunlight.
- 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.
- The device can be mounted in any position.
- It should be mounted so that it is exposed to as little shock and vibration as possible. Optional mounting accessories are available, see "Accessories", page 35.
- During mounting, make sure there is no reflective surface behind the reference target, see "Setup and dimensions".
- To avoid inaccurate measurements when installing multiple devices: Make sure that the laser spot of one device is not in the visible range of another device, see "Mutual interference", page 21.
- Avoid having shiny or reflective surfaces in the scanning range, e.g., stainless steel, aluminum, glass, reflectors, or surfaces with these types of coatings.
- Protect the device from moisture, contamination, and damage.
- Make sure that the status indicator is clearly visible.
- Do not subject the device to excessive shock or vibrations. In systems subjected to heavy vibrations, secure the fixing screws with screw-locking devices.

5.2 Mounting device

1. Mount the LiDAR sensor using the designated fixing holes, see "Setup and dimensions".
2. Make the electrical connection. Attach and tighten a voltage-free cable, see "Connecting the device electrically", page 28 .
3. Switch on the supply voltage.
4. Align the vertical center line of the field of view of the device with the center of the area to be monitored. The marking on the upper side of the optics cover serves as a bearing alignment aid.

5.3 Mutual interference

> **ℹ NOTE**
> Optical sensors and other IR light sources can influence the measurement and detection capabilities of the device.

The device has been designed to minimize the probability of mutual interference with devices of the same type. To rule out even the slightest effects on the measurement accuracy, the devices should be arranged such the laser beams are not received by another device.
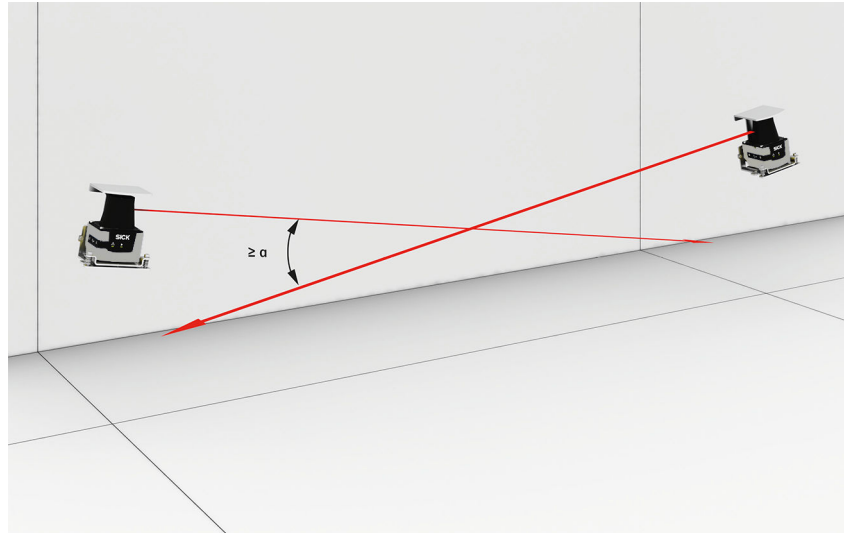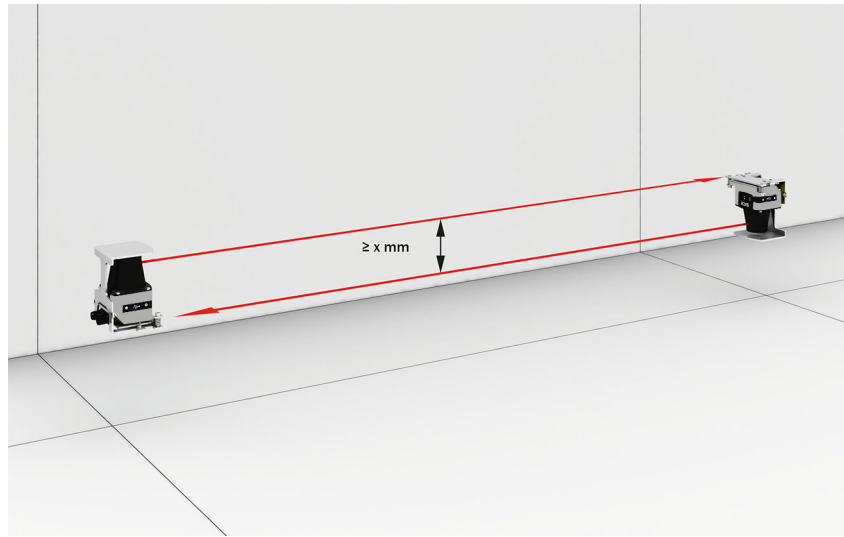
Figure 13: Angle ≥ 6°

Figure 14: Distance ≥ 200 mm

6 Electrical installation

6.1 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 (e.g., ensuring low-impedance and current-carrying equipotential bonding).

The device is connected to the peripheral devices (voltage supply, 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
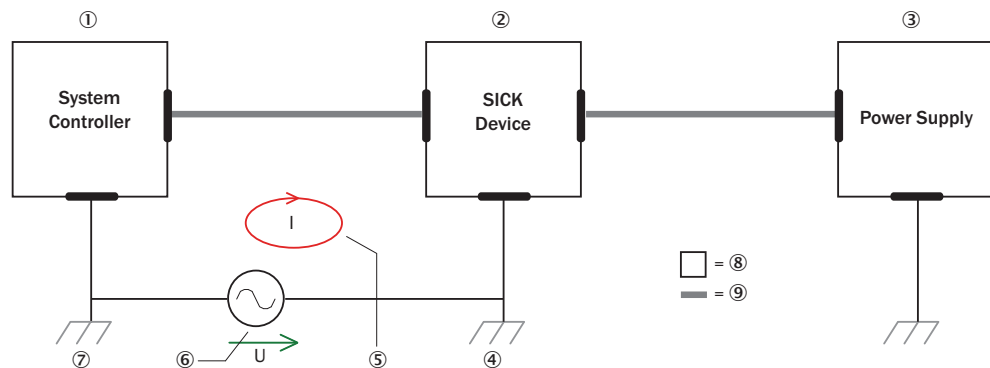

Figure 15: Example: Occurrence of equipotential bonding currents in the system configuration

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.
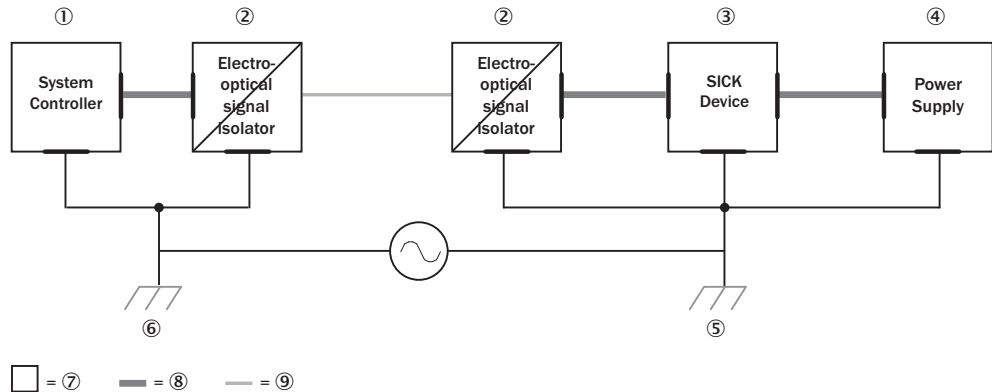

Figure 16: Example: Prevention of equipotential bonding currents in the system configuration by the use of electro-optical signal isolators

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.
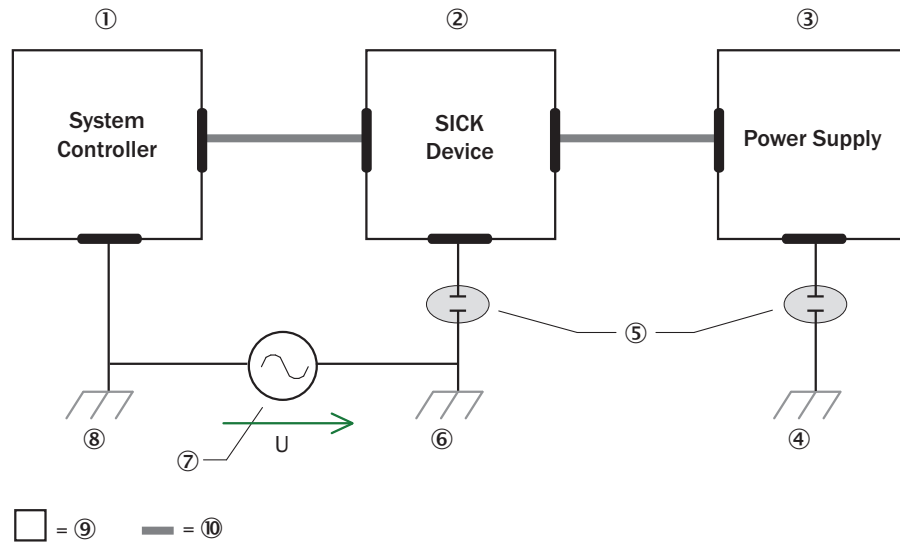

Figure 17: Example: Prevention of equipotential bonding currents in the system configuration by the insulated mounting of the device

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.

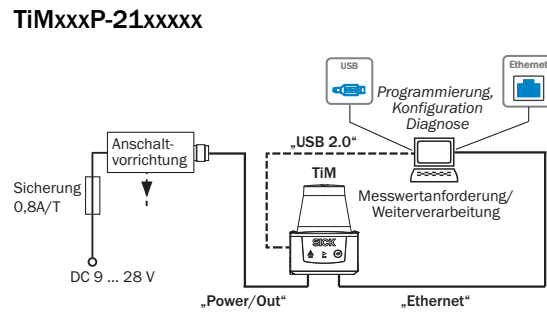## 6.2 Electrical block diagram for commissioning

TiMxxxP-21xxxxx

Figure 18: "Power, I/O" connection: With M12 male connector, 12-pin, A-coded; "Ethernet" connection: M12 female connector, 4-pin, D-coded

6.3 Wiring notes

> **NOTE**
> Preassembled cables can be found online at:
>
> - **www.sick.com/TiM7xx**
>   The cables which are offered for the TiM781 can be used for the TiM8xxP.

> **NOTICE**
> **Faults during operation and device or system defects!**
>
> Incorrect wiring may result in operational faults and defects.
>
> - Follow the wiring notes precisely.

All electrical connections of the device are configured as M12 round connectors.

The protection class stated in the technical data is achieved only with screwed plug connectors or cover caps.

Protect the device from dust and moisture when the USB cover flap is open.

All electrical circuits connected to the device must be configured as SELV or PELV circuits (SELV = Safety Extra Low Voltage, PELV = Protective Extra Low Voltage).

Protect the device with an external 0.8 A slow-blow fuse at the beginning of the supply cable.

Connect the connecting cables in a de-energized state. Switch on the supply voltage only after complete installation/connection of all connecting cables to the device and control system.

Wire cross-sections in the supply cable from the customer's power system should be designed in accordance with the applicable standards.

6.4 Connection diagram

> **NOTE**
> The recommended connecting cables and their associated technical data can be found online at:
> **www.sick.com/TiM7xx**
> The cables which are offered for the TiM781 can be used for the TiM8xxP.

6.4.1   TiMxxxP-21xxxxx
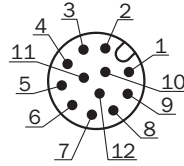
"Power/I/O" connection

Table 4: Male connector, M12, 12-pin, A-coded

Pin	Signal	Function	Wire colors connecting cable part no. 6054974 (5 m), 6054973 (10 m), 6054972 (20 m)[1]
1	GND	Ground	Blue
2	DC 9 V … 28 V	Supply voltage	Brown
3	IN 1	Switching input 1	Red
4	IN 2	Switching input 2	Green
5	OUT 1	Switching output 1	Pink
6	OUT 2	Switching output 2	Yellow
7	OUT 3	Switching output 3	Black
8	OUT 4	Switching output 4	Gray
9	INGND	Common ground for all inputs	White
10	IN 3	Switching input 3	Violet
11	IN 4	Switching input 4	Gray + pink
12	N.c.	–	Red + blue
–	–	Screen	

[1]   Example values when using the specified connecting cable(s). Signal assignment and wire colors can vary when using other connecting cables.
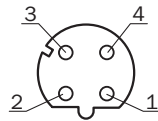
"Ethernet" connection

Table 5: Female connector, 4-pin, D-coded

Contact	Labeling	Description
1	TX+	Sender+
2	RX+	Receiver+
3	TX-	Sender-
4	RX-	Receiver-

6.4.2   USB interface

The Ethernet interface is recommended as a communication interface.

If using the USB interface, please note:
- Use a high-speed UBS cable, maximum length of cable 3 m.
- The connection may be interrupted due to ESD/EMC influences. If necessary: Disconnect USB cable from the device, then reconnect it.

6.5 Connecting the device electrically

> **NOTICE**
> Observe the wiring instructions, see "Wiring notes", page 26.

1. Ensure the voltage supply is not connected.
2. Connect the device according to the connection diagram, see "Connection diagram", page 26.

7 Commissioning

7.1 Programming device with AppStudio

Programming the device parameters to the application as well as diagnostics in the event of malfunctions is undertaken by default with the AppStudio development environment.

Installing and starting the development environment

1. Download and install the latest version of AppStudio from the online product page for the software by following the instructions provided there. supportpor-tal.sick.com
   Administrator rights may be required on the PC to install the software.
2. Enter your personal license key to complete installation.
3. Start program. Path: **Start** > **All programs** > **SICK** > **SICK AppStudio**
4. Select the directory (workspace) where all data and changes are to be automatically saved.
5. Establish a connection between the software and the device via Ethernet or USB (depending on type).
   The connection wizard starts automatically.
6. The following IP addresses are configured by default on the device:
   - IP address: 192.168.0.1

First steps with the device

There are various sensor apps available which can be used to demonstrate certain device properties and as a starting point for programming.

1. The app currently connected on the device is automatically transmitted to the created workspace and displayed on the left side of AppExplorer.
2. Save App with a right mouse click > **Export as zip file** and load additional apps with a right mouse click > **Import app**.
3. Selected desired app and transmit to and activate on the sensor with **Run all apps** in the upper bar.
4. Start Internet browser (recommendation: Chrome, Firefox or Safari) and enter the IP address of the device.
5. Get to know the operating principle of the app and change parameters as needed.
6. In AppExplorer, adjust UI elements in the app under **pages** or change the operating principle of the app under **scripts** (programming in LUA). All changes are automatically saved in the workspace.
7. Transmit changes to the device via **Run all apps** and update the browser for visualization.
8. To compare with the original app: Assign new app name and load the originally saved app back into AppStudio using a right mouse click > **Import app**.

For more information, visit supportportal.sick.com.

8 Maintenance

8.1 Maintenance plan

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

Table 6: Maintenance plan

Maintenance work	Interval	To be carried out by
Cleaning the housing and optics cover	Cleaning interval depends on ambient conditions and climate.	Specialist
Check screw connections and plug connectors	Interval depends on the place of use, ambient conditions, or operational regulations. Recommended: At least every 6 months.	Specialist
Check that the unused connections are sealed with blind plugs	Interval depends on ambient conditions and climate. Recommended: At least every 6 months.	Specialist

8.2 Cleaning

> ❗ **NOTICE**
> **Equipment damage due to improper cleaning.**
> Improper cleaning may result in equipment damage.
> - Only use recommended cleaning agents.
> - Never use sharp objects for cleaning.

▶ Clean the optics hood at regular intervals and in the event of contamination using a lint-free lens cloth (part no. 4003353) and plastic cleaning agent (part no. 5600006). Rinse off coarse dirt first with water. The cleaning interval essentially depends on the ambient conditions.

9 Troubleshooting

9.1 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.

9.2 Returns

▶ Do not dispatch devices to the SICK Service department without consultation.
▶ 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

9.3 Disposal

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 valid regulations on environmental protection.
> - Separate the recyclable materials by type and place them in recycling containers.

10 Technical data

10.1 Features

Variant	TiM881P
Measurement principle	HDDM+
Application	Outdoor
Light source	Infrared (wavelength 850 nm, max. pulse power 880 mW, max. pulse width 5 ns, pulse rate 1,500 kHz)
Laser class	1 (IEC 60825-1:2014, EN 60825-1:2014)
Aperture angle	270° (horizontal)
Scanning frequency	15 Hz
Angular resolution	0.33°
Working range	0.05 m ... 25 m
Scanning range with 10% remission	8 m (typical) [1]

[1] at ambient temperature < -15 °C: typ. 7.5 m

Working range diagram
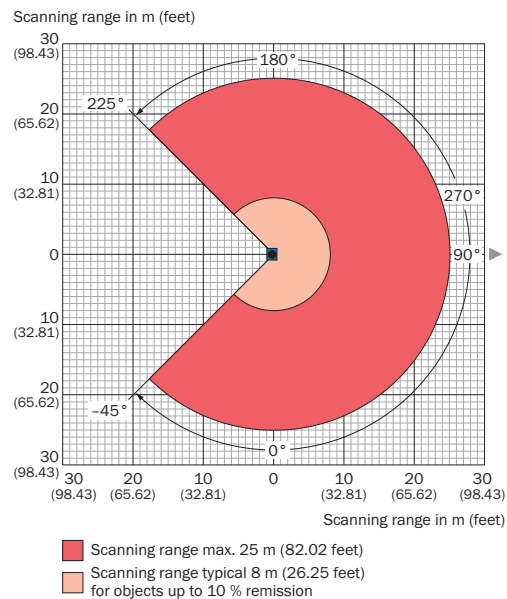
Figure 19: Working range diagram

10.2 Performance

Variant	TiM881P
Response time	Typ. 67 ms
Detectable object shape	Almost any

Variant	TiM881P
Measurement errors	Systematic: ± 60 mm (at room temperature) Static: 20 mm (at room temperature) Temperature drift: 0.5 mm/K

10.3   Interfaces

Variant	TiM881P
Ethernet	TCP/IP Max. data transmission rate: 10 Mbit and 100 Mbit Length of cable: max. 100 m
USB	Type: Micro-USB
Switching inputs	4 (PNP)
Switching outputs	4 (PNP)
Optical indicators	2 LEDs

10.4   Mechanics/electronics

Variant	TiM881P
Electrical connection	1 x Ethernet connection, 4-pin M12 female connector 1 x voltage supply connection, 12-pin M12 male connector 1 x micro USB female connector, type B
Supply voltage	9 V DC … 28 V DC
Power consumption	Typical 4 W with unloaded switching outputs Max. 16 W with max. four loaded switching outputs
Housing	Lower part: Aluminum die cast Optics cover: Polycarbonate with scratch-resistant coating
Housing color	Gray (RAL 7032)
Screw tightening torque	8 Nm
Enclosure rating	IP67 (IEC 60529:1989+AMD1:1999+AMD2:2013), only valid with closed "Aux interface" plastic cover
Protection class	III (IEC 61140:2016-1)
Weight	250 g, without connecting cables
Dimensions (L x W x H)	60 mm x 60 mm x 86 mm
Service life	$MTTF_D$ (mean time to dangerous failure): 100 years, according to EN ISO 13849-1:2015 (at 25 °C ambient temperature) MT (period of use): 10 years

10.5   Ambient data

Variant	TiM881P
Object remission	4% … > 1,000% (reflectors)
Electromagnetic compatibility (EMC)	IEC 61000-6-3:2006+AMD1:2010, IEC 61000-6-2:2005

Variant	TiM881P
Vibration resistance	In accordance with IEC 60068-2-6:2007: Sine resonance scan 10 Hz to 1,000 Hz; 1 g Sine test 10 Hz to 150 Hz; 5 g; 20 frequency cycles In accordance with IEC 60068-2-64:2008 Noise test 10 at 200 Hz, 5 g_{rms}, 120 min
Shock resistance	In accordance with IEC 60068-2-27:2008: 15 g, 11 ms; 6 shocks/axis 10 g, 16 ms; 1,000 shocks/axis
Ambient temperature	Commissioning/Switching on: –10 °C ... +50 °C Operation: –25 °C ... +50 °C Storage: –40 °C ... +75 °C
Ambient humidity	Operation: Max. 80% rF (non-condensing) Storage: Max. 90% rF (non-condensing)
Ambient light immunity	80,000 lx
Altitude	< 5,000 m above sea level
Ambient conditions	In accordance with EN 61010-1:2011-07, Contamination degree 3 outside housing
Moisture, heat	In accordance with EN 60068-2-30:2005-12
Temperature change	In accordance with EN 60068-2-14:2009-07

11   Accessories

> **NOTE**
> Accessories and where applicable mounting information can be found online at:
>
> - **www.sick.com/TiM7xx**
>   The accessory products which are offered for the TiM781 can be used for the TiM8xxP.

12 Annex

12.1 EU declaration of conformity

Placeholder
EU declaration of conformity

12.2 Licenses

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