OPERATING INSTRUCTIONS

scanGrid2 CANopen

Safe multibeam scanner

SICK
Sensor Intelligence.

Described product

scanGrid2 CANopen

Manufacturer

SICK AG
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Germany

Legal information

CANopen

CANopen® is a registered trademark, licensed by CiA - CAN in Automation e.V., Germany.

Original document

This document is an original document of SICK AG.

Contents

1 About this document

1.1 Scope

Product

This document applies to the following products:

- Product code: scanGrid2 CANopen
- “Operating instructions” type label entry: 8025988

Document identification

Document part number:

- This document: 8025990
- Available language versions of this document: 8025988

You can find the current version of all documents at www.sick.com.

1.2 Target groups of these operating instructions

Some sections of these operating instructions are intended for certain target groups. However, the entire operating instructions are relevant for intended use of the product.

Table 1: Target groups and selected sections of these operating instructions

Target group	Sections of these operating instructions
Project developers (planners, developers, designers)	"Project planning", page 18 "Configuration", page 64 "Technical data", page 99 "Accessories", page 105
Installers	"Mounting", page 61
Electricians	"Integrating the equipment into the electrical control", page 31 "Electrical installation", page 63
Safety experts (such as CE authorized representatives, compliance officers, people who test and approve the application)	"Project planning", page 18 "Configuration", page 64 "Commissioning", page 87 "Technical data", page 99 "Checklist for initial commissioning and commissioning", page 112
Operators	"Operation", page 88 "Troubleshooting", page 92
Maintenance personnel	"Maintenance", page 90 "Troubleshooting", page 92

1.3 Further information

www.sick.com

The following information is available via the Internet:

- Data sheets and application examples
- CAD files and dimensional drawings
- Certificates (such as the EU declaration of conformity)
- Guide for Safe Machinery. Six steps to a safe machine
- Safety Designer (software for configuring and diagnosing safety solutions from SICK AG)
- Safety Assistant (app for transferring configurations and diagnosing safety solutions from SICK AG)

1.4 Symbols and document conventions

The following symbols and conventions are used in this document:

Safety notes and other notes

DANGER
Indicates a situation presenting imminent danger, which will lead to death or serious injuries if not prevented.

WARNING
Indicates a situation presenting possible danger, which may lead to death or serious injuries if not prevented.

CAUTION
Indicates a situation presenting possible danger, which may lead to moderate or minor injuries if not prevented.

NOTICE
Indicates a situation presenting possible danger, which may lead to property damage if not prevented.

NOTE
Indicates useful tips and recommendations.

Instructions to action

- ▶ The arrow denotes instructions to action.

1. The sequence of instructions for action is numbered.
2. Follow the order in which the numbered instructions are given.

- ✓ The check mark denotes the result of an instruction.

LED symbols

These symbols indicate the status of an LED:

- ○ The LED is off.
- ☼ The LED is flashing.
- ● The LED is illuminated continuously.

2 Safety information

2.1 General safety notes

Product integration

DANGER
The product can not offer the expected protection if it is integrated incorrectly.

- Plan the integration of the product in accordance with the machine requirements (project planning).
- Implement the integration of the product in accordance with the project planning.

Mounting and electrical installation

DANGER
Death or severe injury due to electrical voltage and/or an unexpected startup of the machine

- Make sure that the machine is (and remains) disconnected from the voltage supply during mounting and electrical installation.
- Make sure that the dangerous state of the machine is and remains switched off.

Laser class 1

CAUTION
If you use different operating or adjusting equipment from the operating or adjustment equipment specified in this document or if you carry out different procedures, this may lead to dangerous radiation effects.

- Only use the operating or adjusting equipment specified in this document.
- Only carry out the procedures specified in this document.
- Do not open the device.

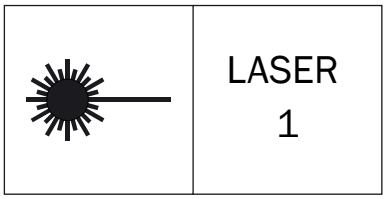


Figure 1: Laser class 1

This device complies with the following standards:

- IEC 60825-1:2014
- 21 CFR 1040.10 and 1040.11, except compliance with IEC 60825-1:2014, as described in Laser Notice No. 56 dated 08.05.2019

The laser is eye-safe.

The laser marking is located on the back of the safe multibeam scanner.

Repairs and modifications

DANGER
Improper work on the product

A modified product may not offer the expected protection if it is integrated incorrectly.

- ▶ Apart from the procedures described in this document, do not repair, open, manipulate or otherwise modify the product.

2.2 Intended use

The safe multibeam scanner is an electro-sensitive protective device (ESPE) and is used for object detection.

The safe multibeam scanner is suitable for the following applications:

- Mobile hazardous area protection
- Access protection

The product may be used in safety functions.

The safe multibeam scanner must only ever be used within the limits of the prescribed and specified technical data and operating conditions.

Incorrect use, improper modification or manipulation of the safe multibeam scanner will invalidate any warranty from SICK; in addition, any responsibility and liability of SICK for damage and secondary damage caused by this is excluded.

2.3 Inappropriate use

The safe multibeam scanner works as an indirect protective measure and cannot provide protection from ejected parts or from emitted radiation. The safe multibeam scanner cannot be used to detect objects that do not reflect light or reflect it incorrectly.

The safe multibeam scanner is not suitable for the following applications, among others:

- Outdoors
- Underwater
- In explosion-hazardous areas

2.4 Requirements for the qualification of personnel

The product must be configured, installed, connected, commissioned, and serviced by qualified safety personnel only.

Project planning

You need safety expertise to implement safety functions and select suitable products for that purpose. You need expert knowledge of the applicable standards and regulations.

Mounting, electrical installation and commissioning

You need suitable expertise and experience. You must be able to assess if the machine is operating safely.

Configuration

You need suitable expertise and experience. You must be able to assess if the machine is operating safely.

Operation and maintenance

You need suitable expertise and experience. You must be instructed in machine operation by the machine operator. For maintenance, you must be able to assess if the machine is operating safely.

3 Product description

3.1 Device overview

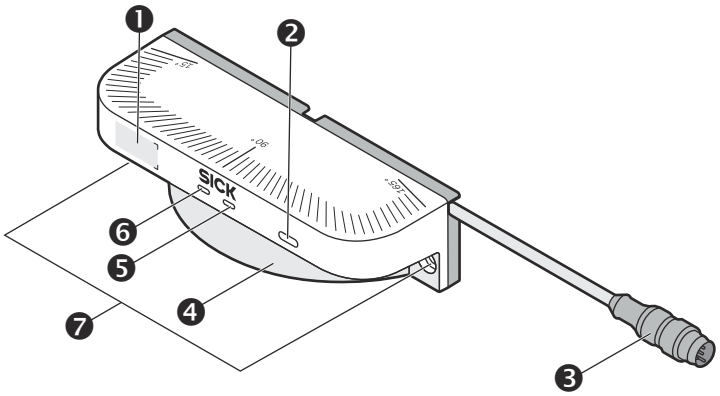


Figure 2: Device overview

1. Near Field Communication (NFC) interface
2. USB connection
3. System connection
4. Front screen
5. STATE LED
6. SAFE OUT LED
7. Fixing holes

3.2 Configuration and function

Overview

The safe multibeam scanner can detect objects that are located in a configurable detection area in front of it. The device scans the environment in two dimensions using infrared laser beams.

The safe multibeam scanner operates on the principle of time-of-flight measurement. It emits light pulses in regular, very short intervals. When the light is reflected from an object, the safe multibeam scanner calculates the distance to the object based on the period of time between transmission and reception (Δt).

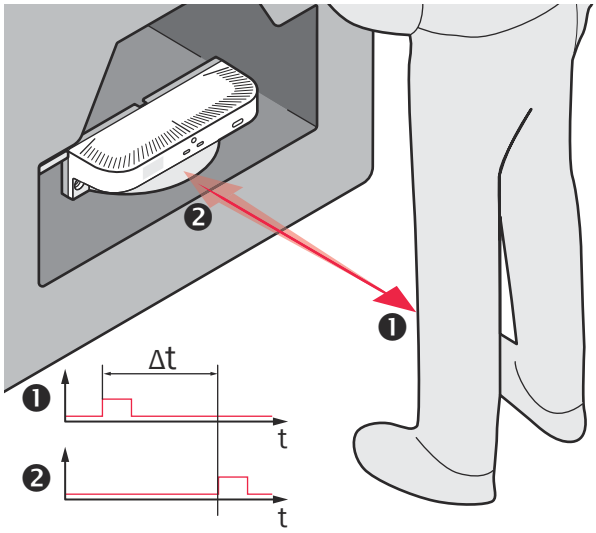


Figure 3: Principle of time-of-flight measurement

❶ Transmitted light pulse

❷ Reflected light pulse

How the detection area works

The safe multibeam scanner can divide its detection range into protective and warning fields.

The protective fields protect the hazardous area in front of a machine. As soon as an object is located in a protective field, the device indicates the detection by means of a signal change at the safety output and the protective field status. The range of the protective fields depends on the adjustable object resolution.

The optionally configurable warning fields have a longer range and can only be used for non-safety functions and, for example, to trigger a warning signal as soon as an object is detected.

The safe multibeam scanner uses 8 geometrically arranged sensor modules to build up a gapless detection area. Each sensor module has its own light source that emits a light pulse. The light pulse of each sensor module is divided into 4 segments, so the detection range of the safe multibeam scanner consists of 32 segments. The 32 segments are numbered from left (1) to right (32) (when viewing the sensor from above, see figure 4, page 14).

The safe multibeam scanner polls each sensor module in turn for the measurement results. The total time required to poll all sensor modules determines the scan cycle time.

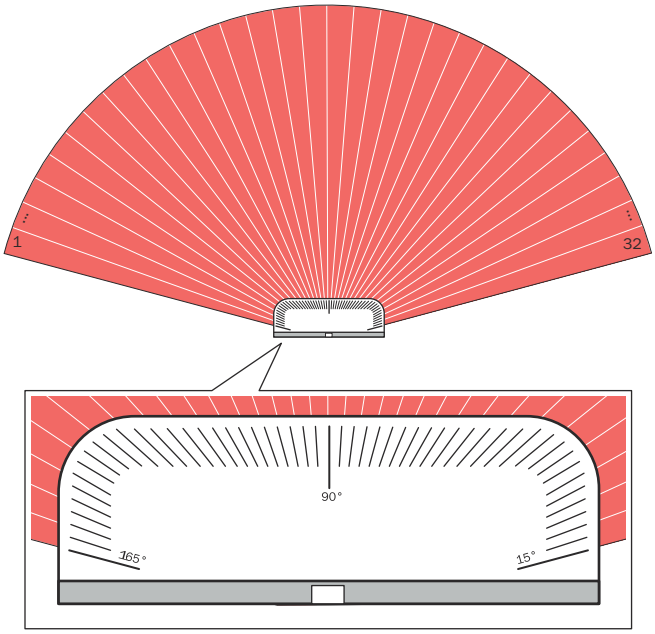


Figure 4: Detection area consisting of 32 segments

Geometry of the scan plane

The emitted laser beams cover a sector of a circle, so an object can be detected in an area of up to 150° as soon as it is completely within the protective field.

The sector of a circle that is covered ranges from 15° to 165°, where 90° corresponds to the central axis of the device.

The vertical position of the scan plane corresponds approximately to the centers of the fixing holes.

The safe multibeam scanner measures the distance to objects relative to the front screen.

3.3 Product characteristics

3.3.1 Integration in the control

The device communicates with the controller via CANopen (CiA 301) to transfer non-safety-related data, or via CANopen Safety (CiA 304) to transfer safety related data [1)]

The following data can be output via the CANopen protocol:

- Safety output
- Device, status, and error information
- Field statuses
- Diagnostic data
- Measurement data

3.3.2 System connection

The safe multibeam scanner is connected to the machine via the system connection. The system connection consists of a flexible cable with an M12 round connector, 5-pin.

3.3.3 Configuration and data output

The safe multibeam scanner has a USB connection and an integrated NFC interface.

1) CANopen® is a registered trademark, licensed by CiA - CAN in Automation e.V., Germany.

You can use the USB connection for comprehensive configuration, diagnostics and data output.

You can read an already verified configuration from one device and transfer it to other devices via NFC (Near Field Communication). You can also display the most important data for easy diagnosis.

Further topics

- "Configuration", page 64
- "Troubleshooting", page 92

3.3.3.1 USB connection

Overview

The safe multibeam scanner has a USB connection for comprehensive configuration and diagnostics on a computer. You need the Safety Designer software provided by SICK to do this.

The USB connection complies with the standard USB 2.0 Type-C©[2].

The USB connection may only be used temporarily and only for configuration and diagnostics.

The USB connection can also be used to supply voltage during configuration or diagnostics. No additional voltage supply via the system connection is therefore required.

NOTE
When you are not using the USB connection for configuration or diagnostics, you need to protect the USB connection from dust using the supplied USB cover.

Further topics

- "Working with configurations", page 68
- "Diagnostics using Safety Designer", page 93

3.3.3.2 Near Field Communication (NFC)

The safe multibeam scanner has an integrated NFC interface to transfer data to an NFC-capable mobile device. You need the Safety Assistant app provided by SICK to do this.

You can read already verified configurations from one device and transfer them to other devices via the NFC interface. You can also display the most important data for easy diagnosis.

Figure 5: NFC symbol [3]

The NFC interface may only be used temporarily and only for the transfer of configurations and diagnostics.

2) USB Type-C® and USB-C® are registered trademarks of USB Implementers Forum.

3) The N-Mark is a trademark or registered trademark of NFC Forum, Inc. in the United States and in other countries.

Further topics

- "Reading and transferring the configuration using the Safety Assistant app", page 70
- "Diagnostics using the Safety Assistant app", page 97

3.3.4 Field types

The safe multibeam scanner checks whether objects are present in one or more areas. The areas to be checked are called fields.

A distinction is made between the following field types, depending on the application type:

- Protective field
- Warning field

The distance to the nearest object is detected and compared with the distance specifications of the configured protective or warning field. If the protective or warning field has been interrupted, the corresponding signal is output.

Table 2: Field types and their function

	Protective field	Warning field
Safe switch off (according to ISO 13849-1)	Yes (PL c)	No
Max. scanning range of the safe multibeam scanner at the set object resolution[1)]	At 50 mm: 0.90 m At 70 mm: 1.10 m At 150 mm: 1.30 m At 200 mm: 1.35 m	4.0 m
Purpose	Detection and protection of people	Functional use (not safety application)
Description	The protective field protects the hazardous area. When the sensor detects an object in the protective field, the safety output switches to the OFF state and the protective field status to the “Interrupted” status. Downstream control elements can use this signal to end the dangerous state, for example, to stop the machine or vehicle	The warning field monitors larger areas than the protective field. Simple switching functions can be triggered with the warning field, e.g. a warning light or an acoustic signal can be triggered if a person approaches, even before the person enters the protective field.

1) Includes the protective field supplement TZ that is generally required for protective fields.

3.4 Example applications

Mobile hazardous area protection

Mobile hazardous area protection is suitable for AGVs (automated guided vehicles) and is used to prevent the vehicle from colliding with persons or objects.

The safe multibeam scanner monitors the area in the viewing direction and stops the vehicle as soon as a person or object is located in the protective field.

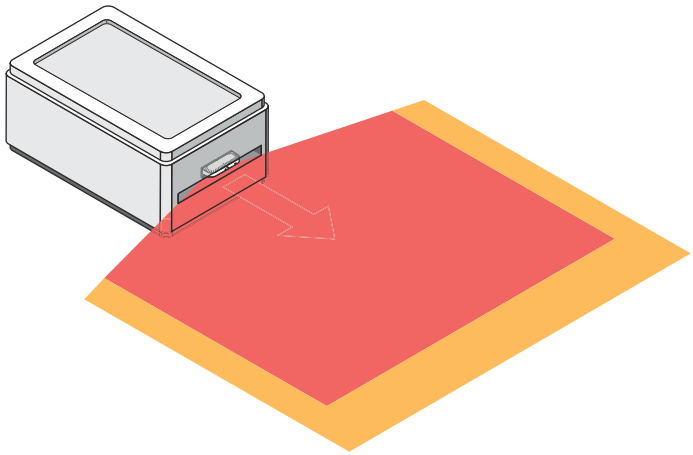


Figure 6: Mobile hazardous area protection: detection of a person or object when a vehicle approaches

Access protection

In an access protection system, if a person passes through the protective field with their whole body, they are detected and a stop signal is triggered.

A person standing behind the protective device will not be detected by the ESPE.

NOTICE

To prevent the access protection from being manipulated, install a mechanical manipulation protection. This prevents the safe multibeam scanner from being manually misadjusted.

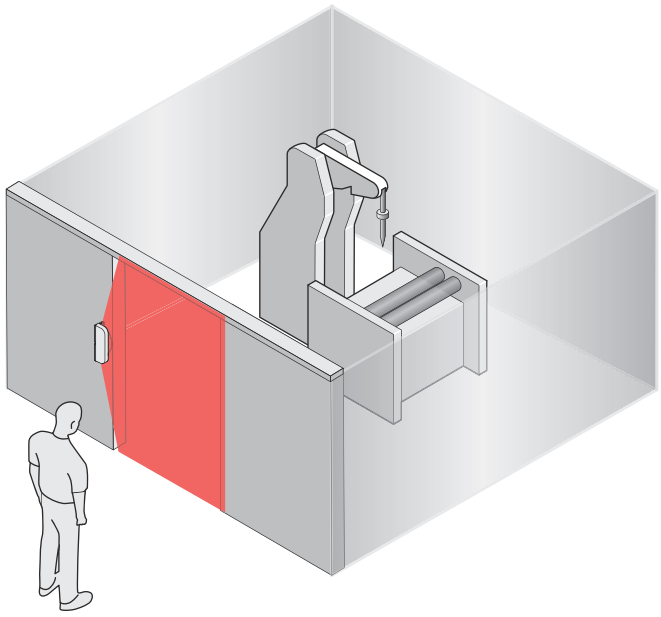


Figure 7: Access protection: detection of a person before they access a hazardous area

4 Project planning

4.1 Manufacturer of the machine

The manufacturer of the machinery must carry out a risk assessment and apply appropriate protective measures. Further protective measures may be required in addition to the product.

The product must not be tampered with or changed, except for the procedures described in this document.

The product must only be repaired by the manufacturer of the product or by someone authorized by the manufacturer. Improper repair can result in the product not providing the expected protection.

4.2 Operating entity of the machine

Changes to the electrical integration of the product in the machine controller and changes to the mechanical mounting of the product 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.

After each change to the configuration, it is necessary to check whether the protective measure provides the necessary protection. The person making the change is responsible for ensuring that the protection measure provides the necessary protection.

The product must not be tampered with or changed, except for the procedures described in this document.

The product must only be repaired by the manufacturer of the product or by someone authorized by the manufacturer. Improper repair can result in the product not providing the expected protection.

4.3 Design

Important information

DANGER

Hazard due to lack of effectiveness of the protective device

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

- Ensure that there are no mirrors or other highly reflective objects in the protective field of the safe multibeam scanner.
- Ensure that there is no smoke, dust or mist in the protective field of the safe multibeam scanner.
- Prevent interference in the optical beam path. If, for example, the device is installed in a paneling, the viewing slit must be sufficiently large.
- Ensure that there are no small objects (e.g. cables) in the protective field of the safe multibeam scanner, even if they do not trigger a field interruption.
- Ensure that no splash water occurs in the protective field of the safe multibeam scanner.
- Do not use an additional front screen.
- Avoid contamination of the front screen and water drops on the front screen.

Prerequisites

- There are no interferences or obstacles in the protective field of the safe multibeam scanner. Where there are unavoidable obstacles, additional protective measures are applied.
- If people can stay between the protective device and the hazardous point without being detected, additional protective measures (e.g., external restart interlock) are applied.
- Reaching under, over and around, crawling beneath and stepping over the safe multibeam scanner, as well as moving it, are prevented.

Contamination and ambient light diagnostics

Objects at a distance of ≤ 50 mm to the front screen of the safe multibeam scanner can erroneously lead to contamination messages.

The safe multibeam scanner only performs a contamination or ambient light diagnostic for those segments of the detection area that are used in at least one configured monitoring case (see "Fields", page 73). Segments that are not configured in any monitoring case are not taken into consideration in the diagnostics.

Complementary information

Certain optical and electromagnetic ambient conditions can affect the safe multibeam scanner and thus reduce the availability of the machine.

Examples:

- Condensation on the front screen
- Strong electrical fields (e.g. welding cables or induction cables)

Further topics

- "Mounting", page 61
- "Dimensional drawings", page 103

4.3.1 Protection from interference

Interference by lasers

Laser beams from other laser sources can affect the safe multibeam scanner and thus reduce the availability of the machine.

Measures to increase availability:

- ▶ Avoid foreign laser beams in the scan plane.
- ▶ Set multiple sampling to the highest value permitted in your application, taking the minimum distances into account.

Interference by strong ambient light

Strong external light sources in the scan plane can affect the safe multibeam scanner and thus reduce the availability of the machine.

Measures to increase availability:

- ▶ Avoid external light sources in the scan plane.
- ▶ Avoid sunlight in the scan plane.
- ▶ Do not position halogen lights, infrared light sources or stroboscopes directly on the scan plane.

Mutual interference of safe multibeam scanners

When using several safe multibeam scanners, they can interfere with each other.
You can avoid mutual interference in many cases by setting the configurable multiple sampling to a value greater than 1.

To avoid mutual interference in all cases, you need to choose a suitable mounting method.

Suitable mounting methods:

- Offset mounting so that the scan planes are on different planes
- Angled mounting so that the scan planes intersect one another (at least 2.5 ° at the same installed height)

Interference due to increased ionizing radiation

Increased ionizing radiation can impair the effectiveness of the safe multibeam scanner and reduce the availability of the machine.

Measures to protect the safe multibeam scanner from ionizing radiation:

- In areas with increased ionizing radiation, shield the safe multibeam scanner, for example with a lead sheath.

4.3.2 Preventing unprotected areas

Overview

The safe multibeam scanner must be mounted so that people cannot enter unsecured areas.

Undetected areas

The safe multibeam scanner has a field of view of 150°. Outside of this field of view, there may be areas which cannot be detected by the safe multibeam scanner.

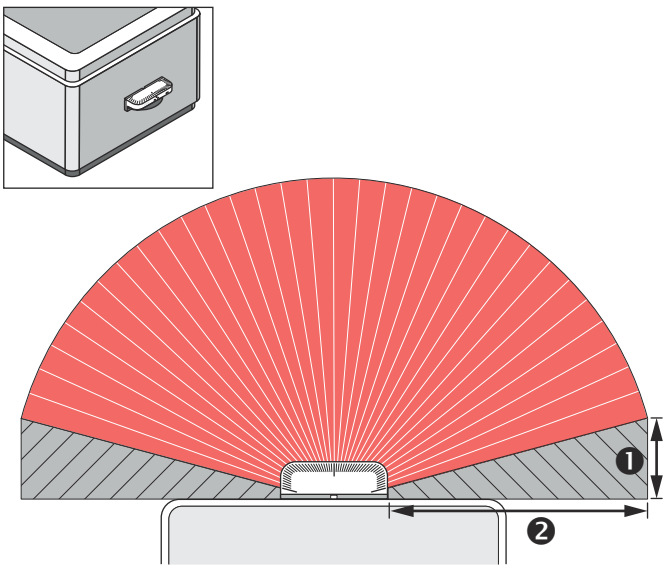


Figure 8: Unsecured areas

❶ Width of the unsecured area

❷ Length of the unsecured area

Remedial measures:

- Mounting of deflector plates to protect the undetected areas
- Mounting the safe multibeam scanner in the machine paneling

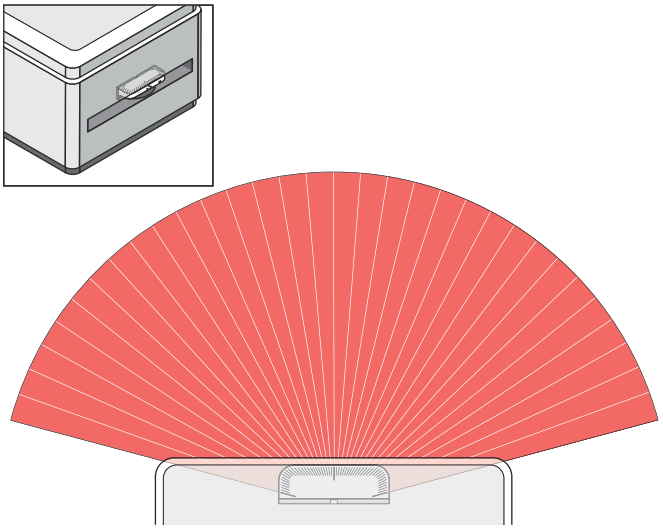


Figure 9: Example remedy: Install the safe multibeam scanner in the machine paneling

Near range

In close proximity (50 mm-wide area in front of the front screen), the detection capability of the safe multibeam scanner may be restricted.

4.3.3 Response time of the safe multibeam scanner

Overview

The response time of the safe multibeam scanner must be taken into account, among other things, so that the safe multibeam scanner can be positioned in a suitable location and the protective fields can be sized correctly.

The protective device's response time is the maximum time between the occurrence of the event leading to the sensor's response and the provision of the switch-off signal to the protective device's interface (for example the OFF state of the safety output).

The response time of the safe multibeam scanner depends, among other things, on the set multiple sampling.

Influence of signal transmission

In addition to the protective device's response time, further signal transmission and processing also influence the time up until the end of the dangerous state. This includes a control's processing time and the response times of downstream contactors, for example.

Further topics

- "Response time", page 102

4.3.4 Monitoring case switching

Overview

The safe multibeam scanner monitors all configured protective and warning fields in parallel. After switching to another monitoring case, the safe multibeam scanner can access the results for the now active protective and warning fields without delay. This also applies if multiple sampling is configured.

The input signals for monitoring case switching are transmitted via CANopen.

Duration of the monitoring case switching

If an object has been detected in a non-active protective or warning field, the safe multibeam scanner can process the corresponding result immediately after the monitoring case is switched. In this case you need to take into account the time required to perform the monitoring case switching.

$t_{CSR} = 20\ ms + 2 \times t_{CANtransmission}$

Where

- t_{CSR} = Duration of monitoring case switching in milliseconds (ms)
- $t_{CANtransmission}$ = Time for the CAN transmission of the PDO/SRDO in milliseconds

$t_{CANtransmission}$ depends on the following configuration settings:

- Configured baud rate
- CAN bus load
- For PDO: transmission type (event-driven or synchronous)
- For PDO: configured inhibit time
- For SRDO: configured refresh time / safeguard cycle time (SCT)

Compare the time required to perform the monitoring case switching with the response time (see "Response time", page 102) of the safe multibeam scanner. If the response time is exceeded, check whether your application requires countermeasures. For example, you can initiate switching earlier or reduce the vehicle speed in the case of mobile hazardous area protection.

When specifying the time of monitoring case switching, also take into account the signal propagation times to the safe multibeam scanner, e.g. the processing time of a control.

4.3.5 Distance from walls

The availability may be impaired if the protective field stretches as far as a wall or a different object. So, a space between the protective field and the object is required. A distance of the TZ value is recommended to ensure availability. (TZ = tolerance zone of the safe multibeam scanner, see "Data sheet", page 99.)

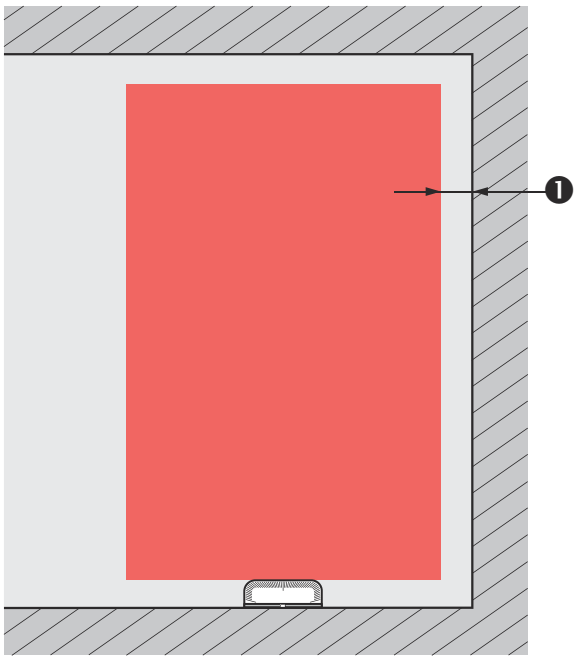


Figure 10: Distance of the protective field from the wall

① Recommended distance of the protective field from the wall.

4.3.6 Mobile hazardous area protection

In mobile hazardous area protection, the safe multibeam scanner is mounted with a horizontal scan plane, e.g., on an automated guided vehicle. The safe multibeam scanner protects the hazardous area created by the vehicle's movement.

The safe multibeam scanner detects a person's legs. The protective field is parallel to the direction of approach.

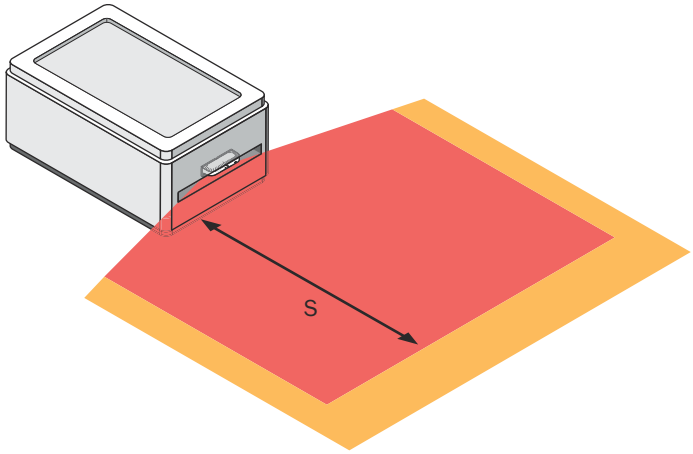


Figure 11: Mobile application with horizontal scan plane

NOTE

- In a mobile application, a resolution of 70 mm (leg detection) is sufficient for detecting people. This also applies to low mounting heights, since the safe multibeam scanner moves together with the vehicle.
- In the following calculation examples, only the vehicle speed is taken into account, not the speed of a walking person. This is based on the assumption that the person recognizes the danger and stands still.

4.3.6.1 Protective field

The protective field must be sufficiently large so that a person located at the minimum distance from the vehicle can be recognized. The minimum distance allows the vehicle to stop in time before it reaches a person or an object.

In mobile hazardous area protection, the minimum distance typically defines the protective field length required. When calculating the protective field length, the impact of turning must be considered separately.

The protective field must be wide enough to cover the width of the loaded vehicle with supplements for measurement error and the lack of ground clearance. When calculating the protective field width, the impact of turning must be considered separately.

If you define a number of monitoring cases with different protective fields, you must calculate the protective field size separately for each protective field used.

4.3.6.2 Supplement Z_F for lack of ground clearance

This supplement is necessary, because, generally, a person is detected above the foot and the braking process cannot take account of the length of the foot in front of the point of detection. A person's foot could be injured if a vehicle has no ground clearance.

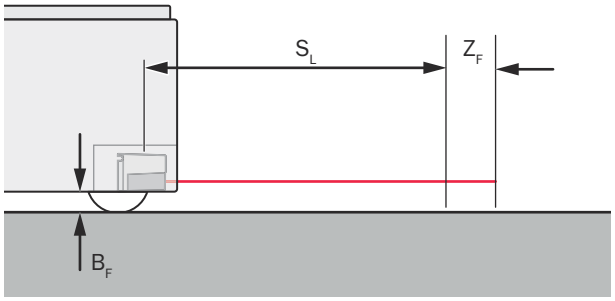


Figure 12: Flat-rate supplement for lack of ground clearance

B_F Ground clearance

S_L Protective field length without a supplement for lack of ground clearance

Z_F Supplement for lack of ground clearance

The lump supplement for ground clearance under 120 mm is 150 mm. This supplement may be reduced further in individual cases, see figure 13, page 24.

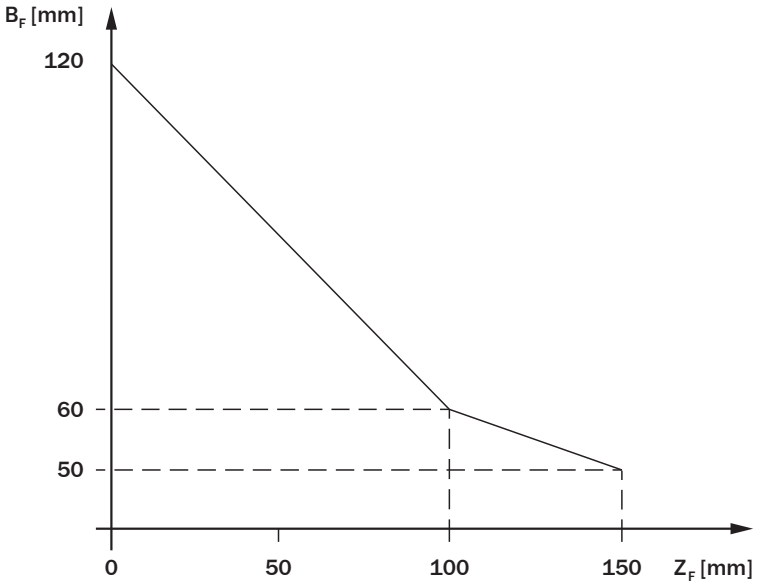


Figure 13: Minimum supplement for lack of ground clearance

B_F Ground clearance in mm

Z_F Supplement for lack of ground clearance in mm

4.3.6.3 Stopping distance S_A

The stopping distance is the sum of the following distances:

- Braking distance of the vehicle
- Distance covered during the response time of the safe multibeam scanner
- Distance covered during the response time of the vehicle control (incl. signal propagation time)

A vehicle's braking distance does not increase linearly with increasing speed, but rather in a squared relationship.

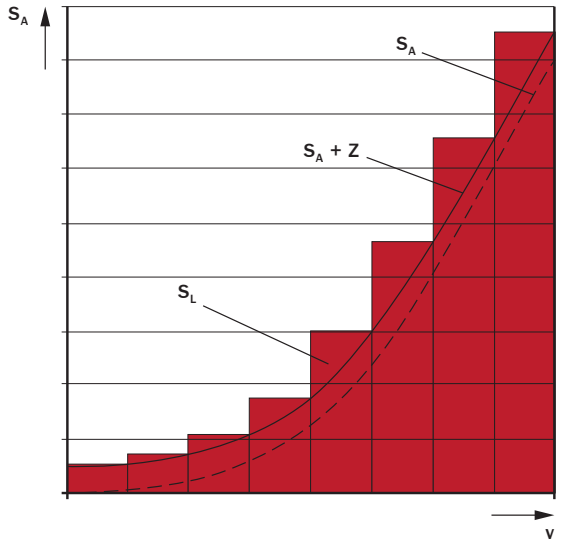


Figure 14: Stopping distance as a function of the vehicle's speed

v Speed
S_A Stopping distance
Z Supplements
S_L Protective field length for the relevant range of speeds

$S_A = S_{Br} + S_{AnF} + S_{AnS}$

where:

- S_A = stopping distance in millimeters (mm)
- S_{Br} = braking distance, from the vehicle documentation, in millimeters (mm)
- S_{AnF} = distance covered during the vehicle control's response time (including signal propagation time), from the vehicle documentation, in millimeters (mm)
- S_{AnS} = distance covered during the response time of the safe multibeam scanner in millimeters (mm)
  The distance S_{AnS} depends on the response time of the safe multibeam scanner and the vehicle's speed. The distance S_{AnS} is calculated using the following formula:
  $S_{AnS} = t_R \times V_{max}$
  where:
  - t_R = response time of the safe multibeam scanner in seconds (s)
  - V_{max} = maximum speed of the vehicle, from the vehicle documentation, in millimeters per second (mm/s) (If you define a number of monitoring cases with different protective fields: V_{max} = maximum speed of the vehicle in the current monitoring case)

Further topics

- "Response time", page 102

4.3.6.4 Calculation example for the protective field length

Calculation example for the protective field length S_L

$S_L = S_A + TZ + Z_F + Z_B$

where:

- S_L = protective field length in millimeters (mm)
- S_A = stopping distance in millimeters (mm)

- TZ = Tolerance zone of the safe multibeam scanner in millimeters (mm), see "Data sheet", page 99
- Z_F = supplement for lack of ground clearance of the vehicle in millimeters (mm)
- Z_B = supplement for the decreasing braking force of the vehicle, from the vehicle documentation, in millimeters (mm)

4.3.6.5 Calculation example for the protective field width

Calculation example for the protective field width S_B

$S_B = F_B + 2 \times (TZ + Z_F)$

where:

- S_B = protective field width in millimeters (mm)
- F_B = vehicle width in millimeters (mm)
- TZ = Tolerance zone of the safe multibeam scanner in millimeters (mm), see "Data sheet", page 99
- Z_F = supplement for lack of ground clearance of the vehicle in millimeters (mm)

4.3.6.6 Height of the scan plane

Overview

Take into consideration both the minimum and maximum height of the scan plane. You can use the fixing holes of the safe multibeam scanner as a reference for the scan plane.

Minimum height

The safe multibeam scanner checks every protective or warning field using a vertical aperture angle of up to 4°. Calculate the minimum height for the scan plane so that the protective or warning field is not disturbed by the floor.

$h_{min} = 0.035 \times L_{max} + 30$ mm

where:

- h_{min} = minimum height in millimeters (mm)
- L_{max} = maximum length used for protective or warning fields in millimeters (mm)

Table 3: Example values for the minimum height

Maximum length used (mm)	Minimum height (mm)
0	30
1000	65
2000	100
3000	135
4000	170

Maximum height

The scan plane must be at a maximum height of 200 mm everywhere. Otherwise, persons lying horizontally may not be detected.

In many cases, a mounting height (height of the scan plane) of 150 mm above the floor is suitable.

Example

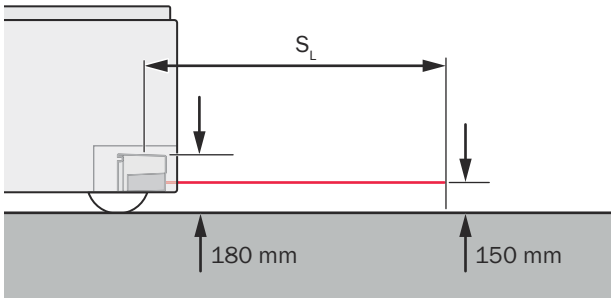


Figure 15: Recommended fitting height

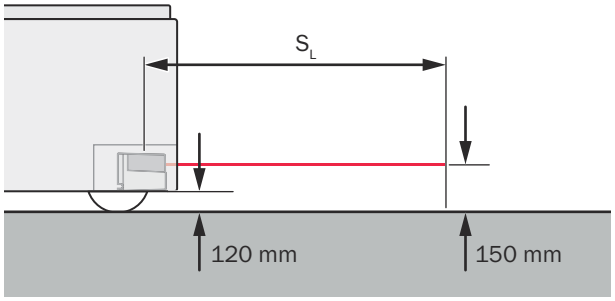


Figure 16: Recommended fitting height for inverted mounting

where:

- S_L = protective field length

4.3.7 Access protection

Overview

The safe multibeam scanner is mounted with a vertical scan plane in a stationary application where access to the hazardous area is at a defined point.

For access protection, the safe multibeam scanner detects an intrusion by a whole body. The protective field is orthogonal to the approach direction and the safe multi-beam scanner is mounted before or after the passage.

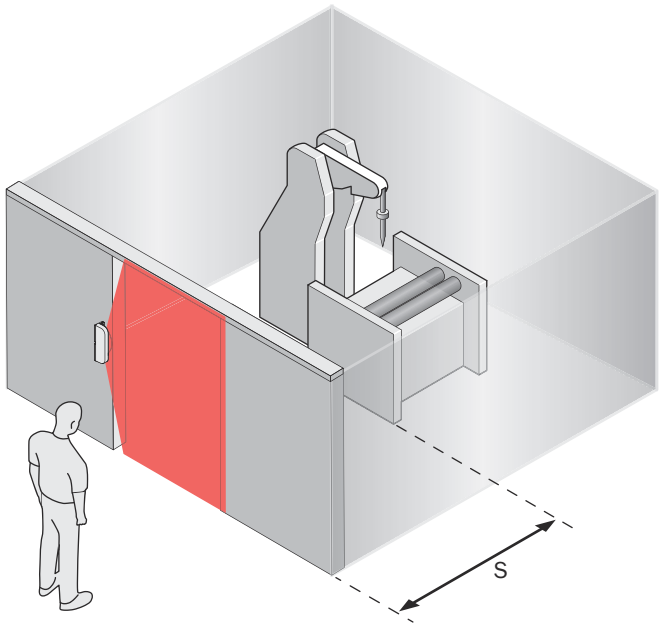


Figure 17: Stationary application with vertical scan plane

Important information

DANGER
Hazard due to lack of effectiveness of the protective device

Unintentional adjustment or manipulation of the safe multibeam scanner can affect the protective field.

- Design the application so that the safe multibeam scanner cannot be misadjusted.

DANGER
Hazard due to lack of effectiveness of the protective device

If there is a background object in the protective field level at a distance ≤ 250 mm from the protective field, it is possible that persons and parts of the body to be protected may not be detected or not detected in time.

- Do not mount the safe multibeam scanner within a passageway, but before or after the passageway.
- Avoid background objects in the protective field level if possible.
- With background objects at the protective field level: Increase overrun of the protective field over the opening to be protected in addition to tolerance zone TZ by supplement Z_E = 220 mm.

DANGER
Hazard due to lack of effectiveness of the protective device

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

- ▶ Make sure that the following construction requirements are met so that the safe multibeam scanner can fulfill its protective function.
  - If people can stay between the protective device and the hazardous point without being detected, check if additional protective measures (e.g., restart interlock) are required.

4.3.7.1 Protective field

In access protection, the minimum distance typically defines the position at which the safe multibeam scanner is mounted.

The protective field must be defined according to the following specifications:

- The distance between the reference plane (floor) and the lower edge of the protective field must not exceed 300 mm.
- The distance between the reference plane (floor) and the upper edge of the protective field must satisfy the following minimum values depending on the object resolution:
  - Object resolution 150 mm: 1,100 mm
  - Object resolution 200 mm: 1,400 mm
- The generally required protective field supplement (tolerance zone TZ, see "Data sheet", page 99) must be considered.
- If background objects are to be expected in the protective field level at a distance ≤ 250 mm from the protective field, the Z_E supplement may have to be taken into account (see "Z_E supplement for background-related measurement error", page 29).

For access protection, only single sampling (multiple sampling = 1) must be set up for the protective field. Otherwise a person could walk undetected through the protective field.

4.3.7.2 Z_E supplement for background-related measurement error

The Z_E supplement is 220 mm and extends the tolerance zone TZ of the protective field. The Z_E supplement must be taken into account if the following two circumstances apply:

- A background object in the protective field level at a distance of ≤ 250 mm from the protective field is to be expected.
- At least one distance value of the 32 segments exceeds the value listed in the following table. For each created field, you can check the distance values of all 32 segments in the configuration report (see "Report", page 84).

Table 4: Maximum distance value without interference by background objects

Object resolution (mm)	Maximum distance value (mm)
50	280
70	400
150	850
200	1140

The Z_E supplement must be taken into account in addition to the generally required tolerance zone TZ (100 mm). In sum, this results in a required protective field supplement of 320 mm for the relevant applications.

4.3.7.3 Minimum distance for stationary applications

Overview

You must ensure the minimum distance between the protective field and hazardous point is adhered to. The minimum distance means that the dangerous state can be ended in good time before the person reaches the hazardous point.

Minimum distance for stationary applications

The calculation of the minimum distance is based on international or national standards and statutory requirements applicable at the place of installation of the machine.

If the minimum distance is calculated according to ISO 13855, then it depends on the following points:

- Machine stopping time (time interval between triggering the sensor function and the end of the machine's dangerous state, if necessary including signal propagation times in the network and processing time in the control)
- Response time of the protective device
- Reach or approach speed of the person
- Resolution (detection capability) of the safe multibeam scanner
- Type of approach: orthogonal for access protection
- Switching time between monitoring cases
- Supplement to prevent reaching through

Complementary information

Additional information is available in the ISO 13855 standard and in the Guide for Safe Machinery from SICK.

SICK offers a stopping/run-down time measurement service in many countries.

Further topics

- "Response time of the safe multibeam scanner", page 21
- "Monitoring case switching", page 21

4.3.7.4 Calculation example for the minimum distance

Calculation example of the minimum distance S according to ISO 13855

The example shows the calculation of the minimum distance for an orthogonal approach to the protective field. A different calculation may be required, depending on the application and the ambient conditions (e.g. for a protective field parallel to or at any angle to the direction of approach or an indirect approach).

S = 1,600 mm/s × T +850 mm

where:

- S = minimum distance in millimeters (mm)
- T = stopping/run-down time for the entire system in seconds (s)
  (Response time of the safe multibeam scanner + machine's stopping/run-down time, incl. response time of the machine's control system and signal propagation time)

The approach speed is already included in the formula.

4.4 Integrating the equipment into the electrical control

Requirements for use

- The control of the machine can be electrically influenced.
- The connected controller and all devices responsible for safety comply with the required performance level and the required category (for example according to ISO 13849-1).
- Power is supplied to all electrically connected devices in accordance with SELV/PELV (IEC 60204-1).
- All electrically connected devices are supplied from the same power supply.
- All electrically connected devices use the same earthing method.

Further topics

- "Electrical installation", page 63

4.4.1 Voltage supply

Prerequisites

- The power supply unit is able to jumper a brief power failure of 20 ms as specified in IEC 60204-1.
- Battery-powered systems must be able to jumper brief power failures of 5 ms.
- The power supply unit provides safe isolation according to IEC 61140 (SELV/PELV as per IEC 60204-1).
- The voltage supply must be provided with a fuse with a rated current of max. 2 A.
- The recommended maximum cable inductance is 100 µH at a supply voltage of 12 V. If the specified supply voltage range is adhered to, values > 100 µH are also allowed.

NOTE
Inductances in the supply cables result in an increase in ripples in the supply voltage to the sensor. This can impair the functioning of the sensor, in particular at low supply voltages.

Further topics

- "Data sheet", page 99

4.4.2 Input signals for monitoring case switching

Overview

The safe multibeam scanner receives the input signals for monitoring case switching either via a PDO or SRDO.

Prerequisites

- The safety-related parts of the control which switch the active protective field provide the same safety level as the safety function. In many cases, this is PL c as per ISO 13849-1 or SIL 1 as per IEC 62061.

Signals for the monitoring cases

The safe multibeam scanner selects the monitoring case based on the CANopen data received.

The CANopen data have a size of one byte. Each bit represents a monitoring case.

Table 5: Selecting a monitoring case

Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8	Selected monitoring case
1	0	0	0	0	0	0	0	1
0	1	0	0	0	0	0	0	2
0	0	1	0	0	0	0	0	3
0	0	0	1	0	0	0	0	4
0	0	0	0	1	0	0	0	5
0	0	0	0	0	1	0	0	6
0	0	0	0	0	0	1	0	7
0	0	0	0	0	0	0	1	8

Sequence of monitoring cases

The safe multibeam scanner does not check the order in which the individual monitoring cases are activated. If necessary, you must ensure the required sequence of monitoring cases externally, e.g. by the device that provides the input signals for monitoring case switching.

Invalid signals

If a combination of input signals cannot be associated with a monitoring case, the safe multibeam scanner outputs an error of the category “Recoverable error”. This monitoring is only performed if more than one monitoring case has been configured.

As soon as the combination of the input signals is valid and can be associated with a monitoring case, the safe multibeam scanner switches back to normal operation and activates the corresponding monitoring case.

Further topics

- "Electrical installation", page 63
- "Technical data", page 99
- "Monitoring cases", page 75

4.4.3 Restart interlock

Overview

Depending on the regulations which apply at the place of installation, a restart interlock may be required.

The restart interlock prevents the machine from automatically starting up, for example after a protective device has responded while the machine is operating or after changing the machine’s operating mode.

The protective device does not have an internal restart interlock. You must therefore implement a restart interlock externally via the circuitry or the control if needed, e.g. in connection with the SICK RLY3-OSSD2 / RLY3-OSSD3 safety relay.

Restart delay

You can use the integrated restart delay to delay the restart of the safety output.

Once the configured restart delay has elapsed, the safety output starts automatically and without manual interaction. The restart delay therefore does not meet the applicable requirements for use as a restart interlock.

4.4.4 External device monitoring (EDM)

The external switching elements (external device monitoring, EDM) must be inspected in line with the regulations which apply at the place of installation or the required reliability of the safety function.

External device monitoring (EDM) monitors the status of downstream contactors.

The protective device does not have an internal EDM. You must therefore implement the EDM externally via the controller.

4.5 Integration into the CANopen network

Prerequisites

- The safe multibeam scanner and the CAN bus must use the same baud rate.

4.5.1 Supported objects and services

The safe multibeam scanner supports the following CANopen object types and services:

- Process data objects (PDOs)
- Safety related data objects (SRDOs)
- Service data objects (SDOs)
- Emergency
- NMT
- SYNC
- Heartbeat
- Node guarding
- LSS slave
- Store/restore

4.5.1.1 Process data objects (PDOs)

Overview

The safe multibeam scanner supports one Receive PDO (RPDO) and nine Transmit PDOs (TPDO1 to TPDO9).

Objects 0x1800 to 0x1808 contain the communication parameters. Objects 0x1a00 to 0x1a08 contain the mapping parameters.

NOTE
The mapping parameters cannot be changed.

RPDO

The safe multibeam scanner receives the input signals for monitoring case switching via the RPDO object.

The RPDO object uses the index 0x6000 and consists of two entries, each 8 bits in size.

Table 6: RPDO contents

Entry	Index	Subindex	Description
1	0x6000	1	Input signals for monitoring case switching
2	0x6000	2	Reserved

Table 7: RDPO, entry 1 (input signals for monitoring case switching)

Bit	Name	Description
0	Input 0	Monitoring case 1

Bit	Name	Description
1	Input 1	Monitoring case 2
2	Input 2	Monitoring case 3
3	Input 3	Monitoring case 4
4	Input 4	Monitoring case 5
5	Input 5	Monitoring case 6
6	Input 6	Monitoring case 7
7	Input 7	Monitoring case 8

TPDO1

The safe multibeam scanner sends device information as well as the status of the protective and warning fields via the TPDO1 object.

The TPDO1 object uses the indexes 0x6200 and 0x6202. The object consists of eight entries, each 8 bits in size.

Table 8: TPDO1 contents

Entry	Index	Subindex	Description
1	0x6200	1	Device status
2	0x6200	2	Reserved
3	0x6200	3	Device status
4	0x6200	4	Device status
5	0x6202	1	Protective field status
6	0x6202	2	Reserved
7	0x6202	3	Warning field status
8	0x6202	4	Reserved

Table 9: TPDO1, entry 1 (device status)

Bit	Name	Description
0	Safety output	0 = OFF 1 = ON
1	Protective field status	Status of the currently active protective field: 0 = Interrupted 1 = Free
2	Operating status	0 = Safety function OFF or error or sleep mode 1 = Safety function ON and no error and not in sleep mode
3	-	Reserved
4	-	Reserved
5	-	Reserved
6	-	Reserved
7	-	Reserved

Table 10: TPDO1, entry 3 (device status)

Bit	Name	Description
0	Warning field status	Status of the currently active warning field: 0 = Interrupted 1 = Free
1	Contamination warning	0 = No contamination 1 = contamination warning

Bit	Name	Description
2	Contamination error	0 = No contamination error 1 = contamination error
3	Status of the input signals for monitoring case switching	0 = Valid or only one monitoring case configured 1 = Invalid
4	Status of the CANopen input data for monitoring case switching	0 = Data were received and are valid or only one monitoring case configured 1 = No data received or invalid data received
5	Supply voltage (24 V) of the safe multibeam scanner	0 = Supply voltage adequate 1 = Supply voltage inadequate (too low)
6	Ambient light immunity	0 = Not exceeded 1 = Exceeded
7	Sleep mode	0 = Not activated 1 = activated

Table 11: TPDO1, entry 4 (device status)

Bit	Name	Description
0	Monitoring case	Outputs the currently active monitoring case 0 = Invalid monitoring case 1 ... 8 = Active monitoring case
1	Monitoring case	
2	Monitoring case	
3	Monitoring case	
4	-	Reserved
5	-	Reserved
6	-	Reserved
7	-	Reserved

Table 12: TPDO1, entry 5 (protective field status)

Bit	Name	Description
0	Protective field 1	Status of the protective field in monitoring case 1: 0 = Interrupted 1 = Free
1	Protective field 2	Status of the protective field in monitoring case 2: 0 = Interrupted 1 = Free
2	Protective field 3	Status of the protective field in monitoring case 3: 0 = Interrupted 1 = Free
3	Protective field 4	Status of the protective field in monitoring case 4: 0 = Interrupted 1 = Free
4	Protective field 5	Status of the protective field in monitoring case 5: 0 = Interrupted 1 = Free
5	Protective field 6	Status of the protective field in monitoring case 6: 0 = Interrupted 1 = Free

Bit	Name	Description
6	Protective field 7	Status of the protective field in monitoring case 7: 0 = Interrupted 1 = Free
7	Protective field 8	Status of the protective field in monitoring case 8: 0 = Interrupted 1 = Free

Table 13: TPDO1, entry 7 (warning field status)

Bit	Name	Description
0	Warning field 1	Status of the warning field in monitoring case 1: 0 = Interrupted 1 = Free
1	Warning field 2	Status of the warning field in monitoring case 2: 0 = Interrupted 1 = Free
2	Warning field 3	Status of the warning field in monitoring case 3: 0 = Interrupted 1 = Free
3	Warning field 4	Status of the warning field in monitoring case 4: 0 = Interrupted 1 = Free
4	Warning field 5	Status of the warning field in monitoring case 5: 0 = Interrupted 1 = Free
5	Warning field 6	Status of the warning field in monitoring case 6: 0 = Interrupted 1 = Free
6	Warning field 7	Status of the warning field in monitoring case 7: 0 = Interrupted 1 = Free
7	Warning field 8	Status of the warning field in monitoring case 8: 0 = Interrupted 1 = Free

TPDO2 to TPDO9

The safe multibeam scanner sends the distance values of the eight sensor modules to the detected objects via the objects TPDO2 to TPDO9.

The objects TPDO2 to TPDO9 use the same index 0x6204. Each of the objects consists of four entries, each 16 bits in size.

This gives a total of 32 subindexes containing the distance values of the segments, see figure 4, page 14. Each entry contains the distance value of a segment of the safe multibeam scanner.

If a segment of the safe multibeam scanner has not detected an object, a distance value of 4,011 mm is output.

NOTE
When transmitting distance values using the objects TPDO2 to TPDO9, there must be no node IDs > 63 within the network.

Table 14: TPDO2 contents

Entry	Index	Subindex	Description
1	0x6204	1	Distance value (mm) for segment 1
2	0x6204	2	Distance value (mm) for segment 2
3	0x6204	3	Distance value (mm) for segment 3
4	0x6204	4	Distance value (mm) for segment 4

Table 15: TPDO3 contents

Entry	Index	Subindex	Description
1	0x6204	5	Distance value (mm) for segment 5
2	0x6204	6	Distance value (mm) for segment 6
3	0x6204	7	Distance value (mm) for segment 7
4	0x6204	8	Distance value (mm) for segment 8

Table 16: TPDO4 contents

Entry	Index	Subindex	Description
1	0x6204	9	Distance value (mm) for segment 9
2	0x6204	10	Distance value (mm) for segment 10
3	0x6204	11	Distance value (mm) for segment 11
4	0x6204	12	Distance value (mm) for segment 12

Table 17: TPDO5 contents

Entry	Index	Subindex	Description
1	0x6204	13	Distance value (mm) for segment 13
2	0x6204	14	Distance value (mm) for segment 14
3	0x6204	15	Distance value (mm) for segment 15
4	0x6204	16	Distance value (mm) for segment 16

Table 18: TPDO6 contents

Entry	Index	Subindex	Description
1	0x6204	17	Distance value (mm) for segment 17
2	0x6204	18	Distance value (mm) for segment 18
3	0x6204	19	Distance value (mm) for segment 19
4	0x6204	20	Distance value (mm) for segment 20

Table 19: TPDO7 contents

Entry	Index	Subindex	Description
1	0x6204	21	Distance value (mm) for segment 21
2	0x6204	22	Distance value (mm) for segment 22
3	0x6204	23	Distance value (mm) for segment 23
4	0x6204	24	Distance value (mm) for segment 24

Table 20: TPDO8 contents

Entry	Index	Subindex	Description
1	0x6204	25	Distance value (mm) for segment 25
2	0x6204	26	Distance value (mm) for segment 26
3	0x6204	27	Distance value (mm) for segment 27
4	0x6204	28	Distance value (mm) for segment 28

Table 21: TPDO9 contents

Entry	Index	Subindex	Description
1	0x6204	29	Distance value (mm) for segment 29
2	0x6204	30	Distance value (mm) for segment 30
3	0x6204	31	Distance value (mm) for segment 31
4	0x6204	32	Distance value (mm) for segment 32

4.5.1.2 Safety related data objects (SRDOs)

Overview

The safe multibeam scanner supports one Transmit SRDO (TSRDO) and one Receive SRDO (RSRDO).

The objects 0x1301 and 0x1302 contain the communication parameters. The objects 0x1381 and 0x1382 contain the mapping parameters.

NOTE
The mapping parameters cannot be changed.

The object 0x13FF contains the checksums of the SRDOs.

RSRDO

The safe multibeam scanner receives the input signals for monitoring case switching via the RSRDO object.

The RSRDO object uses the indexes 0x6010 and 0x6011. The object consists of four entries, each 8 bits in size.

Table 22: RSRDO contents

Entry	Index	Subindex	Description
1	0x6010	1	Input signals for monitoring case switching
2	0x6011	1	Input signals for monitoring case switching inverted
3	0x6010	2	Reserved
4	0x6011	2	Reserved inverted

Table 23: RSRDO, entry 1 (input signals for monitoring case switching)

Bit	Name	Description
0	Input 0	Monitoring case 1
1	Input 1	Monitoring case 2
2	Input 2	Monitoring case 3
3	Input 3	Monitoring case 4
4	Input 4	Monitoring case 5
5	Input 5	Monitoring case 6

Bit	Name	Description
6	Input 6	Monitoring case 7
7	Input 7	Monitoring case 8

TSRDO

The safe multibeam scanner sends device information and the protective field status via the TSRDO object.

The TSRDO object uses the indexes 0x6200 to 0x6203. The object consists of eight entries, each 8 bits in size.

The safety output information and the protective field status are intended for use in safe applications. The operating status can provide additional information.

Table 24: TSRDO contents

Entry	Index	Subindex	Description
1	0x6200	1	Device status
2	0x6201	1	Device status inverted
3	0x6200	2	Reserved
4	0x6201	2	Reserved inverted
5	0x6202	1	Protective field status
6	0x6203	1	Protective field status inverted
7	0x6202	2	Reserved
8	0x6203	2	Reserved inverted

Table 25: TSRDO, entry 1 (device status)

Bit	Name	Description
0	Safety output	0 = OFF 1 = ON
1	Protective field status	Status of the currently active protective field: 0 = Interrupted 1 = Free
2	Operating status	0 = Safety function OFF or error or sleep mode 1 = Safety function ON and no error and not in sleep mode
3	-	Reserved
4	-	Reserved
5	-	Reserved
6	-	Reserved
7	-	Reserved

Table 26: TRSDO, entry 5 (protective field status)

Bit	Name	Description
0	Protective field 1	Status of the protective field in monitoring case 1: 0 = Interrupted 1 = Free
1	Protective field 2	Status of the protective field in monitoring case 2: 0 = Interrupted 1 = Free

Bit	Name	Description
2	Protective field 3	Status of the protective field in monitoring case 3: 0 = Interrupted 1 = Free
3	Protective field 4	Status of the protective field in monitoring case 4: 0 = Interrupted 1 = Free
4	Protective field 5	Status of the protective field in monitoring case 5: 0 = Interrupted 1 = Free
5	Protective field 6	Status of the protective field in monitoring case 6: 0 = Interrupted 1 = Free
6	Protective field 7	Status of the protective field in monitoring case 7: 0 = Interrupted 1 = Free
7	Protective field 8	Status of the protective field in monitoring case 8: 0 = Interrupted 1 = Free

4.5.1.3 Emergency

A safe multibeam scanner uses the node ID N to send an emergency message to inform the other devices of an error state.

Table 27: Emergency messages

CAN-ID	DLC	Data							
80h + N	8	ErrL	ErrH	Err-Reg	M1	M2	M3	M4	M5
ErrL, ErrH	Emergency error code. 16-bit low byte/high byte 1020h: Configuration error 1030h: Critical error								
Err-Reg	Error register. CANopen object SDO 1001h								
M1 ... M5	Reserved								

4.5.1.4 NMT – Network management

NMT – Network management

The broadcast object NMT is used to start, stop or initialize CANopen devices. For this purpose, one device in the CANopen network must perform the role of the NMT master. This is usually the PLC. All other devices are regarded as NMT slaves. NMT services are broadcast services for which the slaves do not generate any responses.

All NMT objects start with the CAN ID 00h.

Broadcast service for an NMT slave with node ID N

Table 28: Network management for an NMT slave with node ID N

CAN-ID	DLC	Data							
00h	2	OP	N						

Broadcast service for all NMT slaves

Table 29: Network management for all NMT slaves

CAN-ID	DLC	Data							
00h	2	OP	0						

OP	NMT command	Explanation
80h	Go into pre-operational	After booting, an NMT slave automatically goes into the pre-operational state. In this state, communication via SDOs is allowed but not via PDOs. The NMT slave can be switched from another state into this state.
01h	Go into operational	The operational state is reached from the pre-operational state. In this state, communication via PDOs is possible and the CANopen slave responds to SYNC commands. **Note:** When transitioning to the operational NMT state, every slave sends a TPDO with transmission type = 255 to ensure the NMT master is informed of the current input configuration.
02h	Go into prepared/stopped	Communication via SDO or PDO is not possible in this state and the device also does not respond to SYNC commands.
81h	Go into reset node	Initiates a reinitialization of the CANopen functionality in the NMT slave.
82h	Go into reset communication	Initiates a reinitialization of the CANopen functionality in the NMT slave; the toggle bit for node guarding is set to 0.

Example for resetting all communication

The following NMT object (CAN ID = 00h) contains 2 data bytes (DLC = 2). Data byte 1 contains the Reset Communication command (82h), while data byte 2 addresses this command to all devices in the CANopen network (address = 0):

Table 30: Example NMT object for resetting all communication

CAN-ID	DLC	Data							
00h	2	82h	0						

4.5.1.5 SYNC

SYNC

The SYNC command causes all TPDOs of a CANopen slave to be sent. It is therefore possible to poll the slave using SYNC.

Table 31: Polling inputs using SYNC

CAN-ID	DLC	Data							
80h	0								

The slave sends all input values when it receives this command. All TPDOs are sent.

In order to ensure that the slave automatically sends the current input values when it receives a SYNC command, the transmission type for the affected PDOs must be set to 1 (cyclic, synchronous). The device must also be in the operational state.

4.5.1.6 Heartbeat

You can configure the heartbeat time for the safe multibeam scanner.

When you set a heartbeat time (i.e., if SDO 1017h contains a value for the heartbeat producer time), the safe multibeam scanner sends a cyclic message with the CAN ID 700h+N, DLC = 1, and byte 1 = 05h. The toggle bit (bit 7 of byte 1) is always 0.

4.5.1.7 Node guarding

An NMT master (e.g., a PLC with an integrated CANopen master) uses the NMT error control object to detect the failure of an NMT slave (e.g., the safe multibeam scanner) with the node ID N.

The safe multibeam scanner must respond to the NMT master request within the node guarding time. The node guarding time must be monitored by the NMT master.

The NMT master sends a CAN message with the identifier 700h + node ID and RTR bit (remote transmission request).

Table 32: NMT master request

CAN-ID	RTR	DLC	Data							
700h + N	1	0								

The safe multibeam scanner sends a response with the following content:

Table 33: Response of the safe multibeam scanner

CAN-ID	DLC	Data							
700h + N	1	Byte1							

Table 34: Byte 1 status byte

Bit	Meaning	
7	Toggle bit, switches the value between two consecutive requests	
6 ... 0	NMT status	4 = Stopped 5 = Operational 127 = Pre-operational

4.5.1.8 LSS

The safe multibeam scanner supports the configuration with LSS by the CAN bus.

You can adjust the following parameters for the safe multibeam scanner via LSS:

- General CAN parameters for the communication of the safe multibeam scanner within the network
  - Node ID
  - Baud rate

4.5.1.9 Store / Restore

Store

The Store object enables the communication parameters to be transmitted into the data memory (EEPROM) of the safe multibeam scanner. This makes the communication parameters available even in the event of loss of power.

The safe multibeam scanner does not distinguish between parameter groups. The string “save” must be sent as part of the data content.

Restore

The Restore object enables the saved communication parameters to be loaded from the data memory (EEPROM) of the safe multibeam scanner.

The existing communication parameters in volatile memory are lost as a result of this. The string “load” must be sent as part of the data content.

4.5.1.10 SDOs

SDO communication

SDOs are Service Data Objects. These objects contain a wide range of different data. This also includes configuration data as well as input and output data. Unlike with PDO communication, reception of each SDO is answered on protocol level, i.e. the receiving device sends a confirmation.

The following protocols are supported in this CANopen PCS implementation:

- SDO Download Expedited (write SDO)
- SDO Upload Expedited (read SDO)
- Upload SDO Segment Protocol (segmented reading of an SDO)

SDO Download Expedited (write SDO)

The client sends a request to server N. The 16-bit index and the subindex for the SDO to be written are contained in this message. The request additionally contains four data bytes with the data to be written.

Table 35: Write SDO

CAN-ID	DLC	Data							
600h + N	8	23h	SDO_L	SDO_H	SUB	Byte 1	Byte 2	Byte 3	Byte 4

SDO_L = SDO index, low byte

SDO_H = SDO index, high byte

SUB = SDO subindex

The server then replies with a confirmation message:

Table 36: SDO write confirmation

CAN-ID	DLC	Data							
580h + N	8	60h	SDO_L	SDO_H	SUB	Byte 1	Byte 2	Byte 3	Byte 4

Bytes 1 to 4 in the write confirmation message contain zeros.

SDO Upload Expedited (read SDO)

The client requests the content of an SDOs with a request to server N. The 16-bit index and the subindex for the SDO to be read are contained in this message. Bytes 1 to 4 in the read request message contain zeros.

Table 37: Read SDO

CAN-ID	DLC	Data							
600h + N	8	40h	SDO_L	SDO_H	SUB	Byte 1	Byte 2	Byte 3	Byte 4

The server replies with the following message: Bytes 1 to 4 contain the value of the requested object.

Table 38: SDO read confirmation

CAN-ID	DLC	Data							
580h + N	8	43h	SDO_L	SDO_H	SUB	Byte 1	Byte 2	Byte 3	Byte 4

The CANopen data types UDINT and UINT

To transmit the data types UDINT or UINT, the data must be in Intel format or Little Endian. For example, the 32-bit value 12345678h in the data bytes 5, 6, 7 and 8 must be transmitted in the following sequence: [5] = 78, [6] = 56, [7] = 34, [8] = 12.

NOTE
This applies also to the SDO index in data byte 2 and 3, which has the data type UINT. That is, the low byte is transferred in data byte 2 and the high byte is transferred in data byte 3.

Example: The following messages are required to read SDO 1003.1h of the CANopen device with the node ID 2. The data type of the data to be read is UDINT.

The client sends:

Table 39: Read SDO (example)

CAN-ID	DLC	Data							
602h	8	40h	03h	10h	01h	00h	00h	00h	00h

The server responds:

Table 40: SDO read conformation (example)

CAN-ID	DLC	Data							
582h	8	43h	03h	10h	01h	08h	00h	50h	02h

The response data combine to the 32-bit word 02500008h.

Further topics

- "Object directory", page 46

4.5.2 Factory settings

Table 41: Factory settings of the CANopen parameters

Parameter	Default value	Description
Baud rate	125 kbit/s	
Node ID	1	
NMT Autostart	False	
Heartbeat time	0 ms	
Sync Producer	False	
Communication Cycle Period	0 µs	Only relevant if the Synchronization object (SYNC) producer function is activated.
Activate PDOs	TPDO1: Active RPDO, TPDO2 ... TPDO9: Inactive	Available for every PDO
Activate SRDOs	Deactivated	Available for every SRDO
PDO - COB-ID	TPDO1: 0x180 + node ID TPDO2: 0x280 + node ID TPDO3: 0x380 + node ID TPDO4: 0x480 + node ID TPDO5: 0x680 + node ID TPDO6: 0x1C0 + node ID TPDO7: 0x2C0 + node ID TPDO8: 0x3C0 + node ID TPDO9: 0x4C0 + node ID RPDO1: 0x200 + node ID	
PDO - Transmission Type	0xFF	Available for every PDO
PDO - Inhibit Time (100 µs)	0	Available for every PDO
PDO - Event Time	TPDO1: 10 ms RPDO, TPDO1 ... TPDO9: 0 ms	Available for every PDO

Parameter	Default value	Description
TSRDO - COB-ID	COB-ID1: 0xFF + 2 x node ID COB-ID2: 0x100 + 2 x node ID	
RSRDO - COB-ID	COB-ID1: 0x111 COB-ID2: 0x112	
SRDO - Refresh Time/Safeguard Cycle Time (SCT)	TSRDO: 25 ms RSRDO: 50 ms	Available for every SRDO
SRDO - SRVT	20 ms	Available for every SRDO

4.5.3 Checksum calculation

Overview

When exchanging safety-related data via SRDOs, it is necessary to calculate a checksum.

The object 0x13FF contains the checksums of the SRDOs.

Example

In the following example, the CRC-16-CCITT (polynomial 1021h) checksum is calculated for an RSRDO.

The checksum is calculated bytewise and begins with the respective low byte of the two objects 1302h and 1382h.

Table 42: Example: CRC-16-CCITT checksum calculation

Object	Subindex	Name	Size	Data
1302h	RSRDO communication parameters			
	01h	Information direction	1 byte	02h
	02h	Refresh time	2 bytes	0032h
	03h	tx: reserved rx: SRVT	1 byte	14h
	05h	COB-ID 1	4 bytes	00000111h
	06h	COB-ID 2	4 bytes	00000112h
1382h	RSRDO mapping parameters			
	00h	Highest subindex	1 byte	04h
		Subindex	1 byte	01h
	01h	Application data 1	4 bytes	60100108h
		Subindex	1 byte	02h
	02h	Inverted application data 1	4 bytes	60110108h
		Subindex	1 byte	03h
	03h	Application data 2	4 bytes	60100208h
		Subindex	1 byte	04h
	04h	Inverted application data 2	4 bytes	60110208h

The following data bytes are used for the checksum calculation:

- 0x02 0x32 0x00 0x14 0x11 0x01 0x00 0x00 0x12 0x01 0x00 0x00 0x04 0x01 0x08 0x01 0x10 0x60 0x02 0x08 0x01 0x11 0x60 0x03 0x08 0x02 0x10 0x60 0x04 0x08 0x02 0x11 0x60
  The checksum is 4370h.

4.5.4 Object directory

Standard objects

The following table describes only those objects that do not have a fixed definition in the CANopen standard.

Table 43: Object directory (standard objects)

Object	Sub	Access	Object name	Default value	Type	Description
0x1000	0x00	RO	Device Type	0	UNSIGNED32	No device profile supported
0x1001	0x00	RO	Error Register		UNSIGNED8	Current error status of the device
0x1003			Predefined Error Field			The object saves the last 10 error states that arose
	0x00	RW	Number of Errors	10	UNSIGNED8	
	0x01	RO	Standard Error Field	0	UNSIGNED32	
0x1005	0x00	RW	COB-ID SYNC message	0x00000080	UNSIGNED32	Setting of the COB-ID of the SYNC object
0x1006	0x00	RW	Communication cycle period	0	UNSIGNED32	
0x1008	0x00	const	Manufacturer device name	scanGrid2 CANopen	VISI-BLE_STRING	Safe multibeam scanner
0x100c	0x00	RW	Guard time	0x0000	UNSIGNED16	Parameter for node guarding
0x100d	0x00	RW	Life time factor	0x00	UNSIGNED8	Parameter for node guarding
0x1010			Store parameters			Object for non-volatile storage of the settings
	0x00	const	Highest sub-index supported	3	UNSIGNED8	
	0x01	RW	Save all parameters		UNSIGNED32	
	0x02	RW	Save communication parameters		UNSIGNED32	
	0x03	RW	Save application parameters		UNSIGNED32	
0x1011			Restore default parameters			Object for restoring the configuration saved in the EEPROM
	0x00	const	Highest sub-index supported	3	UNSIGNED8	
	0x01	RW	Restore all default parameters		UNSIGNED32	
	0x02	RW	Restore communication default parameters		UNSIGNED32	

Object	Sub	Access	Object name	Default value	Type	Description
	0x03	RW	Restore application default parameters		UNSIGNED32	
0x1014	0x00	RO	COB-ID EMCY	$NODEID+0x80	UNSIGNED32	COB-ID of the emergency object
0x1015	0x00	RW	Inhibit Time Emergency	0x0	UNSIGNED16	
0x1017	0x00	RW	Producer Heartbeat Time		UNSIGNED16	Setting of the cycle time of the heartbeat timer
0x1018			Identity Object			Contains the manufacturer number
	0x00	RO	Number of entries	4	UNSIGNED8	
	0x01	RO	Vendor Id	0x01000056	UNSIGNED32	0x01000056 (SICK AG)
	0x02	RO	Product Code	1109414	UNSIGNED32	
	0x03	RO	Revision number	0x1	UNSIGNED32	
	0x04	RO	Serial number		UNSIGNED32	
0x1029			Error behaviour			
	0x00	RO	No of Error Classes	2	UNSIGNED8	
	0x01	RW	Communication Error	1	UNSIGNED8	
	0x02	RW	Specific Error Class		UNSIGNED8	
0x1200			Server SDO parameter			SDO Parameter
	0x00	RO	Number of entries	2	UNSIGNED8	
	0x01	RO	COB ID Client to Server	$NODEID+0x600	UNSIGNED32	
	0x02	RO	COB ID Server to Client	$NODEID+0x580	UNSIGNED32	
0x1300	0x00	RW	Global Failsafe Command		UNSIGNED8	
0x1301			SRDO tx communication parameter			SRDO1 communication parameter
	0x00	RO	Highest sub-index supported	6	UNSIGNED8	
	0x01	RW	Information direction	1	UNSIGNED8	
	0x02	RW	tx : refresh-time rx : SCT	10	UNSIGNED16	
	0x03	RW	tx : reserved rx : SRVT	20	UNSIGNED8	
	0x04	RW	Transmission type	255	UNSIGNED8	
	0x05	RW	COB-ID 1	0x101	UNSIGNED32	

Object	Sub	Access	Object name	Default value	Type	Description
	0x06	RW	COB-ID 2	0x102	UNSIGNED32	
0x1302			SRDO rx communication parameter			SRDO2 communication parameter
	0x00	RO	Highest sub-index supported	6	UNSIGNED8	
	0x01	RW	Information direction	2	UNSIGNED8	
	0x02	RW	tx : refresh-time rx : SCT	20	UNSIGNED16	
	0x03	RW	tx : reserved rx : SRVT	10	UNSIGNED8	
	0x04	RW	Transmission type	255	UNSIGNED8	
	0x05	RW	COB-ID 1	0x111	UNSIGNED32	
	0x06	RW	COB-ID 2	0x112	UNSIGNED32	
0x1381			SRDO tx mapping parameter			SRDO1 Transmit Mapping Parameter
	0x00	const	Highest sub-index supported	8	UNSIGNED8	
	0x01	const	SR application data object 1 (plain data)	0x62000108	UNSIGNED32	
	0x02	const	SR application data object 1 (bitwise inverted data)	0x62010108	UNSIGNED32	
0x1382			SRDO rx mapping parameter			SRDO2 Receive Mapping Parameter
	0x00	const	Highest sub-index supported	4	UNSIGNED8	
	0x01	const	SR application data object 1 (plain data)	0x60100108	UNSIGNED32	
	0x02	const	SR application data object 1 (bitwise inverted data)	0x60110108	UNSIGNED32	
	0x03	const	SR application data object 2 (plain data)	0x60100208	UNSIGNED32	
	0x04	const	SR application data object 2 (bitwise inverted data)	0x60110208	UNSIGNED32	
0x13fe	0x00	RW	Configuration valid	0	UNSIGNED8	Activate safety configuration for SRDO1 and SRDO2
0x13ff			Safety configuration signature			Signatures (checksums) for SRDO1 and SRDO2 configurations

Object	Sub	Access	Object name	Default value	Type	Description
	0x00	RO	Highest sub-index supported	2	UNSIGNED8	
	0x01	RW	SRD01 signature	0	UNSIGNED16	
	0x02	RW	SRD02 signature	0	UNSIGNED16	
0x1400			Receive PDO Communication Parameter			
	0x00	RO	Number of entries	5	UNSIGNED8	
	0x01	RW	COB-ID	$NODEID+0x 200	UNSIGNED32	
	0x02	RW	Transmission type		UNSIGNED8	
	0x03	RW	Inhibit Time	0x0000	UNSIGNED16	
	0x05	RW	Event timer	3000	UNSIGNED16	
0x1600			Receive PDO Mapping Parame-ter			
	0x00	const	Number of entries	2	UNSIGNED8	
	0x01	const	PDO Mapping Entry 1	0x60000108	UNSIGNED32	
	0x02	const	PDO Mapping Entry 2	0x60000208	UNSIGNED32	
0x1800			Transmit PDO Communication Parameter			Transmit PDO for asynchronous transmission (timer-controlled)
	0x00	RO	Number of entries	5	UNSIGNED8	
	0x01	RW	COB-ID	$NODEID+0x 180	UNSIGNED32	
	0x02	RW	Transmission type	0xFF	UNSIGNED8	
	0x03	RW	Inhibit Time	0x0000	UNSIGNED16	
	0x05	RW	Event timer	1000	UNSIGNED16	
0x1801			Transmit PDO Communication Parameter			Transmit PDO for synchronous trans-mission
	0x00	RO	Number of Entries	5	UNSIGNED8	
	0x01	RW	COB-ID	$NODEID+0x 280	UNSIGNED32	
	0x02	RW	Transmission type	0xFF	UNSIGNED8	
	0x03	RW	Inhibit Time	10	UNSIGNED16	
	0x05	RW	Event timer	0	UNSIGNED16	
0x1802			Transmit PDO Communication Parameter			Transmit PDO for synchronous trans-mission

Object	Sub	Access	Object name	Default value	Type	Description
	0x00	RO	Number of Entries	5	UNSIGNED8	
	0x01	RW	COB-ID	$NODEID+0x380	UNSIGNED32	
	0x02	RW	Transmission type	0xFF	UNSIGNED8	
	0x03	RW	Inhibit Time	0	UNSIGNED16	
	0x05	RW	Event timer	0	UNSIGNED16	
0x1803		RO	Transmit PDO Communication Parameter			Transmit PDO for synchronous transmission
	0x00	RW	Number of Entries	5	UNSIGNED8	
	0x01	RW	COB-ID	$NODEID+0x480	UNSIGNED32	
	0x02	RW	Transmission type	0xFF	UNSIGNED8	
	0x03	RW	Inhibit Time	0	UNSIGNED16	
	0x05	RW	Event timer	0	UNSIGNED16	
0x1804			Transmit PDO Communication Parameter			Transmit PDO for synchronous transmission
	0x00	RO	Number of Entries	5	UNSIGNED8	
	0x01	RW	COB-ID	$NODEID+0x680	UNSIGNED32	
	0x02	RW	Transmission type	0xFF	UNSIGNED8	
	0x03	RW	Inhibit Time	0	UNSIGNED16	
	0x05	RW	Event timer	0	UNSIGNED16	
0x1805			Transmit PDO Communication Parameter			Transmit PDO for synchronous transmission
	0x00	RO	Number of Entries	5	UNSIGNED8	
	0x01	RW	COB-ID	$NODEID+0x1C0	UNSIGNED32	
	0x02	RW	Transmission type	0xFF	UNSIGNED8	
	0x03	RW	Inhibit Time	0	UNSIGNED16	
	0x05	RW	Event timer	0	UNSIGNED16	
0x1806			Transmit PDO Communication Parameter			Transmit PDO for synchronous transmission
	0x00	RO	Number of Entries	5	UNSIGNED8	
	0x01	RW	COB-ID	$NODEID+0x2C0	UNSIGNED32	
	0x02	RW	Transmission type	0xFF	UNSIGNED8	

Object	Sub	Access	Object name	Default value	Type	Description
	0x03	RW	Inhibit Time	0	UNSIGNED16	
	0x05	RW	Event timer	0	UNSIGNED16	
0x1807			Transmit PDO Communication Parameter			Transmit PDO for synchronous transmission
	0x00	RO	Number of Entries	5	UNSIGNED8	
	0x01	RW	COB-ID	$NODEID+0x3C0	UNSIGNED32	
	0x02	RW	Transmission type	0xFF	UNSIGNED8	
	0x03	RW	Inhibit Time	0	UNSIGNED16	
	0x05	RW	Event timer	0	UNSIGNED16	
0x1808			Transmit PDO Communication Parameter			Transmit PDO for synchronous transmission
	0x00	RO	Number of Entries	5	UNSIGNED8	
	0x01	RW	COB-ID	$NODEID+0x4C0	UNSIGNED32	
	0x02	RW	Transmission type	0xFF	UNSIGNED8	
	0x03	RW	Inhibit Time	0	UNSIGNED16	
	0x05	RW	Event timer	0	UNSIGNED16	
0x1a00			Transmit PDO Mapping Parameter			Describes the arrangement of the objects contained in the TPDO1
	0x00	const	Number of Entries	8	UNSIGNED8	
	0x01	const	PDO Mapping Entry 1	0x62000108	UNSIGNED32	
	0x02	const	PDO Mapping Entry 2	0x62000208	UNSIGNED32	
	0x03	const	PDO Mapping Entry 3	0x62000308	UNSIGNED32	
	0x04	const	PDO Mapping Entry 4	0x62000408	UNSIGNED32	
	0x05	const	PDO Mapping Entry 5	0x62020108	UNSIGNED32	
	0x06	const	PDO Mapping Entry 6	0x62020208	UNSIGNED32	
	0x07	const	PDO Mapping Entry 7	0x62020308	UNSIGNED32	
	0x08	const	PDO Mapping Entry 8	0x62020408	UNSIGNED32	
0x1a01			Transmit PDO Mapping Parameter			Describes the arrangement of the objects contained in the TPDO2

Object	Sub	Access	Object name	Default value	Type	Description
	0x00	const	Number of Entries	4	UNSIGNED8	
	0x01	const	Mapping Entry 1	0x62040110	UNSIGNED32	
	0x02	const	Mapping Entry 2	0x62040210	UNSIGNED32	
	0x03	const	Mapping Entry 3	0x62040310	UNSIGNED32	
	0x04	const	Mapping Entry 4	0x62040410	UNSIGNED32	
0x1a02			Transmit PDO Mapping Parameter			Describes the arrangement of the objects contained in the TPD03
	0x00	const	Number of Entries	4	UNSIGNED8	
	0x01	const	Mapping Entry 1	0x62040510	UNSIGNED32	
	0x02	const	Mapping Entry 2	0x62040610	UNSIGNED32	
	0x03	const	Mapping Entry 3	0x62040710	UNSIGNED32	
	0x04	const	Mapping Entry 4	0x62040810	UNSIGNED32	
0x1a03			Transmit PDO Mapping Parameter			Describes the arrangement of the objects contained in the TPD04
	0x00	const	Number of Entries	4	UNSIGNED8	
	0x01	const	Mapping Entry 1	0x62040910	UNSIGNED32	
	0x02	const	Mapping Entry 2	0x62040a10	UNSIGNED32	
	0x03	const	Mapping Entry 3	0x62040b10	UNSIGNED32	
	0x04	const	Mapping Entry 4	0x62040c10	UNSIGNED32	
0x1a04			Transmit PDO Mapping Parameter			Describes the arrangement of the objects contained in the TPD05
	0x00	const	Number of Entries	4	UNSIGNED8	
	0x01	const	Mapping Entry 1	0x62040d10	UNSIGNED32	
	0x02	const	Mapping Entry 2	0x62040e10	UNSIGNED32	
	0x03	const	Mapping Entry 3	0x62040f10	UNSIGNED32	
	0x04	const	Mapping Entry 4	0x62041010	UNSIGNED32	
0x1a05			Transmit PDO Mapping Parameter			Describes the arrangement of the objects contained in the TPD06
	0x00	const	Number of Entries	4	UNSIGNED8	
	0x01	const	Mapping Entry 1	0x62041110	UNSIGNED32	
	0x02	const	Mapping Entry 2	0x62041210	UNSIGNED32	
	0x03	const	Mapping Entry 3	0x62041310	UNSIGNED32	
	0x04	const	Mapping Entry 4	0x62041410	UNSIGNED32	

Object	Sub	Access	Object name	Default value	Type	Description
0x1a06			Transmit PDO Mapping Parameter			Describes the arrangement of the objects contained in the TPDO7
	0x00	const	Number of Entries	4	UNSIGNED8	
	0x01	const	Mapping Entry 1	0x62041510	UNSIGNED32	
	0x02	const	Mapping Entry 2	0x62041610	UNSIGNED32	
	0x03	const	Mapping Entry 3	0x62041710	UNSIGNED32	
	0x04	const	Mapping Entry 4	0x62041810	UNSIGNED32	
0x1a07			Transmit PDO Mapping Parameter			Describes the arrangement of the objects contained in the TPDO8
	0x00	const	Number of Entries	4	UNSIGNED8	
	0x01	const	Mapping Entry 1	0x62041910	UNSIGNED32	
	0x02	const	Mapping Entry 2	0x62041a10	UNSIGNED32	
	0x03	const	Mapping Entry 3	0x62041b10	UNSIGNED32	
	0x04	const	Mapping Entry 4	0x62041c10	UNSIGNED32	
0x1a08			Transmit PDO Mapping Parameter			Describes the arrangement of the objects contained in the TPDO9
	0x00	const	Number of Entries	4	UNSIGNED8	
	0x01	const	Mapping Entry 1	0x62041d10	UNSIGNED32	
	0x02	const	Mapping Entry 2	0x62041e10	UNSIGNED32	
	0x03	const	Mapping Entry 3	0x62041f10	UNSIGNED32	
	0x04	const	Mapping Entry 4	0x62042010	UNSIGNED32	

Manufacturer-specific objects

The following table describes the objects defined by the manufacturer.

Table 44: Object directory (manufacturer-specific objects)

Object	Sub	Access	Object name	Default value	Type	Description
0x6000			Inputs for monitoring case selection			
	0x00	RO	NoOfElements	2	UNSIGNED8	
	0x01	RW	B1	0	UNSIGNED8	
	0x02	RW	B2	0	UNSIGNED8	
0x6010			Safety inputs for monitoring case selection			
	0x00	RO	NoOfElements	2	UNSIGNED8	
	0x01	RW	B1	0	UNSIGNED8	
	0x02	RW	B2	0	UNSIGNED8	

Object	Sub	Access	Object name	Default value	Type	Description
0x6011			Safety inputs for monitoring case selection - inverted			
	0x00	RO	NoOfElements	2	UNSIGNED8	
	0x01	RW	B1	0	UNSIGNED8	
	0x02	RW	B2	0	UNSIGNED8	
0x6200			Device data			
	0x00	RO	NoOfObjects	4	UNSIGNED8	
	0x01	RO	B1	0	UNSIGNED8	
	0x02	RO	B2	0	UNSIGNED8	
	0x03	RO	B3	0	UNSIGNED8	
	0x04	RO	B4	0	UNSIGNED8	
0x6201			Device data - inverted			
	0x00	RO	NoOfObjects	2	UNSIGNED8	
	0x01	RO	B1	0	UNSIGNED8	
	0x02	RO	B2	0	UNSIGNED8	
0x6202			Field states			
	0x00	RO	NoOfObjects	4	UNSIGNED8	
	0x01	RO	B1	0	UNSIGNED8	
	0x02	RO	B2	0	UNSIGNED8	
	0x03	RO	B3	0	UNSIGNED8	
	0x04	RO	B4	0	UNSIGNED8	
0x6203			Field states - inverted			
	0x00	RO		2	UNSIGNED8	
	0x01	RO		0	UNSIGNED8	
	0x02	RO		0	UNSIGNED8	
0x6204			Range values			Distance values for the segments 1-32 in mm
	0x00	RO	NoOfObjects	32	UNSIGNED8	
	0x01	RO	Range0	0	UNSIGNED16	
	0x02	RO	Range1	0	UNSIGNED16	
	0x03	RO	Range2	0	UNSIGNED16	
	0x04	RO	Range3	0	UNSIGNED16	
	0x05	RO	Range4	0	UNSIGNED16	
	0x06	RO	Range5	0	UNSIGNED16	
	0x07	RO	Range6	0	UNSIGNED16	
	0x08	RO	Range7	0	UNSIGNED16	
	0x09	RO	Range8	0	UNSIGNED16	
	0x0a	RO	Range9	0	UNSIGNED16	
	0x0b	RO	Range10	0	UNSIGNED16	
	0x0c	RO	Range11	0	UNSIGNED16	

Object	Sub	Access	Object name	Default value	Type	Description
	0x0d	RO	Range12	0	UNSIGNED16	
	0x0e	RO	Range13	0	UNSIGNED16	
	0x0f	RO	Range14	0	UNSIGNED16	
	0x10	RO	Range15	0	UNSIGNED16	
	0x11	RO	Range16	0	UNSIGNED16	
	0x12	RO	Range17	0	UNSIGNED16	
	0x13	RO	Range18	0	UNSIGNED16	
	0x14	RO	Range19	0	UNSIGNED16	
	0x15	RO	Range20	0	UNSIGNED16	
	0x16	RO	Range21	0	UNSIGNED16	
	0x17	RO	Range22	0	UNSIGNED16	
	0x18	RO	Range23	0	UNSIGNED16	
	0x19	RO	Range24	0	UNSIGNED16	
	0x1a	RO	Range25	0	UNSIGNED16	
	0x1b	RO	Range26	0	UNSIGNED16	
	0x1c	RO	Range27	0	UNSIGNED16	
	0x1d	RO	Range28	0	UNSIGNED16	
	0x1e	RO	Range29	0	UNSIGNED16	
	0x1f	RO	Range30	0	UNSIGNED16	
	0x20	RO	Range31	0	UNSIGNED16	
0x6205			Environment data			Ambient data
	0x00	RO	NoOfObjects	3	UNSIGNED8	
	0x01	RO	SupplyVoltage	0	UNSIGNED16	Supply voltage in mV
	0x02	RO	Temperature	0	UNSIGNED16	Temperature inside the device in °C
	0x03	RO	AmbientLightIntensity	0	UNSIGNED16	Intensity of the ambient light The device outputs the maximum measured value of the segments that have been assigned to a configured monitoring case.
0x6206			Signal strength			Signal intensity of a detected object for the segments 1-32 in dB The value increases as the object distance decreases or the object remission increases. The reference value of the dB value is the switching threshold for object detection.

Object	Sub	Access	Object name	Default value	Type	Description
	0x00	RO	NoOfObjects	32	UNSIGNED8	
	0x01	RO	SignalStrength0	0	UNSIGNED8	
	0x02	RO	SignalStrength1	0	UNSIGNED8	
	0x03	RO	SignalStrength2	0	UNSIGNED8	
	0x04	RO	SignalStrength3	0	UNSIGNED8	
	0x05	RO	SignalStrength4	0	UNSIGNED8	
	0x06	RO	SignalStrength5	0	UNSIGNED8	
	0x07	RO	SignalStrength6	0	UNSIGNED8	
	0x08	RO	SignalStrength7	0	UNSIGNED8	
	0x09	RO	SignalStrength8	0	UNSIGNED8	
	0x0a	RO	SignalStrength9	0	UNSIGNED8	
	0x0b	RO	SignalStrength10	0	UNSIGNED8	
	0x0c	RO	SignalStrength11	0	UNSIGNED8	
	0x0d	RO	SignalStrength12	0	UNSIGNED8	
	0x0e	RO	SignalStrength13	0	UNSIGNED8	
	0x0f	RO	SignalStrength14	0	UNSIGNED8	
	0x10	RO	SignalStrength15	0	UNSIGNED8	
	0x11	RO	SignalStrength16	0	UNSIGNED8	
	0x12	RO	SignalStrength17	0	UNSIGNED8	
	0x13	RO	SignalStrength18	0	UNSIGNED8	
	0x14	RO	SignalStrength19	0	UNSIGNED8	
	0x15	RO	SignalStrength20	0	UNSIGNED8	
	0x16	RO	SignalStrength21	0	UNSIGNED8	
	0x17	RO	SignalStrength22	0	UNSIGNED8	
	0x18	RO	SignalStrength23	0	UNSIGNED8	
	0x19	RO	SignalStrength24	0	UNSIGNED8	
	0x1a	RO	SignalStrength25	0	UNSIGNED8	
	0x1b	RO	SignalStrength26	0	UNSIGNED8	
	0x1c	RO	SignalStrength27	0	UNSIGNED8	
	0x1d	RO	SignalStrength28	0	UNSIGNED8	
	0x1e	RO	SignalStrength29	0	UNSIGNED8	
	0x1f	RO	SignalStrength30	0	UNSIGNED8	
	0x20	RO	SignalStrength31	0	UNSIGNED8	

4.6 Testing plan

The manufacturer of the machine and the operating entity must define all required thorough checks. The definition must be based on the application conditions and the risk assessment and must be documented in a traceable manner.

The following tests must be planned:

- Test during commissioning and in certain situations
- Regular thorough checks

A test object is required for some thorough checks. An optically opaque cylinder with a black surface can be used as a suitable test object. The diameter must match the configured resolution.

Further topics

- "Test rods", page 106

4.6.1 Planning the thorough check during commissioning and in certain situations

Overview

Before commissioning the machine and after making changes, you must check whether the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

Minimum requirements

The protective device and its application must be thoroughly checked in the following situations:

- Before commissioning
- After changes to the configuration or the safety function
- After changes to the CAN bus configuration
- After changes to the mounting, the alignment, or the electrical connection
- After exceptional events, such as after manipulation has been detected, after modification of the machine, or after replacing components

The thorough check ensures the following:

- All relevant regulations are complied with and the protective device is active for all of the machine's operating modes. This includes the following points:
  - compliance with standards
  - correct use of the protective device
  - suitable configuration and safety function
  - correct alignment
- The documentation accurately reflects the state/condition of the machine, including the protective device.
- The verified configuration report matches the desired project planning (see "Verifying configuration", page 70).
- The safety CANopen configuration corresponds to the desired project planning.

The thorough checks must be carried out by qualified safety personnel or specially qualified and authorized personnel, and must be documented in a traceable manner.

Recommended thorough checks

In many cases, it makes sense to carry out the following thorough checks during commissioning and in certain situations:

- Test of the relevant points on the checklist, see "Checklist for initial commissioning and commissioning", page 112
- "Visual check of the machine and the protective device", page 59
- "Thorough check of the principal function of the protective device", page 58
- "Thorough check of the area to be protected", page 59
- Instruction of the operators in the function of the protective device

4.6.2 Planning the regular thorough check

Overview

The purpose of regular tests is to detect defects due to changes or external influences (e.g. damage or manipulation) and to ensure that the protective measure provides the necessary protection.

Important information

WARNING
Hazard due to lack of effectiveness of the protective device

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

- ▶ Carry out tests at least once a year.
- ▶ Assign qualified safety personnel to carry out the tests or persons specifically authorized for this purpose.
- ▶ Document tests in a traceable manner.

Minimum requirements for the regular thorough check

The following thorough checks must be carried out at least once a year:

- "Thorough check of the principal function of the protective device", page 58
- Test of the detection capability (resolution), see "Thorough check of the area to be protected", page 59

Recommendations for further thorough checks

In many cases, depending on the application conditions, the risk assessment of the machine determines that further thorough checks are required or that some thorough checks must take place more frequently.

In many cases, it makes sense to carry out the following thorough checks together with the regular thorough check:

- "Visual check of the machine and the protective device", page 59
- Test of the relevant points on the checklist, see "Checklist for initial commissioning and commissioning", page 112

In many cases, it makes sense to carry out the following thorough checks daily:

- "Visual check of the machine and the protective device", page 59
- "Thorough check of the principal function of the protective device", page 58

Complementary information

If a thorough check discovers a fault, the machine must be shut down immediately. In this case, the mounting and electrical installation of the safe multibeam scanner must be checked by appropriately qualified safety personnel.

4.6.3 Notes on the tests

Thorough check of the principal function of the protective device

Recommended approach:

- ▶ Observe the SAFE OUT LED and STATE LED.
  - If the SAFE OUT LED does not light up permanently green or red, there is an error.
  - If the display behavior of the STATE LED does not meet the specification (see "LEDs", page 88), there is an error.
- ▶ Test the function of the protective device. To do this, trigger the protective function once and observe the response of the safety output or the protective field status, for example based on the machine response.
  - All applications: During the test, observe whether the safety multibeam scanner indicates the interruption of the protective field using the LEDs.
  - Mobile application (mobile hazardous area protection):
    - Place the supplied test object in the path of the vehicle and observe whether the vehicle stops.
      OR

- Activate a protective field, which is interrupted by at least one test object and check the expected reaction (for example by an automatic test in the safety controller).

- Stationary application (access protection):
  - Interrupt the protective field with the intended test object and observe whether the machine stops.

If the thorough check reveals an error, the machine should be shut down immediately. In this case, the mounting and electrical installation of the safety multibeam scanner must be checked by appropriately qualified safety personnel.

Thorough check of the area to be protected

The area to be protected and the detection capability are examined during this thorough check.

The thorough check covers the following points:

- Changes in the detection capability (thorough check of all configured fields)
- Modifications, tampering and damage to the protective device or the machine, which lead to changes in the area to be protected or the position of the protective field

Recommended approach for mobile hazardous area protection:

- ▶ Place the supplied test object in the path of the vehicle and check whether the vehicle comes to a stop in time.
- ▶ If a number of protective fields are used (in different monitoring cases for example), check whether the vehicle comes to a stop in time in all of the protective fields.
- ▶ If necessary, change the position of the test object so that a thorough check is carried out for each monitoring case to determine whether the protective field is active over the whole of the required width.
- ▶ Check the height of the scan plane. The scan plane must be at a height of at least 200 mm so that people lying down can be reliably detected. For this purpose, position the supplied test object at a number of points at the edges of the largest protective field. The safety multibeam scanner must detect the test object at each position and indicate the detection. How it is indicated depends on the configuration.

Recommended procedure for access protection:

- ▶ Move the supplied test object along the edges of the area to be protected. The safety multibeam scanner must detect the test object at each position and indicate the detection. How it is indicated depends on the configuration. The protective field must be dimensioned such that reaching around or going around it is impossible.
- ▶ If a number of protective fields are used (in different monitoring cases for example), check the edges of all protective fields.

If the thorough check reveals an error, the machine should be shut down immediately. In this case, the mounting and electrical installation of the safety multibeam scanner must be checked by appropriately qualified safety personnel.

Visual check of the machine and the protective device

Recommended approach:

- ▶ Check whether the machine or the protective device has been modified or manipulated so that the effectiveness of the protective device may be impaired.
- ▶ In particular, check the following points:
  - Has the machine been retrofitted?
  - Have machine parts been removed?
  - Have modifications been made to the surroundings of the machine?

- Are there any defective cables or flying leads?
- Have the protective device or its parts been dismantled?
- Is the protective device damaged?
- Is the protective device severely contaminated?
- Is the front screen contaminated, scratched or destroyed?
- Has the protective device's alignment been changed?
- Are there any objects (e.g., cables, reflective surfaces) in the protective field?

If one of the points applies, the machine should be shut down immediately. In this case, the machine and the protective device must be checked by appropriately qualified safety personnel.

5 Mounting

5.1 Unpacking

Approach

- ▶ Check components for completeness and integrity for all parts.
- ▶ In the event of complaints, contact the responsible SICK subsidiary.

Further topics

- "Scope of delivery", page 104

5.2 Mounting the device

Overview

The safety multibeam scanner can either be mounted on the machine directly or with the help of the optionally available alignment bracket.

The system connection be routed away in different directions.

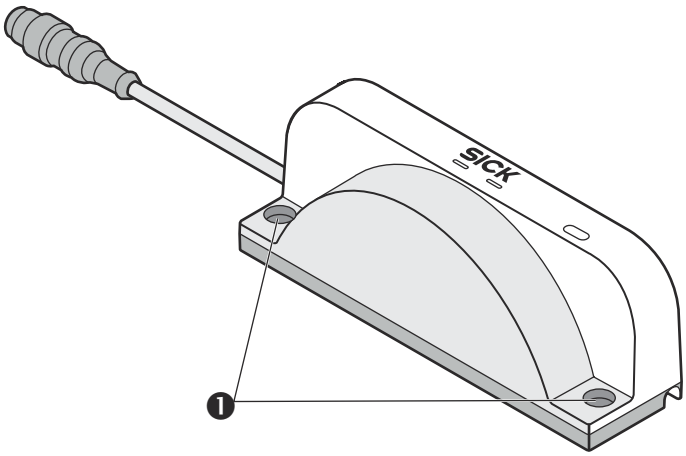


Figure 18: Mounting the safe multibeam scanner

❶ Fixing holes

Prerequisites

- Project planning has been completed.
- Mount according to project planning.
- Dangerous condition of the machine is and remains switched off during mounting.
- The outputs of the device do not affect the machine during mounting.
- Installation location provides protection against moisture, dirt and damage.
- Status indicators are easily visible after mounting.
- Only use SICK-approved brackets for mounting.
- Take appropriate measures for vibration damping if vibration and shock specifications exceed the values and test conditions specified in the data sheet.
- Do not contaminate or scratch the front screen.
- Avoid fingerprints on the front screen.

Approach

1. Screw the safe multibeam scanner to the machine through the two fixing holes.

NOTE

- Use M5 screws.
- Minimum depth of thread: 12 mm.
- Tightening torque: 4.5 Nm ... 5.0 Nm.
- In case of strong vibrations (see data sheet), use screw locking devices to secure the fixing screws.

Complementary information

You can also mount the safe multibeam scanner using the optionally available alignment bracket. When mounted using the alignment bracket, the device can be rotated vertically and aligned. For further information, see the separately available mounting instructions of the alignment bracket.

Further topics

- "Project planning", page 18
- "Dimensional drawings", page 103
- "Accessories", page 105

6 Electrical installation

6.1 Connecting

Overview

The device is connected via the M12 plug connector.

Prerequisites

- Mounting is complete.
- Electrical installation according to project planning.
- Electrical installation according to the requirements of see "Integrating the equipment into the electrical control", page 31.
- Dangerous condition of the machine is and remains off during the electrical installation.
- Outputs of the device have no effect on the machine during electrical installation.
- Avoiding any potential difference between load and device.

Further topics

- "Project planning", Seite 18
- "Mounting", Seite 61

6.1.1 System connection (M12, 5-pin)

Voltage supply and CAN signals

- Male connector
- M12
- 5-pin
- A-coded

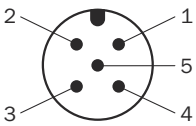


Figure 19: System connection (male connector, M12, 5-pin, A-coded)

Table 45: System connection pin assignment (male connector, M12, 5-pin)

PIN	Designation	Function
1	CAN shield	Shielding
2	+24 V DC	Supply voltage (24 V DC)
3	0 V DC	Supply voltage (0 V DC)
4	CAN HIGH	CAN signal
5	CAN LOW	CAN signal

Requirements on a connecting cable

The safe multibeam scanner requires a shielded, twisted connecting cable. The shield of a connecting cable must be connected to the ground potential on both cable ends.

Complementary information

The safe multibeam scanner does not have an internal CAN bus termination. Termination resistors (typ. 120 Ω) must be added externally at each end of the CAN bus line.

7 Configuration

7.1 Overview

Overview

Before commissioning, you need to configure the safe multibeam scanner according to the project planning.

Delivery state

The safe multibeam scanner is not configured in the delivery state.

Interfaces and applications for configuration

NOTICE
The computer used for configuration must be protected against unintentional interference or modification (e.g. by anti-virus software and firewall).

The safe multibeam scanner has a USB interface and an NFC interface that you can temporarily use for configuration and diagnostics.

The safe multibeam scanner can be supplied with voltage via the USB interface during configuration. Additional voltage supply via the system connection is therefore not required.

The voltage supply via the USB interface is too low for normal operation. The safe multibeam scanner indicates this by a recoverable error.

You can use the following applications from SICK AG for configuration:

- USB connection to a computer: Safety Designer (software for configuring and diagnosing safety solutions)
- NFC connection to an NFC-capable mobile device: Safety Assistant (app for transferring configurations and diagnosing safety solutions)

The CANopen configuration is independent of a verified configuration. Changes to the CANopen configuration can also be made via the CAN bus.

You can use Safety Designer to configure the safe multibeam scanner and verify the configuration.

If you want to configure several devices in the same way or if you want to replace a device, you can use the Safety Assistant app to read a verified configuration from one device and transfer it to another device.

Configuration settings

You can configure the following settings for the safe multibeam scanner:

- Object resolution
  - Jointly for all protective and warning fields
  - Individually for individual protective or warning fields
- Multiple sampling
  - Jointly for all protective and warning fields
  - Individually for individual protective or warning fields
- Create field sets with one protective and one warning field each
- Draw protective and warning fields
- Create monitoring cases
  - Assign field sets
  - Configure sleep mode
- Adjust the general CAN parameters for the communication of the safe multibeam scanner within the network

  - Node ID
  - Baud rate
  - NMT Autostart
  - Heartbeat time
  - SYNC Producer
- Activate or deactivate SRDOs and PDOs
- CANopen parameters for activated SRDOs and PDOs (e.g., COB-ID)

Further topics

- see "Checksum calculation", page 45

7.2 User groups

Overview

The devices contain a hierarchy of user groups that regulate access to the devices.

For certain actions (e.g., transferring a configuration to the device), you are requested to log on with a specific user group. You can view the diagnostic data of a device with any user group.

You can manage the user groups using either the Safety Designer or the Safety Assistant app. Depending on your own user group, you can change the passwords of certain user groups or enable or disable certain user groups.

Important information

NOTICE

If you leave a computer that is connected to devices unattended, you must log out and switch to the **Machine operator** user group so that unauthorized persons cannot transfer configurations to the devices.

User groups

Table 46: User groups

User group	Password	Authorizations in Safety Designer	Authorizations in the Safety Assistant app
Machine operator	No password required. Anyone can log on as a machine operator.	• May read configuration from the device.	• May read configuration from the device.
Maintenance personnel	Deactivated ex-works, i.e. it is not initially possible to log on as a maintenance technician. The user group can be activated by the user group administrator and provided with a password.	• May read configuration from the device. • Changing own password allowed.	• May read configuration from the device. • May transfer verified configuration to the device. • Change own password allowed.

User group	Password	Authorizations in Safety Designer	Authorizations in the Safety Assistant app
Authorized client	Deactivated ex-works, i.e. it is not initially possible to log on as an authorized customer. The user group can be activated by the user group administrator and provided with a password.	• May read configuration from the device. • May transfer verified and unverified configuration to the device. • May verify configuration. • Change own password allowed. • Changing the password of the **Maintenance personnel** user group is allowed.	• May read configuration from the device. • May transfer verified configuration to the device. • Change own password allowed. • Changing the password of the **Maintenance personnel** user group is allowed.
Administrator	The password SICKSAFE is created at the factory. ▶ Change this password to protect the device against unauthorized access.	• May read configuration from the device. • May transfer verified and unverified configuration to the device. • May verify configuration. • Resetting whole device to factory settings allowed. • Activating and deactivating the **Maintenance personnel** and **Authorized client** user groups is allowed. • Change own password allowed. • Changing the passwords of the **Maintenance personnel** and **Authorized client** user groups is allowed.	• May read configuration from the device. • May transfer verified configuration to the device. • Activating and deactivating the **Maintenance personnel**, **Authorized client** and **SICK service** user groups is allowed. • Change own password allowed. • Changing the passwords of the **Maintenance personnel** and **Authorized client** user groups is allowed.

NOTICE

If you change passwords with the Safety Assistant app with a voltage-free device and using the default password (delivery state), unauthorized persons must be prevented from accessing the contents of the NFC tag.

This is relevant until the sensor is commissioned. When the voltage supply is active, the new passwords are adopted by the device and the contents of the NFC tag are overwritten.

7.3 Introduction to the Safety Designer

The safe multibeam scanner is configured using Safety Designer.

This section describes the user interface of Safety Designer. For more information on the Safety Designer, see the operating instructions for the Safety Designer, part no. 8018178.

7.3.1 User interface

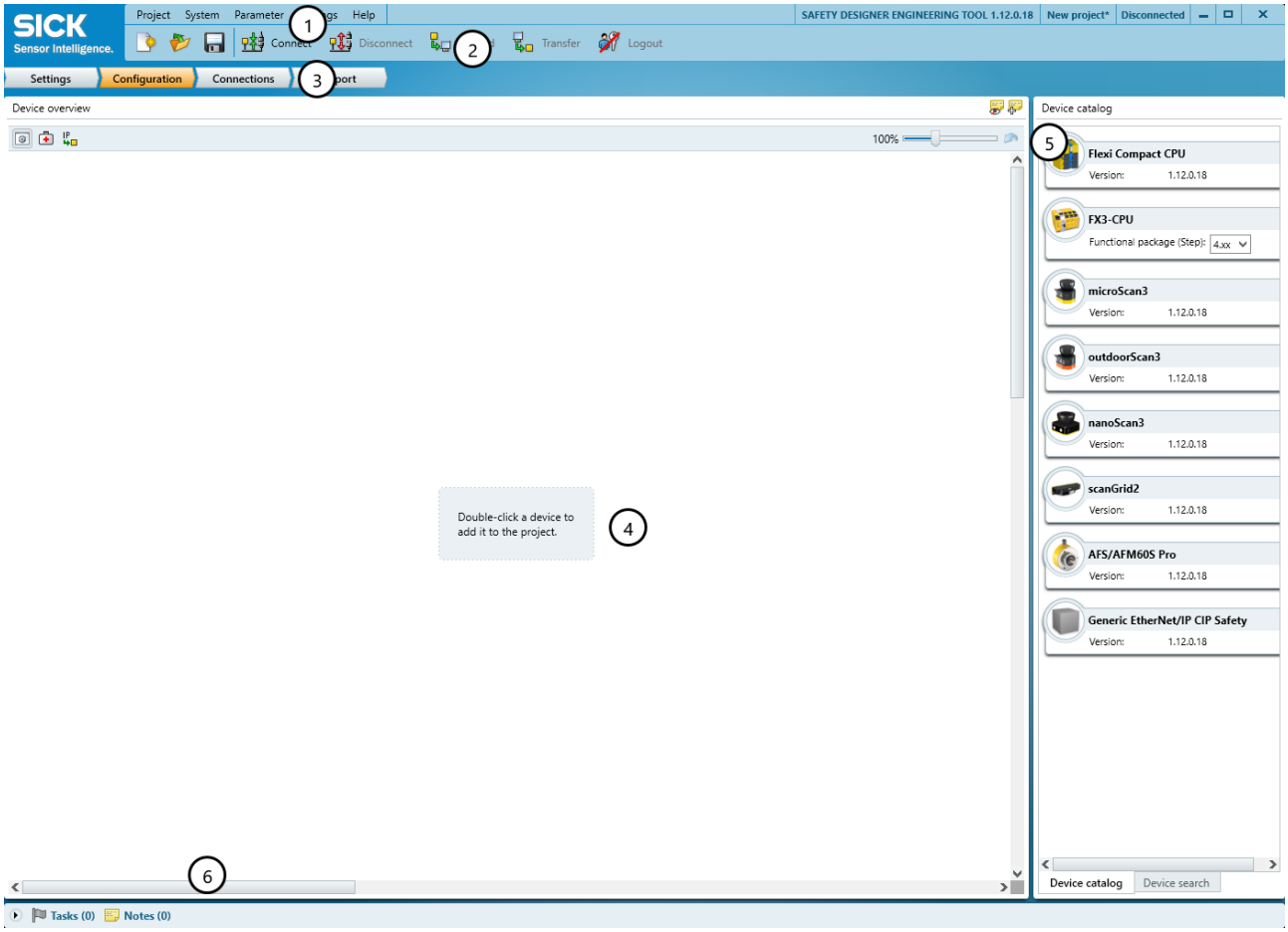


Figure 20: Software controls

① Menu bar
② Toolbar
③ Main navigation
④ Working range
⑤ Device catalog
⑥ Task list and notes

7.3.2 The device window for the safe multibeam scanner

Overview

The device window contains all device-specific settings, data and functions. The device window has a similar user interface to the main window of Safety Designer.

You can switch between the different areas via the main navigation menu:

- **Overview**: Here you can check the most important information as well as the measurement data and the current status of the device (see "Overview (Safety Designer)", page 71).
- **Configuration**: Here you can set all the parameters that can be configured for the safe multibeam scanner on various subpages (see "Configuring the safe multibeam scanner (Safety Designer)", page 72).
- **Report**: Here you can view the configuration of the device (see "Report", page 84).

- **Service**: Here you can restart the device, reset it to factory settings or manage the user passwords (see "Service", page 84).
- **Diagnostics**: Here you can display the messages of the device, record data of the safe multibeam scanner or view stored recordings (see "Diagnostics using Safety Designer", page 93).

7.4 Working with configurations

Overview

A configuration is a compilation of all parameters and values that you can set for the safe multibeam scanner. A configuration is saved directly on the device or on the computer as a configuration file.

You always use Safety Designer to create and change a configuration. You can configure a device online or offline.

The user groups activated for a device and their passwords are not part of the configuration and are not applied when transferring a configuration to another device.

Online configuration

To configure a device online, first connect the device to your computer via USB and read the current configuration of the device.

Next modify the configuration and transfer the modified configuration back to the device.

Offline configuration

To configure one or more devices offline, create a “Project device” in Safety Designer without linking it to a physical device.

You can then configure the project device in Safety Designer and save the configuration on the computer. You can transfer the configuration to different physical devices at a later time.

Verified configurations

To use a configuration on a device for safety functions, you must verify the configuration once in Safety Designer.

If you modify a configuration, you must verify the configuration again before you can use the configuration for safety functions.

Configuration for multiple devices

You can use a verified configuration for multiple devices. You can read the verified configuration from one device using an NFC-capable mobile device and the Safety Assistant app and transfer the configuration to other devices. The transferred configuration does not need to be verified again.

Further topics

- "Transferring a configuration", page 69
- "Verifying configuration", page 70
- "Reading and transferring the configuration using the Safety Assistant app", page 70

7.4.1 Reading configuration

Overview

You can read the configuration of a device and save it in Safety Designer. You can then edit the configuration or transfer it to other devices.

Approach

1. Connect the device to the computer via USB.
2. Open the connected device in the device window.
3. Click on **Identify the device** in the toolbar to ensure that the desired device is connected.

✓ The STATE LED of the connected device flashes red and green alternately.

4. In the main navigation pane, click on **Configuration**.

✓ The **Configuration** menu opens. The different pages within the configuration are displayed in the **Navigation** area.

5. In the navigation area, click on **Read out**.

✓ The **Read out** page opens. On this page, you will find the device being configured in Safety Designer on the left, and the connected physical device on the right. The checksums of the two devices indicate whether the configurations differ.

6. Click on **Read from device**.

✓ The transfer process is displayed in Safety Designer. Safety Designer will notify you as soon as the transfer process is complete.

7.4.2 Transferring a configuration

Overview

A configuration is first saved in your Safety Designer project as a configuration file. You transfer the configuration to the connected device.

At the left, you see the values configured in the project for the device. If the device is connected, you see the values saved in the device at the right.

The compatibility of the configuration is checked during transmission. An existing configuration on the device is overwritten.

Approach

1. Connect the device to the computer via USB.
2. Open the connected device in the device window.
3. Click on **Identify the device** on the toolbar to ensure that the desired device is connected.

✓ The STATE LED of the connected device flashes red and green alternately.

4. In the main navigation pane, click on **Configuration**.

✓ The **Configuration** menu opens. The different pages within the configuration are displayed in the **Navigation** area.

5. Check the configuration thoroughly.
6. In the navigation area, click on **Transfer**.

✓ The **Transfer** page opens. On this page, you will find the device being configured in Safety Designer on the left, and the connected physical device on the right. The checksums of the two devices indicate whether the configurations differ.

7. Click on **Transfer to device**.

✓ The transfer process is displayed in Safety Designer. Safety Designer will notify you as soon as the transfer process is complete.

Further topics

- "USB connection", page 15
- "Verifying configuration", page 70

7.4.3 Verifying configuration

Overview

By verifying the configuration, you can confirm that the configuration complies with the planned safety function and fulfills the requirements in the risk assessment.

During verification, Safety Designer reads back the configuration transferred to the device. It compares the configuration with the configuration saved in Safety Designer. If both configurations are identical, Safety Designer displays the verification report. If the user confirms that this is correct, the system is considered to be verified.

Important information

DANGER
Hazard due to lack of effectiveness of the protective device

Errors can occur when transferring the configuration to the device, e.g. due to environmental influences or faulty cables. The verification report always contains the exact settings stored in the device.

▶ Check the verification report carefully before confirming.

DANGER
Hazard due to lack of effectiveness of the protective device

The CANopen configuration is not part of the verified configuration.

▶ Check the CANopen configuration separately.

Prerequisites

- The configuration corresponds to the planned safety function and meets the requirements of the risk assessment.
- The configuration has been transferred to the device.

Approach

1. Click on **Verify** in the toolbar.
✓ Safety Designer displays the verification report.
2. Thoroughly review the verification report.
   ▶ If the verification report does not match the planned safety function, click on **Cancel**, correct the configuration and start again from step 1.
   ▶ If the verification report matches the planned safety function, click on **OK**.

✓ Device configuration is shown as verified.

Complementary information

If the configuration is verified, the device automatically starts the safety function after switching on the voltage supply.

If the configuration is not verified, the device may not be operated as a protective device. You can start the safety function manually to test the device and the configuration.

The test operation is limited to four hours, but can be restarted afterwards.

7.4.4 Reading and transferring the configuration using the Safety Assistant app

You can use the Safety Assistant app to read an already verified configuration incl. the CANopen configuration from one device and transfer it to other devices.

Take the following points into consideration when reading and transferring a configuration:

- You need to establish an NFC connection between the safe multibeam scanner and the mobile device. To do so, hold the NFC-capable mobile device close to the marked NFC area.
- Reading out and transfer are also possible in the voltage-free state of the safe multibeam scanner.
- Reading out and transfer are also possible in the in the Safety Assistant app via the **Configure scanGrid2** menu item.
- The read configurations are stored on the mobile device.
- When transferring a configuration, you need to select the configuration on the mobile device based on the configuration checksum.
- After transferring a configuration to a safe multibeam scanner, the safety function remains stopped for the time being.

  Starting safety function:
  - If the configuration was transferred in a voltage-free state, the safe multibeam scanner must first be supplied with voltage.
  - You must verify that the correct configuration has been transferred to the safe multibeam scanner. You can use the function for comparing configuration checksums of the Safety Assistant app for this purpose.
  - After successfully comparing the configuration checksums, you can start the safety function in the Safety Assistant app.

7.5 Overview (Safety Designer)

On the **Overview** page you will find information about your project and the device as well as current data of the device.

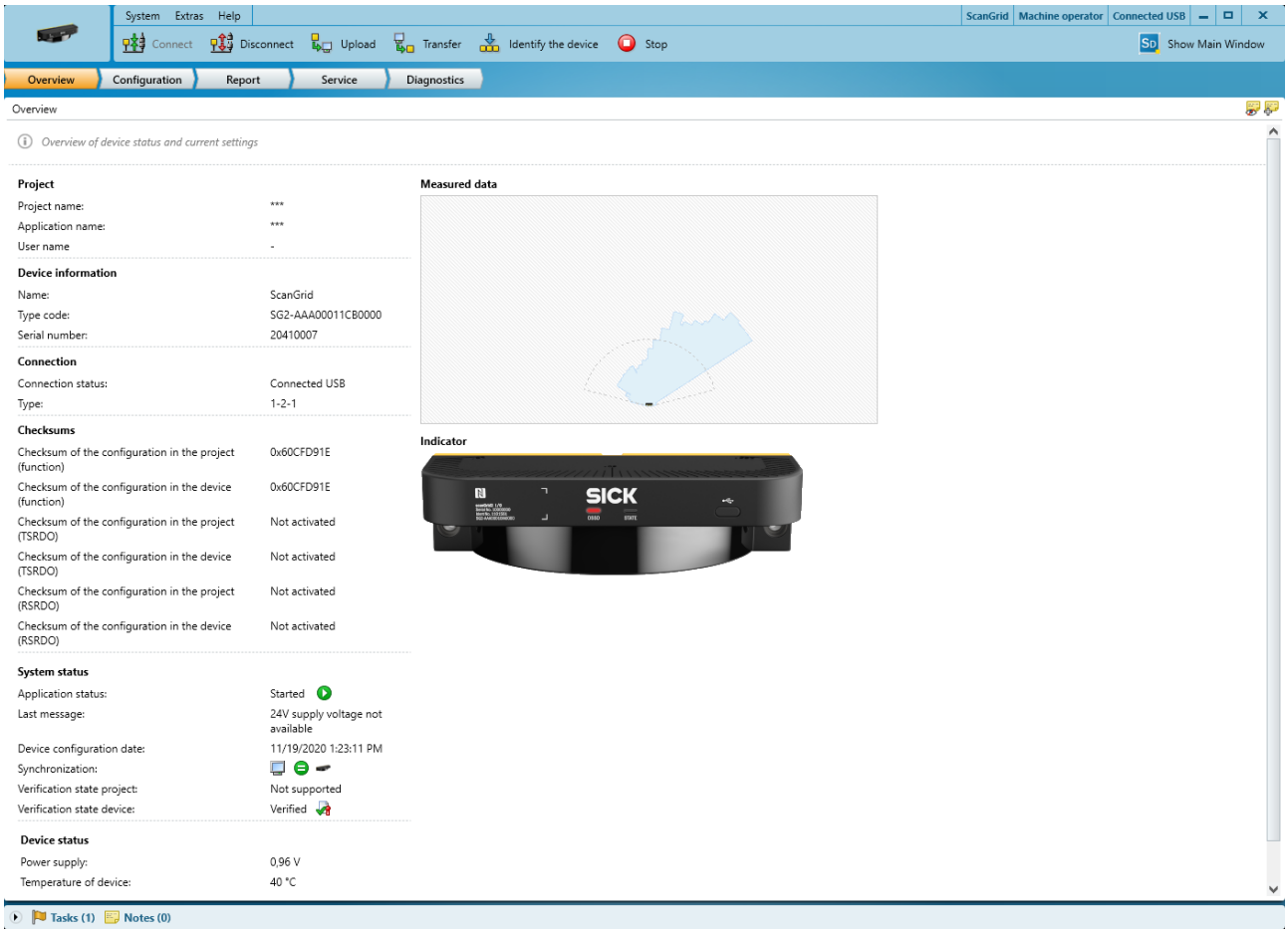


Figure 21: Device window (“Overview” page)

7.6 Configuring the safe multibeam scanner (Safety Designer)

Overview

The configuration of the safe multibeam scanner is initially performed on the computer only and is saved in your Safety Designer project. This section describes the procedure for configuring the device in Safety Designer and which configuration options you have.

To configure a safe multibeam scanner, you need to select the device in your project and open it in the device window.

Approach

1. In the main navigation menu of the device window, click on **Configuration**.
✓ The **Configuration** menu opens. The different pages within the configuration are displayed in the **Navigation** area.
2. In the **Navigation** area, click on **Identification**.
✓ The **Identification** page opens. On this page, you specify the device name, application name and other attributes (see "Identification", page 72).
3. In the **Navigation** area, click on **Fields**.
✓ The **Fields** page opens. On this page, you create the field sets with fields and set the object resolution and multiple sampling (see "Fields", page 73).
4. In the **Navigation** area, click on **Monitoring cases**.
✓ The **Monitoring cases** page opens. On this page, you create the different monitoring cases for the device (see "Monitoring cases", page 75).

7.6.1 Identification

Overview

On the **Identification** page, you can optionally enter attributes for the device. The attributes are used to identify the device or to distinguish between different devices. The attributes appear in reports and in the diagnostic data.

Device name

If a number of devices are used in an application or in a project, a unique device name helps to tell the individual devices apart.

Project name

The project name is used to identify an entire project. The same project name should be chosen for all devices in the project.

Application name

The application name can be the same for a number of devices in the project.

User name

The optional user name helps later users to find a contact for the application.

Application image

An image helps to identify the application more quickly. The application image is saved in the project file on the computer and transmitted to the device. The Safety Designer supports the following file formats: BMP, GIF, JPG, PNG, TIF.

Description

A description makes it easier to understand an application’s context more quickly.

7.6.2 Fields

Overview

On the **Fields** page, you create field sets and draw the associated protective and warning fields. You can create one protective field and one warning field for each field set.

In the **Field sets** area, you create the field sets and fields. You can also set the object resolution and multiple sampling for the selected field, or for all fields under **General field settings**.

In the **Fields** area, you draw the selected field of a field set using the tools on the toolbar. The drawn protective fields must contain the relevant protective field supplement.

The edge length or the diameter of each field must be at least as large as the selected object resolution. In addition, the selected multiple sampling as well as the maximum object speed to be assumed have an influence on the minimum required field dimensions.

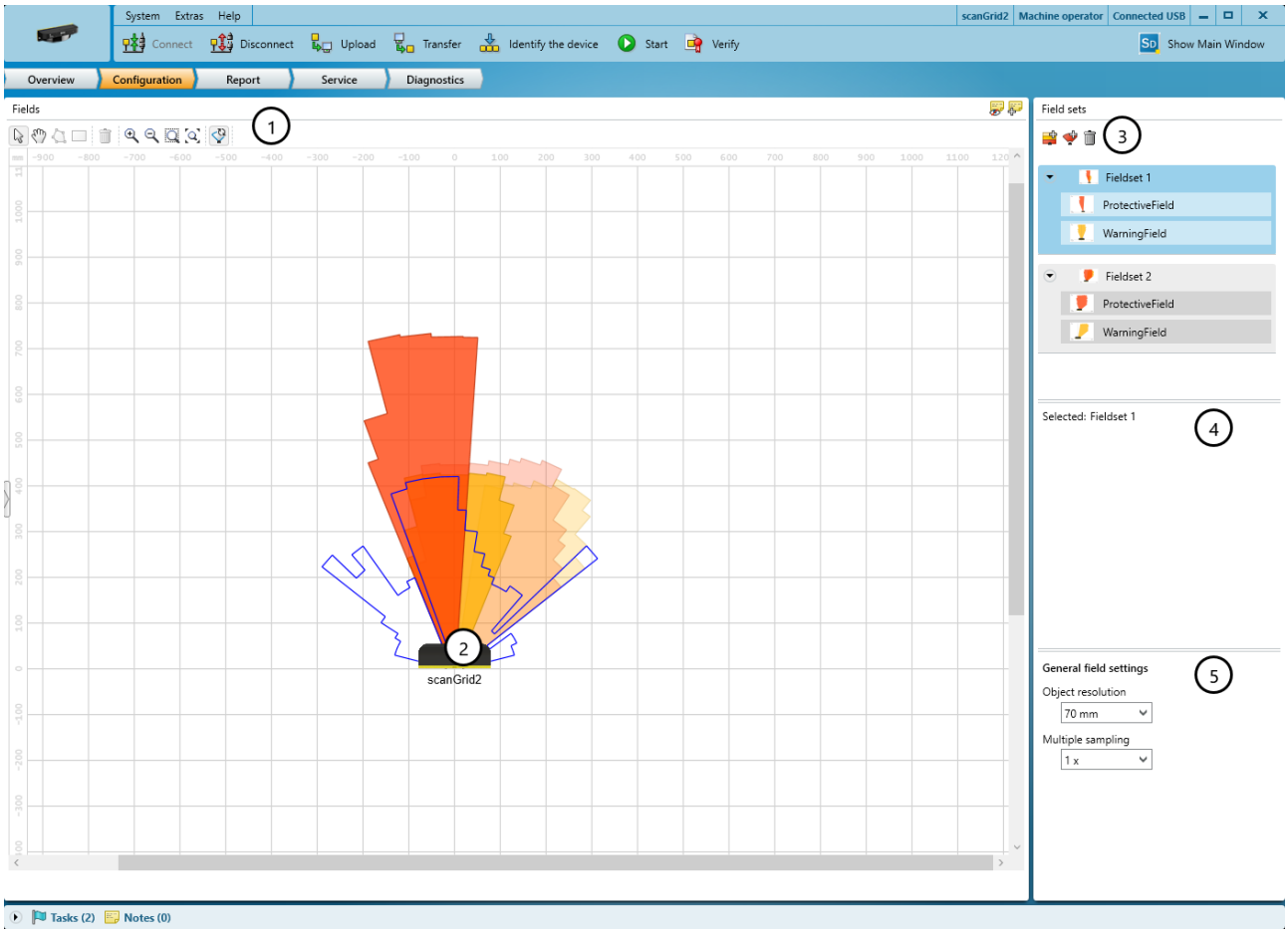


Figure 22: Field editor in the device window

① Toolbar
② The protective field (red) or warning field (yellow) created
③ Create or delete field sets and fields
④ Settings for the selected field
⑤ General settings for all fields

Toolbar

Use the tools to draw the fields of a field set.

Table 47: Buttons on the toolbar

	Arrow tool for selecting objects
	Hand tool, for moving the work space
	Draw a field using points (polygon)
	Draw rectangle
	Delete selected object
	Zoom in
	Zoom out
	Area zoom
	Fit to window size
	Display live measuring data

Field display

The fields in Safety Designer are drawn in a Cartesian coordinate system. The zero point is located in the middle of the back of the safe multibeam scanner.

The fields are displayed realistically. Due to the functioning of the safe multibeam scanner and the division of the detection area into 32 segments, the contour of the fields may contain steps.

Based on the drawn field, the Safety Designer calculates the distance from the safe multibeam scanner to the end of the drawn field for all 32 segments. The front screen of the safe multibeam scanner is the reference point for the calculation. The calculated distance values can be viewed on the **Report** page.

Safety Designer displays the field types in different colors.

Table 48: Colors of the field types

Protective field	**Warning field**
	
Red	Yellow

Fields and field sets

You can create up to 8 field sets. You can create one protective field and one warning field per field set.

If you create a field set with a protective field and a warning field, you should first create the protective field and then the warning field. The fields are then assigned to the correct outputs in the monitoring case table.

Table 49: Buttons on the toolbar

	Add field set
	Add field to field set

	Delete field or field set

To display or edit the protective field or warning field in the **Fields** area, click on the relevant field in the field set.

Object resolution

First set the object resolution for all fields in the **General field settings** area. If necessary, you can make changes to each individually at a later date.

Multiple sampling

First set the multiple sampling for all fields in the **General field settings** area. If necessary, you can make changes to each individually at a later date.

Further topics

- "Monitoring cases", Seite 75

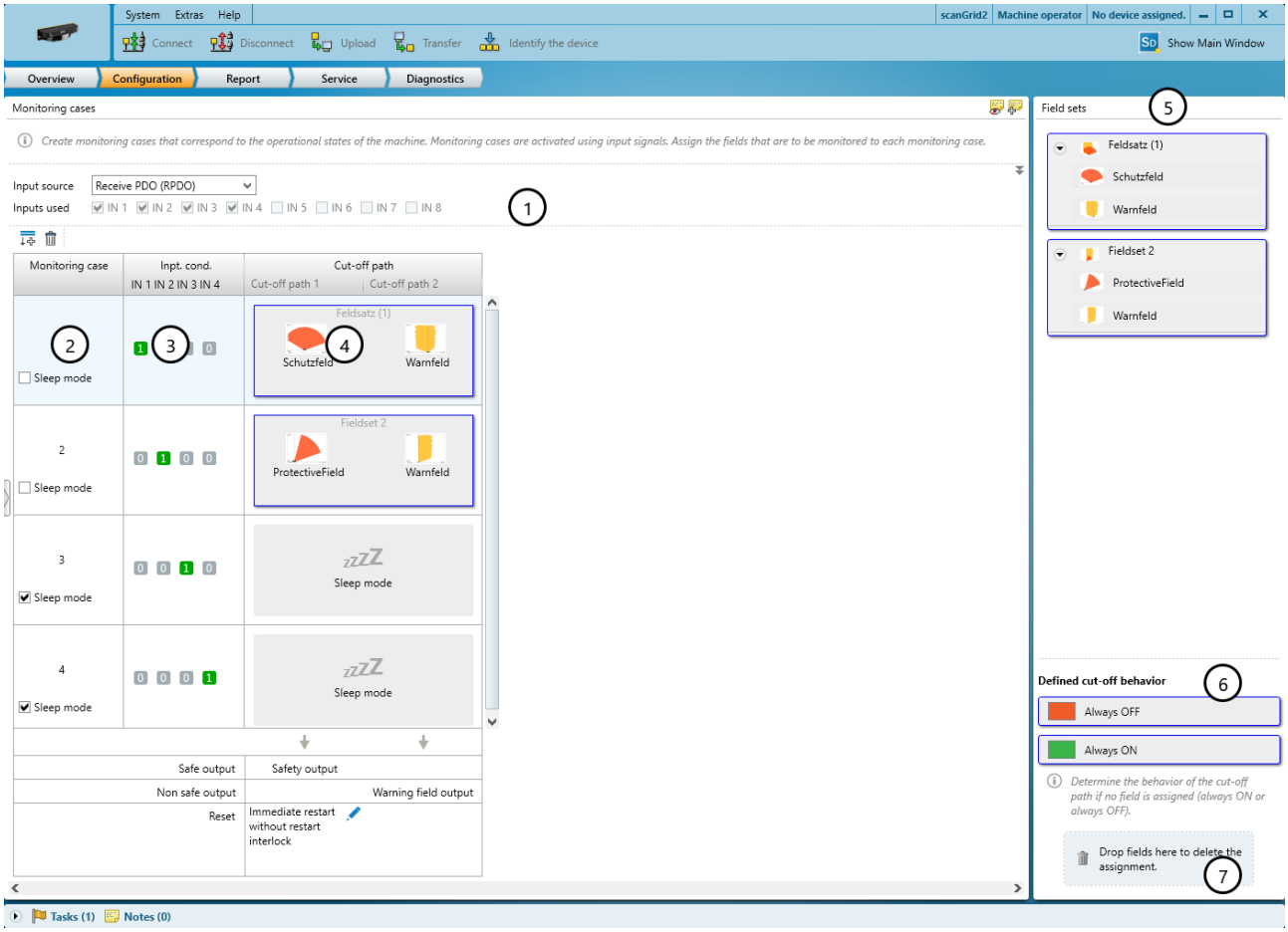
7.6.3 Monitoring cases

Overview

On the **Monitoring cases** page, you create different monitoring cases for the device.

For each monitoring case, you can use the fields defined on the **Fields** page or the predefined cut-off behaviors to define the cut-off paths. You can use protective fields for the safety cut-off path 1, and warning fields for the non-safety cut-off path 2.

You can also assign sleep mode to one monitoring case.



① Settings for all monitoring cases
② Settings for a single monitoring case
③ Input conditions for the monitoring case
④ Cut-off paths with the assigned field sets
⑤ Configured field sets
⑥ Areas for defined cut-off behavior
⑦ Remove field set from a monitoring case

Monitoring case table

You can create different monitoring cases in the monitoring case table. You have the following options for each monitoring case:

- Assign the cut-off paths via a field set with fields or using a predefined cut-off behavior.
- Activate sleep mode for the safe multibeam scanner.

Input source

In **Input source**, you specify which CANopen object types are used for monitoring case switching. You can select either RPDO or RSRDO as the input source. The prerequisite for this is that RPDO or RSRDO are enabled in the CANopen configuration.

Input conditions

The input conditions are only displayed if you have created at least two monitoring cases.

The input conditions indicate for which combination of input signals a monitoring case is activated. When you add a monitoring case, a new combination is automatically set as the input condition.

Input signals for unused monitoring cases must be set to 0.

Cut-off paths

Each monitoring case has two cut-off paths. The cut-off paths switch different outputs when the active field is interrupted.

- Cut-off path 1: Safety output
- Cut-off path 2: Warning field output

Restart delay (cut-off path 1)

In the **Reset** line, you can configure a restart delay for the safety output.

- **Immediate restart without restart interlock**: If there is no longer an object in the protective field, the safe multibeam scanner immediately switches the safety output to the ON state.
- **Automatic restart after**: If there is no longer an object in the protective field, the safe multibeam scanner switches the safety output to the ON state after the specified delay. You can enter a delay between 2 s and 60 s.

The restart delay does not affect the protective and warning field status.

Sleep mode

The safe multibeam scanner can be put into sleep mode to save machine resources. The sleep mode is assigned to a monitoring case and can then be activated via the controller.

In sleep mode, the following restrictions apply:

- Safety output permanently in the OFF state and protective field status permanently in the “Interrupted” state
- No thorough check of the protective fields and warning fields
  - No object detection
  - No distance measurement
- No update of the contamination information (front screen)

The following functions continue to be active in sleep mode:

- Communication via USB and NFC
- Communication via CANopen

Field Sets

The field sets that have been created are listed in the **Field sets** area.

You use drag-and-drop to assign a field set to a monitoring case. The fields in a field set are arranged in the monitoring case as they were drawn in the field editor.

Protective fields are allowed for the safety-related cut-off path 1, and warning fields can be used for the non-safety-related cut-off path 2.

You can cancel the assignment by dragging a field set from a monitoring case onto the trash can symbol.

Defined cut-off behavior

In a monitoring case, you can assign a defined cut-off behavior to a cut-off path instead of a field:

- Always OFF: If the monitoring case becomes active, the cut-off path is always in the OFF state.
- Always ON: If the monitoring case becomes active, the cut-off path is in the ON state.

7.6.4 Configuring the CANopen parameters

Overview

You can configure general settings for the safe multibeam scanner to integrate it into a CANopen network. You can also activate individual data objects and adjust their CANopen parameters.

Important information

NOTE

The CANopen parameters can be configured either using the Safety Designer or via the CANopen network.

When the CANopen parameters are configured via the CANopen network, the Safety Designer may under certain circumstances show a different configuration of the CANopen parameters.

Approach

1. In the main navigation menu of the device window, click on **Configuration**.

✓ The **Configuration** menu opens. The different pages within the configuration are displayed in the **Navigation** area.

2. In the **Navigation** area under **CANopen**, click on **Network settings**.

✓ The **Network settings** page opens. You can use this page to adjust the parameters for the communication of the safe multibeam scanner within the CANopen network (see "Network settings", page 79).

3. In the **Navigation** area under **CANopen**, click on **Process data objects (PDOs)** and then on **Receive PDO (RPDO)**.

✓ The **Receive PDO (RPDO)** page opens. You can use this page to activate or deactivate the available RPDO and change the CANopen parameters for the RPDO (see "Receive PDO (RPDO)", page 80).

4. In the **Navigation** area, click on **Transmit PDO (TPDO)**.

✓ The **Transmit PDO (TPDO)** page opens. You can use this page to activate or deactivate the available TPDOs and change the CANopen parameters for the TPDOs (see "Transmit PDO (TPDO)", page 80).

5. In the **Navigation** area under **CANopen**, click on **Safety related data objects (SRDOs)** and then on **Receive SRDO (RSRDO)**.

✓ The **Receive SRDO (RSRDO)** page opens. You can use this page to activate or deactivate the available RSRDO and change the CANopen parameters for the RSRDO (see "Receive SRDO (RSRDO)", page 81).

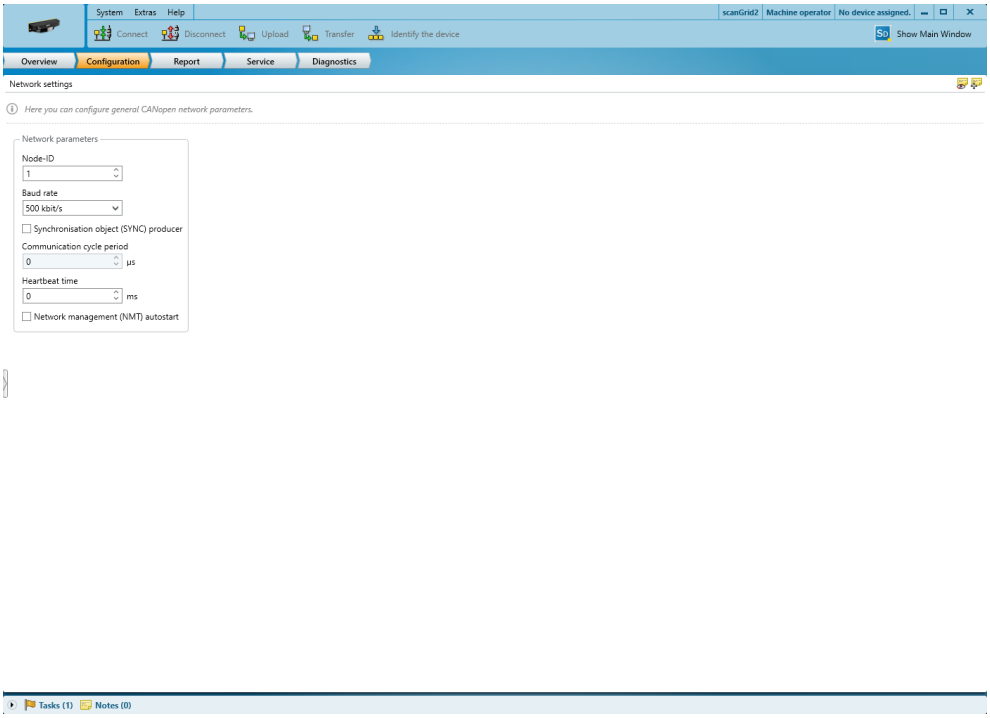
6. In the **Navigation** area, click on **Transmit SRDO (TSRDO)**.

✓ The **Transmit SRDO (TSRDO)** page opens. You can use this page to activate or deactivate the available TSRDO and change the CANopen parameters for the TSRDO (see "Transmit SRDO (TSRDO)", page 82).

7.6.5 Network settings

Overview

On the **Network settings** page, you can adjust the general CANopen parameters for communication within the CANopen network.



Network parameters

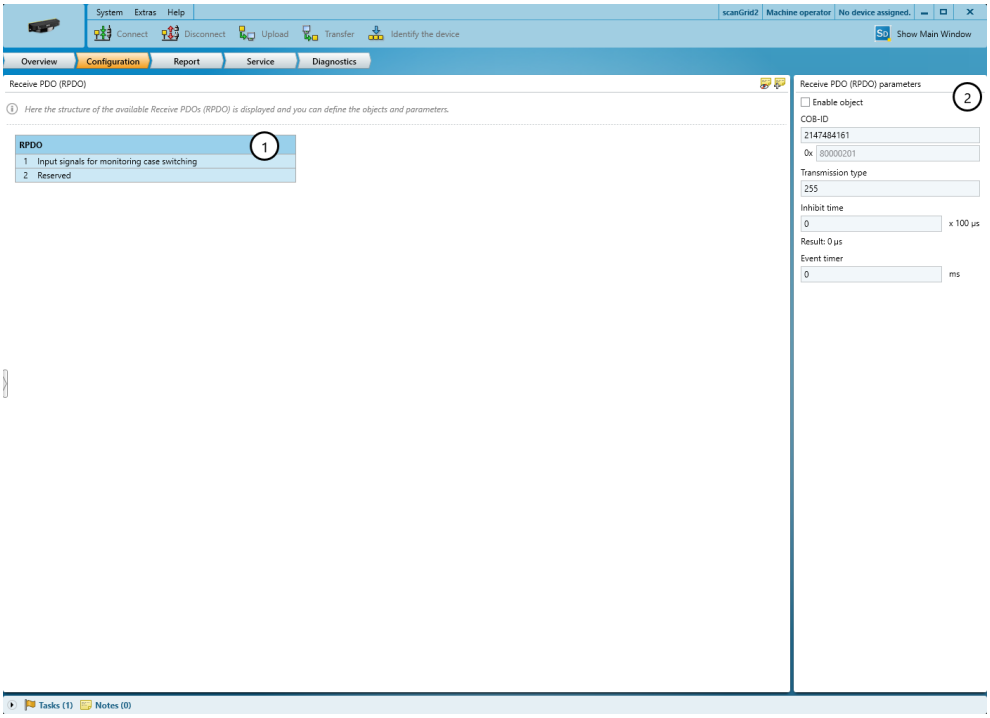
You can adjust the following CANopen parameters.

- **Node-ID**: Enter the ID of the safe multibeam scanner for the communication within the CANopen network.
  - The node ID must be between 1 and 127 and must not already be allocated within the CANopen network.
    When transmitting distance values using the objects TPDO2 to TPDO9, there must be no node IDs > 63 within the network.
  - The CAN bus uses the node ID to identify the safe multibeam scanner.
  - If you change the node ID, the COB-IDs of the PDOs (RPDO, TPDO1 to TPDO9) and TSRDOs automatically change also.
- **Baud rate**: Select the speed of transmission of the data objects.
  - The baud rate of the safe multibeam scanner must match the baud rate of the CAN bus.
- **Synchronisation object (SYNC) producer**: Activate the SYNC Producer function.
  - When activated, the safe multibeam scanner responds to the SYNC command of the CAN bus and sends the TPDOs within the specified **Communication cycle period**.
  - **Communication cycle period**: Enter a value between 0 and 4294967295 µs.
- **Heartbeat time**: Enter a value between 0 and 65,355 ms.
- **Network management (NMT) autostart**: Activate the NMT Autostart function (not supported in combination with SRDOs).
  - When activated, the safe multibeam scanner automatically switches to the “Operational” state after starting the safety function.

7.6.6 Receive PDO (RPDO)

Overview

On the **Receive PDO (RPDO)** page, you can find an overview of the available Receive PDO and activate it. Once you have activated the RPDO, you can adjust the CANopen parameters for the RPDO (e.g., the COB-ID).



① Overview of the selected RPDO (highlighted in blue)

② Settings for the selected RPDO

Changing the settings

You can use the **Enable object** checkbox to activate or deactivate the selected RPDO for the safe multibeam scanner.

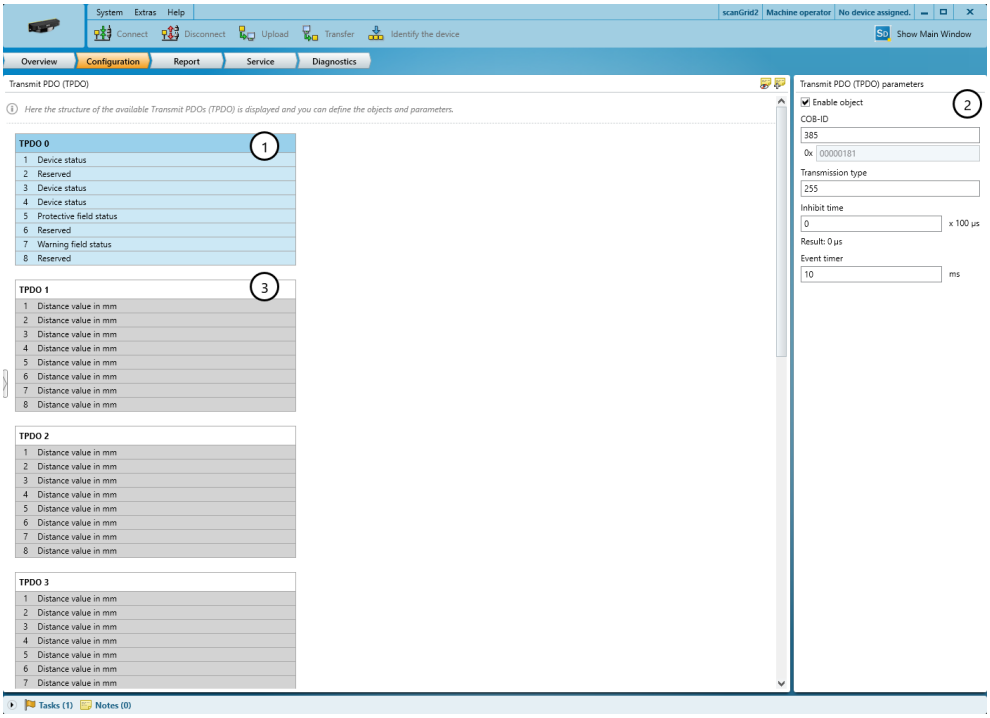
You can change the following CANopen parameters for an activated RPDO:

- **COB-ID**: Enter the ID of the RPDO for the communication within the network.
  - You can enter a value between 513 (0x201) and 639 (0x27F).
- **Transmission type**: Enter a value between 0 and 255 for the transmission type for the RPDO.
  - 0 ... 240 = synchronous
  - 255 = event-driven
- **Inhibit time**: Enter a value between 0 and 65,535 for the transmit delay time for the RPDO.
- **Event timer**: Enter a value between 0 and 65,535 for the time, after the elapse of which the RPDO automatically receives an event (transmission period).

7.6.7 Transmit PDO (TPDO)

Overview

On the **Transmit PDO (TPDO)** page, you can find an overview of all available Transmit PDOs and can activate the individual TPDOs. Once you have activated a TPDO, you can adjust the CANopen parameters for the TPDO (e.g., the COB-ID).



① Overview of the selected TPDO (highlighted in blue)

② Settings for the selected TPDO

③ Overview of other TPDOs

Changing the settings

You always change the settings for the currently selected (highlighted in blue) TPDO. To select a different TPDO, click on the header with the name of the TPDO (e.g., TPDO1).

You can use the **Enable object** checkbox to activate or deactivate the selected TPDO for the safe multibeam scanner.

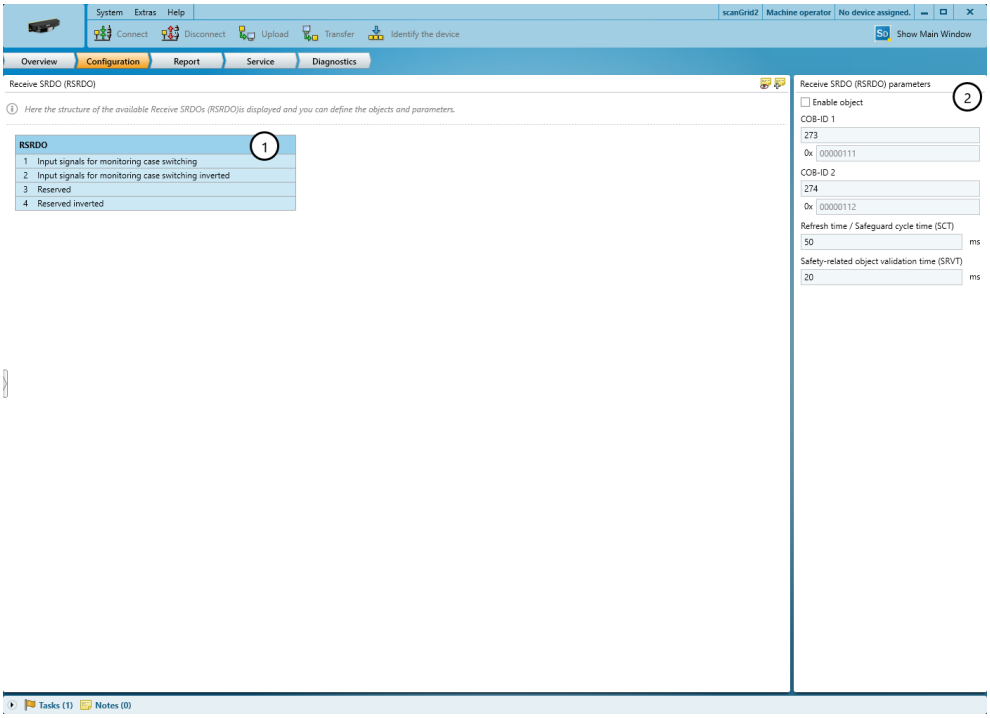
You can change the following CANopen parameters for an activated TPDO:

- **COB-ID**: Enter the ID of the TPDO for the communication within the network.
  - You can enter a value between 385 (0x181) and 1,727 (0x6BF).
- **Transmission type**: Enter a value between 0 and 255 for the transmission type for the TPDO.
  - 0 = synchronous (acyclic)
  - 1 ... 240 = synchronous (cyclic, n * sync)
  - 252 = RTR (synchronous)
  - 253 = RTR (event-driven)
  - 255 = event-driven
- **Inhibit time**: Enter a value between 0 and 65,535 for the transmit delay time for the TPDO.
- **Event timer**: Enter a value between 0 and 65,535 for the time, after the elapse of which the TPDO automatically sends a TPDO (transmission period).

7.6.8 Receive SRDO (RSRDO)

Overview

On the **Receive SRDO (RSRDO)** page, you can find an overview of the available Receive SRDO and activate it. Once you have activated the RSRDO, you can adjust the CANopen parameters for the RSRDO (e.g., the COB-ID).



① Overview of the selected RSRDO (highlighted in blue)

② Settings for the selected RSRDO

Changing the settings

You can use the **Enable object** checkbox to activate or deactivate the selected RSRDO for the safe multibeam scanner.

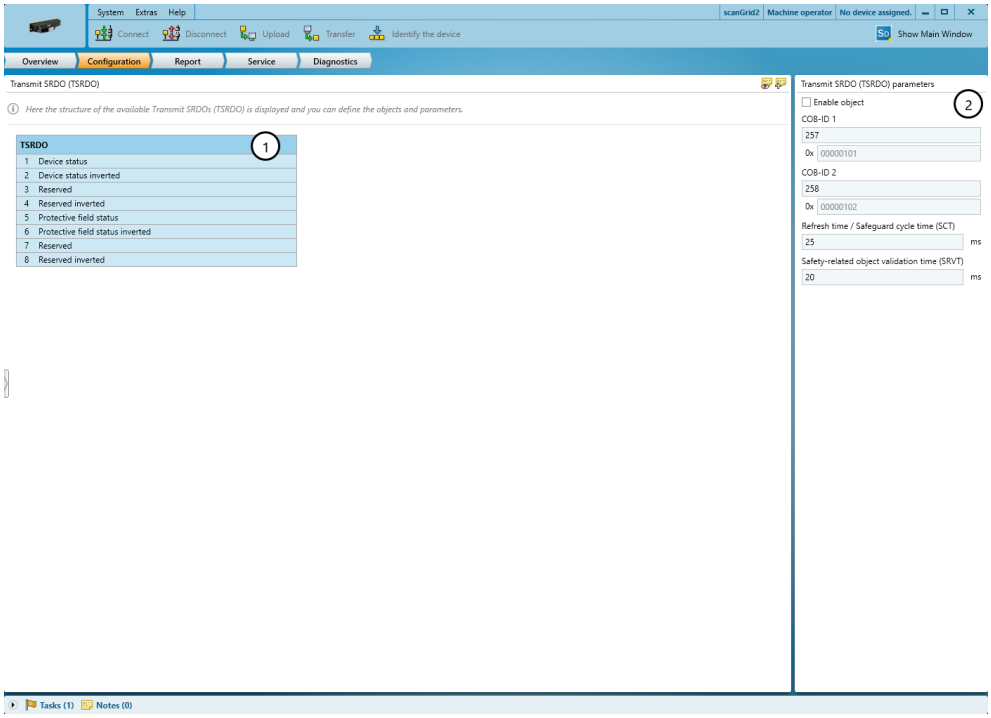
You can change the following CANopen parameters for an activated RSRDO:

- **COB-ID 1** and **COB-ID 2**: Enter an odd value between 257 (0x101) and 383 (0x17F) for the **COB-ID 1** and an even value between 258 (0x102) and 384 (0x180) for the **COB-ID 2**.
- **Refresh time / Safeguard cycle time (SCT)**: Enter a value between 0 and 65,535 for the maximum time that can pass between two transmission cycles.
- **Safety-related object validation time (SRVT)**: Enter a value between 0 and 65,535 for the maximum time that can pass between the two signals of a transmission cycle.

7.6.9 Transmit SRDO (TSRDO)

Overview

On the **Transmit SRDO (TSRDO)** page, you can find an overview of the available Transmit SRDO and activate it. Once you have activated a TSRDO, you can adjust the CANopen parameters for the TSRDO (e.g., the COB-ID).



① Overview of the selected TSRDO (highlighted in blue)

② Settings for the selected TSRDO

Changing the settings

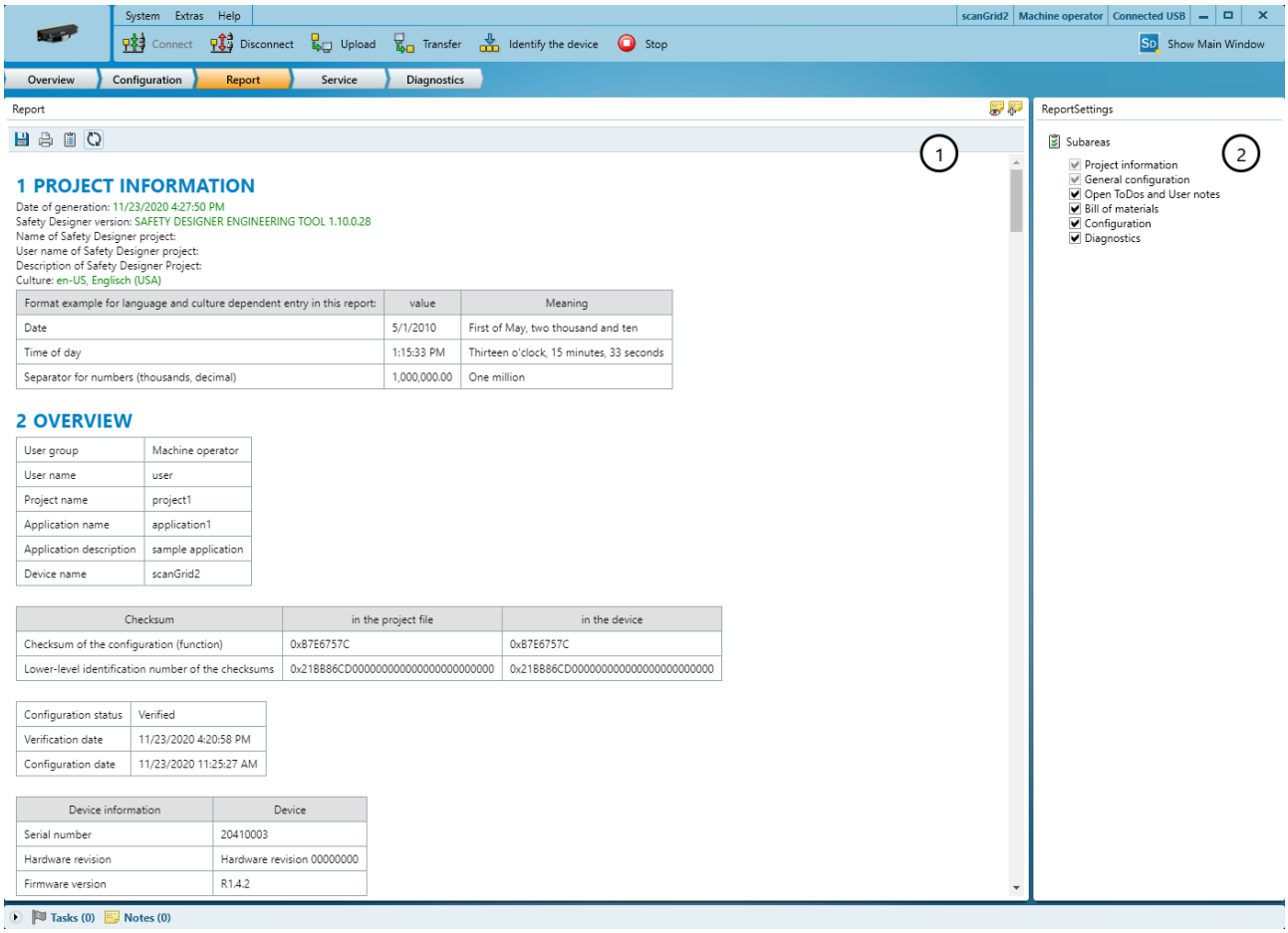
You can use the **Enable object** checkbox to activate or deactivate the selected TSRDO for the safe multibeam scanner.

You can change the following CANopen parameters for an activated TSRDO:

- **COB-ID 1** and **COB-ID 2**: Enter an odd value between 257 (0x101) and 383 (0x17F) for the **COB-ID 1** and an even value between 258 (0x102) and 384 (0x180) for the **COB-ID 2**.
- **Refresh time / Safeguard cycle time (SCT)**: Enter a value between 0 and 65,535 for the maximum time that can pass between two transmission cycles.
- **Safety-related object validation time (SRVT)**: Enter a value between 0 and 65,535 for the maximum time that can pass between the two signals of a transmission cycle.

7.7 Report

Overview



① Content of the report

② Composition of the report

A report shows the settings and data of a device. You have the option of saving and archiving these data as a PDF.

Report

When you open the **Report** dialog box, the Safety Designer creates a report. If you click on **Update** after making changes to the configuration, you will receive an updated report.

Composition of the report

You can assemble the contents of the report as required.

Complementary information

National and international standards promote or recommend specific data and the person responsible for it. The required data are included in the report.

7.8 Service

Overview

The following functions are available on the **Service** page when the device is connected via the USB connection:

- **Restart device**
- **Factory settings**
- **User password**

Device restart

If there are problems with the device, you can **Restarting the device completely**. This has the following effects.

- The device behaves exactly as it does when the voltage supply is switched off and back on again.
- The device's function is also re-established after serious faults if the cause has been rectified.
- Communication with the device is interrupted (connections for configuration, safety function and data not relating to safety).

Factory settings

Before reconfiguring the device, you can completely reset the device to factory settings. (**Resetting the device completely**). This has the following effects.

- The configuration is reset to the factory settings.
- The **Maintenance personnel** and **Authorized client** user groups are deactivated.
- The password of the **Administrator** user group is reset to the factory settings.

User password

In the **Roles and passwords** area, you can activate or deactivate certain user groups and change the passwords of the various user groups.

You can also start the process to reset the password of the **Administrator** user group.

Further topics

- "User groups", page 65
- "Resetting the password for the "Administrator" user group", page 85

7.8.1 Resetting the password for the "Administrator" user group

Overview

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

Approach

1. Request the form for resetting your password from SICK support.
2. Connect the device to the computer via USB.
3. Open the connected device in the device window.
4. Click on **Identify the device** on the toolbar to ensure that the desired device is connected.

✓ The STATE LED of the connected device flashes red and green alternately.

5. In the main navigation pane, click on **Service**.

✓ The **Service** menu opens. Various pages are displayed in the **Navigation** area.

6. In the navigation area, click on **User password**.

✓ The **Password management** page opens.

7. Click on **Start process for resetting the password**.
8. Send the information displayed on the form to SICK support.

✓ You will then receive an activation code.

9. Enter and confirm the activation code in the field provided.

✓ The password of the **Administrator** user group is reset to factory settings (SICK-SAFE). The **Maintenance personnel** and **Authorized client** user groups are deactivated. The configuration is not changed.

7.9 Starting and stopping safety function

Overview

In some situations, for example tests during commissioning, you can start or stop the safety function manually.

Approach

Start safety function

▶ Click on the  button.

Stop the safety function

▶ Click on the  button.

8 Commissioning

8.1 Overview

Prerequisites

- Project planning is completed.
- Mounting is completed.
- Electrical installation is completed.
- Configuration is completed.
- Dangerous state of the machine is and remains off during commissioning.
- The outputs of the device do not affect the machine during commissioning.
- No-one is in the hazardous area during commissioning.
- The machine has been inspected and released by qualified safety personnel.
- Protective device works properly.
- The protection function is checked after each change to the machine or to the integration or the operating and boundary conditions of the device.

Further topics

- "Project planning", page 18
- "Mounting", page 61
- "Electrical installation", page 63
- "Configuration", page 64

8.2 Alignment

If the safe multibeam scanner has been mounted on the machine using the optional alignment bracket, you can align the safe multibeam scanner vertically in both directions by up to 10°. For further information, see the separately available mounting instructions of the alignment bracket.

8.3 Switching on

After the device is switched on, the STATE LED and the SAFE OUT LED light up briefly and the safety multibeam scanner initializes itself.

When initialization is complete, the LEDs indicate the current operational status of the safety multibeam scanner.

In normal operation, the STATE LED lights up green or yellow (e.g. warning field interrupted) and the SAFE OUT LED lights up green or red (protective field interrupted).

Further topics

- "Troubleshooting", page 92

8.4 Check during commissioning and modifications

The thorough check is intended to ensure that the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

▶ Carry out the checks specified in the test plan of the manufacturer of the machine and the operating entity.

9 Operation

9.1 Safety

NOTE
This document does not provide instructions for operating the machine in which the safe multibeam scanner is integrated.

9.2 Regular thorough check

The thorough check is intended to ensure that the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

- ▶ Carry out the checks specified in the test plan of the manufacturer of the machine and the operating entity.

9.3 LEDs

Overview

The safety multibeam scanner has a STATE LED and an SAFE OUT LED.

The SAFE OUT LED indicates the state of the safety output (ON or OFF). The STATE LED indicates the status or error on the device.

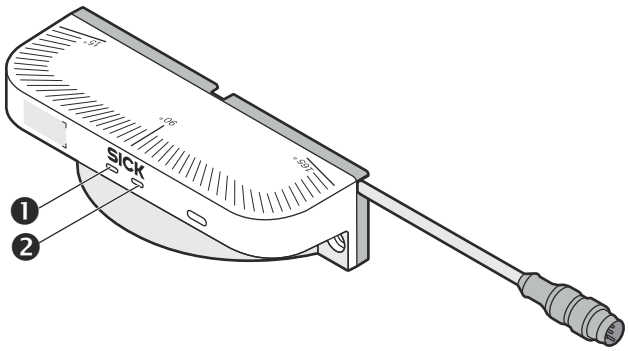


Figure 23: Status indicators

❶ SAFE OUT LED
❷ STATE LED

Table 50: LEDs

Number	Name	Function	LED state (color)	Meaning
❶	SAFE OUT LED	Indicates the state of the safety output, which the device outputs.	● Green	ON state: The safety output is in the ON state.
			● Red	OFF state: The safety output is in the OFF state.
❷	STATE LED	Indicates the status of the device.	● Green	ON state: The device is in normal mode. The device has been configured correctly and the configuration is verified. There is no error, no warning and no interruption of the active warning field. The restart delay is not active.
			● Yellow	Interruption of the active warning field
			○ Off	Sleep mode or safety function stopped
			●● Flashing red and green alternately	Device was identified in Safety Designer.
			● Flashing red	Device error (see "Error categories", page 92)
			● Flashing yellow (3 Hz)	Recoverable error (see "Error categories", page 92)
			●● Flashing red and yellow alternately	The device is not configured or an error has been detected in the configuration.
			●● Flashing yellow and green alternately	The device is configured, but the configuration is not verified.
			● Flashing green (3 Hz)	Restart delay active
			● Flashing yellow (1 Hz)	Contamination warning
			● Flashing green (1 Hz)	Test mode (for testing an unverified configuration)

○ LED off. ● LED flashes. ● LED illuminates.

Complementary information

The status indicators are only used for diagnostic purposes and are not safety-relevant. Even if the status indicators are displaying incorrect information or have failed, the safety multibeam scanner will still supply the signals required for the safety function.

10 Maintenance

10.1 Safety

DANGER
Improper work on the product

A modified product may not offer the expected protection if it is integrated incorrectly.

- ▶ Apart from the procedures described in this document, do not repair, open, manipulate or otherwise modify the product.

10.2 Regular cleaning

Overview

Depending on the ambient conditions, the front screen must be cleaned regularly and in the event of contamination. Static charges, for example, can cause dust particles to be attracted to the front screen.

The safety multibeam scanner checks the front screen regularly and signals if the front screen is contaminated:

- Contamination warning (front screen must be cleaned, operation still possible)
- Contamination error (limited detection capability, operation no longer possible)

If contamination of the front screen is detected, the safety multibeam scanner signals the contamination warning or contamination error as follows:

- The STATE LED of the safety multibeam scanner flashes yellow.
  - 1 Hz for a contamination warning
  - 3 Hz for a contamination error
- The safety multibeam scanner sends the contamination information to the machine via CANopen.
- For contamination errors only: The safety multibeam scanner switches the safety output to the OFF state and the protective field status to the “Interrupted” status.
  - The SAFE OUT LED lights up red accordingly.
  - As soon as the safety multibeam scanner detects that the front screen is clean and the detection capability is restored, the safety output switches back to the ON state and the protective field status to the “Free” status.

Important information

WARNING
Contamination or damage to the front screen

If the optical properties of the front screen are impaired, persons or body parts might not be detected or not detected in time.

- ▶ Remove any contamination (e.g., droplets, condensation, frost, ice formation).
- ▶ If the front screen is damaged, replace the safety multibeam scanner.
- ▶ Keep the front screen free of substances containing oil and grease.

NOTICE

- ▶ Do not use aggressive or abrasive cleaning agents.
- ▶ Recommendation: Use anti-static cleaning agents.
- ▶ Recommendation: Use anti-static plastic cleaners and lens cloths from SICK.

Approach

Clean the front screen:

1. Make sure that the dangerous state of the machine is and remains switched off during the cleaning.
2. Remove dust from the front screen using a soft, clean brush.
3. Moisten a clean, soft towel with anti-static plastic cleaner and use it to wipe the front screen.
4. Check the effectiveness of the protective device.

Further topics

- "Cleaning agent", page 105

10.3 Replacing the device

Important information

DANGER
Hazard due to lack of effectiveness of the protective device

If an unsuitable configuration has been saved, it may cause the dangerous state to not end in time.

- ▶ Make sure that the configuration is restored after replacing the device.
- ▶ Make sure that the safe multibeam scanner is aligned correctly after replacing the device.

Approach

1. Disconnect the connecting cables to the safe multibeam scanner.
2. Unscrew the fixing screws and remove the defective safe multibeam scanner.
3. Mount the new safe multibeam scanner.
4. Reconnect the connecting cables to the new safe multibeam scanner.
5. Configure the safe multibeam scanner.

NOTE
You can use the Safety Assistant app to copy the verified configuration of a device and transfer it to a new device.

6. Perform commissioning again, taking particular care to conduct all of the thorough checks described.

Further topics

- "Mounting the device", page 61
- "Connecting", page 63
- "Reading and transferring the configuration using the Safety Assistant app", page 70
- "Commissioning", page 87

10.4 Regular thorough check

The thorough check is intended to ensure that the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

- ▶ Carry out the checks specified in the test plan of the manufacturer of the machine and the operating entity.

11 Troubleshooting

11.1 Overview

Information on the status as well as diagnostics and troubleshooting of the safe multibeam scanner can be displayed as follows:

- LEDs
  Status and error information are displayed directly on the device by means of the STATE LED and the SAFE OUT LED.
- Diagnostics via Safety Designer
  You can display diagnostic data in Safety Designer. If the safe multibeam scanner is connected to the computer via USB, you can read the current diagnostic data from the device. You can also save or export the data that was read, and view the data at a later time in Safety Designer.
- Diagnosis via the Safety Assistant app
  You can display diagnostic data in the Safety Assistant app. If the safe multibeam scanner is connected to the mobile device via NFC, you can read the current diagnostic data from the device. You can also save or export the data that was read, and view the data at a later time in Safety Assistant app.

Further topics

- "LEDs", Seite 88

11.2 Safety

DANGER
Hazard due to unexpected starting of the machine

▶ When any work is taking place, use the protective device to secure the machine or to ensure that the machine is not switched on unintentionally.

NOTE
Additional information on troubleshooting can be found at the responsible SICK subsidiary.

11.3 Error categories

Overview

The safe multibeam scanner distinguishes between the following categories of errors:

- Recoverable error
- Configuration error
- Device error

The categories differ in regards to the method of troubleshooting, and the measures required to restore the safe multibeam scanner to normal operation.

The safe multibeam scanner creates an entry in the message history for each error.

Recoverable error

In the event of a recoverable error, the safety output switches to the OFF state and the protective field status to the “Interrupted” status.

As soon as you have eliminated the cause of the error, the safety output switches back to the ON state and the protective field status to the “Free” status.

The following errors are classified as recoverable errors:

- Invalid signal for monitoring case switching
- No CANopen data was received or the CANopen data received does not meet the specifications. To enable valid CANopen data to be received again, the NMT status must be set to operational by the NMT master.
- Contamination error (front screen)
- Supply voltage of the safe multibeam scanner is too low (e.g., supply via the USB interface only)
- Ambient light intensity exceeds the ambient light immunity of the safe multibeam scanner

Configuration error

In the event of a configuration error, the safety output switches to the OFF state and the protective field status to the “Interrupted” status.

You need to check the configuration in Safety Designer and, if necessary, reconfigure the device.

Device error

Device errors are serious errors where the safety output switches to the OFF state, the protective field status to the “Interrupted” status, and the device goes into the interlocked state.

Once the cause of the error has been rectified, you need to restart the device.

11.4 Diagnostics using Safety Designer

The following diagnostics tools are available in the device window:

- Message history
- Data recorder

The diagnostic data are transferred via the USB connection. [4)]

11.4.1 Message history

On the **Message history** page, you can see all errors, warnings and information about the device. You have the option of saving or printing the message history as a PDF. You can also delete the entries in the message history.

4) The USB connection may only be used temporarily and only for configuration and diagnostics.

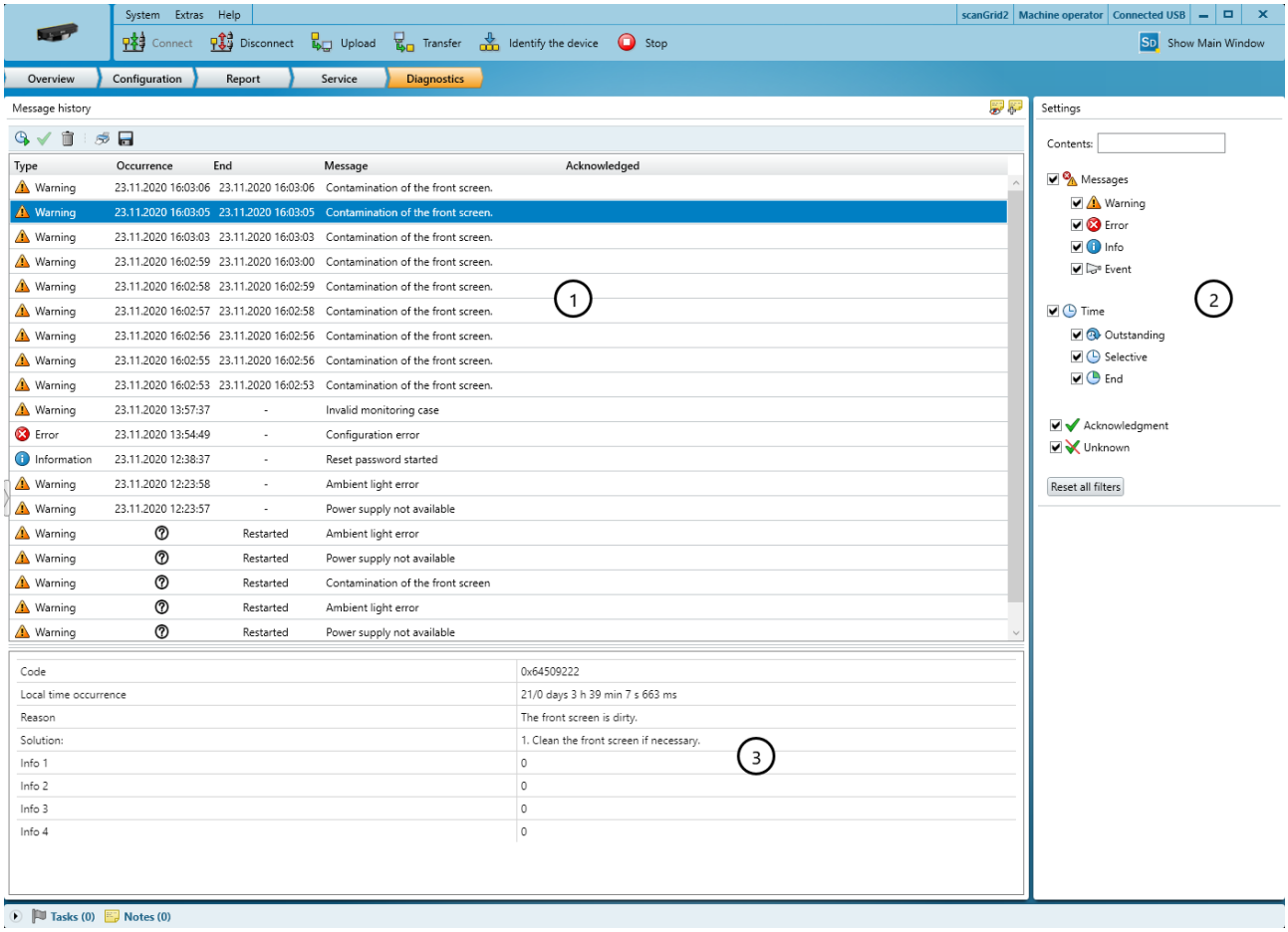


Figure 24: Message history

① Message history

② Display filter

③ Details about the selected message

By right-clicking on the table header, you can select the columns displayed in the message history.

Safety Designer shows details about the events in the bottom part of the window, ways to solve them are also shown.

11.4.2 Data recorder

Overview

You can use the data recorder to record the device signals and play saved recordings. Depending on the utilization of the interface, the measurement data may not be transmitted and shown for every scan cycle.

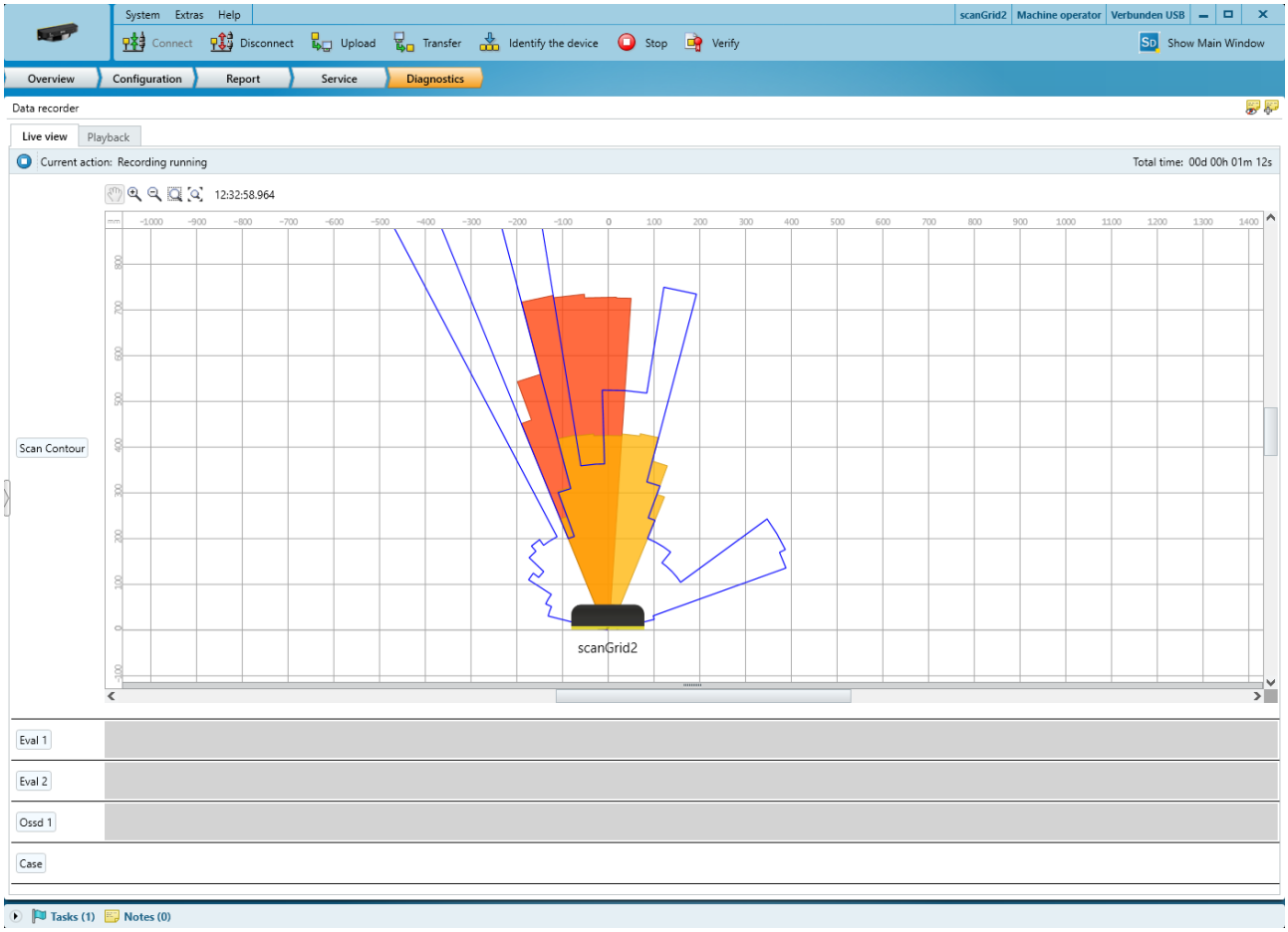


Figure 25: Live view

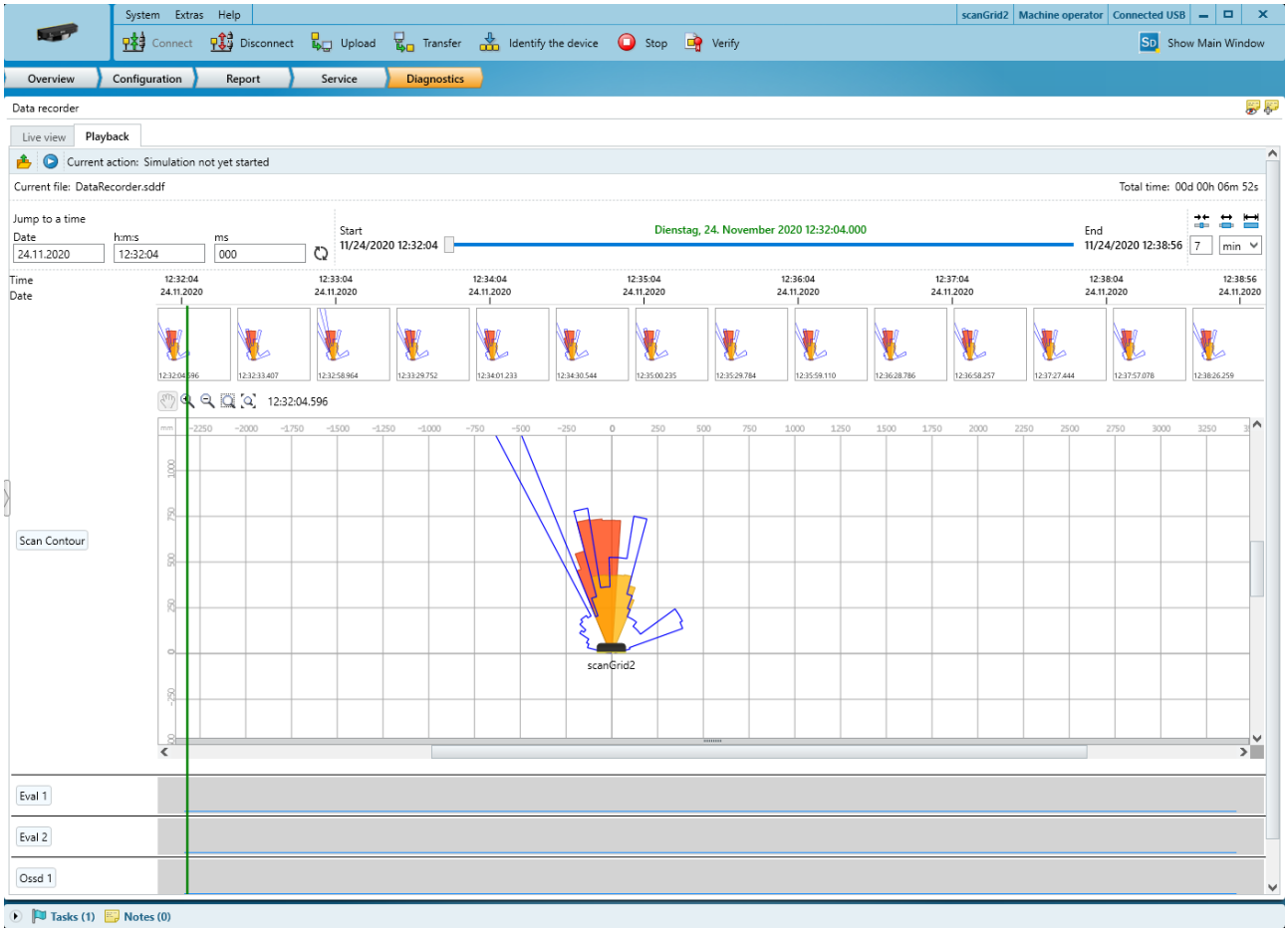


Figure 26: Replay

The data is saved in a data recorder diagnostics file.

You can play the data recorder diagnostic file in the data recorder.

You can adjust the settings in the Safety Designer main window.

Table 51: Data recorder

	Start recording
	Stop recording

Prerequisites

- Existing connection between Safety Designer and device
- Configuration in the project and configuration in the device are synchronized.

Typical applications

- Check where a person can stay or when a person is detected
- Check input information about the current monitoring case
- Check why a signal change occurred on the safety output

11.5 Diagnostics using the Safety Assistant app

Overview

You can use the Safety Assistant app to read the diagnostic data of the safe multibeam scanner via NFC and display it on an NFC-capable mobile device.

Diagnostic data

The following diagnostic data can be displayed in an NFC-capable mobile device:

- Device information, e.g., name, serial number, type code
- Device status, e.g., status of the safety output, status of the segments
- Configuration information
- Fault diagnosis with error code, error description, STATE LED and troubleshooting details

Approach

▶ Hold the NFC-capable mobile device near the marked NFC-area on the safe multibeam scanner to retrieve the diagnostic data.

Complementary information

The diagnostic data can also be read out in the voltage-free state of the safe multibeam scanner. However, you will receive more information if the safe multibeam scanner is supplied with voltage.

12 Decommissioning

12.1 Disposal

Approach

- Always dispose of unusable devices in accordance with national waste disposal regulations.

Complementary information

SICK will be glad to help you dispose of these devices on request.

13 Technical data

13.1 Data sheet

Table 52: General data

Protective field range	≤ 1.1 m (for an object resolution of 70 mm), details: "Protective field range", page 103
Warning field range	≤ 4.0 m [1]
Fields	≤ 16
Field sets	≤ 8
Monitoring cases	≤ 8
Scanning angle	150° (15° ... 165°)
Object resolution	50 mm, 70 mm, 150 mm, 200 mm
Maximum object speed	1.6 m/s
Angular resolution	≤ 6°
Vertical aperture angle	≤ 4°
Response time	≤ 63 ms + $t_{CANtransmission}$ (for multiple sampling = 1), details: "Response time", page 102
Scan cycle time	≤ 46 ms
Switch-on delay of the safety output or protective field status	< 190 ms + $t_{CANtransmission}$
Duration of monitoring case switching t_{CSR}	≤ 20 ms + 2 x $t_{CANtransmission}$, see "Monitoring case switching", page 21
Generally necessary protective field supplement (TZ = tolerance zone of the safe multi-beam scanner)	100 mm
Additional protective field supplement Z_E for background-related measurement error	220 mm, details: "Z_E supplement for background-related measurement error", page 29
Multiple sampling	1 ... 4

[1] At a minimum object size of 70 mm and a remission of 80%.

Table 53: Safety-related parameters

Type	Type 2 (IEC 61496-3)
Safety integrity level	SIL 1 (IEC 61508)
SIL claim limit	SILCL 1 (IEC 62061)
Category	Category 2 (ISO 13849-1)
Performance level	PL c (ISO 13849-1)
Maximum demand rate	4 / h
Minimum internal test rate	400 / h
PFH_D (mean probability of a dangerous failure per hour)	1.3 x 10^{-6}
T_M (mission time)	20 years (ISO 13849-1)
Safe status when a fault occurs	The state of the safety output transmitted via CANopen Safety is OFF and the transmitted statuses of the protective fields are “Interrupted”. No safety-related data is transmitted via CANopen Safety.

Table 54: Interfaces

Automatic restart of the safety output after	Immediately or between 2 s ... 60 s (configurable)
Length of cable for system connection[1)]	
For a baud rate of 1,000 kBit/s	≤ 30 m
Cable type to be connected	Twisted pairs with copper braid screen
Impedance of the cable to be connected	108 Ω ... 132 Ω (typ. 120 Ω)
Terminator	External
CAN interface	
Baud rate	Configurable: • 10 kBit/s • 20 kBit/s • 50 kBit/s • 125 kBit/s • 250 kBit/s • 500 kBit/s • 1,000 kBit/s
Address range (node ID)[2)]	1 ... 127 (configurable)
USB interface for configuration and diagnostics	
Connection type	USB 2.0 Type-C
Transmission rate	12 Mbit/s (Full Speed)
Length of cable	≤ 5 m

1) For a cable cross-section of 0.25 mm² .
2) When transmitting distance values using the objects TPDO2 to TPDO9, there must be no node IDs > 63 within the network.

Table 55: Electrical data

Operating data	
Protection class	III (IEC 61140)
Supply voltage V_S	24 V DC (8.4 V ... 30 V DC) (SELV/PELV) [1) 2) 3)]
Residual ripple	± 10% [4)]
Power consumption (maximum value)	≤ 3 W
Average power consumption during a scan cycle	≤ 2 W
Power consumption in sleep mode	≤ 1 W
Power-up delay	≤ 2 s
Galvanic separation	No
CAN signal	
Signal level	In accordance with ISO11898-2 (high speed CAN)
Common-mode operating range	-25 V ... 25 V

Error tolerance for CAN_HI/ CAN_LO	-30 V ... 30 V [5]

1) The power supply unit must be able to jumper a brief power failure of 20 ms as specified in IEC 60204-1. Suitable power supply units are available as accessories from SICK. Battery-powered systems must be able to jumper brief power failures of 5 ms.
2) A fuse with a maximum rated current of 2 A (slow blow) must be installed in the power supply circuit to the device in order to limit the available current.
3) The system is intended for operation with power sources with a nominal voltage of 12 V to 24 V.
4) The voltage level must not fall below the specified minimum voltage.
5) Every CAN bus node must be supplied with a maximum supply voltage of 30 V. If the supply voltage is > 30 V (e.g., 48 V battery system), measures must be taken to limit the CAN voltage to < 30 V in the event of a fault.

Table 56: Mechanical data

Dimensions (W × H × D)	160 mm x 43 mm x 56 mm
Weight	0.17 kg
Housing material	Durabio (front part, black) Polycarbonate (back part, colza yellow)
Housing color	RAL 9005 (black) and RAL 1021 (colza yellow)

Table 57: Ambient data

Enclosure rating [1]	IP65 (IEC 60529)
Ambient light immunity	≤ 10 klx [2]
Ambient operating temperature	0 °C ... 50 °C
Storage temperature	–30 °C ... 70 °C
Air humidity	15% ... 95%, non-condensing [3]
Height above sea level during operation	≤ 3,000 m
EMC	According to IEC 61496-1, IEC 61000-6-2, IEC 61000-6-3
Vibration resistance [4]	
Standards	• IEC 60068-2-6 • IEC 60068-2-64 • IEC 60721-3-5 • IEC TR 60721-4-5 • IEC 61496-3
Class	5M1 (IEC 60721-3-5)
Sinusoidal vibrations	• 0.35 mm, 50 m/s^2, 10 Hz ... 55 Hz • 1.5 mm, 2 Hz ... 9 Hz • 5 m/s^2, 9 Hz ... 200 Hz
Noise vibrations	• 0.5 m^2/s^3, 5 Hz ... 200 Hz • 0.1 m^2/s^3, 200 Hz ... 500 Hz
Shock resistance [4]	
Standards	• IEC 60068-2-27 • IEC 60721-3-5 • IEC TR 60721-4-5 • IEC 61496-3
Class	5M1 (IEC 60721-3-5)
Single shock	50 m/s^2, 11 ms

Continuous shock	100 m/s², 16 ms

1) The specified enclosure rating only applies when the USB connection is sealed with the protective cover.
2) Against indirect ambient light (reflected from the background) according to IEC 61496-3: ≤ 1,500 lx
3) IEC 61496-1, no. 4.3.1 and no. 5.4.2, IEC 61496-3, no. 4.3.1 and no. 5.4.2. Condensation has an influence on normal operation.
4) For direct mounting.

Table 58: Miscellaneous data

Type of light	Pulsed laser diode
Wavelength	850 nm
Detectable remission	4% ... several 1,000%
Maximum uniform contamination of the front screen without reducing the detection capability [1]	30%
Area where detection capability is restricted	≤ 50 mm [2]
Pulse duration	Typ. 1.5 ns
Laser class	1 [3]
Measurement error with measurement data output	Typ. ± 60 mm

1) In the event of strong contamination, the safe multibeam scanner indicates a contamination error and switches the safety output to the OFF state and the protective field status to the “Interrupted” status.
2) In close proximity (50 mm-wide area in front of the front screen), the detection capability of the safe multibeam scanner may be restricted.
3) This laser product is rated as a class 1 laser according to IEC 60825-1:2014. In some cases, evaluation is required according to the older IEC 60825-1:2007 standard, e.g. by employers in the EU according to Directive 2006/25 / EC. According to the older IEC 60825-1:2007 standard, laser class 1M must be used as the basis.

13.2 Response time

Overview

The protective device’s response time is the maximum time between the occurrence of the event leading to the sensor’s response and the provision of the switch-off signal to the protective device’s interface (for example the OFF state of the safety output).

In addition to the response time of the safe multibeam scanner, further signal transmission and processing also influence the time up until the end of the dangerous state. This includes a control’s processing time and the response times of downstream contactors, for example.

Response time

The response time of the safe multibeam scanner depends, among other things, on the set multiple sampling.

You can calculate the response time using the following formula:

$t_R = n \times t_{SC} + t_{RO} + t_{CANtransmission}$

Where:

- t_R = Response time of the safe multibeam scanner
- n = Set multiple sampling (default: n = 1)
- t_{SC} = Scan cycle time (≤ 46 ms)
- t_{RO} = Supplement for the response time (≤ 17 ms)
- $t_{CANtransmission}$ = Time for the CAN transmission of the PDO/SRDO in milliseconds

$t_{CANtransmission}$ depends on the following configuration settings:

- Configured baud rate
- CAN bus load
- For PDO: transmission type (event-driven or synchronous)
- For PDO: configured inhibit time
- For SRDO: configured refresh time / safeguard cycle time (SCT)

Calculation example:

- $t_R = 1 \times 46\ ms + 17\ ms + 2\ ms = 65\ ms$ (n = 1, $t_{CANtransmission} = 2\ ms$)
- $t_R = 2 \times 46\ ms + 17\ ms + 2\ ms = 111\ ms$ (n = 2, $t_{CANtransmission} = 2\ ms$)

Further topics

- "Response time of the safe multibeam scanner", page 21
- "Monitoring case switching", page 21

13.3 Protective field range

The effective protective field range depends on the object resolution that has been set.

Table 59: Protective field range

Resolution	Protective field range[1)]
200 mm	1.35 m
150 mm	1.30 m
70 mm	1.10 m
50 mm	0.90 m

1) Includes the generally necessary protective field supplement TZ.

13.4 Dimensional drawings

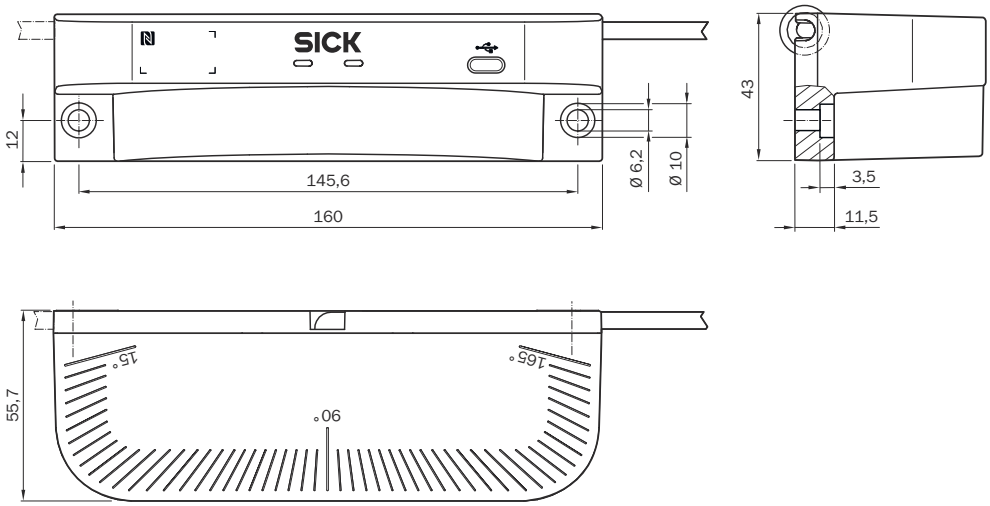


Figure 27: Dimensional drawing

14 Ordering information

14.1 Scope of delivery

- Safe multibeam scanner
- USB protective cover
- Safety note
- Mounting instructions
- Operating instructions for download: www.sick.com

14.2 Ordering information

Table 60: Ordering information

Designation	Type code	Part number
scanGrid2 CANopen	SG2-AAA00011CB0000	1109414

15 Accessories

15.1 Brackets

Table 61: Brackets ordering information

Part	Part number
Alignment bracket	2116913

15.2 Alignment aid

Table 62: Alignment aid ordering information

Part	Part number
Alignment aid	2101720

15.3 Connectivity

Table 63: Ordering information for M12 connecting cable, 5-pin (2 x 0.34 mm², 2 x 0.25 mm², 1 x shield wire)

Part	Type code	Part number
Female connector, straight, 2 m cable, flying leads	YF2A15-020C1BXLEAX	2106283
Female connector, straight, 5 m cable, flying leads	YF2A15-050C1BXLEAX	2106284
Female connector, straight, 10 m cable, flying leads	YF2A15-100C1BXLEAX	2106286

Table 64: Ordering information for the USB connection cable

Part	Type code	Part number
USB type C to USB type A (USB 2.0), 2.0 m cable	YMUSA4-020VG5MUSC4	2119989

Table 65: Ordering information for terminator

Part	Part number
CAN male connector, M12, 5-pin (120 Ω terminator)	6021167

Table 66: Distributor ordering information

Part	Type code	Part number
T distributor, 5-pin	DSC-1205T000025KM0	6030664

15.4 Cleaning agent

Table 67: Cleaning agent ordering information

Part	Part number
Anti-static plastic cleaner	5600006
Lens cloth	4003353

15.5 Test rods

Table 68: Ordering information, test rods

Part	Part number
Test rod 50 mm	2095105
Test rod 70 mm	2095139
Test rod holder	4096204

16 Glossary

Dangerous state	A dangerous state is a status of the machine or facility, where people may be injured. Protective devices prevent this risk if the machine is operated within its intended use. The figures in this document always show the dangerous state of the machine as movement of a machine part. In practice, there are different dangerous states, such as: • Machine movements • Electrical parts • Visible and invisible beam • A combination of multiple hazards
Demand rate	The demand rate refers to the number of events in a specified time period that trigger the safety function of a safety-related component.
EDM	External device monitoring
Electro-sensitive protective device	An electro-sensitive protective device is a device or system of devices for safety-related detection of people or parts of the body. It is used to protect people from machines and facilities that pose a risk of injury. It triggers the machine or facility to adopt a safe state before a person is exposed to a hazardous situation. Examples: Safety light curtain, safety laser scanner.
ESPE	Electro-sensitive protective device
External device monitoring	The external device monitoring (EDM) monitors the status of downstream contactors. In order to use external device monitoring, positively guided contactors must be used to switch off the machine. If the auxiliary contacts of the positively guided contactors are connected to the external device monitoring, the external device monitoring checks whether the contactors switch correctly when the OSSDs are switched off.
Field set	A field set consists of one or more fields. The fields in a field set are monitored simultaneously. A field set can contain different field types, e.g., a protective field and a warning field.
Hazardous area	Hazardous area is any space within and/or around machinery in which a person can be exposed to a hazard. (ISO 12100)
Master	The master device actively builds data connections in a network. A device in a network which is addressed by a master device has the role of slave. In some modern networks, many or all devices can switch between roles or have both roles at one time.
Monitoring case	A monitoring case indicates the machine status to the sensor. Generally, one field set is assigned to each monitoring case. The sensor receives a defined signal for the current machine status. When a signal change occurs, the sensor activates the monitoring case and thereby the field set that is associated with the new machine status.
NFC	Near field communication. International transmission standard for the contactless exchange of data by electromagnetic induction.

OFF state	The OFF state is the status of the outputs of the protective device, where the controlled machine is triggered to quit its dangerous state and the start-up of the machine is prevented (e.g., the voltage at the OSSDs is LOW, so that the machine is switched off and remains still).
ON state	The ON state is the status of the outputs of the ESPE, where the controlled machine is permitted to operate (e.g., the voltage at the OSSDs is HIGH so that the machine can run).
PFH_D	Probability of dangerous failure per hour
PL	Performance level (ISO 13849)
Protective field	The protective field is the area in which the test object specified by the manufacturer is detected by the electro-sensitive protective equipment (ESPE). As soon as the electro-sensitive protective device detects an object in the protective field, it switches the associated safety outputs to the OFF state. This signal can be passed to controllers resulting in the dangerous state coming to an end, e.g. to stop the machine or the vehicle.
Reset	When a protective device has sent a stop command, the stopped state must be maintained until a reset device is activated and the machine can be restarted in a second step. The reset brings the protective device back to the monitoring state after it has sent a stop command. The reset also quits the start-up or restart interlock of a protective device, so that the machine can be restarted in a second step. The reset must only be possible, when all safety functions and protective devices are functional. The reset of the protective device must not introduce any movement or dangerous situations itself. The machine is only permitted to start after the reset once a separate start command has been sent. • Manual resets are performed using a separate, manually operated device, such as a reset pushbutton. • Automatic resets by the protective device are only permitted in special cases, if one of the following conditions is met: o It must not be possible for people to be in the hazardous area without triggering the protective device. o It must be ensured that no people are in the hazardous area during or after the reset.
Resolution	The resolution of an active opto-electronic protective device (also known as the sensor detection capability) is the minimum size of an object for it to be reliably detected.
Response time	The protective device's response time is the maximum time between the occurrence of the event leading to the sensor's response and supply of the switch-off signal to the protective device's interface (for example OFF state of the OSSD pair).
Restart interlock	The restart interlock prevents the machine from automatically starting up, for example after a protective device has responded while the machine is operating or after changing the machine's operating mode. The restart interlock can be implemented in the protective device or in the safety controller. A command to reset the protective device must be given, for example using a reset pushbutton, before the machine can be restarted.
Safety function	Function of a machine whose failure can result in an immediate increase of the risk(s). (ISO 12100)

Safety output	A safety output provides safety-related information. Safety outputs are OSSDs, for example, or safety-related information on a safety-related network.
Scan cycle time	The scan cycle time is the time the sensor needs for a complete scan of its detection area. Example: Time required by the mirror of a safety laser scanner for one rotation.
SIL	Safety integrity level
SILCL	SILCL: SIL claim limit. Designation in older versions of IEC 62061. Replaced by SIL in versions from 2021.
Slave	A slave device provides data in a network on request. A device in the network to which a slave device provides data has the role of master. In some modern networks, many or all devices can switch between roles or have both roles at one time.
Test rod	The test rod is an opaque, cylinder-shaped object used to check the detection capability of the active opto-electronic protective device. The diameter of the test rod is the same as the resolution of the active opto-electronic protective device.
Warning field	The warning field monitors larger areas than the protective field. Simple switching functions can be triggered with the warning field, e.g. a warning light or an acoustic signal can be triggered if a person approaches, even before the person enters the protective field. The warning field must not be used for safety applications.

17 Annex

17.1 Conformities and certificates

You can obtain declarations of conformity, certificates, and the current operating instructions for the product at www.sick.com. To do so, enter the product part number in the search field (part number: see the entry in the “P/N” or “Ident. no.” field on the type label).

17.1.1 EU declaration of conformity

Excerpt

The undersigned, representing the manufacturer, herewith declares that the product is in conformity with the provisions of the following EU directive(s) (including all applicable amendments), and that the standards and/or technical specifications stated in the EU declaration of conformity have been used as a basis for this.

- ROHS DIRECTIVE 2011/65/EU
- MACHINERY DIRECTIVE 2006/42/EC
- RE DIRECTIVE 2014/53/EU

17.1.2 UK declaration of conformity

Excerpt

The undersigned, representing the following manufacturer herewith declares that this declaration of conformity is issued under the sole responsibility of the manufacturer. The product of this declaration is in conformity with the provisions of the following relevant UK Statutory Instruments (including all applicable amendments), and the respective standards and/or technical specifications have been used as a basis.

- Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
- Supply of Machinery (Safety) Regulations 2008
- Radio Equipment Regulations 2017

17.2 Note on standards

Standards are specified in the information provided by SICK. The table shows regional standards with similar or identical contents. Not every standard applies to all products.

Table 69: Note on standards

Standard	Standard (regional)
	China
IEC 60068-2-6	GB/T 2423.10
IEC 60068-2-27	GB/T 2423.5
IEC 60204-1	GB/T 5226.1
IEC 60529	GB/T 4208
IEC 60825-1	GB 7247.1
IEC 61131-2	GB/T 15969.2
IEC 61140	GB/T 17045
IEC 61496-1	GB/T 19436.1
IEC 61496-2	GB/T 19436.2
IEC 61496-3	GB 19436.3
IEC 61508	GB/T 20438

Standard	Standard (regional)
	China
IEC 62061	GB 28526
ISO 13849-1	GB/T 16855.1
ISO 13855	GB/T 19876

17.3 Checklist for initial commissioning and commissioning

Checklist for manufacturers or installers for installing electro-sensitive protective device (ESPE)

The details relating to the items listed below must be available no later than when the system is commissioned for the first time. However, these depend on the specific application (the requirements of which must be reviewed by the manufacturer or installer).

This checklist should be retained and kept with the machine documentation to serve as reference during recurring tests.

This checklist does not replace the initial commissioning, nor the regular inspection by qualified safety personnel.

Have the safety rules and regulations been observed in compliance with the directives and standards applicable to the machine?	Yes ☐ No ☐
Are the applied directives and standards listed in the declaration of conformity?	Yes ☐ No ☐
Does the protective device correspond to the required PL/SIL and PFHd in accordance with ISO 13849-1 / IEC 62061 and the required type in accordance with IEC 61496-1?	Yes ☐ No ☐
Is access to the hazardous area or hazardous point only possible through the protective field of the ESPE?	Yes ☐ No ☐
Have appropriate measures been taken to protect (mechanical protection) or monitor (protective devices) any persons or objects in the hazardous area when protecting a hazardous area or hazardous point, and have these devices been secured or locked to prevent their removal?	Yes ☐ No ☐
Are additional mechanical protective measures fitted and secured against manipulation which prevent reaching below, above or around the ESPE?	Yes ☐ No ☐
Has the maximum shutdown and/or stopping time of the machine been measured, specified and documented (at the machine and/or in the machine documentation)?	Yes ☐ No ☐
Has the ESPE been mounted such that the required minimum distance from the nearest hazardous point has been achieved?	Yes ☐ No ☐
Are the ESPE devices properly mounted and secured against manipulation after adjustment?	Yes ☐ No ☐
Are the required protective measures against electric shock in effect (protection class)?	Yes ☐ No ☐
Is the control switch for resetting the protective devices (ESPE) or restarting the machine present and correctly installed?	Yes ☐ No ☐
Are the outputs of the ESPE (OSSDs or safety outputs via the network) integrated according to the required PL/SIL in accordance with ISO 13849-1 / IEC 62061 and does the integration correspond to the circuit diagrams?	Yes ☐ No ☐
Has the protective function been checked in compliance with the test notes of this documentation?	Yes ☐ No ☐
Are the specified protective functions effective at every operating mode that can be set?	Yes ☐ No ☐
Are the switching elements activated by the ESPE, e.g. contactors, valves, monitored?	Yes ☐ No ☐
Is the ESPE effective over the entire period of the dangerous state?	Yes ☐ No ☐
Once initiated, will a dangerous state be stopped when switching the ESPE on or off and when changing the operating mode, or when switching to another protective device?	Yes ☐ No ☐

18 List of figures

19 List of tables

8025990/1FYD/2022-10-28/en

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