Safety Products Light Curtains & Safety Relays

November 2023

EVERY CONNECTION COUNTS

Agenda

INTRODUCTION

• **Basics on safety**

PROJECT SCOPE

SAFETY LIGHT CURTAINS

• **Concept & features**
• **Product scope**
• **Accessories**

SAFETY INTERFACES

• **Concept & features**
• **Product scope**

MARKETING COLLATERALS

CONCLUSION

BASICS ON SAFETY

EVERY CONNECTION COUNTS

WHAT IS SAFETY?

Machinery Safety

Machinery safety is the basis for secure cooperation between human and machine. The use of secure automation helps protect staff from the hazards that emanate from plant and machinery, enables smooth operation and helps increase production quality.

Machinery safety refers to the practices, measures, and standards put in place to help ensure the well-being of individuals interacting with machines.

WHAT IS SAFETY?

Safety

Active protective measures are usually implemented by selecting and combining in an appropriate way hardware components (such as sensors, switches, logic units, relays etc.) to build up a Safety Related Control System

A control system that executes an active protective measure is said to carry out a **safety function** and the control system itself is called **Safety Related Control System.**

Safety function	Example of application
Safety –related stop function initiated by a safeguard	Stop a motor in response to tripping of a protective device
Manual reset function	Intended action to re-establishes the safeguard after its actuation. Acknowledgement that risk is no more present
Start/restart function	Start of a dangerous movement can take place only when an hazardous situation no more exists
Muting function	Automatic temporary suspension of a safety function
Hold-to-run function	Hazardous machine movements can be controlled from a position within the hazard zone, e.g., inching mode during setup
Prevention of unexpected start-up	Keeping a machine in a stopped condition while persons are present in danger zones
Operating mode selection	Activation of safety functions by an operating mode selector switch
Safe motion, safe position	Overspeed, overtravel control

WHAT IS SAFETY?

Main standards Europe

Fundamental product European directives :
2006/42/EC: "Machine Directive**"** → for machine manufacturers
2014/30/EU: "Electromagnetic Compatibility Directive" → applies to electrical & electronic devices
2014/35/EU: "Low Voltage Directive" → Applies to electrical equipmentl from 50 V to 1500 V

Umbrella machinery safety standards
ISO 13849 "Safety of machinery"
IEC 61508 "Functional safety of electrical / electronic / programmable electronic safety related systems" which impacts safety of machinery especially through
IEC 62061 "Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems"
IEC61496 "Safety of machinery – Electro-sensitive protective equipment

Examples of standards		
EN ISO 1200	→ A-standards	Giving basic concepts, principles for design, and general aspects that can be applied to all machinery
EN ISO 13857 EN 349 EN ISO 13849-1 EN ISO 13855	→ B1-standards	B1: Standards on particular safety aspects (e.g. safety distances, surface temperature, noise)
EN ISO 13850 EN ISO 14119 EN 60204-1 EN 61496...	→ B2-standards	B2: Standards on safeguards (e.g. two-hand controls, interlocking devices, pressure sensitive devices, guards)
EN ISO 10218-1 EN 692 EN 693	→ C-standards	Dealing with detailed safety requirements for a particular machine or group of machines

The Machinery Directive 2006/42/EC

A type C Standard takes priority over type A and B Standards

Main standards North America

Health & Safety is governed by OSHA (Occupational Health and Safety Administration)
ANSI (American National Standard Institute) issue standards on the safety of machine tools and construction
Underwriters Laboratories Inc (UL) or CSA are the bodies that issue certifications for safety equipment

WHAT IS SAFETY?

Safety levels

SAFETY LEVEL

TYPE 4
SIL 3 - SILCL 3 | PL e - Cat. 4

TYPE 2
SIL 1 - SILCL 1 | PL c - Cat. 2

SIL (Safety Integrity Level) as per EN 62061
Can only be used for electrical, electronic or programmable safety solutions.

PL (Performance Level) as per EN ISO 13849-1
is a technology-neutral concept that can be used for electrical, mechanical, pneumatic and hydraulic safety solutions.
Category : refers to the machine itself and achievable PL.
Goes from category B (basic) to category 4 (highest).
Ex: Category 4 allow to reach PL e (highest protection against higher risk)
Type : refers to the specific design of protection equipment like a safety light curtain or relay.

Type 4 device would be most likely to be used in a category 4 application, and a Type 2 light curtain could probably only be used for a category 2 application

SIL is particularly well-suited to large, complex facilities or factories with multiple machines, while **PL** is suitable for individual machines.

WHAT IS SAFETY?

RISK EVALUATION :   PLr (Protection Level required)

Machinery Directive - Overview of the steps to achieve the level of safety required by each application

▼ Objective: risk reduction by applying defined control measures

Risk assessment EN ISO 12100

Define risk reduction measures

Design and implement the EN ISO 13849 safety system
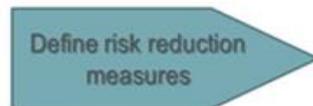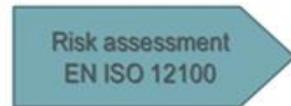
How to determine the required performance level – PLr:

- S = severity of the damage:
  - S1= light damage– reversible;
  - S2= serious damage– irreversible.

- F = frequency and/or danger exposition:
  - F1= rare and/or for a limited time;
  - F2= frequent/continuous and/or for an extended period of time.

- P = possibility of avoiding the danger or limiting the damage:
  - P1= possible within certain conditions;
  - P2= hardly possible.

LOW RISK

HIGH RISK
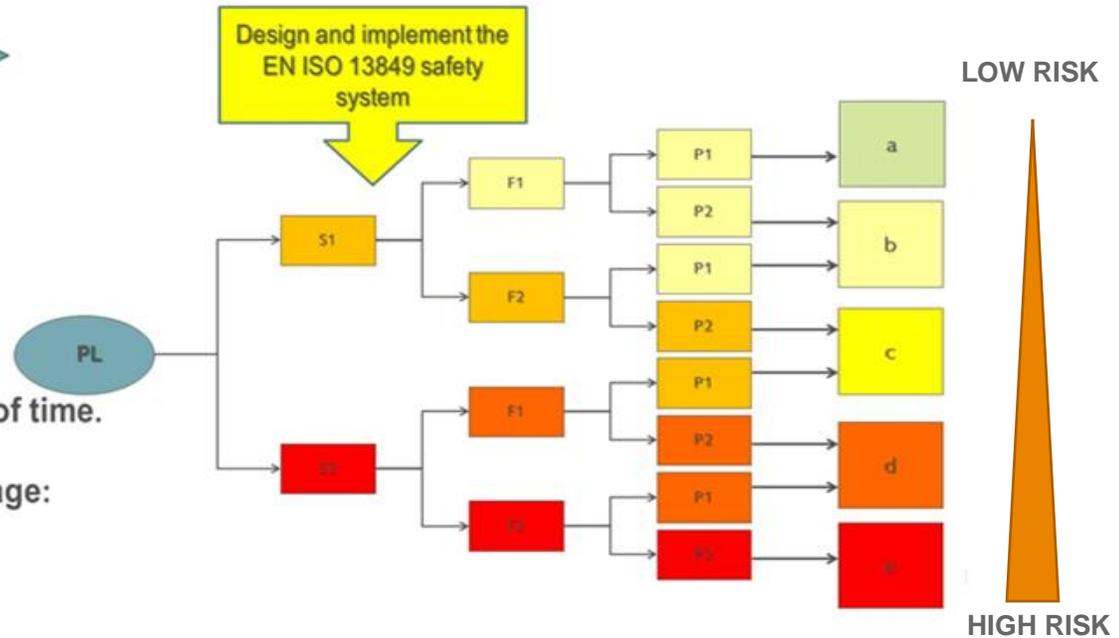
PLr(e) provides the greatest contribution to risk reduction

PROJECT SCOPE

EVERY CONNECTION COUNTS

Product portfolio

SAFETY LIGHT CURTAINS

SLC4 Range

SAFETY LEVEL

TYPE 4
SIL 3 - SILCL 3 | PL e - Cat. 4

SLC2 Range

SAFETY LEVEL

TYPE 2
SIL 1 - SILCL 1 | PL c - Cat. 2

SAFETY INTERFACES

SRS - SRK RANGE

SINGLE & MULTI-FUNCTION SAFETY RELAYS
Type 4 SIL 3 - SILCL 3 | PL e - Cat. 4
OR
Type 2 SIL 1 - SILCL 1 | PL c - Cat. 2

SAFETY LIGHT CURTAINS

SLC Range

EVERY CONNECTION COUNTS
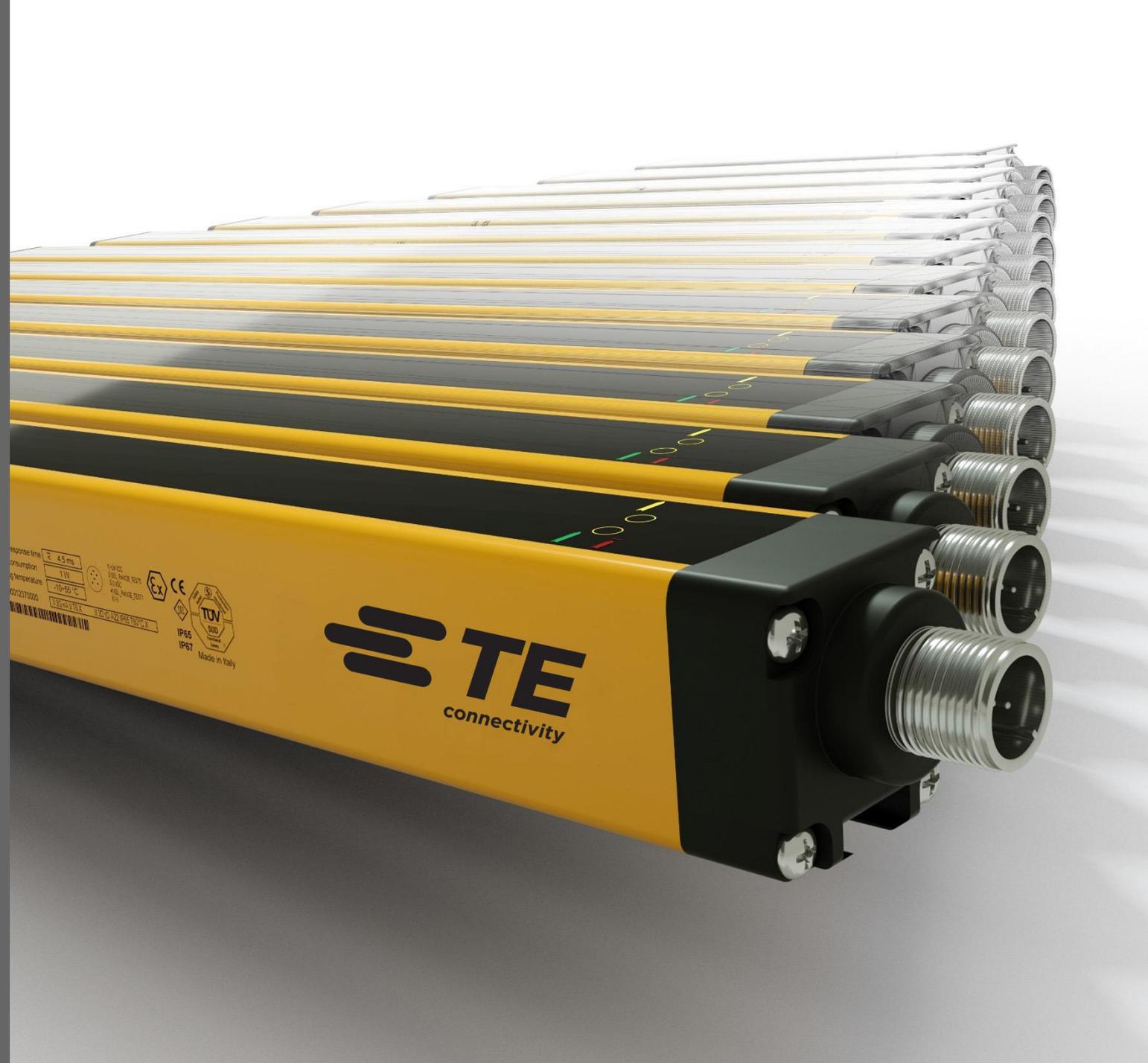
Safety Light Curtain : Principle of operation

The SLC uses a combination of an emitter and a receiver. Multiple parallel beams are emitted with various resolutions (distance between beams).
If no object or people are blocking the beam between the emitter and receiver, the machine is in a secure state and is allowed to operate.
On the other hand, if any or all of the light beams are blocked by a human finger, hand or body, the machine determines the situation to be hazardous and turns off the output of the receiver to stop the machine.

SLC's are considered as **sensors**

Emitter   Receiver

Safety Light Curtain : Advantages

- Effective protection in the event of fatigue or distraction of the operator.

- Increase in the productive capacity of the machine as the SLC does not require the manual handling of physical guards or waiting for them to open.

- Faster machine loading/unloading operations.

- Reduced times of approach to the working areas.

- Virtually elimination risk of tampering since any irregular intervention on the light curtain stops the machine.

- Simple and quick installation, with greater flexibility of adjustment on the machine, even in the case of subsequent repositioning.

- Possibility to build up large sized protections, either linear or along a perimeter, on several sides, at greatly reduced costs.

- Facilitated and fast maintenance of the machine, as there is no need to remove physical guards, such as grids, gates, etc.

- Improved appearance and ergonomic effectiveness of the machine.

SLC4 Type 4 Safety Light Curtain

Main features

SLC4

4 types of detection

6 resolutions :

- 14 mm for finger detection
- 20 mm, 30 mm, 40 mm for hand detection
- 50 mm, 90 mm for detection of the body in a dangerous area

Access control : 2-3-4 beams for body detection

Protected height range 160 mm to 2250 mm

Maximum range:

- Selectable 3 m to 6 m for 14 mm resolution models (finger)
- Selectable 4 m to 12 m for other models (hand & body)
- Selectable 10 m to 20 m for L versions

Integrated manual or automatic Start/Restart

Feedback input for external relay monitoring

M12 5/8 poles connectors

Use of unshielded cables up to 100m
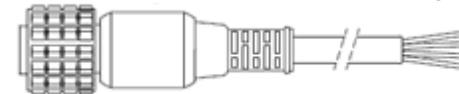
SLC4 Type 4 Safety Light Curtain

Models with automatic restart, integrated functions and longer range

SLC4
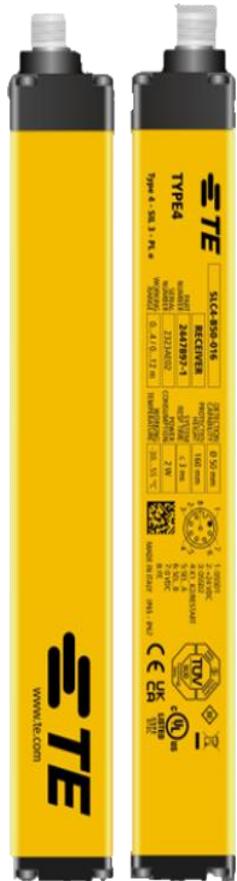
SLC4…

Manual/Automatic Start/Restart

Feedback input - EDM

Connectors: M12/5 (Emitter), M12/8 (Receiver)

Max range: 6 m (14 mm), 12 m (20 mm, 30 mm, 40 mm, 50 mm, 90 mm and 2-3-4 beams)

SLC4…L

Manual/Automatic Start/Restart

Feedback input - EDM

Connectors: M12/5 (Emitter), M12/8 (Receiver)

Max range: 20 m for 20 mm, 30 mm, 40 mm, 50 mm, 90 mm and 2-3-4 beams

SAFETY LEVEL

TYPE 4

SIL 3 - SILCL 3
PL e - Cat. 4

Type 4	IEC 61496-1-2
Category 4	ISO/EN 13849-1
PL e	ISO/EN 13849-1
SIL 3	IEC 61508
SIL CL 3	EN 62061

SLC2 Type 2 Safety Light Curtain

Manual/Automatic Start/Restart

SLC2…

3 types of detection

4 Resolutions

- 30 mm - 40 mm for hand detection
- 50 mm - 90 mm for detection of the body in a dangerous area

Access control : 2-3-4 beams for body detection

Protected height range 160 mm to 2250 mm

Max range 12 m (20 mm, 30 mm, 40 mm, 50 mm, 90 mm and 2-3-4 beams)

Integrated manual or automatic Start/Restart

Feedback input for external relay monitoring

M12 5/8 poles connectors

Use of unshielded cables up to 100 m

SAFETY LEVEL

TYPE 2

SIL 1 - SILCL 1
PL c - Cat. 2

- Type 2   IEC 61496-1:2004
  IEC 61496-2:2006
- Category 2   ISO/EN 13849-1:2008
- PL c   ISO/EN 13849-1:2008
- SIL 1   IEC 61508-1:1998
  IEC 61508-2:2000
- SIL CL 1   EN 62061:2005

One simple product range to cover wide range of today's industrial applications

Reliable and compact

High ingress protection ratings

IP67 and IP65 supports protection against dirt, dust, sand, water, projections and other liquids with IP67 and IP65 ratings. High resistance to infiltration by dust and liquids in a highly compact light curtain

Compact size

SLC is one of the smallest light curtains in the market (with integrated safety functions) With a minimal cross section: 28 mm x 30 mm

Robustness

Thanks to powder-coated aluminum casing, SLC range can obtain high level of reliability. Also, highly reliable in cold storage facilities with -30° C to +55° C operating temperature

Safe and Smart

Virtually no blind area

Thanks to the position of the 1st beam on the connector side, this helps protected area to extend until the light curtain end and maintain the resolution

Fast, simple installation

Plug and play thanks to the M12 connectors and the use of unshielded cables. Virtually no programming necessary Easy to install and replace

User-friendly diagnostics via LEDs

Status indicating display that including alignment aids are helping the user to diagnose the status

High level of productivity and safety

High Safety grades

Type 2 and Type 4 SLC light curtains approved in accordance with;
- EN IEC 61496-1/-2
- ANSI / UL 1998

Finger, hand and body protection

From safety light barriers supporting body protection to the light safety light curtain for higher finger and hand protection, the product series SLC4 and SLC4 cover a large portfolio

A range updated to your needs

Integrated safety functions, including self-monitoring of static outputs, control of external contactors (EDM) and selectable automatic/manual restart, supports increased productivity due to reduced downtimes

Reliable and compact

High ingress protection ratings IP67 and IP65

- Helps protect against dirt, dust, sand, water, projections and other liquids
- Resistance to infiltration by dust and liquids in a highly compact light curtain

Compact size

SLC is one of the smallest light curtains in the market (with integrated safety functions) With a minimal cross section: 28 mm x 30 mm

30 mm

28 mm
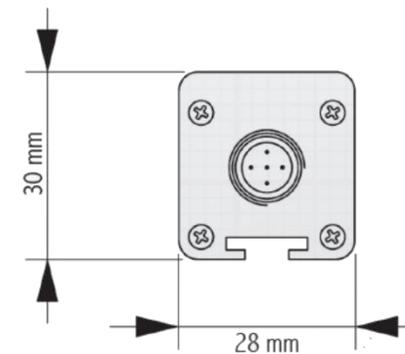
Robustness

Thanks to powder-coated aluminum casing SLC range can obtain high level of mechanical reliability. Also, highly reliable in cold storage facilities with -30° C to +55° C operating temperature

Safe and Smart

Virtually no blind area

Thanks to the position of the 1st beam on the connector side, this helps protected area to extend until the light curtain end and maintain the resolution.
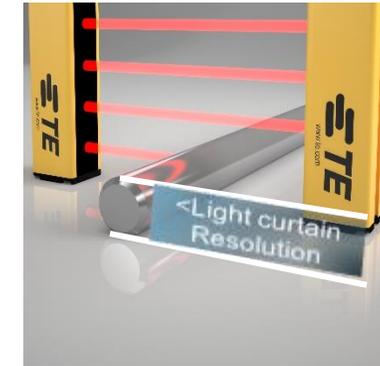
Fast, simple installation

Plug and play, easy to install & replace thanks to the M12 connectors
Unshielded cables.
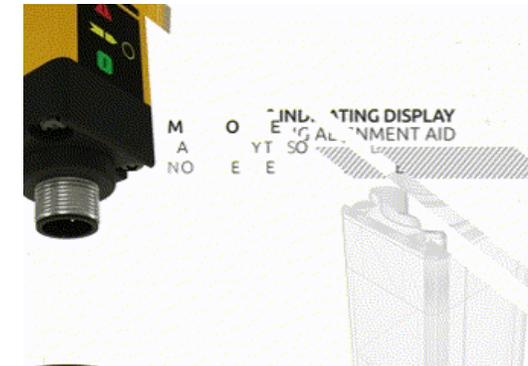
User-friendly diagnostics via LEDs

Status indicating display that including alignment aids are helping the user to diagnose the status

Safe and Smart : Virtually no blind area on one side

1 Thanks to the position of the 1st beam, The protected area extends until the light curtain end maintaining the finest resolution up to (14 mm)

2 Fingers and hands are always detected and protected on the entire height

3 2 L-mounted light curtains maintain 40 mm resolution (hand detection) in corner (models with resolution 30 mm and 40 mm)
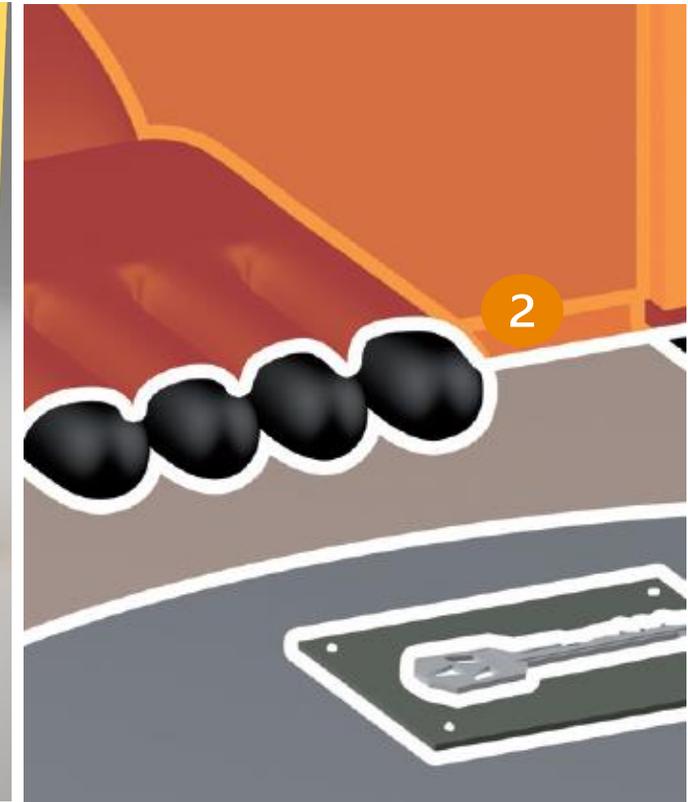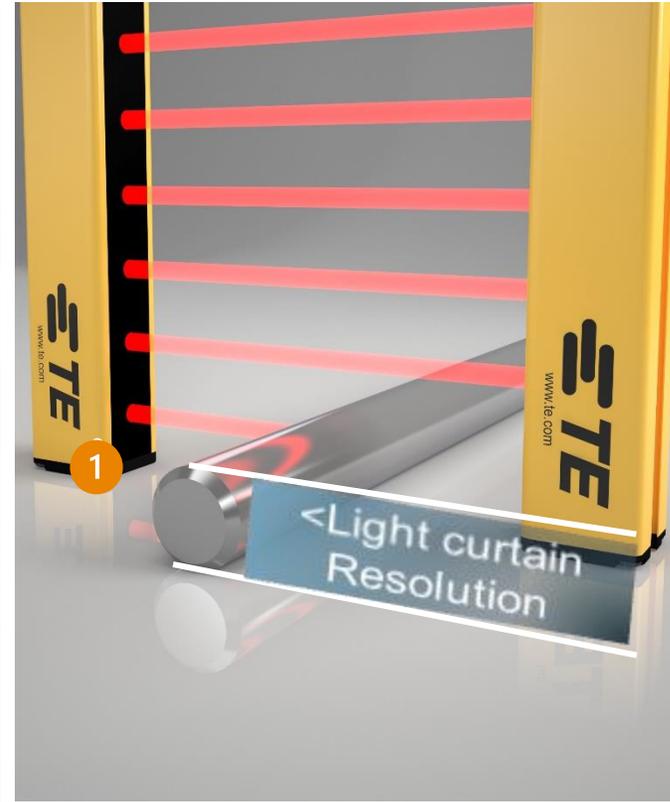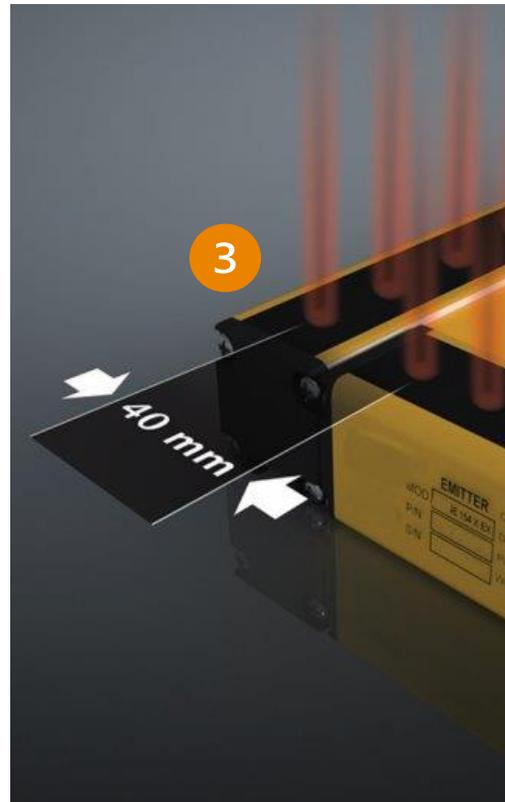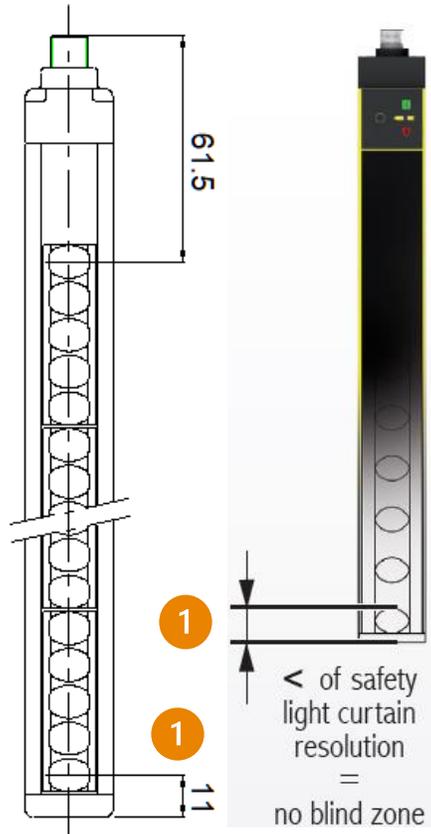
User interface

Pin-out and display information

Pin-out (X/XH models)

Emitter 5 poles

- 3 — 0VDC
- 5 — FE
- 4 — RANGE 1
- 2 — RANGE 0
- 1 — 24 VDC

Receiver 8 poles

- 8 — FE
- 7 — 0VDC
- 1 — OSSD1
- 6 — SEL B
- 2 — 24 VDC
- 5 — SEL A
- 3 — OSSD2
- 4 — K2 K2 / RESTART
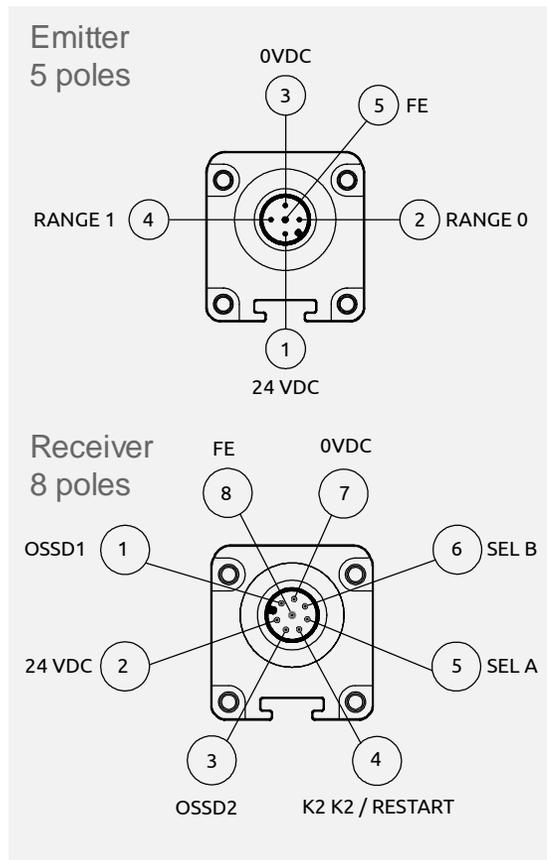
Display information
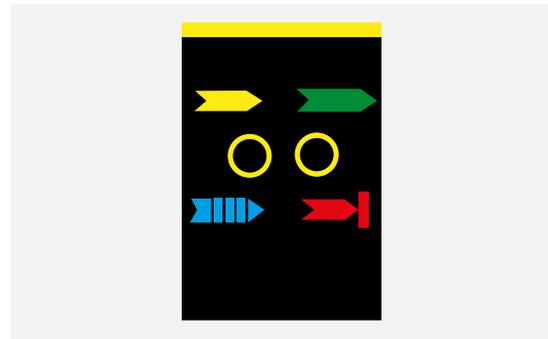
On the receivers of 14 mm resolution and H models a blue LED indicates a weak signal intensity.

During alignment operations, checking the blue LED status can be helpful. During standard operation it must remain off.

Emitter - All models

Three colour LED		Meaning
🔴		System power-on - Initial TEST
🟢	2 blinks	System power-on - HIGH working range selected
🔴	blinking	FAIL condition - The type of fault is identified by the number of flashes - See technical manual
🟤		TEST condition
🟢		Normal operating condition
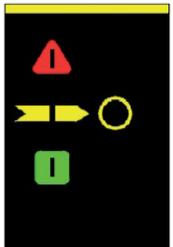
Receiver - All models except SLC4 14 mm and L (range 20 m) versions

1 - Yellow LED		2 - Two colour LED		Meaning
🟡		🔴		System power-on - Initial TEST
⚪		🔴		BREAK condition
🟡		⚪		CLEAR condition - SLC4 (with integrated control functions) only
🟡	blinking	🔴	blinking	BREAK_K condition - SLC4 (with integrated control functions) only
⚪		🟢		GUARD condition
⚪		🔴	blinking	FAIL condition - The type of fault is identified by the number of flashes - See technical manual
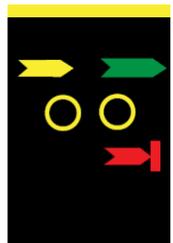
SAFETY RELAYS

SRS-SRK Range

EVERY CONNECTION COUNTS

Safety Relays

…for barriers with automatic start/restart (SLC series)

SRS safety relays

The Safety Relays are a dedicated interface between safety light curtains, equipped with self-controlled safety static outputs, and control circuits of the machine or plant

- SRS-2NO-1NC ➔ Safety interface for devices with integrated feedback input for EDM (with auxiliary contact). 2 NO + 1 NC. Screw Terminal Blocks

- SRS-2NO ➔ Safety interface for devices with integrated feedback input for EDM. 2 NO. Screw Terminal Blocks

- SRS4-2NO ➔ Safety interface for OSSD output devices. 2 NO. Screw Terminal Blocks

- SRS4M-2NO ➔ Safety interface with integrated Muting functions for OSSD output devices. 2 NO. Screw Terminal Blocks

- SRS MULTI ➔ Multifunction Safety Relay, Screw Terminal Block

(Safety Light Curtains, Solid-State-Output Devices (i.e. RFID safety switches), Dual-Channel Emergency Stops, Two-Hand Controls and Safety, Photocells)

How is it functioning?

Safety relays are devices used to control the safety-related part of control systems in such a way that machine operation is only allowed when safety is confirmed. It supports safety by controlling signals coming from inputs, especially emergency stop switches and locking switches and controls the contactors and other devices connected to the outputs according to the results of this detection. In other words, the safety relay module and safety controller play a central role as the logic unit in the safety-related part of the control system.

Input signal

Output signal

Start/reset
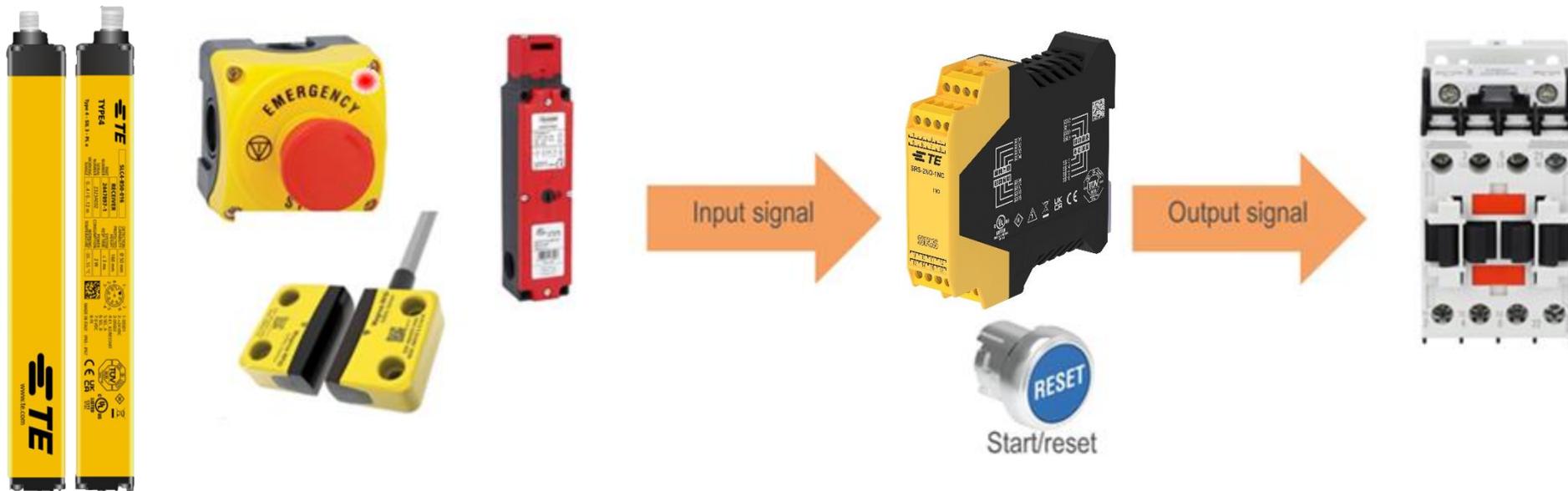
Typical applications

- Robotics

- Food & beverage

- Packaging

- Pharmaceutics

- Paper

- Logistics

- Metalworking

- Woodworking

- Chemicals

- Injection moulding

- Printing

AFG- Robotics, Machinery, Control cabinet

Safety area with light curtains and mirrors
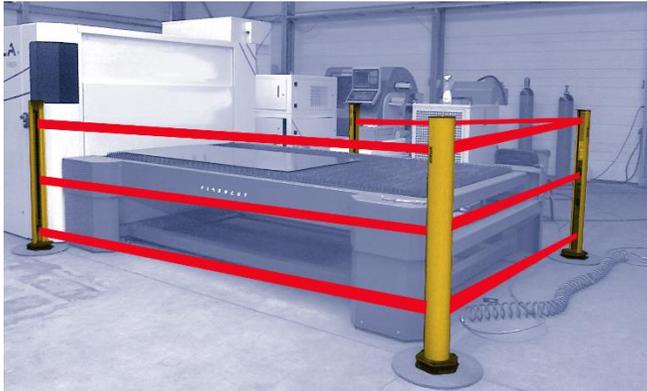
Safety area with light curtains for machinery

Safety solution for OEM machine builders
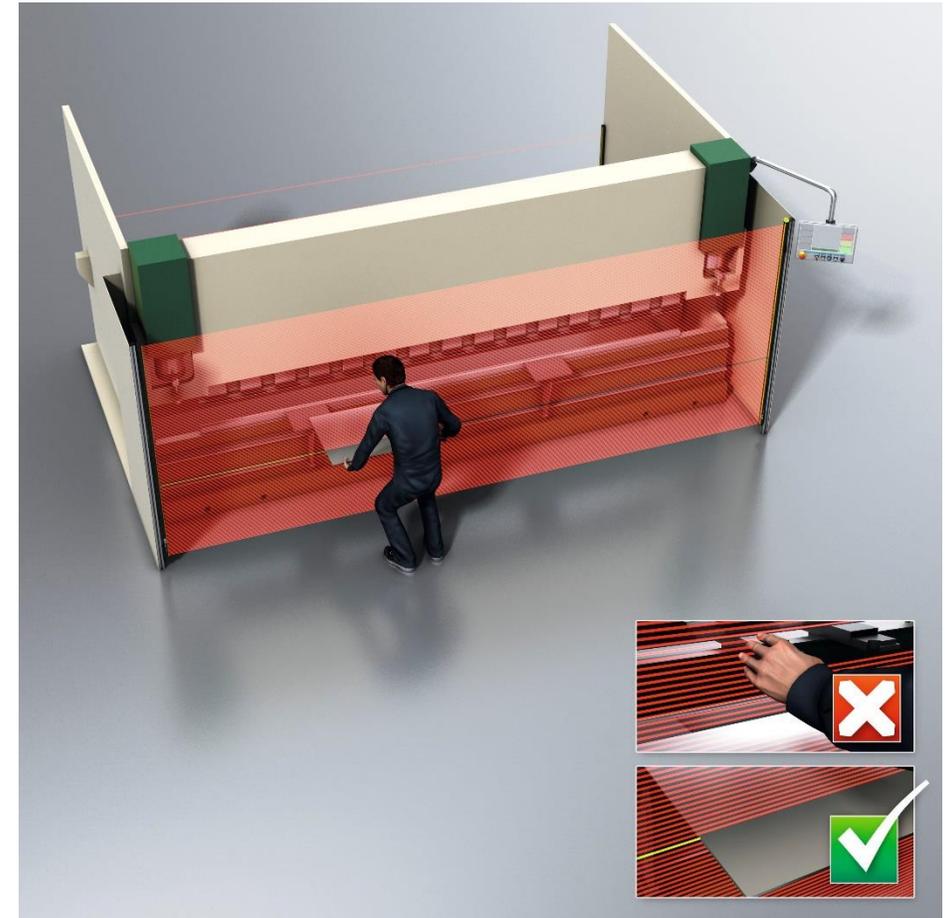
Safety systems for robots
Safe Robotics Area supports protection, safer access to cooperative robot applications for less downtime, enhanced work processes and higher productivity.

Marketing Materials

TE.COM

Product sheet
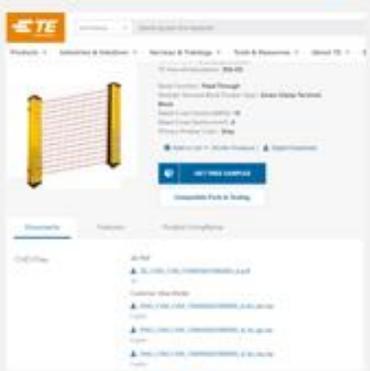
CVM Samples

Technical guides

Manuals and Quick guides
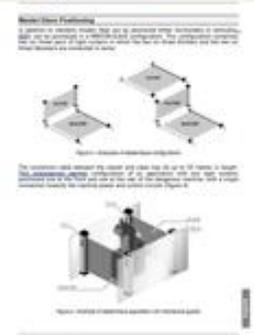
Media

Datasheets, Catalogue page

Demokit

Demo kits

Training Materials

1. Webinars
2. Training PPT
3. Customer PPT

SLC: the compact safety barrier

CONNECT
LIKE THE WORLD
DEPENDS ON IT.
BECAUSE IT DOES.

EVERY CONNECTION COUNTS

TE
connectivity