

TiM4xx

2D LiDAR sensors

SICK
Sensor Intelligence.



Described product

TiM4xx

Manufacturer

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

Legal information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for SICK AG. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, abridgment or translation of this document is prohibited without the express written permission of SICK AG.

The trademarks stated in this document are the property of their respective owner.

© SICK AG. All rights reserved.

Original document

This document is an original document of SICK AG.



Contents

1	About this document.....	5
1.1	Information on the operating instructions.....	5
1.2	Explanation of symbols.....	5
1.3	Further information.....	6
2	Safety information.....	7
2.1	Intended use.....	7
2.2	Improper use.....	7
2.3	Cybersecurity.....	7
2.4	Limitation of liability.....	7
2.5	Modifications and conversions.....	8
2.6	Requirements for skilled persons and operating personnel.....	8
2.7	Operational safety and specific hazards.....	8
3	Product description.....	10
3.1	Scope of delivery.....	10
3.2	Setup and dimensions.....	11
3.3	Display and operating elements.....	14
3.4	Type code.....	14
3.5	Product identification.....	15
3.6	Principle of operation.....	15
3.6.1	Measurement principle.....	15
3.6.2	Distance measurement.....	16
3.6.3	Direction measurement.....	16
3.6.4	Object sizes.....	16
3.6.5	Scan field flatness (conical error and tilt).....	18
3.6.6	Impact of object surfaces on the measurement.....	18
3.6.7	Scanning range.....	20
3.6.8	RSSI values.....	21
3.6.9	Filter.....	21
4	Transport and storage.....	25
4.1	Transport.....	25
4.2	Unpacking.....	25
4.3	Transport inspection.....	25
4.4	Storage.....	25
5	Mounting.....	26
5.1	Mounting instructions.....	26
5.2	Mounting device.....	26
5.3	Mutual interference.....	27
6	Electrical installation.....	28
6.1	Prerequisites for safe operation of the device.....	28
6.2	Electrical block diagram for commissioning.....	31

6.3	Wiring instructions.....	32
6.4	Connection diagram.....	32
6.4.1	TiMxxx-20xxxx.....	32
6.5	Connecting the device electrically.....	33
6.6	Wiring the SYNC/Device Ready digital output.....	33
7	Operation.....	35
7.1	SOPAS ET.....	35
7.1.1	Parameter - network.....	37
7.1.2	Parameter - filters.....	37
7.2	Measurement data output.....	37
7.2.1	Monitor - scan view pro.....	37
7.2.2	Parameter - data processing.....	38
7.2.3	Telegram.....	38
7.3	ROS driver.....	39
8	Maintenance.....	40
8.1	Maintenance plan.....	40
8.2	Cleaning.....	40
9	Troubleshooting.....	41
9.1	Detecting and displaying errors.....	41
9.2	Resetting the password for the Service user level.....	41
9.3	Repairs.....	42
9.4	Returns.....	42
9.5	Disposal.....	42
10	Technical data.....	43
10.1	Features.....	43
10.2	Performance.....	44
10.3	Interfaces.....	45
10.4	Mechanics/electronics.....	45
10.5	Ambient data.....	45
11	Accessories.....	47
12	Annex.....	48
12.1	Declarations of conformity and certificates.....	48
12.2	Licenses.....	48

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 product 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 TiM4xx 2D LiDAR sensor features a scan plane and is designed for the following applications:

- Detection of objects during continuous output of measurement data as required.

It is suitable for applications which demand precise, non-contact optical measuring contours and dimensioning. Typical fields of application are, for example, stationary field protection, area monitoring, access control, mobile applications (navigation and anti-collision of mobile platforms).

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.

2.2 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	<ul style="list-style-type: none"> ■ Basic practical technical training ■ Knowledge of the current safety regulations in the workplace
Electrical installation, device replacement	<ul style="list-style-type: none"> ■ Practical electrical training ■ Knowledge of current electrical safety regulations ■ Knowledge of the operation and control of the devices in their particular application
Commissioning, configuration	<ul style="list-style-type: none"> ■ 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	<ul style="list-style-type: none"> ■ 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.

**CAUTION****Optical radiation: Class 1 Laser Product**

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.

Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

It is not possible to entirely rule out temporary disorienting optical effects, particularly in conditions of dim lighting. Disorienting optical effects may come in the form of dazzle, flash blindness, afterimages, photosensitive epilepsy, or impairment of color vision, for example.

**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

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	Without connecting cables
1	Printed safety notes, multilingual	Quick guide and general safety notes

3.2 Setup and dimensions

TiM44x

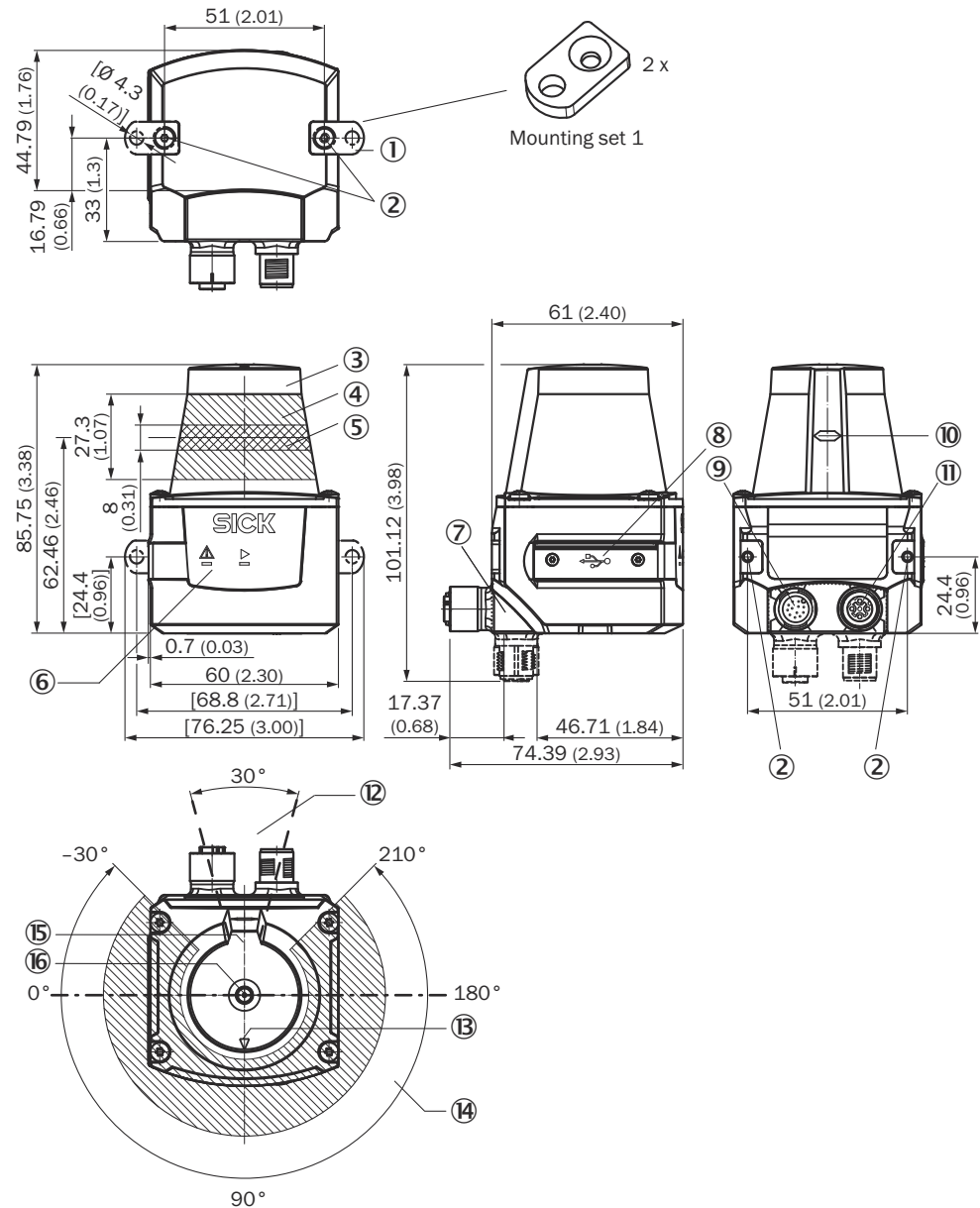


Figure 1: Structure and dimensions, unit: mm (inch), decimal separator: period

- ① 2x fastening clip with M3 x 5 mm countersunk screw, self-locking (optional)
- ② M3 threaded mounting hole, 2.8 mm deep (blind hole thread), max. tightening torque 0.8 Nm
- ③ Optics cover
- ④ Receiving range (light inlet)
- ⑤ Transmission range (light emission)
- ⑥ Red and green LED (status indicators)
- ⑦ Swivel connector unit with electrical connections (recess the area for surface mounting)
- ⑧ Micro USB female connector, type B (without function)
- ⑨ Voltage supply connection, 5-pin M12 female connector
- ⑩ Marking for the position of the light emission level
- ⑪ Ethernet connection, 4-pin M12 female connector

3 PRODUCT DESCRIPTION

- ⑫ Area in which no reflective surfaces are permitted when the device is mounted
- ⑬ Bearing marking to support alignment (90° axis)
- ⑭ 240° aperture angle (field of vision)

TiM47x, TiM48x

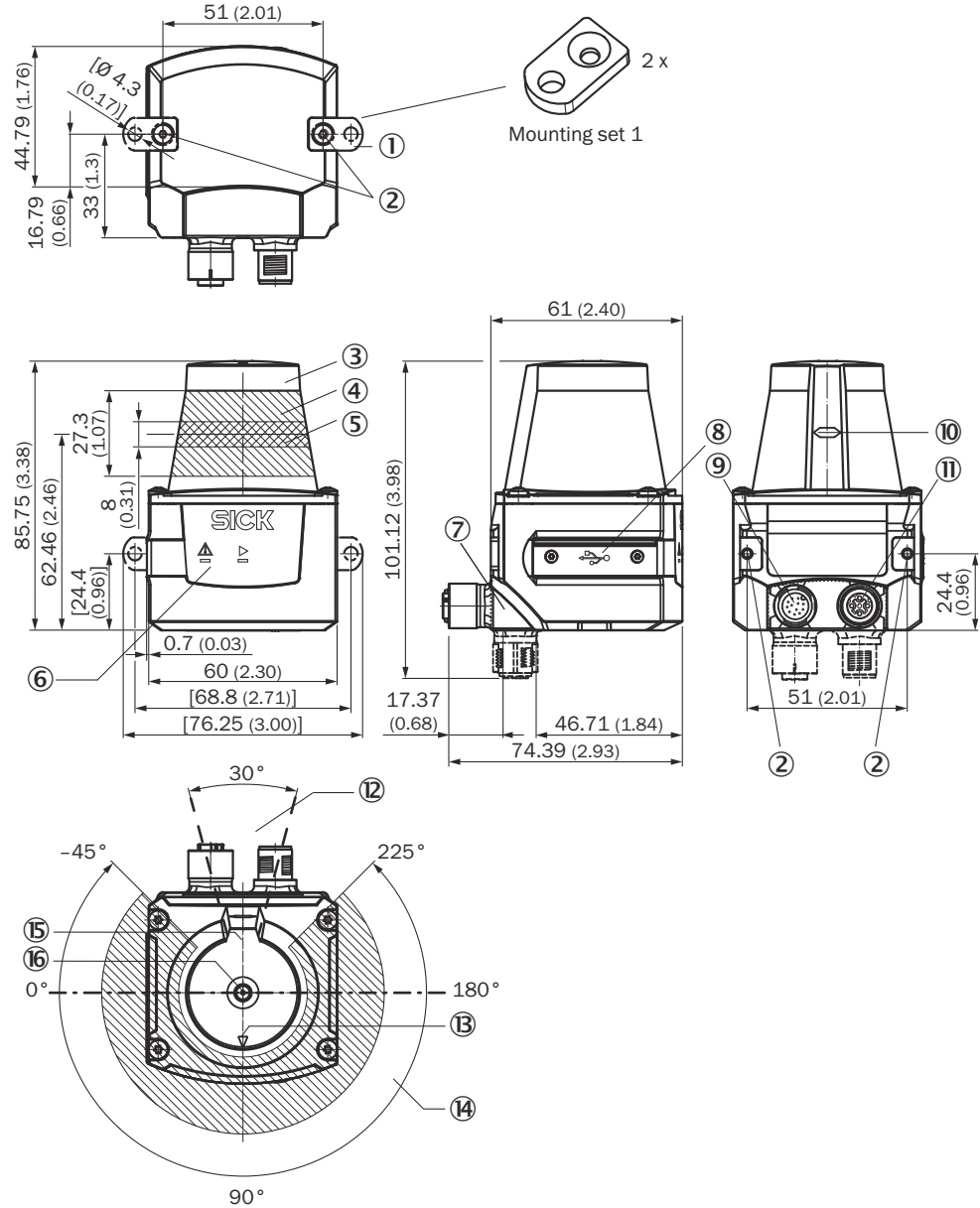


Figure 2: Structure and dimensions, unit: mm (inch), decimal separator: period

- ① 2x fastening clip with M3 x 5 mm countersunk screw, self-locking (optional)
- ② M3 threaded mounting hole, 2.8 mm deep (blind hole thread), max. tightening torque 0.8 Nm
- ③ Optics cover
- ④ Receiving range (light inlet)
- ⑤ Transmission range (light emission)
- ⑥ Red and green LED (status indicators)
- ⑦ Swivel connector unit with electrical connections (recess the area for surface mounting)
- ⑧ Micro USB female connector, type B (without function)
- ⑨ Voltage supply connection, 5-pin M12 female connector
- ⑩ Marking for the position of the light emission level
- ⑪ Ethernet connection, 4-pin M12 female connector
- ⑫ Area in which no reflective surfaces are permitted when the device is mounted

- ⑬ Bearing marking to support alignment (90° axis)
- ⑭ 270° aperture angle (field of vision)

3.3 Display and operating elements

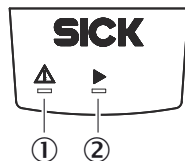


Figure 3: Display and control elements

- ① Red LED (status indicator)
- ② Green LED (status indicator)

There are no control elements on the device.

Status indicators

LED (red)	LED (green)	Description
-	●	Device ready/monitoring mode
☉	-	Error, start up, firmware update, parameterization
-	-	Device without supply voltage

● = illuminated; ☉ = flashing

3.4 Type code

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

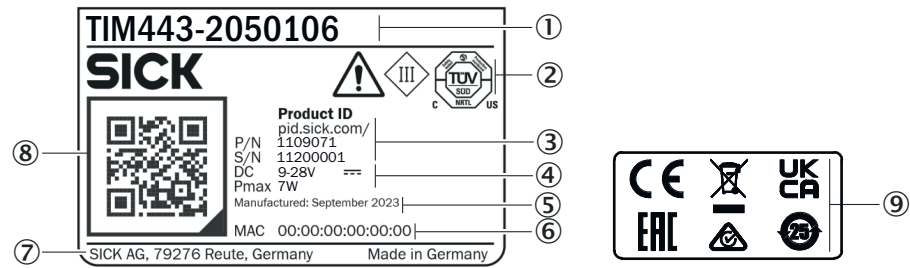
TIM	x	y	z		-	aa	bb	c	dd
1	2	3	4	5		6	7	8	9

Table 3: Type code

Position	Description	Characteristic
1	Device name	TIM: Short range 2D-LiDAR sensor
2	Device type	4: Data supplier
3	Performed by	4: 15 m measuring range, 0.33° angular resolution, commercial performance 7: 25 m measuring range, 0.33° angular resolution, performance professional, HDDM 8: 25 m measuring range, 0.33° angular resolution, performance professional, HDDM+
4	Housing	3: IP64 housing without heating
5		"Empty": standard
6	Connection	20: Rotating connection unit, 1 x M12 male connector, 5-pin, D-coded (Power); 1x M12 female connector, 4-pin, A-coded (Ethernet)
7	Application	50: Measurement data supplier
8	Laser type	1: Pulse power up to 880 mW, pulse width up to 5 ns, pulse rate 1,500 kHz
9	Color	06: Non-coated

3.5 Product identification

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



- ① Type code
- ② Conformity mark/certification mark, symbol: Observe the operating instructions!
- ③ Product ID with part number (P/N) and serial number (S/N)
- ④ Voltage supply, maximum power consumption
- ⑤ Production date
- ⑥ MAC address
- ⑦ Manufacturer/production location
- ⑧ QR code with product data (part number, serial number), example: pid.sick.com/1090608/23000000
- ⑨ Conformity mark/certification mark

3.6 Principle of operation

3.6.1 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. This 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.

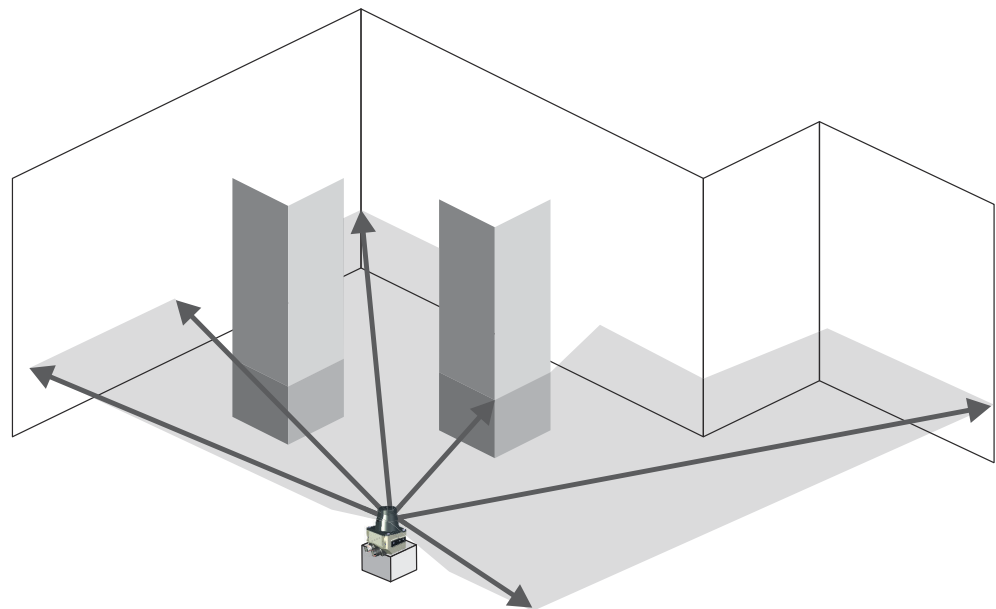


Figure 4: The 2D LiDAR sensor measurement principle

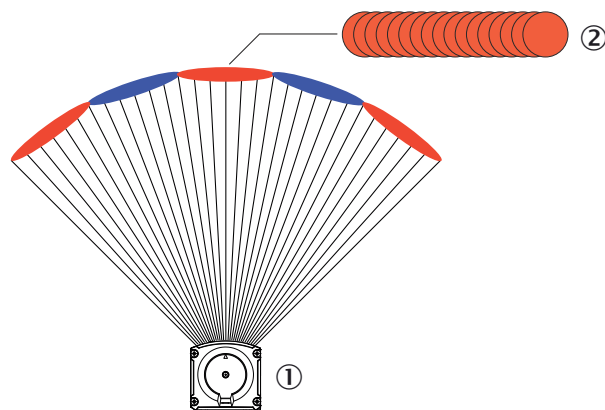
3.6.2 Distance measurement

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/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.

3.6.3 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

3.6.4 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

Required values for calculating the light spot size and minimum object size:

- Light spot size on the device cover: 7 mm (rounded up)
- Light spot divergence per single pulse: 0.49 deg (8.6 mrad)
- supplement HDDM/HDDM+ (1 measured value consists of several overlapping single pulses): 5.8 mrad

Formula for calculating the light spot width:

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

Calculation example of light spot width at a distance of 4 m, with supplement 5.8 mrad:

$$(8.6 \text{ mrad} + 5.8 \text{ mrad}) * 4,000 \text{ mm} + 7 \text{ mm} = 64.6 \text{ mm}$$

Formula for calculating the height of the light spot:

$$\text{Light spot divergence [mrad]} * \text{Distance [mm]} + \text{Light spot size at the device cover [mm]} = \text{Light spot width [mm]}$$

Example calculation of the light spot height at a distance of 4 m:

$$8.6 \text{ mrad} * 4,000 \text{ mm} + 7 \text{ mm} = 41.4 \text{ mm}$$

Formula for calculating the minimum object size:

$$2 * \text{supplement [mrad]} * \text{distance [mm]} + \text{light spot height [mm]} = \text{minimum object size [mm]}$$

Calculation example of minimum object size at a distance of 4 m, with supplement 5.8 mrad:

$$2 * 5.8 \text{ mrad} * 4,000 \text{ mm} + 41.4 \text{ mm} = 87.8 \text{ mm}$$



NOTE

For reliable measurement, an object needs to be hit 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.

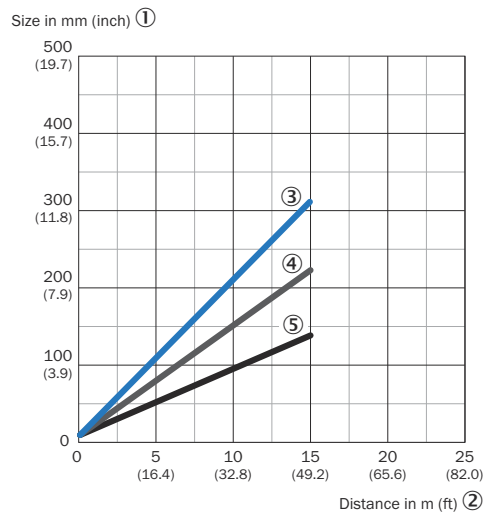


Figure 6: Minimum object size TiM44x

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

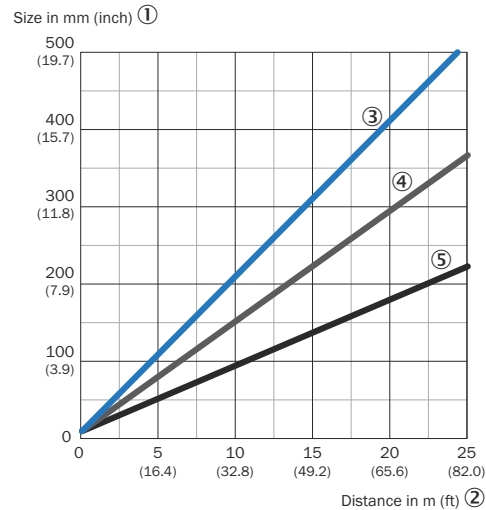


Figure 7: Minimum object size TiM47x/TiM48x

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

3.6.5 Scan field flatness (conical error and tilt)

The scan field flatness describes the production-related vertical deviation of the horizontal scan plane of the sensor. Conical errors and tilt can affect the three-dimensional measurements. This should be taken into consideration to ensure reliable measurement results. Conical errors can only be corrected for a small viewing range. Tilt errors can be compensated for in many cases by mounting the sensor at a compensating angle. An alignment aid (e.g. item no.: 2086761) can help to position the sensor precisely and avoid alignment errors.

3.6.6 Impact of object surfaces on the measurement

Remission value

Remission is the ability of a material to reflect light. The remission correlates with the amount of laser light emitted by the LiDAR sensor which is reflected by an object (see Lambert's law).

Glossy surfaces have different remissions at the same distance with different angles of impact. In the case of shiny surfaces, maximum remission is achieved when the beam makes vertical impact.

Matt and dull surfaces have diffuse remission. They therefore exhibit similar relative remissions with the same angle of impact regardless of the distance from the zero point.

Table 4: Typical remissions of frequently used materials

Material	Typ. relative remission
Rubber tires (vulcanized, black)	2%
Foam rubber (black)	2.4%
Photographic board (black, matte)	10%
Cardboard (gray)	20%
Wood (untreated fir, soiled)	40%

Material	Typ. relative remission
PVC (gray)	50%
Paper (white, matte)	80%
Plaster (white)	100%
Aluminum (black anodized)	110 ... 150%
Steel (stainless, shiny)	120 ... 150%
Steel (high gloss)	140 ... 200%

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, a large proportion of the energy is lost due to absorption. 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.

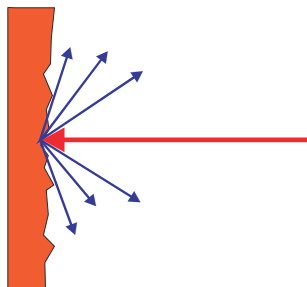


Figure 8: Reflection of light on the surface of the object

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.

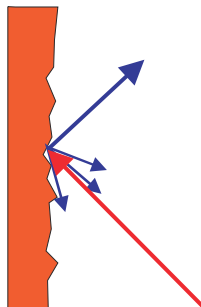


Figure 9: Angle of reflection

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.

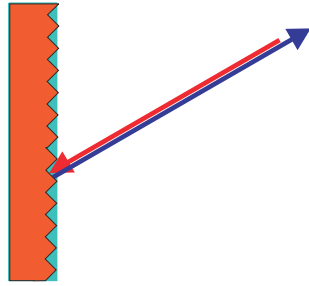


Figure 10: Retroreflection

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.

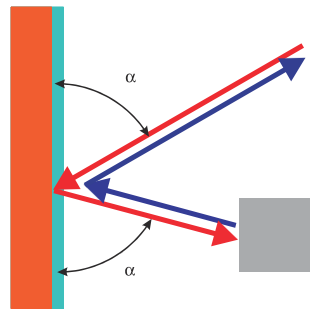


Figure 11: Specular surfaces

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. This can lead to a corruption of the measured value.

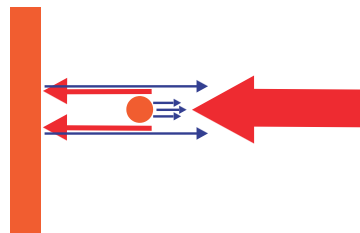


Figure 12: Object smaller than the laser beam diameter

3.6.7 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.

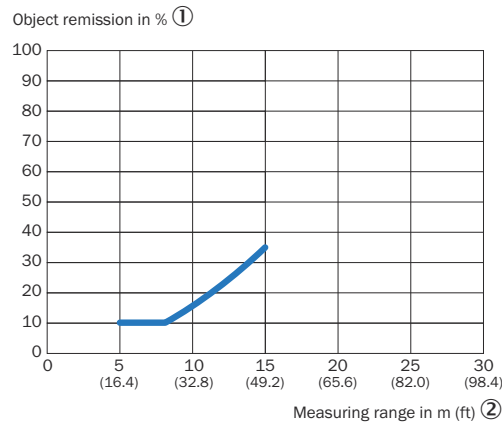


Figure 13: Scanning range as a function of object remission, TIM44x

- ① Object remission in percent
- ② Measuring range in meters (feet)

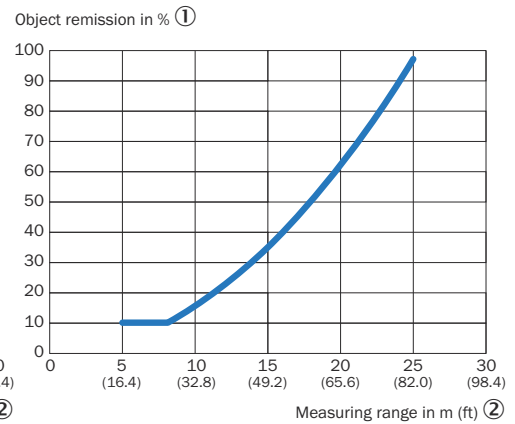


Figure 14: Scanning range as a function of object remission, TIM47x / TIM48x

- ① Object remission in percent
- ② Measuring range in meters (feet)

3.6.8 RSSI values

RSSI (Received Signal Strength Indicator) is an indication of the received signal strength for each measuring point. The RSSI values have a resolution of 8 bits with integer values between 0 and 254, where 0 represents no received signal and 254 the strongest signal.

The value changes non-linearly and is not calibrated. Low signal strengths are represented by a larger value range than high signal strengths.

Besides the remission of the measuring object, the angle of incidence of the measurement beam, ambient light, and temperature, this unitless value also depends on the distance.

The RSSI values can vary slightly among different devices and during the service life of the sensor.

3.6.9 Filter

The device has digital filters for pre-processing and optimizing the measured distance values. They enable the device to be adapted to meet the specific requirements of the respective application.

The filters can be combined without restrictions. If several filters are active, then the filters are applied sequentially to the results of the preceding filter. The processing sequence is as follows:

- Edge filter
- Particle filter
- Median filter
- Average filter

The active filter functions affect the output measured values. It is not possible to recalculate the original measured values from the filtered output values. For this reason, certain combinations of filters might not be advisable.

A particularly effective way to reduce the data in a scan (reduction of measurement points) is to restrict the scan range (“Data output” > “Output range”) or the media filter.

3.6.9.1 Edge filter

The edge filter eliminates erroneous or extreme distance values at edges. These arise as a result of laser light that partially hits an object in the front and partially hits an object farther away, or due to too little light remission at the object itself, [see "Impact of object surfaces on the measurement", page 18](#). The filter evaluates the difference in distance between adjacent points.

The previous and next measurement point are taken into consideration in this. As soon as the configured maximum adjacent distance to the previous **and** next measurement point is exceeded, the device sets the distance value to 0 (value highlighted in [see table 5, page 22 bold](#)). If the maximum adjacent distance is not exceeded, or only exceeded to one of the adjacent measurement points, the measurement point is not filtered. If the measurement point or one of the adjacent measurement points is 0, then the filter is not applied to this measurement point.

Table 5: Example: Measured values with and without edge filter

	Measurement points (distance values in mm)							
	1	2	3	4	5	6	7	...
not filtered	1800	1750	1145	1150	1147	800	871	...
filtered	1800	1750	1145	1150	1147	0	871	...

The edge filter enables points to be entirely suppressed at the outer edges of the object.

Maximum edge filter range (range limitation)

The maximum distance can be set to 8,000 mm ¹⁾. The measurement points within the configured range are taken into account.

3.6.9.2 Particle filter

The particle filter blanks small, irrelevant reflection pulses in dusty environments and in rain or snow which are caused by dust particles, raindrops, snowflakes or the like.

In doing so, successive scans are continuously evaluated in order to detect static objects.

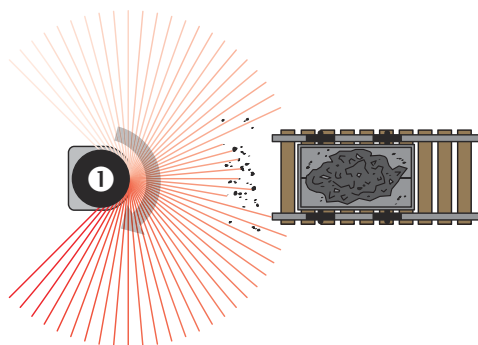


Figure 15: Without the particle filter: Violation of the contour due to dust particles in the vicinity of the object.

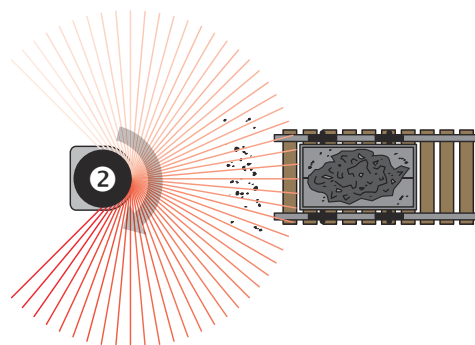


Figure 16: Using the particle filter: The response to dust particles in the detection field is delayed by one scan. Particles can thereby be blanked.

¹⁾ For the variants TiM310 / TiM320, the maximum distance can be set to 4,000 mm.

3.6.9.3 Median filter

The median filter filters out unwanted outliers in the measured data. When filtering, a distance value is compared with its two neighboring measuring points in a scan. The distance values are sorted by size and the distance value in the middle is output with the corresponding RSSI value.

There are two different types of median filter:

- The **moving median filter**, in which the viewing window of the original scan shifts by one after each filtered measuring point; this does not result in any data reduction.
- The **non-moving median filter** first looks at the first three measuring points of the original scan and filters this viewing window. The viewing window moves forward by the number of previously filtered measuring points and thus reduces by a third the number of measuring points that are output. The two outer measuring points at the start and end of a scan are not filtered.

Table 6: Example: Measured values without median filter

	Angle (distance values in mm)					
Scan	1	2	3	4	5	...
1	850	852	851	849	850	...
2	849	851	850	853	852	...
3	850	849	853	851	850	
4	851	852	854	851	849	
...

Table 7: Example: Measured values with moving median filter

	Angle (distance values in mm)					
Scan	1	2	3	4	5	...
1	850	851	851	850
2	849	850	851	852
3	850	850	851	851
4	851	852	852	851
...

Table 8: Example: Measured values with non-moving median filter

	Angle (distance values in mm)					
Scan	1	2	3	4	5	...
1		851			...	
2		851			...	
3		850			...	
4		852			...	
...		

3.6.9.4 Average filter

The sliding average filter smooths the distance value. It does this by calculating the arithmetic mean from several scans of the same point. The number of scans can be configured (maximum 4 scans).

Table 9: Example: Average filter over 5 scans

Scan	Angle (distance values in mm)									
	1	2	3	4	5	6	7	8	9	...
1	0	0	1100	1100	1150	1150	1380	1380	0	...
2	0	0	1200	1200	1190	950	1500	1500	0	...
3	0	0	1150	1450	1200	1200	1450	1450	0	...
4	0	0	1170	1170	1220	1220	1470	1150	0	...
1 Output value (scan 1-4)	0	0	1155	1230	1190	1130	1450	1370	0	...
5	0	0	0	1110	1150	1150	1380	1380	0	...
2. Output value (scan 2-5)	0	0	1173	1225	1190	1130	1450	1370	0	...
6	0	0	1200	1210	1190	0	1500	1500	0	...
3. Output value (scan 3-6)	0	0	1173	1235	1190	1190	1450	1370	0	...
7	0	730	1150	0	1200	1200	1450	1450	0	...
4. Output value (4-7)	0	730	1173	1163	1190	1190	1450	1370	0	...
...

Individual outliers (shown in **bold** in the table) influence the average value.

Once the measured value telegram has been confirmed, the first measured value is not output until after the configured number of scans. Therefore, there is always a time delay equivalent to the number of scans configured for averaging. The digit of the first scan included in the averaging calculation is always output in the scan counter. Invalid distance values (= 0) are not included in the averaging calculation, so that in these places a smaller number of scans is used in the division calculation.

Based on the scanning frequency of 15 Hz, a measured value is generated every 67 s. The time delay affecting data output results from this base value multiplied by the number of averaging operations (e.g., 2 averaging operations = 134 ms, 10 averaging operations = 670 ms).

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.

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

- 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.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: [see "Technical data", page 43](#).
- Relative humidity: [see "Technical data", page 43](#).
- 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 47](#).
- In application areas with severe vibrations or shocks caused by vibrations, jolts or abrupt changes in directions (e.g., when mounted to a manned forklift truck), mounting with vibration dampers is to be carried out ([see "Accessories", page 47](#)). Mount the device in a freely suspended manner.
- When mounting the device, make sure there are no reflective surfaces behind the reference target, [see "Setup and dimensions", page 11](#).
- When mounting the device, make sure the swivel connector area is recessed so it does not lie on the mounting surface [see "Setup and dimensions", page 11](#).
- 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 27](#).
- 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.
- The optionally available M3 x 5 screws are intended for mounting the fastening clips via the blind hole threads on the rear or underside of the device, [see "Setup and dimensions", page 11](#). If the mounting clamps are not used or if other screws are used, the screws must not be screwed into the thread by more than 2.8 mm. The maximum tightening torque is 0.8 Nm.

5.2 Mounting device

1. Mount the LiDAR sensor using the designated fixing holes, [see "Setup and dimensions", page 11](#).



NOTICE
Risk of damage to the device

the device will be damaged if the tightening torque of the mounting screws is too high or if the maximum screw-in depth of the blind hole threads is exceeded.

- ▶ Observe maximum tightening torque.
- ▶ Use suitable mounting screws for the blind hole threads of the device. Observe the maximum screw-in depth.

-
2. Make the electrical connection. Attach and tighten a voltage-free cable, [see "Connecting the device electrically", page 33](#).
 3. Switch on the supply voltage.
 - ✓ The green operating LED lights up.
 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 (90° axis) on the upper side of the optics cover serves as a alignment aid.

5.3 Mutual interference

**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.

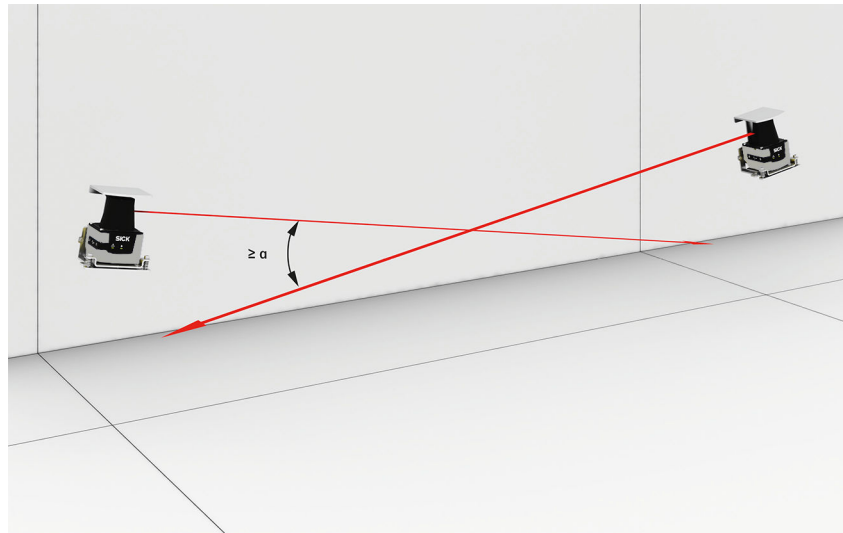


Figure 17: Angle $\geq 6^\circ$

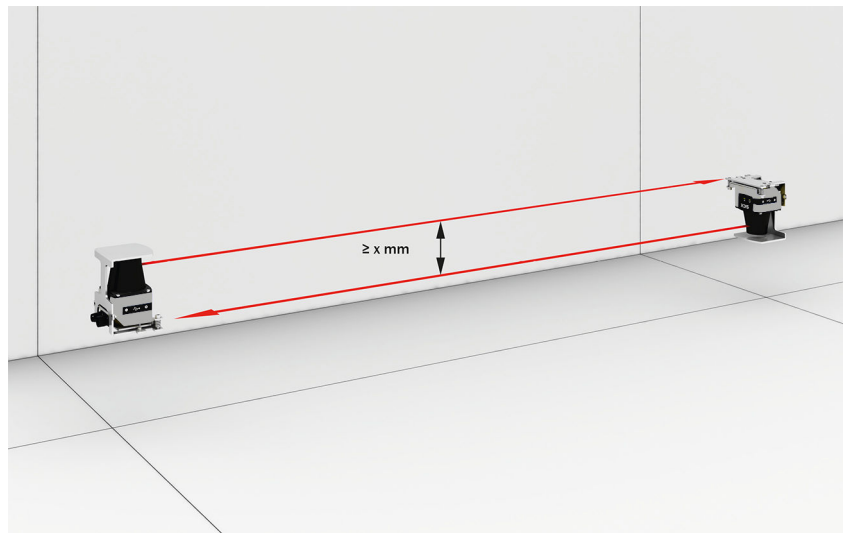


Figure 18: Distance $\geq 200 \text{ mm}$

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. 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

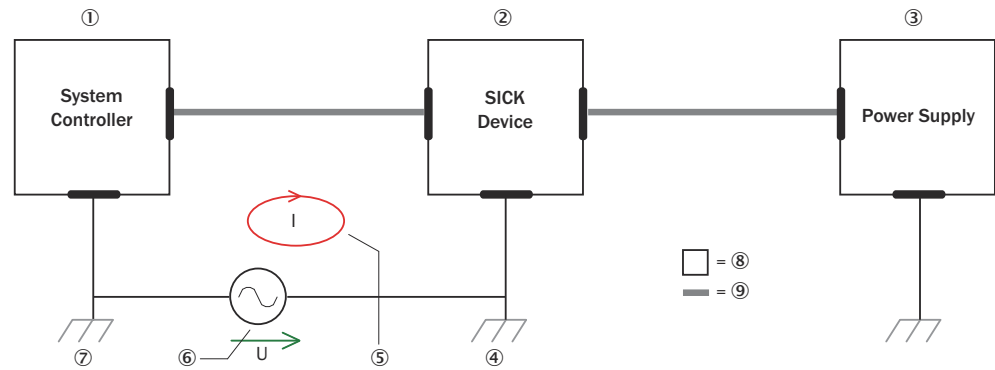


Figure 19: Example: Occurrence of equipotential bonding currents in the system configuration

- 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.

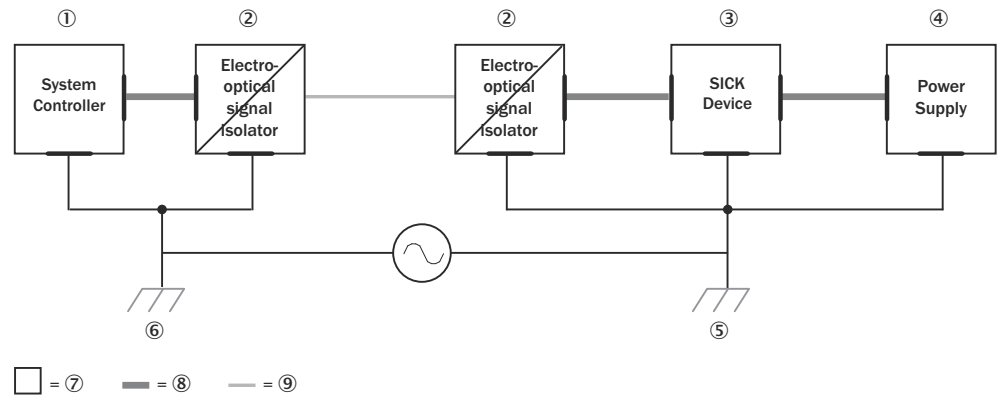


Figure 20: Example: Prevention of equipotential bonding currents in the system configuration by the use of electro-optical signal isolators

- 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.

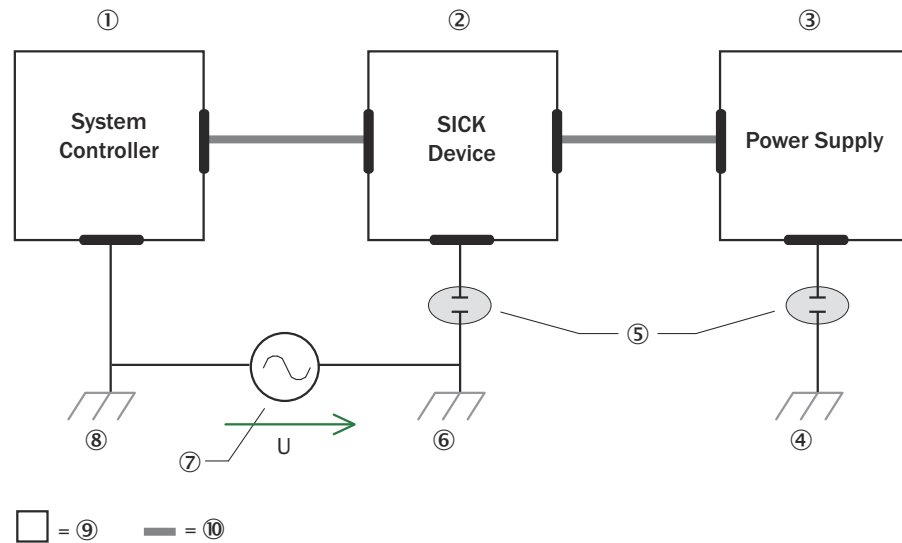


Figure 21: Example: Prevention of equipotential bonding currents in the system configuration by the insulated mounting of the device

- 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

TiMxxx-20xxxx

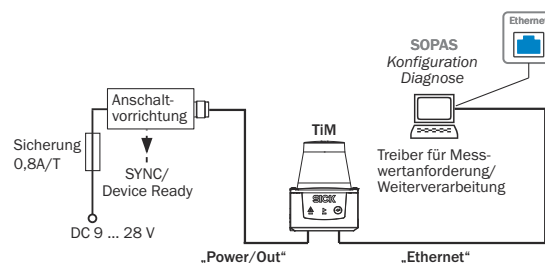


Figure 22: "Power, I/O" connection: With M12 male connector, 5-pin, A-coded; "Ethernet" connection: M12 female connector, 4-pin, D-coded

6.3 Wiring instructions



NOTE

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

The product 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.

All 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. Do not switch on the supply voltage until installation is complete and all connecting cables are connected to the device and control.

Wire cross-sections in the supply cable from the customer’s power system must be implemented in accordance with the applicable standards.

6.4 Connection diagram



NOTE

The recommended connecting cables and their associated technical data can be found on the online product page.

The product 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).

6.4.1 TiMxxx-20xxxxx

Power connection

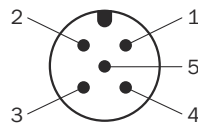


Table 10: Male connector, M12, 5-pin, A-coded

Pin	Signal	Function	Wire colors of connecting cable with flying leads ¹⁾
1	V _S	Supply voltage	Brown
2	SYNC/ Device Ready	Synchronization digital output	White
3	GND	Ground	Blue or Yellow
4	-	Reserved, do not wire this PIN!	-
5	-	Reserved, do not wire this PIN!	-

Pin	Signal	Function	Wire colors of connecting cable with flying leads ¹⁾
-	-	Shielding	-

¹⁾ Example values when using the connecting cable part number 6036159 (5 m). Signal assignment and wire colors can vary when using other connecting cables.

"Ethernet" connection

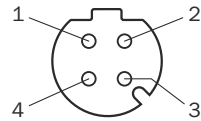


Table 11: Female connector, 4-pin, D-coded

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

6.5 Connecting the device electrically



NOTICE

Observe the wiring instructions, see ["Wiring instructions"](#), page 32.

1. Ensure the voltage supply is not connected.
2. Connect the device according to the connection diagram, see ["Connection diagram"](#), page 32.

6.6 Wiring the SYNC/Device Ready digital output

The SYNC/Device Ready digital output is used to issue an error and a regular index pulse.

The structure and wiring principle of the digital output are shown below.

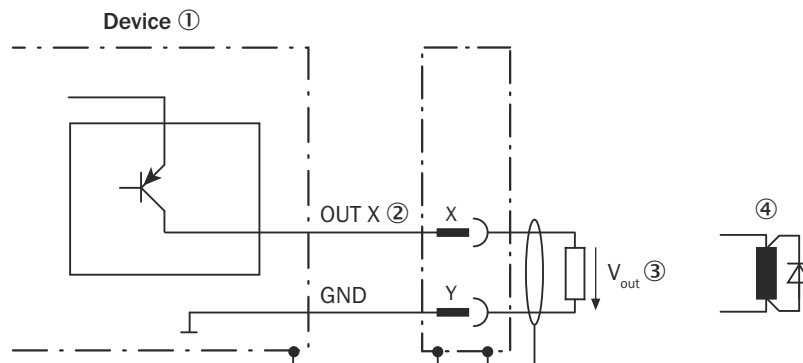


Figure 23: Wiring of the SYNC/Device Ready digital output

- ① Device
- ② SYNC/Device Ready output signal
- ③ Output voltage V_{out}
- ④ If inductive load is present: Provide an arc-suppression switch at the digital output. Attach a freewheeling diode directly to the load for this purpose.

Switching behavior	PNP switching against supply voltage UV Resting level: High (device ready) working level: Low (error), low pulse (15 Hz, index, corresponds to measurement at 90°)
Features	Short-circuit protected and temperature protected Not electrically isolated from supply voltage U _v
Electrical values	see "Mechanics/electronics", page 45

Longer connecting cables at the digital output 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.

7 Operation

7.1 SOPAS ET

The following activities are normally performed using the SOPAS ET configuration software:

- Measurement data output application: displaying the surrounding contour (measured line) detected by the device.
- Parameterization: tailoring other device parameters to the application.
- Diagnosis: determining the cause of a fault.

To configure the device, you will require a computer with SOPAS ET installed and a free Ethernet connection.



NOTE

The most up-to-date version of the SOPAS ET software can be downloaded from www.sick.com/SOPAS_ET. The respective system requirements for installing SOPAS ET are also specified there.

1. Connect the communication interface of the device to the computer.
 2. Switch on and start the computer.
 3. Supply the device with voltage.
- ✓ Following successful initialization, the green status LED lights up. The device is ready for use.



NOTE

To use SOPAS ET with the device, you need a device description file (SDD) for this device. You can install this in SOPAS ET using the device catalog. The device description file is saved on the device and can be installed there. Alternatively, installation is possible from the SICK website (Internet connection required). Use the wizard in SOPAS ET to do this.

Following installation of the device description file, the device can be selected from the device catalog and added to a project.

A connection to the device is established via the communication interface. The connection must be activated for data transmission (**online**).

Certain functions (e.g., Edit parameters) require you to be logged in to the device:

> **Device** > **Login** > Select user level and enter password:



NOTE

Software access to the device is protected by user levels and passwords. After successfully configuring the device, you should change the passwords so they can fulfill their protective function.

User levels	Password
Machine operator	-
Maintenance staff	main
Authorized client	client
Service	servicelevel

Table 12: User level and authorization

Machine operator	<p>A Machine operator level user can view the basic device parameters.</p> <ul style="list-style-type: none"> • No password required • Read only permissions • Not all parameters are visible
Maintenance	<p>Maintenance can view the application-related device parameters.</p> <ul style="list-style-type: none"> • Read only permissions • Not all parameters are visible • Can change the password for this user level
Authorized Client (Integrator)	<p>Device parameters can be set as an Authorized Client.</p> <ul style="list-style-type: none"> • Access to most parameters • Can change the password for this user level and the password for the Maintenance user level. • Can create a diagnostic report
Service	<p>A Service level user can configure all device parameters.</p> <ul style="list-style-type: none"> • Access to all parameters • Can change the password for this user level as well as the password for the user levels Maintenance and Authorized Client • Can create a diagnostic report • Can perform firmware updates



NOTE

Change the passwords during initial commissioning to protect your device. A higher user level can change the password of a lower user level.



NOTE

If the password for the Service user level has been lost: see "[Resetting the password for the Service user level](#)", page 41.

Information about the device is displayed in the device window (> **Device** > **Open**) and the device can also be configured here.



NOTE

Changes to parameters that are made in SOPAS ET are not saved automatically in the device. After you have completed the configuration, you must save it in the device permanently by pressing the **Save permanent** button.



NOTE



To reset the device to the factory settings, use the **Load defaults** option in SOPAS ET. With the **Load application defaults** option, the network settings remain unchanged, all other settings are reset to the factory settings.

Tools

Depending on the selected view, different tools are available to help you perform configurations or customize the display.

The following are examples of some of the tools for customizing the display:

- button: Change the device view. Device black: View from above, device blue: View from below.

- Button  or : Switch off display of the full measuring line or display measuring line as dotted.

7.1.1 Parameter - network

The network area has input screens for configuring the Ethernet connection, the digital inputs / digital outputs and the device.

For Ethernet configuration, note that the IP-Address / subnet-mask must correspond with the address space of the subsequent application.

Table 13: IP-Address factory setting

Parameter	Value
IP-Address	192.168.0.1
Subnet mask	255.255.255.0



NOTE

If you change the parameters of the Ethernet interface via the Ethernet interface, you must first save the data permanently to non-volatile memory in the device and then restart the device. A **Restart** button is provided in SOPAS ET for this purpose.

7.1.2 Parameter - filters

When selecting the filter, consider filter mutual interference, see "Filter", page 21.

7.2 Measurement data output

7.2.1 Monitor - scan view pro

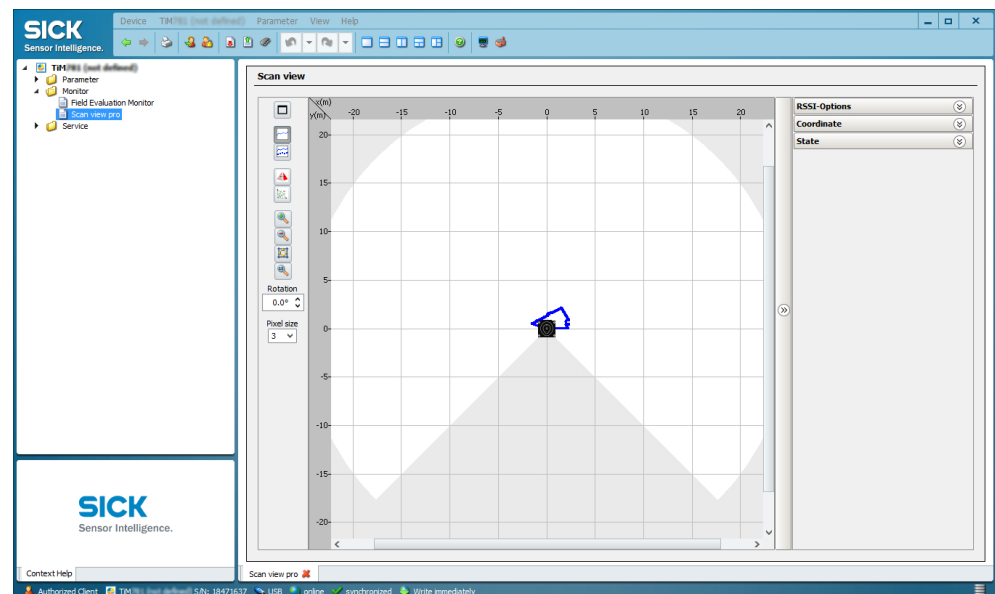


Figure 24: Device window: Monitor - scan view pro

In the Pro scan display window, SOPAS displays the field contour (scan line) currently seen by the device through ambient reflection in blue.

The user can change parameters in the right part of the program window under Settings & Device Status. SOPAS immediately transfers these changes to the device (default setting).

7.2.2 Parameter - data processing

Data output format of the measured values

The data output format per scan is comprised of the measured values (radial distance, RSSI signal level), device and status information and time stamp.

In the default settings, the distance is output as a measured value (in mm).

In order to output remission values in the telegram, select the RSSI checkbox.

To display the remission values in the scan as well, select the RSSI... checkbox under "Monitor" > "scan view pro".

Output range of the measured values

TiM44x: The device scans an angular range of 240° (-30° to 210°) and outputs one measured value per angular increment (0.33°).

TiM47x/TiM48x: The device scans an angular range of 270° (-45° to 225°) and outputs one measured value per angular increment (0.33°).

The angle range for which measured values can be output can be set using the Output range input field (resolution corresponds to the angular resolution of the device).

7.2.3 Telegram

If the device receives one of the two following commands by telegram over the Ethernet interface, it will start the output of measured values in real time over these data interfaces.

The detailed construction of the output telegram as well as the flow of requests and outputs is described in the Telegram Listing publication (no. 8014631).

One-off output of measured values:

Telegram structure: sRN LMDscandata

Telegram part	Description	Variable type	Length (Byte)	Value range
Command type	Request (SOPAS read by name)	String	3	sRN
Command	Request data	String	11	LMDscandata

Example:

Telegram type	Command
ASCII	<STX>sRN{SPC}LMDscandata<ETX>
HEX	02 73 52 4E 20 4C 4D 44 73 63 61 6E 64 61 74 61 03
Binary	02 02 02 02 00 00 00 0F 73 52 4E 20 4C 4D 44 73 63 61 6E 64 61 74 61 05

Continuous output of measured values:

Telegram structure: sEN LMDscandata measurement start/stop

Telegram part	Description	Variable type	Length (Byte)	Value range
Command type	Request (SOPAS event by name)	String	3	sEN
Command	Request data	String	11	LMDscandata

Telegram part	Description	Variable type	Length (Byte)	Value range
StartStop measurement	Starting/stopping the output of measured values	Enum8	1	0: Stop 1: Start

Example:

Telegram type	Command
ASCII	<STX>sEN{SPC}LMDscandata{SPC}1<ETX>
HEX	02 73 45 4E 20 4C 4D 44 73 63 61 6E 64 61 74 61 20 31 03
Binary	02 02 02 02 00 00 00 11 73 45 4E 20 4C 4D 44 73 63 61 6E 64 61 74 61 20 01 33

Activating the output of the measured values in SOPAS on a trial basis:

1. Start the terminal emulator with the button.
2. Select the Connect... command in the Connections menu in the dialog window and establish communication with the TiM over the Ethernet interface.
3. Enter one of the two telegrams in the "Send telegram" input line as they appear (automatically framed by STX and ETX when sending in the default setting). Pay attention to blank characters in the string.
4. Use the button to transmit the telegram to the device.
- ✓ The device responds by providing the data as a one-off or continuously in the display area of the terminal emulator.

7.3 ROS driver

Suitable drivers for integrating the device into the ROS (Robot Operating System) are available for download on the product page.

The product 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).

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 14: 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 housing and optics cover.	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

8.2 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.
-
- ▶ Clean the optics cover at regular intervals and in the event of contamination with a lint-free lens cloth and plastic cleaning agent. Rinse off coarse dirt first with water. The cleaning interval essentially depends on the ambient conditions.

9 Troubleshooting

9.1 Detecting and displaying errors

Error memory

The device has an error memory where its internal error states are recorded. The content of the error memory is retained when the device is switched off and when the “Restore Factory Settings” function is used.

The SOPAS ET software can be used to create a diagnostics report containing error information (**Complete** view, **Configuration** tab, **Start Diagnosis** button).

9.2 Resetting the password for the Service user level

If you have forgotten the password of the **Service** user level, you can reset it with the assistance of SICK.



NOTE

The responsible SICK sales company or the responsible SICK service partner carefully checks each code request to reset the password. A risk of deception by third parties nevertheless exists. The operating entity should therefore take suitable security measures.

The operating entity should also take suitable measures to limit, as best as possible, access to the product. This includes, in particular, physical access as well as access to the software interfaces of the product.

Requesting an unlock code

1. Open SOPAS ET.
2. Open the device window.
3. Open the device name > **Password** > **Reset Service password**.
- ✓ The **Reset password** window appears.
4. Enter the relevant data.
 - ① **NOTE** | Do not press **Generate** if an unlock code has already been requested from SICK. Only press this button if a new device code is required when inquiring again.
5. Click **Generate e-mail with data**.
- ✓ Your SICK subsidiary will create the unlock code based on the information provided and send it to you.

The code is only valid once for the reset process. You can close the window by clicking on the x without interrupting the reset process. If you select **Cancel** or enter an incorrect code several times, the current reset process is terminated. The requested code is no longer valid. The process must be restarted.
6. Wait for the unlock code: The dialog box can be closed and the device switched off.

Entering the unlock code

Prerequisite

- SICK has sent an unlock code.
1. Open SOPAS ET.
 2. Open the device window.
 3. Open the device name > **Password** > **Reset Service password**.
 - ✓ The **Reset password** window appears.
 4. Click **Next**.
 5. Enter the code sent by SICK.

6. Click **Ok**.
- ✓ Password has been reset to the default password `servicelevel`. Parameters are not changed.

Assigning a new password for the Service user level

1. Open SOPAS ET.
2. Log on to the device with the **Service** user level and the default password `servicelevel`.
3. Open the device name > **Password** > **Change password**.
4. Assign the new password for the **Service** user level.

9.3 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.

9.4 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
-

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

10 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 product 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.

10.1 Features

Variant	TiM4xx
Measurement principle	TiM443-xxxxxxS80 / TiM473x: HDDM (lower statistical error) TiM44x/TiM483x: HDDM+ (improved behavior with edge hits)
Application	Indoor
Light source	Infrared (wavelength 850 nm, max. pulse power 880 mW, max. pulse width 5 ns, pulse frequency 1,500 kHz)
Laser class	1 (IEC 60825-1:2014, EN 60825-1:2014+A11:2021) Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed.3., as described in Laser Notice No. 56 dated 8 May 2019.
Aperture angle	TiM44x: 240° (horizontal) TiM47x/TiM48x: 270° (horizontal)
Scan field flatness ¹⁾	Typ. ± 1.5°
Scanning frequency	15 Hz
Angular resolution	0.33°
Working range	TiM44x: 0.05 m ... 15 m TiM47x/TiM48x: 0.05 m ... 25 m
Scanning range for 5% remission	5 m (typical)
Sensing range for 10% remission	8 m (typical) ²⁾
Distance resolution	1 mm
Spot size	Spot size on the optics cover: 7 mm Divergence: 8.6 mrad (0.49°)
Number of echoes evaluated	1
Scan/frame rate	10845 measurement point(s)

¹⁾ Reference area for base of housing

²⁾ at ambient temperature < -15 °C: 7.5 m (typical)

Working range diagram

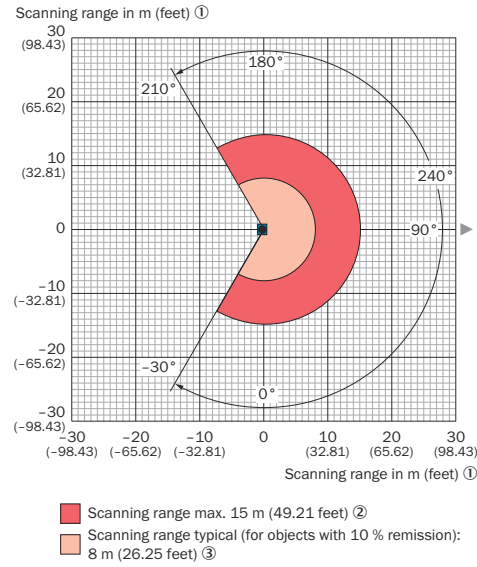


Figure 25: TiM44x working range diagram

- ① Sensing range in meters (feet)
- ② Maximum sensing range: 15 m (49.21 feet)
- ③ Typical sensing range for objects with 10% remission: 8 m (26.25 feet)

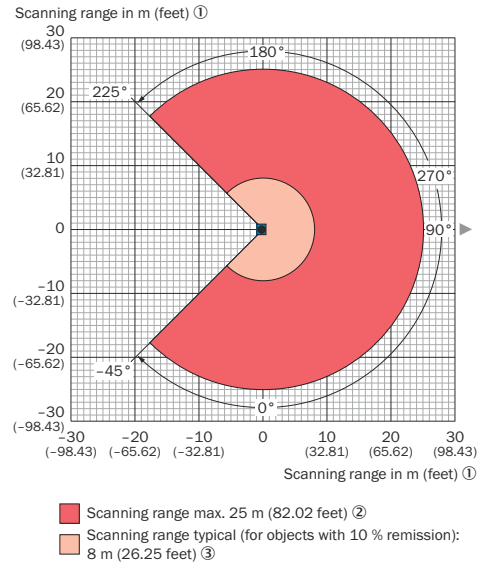


Figure 26: TiM47x / TiM48x working range diagram

- ① Sensing range in meters (feet)
- ② Maximum sensing range: 25 m (82.02 feet)
- ③ Typical sensing range for objects with 10% remission: 8 m (26.25 feet)

10.2 Performance

Variant	TiM4xx
Response time	Typ. 1 scan: 67 ms Max. 2 scans: 134 ms ¹⁾
Power-up delay	Typ. 20 s
Detectable object shape	Almost any
Measurement errors	Statistical (1 σ): < 20 mm ²⁾ / < 10 mm ³⁾ Systematic: \pm 60 mm ²⁾ Temperature drift: 0.5 mm/K
Integrated application	Measurement data output (radial distance, RSSI signal level, device and status information, time stamp)
Filter	Edge filter Particle filter Median filter Average filter

1) Corresponds to max. 134 ms between +45° and +225° of the working range, max. 150 ms between -45° and +45° of the working range (see "Working range diagram", page 44).
 2) Typical value at 90% remission up to maximum sensing range; real value depends on ambient conditions.
 3) Only devices with HDDM measurement principle: Typical value at 10% remission up to 6 m sensing range; real value depends on ambient conditions.

10.3 Interfaces

Variant	TiM4xx
Ethernet	TCP/IP Max. data transmission rate: 10 Mbit and 100 Mbit Length of cable: max. 100 m
Digital outputs	1 (PNP, SYNC/Device Ready) $I_{out} \leq 100$ mA, not electrically isolated from the supply voltage, short-circuit proof/temperature protected
Optical indicators	2 LEDs (ON, Device Ready)

10.4 Mechanics/electronics

Variant	TiM4xx
Electrical connection	1 x Ethernet connection, 4-pin M12 female connector 1 x "voltage supply/SYNC" connection, 5-pin M12 male connector
Supply voltage	9 V DC ... 28 V DC SELV and PELV acc. to IEC 60364-4-41:2005-12
Output voltage	Low: $0 \text{ V} \leq V_{out} \leq 2 \text{ V}$ High: $(V_S - 2 \text{ V}) \leq V_{out} \leq V_S$; $I_{out} \leq 100$ mA
Power consumption	4 W (typical), with unloaded digital outputs, incl. start-up current 7 W, with loaded SYNC digital output
Housing	Base part: Aluminum die cast, passivated Optics cover: Polycarbonate with scratch-resistant coating
Enclosure rating	IP64 (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
MTTF_D	Mean time to dangerous failure: 100 years, at 25 °C ambient temperature (EN ISO 13849-1:2015)

10.5 Ambient data

Variant	TiM4xx
Object remission	4% ... 1,000% (reflectors)
Electromagnetic compatibility (EMC)	Radiation emitted: Residential area (EN 61000-6-3:2007-01+AMD:A1:2011) Electromagnetic compatibility: Industrial environment (EN 61000-6-2:2005)
Vibration resistance	Sine resonance scan: 10 Hz ... 1,000 Hz (IEC 60068-2-6:2007) Sine test: 10 Hz ... 500 Hz; 5 g; 10 frequency cycles (IEC 60068-2-6:2007) Noise test: 10 ... 250 Hz; 4.24 grms, 5 h (IEC 60068-2-64:2008)

Variant	TiM4xx
Shock resistance	50 g; 11 ms; 6 shocks/axis 25 g; 6 ms; 2,000 shocks/axis 50 g; 3 ms; 10,000 shocks/axis (IEC 60068-2-27:2008)
Ambient temperature	Commissioning/switching on: 0 °C ... +50 °C Operation: -10 °C ... +50 °C Storage: -40 °C ... +75 °C (IEC 60068-2-14:2009)
Ambient humidity	Operation: ≤ 80%, non-condensing ≤ 95%, non-condensing (EN 60068-2-30:2005)
Ambient light immunity	50,000 lx (indirect exposure)
Altitude	< 5,000 m above sea level
Ambient conditions	Contamination level 3 outside the housing (EN 61010-1:2011-07)
Damp heat	+25 °C ... +55 °C, 95% r.h., 6 cycles (EN 60068-2-30:2005)
Temperature change	-25 °C ... +50 °C, 10 cycles (EN 60068-2-14: 2009)

11 Accessories

**NOTE**

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

The product 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).

12 Annex

12.1 Declarations of conformity and certificates

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

The product 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).

12.2 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.

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 erteakesites@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