OPERATING INSTRUCTIONS

TiM361S

Safety-related 2D LiDAR sensor

SICK
Sensor Intelligence.

Product described

TiM361S

Manufacturer

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Legal notes

Original document

This document is an original document of SICK AG.

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1 About this document

1.1 Function

These operating instructions contain the information required during the life cycle of the TiM361S safety-related 2D LiDAR sensor (2D laser scanner).

These operating instructions must be made available to everyone who works with this sensor.

Please read these operating instructions carefully and make sure that you understand the content fully before working with the sensor.

1.2 Scope

These operating instructions apply to the TiM361S safety-related laser scanner (also referred to as TiM361S, device or sensor) with part number 1090608 and the associated safety notes, part number 8018793.

The TiM361S comes with the conformity for use within the scope of application of the Machinery Directive 2006/42/EC and the associated standards and regulations (see also chapter 2.5).

1.3 Target groups

These operating instructions are intended for the following target groups: project developers (planners, developers, designers), installers, electricians, safety experts (such as CE authorized representatives, compliance officers, people who test and approve the application), operators, and maintenance personnel.

Commissioning, operation and maintenance.

In many applications, the target groups consist of the manufacturer and the operating entity of the machine in which the TiM361S is integrated, as follows:

Target group		Specific chapters of these operating instructions[1]
Manufacturer	Project developers (planners, developers, designers)	Project planning, page 8 Configuration, page 8 Technical data, page 40 Accessories, page 13
	Installers	Mounting, page 17
	Electricians	Commissioning , page 18
	Safety experts	Project planning, page 8 Configuration, page 8 Commissioning , page 18 Regular thorough checks, page 38 Technical data, page 40

[1] Chapters not listed here are intended for all target groups. All target groups must comply with the safety notes in all of the operating instructions!

Target group		Specific chapters of these operating instructions[1]
Operating entity	Operator of the device/person who performs device configuration	Configuration of the sensor, page 22
	Maintenance personnel	Regular thorough checks, page 38 Accessories, page 13

2 Safety information

2.1 Intended use

The TiM361S is a safety-related sensor suitable for the following applications:

- Hazardous area protection
- Hazardous point protection
- Access protection
- Mobile hazardous area protection (protection of mobile platforms)

The safety-related 2D LiDAR sensor must only be used within the limits of the prescribed and specified technical data (see 10.2 Safety-related technical data, page 41) and operating conditions at all times.

Use inconsistent with the intended use, operation beyond the technical limits, improper modification of, or manipulation of the TiM361S, will invalidate any warranty from SICK; in addition, any responsibility and liability of SICK AG for damage and consequential damage caused by this is excluded.

Reasonably foreseeable misuse

DANGER

Risk of ineffectiveness of the protective device

Persons and parts of the body to be protected may not recognized in case of non-observance. The TiM361S works as an indirect protective measure and cannot provide protection from pieces thrown from the application nor from emitted radiation. Objects within the blind zone and outside of the safety-related detection zone as well as transparent objects will not be detected.

▶ You must only use the sensor as an indirect protective measure.

The TiM361S is **not** suitable for the following applications, among others:

- Outdoors
- Underwater
- In explosion-hazardous areas
- Use beyond the technical specifications

As a safety-related sensor, the TiM361S safety-related 2D LiDAR sensor with performance level b (PL b), Category B, according to EN ISO 13849 is only intended to perform part of the safety function (partial safety function). In its safety function, it provides sensor information to a downstream logic unit for further processing.

The safety function arises only in context with the target application, e.g., machine tools, a mobile platform or service robot.

Requirements and features of the application may differ from the features and characteristic values of the product and must be evaluated within the scope of project planning.

2.2 Application area

The TiM361S safety-related laser scanner is intended for use as a sensor in personal protection equipment, in mobile applications on electrically operated autonomous platforms in industrial environments, as well as in stationary applications for access protection and presence monitoring in industrial environments.

2.3 Requirements for the qualification of personnel

The TiM361S safety-related laser scanner must be configured, installed, connected, commissioned and serviced only by qualified safety personnel.

Project planning

For project planning, a person is considered qualified when he/she has expertise and experience in the selection and use of protective devices on machines in the respective area of application, and is familiar with the relevant technical rules and national work safety regulations.

Mechanical mounting

For mechanical mounting, a person is considered qualified when he/she has the expertise and experience in the relevant field and is sufficiently familiar with the use of the protective device on machines in the respective area of application to be able to assess whether it is in an operationally safe state.

Electrical installation

For electrical installation, a person is considered qualified when he/she has the expertise and experience in the relevant field and is sufficiently familiar with the use of the protective device on machines in the respective area of application to be able to assess whether it is in an operationally safe state.

Configuration

For configuration, a person is considered qualified when he/she has the expertise and experience in the relevant field and is sufficiently familiar with the use of the protective device on machines in the respective area of application to be able to assess whether it is in an operationally safe state.

Commissioning

For commissioning, a person is considered qualified when he/she has the expertise and experience in the relevant field and is sufficiently familiar with the use of the protective device on machines in the respective area of application to be able to assess whether it is in an operationally safe state.

Regular thorough checks

For these regular thorough checks, a person is considered qualified when he/she has the expertise and experience in the relevant field and is sufficiently familiar with the use of the protective device on machines in the respective area of application to be able to assess whether it is in an operationally safe state.

Operation and maintenance

For operation and maintenance, a person is considered qualified when he/she has the expertise and experience in the relevant field, is sufficiently familiar with the use of the protective device on machines in the respective area of application, and has been instructed by the operating entity of the machine in the details of operation.

An operator may clean the device and carry out specific thorough checks as instructed.

2.4 Safety notes

Caution

Optical radiation: Laser class 1!

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

- Do not open the housing. Opening the housing will not switch off the laser. Opening the housing may increase the level of risk.
- Current national regulations regarding laser protection must be observed.

Warning

Electrical voltage!

Electrical voltage can cause severe injury or death.

- Work on electrical systems must only be performed by qualified electricians.
- The power supply must be disconnected when attaching and detaching electrical connections.
- The product must only be connected to a voltage source 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

Dangerous equipotential bonding 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.

2.5 Regulations and standards

- EN/IEC 60825-1:2014 - Laser safety standard
- Complies with 21 CFR 1040.10 and 1040.11 except for the listed tolerances in the document "Laser Notice No. 50" of June 24, 2007.

For safety-related parts of control systems

- EN ISO 13849-1:2015
  Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design

For mobile applications

- EN ISO 13482:2014
  Robots and robotic devices – Safety requirements for personal assistance robots

For stationary applications

- DIN ISO 13855:2010
  Safety of machinery – Positioning of protective devices with respect to the approach speeds of parts of the human body
- DIN CLC/TS 62046:2009
  Safety of machinery – Application of protective equipment to detect the presence of persons

3 Product description

TiM361S safety-related laser scanner

- Item description: TiM361S-2134101
- Design: PNP
- Part no. 1090608
- Valid firmware version: 2.59 or higher

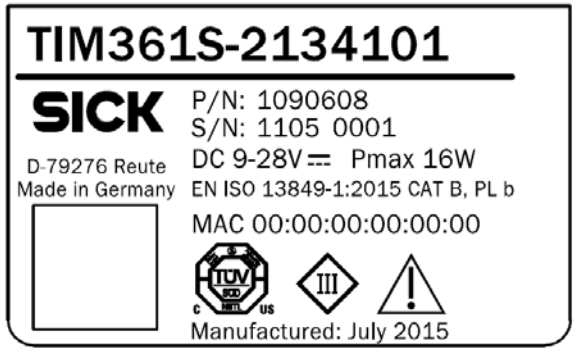
SOPAS configuration software

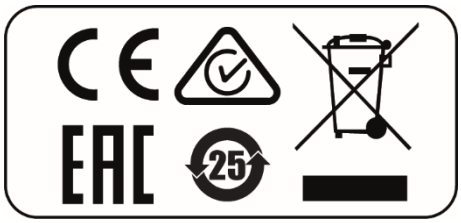
- Item description: SOPAS ET
- Valid software version: 3.3.3 or higher

3.1 Scope of delivery

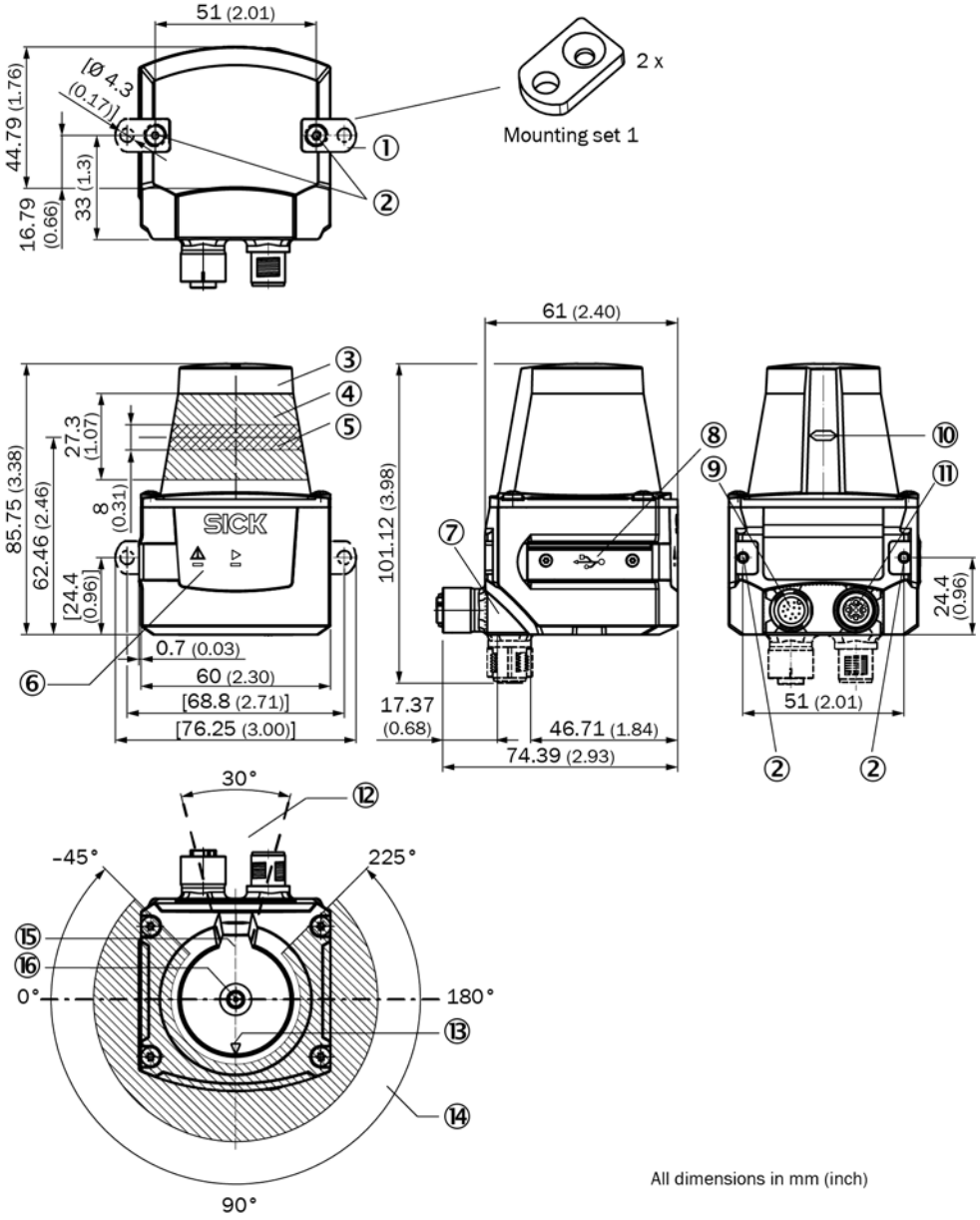
- TiM361S--2134101 including mounting kit 1
  (two straight plates, 2 M3 x 4 mm screws)
- Printed safety notes with reference to the operating instructions in German and English; in other languages via the SICK AG website, if required
- Other optional accessories (if these have been ordered)

3.2 Type label





3.3 Device layout



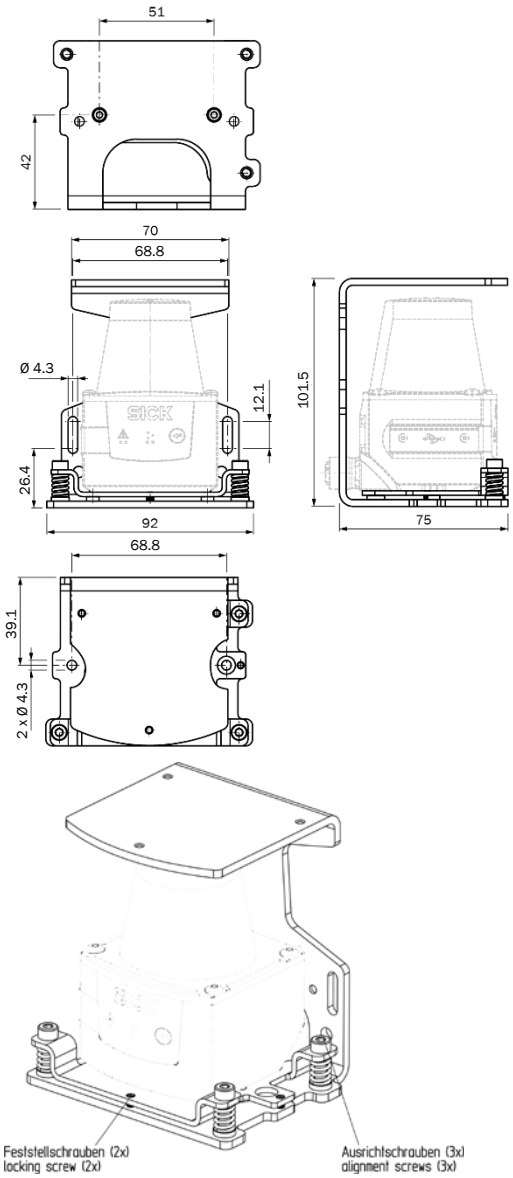
1	2 x straight plates with M3 x 4 mm screw (included in scope of delivery)
2	M3 threaded mounting hole, 2.8 mm deep (blind hole thread)
3	Optics cover
4	Receiving range (light inlet)
5	Transmission range (light emission)
6	Red and green LED (status displays)
7	Swivel connector unit with electrical connections
8	Micro USB port, behind the black plaster cover ("Aux interface" connection for configuration with PC)
9	"Power/inputs and outputs" connection, 12-pin M12 male connector
10	Marking for the position of the light emission level
11	Connection (4-pin M12 female connector: not used)
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 (visual range)
15	Internal reference target
16	Measurement origin

3.4 Accessories

The following accessories are permissible for safety-related use in connection with the TiM361S.

Mounting kit with fine adjustment (2086761)

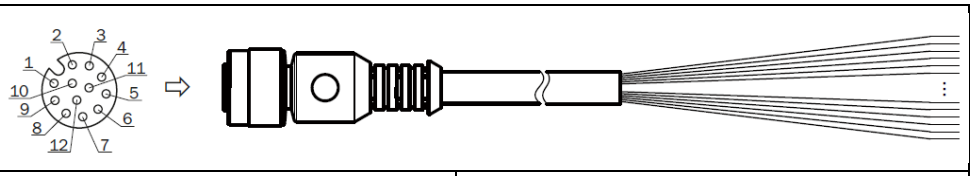
The mounting kit acts as a bracket, incl. the option of performing fine adjustment of the scan level, and provides impact protection. The sensor can also be mounted directly on the bracket without the adapter plate (mechanical collision protection only).



Cables

Designation	Part number
USB – Guide for configuring the sensor	6036106
M12 female connector – open, 5 m, 12-wire, shielded, PUR, halogen-free	6054974

Wire assignment, part number 6054974

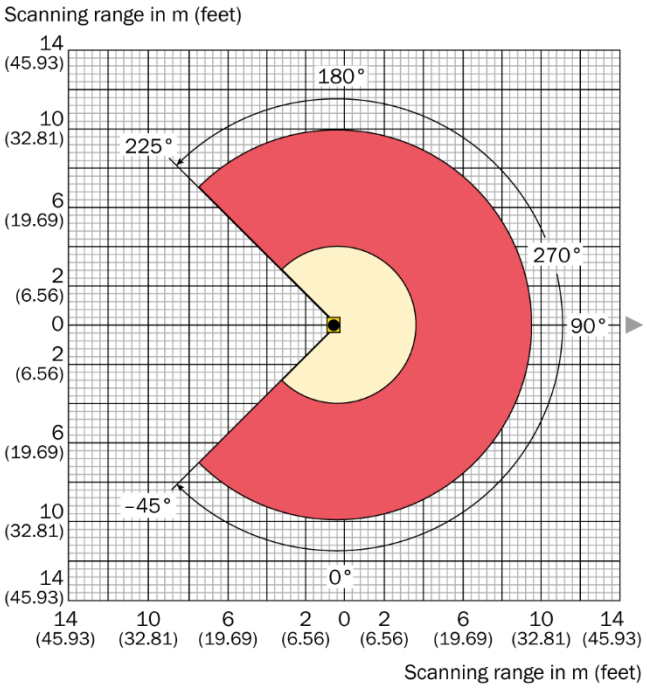


M12 female connector, 12-pin, A-coded (frontal view)	Illustration may differ

PIN	Signal	Function	Wire color, connection 6054974 (5 m)
1	GND	Ground	Blue
2	DC 9 V ... 28 V	Supply voltage	Brown
3	IN 1	Switching input 1 (field set selection)	Red
4	IN 2	Switching input 2 (field set selection)	Green
5	OUT 1	Switching output 1 (field breach)	Pink
6	OUT 2	Switching output 2 (field breach)	Yellow
7	OUT 3	Switching output 3 (field breach)	Black
8	OUT 4	Switching output 2 (index/error)	Gray
9	PNP: INGND NPN: IN DC 9 V ... 28 V	PNP: Common ground for all inputs NPN: Common reference potential of all inputs	White
10	IN 3	Switching input 3 (field set selection)	Violet
11	IN 4	Switching input 4 (field set selection)	Gray-pink
12	N. c.	-	Red-blue
-	-	Shield	

Measurement principle

The TiM361S is an opto-electronic 2D LiDAR sensor that uses laser beams to scan the outline of its surroundings on a plane. The TiM361S measures its surroundings in two-dimensional polar coordinates, relative to its measurement origin in the middle of the optics cover. The arrow visible on the optics cover marks the 90° angle as the middle of the scanning range. If a laser beam strikes an object, the position of that object is determined in terms of length (distance) and direction (angle).



Range for **not safety-related** detection:
0.05 m to max. 10 m (32.81 feet)

Range for **safety-related** detection:
0.05 m to max. 4 m (13.21 feet)

Attention! From the measurement origin up to a distance of 0.05 m (0.17 feet) no objects are detected (blind zone!) over the entire radial field of view (scanning range of 270°).

The sensor uses a rotating mirror to deflect the emitted laser beams, thereby scanning its surroundings in a circular pattern across a 270° segment. The measurements are triggered internally by an encoder in regular angle increments.

The TiM361S works with a scanning frequency of 15 Hz (15 measurements per second).

Safety function

The sensor is intended for use in personal protective equipment for detecting safety-related objects in mobile and stationary applications in industrial environments.

It additionally has a safety function (also see chapter 5.5.1 Operating modes/Statuses)

In its normal functioning (monitoring mode) the **safety function** is to report the presence or penetration of detected objects in its active protective fields.

The TiM361S meets the requirements of performance level b (PL b), Category B, per EN ISO 13849 and can be used within its area of application for risk reduction according to its features.

3.5 Safety characteristic values

The TiM361S safety-related laser scanner has the following safety characteristic values per EN ISO 13849-1:2015:

- Performance level (PL): b
- Category (Cat.): B
- Mean Time To Dangerous Failure ($MTTF_D$): 100 years (at 25° ambient temperature)
- Mission Time (MT) (period of use): 20 years

3.6 Safety-related detection capability

With the TiM361S safety-related laser scanner, with its emission wavelength, the following objects can be reliably and safely detected up to a relative speed of 1.6 m/s and at min. 5% remission:

- Objects 50 mm in diameter and 400 mm in length (standing up) at a distance of 0.05 m up to max. 1.5 m with a horizontal protective field
- Objects 70 mm in diameter and 400 mm in length (standing up) at a distance of 0.05 m up to max. 2 m with a horizontal protective field
- Objects 200 mm in diameter and 600 mm in length in or penetrating a vertical protective field and those lying on the ground with a horizontal protective field, at a distance of 0.05 m up to max. 4 m

Restrictions

The safety-related detection capability (determined by the measurement procedure) can be impaired for measurement of objects with edges and/or corners and/or those moving too quickly. This can result in incorrect distance values, causing impairment, reduction or complete loss of detection capability, and the device no longer being able to perform its function.

Blind zone

No objects will be detected within a range of 0.05 m from the measurement origin, across the entire scanning range of the TIM361S!

NOTE

Due to the necessary system reserve of the TiM361S, its detection range and/or system range is greater than the assured distances for safety-related detection.

This system reserve **must not** be used for safety-related analysis!

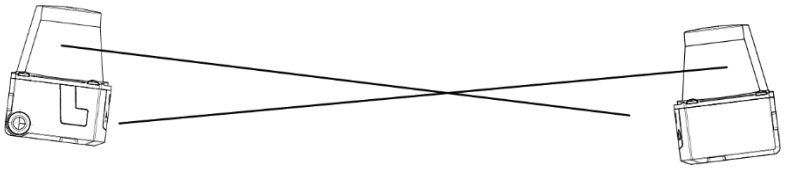
4 Mounting

4.1 Notes on mounting

- Mount the TiM361S safety-related laser scanner using the optionally available mounting accessories (see chapter 3.4 "Accessories").
- Mount the TiM361S on a prepared bracket. The sensor should be mounted and operated as free from shock and vibration as possible.
- The TiM361S can be mounted in any position depending on the application purpose.
- Mount the TiM361S so that it is not exposed to direct sunlight (window, skylight) or other sources of heat. This prevents the temperature inside the device from increasing unacceptably as well as the reduction or loss of detection capability.
- During mounting, make sure there is no reflective surface behind the internal reference target (see chapter 3.3 "Device Structure").
- In general, the mounting position of the sensor should be chosen such that in the sensor's rear range (behind the internal reference target, see chapter 3.3 "Device Structure"), dazzle due to other light sources is excluded, in order to prevent reduction or loss of detection capability.

4.2 Mutual interference

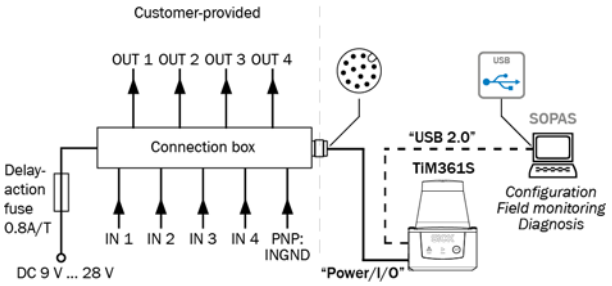
The TiM361S safety-related laser scanner has been designed to minimize the probability of mutual interference with sensors of the same type as the TiM361S. To rule out even the slightest effects on the measurement accuracy, the devices should be arranged such the laser beams are not received by another device.



5 Commissioning and configuration

Electrical block diagram for commissioning:

TiM361S-2134101



5.1 Notes on the electrical installation

- Requirements for the IP 65/IP 67 enclosure rating: the black rubber plate (USB female connector) must be flush-mounted on the housing.
- Protect the TiM361S against moisture and dust when the cover to the USB female connector is open.
- Electrical connections between the sensor and other devices may only be made or separated in a voltage-free state. Otherwise, the devices may be damaged.
- Wire cross-sections in the supply cable from the customer's power system should be chosen in accordance with the applicable standards.
- All electrical circuits connected to the sensor must be configured as SELV or PELV circuits (SELV = Safety Extra Low Voltage, PELV = Protective Extra Low Voltage).
- The supply voltage of the TiM361S must be secured accordingly.
- Only switch on the supply voltage to the sensor when the connection tasks have been completed and the wiring has been thoroughly checked.

5.2 Prerequisites for safe electrical operation

The sensor is designed and tested for electrical safety in accordance with IEC 61010-1:2010-06.

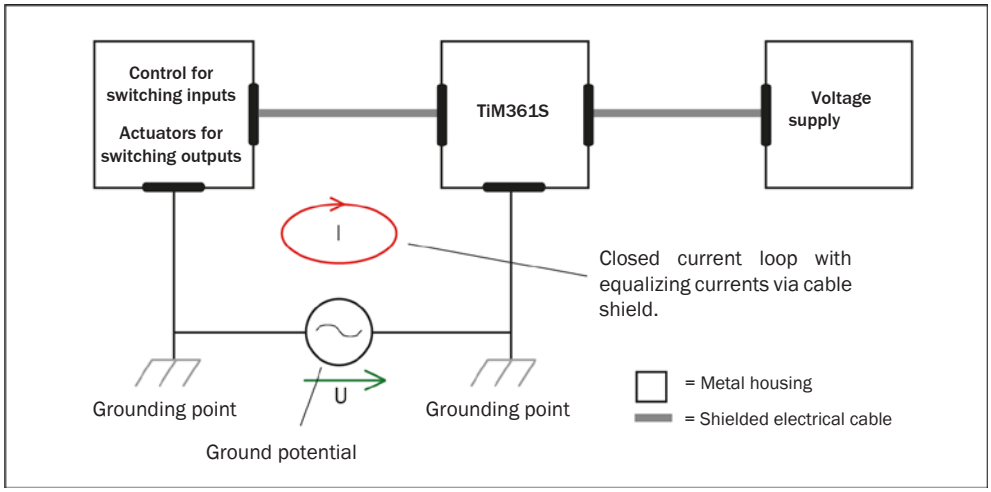
It is connected to the peripheral devices (voltage supply, control, actuators) via shielded cables. The cable shield – for the supply cable, for example – rests against the metal housing of the TiM361S. The device can either be grounded through the cable shield or through both fastening latches.

If the peripheral devices have metal housings and if the cable shields also lie on 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, among others:

- Mounting the devices on conductive metal surfaces
- Correct grounding of the devices/metal surfaces in the system
- Low-impedance and current-carrying equipotential bonding between areas with different ground potentials, if necessary.

If these conditions are not met, e.g., on devices in a widely distributed system over several buildings, potential equalization currents may, due to different ground potentials, flow along the cable shields between the devices and create hazards or malfunctions.



Due to insufficient ground potential equalization, voltage differences arise between grounding points 1 and 2. The current loop closes via the shielded cables and metal housing.

DANGER

Risk of injury/risk of damage due to electrical current!

Potential equalization currents between the TiM361S and other grounded devices in the system can have the following effects:

- Dangerous voltages on the metal housing
- Incorrect function or irreparable damage to the devices
- Damage/irreparable damage of the cable shield due to heating and cable fires

▶ Where local conditions are unfavorable and thus do not meet conditions for a safe earthing method (same ground potential at all grounding points), take measures in accordance with the following formats.

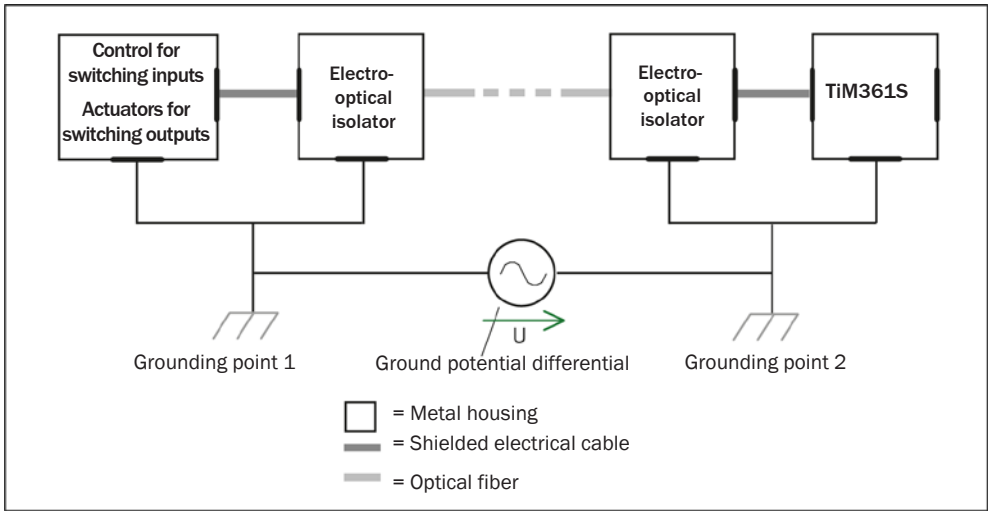
Remedial measures

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

Important! We expressly advise against opening up the cable shields. This would mean that the EMC limit values can no longer be guaranteed.

Measures for widely distributed system installations

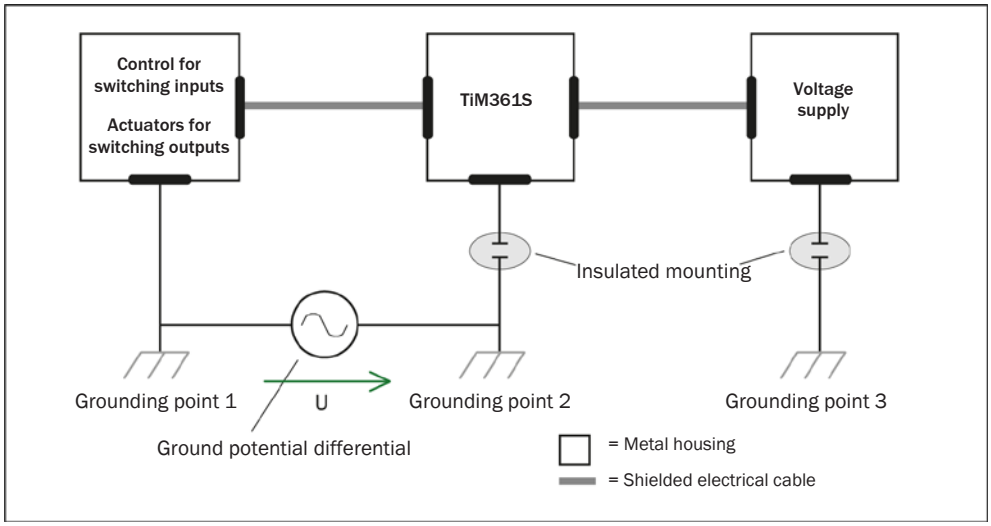
On widely distributed system installations with correspondingly large potential differences, we recommend setting up local islands and connecting them using commercially available electro-optical signal isolators. This measure achieves a high degree of resistance to electromagnetic interference.



The ground loop is isolated by using the electro-optical signal isolator between the islands. Within the islands, 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 sensor and of peripheral devices may be a sufficient solution.



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.

Important! The voltage supply of the TiM361S safety-related laser scanner and of the connected peripheral devices must also guarantee the required insulation level. Under certain circumstances, a tangible potential can develop between the insulated metal housings and the local ground potential.

5.3 Installation of SOPAS Engineering Tool

System requirements for SOPAS ET, version 3.3.3

System	Minimum requirement
Processor	Standard Intel Pentium PC or compatible, at minimum Pentium III 500 MHz
Frequency and working memory	Min. 1 GHz / 1 GB RAM
Interface	USB 2.0 or compatible
Operating system	Windows XP, Vista, Windows 7 or Windows 8 (32/64 bit)
Minimum resolution	1024 x 768 px
Memory	At least 450 MB

5.3.1 Installation process

When selecting between "installation" and "portable version," always choose the "installation" version. This ensures that all SOPAS ET functions and drivers are available. For installation, it may also be necessary to have administrator authorizations.

1. Select the installation language.

   This selection only determines the language of the installation wizard. Regardless of the selected installation language, all SOPAS ET languages can be selected subsequently.

2. Chose whether you want to have an icon on the desktop or on the Start Menu bar, and click **Next >**.
3. Select the installation location for SOPAS ET.

   It is recommended not to change the suggested location.

4. Click **Next>**.

The installation process starts. Please wait until it is fully complete and the next page appears. The checkbox Run SOPAS Engineering Tool is preselected.

5. Use the **Close** button to complete the installation and launch SOPAS ET.

5.3.2 Installing the device driver

Installing the device driver for the TiM36S device occurs automatically the first time a connection is established between SOPAS ET and the device.

5.4 Configuration of the sensor

Configuration of the sensor is done with SOPAS ET PC software.

DANGER

Risk of ineffectiveness of the protective device

- Before establishing a connection between SOPAS ET and the TiM361S safety-related laser scanner and before beginning configuration, ensure that the machine, plant or application in which the TiM361S is involved as part of a safety function is in a safe state.

5.4.1 Establishing the connection

Before launching SOPAS ET, a suitable cable (see chapter 3.4 "Accessories") must be used to establish a USB connection between the configuration interface of the TiM361S and the PC.

▶ Double-click the program icon to start SOPAS ET – a new project is opened.

A quick search for connected devices is performed.

The progress bar shows how far the process has progressed. The x symbol to the right of the progress bar enables you to end the search process prematurely.

Found devices are listed in the search results window. If the TiM361S was previously connected to the PC via USB, it will appear in the search results.

Found devices can be inserted into the project from the search results area via drag & drop, double-click, the Enter key, or the Add icon. They will remain in the search results but are displayed in gray.

Devices can only be configured and observed if they are inserted into the project.

No actions can be performed on the device in the search results window.

A device driver must be installed before establishing a connection with the TiM361S for the first time. Follow the instructions provided by SOPAS ET. When selecting the source for the driver installation, choose the option "Upload from device."

5.4.2 Configure the device

▶ To configure a device, double-click on the desired device.

This opens the device window which displays all the device parameters. You can configure the device, download parameters to and from the device, or observe parameter values in this window.

The parameter values then also remain in the project after you close the device window.

Only when the main window is closed will you be informed that parameters must be permanently saved in the device and parameter values will be lost if the project has not been saved.

5.4.3 Display of the current operational status

The "Monitor field analysis" page (in the navigation area of the device window, below the "monitor" node) displays the current operational status consisting of measurement data, status of the individual fields as well as status of the switching inputs and outputs.

The field monitor, which is placed in the middle of the page, displays measurement data as blue points and/or a blue line. Penetrated fields are shown in yellow; free fields appear in green.

5.4.4 Changing parameters

DANGER

Risk of injury/risk of damage due to incorrect parameters!

- Parameter changes are transferred to the device and take effect immediately after being edited. Permanent saving (in the non-volatile memory of the device) does not occur, however, until the "Save permanently" button is clicked.
- After parameter changes, the effectiveness of the protective device in the application must be reviewed and documented.
- Before beginning configuration ensure that the machine, plant or application in which the TiM361S is involved as part of a safety function is in a safe state.

Please note:

The individual parameters of the device can be changed on the pages below the "Parameters" node in the navigation area.

The TiM361S must be configured using the SOPAS configuration software.

5.4.5 Default configuration

The product is delivered with the following default configuration, which prevents unintentional or unaware sensor activation.

DANGER

Risk of ineffectiveness of the protective device

- After configuring the product or after making parameter changes, the effectiveness of the protective device in the application must be reviewed and documented.

For a safety-related use of the TiM361S, the configuration and commissioning must only be performed by appropriately qualified personnel (see also Qualification).

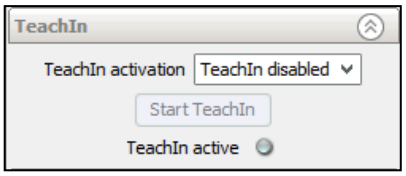
Particle filter

Default: Particle filter is "deactivated"

The particle filter should be deactivated, since otherwise objects that appear sporadically and for a short time will not be detected and/or filtered out. Similarly, the particle filter also delays the functioning of the switching outputs.

Teach button

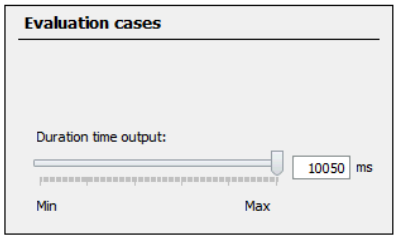
Default: TeachIn (SOPAS) is deactivated ("TeachIn disabled")



The TeachIn function (including via switching input) is deactivated in order to prevent unintentional configuration.

Duration time for the outputs

Default: Maximum (Duration Time) on the outputs

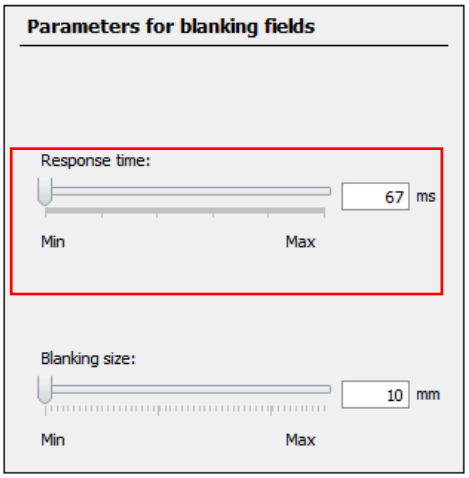


The sensor automatically releases its protective field outputs when no more objects are detected. The maximum output delay (duration time) therefore prevents immediate restart.

Important! Continuous restart interlock with reset function must be implemented by the user in the application.

Response time for object detection

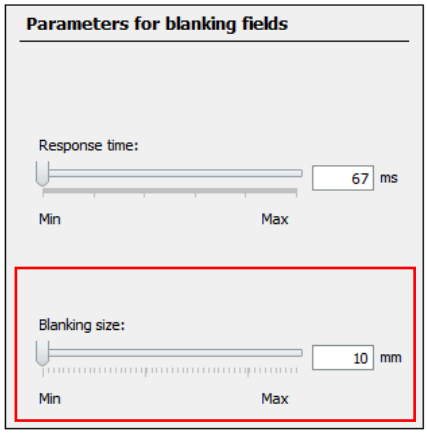
Default: Minimum Response Time for object detection



The shortest configurable response time is preset to 67 ms and represents the most rapid object detection.

Object sensitivity

Default: Maximum "sensitivity" (Blanking Size) for object detection



The smallest configurable blanking size of 10 mm represents the greatest degree of object detection (i.e., the smallest detectable object).

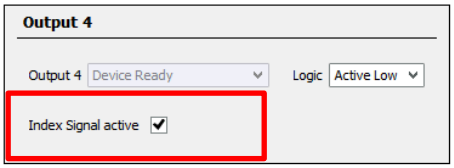
Switching outputs/Index signal

Default: Set all outputs to "active low" in PNP version

With its PNP switching outputs, the TiM361S safety-related laser scanner applies the principle of energy release as an active status by using the "active low" logic.

Index Signal

Default: Index Signal is "active"

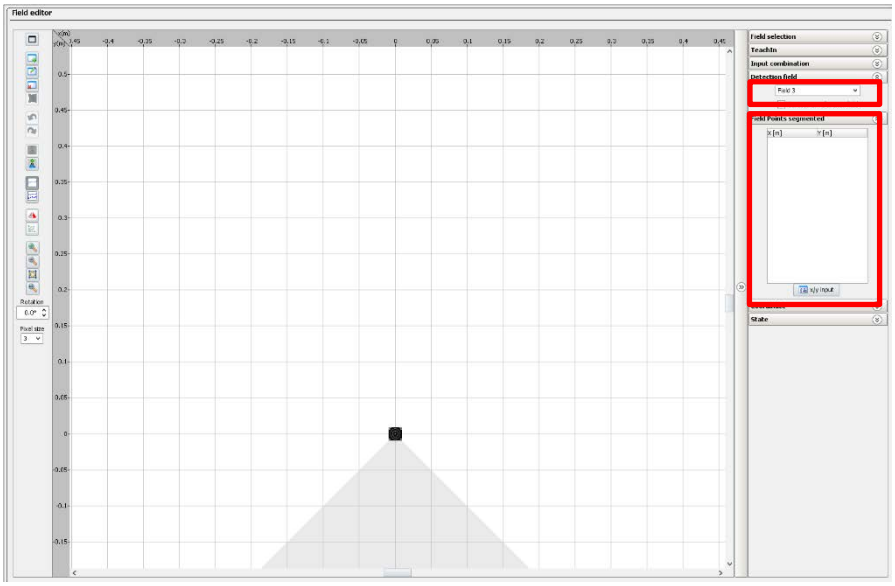


The index signal can be used as a "live signal" for the TiM361S safety-related laser scanner by a downstream controller.

Protective fields

Default: No protective fields are configured, i.e., all field points, segments of a protective field are deleted (no entries).

For all fields in all field sets, the reference contour (Contour as Reference) is "deactivated".



Deleting the field points means that the corresponding outputs for signaling protective field infringements are active (active low) until they are actively changed.

When the field points are deleted, the field editor will not display any protective fields!

5.4.6 Passwords

Software access to the TiM361S is protected by various passwords. After configuring the device successfully, the respective password must be changed so that it can fulfill its protective function.

User level	Password factory settings
Maintenance	sicksafe98
Authorized client	sicksafe99

The "Maintenance" user level enables parameter changes to be saved, among other things.

The "Authorized client" user level allows for general sensor configuration.

5.5 Editing fields

Fields can be created and edited on the "Analysis fields" page (below the "Parameters" node).

Before editing a field, first select the desired field set itself and the desired field within the field set.

Field set no. 1 and Field no. 1 are preset.

Different from all other parameters, changes to fields (adding, moving or removing individual field points or entire fields) are not transferred to the device until the "Download all fields to device" button is clicked.

5.5.1 Operating modes/operational statuses

The TiM361S safety-related laser scanner has the following operating modes and operational statuses:

Power On and boot phase

Begins after connecting and/or interruption of the supply voltage, and ends with operational readiness or fault/error

Operational readiness

Begins after Power On and boot phase, and ends 1 min or more after connection of the supply voltage. Operational readiness is indicated optically by the "green" LED on the device.

Operational status (monitoring mode)

(See also Normal functioning)

The TiM361S automatically enters this status after reaching operational readiness and after the output "Device Ready" (OUT4) has changed to the "high" status. To do so, the TiM361S must not be in configuration mode. (See Configuration mode)

Configuration mode

Once the sensor is connected to the SOPAS configuration software via the USB interface, the sensor can be configured.

The output "Device Ready" remains unchanged until write access to the device is initiated by SOPAS (e.g., changing a parameter, downloading field data, or accessing the "Save permanently" function), then the output "Device Ready" (OUT4) enters the status "low" for a period of approx. 1 s.

Fault/error

The TiM361S automatically enters this status when it detects an internal error. If there is an internal error, the output "Device Ready" (OUT4) is deactivated and enters the "low" status. This status is shown optically on the device.

Safety function

The TiM361S safety-related laser scanner has a safety function.

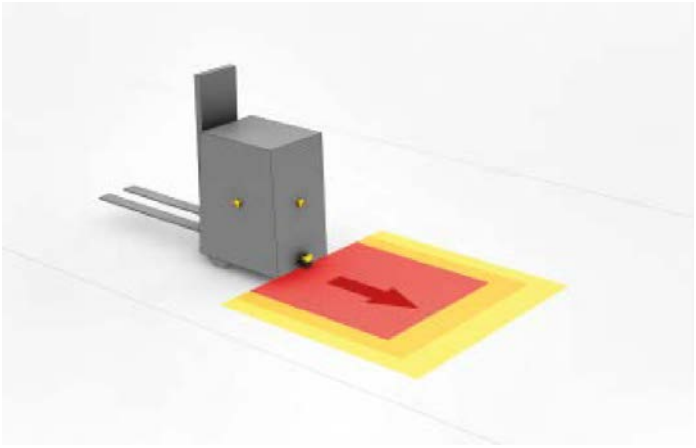
The **safety function** is detecting the presence or penetration of an object in a defined detection field (protective field).

When the **safety function** is requested, the **Defined status** is entered within max. 134 ms (max. 2 scans) and the safety-related output signals (OUT1-3) assigned according to the detection field are switched off. (deactivated status)

Example:

When a mobile platform approaches a person, a protective field can trigger an optical or acoustic signal. If the person does not respond and the mobile platform continues to approach, the infringement of an additional protective field by the person can be used

to stop the mobile platform via the associated safety outputs, before it reaches the person.



Defined statuses

The TiM361S has three defined statuses.

When the safety function is requested, defined Status 1 is to switch off (deactivated status) the safety-related output signal (OUT1, OUT2, OUT3) assigned according to the detection field.

Defined Status 2 is the status in which one or more of the safety-related output signals (OUT1, OUT2, OUT3) has entered the switched off (deactivated) status while the **safety function was not requested**.

Defined Status 3 is the status in which the safety-related output signal "Device Ready" (OUT4) has entered the switched off (deactivated) status for more than 67 ms.

Response times for defined statuses

Upon request of the **safety function,** the sensor enters **defined status 1** with a response time of 134 ms or less (max. 2 scans).

It enters **defined status 2** with a response time of 3,000 ms or less (15 scans) and **defined status 3** with a response time of 3,000ms or less (15 scans).

Protective field analysis

In its normal functioning (monitoring mode), the TiM361S reports, with an angular resolution of 0.33° in its detection field (detection range), the presence or penetration of detected objects in its active protective fields.

Protective fields

The TiM361S can simultaneously analyze 3 independent protective fields (detection fields). Each protective field is assigned to a digital output OUT1, OUT2, OUT3 which is activated upon infringement of the protective field (active low). The 3 independent protective fields are configured in a field set in the TiM361S and saved.

If a field set change occurs, the sensor activates analysis of the new protective fields with a response time of 134 ms or less (max. 2 scans).

Field sets

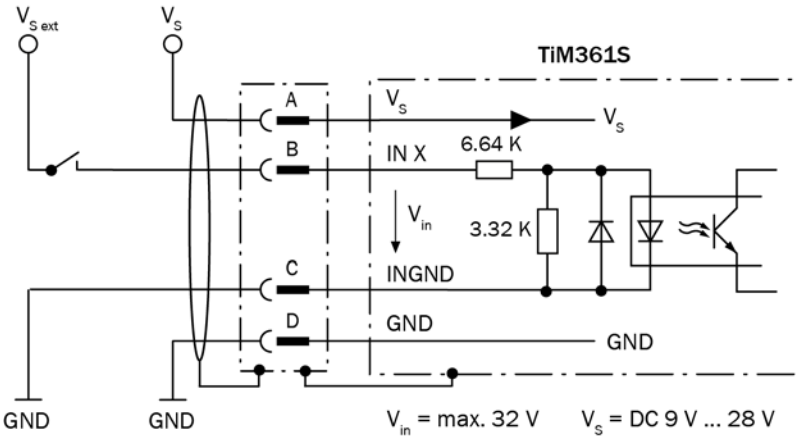
The sensor has 16 independent field sets. Selection of the active field set, and therefore also of the active protective fields, is performed via inputs IN1, IN2, IN3, IN4.

5.5.2 Digital inputs/outputs

The TiM361S has the following safety-related interfaces, the statuses of which only become valid after operational readiness is reached (see also Operating modes/operational statuses):

Digital inputs

The sensor has 4 digital PNP switching inputs (IN 1-4), which by means of selecting the corresponding binary combination (see table, below), activate one of the 16 available field data sets, and therefore the active protective fields.



Structure and wiring principle of input IN 2, IN 3 and IN 4 same as input IN 1.

Field set factory settings – switching inputs:

Field set	Switching inputs			
	IN 1	IN 2	IN 3	IN 4
1	0	0	0	0
2	1	0	0	0
3	0	1	0	0
4	1	1	0	0
5	0	0	1	0
6	1	0	1	0
7	0	1	1	0
8	1	1	1	0
9	0	0	0	1
10	1	0	0	1
11	0	1	0	1
12	1	1	0	1
13	0	0	1	1
14	1	0	1	1
15	0	1	1	1
16	1	1	1	1

Input level:

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

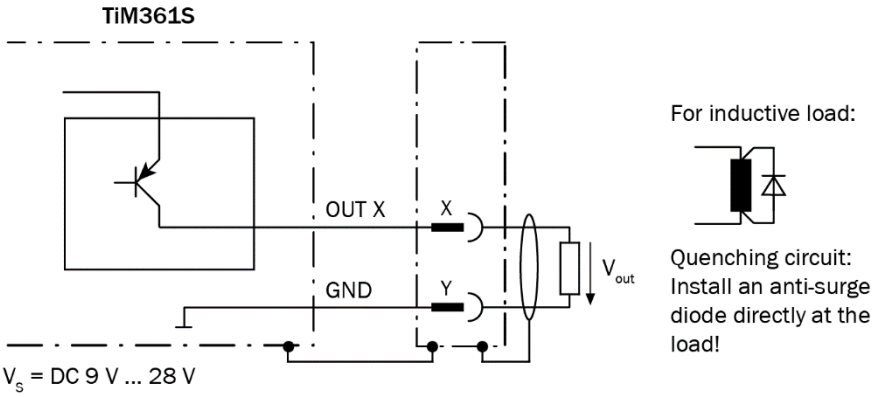
Characteristic data of the switching inputs:

The characteristic data is identical for of all switching inputs.

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
PNP electrical values	Low: $U_e \leq 2$ V, $I_e \leq 0.3$ mA High: 8 V ≤ $U_e \leq 32$ V, 0.7 mA ≤ $I_e \leq 5$ mA

Digital outputs

Infringement of the respective protective field is displayed in the active field data set by means of 3 available digital PNP switching outputs (OUT1 ... OUT3).
The factory setting for the digital outputs is the status "Field 1, 2, and 3 infringed."



Structure and wiring principle of output OUT 2, OUT 3 and OUT 4 same as output OUT 1

Assignment of infringed fields – switching outputs:

Fields of a field set	Switching outputs		
	OUT 1	OUT 2	OUT 3
Fields 1, 2, and 3 infringed	Active	Active	Active
Fields 2 and 3 infringed	Disabled	Active	Active
Field 3 infringed	Disabled	Disabled	Active
All fields free	Disabled	Disabled	Disabled
Field 1 inside, Field 2 middle, Field 3 outside Active: in working position; deactivated: in resting position			

Initial level:

The level of the PNP switching outputs OUT 1 ... OUT 3 is active low (deactivated status, 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.

PNP switching output 4 works with the following levels:

Function	Level
Device ready	High
Index signal (15 Hz), corresponds to measurement at 90°	Low peaks
Error	Low

Characteristic data of the switching outputs:

PNP switching behavior	PNP switching to supply voltage U_V. • OUT1 ... OUT3: resting level: high (no field infringement), working level: low (field infringement) response time 134 ms ... 30 s (configurable via SOPAS ET), Duration time: 0 ms ... 10 s (configurable via SOPAS ET) • OUT4: resting level: high (Device Ready), working level: low (error), low-impulse (15 Hz, index, corresponds to measurement at 90°)
Properties	Short-circuit protected and temperature protected Not electrically isolated from supply voltage U_V
PNP electrical values	$0\ V \leq U_a \leq U_V$ $(U_V - 1{,}5\ V) \leq U_a \leq U_V$ where $I_a \leq 100\ mA$

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

ΔU = 2 x length x current / conductance value x cross-section

Conductance value for copper 56 m/Ω mm^2

5.5.3 Function and status displays

LED ⚠ (red)	LED ▶ (green)	Status
-	Lights up	Device ready/monitoring mode
Lights up	Lights up	Field infringement
Flashing	-	Error
-	-	Device without supply voltage

6 Error behavior

6.1 General

A non-hazardous failure of the laser scanner occurs:

- When the laser scanner switches to defined status 2 and/or 3 **without request of the safety function**.
- When the laser scanner switches to defined status 2 and/or 3 in the event of a **detected internal error**.

A hazardous undetected failure occurs:

- When the laser scanner fails to switch to defined status 1, defined status 2 and/or defined status 3 upon request of the **safety function**.

6.2 Detected errors

The TiM361S detects some internal errors merely to improve its availability and support troubleshooting in the event of a fault.

The sensor has diagnostic coverage (DC) of zero in accordance with EN ISO 13849-1 PL b. The internal errors detected by the sensor **cannot** be used to increase the DCs within the meaning of this standard! (See also Error codes of the 2D LiDAR sensor)

6.3 Undetected errors and faults

The TiM361S will **not** detect the following errors and faults, among others:

- Digital inputs:
  wire break, short-circuit, cross-circuit to the digital inputs for field set selection (IN1, IN2, IN3, IN4), making it possible to select an incorrect field set.
- Digital outputs:
  wire break, short-circuit, cross-circuit to the digital outputs for field set infringement (OUT1, OUT2, OUT3) and Device Ready (OUT4), with the effect that the defined statuses can no longer be detected by the downstream controller.
- Status indicators:
  Failure of the status indicators for field set status, with the result that infringement of the protective field is not correctly displayed optically on the device.
- Contamination:
  Contamination of the optics and/or the front screen, causing impairment, reduction or complete loss of detection capability, and the device no longer being able to perform the safety function.
- Ambient light:
  Malfunctions due to faults of other scanners and light sources within the level of the scan field, causing impairment, reduction or complete loss of detection capability, and the device no longer being able to perform its function.
- Incorrect measurements:
  Measurement of objects with edges and/or corners and/or which are moving too quickly (determined by the measurement procedure) can result in incorrect distance values, causing impairment, reduction or complete loss of detection capability, and the device no longer being able to perform the safety function.
- Blind zone:
  Objects, especially covering objects, located within the blind zone extending f

0.05 m from the measurement origin of the TIM361S, causing impairment, reduction or complete loss of detection capability, and the device no longer being able to perform the safety function.

DANGER

Risk of ineffectiveness of the protective device

Undetected errors and faults of the TiM361S can cause impairment, reduction or complete loss of detection capability, such that the device is no longer able to perform the safety function.

NOTE

As per EN ISO 13849-1 PL b, the sensor has diagnostic coverage (DC) of zero, i.e., it must not detect errors and if they occur, can result in loss of the **safety functions.**

Testing and diagnostic measures can identify errors, such as those of the downstream controller.

6.4 Fault exclusions

No fault exclusions have been specified for the sensor. The occurrence of faults can result in the loss of the **safety function**.

6.5 Manipulation

The device does not have any protective measures against manipulation, especially none that relate to the optical system. Objects, especially covering objects on the optics cover and/or in the blind zone, are not detected by the TiM361S, causing impairment, reduction or complete loss of detection capability, and the device no longer being able to perform the safety function.

Manipulations with effects similar to undetected faults (see chapter 6.3 "Undetected errors and faults") are also not detected.

7 Project planning

7.1 Manufacturer of the machine

DANGER

Risk of ineffectiveness of the protective device

Persons and parts of the body to be protected may not recognized in case of non-observance.

- Use of the sensor requires a risk assessment. Check whether additional protective measures are required.
- Comply with the applicable national regulations derived from the application (e.g., work safety regulations, safety rules, or other relevant safety guidelines).
- Apart from the procedures described in this document, the components of the device must not be opened.
- The TiM361S must not be tampered with or changed.
- Improper repair of the device can lead to loss of the safety function. The protective device must only be repaired by the manufacturer or by someone authorized by the manufacturer.

7.2 Operating entity of the machine

DANGER

Risk of ineffectiveness of the protective device

Persons and parts of the body to be protected may not recognized in case of non-observance.

- Changes to the electrical integration of the sensor in the control of a machine and changes to the mechanical mounting of the TiM361S safety-related laser scanner necessitate a new risk assessment. The results of this risk assessment may require the entity operating the machine to meet the obligations of a manufacturer.
- Changes to the device's configuration may impair the safety function of the TiM361S safety-related laser scanner. Therefore the device's safety function and the effectiveness of the protective device must be checked after any change in configuration. The person carrying out the change is responsible for maintaining the safety function of the device and the protective device.
- The TiM361S must not be tampered with or changed.
- Improper repair of the device can lead to loss of the safety function. The protective device must only be repaired by the manufacturer or by someone authorized by the manufacturer.

DANGER

Danger due to optical and electromagnetic ambient conditions

Optical and electromagnetic ambient conditions can impair the functioning of the TiM361S.

This can result in loss of the **safety function**. Please note the following:

- Avoid having strong electric fields in the vicinity of the laser scanner. These may be caused by nearby welding or induction cables, for example.
- Prevent condensation on and/or contamination of the optics cover. To ensure the continuing, reliable safety function of the device, the optics cover must be cleaned regularly.

8 Regular thorough checks

At regular intervals the user must demonstrate that the measures taken still fulfill the protective purpose, and that the protective device still functions correctly in the application during the service life.

Thorough checks and tests are required in this regard:

- Upon commissioning (e.g., initial commissioning, recommissioning)
- After changes and extraordinary events (e.g., conversion, change of parameters, modification, retrofitting and equipment, damage, repair, ...)
- And at regular intervals (e.g., recurring thorough checks intended to ensure that a safety function and/or safety function still functions correctly in the application)

These thorough checks must be documented clearly and comprehensibly.

Determination of the time intervals for thorough checks at regular intervals must be decided and established by the manufacturer of the machine and/or by the operating entity depending on the specific application, place of application and influencing factors prevailing there. (e.g., dirt, demand rate, EMC, ...).

Example: thorough check of the effectiveness of protective fields

The effectiveness of protective fields can be demonstrated, for example, by positioning a suitable test object with the diameter and remission of the desired detection capability at multiple points along the effective protective range, and having the sensor detect them.

9 Working with the product

9.1 Maintenance and care

The TiM361S safety-related laser scanner does not contain any components that require maintenance. The device must not be opened. Maintenance is not necessary to ensure compliance with laser class 1, either.

- The black, infrared-transparent optics cover should be cleaned, at regular intervals and in the event of contamination, with a lint-free lens cloth (part no. 4003353) and plastic cleaning agent (part no. 5600006). In this regard, the cleaning interval essentially depends on the ambient conditions.

9.2 Transport and storage

The TiM361S safety-related laser scanner must be transported and stored in its original packaging with the USB protective cap plugged in. Do not store outdoors. To ensure that any residual moisture present can escape, do not store the device in airtight containers. Do not expose to aggressive media (e.g. solvents).

Storage conditions: Dry, dust-free, no direct sunlight, as little vibration as possible, storage temperature –40 to +75 °C, relative humidity max. 90% (non-condensing).

9.3 Repairs

Repair work on the TiM361S safety-related laser scanner may only be performed by qualified and authorized service personnel from SICK AG.

9.4 Disassembly and disposal

Any TiM361S safety-related laser scanner which can no longer be used at the end of the product life cycle must be disposed of in an environmentally-friendly manner in accordance with the country-specific waste disposal regulations that are applicable at the time.

The TiM361S safety-related laser scanner is electronic waste and must under no circumstances be disposed of with general waste.

10 Technical data

10.1 General technical data

Characteristic	Values
Field of view	Radial, aperture angle 270°
Angular resolution	0.33°
Scanning frequency	15 Hz (15 scans/s)
Detection range/system distances	0.05 m ... 4 m; at 5% remission 0.05 m ... 8 m; at 10% remission 0.05 ... 10 m, at > 50% remission
Minimum physical object sizes (cross-section)	121 mm at a distance of 8 m, 66 mm at a distance of 4 m, 38 mm at a distance of 2 m, at respective remission
Light source	Laser diode, infrared (λ = 850 nm +/- 10 nm)
Laser class	Laser class 1 according to EN 60825-1 (eye-safe)
Max. radiated power	1.5 W
Max. pulse duration	5 ns
Configuration interface	USB 2.0 for configuration, connecting cable max. 3 m
Electrical connections	1 x 12-pin M12 power male connector 1 x micro USB female connector, type B (covered)
Optical indicators	2 x LED
Supply voltage	DC 9 ... 28 V, SELV and PELV according to IEC 60364-4-41
Power consumption	Typical power consumption of 4 W with unloaded switching outputs Max. power consumption 16 W with max. four loaded switching outputs
Protection	The supply voltage must be protected with a max. 0.8 A slow-blow fuse (take into account the cable cross-section of the wiring!)
Housing	Lower part: aluminum die cast Optics cover: polycarbonate with scratch-resistant coating
Weight	Approx. 250 g without cables
Electrical safety	According to IEC 61010-1 (ed.3)
Protection class	III, acc. to EN 61140: IEC 60010-1 (ed. 3)
Ambient light immunity	60,000 lx (indirect)
Ambient Temperature	–10°...50 °C
Temperature change	Thorough check N according to EN 60068-2-14

Characteristic	Values
Damp heat	According to EN 60068-2-30
Air humidity	< 80% (non-condensing)
Enclosure rating	IP67
Altitude	max. 2,900 m ASL
EMC	Residential area according to EN 61000-6-3 Industrial area according to EN 61000-6-2
Vibration resistance	(according to EN 60068-2-6)
Shock resistance	(in accordance with EN 60068-2-27)
Contamination	Contamination level 1, EN 61010-1 outside housing Contamination level 3, EN 61010-1 outside housing, with sealed USB connection (All specifications regarding contamination **do not** apply to the optics)

For further technical specifications, see the Online data sheet on the product page on the web (www.sick.com/tim3xx).

10.2 Safety-related technical data

Characteristic	Values
Performance level (PL)	PL b according to EN ISO 13849-1:2015
Category (Cat.)	Cat. B according to EN ISO 13849-1:2015
Mean Time To Dangerous Failure ($MTTF_D$)	100 years according to EN ISO 13849-1:2015 (at 25° ambient temperature)
Mission Time (service life)	20 years
Safety-related detection range	0.05 m ... 4 m; at 5 % remission
Safety-related detection capability	Objects 50 mm in diameter at a distance of 0.05 m up to max. 1.5 m or objects 70 mm in diameter at a distance of 0.05 m up to max. 2 m or objects 200 mm in diameter at a distance of 0.05 m up to max. 4 m, up to a relative speed of 1.6 m/s and at min. 5% remission.
Blind zone	No objects are detected across the entire radial visual range (scanning range of 270°) from the measurement origin up to a distance of 0.05 m
Response time	Response of the switching outputs upon detection of an object Max. 134 ms (2 scans); typically 67 ms (1 scan)

Characteristic	Values
Protective field/Field analysis	1 analysis case with 1 field set and up to 3 independent protective fields, signaling of field infringements via a combination of 3 PNP switching outputs (OUT1 ... OUT3)
Protective field tolerance	+100 mm; 0.66° acc. To DIN CLC/TS 62046:2009 at 5% remission Temperature drift: 1.5 mm/Kelvin
Number of field sets	16 field sets with 3 independently configurable protective fields each
Switching inputs	PNP inputs: 4 x IN, IN1 ... IN4, (U_e = max. 28 V, I_e = max. 5 mA), opto-decoupled, debounce approx. 10 ms
Switching outputs	PNP outputs: 4 x OUT, OUT1 ... OUT4, (each I_a max. 100 mA), not electrically isolated from supply voltage, short-circuit protected/ temperature protected Configurable for OUT 1 ... OUT 3: Response time (67 ms ... 30 s) Duration time (0 ms ... 10 s) [2]

For further technical specifications, see the online data sheet on the product page on the web (www.sick.com/tim3xx).

NOTE

The product is intended for use in industrial environments, under indoor conditions. It is not suitable for use in special surroundings (e.g., radiation and sparks from welding systems, strong sources of infrared, thermal convection, fluorescent and stroboscopic light sources, snow, rain, contamination) or must yet be made suitable, if applicable.

[2] The TiM has an internal, system-related time delay of 67 ms

11 Declaration of conformity

EU declaration of conformity

The undersigned, who represents the manufacturer below, hereby declares that the product complies with the regulations of the EU directive(s) below (including all relevant changes), and that it is based on the relevant standards and/or technical specifications.

Complete EU declaration of conformity for download

You can call up the EU declaration of conformity and the current operating instructions for the product by entering the part number in the search field at www.sick.com.

(Part number: see the type label entry in the "P/N" field).

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