OPERATING INSTRUCTIONS

TiM3xx

2D LiDAR sensors

SICK
Sensor Intelligence.

Product described

TiM3xx

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 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 TiM3xx 2D LiDAR sensor features a scan plane and is designed for the following applications:

- Field monitoring of freely defined areas with signaling of object detection via digital outputs.

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	▪ 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, configura-tion	▪ Basic knowledge of the computer operating system used ▪ Basic knowledge of the design and setup of the described connections and interfaces ▪ Basic knowledge of data transmission
Operation of the device for the particular application	▪ Knowledge of the operation and control of the devices in their particular application ▪ Knowledge of the software and hardware environment for the particular application

2.7 Operational safety and specific hazards

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

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.

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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 2x fastening clips, 2x M3 x 5 mm screws	TiM310 / TiM320: Connecting cable on the device TiM351 / TiM361: No connecting cables
1	Printed safety notes, multilingual	Quick guide and general safety notes

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

3.2 Setup and dimensions

TiM31x, TiM32x

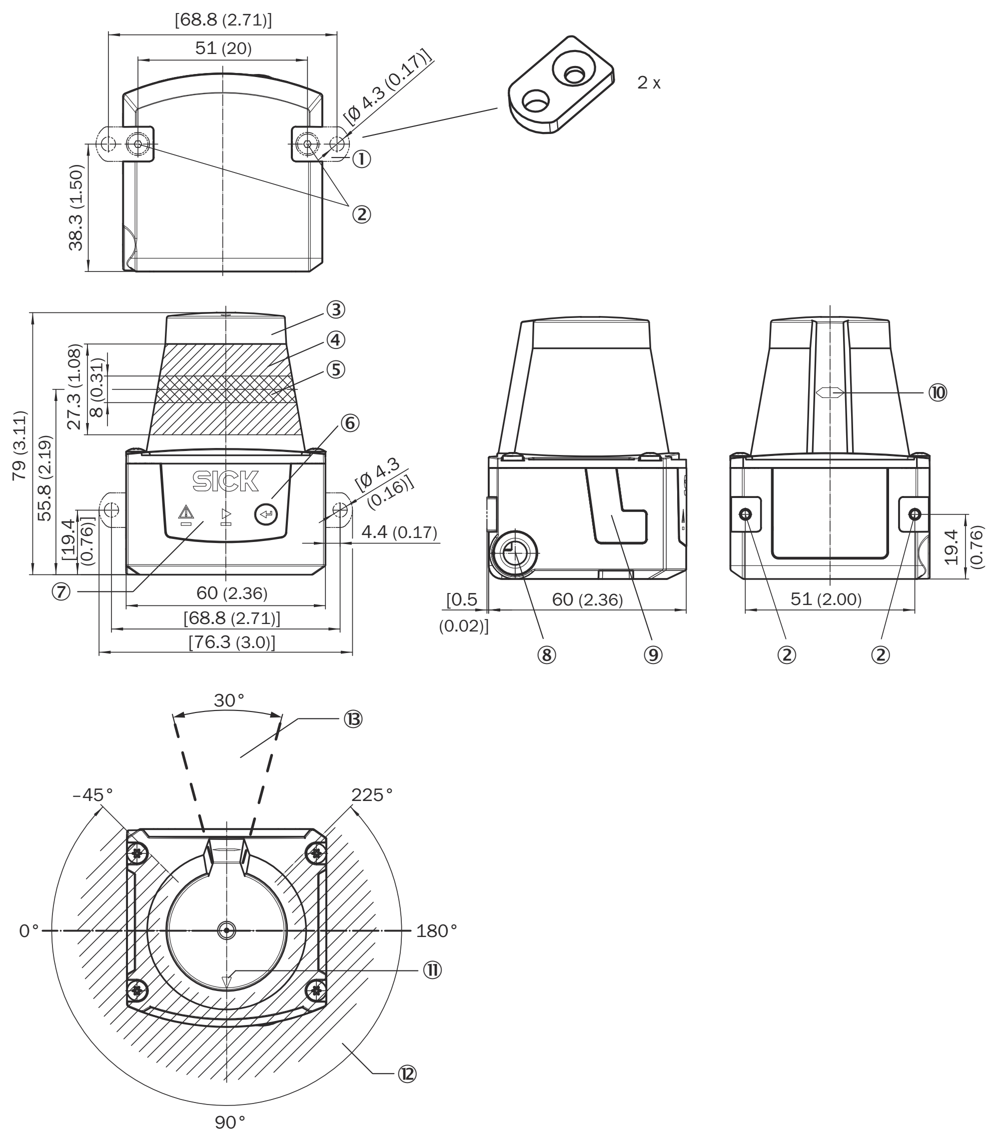


Figure 1: Structure and dimensions, unit: mm (inch), decimal separator: period

①	2x fastening clip with M3 x 5 mm countersunk screw, self-locking (included in scope of delivery)
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	Function button for teach-in
⑧	Connecting cable outlet 0.9 m with 15-pin D-Sub HD male connector or connecting cable 0.8 m with 12-pin M12 plug (“power/digital inputs/outputs” connection)
⑨	Micro USB female contact, behind the black plastic cover (“Aux interface” connection for configuration with computer)
⑩	Marking for the position of the light emission level
⑪	Bearing marking to support alignment (90° axis)

⑫ 270° aperture angle (visual range)

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

TiM35x, TiM36x

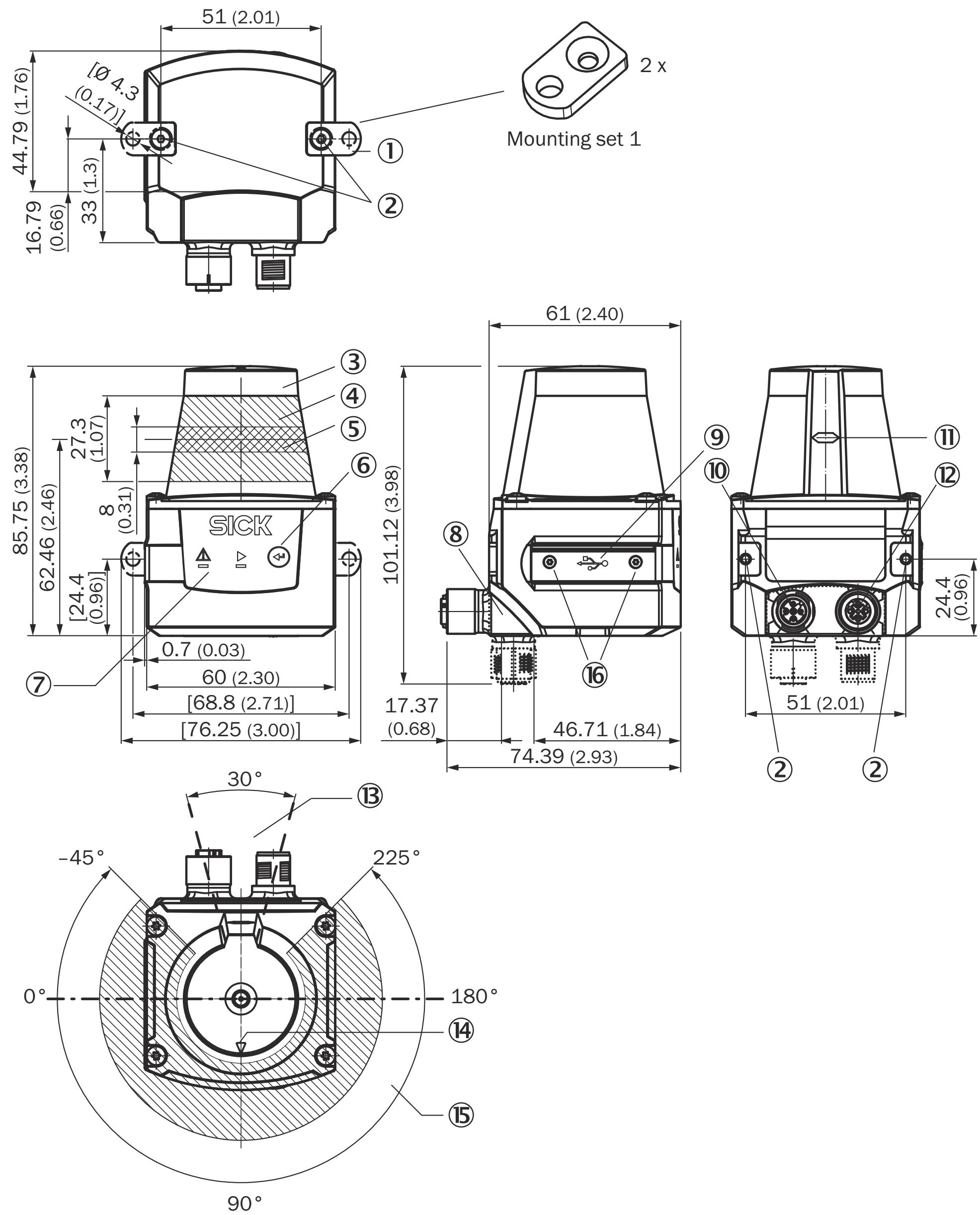


Figure 2: Structure and dimensions, unit: mm (inch), decimal separator: period

① 2x fastening clip with M3 x 5 mm countersunk screw, self-locking (included in scope of delivery)

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 Function button for teach-in

⑦ Red and green LED (status indicators)

⑧ Swivel connector unit with electrical connections

⑨ Micro USB port, behind the black plastic cover ("Aux interface" connection for configuration with computer)

⑩ Connection for power supply, digital inputs/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)
⑯ 2 x countersunk screw (Torx TX 6) M2 x 4 mm

3.3 Display and operating elements

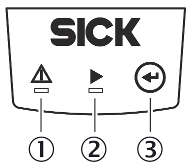


Figure 3: Display and operating elements

① Red LED (status indicator)
② Green LED (status indicator)
③ Teach-in pushbutton

Status indicators

LED (red)	LED (green)	Description
-	●	Device ready/monitoring mode
●	●	Object detection within field/fields (if there are lots of object detections in a short space of time, the red LED lighting up might look like flashing)
-	✸	Teach-in: start
●	●	Teach-in: End of pre-warning stage, 60 seconds teach-in stage
-	✸	Teach-in: End of teach-in phase
✸	-	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

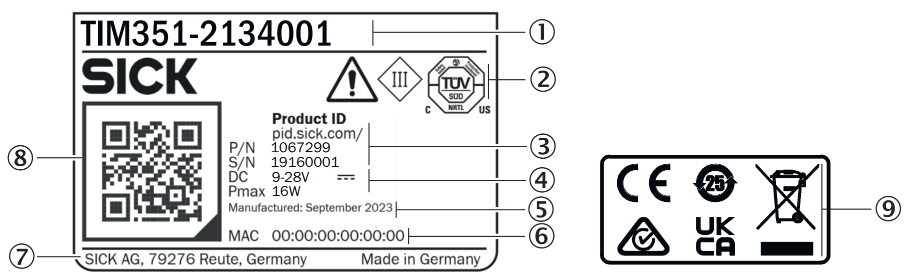
Table 3: Type code

Position	Description	Characteristic
1	Device name	TIM: Short range 2D-LiDAR sensor
2	Device type	3: Field evaluation
3	Performed by	1: 4 m measuring range, performance basic 2: 4 m measuring range, performance advanced 5: 10 m measuring range, 1.0° angular resolution, performance professional 6: 10 m measuring range, 0.33° angular resolution, performance professional

Position	Description	Characteristic
4	Housing	0: Housing IP65 without heating
5		“Empty”: standard
6	Connection	01: Cable 12-pin (2.0 m), open strand 10: Cable (approx. 0.9 m) with male connector, D-Sub-HD, 15-pin 11: Cable (approx. 0.8 m) with M12 male connector, 12-pin, D-coded
7	Application	30: Standard field evaluation 31: Flexible field evaluation 34: Flexible field evaluation with contour fields and particle filters
8	Laser type	0: Pulse power up to 880 mW, pulse width up to 5 ns, pulse rate 500 kHz 1: Pulse power up to 880 mW, pulse width up to 5 ns, pulse rate 1,500 kHz
9	Color	00: Blue

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.

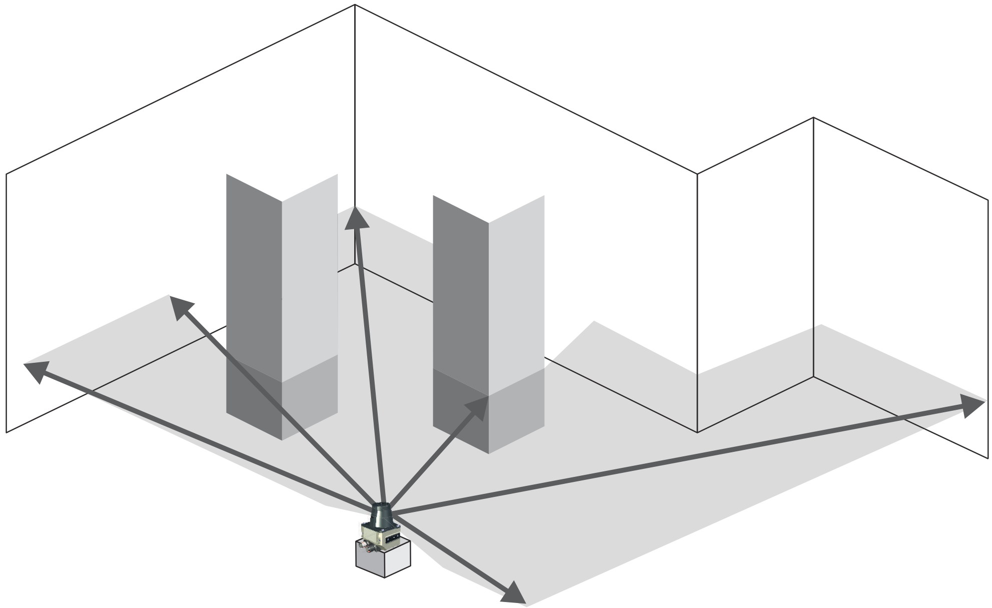


Figure 4: The 2D LiDAR sensor measurement principle

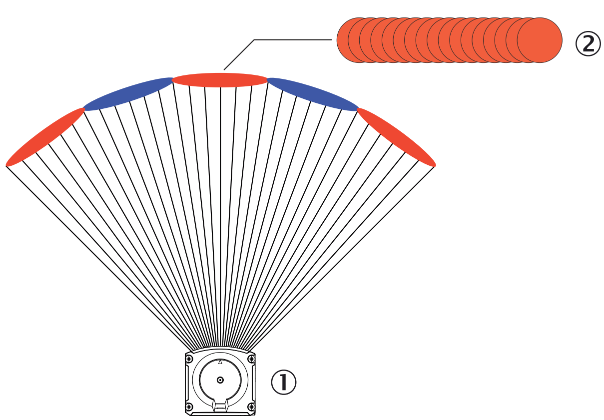
3.6.2 Distance measurement

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 for devices with 0.33° angular resolution; 17.5 mrad for devices with 1° angular resolution

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 mrad +5.8 mrad) * 4,000 mm +7 mm = 64.6 mm

Formula for calculating the height of the light spot:

Light spot divergence [mrad] * Distance [mm] + Light spot size at the device cover [mm] = Light spot width [mm]

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

8.6 mrad * 4,000 mm +7 mm = 41.4 mm

Formula for calculating the minimum object size:

2 * supplement [mrad] * distance [mm] + light spot height [mm] = minimum object size [mm]

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

2 * 5.8 mrad * 4,000 mm + 41.4 mm = 87.8 mm

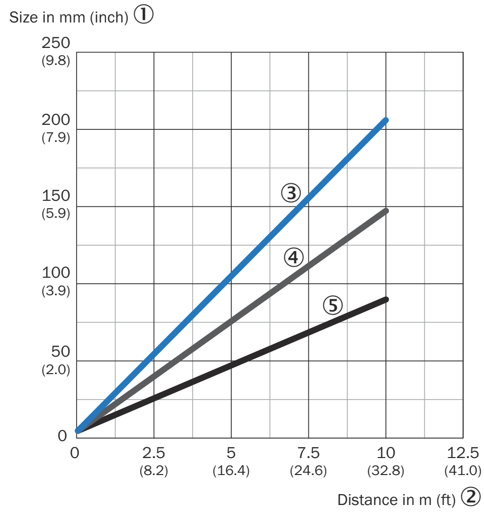


Figure 6: Minimum object size TiM36x

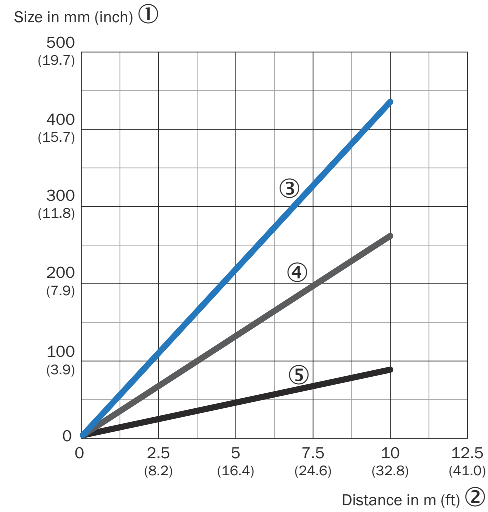


Figure 7: Minimum object size TiM31x/TiM32x (max. distance: 4 m) and TiM35x

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.

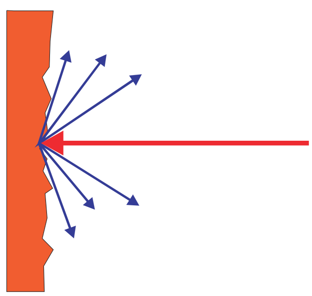


Figure 8: Reflection of light on the surface of the object

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.

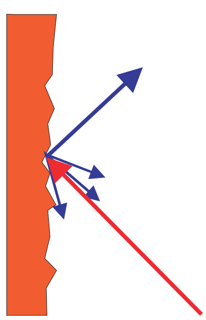


Figure 9: Angle of reflection

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.

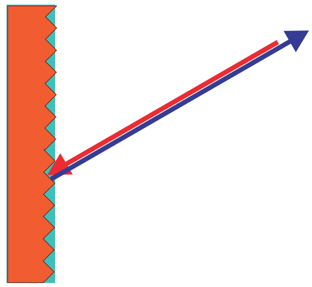


Figure 10: Retroreflection

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.

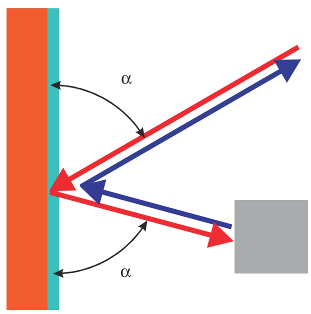


Figure 11: Specular surfaces

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.

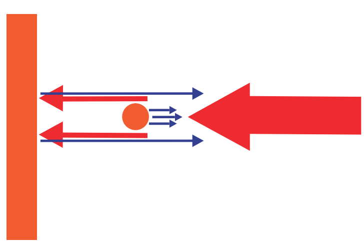


Figure 12: Object smaller than the laser beam diameter

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.

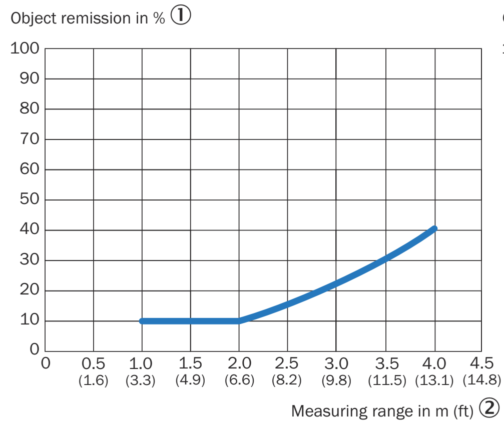


Figure 13: Scanning range as a function of object remission, TiM31x / TiM32x

① Object remission in percent

② Measuring range in meters (feet)

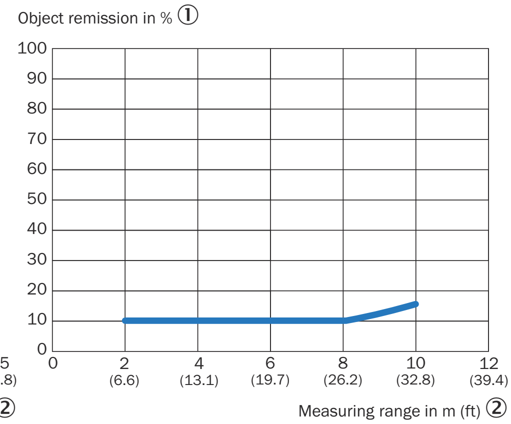


Figure 14: Scanning range as a function of object remission, TiM35x / TiM36x

① Object remission in percent

② Measuring range in meters (feet)

3.6.8 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
- 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.

3.6.8.1 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 21 **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	...

	Measurement points (distance values in mm)							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**...**
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.

3.6.8.2 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.

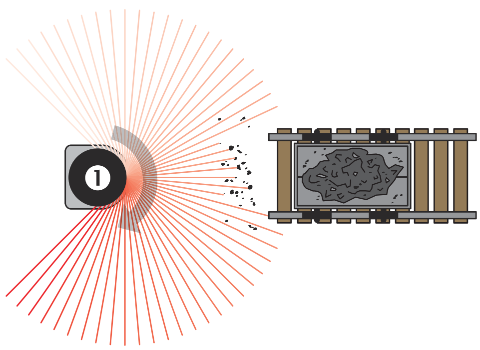


Figure 15: Without the particle filter: Violation of the contour due to dust particles in the vicinity of the object.

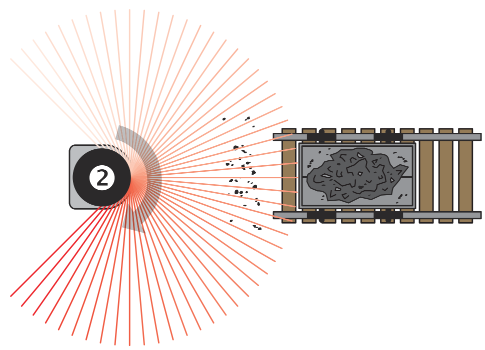


Figure 16: Using the particle filter: The response to dust particles in the detection field is delayed by one scan. Particles can thereby be blanked.

3.6.8.3 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 6: Example: Average filter over 5 scans

	Angle (distance values in mm)									
Scan	**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	...

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

	Angle (distance values in mm)									
Scan	1	2	3	4	5	6	7	8	9	...
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).

3.6.9 Calculation of the field size for mobile applications

In order to prevent collisions between vehicles, and between vehicles and fixed objects, the switching field must have sufficient length and width.

To calculate the switching field length, you need to take into consideration the stopping distance of the vehicle. This comprises the following:

- the braking distance, which can be found in the vehicle documentation
- the distance covered during the vehicle control's response time, which can be found in the vehicle documentation
- The distance covered during the response time of the LiDAR sensor, "Technical data", page 55.

NOTE

- We recommend adding a supplement of at least 100 mm to the protective field length in order to stop the vehicle before a possible collision.
- If retro-reflectors are situated in the path of the vehicles, or if you anticipate that the braking force of the vehicle will diminish over time, you may, under certain circumstances, need to increase the recommended supplement.
- The width of the switching field should cover the vehicle width. You should also configure a supplement of at least 100 mm on every side.

Mounting height

The recommended mounting height for mobile applications is at least 150 mm.

3.6.9.1 Switching field length

You must configure the switching field so that a minimum distance to the vehicle is maintained at all times. This ensures that a vehicle monitored by the LiDAR sensor stops before an object is reached. You can define multiple monitoring cases each with different switching fields. These can be switched over dynamically via static control inputs, for example to adjust the protective field size based on the vehicle speed.

In this kind of application, you must calculate the switching field sizes (in particular the switching field lengths) for all speeds.

The switching field length SL can be calculated using the following formula (guideline values based on a pixel calculation):

SL = SA + ZG + ZR + ZB

SA = Stopping distance

ZG = General supplement of the LiDAR sensor = 100 mm

ZR = Supplement for application-related influences or the selected application parameters

ZB = Supplement for the decreasing braking force of the vehicle. This can be obtained from the relevant vehicle documentation, or alternatively: 10% of the stopping distance.

Stopping distance SA

The stopping distance comprises the vehicle's braking distance and the distance covered during the response time of the LiDAR sensor and the vehicle control's response time.

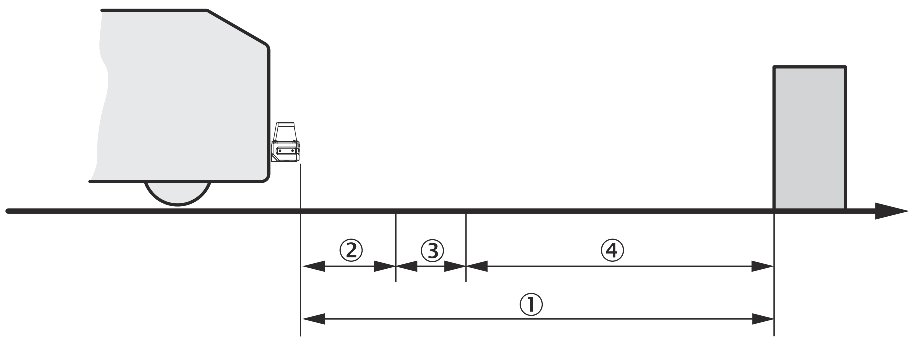


Figure 17: Stopping distance

① S_A

② S_{AnF}

③ S_{AnS}

④ S_{Br}

NOTE
Please note that a vehicle's braking distance does not increase linearly with increasing speed, but rather in a squared relationship. This is particularly important if you switch between different-sized switching fields depending on the speed.

How to calculate the stopping distance SA:

SA = $\mathbf{S_{AnF} + S_{AnS} + S_{Br}}$

$\mathbf{S_{AnF}}$ = The distance covered during the vehicle control's response time, which is specified in the vehicle documentation

$\mathbf{S_{AnS}}$ = The distance covered during the response time of the LiDAR sensor

$\mathbf{S_{Br}}$ = The braking distance, found in the vehicle documentation

The distance S_{AnS} covered during the response time of the LiDAR sensor depends on:

- the response time of the LiDAR sensor
- the maximum speed of the vehicle in your mobile application

For more information on the response time T_S of the LiDAR sensor, see "Technical data", page 55.

How to calculate the distance S_{AnS} covered during the response time of the LiDAR sensor:

$$S_{AnS} = T_S \times V_{max}$$

T_S = Response time of the LiDAR sensor

V_{max} Maximum speed of the vehicle, from the relevant vehicle documentation

The response time T_S of the LiDAR sensor depends on:

- the base response time of the LiDAR sensor
- whether multiple sampling is set
- Filter settings (e.g., particle filter)

ZR supplement

This supplement must be determined on an application-specific basis and taken into account appropriately. The following factors can make it necessary to use a supplement: reflectors or shiny objects on the scan plane, multi-echo analysis, blanking size, device filter (e.g., particle filter).

3.6.9.2 Switching field width

The width of the switching field must cover the width of the vehicle and take into account the supplements for the measurement error.

The switching field width SB can be calculated using the following formula (guideline values based on a pixel calculation):

$$SB = FB + 2 \times (ZG + ZR)$$

FB = Vehicle width

ZG = General supplement of the LiDAR sensor = 100 mm

ZR = Supplement for application-related influences or the selected application parameters

4 Transport and storage

4.1 Transport

NOTICE
Damage due to improper transport!

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

4.2 Unpacking

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

4.3 Transport inspection

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

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

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

4.4 Storage

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

5 Mounting

5.1 Mounting instructions

- Observe the technical data.
- Protect the sensor from 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 59.
- 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 59). 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 28.
- 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 M3 x 5 screws included with delivery 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 37 .
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.

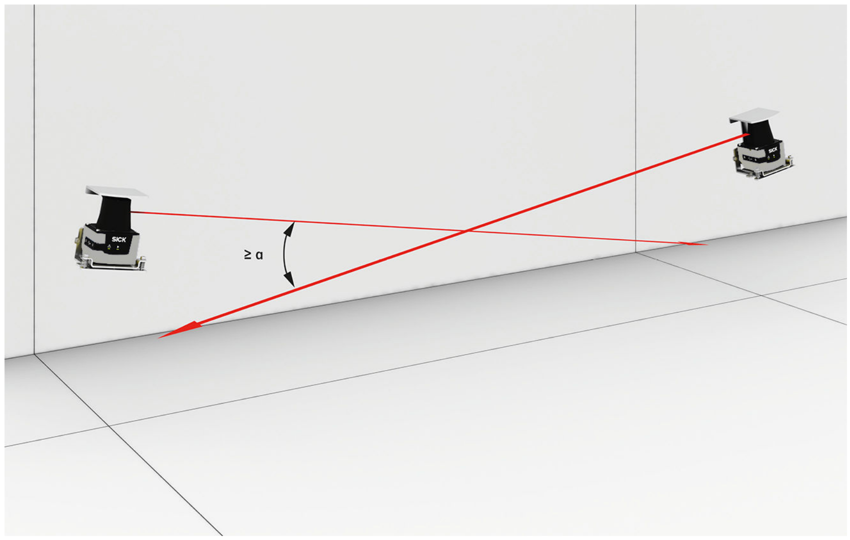


Figure 18: Angle ≥ 6 °

Figure 19: 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. 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

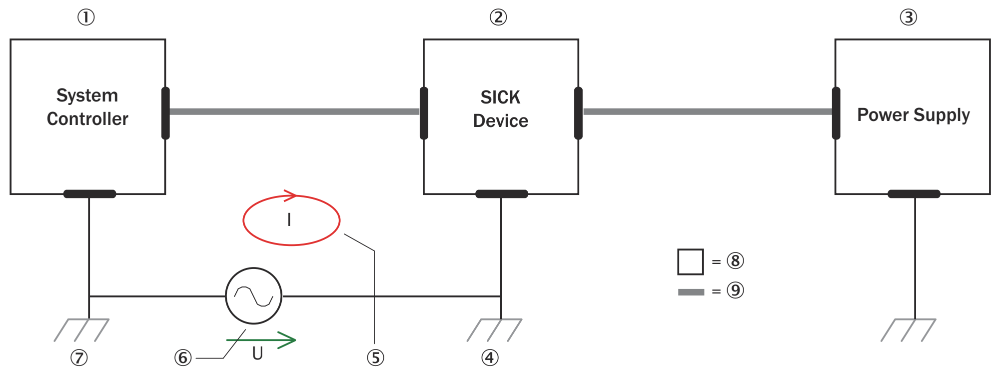


Figure 20: Example: Occurrence of equipotential bonding currents in the system configuration

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.

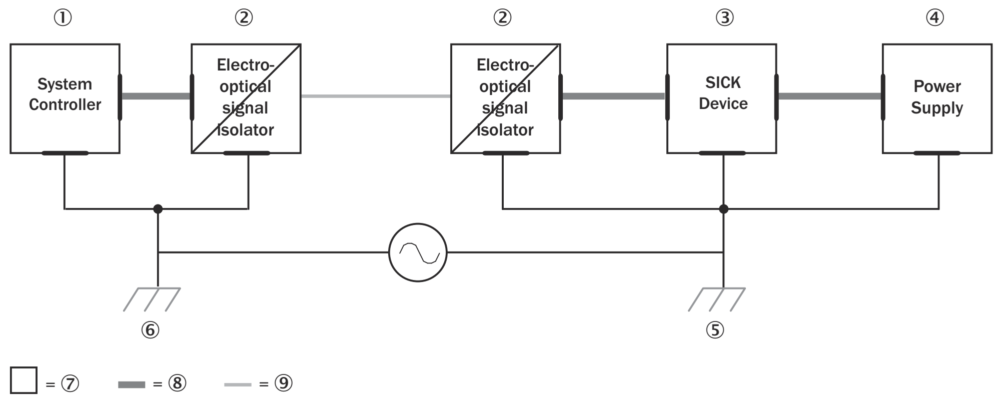


Figure 21: Example: Prevention of equipotential bonding currents in the system configuration by the use of electro-optical signal isolators

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.

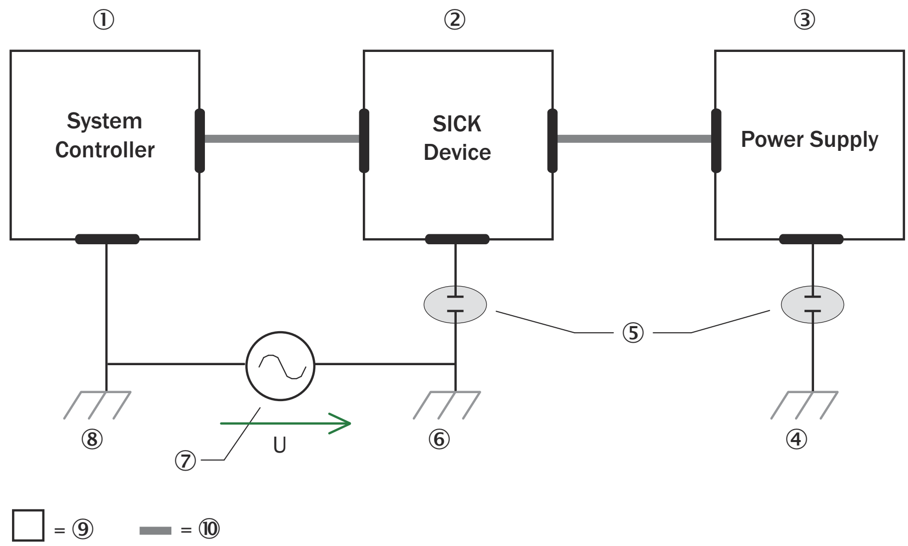


Figure 22: Example: Prevention of equipotential bonding currents in the system configuration by the insulated mounting of the device

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-01xxxxx

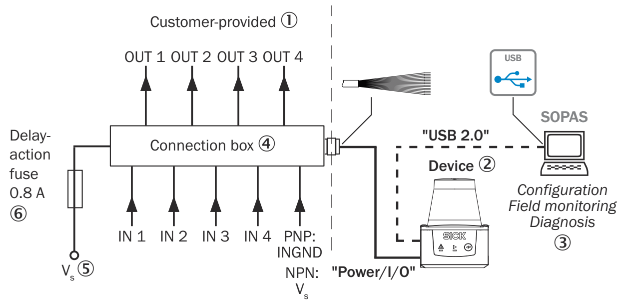


Figure 23: "Power, I/O" connection: Cable with open end

①	Connection modules

②	Device

③	Configuration, field monitoring or diagnostics

④	Supply voltage V_s

TiMxxx-10xxxxx

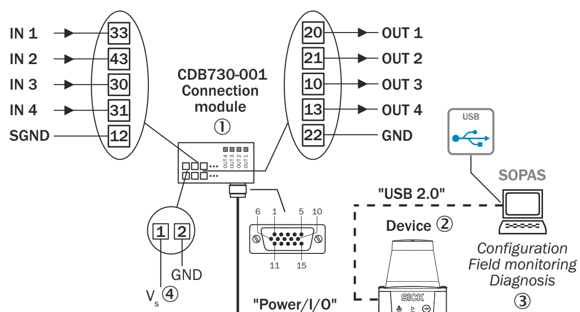


Figure 24: "Power, I/O" connection: Cable with 15-pin D-Sub-HD male connector

①	Connection modules

②	Device

③	Configuration, field monitoring or diagnostics

④	Supply voltage V_s

TiMxxx-11xxxxx

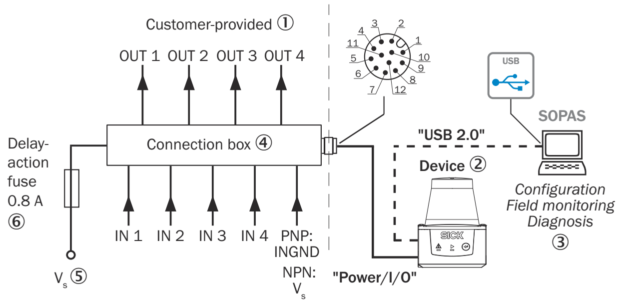


Figure 25: "Power//I/O" connection: Cable with 12-pin A-coded M12 male connector

① Provided by customer
② Device
③ Configuration, field monitoring or diagnostics
④ Connecting device
⑤ Supply voltage V_s
⑥ Fuse 0.8 A, slow-acting

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.

The enclosure rating stated in the technical data is achieved only with screwed plug connectors or protective caps.

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

The USB interface is only for parameterization. Remove the USB cable for problem-free operation of the device.

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.

When operating the device together with a connection module, observe the operating instructions of the connection module!

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-01xxxxx

“Power/I/O” connection

NOTE
All products with the type code TiM3xx-01xxxxx are intended to be operated with flying leads. For production-related reasons, individual product variants with this type code are delivered with a 15-pin D-Sub HD male connector. For these products, the customer is responsible for cutting off the male connector and creating the cable end. Alternatively, the products may be operated with a male connector. In this case, the information for the product variants with the type code TiMxxx-10xxxxx applies for the PIN assignment.

Table 7: Connecting cable 15-wire with open end

Signal	Function	Wire color
V_S	Supply voltage	Red
N.c.	–	Violet
N.c.	–	Yellow
OUT 4	Digital output 4 (index/error)	Red and black
GND	Ground	Black
N.c.	–	Light blue
N.c.	–	Dark blue
IN 1	Digital input 1 (field set selection)	Turquoise or light gray
IN 2	Digital input 2 (field set selection)	Green
IN 3	Digital input 3 (field set selection)	Gray
IN 4	Digital input 4 (field set selection)	Pink
OUT 1	Digital output 1 (object detection)	Brown
OUT 2	Digital output 2 (object detection)	Orange
OUT 3	Digital output 3 (object detection)	White
PNP: IN_{GND} NPN: V_s	PNP: Common ground for all inputs NPN: Common reference potential for all inputs	White and black
–	Shielding	Metal

6.4.2 TiMxxx-10xxxxx

“Power/I/O” connection

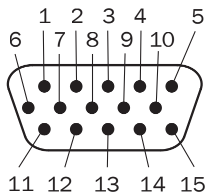


Table 8: Connecting cable with male connector, D-Sub-HD, 15-pin

Pin	Signal	Function	Wire colors of connecting cable with flying leads [1)]
1	V_S	Supply voltage	Red
2	N.c.	–	Violet
3	N.c.	–	Yellow
4	OUT 4	Digital output 4 (index/error)	Red and black
5	GND	Ground	Black
6	N.c.	–	Light blue
7	N.c.	–	Dark blue
8	IN 1	Digital input 1 (field set selection)	Turquoise or light gray
9	IN 2	Digital input 2 (field set selection)	Green
10	IN 3	Digital input 3 (field set selection)	Gray
11	IN 4	Digital input 4 (field set selection)	Pink
12	OUT 1	Digital output 1 (object detection)	Brown
13	OUT 2	Digital output 2 (object detection)	Orange
14	OUT 3	Digital output 3 (object detection)	White
15	PNP: IN_{GND} NPN: V_s	PNP: Common ground for all inputs NPN: Common reference potential of all inputs	White and black
–	–	Shielding	Metal

1) Example values when using the connecting cable part number 2043413. Signal assignment and wire colors can vary when using other connecting cables.

6.4.3 TiMxxx-11xxxxx/TiMxxx-21xxxxx

“Power/I/O” connection

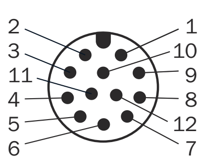


Table 9: Male connector, M12, 12-pin, A-coded

Pin	Signal	Function	Wire colors of connecting cable with flying leads [1)]
1	GND	Ground	Blue
2	V_S	Supply voltage	Brown
3	IN 1	Digital input 1 (field set selection)	Red
4	IN 2	Digital input 2 (field set selection)	Green

Pin	Signal	Function	Wire colors of connecting cable with flying leads [1)]
5	OUT 1	Digital output 1 (object detection)	Pink
6	OUT 2	Digital output 2 (object detection)	Yellow
7	OUT 3	Digital output 3 (object detection)	Black
8	OUT 4	Digital output 4 (index/error)	Gray
9	PNP: IN_{GND} NPN: V_S	PNP: Common ground for all inputs NPN: Common reference potential of all inputs	White
10	IN 3	Digital input 3 (field set selection)	Violet
11	IN 4	Digital input 4 (field set selection)	Gray and pink
12	–	Reserved, do not wire this PIN!	Rot and blue
–	–	Shielding	–

1) Example values when using the connecting cables part numbers 6054974 (5 m), 6054973 (10 m), 6054972 (20 m). Signal assignment and wire colors can vary when using other connecting cables.

"Ethernet" connection (only TiMxxx-21xxxxx)

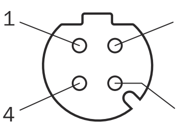


Table 10: Female connector, 4-pin, D-coded

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

6.4.4 USB interface (TiM35x / 36x only)

The Ethernet interface is recommended as a communication interface.

If using the USB interface, please note:

- Use a high-speed USB 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. Restart communication via SOPAS ET software (“Online” button).

6.5 Connecting the device electrically

NOTICE
Observe the wiring instructions, see "Wiring instructions", page 34.

1. Ensure the voltage supply is not connected.
2. Connect the device according to the connection diagram, see "Connection diagram", page 35.

6.6 Wiring digital inputs / digital outputs

Digital inputs

The 4 switching digital inputs activate one of the 16 field sets in a binary combination as an evaluation case.

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

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

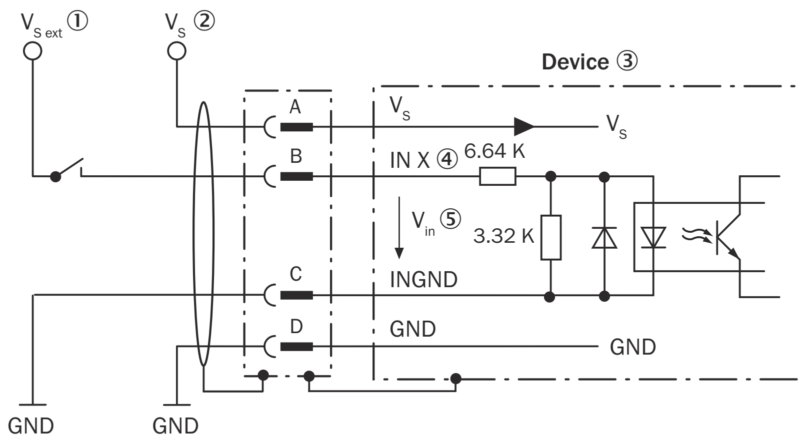


Figure 26: Wiring of digital input (PNP version)

① External supply voltage $V_{S\ ext}$

② Supply voltage V_s for device

③ Device

④ Signal IN X

⑤ Input voltage V_{in}

Posi-tion	Signal	TiM3xx-01xxxx (cable with flying leads): wire color	TiM3xx-10xxxx (15-pin D-Sub-HD male connector): PIN	TiM3xx-11xxxx, TiM3xx-21xxxx (12-pin M12 male connector): PIN
A	V_S	Red	1	2
D	GND	Black	5	1
C	IN_{GND}	White and black	15	9
B1	IN 1	Turquoise or light gray	8	3
B2	IN 2	Green	9	4
B3	IN 3	Gray	10	10
B4	IN 4	Pink	11	11

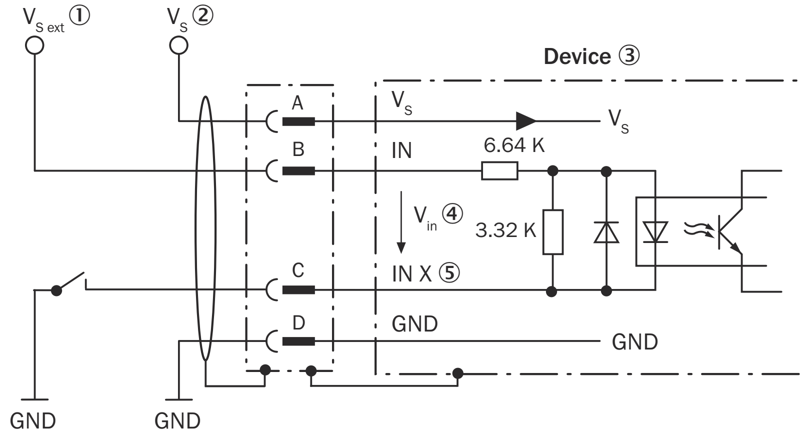


Figure 27: Wiring of digital input (NPN version)

① External supply voltage $V_{S\ ext}$

② Supply voltage V_s for device

③ Device

④ Input voltage V_{in}

⑤ Signal IN X

Posi-tion	Signal	TiM3xx-01xxxx (cable with flying leads): wire color	TiM3xx-10xxxx (15-pin D-Sub-HD male connector): PIN	TiM3xx-11xxxx, TiM3xx-21xxxx (12-pin M12 male connector): PIN
A	V_S	Red	1	2
B	V_{IN}	White and black	15	9
D	GND	Black	5	1
C1	IN 1	Turquoise or light gray	8	3
C2	IN 2	Green	9	4
C3	IN 3	Gray	10	10
C4	IN 4	Pink	11	11

Switching behavior	Current to the input starts the assigned function in the device. Default: Active high level, debounce 10 ms
Properties	Opto-decoupled Switchable with an electronic switch (PNP output) or mechanical switch
Electrical values	see "Mechanics/electronics", page 57

Digital outputs

The device has 4 switching digital outputs.

In combination, the digital outputs OUT 1 to OUT 3 signal the breach of the individual fields of a field set.

The digital output OUT 4 is used to issue an error and a regular index pulse.

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

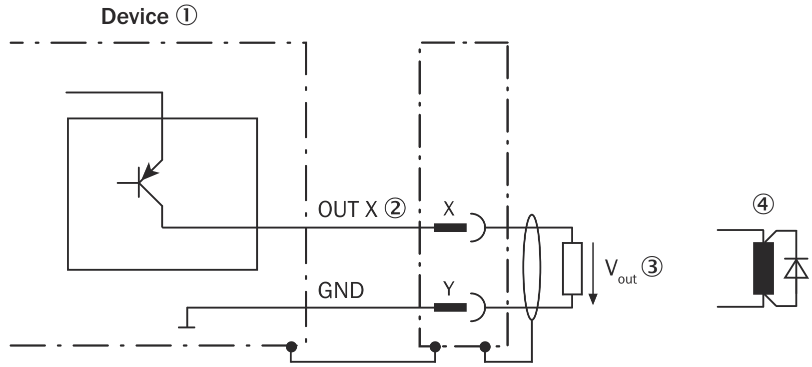


Figure 28: Wiring of digital output (PNP version)

① Device
② Signal OUT X
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.

Posi-tion	Signal	TiM3xx-01xxxx (cable with flying leads): wire color	TiM3xx-10xxxx (15-pin D-Sub-HD male connector): PIN	TiM3xx-11xxxx, TiM3xx-21xxxx (12-pin M12 male connector): PIN
X1	OUT 1	Brown	12	5
X2	OUT 2	Orange	13	6
X3	OUT 3	White	14	7
X4	OUT 4	Red and black	4	8
Y	GND	Black	5	1

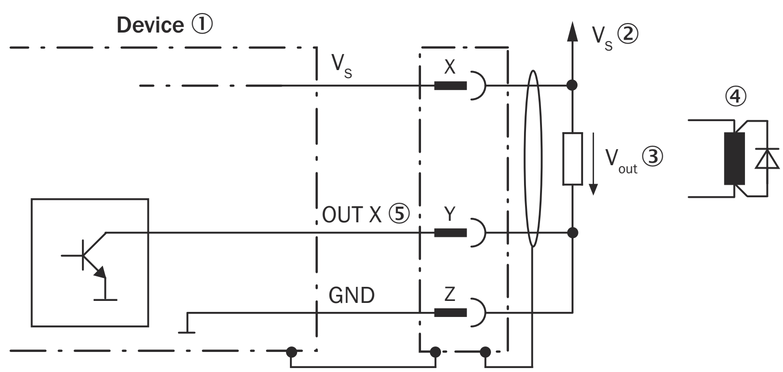


Figure 29: Wiring of digital output (NPN version)

① Device
② Supply voltage V_s of the device
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.
⑤ Signal OUT X

Posi-tion	Signal	TiM3xx-01xxxx (cable with flying leads): wire color	TiM3xx-10xxxx (15-pin D-Sub-HD male connector): PIN	TiM3xx-11xxxx, TiM3xx-21xxxx (12-pin M12 male connector): PIN
X	V_S	Red	1	2
Y1	OUT 1	Brown	12	5

Posi-tion	Signal	TiM3xx-01xxxx (cable with flying leads): wire color	TiM3xx-10xxxx (15-pin D-Sub-HD male connector): PIN	TiM3xx-11xxxx, TiM3xx-21xxxx (12-pin M12 male connector): PIN
Y2	OUT 2	Orange	13	6
Y3	OUT 3	White	14	7
Y4	OUT 4	Red and black	4	8
Z	GND	Black	5	1

Switching behav-ior	PNP switching against supply voltage UV **OUT 1 … OUT 3:** Resting level: High (no object detection), working level: Low (object detec-tion) Response time: 134 ms … 30 s (configurable via SOPAS ET), holding time: 0 ms … 10 s (configurable via SOPAS ET) **OUT 4:** Resting level: High (device ready) working level: Low (error), low pulse (15 Hz, index, corresponds to meas-urement at 90 °)
Properties	Short-circuit protected and temperature protected Not electrically isolated from supply voltage U_v
Electrical values	see "Mechanics/electronics", page 57

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

Δ U = (2 x length x current) : (conductance value x cross-section)

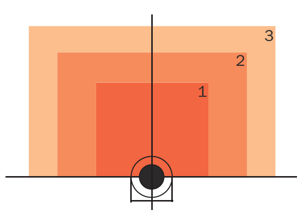
Conductance value for copper: 56 m/Ω mm^2.

Assignment of infringed fields – digital outputs

Output level: The level of the digital outputs OUT 1 … OUT 3 is active low (in resting position: high, in working position: low (field infringed)).

All fields of a field set are considered infringed upon switching on, booting, in the event of an error and when the device is switched off.

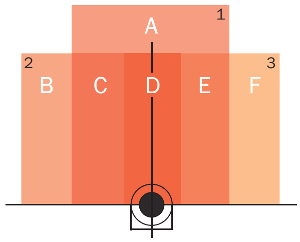
Example 1: 3 fields, rectangular, nested inside each other



Infringed fields	Digital outputs		
	OUT 1	**OUT 2**	**OUT 3**
Fields 1, 2, and 3 infringed	Active	Active	Active
Fields 2 and 3 infringed	Deactivated	Active	Active
Field 3 infringed	Deactivated	Deactivated	Active
No field infringed:	Deactivated	Deactivated	Deactivated

Example 2: 3 fields, rectangular, overlapping

The overlapping fields create areas that can be used as additional fields.



Infringed areas (fields)	Digital outputs		
	OUT 1	**OUT 2**	**OUT 3**
A (field 1 infringed)	Active	Deactivated	Deactivated
B (field 2 infringed)	Deactivated	Active	Deactivated
C (fields 1 and 2 infringed)	Active	Active	Deactivated
D (fields 1, 2, and 3 infringed)	Active	Active	Active
E (fields 1 and 3 infringed)	Active	Deactivated	Active
F (field 3 infringed)	Deactivated	Deactivated	Active
- (no field infringed)	Deactivated	Deactivated	Deactivated

7 Operation

7.1 SOPAS ET

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

- Field evaluation application: adjusting the 3 fields of a field set.
- Parameterization: tailoring other device parameters to the application.
- Diagnosis: determining the cause of a fault.

To parameterize the device, you will require a computer with SOPAS ET installed and a free Ethernet connection (recommended) or, alternatively, a free USB interface.

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 11: User level and authorization

Machine operator	A **Machine operator** level user can view the basic device parameters. • No password required • Read only permissions • Not all parameters are visible
Maintenance	**Maintenance** can view the application-related device parameters. • Read only permissions • Not all parameters are visible • Can change the password for this user level
Authorized Client (Integrator)	Device parameters can be set as an **Authorized Client**. • 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	A **Service** level user can configure all device parameters. • 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 53.

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.

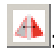
With the **Load application defaults** option, the network settings remain unchanged, all other settings are reset to the factory settings.

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 : Display fields in the polar coordinates system.

- Button : Change over the view of the device/fields. 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 12: 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 Field evaluation

If the field shape of field set 1 has been taught in without a computer using the teach-in pushbutton, SOPAS is generally used to continue the configuration.

This includes the following:

- Setting of field shapes/sizes and, if applicable, non-programmable field sets based on the default setting and the setting of response time of the fields
- Setting of the blanking size and the holding time of the assigned digital outputs OUT 1 ... OUT 3

7.2.1 Teach-in / Field set selection

For the field evaluation application, it is possible to configure the device as follows rather than configuring it via SOPAS:

- Selection of one of 16 field sets, each with 3 fields of the same size nested into one another, by means of input wiring.
- Teach-in of the surrounding contour to automatically generate the outer field with any shape, including more complex shapes, and to deduce the two inner fields.

The field sets are organized into groups in segmented field shapes. The shape can be changed at will, the default is rectangular.

In the factory setting, the 3 origin-oriented fields of a field set are nested inside one another. The size of field 2 corresponds to field 1 plus 25%. The size of field 3 corresponds to field 1 plus 52%.

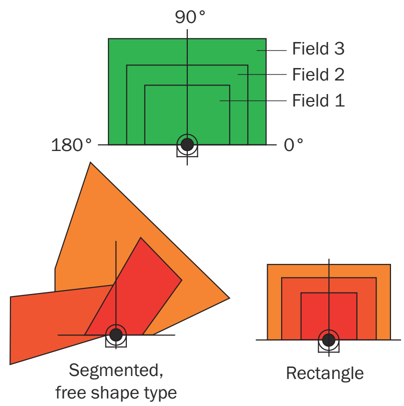


Figure 30: Structure of the fields of a field set and possible field shapes

① Segmented, free field shape
② Nested together, rectangle

7.2.1.1 Teach-in

Preparation

- Remove all objects that will not permanently be in the field of view in monitoring mode later on.
- Distance yourself sufficiently from the device during the advance warning phase of the teach-in so that you are not detected as part of the field contour.

Teaching in the field contour

The device uses field set 1 (segmented, initial shape: rectangle) to adjust the field shape and size to the surrounding contour that was detected. The digital inputs are not allowed to be supplied with current during this process.

The device forms the outer field 3 from the surrounding contour with a negative offset of 100 mm, and derives from this the limits of the two inner fields: field 1 = field 3 minus 33%, and field 2 = field 3 minus 17%.

The device stores the shortest value measured during the teach-in phase as a field limit for each angle.

A parameter upload is required in order to display the newly taught-in field contour in SOPAS.

1. Press and hold the Teach-in pushbutton for 3 s to start the teach-in process.
2. The field shape to be formed can be defined by pacing out the limits during the teach-in phase. Do not wear black clothing during this process!

The LEDs display the individual phases of the teach-in process:

LED (red)	LED (green)	Phase
-	☀ (flashing)	**Teach-in pre-warning:** LED flashes slowly at first (0.5 Hz) LED flashes increasingly rapidly within 15 s
●	●	**Teach-in:** Duration 60 seconds
-	☀ (flashing)	**Teach-in completion:** LED flashes increasingly rapidly within 15 s

LED (red)	LED (green)	Phase
-	●	**Monitoring mode:** Automated return after teach-in complete All fields free
●	●	**Monitoring mode:** If an object detection has occurred

● = illuminated; ☀ = flashing

The taught-in field contour is automatically and permanently saved as a new field set 1.

7.2.1.2 Field set selection via input wiring

One of the predefined field sets can be activated by wiring the digital inputs.

Field set factory settings – digital inputs

Field set	Digital inputs				Field shape Default size of field 1
	IN 1	IN 2	IN 3	IN 4	
1	0	0	0	0	Rectangle, segmented L: 1 m, W: 2 m
2	1	0	0	0	Rectangle, segmented L: 1.25 m, W: 2 m
3	0	1	0	0	Rectangle, segmented L: 1.5 m, W: 2 m
4	1	1	0	0	Rectangle, segmented L: 1.75 m, W: 2 m
5	0	0	1	0	Rectangle, segmented L: 1 m, W: 2 m
6	1	0	1	0	Rectangle, segmented L: 1.25 m, W: 2 m
7	0	1	1	0	Rectangle, segmented L: 1.5 m, W: 2 m
8	1	1	1	0	Rectangle, segmented L: 1.75 m, W: 2 m
9	0	0	0	1	Rectangle, segmented L: 1 m, W: 2 m
10	1	0	0	1	Rectangle, segmented L: 1.25 m, W: 2 m
11	0	1	0	1	Rectangle, segmented L: 1.5 m, W: 2 m
12	1	1	0	1	Rectangle, segmented L: 1.75 m, W: 2 m
13	0	0	1	1	Rectangle, segmented L: 1 m, W: 2 m
14	1	0	1	1	Rectangle, segmented L: 1.25 m, W: 2 m
15	0	1	1	1	Rectangle, segmented L: 1.5 m, W: 2 m
16	1	1	1	1	Rectangle, segmented L: 1.75 m, W: 2 m
Output form (rectangle), can be changed as desired, L = length, W = width					

Input level: Low (in resting position): ≤ 2 V, high (in working position): ≥ 8 V

7.2.2 Monitor - field evaluation monitor

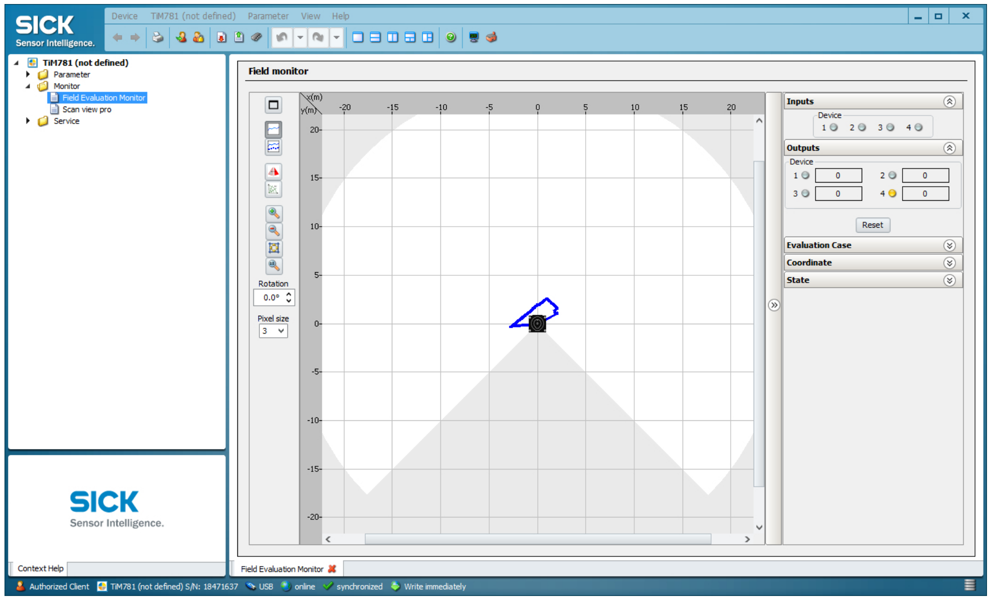


Figure 31: Device window: Monitor - field evaluation monitor

In the **Field evaluation monitor** window, SOPAS displays the field contour (scan line) currently seen by the device through ambient reflection in blue.

If the 4 digital inputs are not energized, SOPAS displays the following for field set 1 according to the default setting of the device:

- 3 evaluation fields (segmented rectangles) or the field shape generated with the aid of teach-in with its dimensions
- Status of the digital inputs/outputs
- Position of the mouse pointer

SOPAS displays the fields as green if no object detection is present.

If objects of a certain size are located for a certain duration in the part of the visual range that is covered by fields, the device will recognize this as an object detection. SOPAS displays this separately in yellow for the individual fields.

Click the “Reset” button to make SOPAS reset the digital output counters.

7.2.3 Parameter - evaluation cases

Response time, blanking size and digital output holding time

The blanking size is the smallest size from which an object can be detected in a field by the device and lead to an object detection. All objects that are smaller than the minimum size are blanked out.

Like the response time and the holding time, the blanking size applies to all field sets and their fields.

Objects that are smaller than the blanking size can cause shadows to be cast at close range. Objects that are larger than the blanking size may be located within this shadow. These may not be detected correctly.

Parameter	Factory setting
Blanking size	Cross-section 200 mm
Response time of the fields	335 ms (5 scans)
Digital output holding time	335 ms (5 scans)

When selecting the response time, note that the device internal reaction time must also be added (max. 67 ms).

To test the effects of the changed settings, change to the **Field evaluation monitor** view.

If the changed fields have been transferred to the device as described, SOPAS will also display these in the monitor, displaying the infringed fields in yellow. If you wish to observe another field set, it must first be activated accordingly using the digital inputs.

7.2.4 Parameters - detection fields

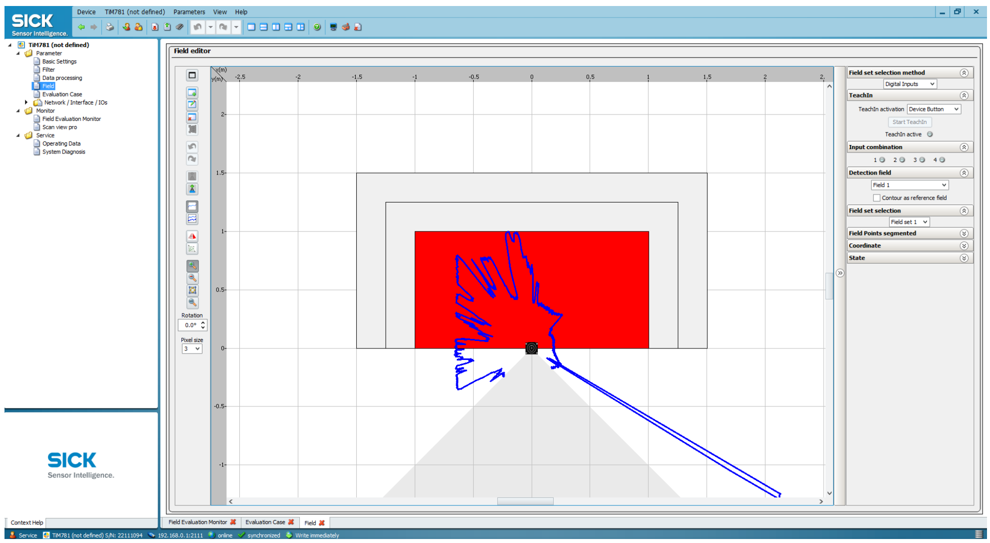


Figure 32: Device window: Parameters - detection fields

The user can change parameters in the right part of the window. SOPAS immediately transfers these changes to the device (default setting).

However, detection fields that have been changed in size and shape must always be manually transferred to the device using the button. All changed parameters are only temporarily stored in the device for the time being and are not stored on the computer.

In order to optimize the dimensions of the detection fields:

1. Under Field selection, for example, select field set 1.
2. Select the field to be configured.
3. Make the required optimizations, see description in the following sections.

Shifting field positions

1. Button .
2. Click on the green marking rectangle of the desired field position in the outer field.
✓ The color of the marker square changes to blue.
3. Re-click the rectangle and drag it to the desired position, then release the push-button.
✓ SOPAS controls the available positioning area during shifting.

Inserting additional field positions

1. Button .
2. Click on the desired position on the limits of the outer field.
✓ SOPAS inserts a new green marker square. This can also be shifted.

Deleting field points

1. Button .
2. Click on the green marking rectangle of the field position to be deleted in the outer field.

✓ The color of the marking rectangle changes to red.

3. Re-click the marking rectangle.

✓ SOPAS removes the marker square and instead connects the two nearest marker squares with a new line.

Rotating the field pair and device around the central axis

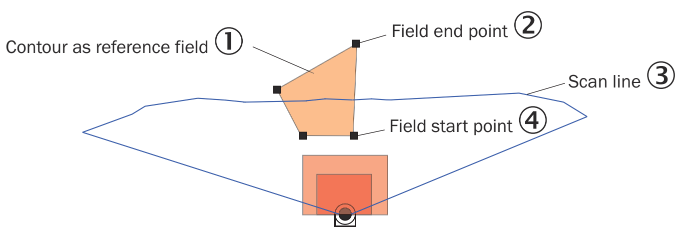
► In order to align the position of the field pair in SOPAS to the conditions on site from the user´s perspective, enter and confirm the desired angle of rotation in the 0.0° input. A negative “-” sign sets the turning direction to the right.

Setting up the contour as reference field

In each field set, any field can be selected as a contour as reference field.

The contour as reference field is used to monitor contours. This can be used to check whether the background is still recognized correctly. If this is no longer the case, possible reasons are that the device is covered or rotated.

The same evaluation strategy is used for all contour as reference fields (evaluation time and blanking size).



① Contour as Reference field

② End point of contour

③ Scanning line

④ Start point of contour

1. Select the required field in the field set.
2. Select the **contour as reference field** check mark under **Field selection.**
3. Delete the two field positions closest to the device.
4. Mark the two remaining field positions and shift them outside of the required reference contour area.
5. The button can switch to the configuration for the contour as reference field start points.
   The field starting points must lie between the scan line and the device so that the scan line passes between the start and end points of the contour as reference field.
6. Depending on the required shape of the reference contour field, create additional field points between the device and the reference contour field. The distance between the start and end points of the contour as reference field should be approximately 20 cm.

The button can be used to switch between the start and end points of the contour as reference field for editing purposes. The active points are highlighted in light green while the deactivated points are dark green.

7.3 ROS driver

Suitable drivers for integrating the product 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 13: 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 the mounting accessories and vibration dampers used.	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.
   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	TiM31x	TiM32x	TiM35x	TiM36x
Measurement principle	HDDM+ (improved behavior for edge hits)			
Application	Indoor		Outdoor	
Light source	Infrared (wavelength 850 nm, max. pulse power 880 mW, max. pulse width 5 ns, pulse frequency 550 kHz)			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	270°			
Scan field flatness [1]	Typ. ± 3.0°		Typ. ± 1.5°	
Scanning frequency	15 Hz			
Angular resolution	1°			0.33°
Working range	0.05 m ... 4 m		0.05 m ... 10 m	
Scanning range for 5% remission	–		5 m (typical)	
Scanning range with 10% remission	2 m (typical)		8 m (typical) [2]	
Spot size	Spot size on the optics cover: 7 mm Divergence: 8.6 mrad (0.49°)			
Number of echoes evaluated	1			

1) Reference area for base of housing
2) at ambient temperature < -15 °C: typ. 7.5 m

Working range diagram

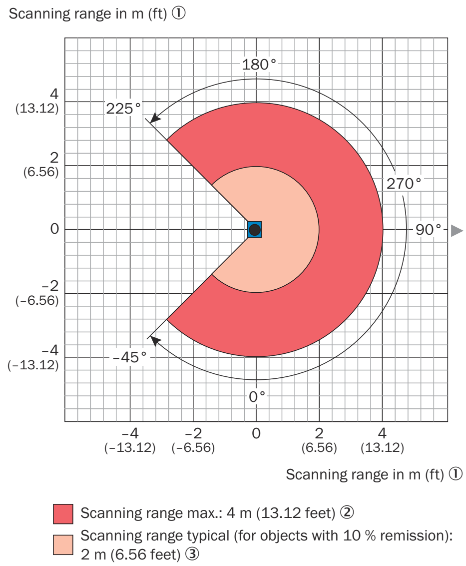


Figure 33: TiMx1x / TiMx2x working range diagram

① Sensing range in meters (feet)
② Maximum sensing range: 4 m (13.12 feet)
③ Typical sensing range for objects with 10% remission: 2 m (6.56 feet)

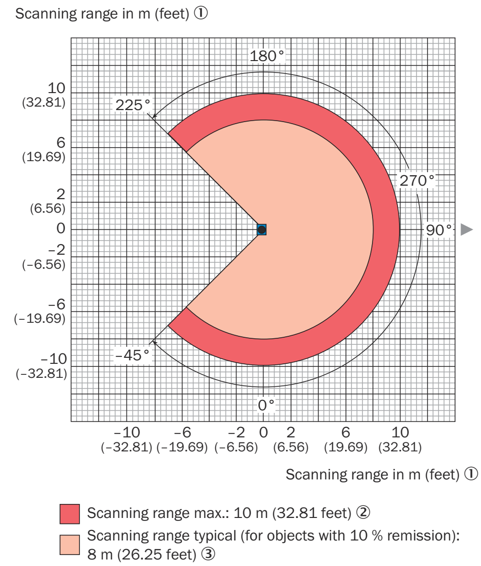


Figure 34: TiMx5x / TiMx6x working range diagram

① Sensing range in meters (feet)
② Maximum sensing range: 10 m (32.81 feet)
③ Typical sensing range for objects with 10% remission: 8 m (26.25 feet)

10.2 Performance

Variant	TiM31x	TiM32x	TiM35x	TiM36x
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): < 30 mm 2) Systematic: ± 40 mm 2) Temperature drift: 0.5 mm/K		Statistical (1 σ): < 20 mm 2) Systematic: ± 60 mm 2) Temperature drift: 0.5 mm/K	
Integrated application	Field evaluation	Field evaluation with flexible fields		
Number of field sets	16 triple fields (48 fields), of which 1 triple (3 fields) can be configured directly at the scanner		16 triple fields, (48 fields, contour as reference; 1 triple (3 fields) can be configured directly at the scanner)	
Simultaneous evaluation cases	1 (3 fields)		1 (3 fields) 2 (2 fields for detection and 1 field for contour as reference)	
Filter	Edge filter Particle 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 56).
2) Typical value at 90% remission up to maximum sensing range; real value depends on ambient conditions.

10.3 Interfaces

Variant	TiM31x	TiM32x	TiM35x	TiM36x
Ethernet	-		TCP/IP (SOPAS parameterization)	
USB	Type: Micro-USB Function: AUX, configuration			
Digital inputs	4 PNP: V_{in} = max. 28 V, I_{in} = max. 5 mA), opto-decoupled, debouncing time approx. 10 ms NPN: Common reference potential 9 ... 28 V			
Digital outputs	3 (NPN, additional 1x "device ready") Each I_{out} ≤ 100 mA, not electrically isolated from the supply voltage, short-circuit proof/temperature protected			
Delay time	67 ms ... 30,000 ms (can be configured)			
Holding time	67 ms ... 600,052 ms (can be configured)			
Optical indicators	2 LEDs (On, output state)			
Control elements	Pushbutton (teach-in)			

10.4 Mechanics/electronics

Variant	TiM31x	TiM32x	TiM35x	TiM36x
Electrical connection	TiM3xx-01xxxxx: Connecting cable with open end, 15-wire [1)] TiM3xx-10xxxxx: Connecting cable with male connector, D-Sub-HD, 15-pin TiM3xx-11xxxxx: Connecting cable with male connector, M12, 12-pin, A-coded		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 SELV and PELV acc. to IEC 60364-4-41:2005-12			
Power consumption	4 W (typical), with unloaded digital outputs, incl. start-up current 16 W, with 4 max. loaded digital outputs			
Input voltage	Low: V_{in} ≤ 2 V; I_{in} ≤ 0.3 mA High: 8 V ≤ V_{in} ≤ 32 V; 0.7 mA ≤ I_{in} ≤ 5 mA			
Output voltage	Low: 0 V ≤ V_{out} ≤ 2 V High: (V_S – 2 V) ≤ V_{out} ≤ V_S; I_{out} ≤ 100 mA			
Housing color	Light blue (RAL 5012)		Gray (RAL 7032)	
Enclosure rating	IP65 (IEC 60529:1989+AMD1:1999+AMD2:2013)		IP67 (IEC 60529:1989+AMD1:1999+AMD2:2013), only valid with closed “Aux interface” plastic cover	
Protection class	III (IEC 61140:2016-1)			
Housing	Base part: Aluminum die cast Optics cover: Polycarbonate with scratch-resistant coating			
Weight	150 g, without connecting cables		250 g, without connecting cables	
Dimensions (L x W x H)	60 mm x 60 mm x 79 mm		60 mm x 60 mm x 86 mm	

Variant	TiM31x	TiM32x	TiM35x	TiM36x
$MTTF_D$	Mean time to dangerous failure: 100 years, at 25 °C ambient temperature (EN ISO 13849-1:2015)			

1) All products with the type code TiM3xx-01xxxxx are intended to be operated with flying leads. For production-related reasons, individual product variants with this type code are delivered with a 15-pin D-Sub HD male connector. For these products, the user is responsible for cutting off the male connector and creating the cable ends. Alternatively, the products may be operated with a male connector. In this case, the information for the product variants with the type code TiM3xx-10xxxxx applies for the PIN assignment.

10.5 Ambient data

Variant	TiM31x	TiM32x	TiM35x	TiM36x
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)			
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)			
Impact resistance	IK05 (0.7 joule) and IK06 (1 joule) as per DIN EN 62262:2022-02			
Ambient temperature	Operation: -10 °C ... +50 °C Storage: -30 °C ... +70 °C (IEC 60068-2-14:2009)		Commissioning/switching on: –10 °C ... +50 °C Operation: –25 °C ... +50 °C Storage: –40 °C ... +75 °C (IEC 60068-2-14:2009)	
Ambient humidity	Operation: ≤ 80%, non-condensing Storage: ≤ 95%, non-condensing (EN 60068-2-30:2005)			
Altitude	< 5,000 m above sea level			
Ambient light immunity	80,000 lx (indirect exposure)			
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	-10 °C ... +50 °C, 10 cycles (EN 60068-2-14: 2009)		-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).

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