OPERATING INSTRUCTIONS

Safeguard Detector

Safety System

SICK
Sensor Intelligence.

Described product

Safeguard Detector

Manufacturer

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

Legal information

Original document

This document is an original document of SICK AG.

Contents

1 About this document

1.1 Information on the operating instructions

To become familiar with the product and its functions, read the operating instructions carefully before starting any work.

The operating instructions are an integral part of the product. Keep the manual accessible to personnel at all times. If the product is passed on to third parties, the operating instructions must also be handed over.

1.2 Target groups and structure of these operating instructions

These operating instructions are intended for the following target groups: project developers (planners, developers, designers), installers, electricians, operators, and maintenance personnel.

These operating instructions are organized by the life phases of the safety system: project planning, mounting, electrical installation, commissioning, operation and maintenance.

1.3 Further Informations

The product page with further information can be found at the **SICK Product ID** under: pid.sick.com/{**P/N**}.

P/N corresponds to the part number of the product.

The following information is available depending on the product:

- Data sheets
- This document in all available language versions
- CAD data and dimensional drawings
- Certificates (e.g. declaration of conformity)
- More publications
- Software
- Accessories

1.4 Related applicable documents

Related applicable documents from SICK

Document	Title	Part number
Operating instructions	Flexi Soft modular safety controller hardware	8012999
Operating instructions	Flexi Soft in Flexi Soft Designer	8012998
Operating instructions	Flexi Classic [1)]	8011562
Operating instructions	W4F MultiPulse	8027506

1) The UE410-SD safety controller is a variant of the Flexi Classic safety controller produced for Safeguard Detector.

1.5 Symbols and document conventions

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.

2 Safety information

2.1 General safety note

The information and tools will not fulfill the safety requirements for your application without further adjustments being made. The project planning provided by way of example is intended to serve as the basis to allow you to perform your own project planning and programming in line with your specific requirements. What this means is that the information and tools merely provide an example to demonstrate how a safety function can be taken care of.

When it comes to your own project planning and programming, you will need to rely on qualified staff given that it is your responsibility to ensure that the following requirements are complied with at the very least:

- ► Carrying out a risk assessment
- ► Taking into account applicable standards
- ► Verifying and validating the safety functions.

2.2 Intended use

The Safeguard Detector safety system is used on machines with material transportation systems, such as a magazine with cartons or plastic containers on a packaging machine. The safety system reduces the risk of a person being injured by the empty material transportation system when reaching into the machine.

The product may be used in safety functions.

The product must only be used within the limits of the prescribed and specified technical specifications and operating conditions at all times.

Incorrect use, improper modification or manipulation of the product 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 Improper use

Unsuitable ambient conditions

- In outdoor areas or covered outdoor areas
- Outside an industrial environment
- Direct sunlight
- Low-frequency ambient light in the 100 Hz range or high-frequency ambient light in the kHz range

2.4 Qualification of personnel

Any work on the product may only be carried out by personnel qualified and authorized to do so.

Qualified personnel are able to perform tasks assigned to them and can independently recognize and avoid any potential hazards. This requires, for example:

- technical training
- experience
- knowledge of the applicable regulations and standards

3 Product description

3.1 Design

The following elements work together:

- Material as a physical guard
- 2 × sensors
- 1 × safety controller (including software)
- 1 × machine

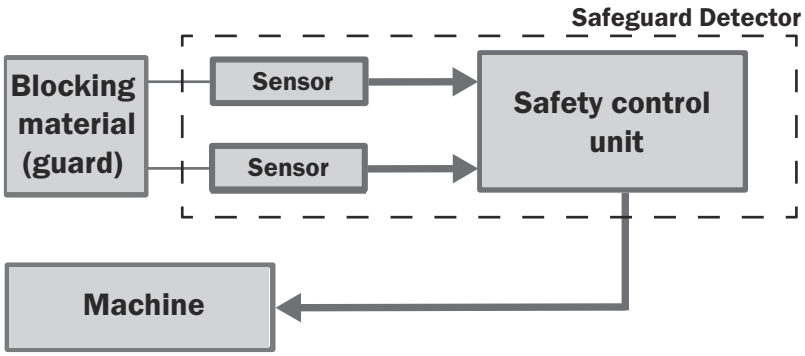
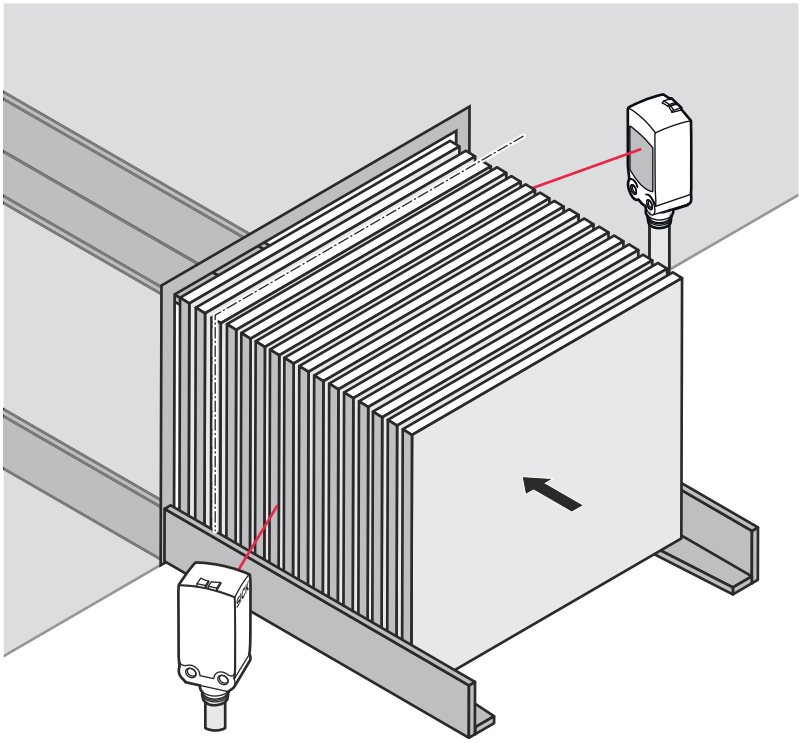


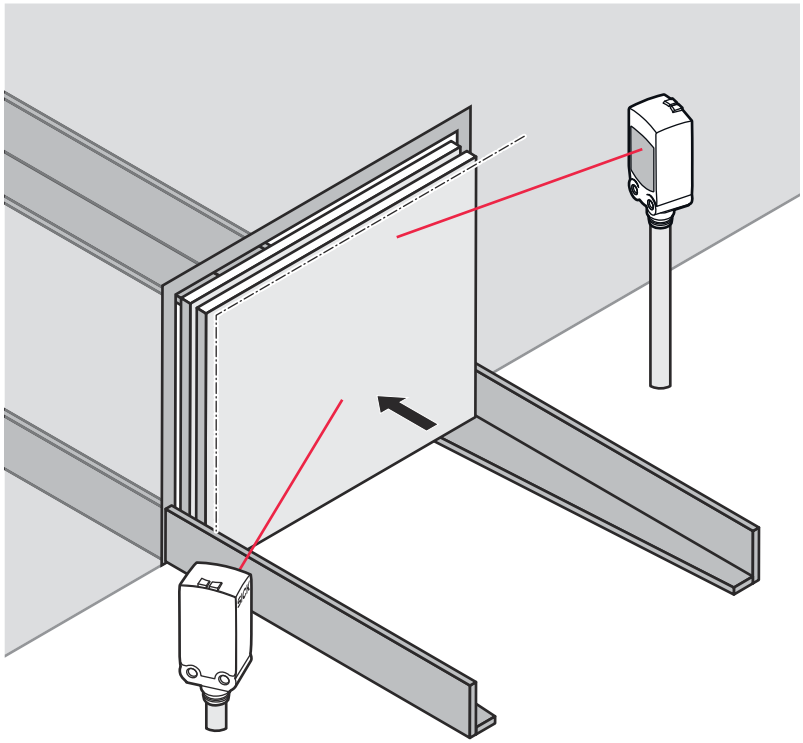
Figure 1: Design

3.2 Functionality

On machines with a material transportation system, the opening for the material transportation provides an opportunity for reaching into the hazardous area. The material itself, however, may be sufficient to prevent reaching into the hazardous area. In this case, the blocking material fulfills the safety-related function of a physical guard.



During operation, the material is continuously consumed. The function of a physical guard can only be fulfilled as long as there is sufficient material in the material feed system. The minimum quantity required depends on the nature of the material and other factors.



The safety system detects the material using 2 sensors. The distance between the sensors and the material opening determines the switching point of the safety system. This means that the safety system switches to the safe state as soon as the material quantity is no longer sufficient to act as a physical guard.

3.3 Requirements on the application

- There must be no strong light sources in the vicinity of the sensors. Maximum luminosity:
  - 24 kLux for light falling directly on the optics of the sensors
  - 19 kLux for light sources at a distance < 80 mm
- The sensors are mounted near the machine opening for functional reasons. You should therefore consider the effect of the machine on the ambient conditions of the sensors. For example, air escaping from a machine opening could raise the ambient temperature above the value for which the sensors are rated.
- The application requires a reset pushbutton on the safety controller.
- The application requires a manual restart. You must ensure that the “Restart required” signal does not trigger an automatic restart in the event of a short-circuit.
  You must integrate the manual restart independently via a separate controller. In the case of configurable safety controllers, it may be possible to integrate the manual restart into the safety controller (see "Safeguard Detector User Interface page", page 27).
- All components of the safety system must be operated in ambient conditions that correspond to the respective technical data (see "Related applicable documents", page 5).

3.4 Product characteristics

3.4.1 Components

Components relevant for the safety system

Table 1: Hardware

Component	Part of the safety system?	Included in scope of delivery
Flexi Soft safety controller • FX3-CPU0 main module • Expansion module FX3-XTIO • FX3-MPL0 system plug	Yes	Variant-dependent [1]
UE410-SD safety controller	Yes	Variant-dependent [1]
W4F MultiPulse miniature photoelectric sensor, 100 mm variant	Yes	Variant-dependent [1]
W4F MultiPulse miniature photoelectric sensor, 150 mm variant	Yes	Variant-dependent [1]
Reset pushbutton	Yes	No [2]
Restart button	No	No [2]

1) The component is not part of the scope of delivery for all variants of the safety system.
2) You must choose a component that meets the requirements of your application and the safety system. The minimum requirements of the safety system on the component are listed in the Project planning section.

Table 2: Software

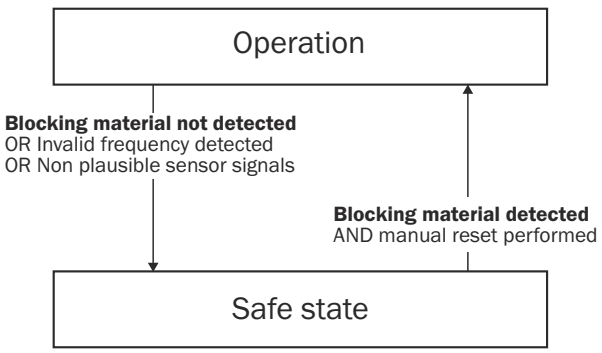
Name	Availability for safety systems with UE410-SD safety controller	Availability for safety systems with Flexi Soft safety controller
Software with logic for the safety controller	Permanently installed in the safety controller.	The files are available in the Flexi Soft Designer configuration software once the safety system has been added to the project.
Complete subsystems for SISTEMA	www.sick.com/Safeguard_Detector	
Circuit diagram (ePLAN)		
Operating instructions for the safety system		

Further topics

- "Ordering information and scope of delivery", page 35

3.4.2 System states

System states and transitions



In the safe state, the appropriately parameterized output signal switching devices are in the OFF state. The safe state is triggered when **one** of the following events occurs:

- At least one sensor is not detecting any material.
- Incorrect frequency in the signal of the sensors
- Signals from the sensors are not plausible.
- An error is diagnosed in at least one sensor.
- An internal error occurs on a component.
- At least one connection between the sensor and safety controller is interrupted.
- The voltage supply to the safety controller or at least one sensor is interrupted.

The operational state is triggered when **all** of the following events occur:

- Material detected
- Manual reset performed

Signal behavior

System status	Safety signal	Safety output
Operational status	TRUE	HIGH (24 V)
Safe state	FALSE	LOW (0 V)

Complementary information

The safety system is always active. You can extend the safety system on your own responsibility to take into account different operating modes of the machine.

4 Project planning

4.1 Manufacturer of the overall system

The safety system was developed under consideration of typical application cases. A partial safety function can be implemented with the safety system in these application cases. The manufacturer must check whether the safety system is suitable for its specific application case (risk assessment according to ISO 12100). Further protective measures may be required in addition to the safety system.

If the thorough check shows that the safety system is not suitable for the specific application case, the safety system can be used as a basis for an individualized development suitable for the specific application case. This case will not be considered further in this document.

In any event, additional work is necessary for the safety system to be used, e.g. subsequent configuration of the safety controller.

The manufacturer has the following duties:

- ► Executing a risk assessment.
- ► Verifying and validating the safety functions.
- ► Integrating the individual components in accordance with the appropriate standards.
- ► Please note that C standards have priority compared to statements about this safety system.

4.2 Operating entity of the overall system

Changes to the electrical integration of the safety system in the machine control and changes to the mechanical mounting of the safety system necessitate a new risk assessment. The results of this risk assessment may require the entity operating the machine to meet the obligations of a manufacturer.

Changes to the safety system's configuration may impair the protective function. The effectiveness of the safety system must be checked after any change to the configuration. The person carrying out the change is also responsible for maintaining the protective function of the safety system.

4.3 Design

4.3.1 Requirements on the material

Overview

The material blocks the opening to the hazardous area and thus acts as a physical guard. The material performs a safety function. To ensure the sensors can detect the material, the material must meet certain requirements.

Important information

DANGER
Material with unsuitable properties as a physical guard.
Material may not be able to perform the intended protective function.

- Evaluate whether the type and quantity of material is suitable for use as a physical guard (safety function).

Minimum size

- Round material: Ø 120 mm
- Rectangular material: 120 mm × 120 mm

There is usually a gap between the material and the opening of the material feed system. You must ensure that people cannot reach into the hazardous area through the gap.

Remission factor

The sensors detect the material via the reflected light. Materials with a low remission factor do not reflect enough light for reliable detection. If the material cannot be reliably detected, this leads to availability problems.

Remission factor of the material: 6% ... 90%. This corresponds to a range of surfaces from black to matte white.

The remission factor affects the sensing range of the sensors.

The light reflected from the material must not exceed a luminosity of 59 kLux.

Glossy materials

Glossy materials can lead to a change in the sensing range of the sensors. The range can increase or decrease. Glossy materials should ideally be avoided. If this is not possible, tilt the sensor and material towards each other so that the light from the sensor is not reflected directly back to the sensor. For dark glossy materials, use an angle < 45° .

Transparent materials

Transparent materials cannot be reliably detected in all applications. If necessary, check whether the safety system is suitable for your application.

4.3.2 Required amount of material for minimum distance

Overview

In order for the material to act as a physical guard, a certain amount of material must be present in the material feed system. This minimum material quantity must be further increased to take into account ambient influences and response times.

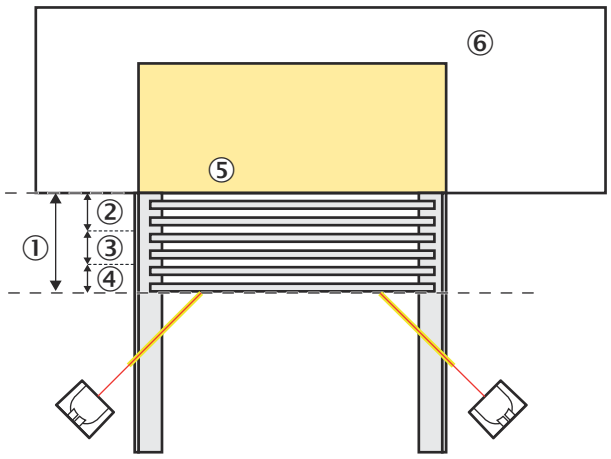


Figure 2: Minimum distance to hazardous area

① Required amount of material. Corresponds to the minimum distance to the hazardous area (S).

② Required amount of material to function as a physical guard

③ Additional amount of material as a supplement Z_{sensor}

④ Additional amount of material as a supplement $Z_{responsetime}$

⑤ Hazardous area

⑥ Machine

The information in this section will help you to determine the required minimum amount of material yourself.

Important information

WARNING

Unreliable detection of material inside the machine.

In the case of non-compliance, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

► Regardless of the result of the calculation in this section: Select the minimum material quantity so that the material is always detected outside the machine housing.

Calculation of the minimum distance to the hazardous area

You must calculate the minimum distance to the hazardous area.

$S = Z_{guard} + Z_{sensor} + Z_{responsetime}$

Table 3: Parameters for calculating the minimum distance

Parameter	Description
S	Minimum distance to hazardous area
Z_{guard}	Required minimum amount of material for the material to act as a physical guard.
Z_{sensor}	Supplement for the use of sensors in this safety system. $Z_{sensor} = Z_{offset} + Z_{humidity} + Z_{temperature}$
Z_{offset}	Supplement for different material colors = fixed value, depending on the selected sensor • WTB4F 100 mm variant: 4 mm • WTB4F 150 mm variant: 18 mm
$Z_{humidity}$	Supplement for the change in max. sensing range depending on the air humidity = 5 mm
$Z_{temperature}$	Supplement due to temperature changes during operation. The sensing range increases as the temperature rises. If the temperature in the operational state can become higher than at the time of commissioning, this supplement must be added. 3 mm per 10 K above the commissioning temperature.
$Z_{responsetime}$	Supplement for material consumption (depending on the machine cycle) during the response time $Z_{responsetime} = (t_{safetysystem} + t_{actor}) / t_{machinecyle} \times d_{material}$
$t_{safetysystem}$	Depends on the safety controller type • Flexi Soft: see table 4, page 15 • UE410-SD: see table 5, page 15
t_{actor}	The decisive factor here is the stopping time of the parts of the system that represent a dangerous state. Stopping time of the system, including run-down time
$t_{machinecycle}$	Cycle time during which a quantity of the material is processed.

Parameter	Description
$d_{material}$	Material thickness of a quantity of the material

Response time $t_{safetysystem}$ system with Flexi Soft safety controller

$t_{safetysystem} = t_{sensor} + t_{safetycontroller} + t_{monitoring}$

Table 4: Parameters for calculating $t_{safetysystem}$ with Flexi Soft safety controller

Parameter	Description
t_{sensor}	100 ms
$t_{safetycontroller}$	Safety controller response time $t_{safetycontroller} = t_{input} + 2 \times t_{logic} + t_{output}$ $t_{safetycontroller} = 6.5$ ms $+ 2 \times t_{logic} + 4.5$ ms $t_{safetycontroller} = 11$ ms $+ 2 \times t_{logic}$
t_{input}	6.5 ms
t_{logic}	t_{logic} corresponds to the logic cycle time of the safety controller. The value depends on the specific logic configuration. The value must be between 4 ms and 28 ms.
t_{output}	4.5 ms
$t_{monitoring}$	Tolerance for frequency monitoring 30 ms + t_{logic}

Response time $t_{safetysystem}$ with UE410-SD safety controller

$t_{safetysystem} = t_{sensor} + t_{safetycontroller} + t_{monitoring} = 162$ ms

Table 5: Parameters for calculating $t_{safetysystem}$ system with UE410-SD safety controller

Parameter	Description
t_{sensor}	100 ms
$t_{safetycontroller} + t_{sensor}$	Combined response time[1)] of the safety controller and the sensor. 150 ms
$t_{monitoring}$	Tolerance for frequency monitoring 12 ms

1) For technical reasons, the two parameters $t_{safetycontroller}$ and t_{sensor} must not considered in isolation.

Example

Assumptions:

- $t_{safetysystem} = 153$ ms (with Flexi Soft safety controller, where $t_{logic} = 4$ ms)
- $t_{actor} = 100$ ms
- $t_{machinecycle} = 75$ ms
- $d_{material} = 10$ mm
- Z_{guard} = 6 cartons of 10 mm each are sufficient as a physical guard = 60 mm
- Z_{sensor} = WTB4F 100 mm variant; no temperature fluctuation = 9 mm
- $Z_{responsetime}$
  $= (t_{safetysystem} + t_{actor}) / t_{machinecycle} \times d_{material}$
  $= (153$ ms $+ 100$ ms $) / 75$ ms $\times 10$ mm)
  $= 33.7$ mm
  $>$ 4 cartons = 40 mm

Calculation:

$S = Z_{guard} + Z_{sensor} + Z_{responsetime}$

$S = 60$ mm $+ 9$ mm $+ 40$ mm

S = 109 mm

> The minimum quantity of material (corresponds to a minimum distance from the hazardous area S) is 11 cartons.

4.3.3 Design of the material opening

- There is usually a gap between the material and the opening of the material feed system. You must ensure that people cannot reach into the hazardous area through the gap.
  The material can usually be moved to a certain extend, e.g., by shifting or tilting. If necessary, measures must be taken to ensure that no gap can occur through which persons can reach into the hazardous area.
- It must not be possible to position the material in such a way that all sensors detect the material, but there is still a gap through which people can reach into the hazardous area.
- There must be no light source and no retroreflective or specular surface behind the detection zone of the sensors (behind the material). If this cannot be ruled out, then the correct switching behavior of the sensors must be checked by means of a suitable test.
- In some applications, a person can remove the material faster than the overall system can go into the safe state. This can be prevented, for example, with the following measures:
  - Protective plate over the material
  - Required amount of material is too large or too heavy to remove all material with one hand.

4.3.4 Number of sensors

The safety system is supplied with a pair of sensors. A second pair of sensors can optionally be used. This is useful in the following cases:

- There is a second material opening that needs to be secured at the same time and using the same principles.
- The material used has a large format and can be bent or folded. People can, for example, bend a corner of the material and reach into the hazardous area without the detection by the sensors being interrupted. Using 2 pairs of sensors, it is possible to detect the material at 4 points instead of only 2.

4.3.5 Position of the sensors

- The light beams should be directed at the material at a slightly oblique angle. The angle must large enough that no material is ever detected in the near range, regardless of the level of the material.
  This is related to the safety-related sensing range of the sensors see figure 3, page 17.
- Sensors must be positioned at different heights.
- The sensors must be positioned on 2 sides of the material.
- The light beams of the two sensors must not cross each other.
- Both sensors detect the same material
- Position the sensors upright for better availability.
- If there are highly reflective or glossy parts behind the material, they must be at a minimum distance from the sensors.
  - Minimum distance for 100 mm variant: 300 mm
  - Minimum distance for 150 mm variant: 550 mm

Further topics

- "Sensing ranges of the sensors", page 17

4.3.6 Sensing ranges of the sensors

Overview

The sensing ranges of the sensors depend on several factors:

- Sensor type
- Remission factor of the material
- Ambient temperature

There is no guaranteed value, therefore, for the sensing ranges of the sensors.

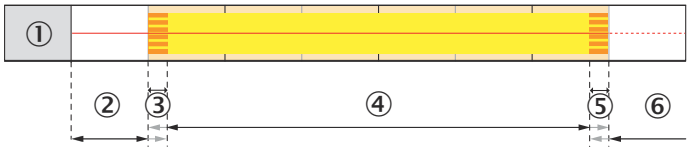


Figure 3: Areas in the light beam of the sensor

① Sensor

② Near range. This area must be free of material or other objects at all times.

③ Tolerance zone for min. sensing range
Various factors affect the exact sensing range.

④ Safety-relevant sensing range
The material is detected in this range.

⑤ Tolerance zone for max. sensing range
Various factors affect the exact sensing range.
During commissioning, the sensor is positioned so that the sensing range for the far range and the threshold value for the required material quantity match.

⑥ Far range. No detection.

Important information

NOTE

The sensing ranges of the sensors are not configurable. It is therefore only possible to a limited extent to plan the assembly position before commissioning. The exact distance of the sensors is determined during commissioning.

The information in this section is therefore only a tool for determining in advance the approximate values for the actual sensing ranges.

Remission factor of the material

Typical values for sensing range as a function of the remission factor of the material:

Table 6: Typical sensing ranges for WTB4F 100 mm

Remission factor of the material	90%	6%
Typical min. sensing range	30 mm	30 mm
Typical max. sensing range	100 mm	96 mm

Table 7: Typical sensing ranges for WTB4F 150 mm

Remission factor of the material	90%	6%
Typical min. sensing range	30 mm	30 mm
Typical max. sensing range	150 mm	132 mm

Ambient temperature

The ambient temperature affects the sensing ranges. You must take this into account so that the sensors still switch before the material quantity is no longer sufficient.

The sensing ranges increase by 3 mm per 10 K.

Complementary information

The light spot size of the sensors depends on the maximum sensing range.

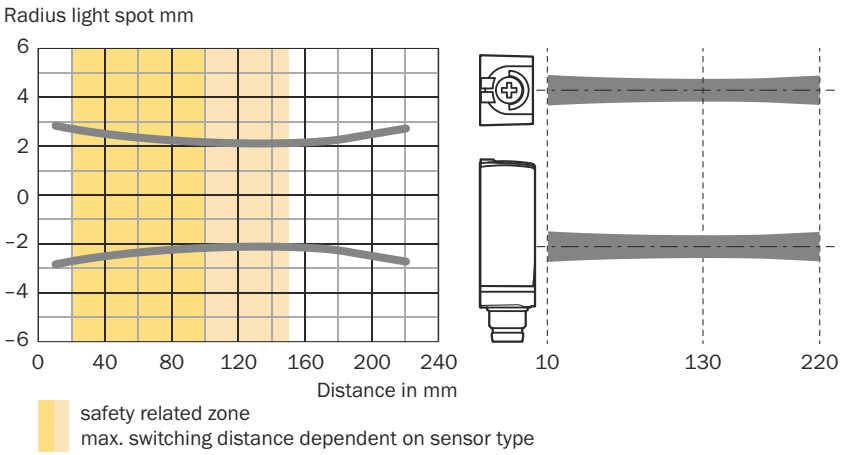


Figure 4: Light spot size for WTB4F type sensors

4.3.7 Requirements for the reset pushbutton and restart button

Overview

The sensors cannot differentiate between an object in the magazine and body parts. A restart interlock is therefore required.

You must ensure that the “Restart required” signal does not trigger an automatic restart in the event of a short-circuit.

You must integrate the manual restart independently via a separate controller.

In the case of configurable safety controllers, it may be possible to integrate the manual restart into the safety controller (see "Safeguard Detector User Interface page", page 27)

Prerequisites

- The reset pushbutton and the restart button must be designed according to EN 60204.

Requirements for the integration design

- The reset pushbutton and the restart button must be installed outside of the hazardous area.
- From the position of the reset pushbutton and the restart button, there must be a complete view of the hazardous area.

4.4 Extension of the safety system

4.4.1 Different operating modes

The safety system has only one operating mode. It is always active.

If the application requires multiple operating modes, then you need to extend the safety system on your own responsibility.

4.5 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.

The following tests must be planned:

- A thorough check must be carried out during commissioning and following modifications.
  The check must detect if it is possible to enter the hazardous area without the safety system changing to the safe state.
- The regular thorough checks of the safety system must fulfill certain minimum requirements. The minimum requirements for the thorough check of the safety system comply at least with the sum of the minimum requirements for the thorough check of the components of the safety system (see operating instructions of the components).
  The check must detect if it is possible to enter the hazardous area without the safety system changing to the safe state. Such possibilities may exist due to modifications, manipulations or external influences.
- In many cases, depending on the application conditions, the risk assessment can determine that further thorough checks are required.

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.

The regular thorough checks serve to assess the effectiveness of the safety system and to identify defects as a result of changes or other influences (e.g., damage or manipulation).

4.5.1 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 for testing during commissioning and in certain situations

- All safety-related aspects of the installation (wiring, connected sensors and actuators, configuration) must comply with the requirements of the relevant standard (e.g., EN ISO 13849-1).
- Check whether the material prevents reaching into the hazardous area.
- Check whether reaching into the hazardous area poses any danger to persons when in the safe state (machine stopped).
- Check the devices connected to the safety controller as per the test instructions in the respective operating instructions.
- Clearly mark all conductors connected to the safety controller. This is to prevent conductors from being incorrectly connected to the safety controller during subsequent maintenance work.
- Check the signal paths and check for correct integration into the higher-level controller.
- For the Flexi Soft safety controller only: Check the logic configuration of the safety controller.
- Perform a complete validation of the safety functions of the system in every operating mode. In addition, simulate errors and pay special attention to the response times of the applications.

- Document fully the system configuration, individual devices, stopping times, and the results of the safety check.
- For the Flexi Soft safety controller only: To prevent unintentional overwriting of the logic configuration of the safety controller, activate write protection.

Further topics

- "Checklist for initial commissioning and commissioning", page 36

4.5.2 Planning the regular thorough check

Overview

The purpose of regular tests is to detect defects due to modifications 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

People may be able to reach into the machines without the safety system going into the safe state.

- ► Perform thorough checks on a regular basis.
- ► 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 regular intervals:

- Visually inspect the machine. Check whether the machine 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?
- Visually inspect the sensors
  - Have the protective device or its parts been dismantled?
  - Is the protective device damaged?
  - Is the protective device severely contaminated?
  - Are the front screens contaminated, scratched or badly damaged?
  - Has the protective device's alignment been changed?
  - Are there any objects (e.g., cables, specular surfaces) in the field of view?
- Functionally check the sensors
  - The sensors only switch (oscillating signal) if material is in the detection zone.
  - While material is in the detection zone, it is constantly detected by the sensors. The orange LEDs of both sensors flash (not continuously light).
  - Remove all material from the material feed system. The sensors must not respond to reflections caused by machine parts.
  - If there is no material in the material feed system, the sensor does not switch (no oscillating signal).
  - Are the LED indicators behaving correctly?

Complementary information

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

Further topics

- "Checklist for initial commissioning and commissioning", page 36

5 Mounting

5.1 Mounting the components

Approach

Mounting

1. Mount the safety controllers as per their associated operating instructions.
2. Prepare for mounting the sensors as per their associated operating instructions. Use the intended brackets (accessories) for the sensors. The final position of the sensors is only determined during commissioning, however.
3. Lay the sensor cables separately from each other.

6 Electrical installation

6.1 Pin assignment for safety controller

Pin assignment for Flexi Soft safety controller

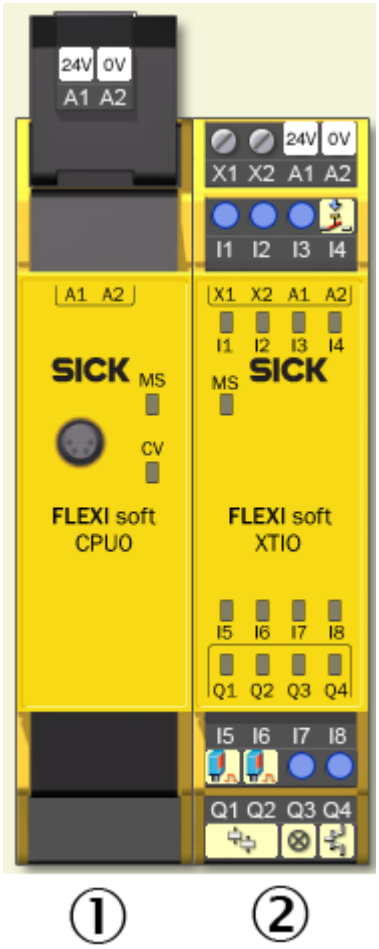


Figure 5: Configuration of the safety controller

Table 8: Module connections ①

Terminal	Function
A1	Supply voltage +24 V DC [1]
A2	Supply voltage 0 V DC

[1] Voltage source type: SELV/PELV. Fuse protection: 4 A

Table 9: Module connections ②

Terminal	Function
I1 ... I3	Not assigned
I4	Reset pushbutton
I5	1st sensor Q (pair 1)
I6	2nd sensor Q (pair 1)
I7	• 1 sensor pair only: Not assigned • 2 sensor pairs: 3rd sensor Q (pair 2)

Terminal	Function
I8	• 1 sensor pair only: Not assigned • 2 sensor pairs: 4th sensor Q (pair 2)
Q1 / Q2	Safety output
Q3	“Reset required” signal
Q4	Voltage supply for sensors [1]

1) The test pulses on the voltage source must not be deactivated.

Pin assignment for UE410-SD safety controller

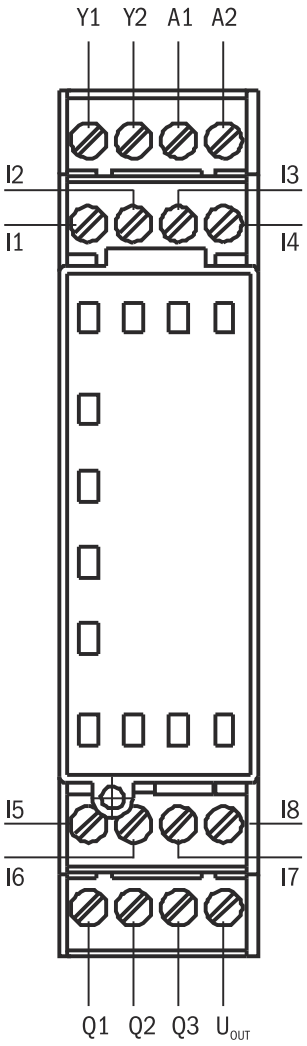


Figure 6: Pin assignment for UE410-SD

Table 10: Connections

Terminal	Function
I1	Wiring depends on the number of sensor pairs used: • 1 sensor pair: +24 V DC • 2 sensor pairs: Not assigned
I2	Wiring depends on the use of the “Reset required” signal (Q3 output): • Q3 > higher-level controller: +24 V DC • Q3 > signal lamp: Not assigned

Terminal	Function
I3	Not assigned
I4	Reset pushbutton
A1	24 V DC supply voltage
A2	Supply voltage 0 V DC
Y1	Diagnostic output for sensor pair 1
Y2	Diagnostic output for sensor pair 2
Q1 / Q2	Safety output
Q3	“Reset required” signal
U_{OUT}	Voltage supply of sensors
I5	1st sensor Q (pair 1)
I6	2nd sensor Q (pair 2)
I7	• 1 sensor pair only: Not assigned • 2 sensor pairs: 3rd sensor Q (pair 2)
I8	• 1 sensor pair only: Not assigned • 2 sensor pairs: 4th sensor Q (pair 2)

6.2 Connecting the sensors

Important information

WARNING
Error during initialization of the sensor. The sensor may not be able to correctly perform its function.

► Ensure the electrical installation is carried out in a de-energized state.

NOTE
If the cable between the sensor and the safety controller is longer than 30 m, additional measures must be taken for surge protection.

Approach

1. Supply the sensors with voltage via the outputs of the safety controller.
2. Route the sensor cables separately to prevent cross-circuits.

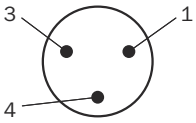


Figure 7: Pin assignment for male connector, M8, 3-pin

PIN	Color	Function
1	BN	+ (L+)
3	BU	- (M)
4	BK	Q

7 Configuration

7.1 Variant-dependent configuration

Only safety systems with the Flexi Soft safety controller can be configured.

7.2 Requirements for software and firmware

Table 11: SICK component versions

Software and firmware	Minimum version
Flexi Soft Designer	1.9.5
Firmware FX3-CPU0	4.0
Firmware FX3-XTIO	3.0
Firmware UE410-SD	16.0

7.3 Main module configuration

7.3.1 Adding a safety system in Flexi Soft Designer

Overview

When adding a safety system, the hardware configuration and logic configuration for the current project are imported into Flexi Soft Designer.

Approach

Selecting the safety system

1. Open Flexi Soft Designer.
2. **Project** > **New** > **Standalone station project**
3. Drag the desired main module out of the **Modules** window into the **Configuration area**.
4. Click on the **Safety Systems** selection window in the bottom left.
5. In the **Available Safety System** list, select the desired safety system.

✓ A description of the selected safety system is displayed.

Checking the version of the safety system

ⓘ **NOTE** | Which versions of the safety system are pre-installed depends on the version of the configuration software. Because the license applies only to the current version of the safety system, verification problems may arise if you do not use the current version of the safety system.

6. To check the safety system version: Continue at step 7..
   If the version has been confirmed as current: Continue at step 15..
7. Click on the **Description** tab and check the version number of the safety system in the **Version** field.
8. Click on **Find the latest safety systems.**

✓ The SICK website is opened.

9. On the **Downloads** > **Software** tab, search for the desired safety system and check the version of the safety system available online.
10. If the version in the configuration matches the version on the website, continue at step 15..

Importing the current version from the website

11. On the SICK website, click on **Download** for the desired safety system and save the SSA file locally.

✓ The SSA file of the safety system is downloaded.

12. In the configuration software, click on the **Import Safety System and add to list** button.

13. Select the downloaded SSA file and click **OK** to confirm.
14. In the **Available Safety System** list, select the new version of the safety system.

Adding the safety system

15. Click on **Add Safety System** in the bottom left.

✓ The safety system is added.

Further topics

- "Activating the license for the safety system", page 29

7.3.1.1 Checksums

Important information

NOTE

The specified checksums are valid only for the delivery state and after importing the safety system into the configuration software. Custom changes to the logic configuration result in a change in the checksums.

Checksums for Flexi Soft CPU0

Page	Verified in the delivery state	Number of sensor pairs	
		1	2
Safeguard Detector User Interface	No	0x733F3EE6	0x42B482A7
Safeguard Detector Functionblock	Yes	0xFD68DE80	0xDB8943FA
Safeguard Detector WTB4F V1.0	Yes	0x5A280C01	0x5A280C01
Safeguard Detector WTB4F V1.0 [1]	Yes	–	0x5A280C01

7.3.2 Safeguard Detector User Interface page

Overview

You can extend the logic of the safety system on this page.

Important information

WARNING

Changed behavior of the safety outputs due to additional or changed logic

The dangerous state may not be stopped or not be stopped in a timely manner in the event of non-compliance.

- ► Ensure the safety outputs always go into the safe state when required.
- ► Take into account that additional or changed logic can affect the response times of the safety controller.

Logic network: Safeguard Detector SafetyOutput

In this network, the safety signal is routed to the safe outputs Q1 and Q2.

Logic network: Safeguard Detector Reset

In this network, the signal of the reset pushbutton is routed to the Safeguard Detector function block. In addition, the “Reset required” signal is routed to the safe Q3 output.

Logic network: Safeguard Detector Diagnostic signals

In this network, signals are freely available for diagnostic purposes.

Table 12: Diagnostic signals

Jump address	Description
DIAG Sensor 01 ok	Signal state HIGH: Sensor 1 detects material and the sensor frequency is OK.
DIAG sensor 02 ok	Signal state HIGH: Sensor 2 detects material and the sensor frequency is OK.
DIAG Error Dual Channel	Signal state HIGH: Discrepancy time exceeded at both sensors
DIAG Confidence Info	Information on the discrepancy of material detection • Signal state LOW: Different material detection at both sensors • Signal state HIGH: Same material detection at both sensors. I.e. both sensors detect the material or both sensors do not detect the material.
DIAG Reset Required	Signal state HIGH: Both sensors detect material and reset is required.

Network Safeguard Detector Sensor Powersupply Diagnostic

The **XTIO[1] Status output data** signal indicates short-circuits in the voltage supply of the sensors. If the sensors are not supplied with voltage via the first XTIO module, the signal must be replaced.

Example 1: Integrating manual restart

In the **Safeguard Detector SafetyOutput** network, the safety signal is routed to the safety outputs Q1 and Q2.

To integrate a manual restart, you can, for example, delete the **Routing N:N** function block and replace it with a **Restart** function block. Then connect the signals as shown in the image.

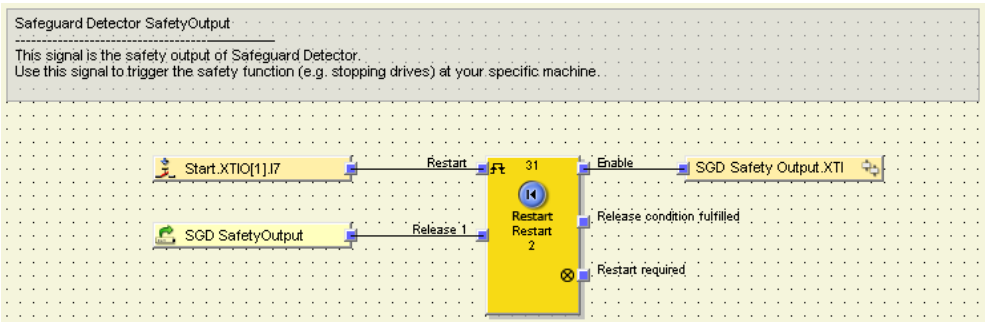


Figure 8: Example for integrating a manual restart

NOTE | All outputs of the safety controller may already be assigned in the delivery state. If additional outputs are required for the “Restart required” signal, then the safety controller must be extended if necessary by another “XTIO” type module.

Example 2: Integrating external device monitoring (EDM)

In the **Safeguard Detector SafetyOutput** network, the safety signal is routed to the safety outputs Q1 and Q2.

To integrate external device monitoring, you can, for example, delete the **Routing N:N** function block and replace it with an **External Device Monitoring** function block. Then connect the signals as shown in the image.

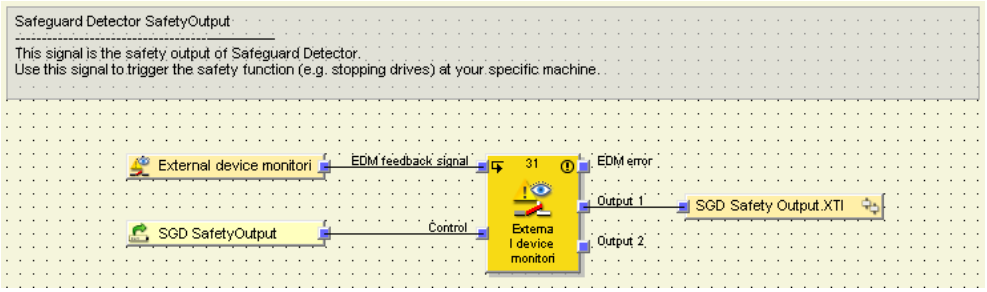


Figure 9: Example for integrating external device monitoring

7.3.3 Safeguard Detector Functionblock page

This page does not require any configuration by the user. All function blocks and the page itself are password protected.

7.3.4 Activating the license for the safety system

Overview

A project can only be verified if a license is activated.

Approach

1. In the **Extras** menu, select the **Software licenses** command.
2. In the **Software licenses** dialog box, click on the **Activate** button.
3. Enter the Ticket ID and confirm with **OK**.

✓ The CodeMeter License Central WebDepot opens in your browser.

4. Select the binding for the licenses:
   - Binding to a PC
   - Binding to a dongle
5. Select the desired licenses.

   ℹ **NOTE** | Note the specified number of licenses. If you have purchased a license package and only want to activate specific licenses in it, you need to first distribute the licenses.
6. Activate the licenses by clicking the **Now activate the selected licenses** button.
7. Click on **Close** to apply the changes and close the **Software licenses** window.

Complementary information

- It is also possible to activate a license offline. To do so, following the **File-based license transfer** instructions in the WebDepot.
- Licenses are only marked as used after being transfered to the controller.
- Licenses cannot be copied or transferred. It is not possible, for example, to transfer it back to the PC.
- For details on managing licenses, see the operating instructions for the configuration software: 8012998.

8 Commissioning

8.1 Safety

WARNING
Hazard due to lack of effectiveness of the protective device

- ► Before commissioning the machine, make sure that the machine is first checked and released by qualified safety personnel.
- ► Only operate the machine with a perfectly functioning protective device.

DANGER
Dangerous state of the machine

During commissioning, the machine or the protective device may not yet behave as you have planned.

- ► Make sure that there is no-one in the hazardous area during commissioning.

Before commissioning can be performed, project planning, mounting, electrical installation and configuration must be completed in accordance with this document.

8.2 Aligning and securing the sensors

Important information

WARNING
The max. sensing range can vary when using different materials.

In the case of non-compliance, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

- ► Check the max. sensing range for all materials used. Different colors should be regarded as different materials.
- ► Position sensors so the max. sensing range can detect the required amount of material for each material type.

Prerequisites

- All material types that will later be used in the application are available. The material has the same properties as the material used in production (no preliminary production samples).

Approach

1. Switch on the voltage supply of the safety controller.
2. Fill the material feed system with the required amount of material.
3. Aim the red emitted light beam at the last material in the material feed system.

✓ The yellow LED flashes.

4. Increase the distance between the sensor and the material until the material just begins to not be detected.

✓ The yellow LED is off.

5. Ensure no material can be detected between the sensor and the min. sensing range even when the material feed system is completely filled. If necessary, increase the distance between the sensor and the material feed system so that the sensor detects the material at a larger angle.
6. Mount the sensor securely in this position. Tightening torque: 0.4 Nm.

7. Secure the mounting screws with locking varnish to protect against manipulation.
8. Repeat the procedure for all other sensors. Take into consideration all the other requirements on the position of the sensors.

Approach

- "Position of the sensors", page 16

9 Troubleshooting

9.1 Troubleshooting the sensors

If the LEDs are behaving abnormally, the sensors must be replaced (see table 12, page 28).

9.2 Troubleshooting the components

NOTE
Information is included in the operating instructions for the components.

10 Decommissioning

10.1 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.

11 Technical data

11.1 Data sheet

Table 13: Data sheet

Performance Level (ISO 13849-1)	PL d
SRS performance class (IEC/TS 62998)	Performance Class D
Voltage supply	24 V DC (SELV/PELV)
Type of sensors (ISO 60947-5-2)	photoelectric proximity switches
SRS function (IEC/TS 62998)	Hazardous object function The safety system differs from this in that it is not the dangerous object that is detected but rather the physical guard.
Error time	The error time is always less than the response time of the safety system and therefore does not need to be taken into account.
Response time	see "Required amount of material for minimum distance", page 13

12 Ordering information

12.1 Ordering information and scope of delivery

Table 14: Ordering information Safeguard Detector

	Hardware and software						Sensors only		Soft-ware only
Part number	**1129622**	**1129625**	**1129652**	**1129654**	**1129655**	**1129656**	**1129653**	**1129657**	**1129661**
Hardware									
Flexi Soft safety controller									
CPU0 main module	1 ×			1 ×					
System plug for CPU0	1 ×			1 ×					
XTIO expansion module (8 inputs, 4 outputs)	1 ×			1 ×					
UE410-SD safety controller									
UE410-SD400 (spring clamp terminals)		1 ×			1 ×				
+UE410-SD300 (screw terminals)			1 ×			1 ×			
Sensors									
Miniature photoelectric sensor WTB4F 100 mm	2 ×	2 ×	2 ×				2 ×		
Miniature photoelectric sensor WTB4F 150 mm				2 ×	2 ×	2 ×		2 ×	
Software									
Ticket ID for software license	1 ×			1 ×					1 ×
Files	The availability of the files (e.g., SISTEMA and circuit diagram) depends on the safety controller type. Flexi Soft: The files are available free of charge in the configuration software. see "Adding a safety system in Flexi Soft Designer", page 26 UE410-SD: www.sick.com/Safeguard_Detector								

13 Annex

13.1 Checklists

13.1.1 Checklist for initial commissioning and commissioning

Important information

NOTE

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

This checklist is not a substitute for initial commissioning or periodic thorough checks by qualified safety personnel.

NOTICE

Long cable lengths can affect the availability of the safety system. You should therefore always perform the initial commissioning and commissioning tests using the final cable configuration.

Tests for the “Trigger safe state” safety function

Table 15: Tests for the “Trigger safe state” safety function

Test sequence	Expected result	Result OK?
1. Ensure both sensors detect the material. 2. Move the material so that only one sensor detects the material. ✓ SGD Safety Output switches to the LOW state. 3. Move the material so that both sensors detect the material. 4. Press the reset pushbutton. ✓ SGD Safety Output switches to the HIGH state. 5. Repeat the test sequence for the other sensor.	SGD Safety Output is in the LOW state as soon as at least one sensor does not detect the material.	Yes ☐ No ☐

Tests for the “Prevent unexpected restart” safety function

Table 16: Tests for the “Prevent unexpected restart” safety function

Test sequence	Expected result	Result OK?
1. Switch on the safety system (supply with voltage). 2. Ensure both sensors detect the material. ✓ SGD Safety Output is in the LOW state. 3. Press the reset pushbutton. ✓ SGD Safety Output switches to the HIGH state. 4. Move the material so that only at least one sensor does not detect the material. ✓ SGD Safety Output switches to the LOW state. 5. Press the reset pushbutton. ✓ SGD Safety Output remains in the LOW state. 6. Move the material so that both sensors detect the material. 7. Press the reset pushbutton. ✓ SGD Safety Output switches to the HIGH state.	A reset is required after switching on. Reset is only successful if both sensors detect the material. Reset becomes necessary as soon as a sensor can no longer detect the material. Static objects in the machine that could reflect the light from the sensors do not cause the sensors to switch when the material feed system is empty.	Yes ☐ No ☐

13.2 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).

13.2.1 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
- EMC DIRECTIVE 2014/30/EU
- MACHINERY DIRECTIVE 2006/42/EC

13.2.2 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
- Electromagnetic Compatibility Regulations 2016
- Supply of Machinery (Safety) Regulations 2008

8026276/2023-02-06/en

Australia
Phone +61 (3) 9457 0600
1800 33 48 02 – tollfree
E-Mail sales@sick.com.au

Austria
Phone +43 (0) 2236 62288-0
E-Mail office@sick.at

Belgium/Luxembourg
Phone +32 (0) 2 466 55 66
E-Mail info@sick.be

Brazil
Phone +55 11 3215-4900
E-Mail comercial@sick.com.br

Canada
Phone +1 905.771.1444
E-Mail cs.canada@sick.com

Czech Republic
Phone +420 234 719 500
E-Mail sick@sick.cz

Chile
Phone +56 (2) 2274 7430
E-Mail chile@sick.com

China
Phone +86 20 2882 3600
E-Mail info.china@sick.net.cn

Denmark
Phone +45 45 82 64 00
E-Mail sick@sick.dk

Finland
Phone +358-9-25 15 800
E-Mail sick@sick.fi

France
Phone +33 1 64 62 35 00
E-Mail info@sick.fr

Germany
Phone +49 (0) 2 11 53 010
E-Mail info@sick.de

Greece
Phone +30 210 6825100
E-Mail office@sick.com.gr

Hong Kong
Phone +852 2153 6300
E-Mail ghk@sick.com.hk

Hungary
Phone +36 1 371 2680
E-Mail ertekesites@sick.hu

India
Phone +91-22-6119 8900
E-Mail info@sick-india.com

Israel
Phone +972 97110 11
E-Mail info@sick-sensors.com

Italy
Phone +39 02 27 43 41
E-Mail info@sick.it

Japan
Phone +81 3 5309 2112
E-Mail support@sick.jp

Malaysia
Phone +603-8080 7425
E-Mail enquiry.my@sick.com

Mexico
Phone +52 (472) 748 9451
E-Mail mexico@sick.com

Netherlands
Phone +31 (0) 30 204 40 00
E-Mail info@sick.nl

New Zealand
Phone +64 9 415 0459
0800 222 278 – tollfree
E-Mail sales@sick.co.nz

Norway
Phone +47 67 81 50 00
E-Mail sick@sick.no

Poland
Phone +48 22 539 41 00
E-Mail info@sick.pl

Romania
Phone +40 356-17 11 20
E-Mail office@sick.ro

Singapore
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Slovakia
Phone +421 482 901 201
E-Mail mail@sick-sk.sk

Slovenia
Phone +386 591 78849
E-Mail office@sick.si

South Africa
Phone +27 10 060 0550
E-Mail info@sickautomation.co.za

South Korea
Phone +82 2 786 6321/4
E-Mail infokorea@sick.com

Spain
Phone +34 93 480 31 00
E-Mail info@sick.es

Sweden
Phone +46 10 110 10 00
E-Mail info@sick.se

Switzerland
Phone +41 41 619 29 39
E-Mail contact@sick.ch

Taiwan
Phone +886-2-2375-6288
E-Mail sales@sick.com.tw

Thailand
Phone +66 2 645 0009
E-Mail marcom.th@sick.com

Turkey
Phone +90 (216) 528 50 00
E-Mail info@sick.com.tr

United Arab Emirates
Phone +971 (0) 4 88 65 878
E-Mail contact@sick.ae

United Kingdom
Phone +44 (0)17278 31121
E-Mail info@sick.co.uk

USA
Phone +1 800.325.7425
E-Mail info@sick.com

Vietnam
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Detailed addresses and further locations at **www.sick.com**

SICK AG | Waldkirch | Germany | www.sick.com

SICK
Sensor Intelligence.